Comparison of Size of Capture of the Parrotfishes *Sparisoma viride* and *Sparisoma chrysopterum* in Puerto Rico Using Traps and Entanglement Nets during 1988-1992

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ABSTRACT

Puerto Rico's fishery consists primarily of shallow water reef fishes and shellfish (mainly lobster and conch). The Fisheries Research Laboratory (FRL) of the Puerto Rico Department of Natural Resources is continuously collecting data to evaluate the status of fisheries resources.

Throughout 1988-1992, FRL's port agents randomly selected complete samples of commercial landings around the 42 coastal municipalities to obtain landings data (pounds of fish and shellfish landed) and biostatistical data (identified individuals by species, measured in fork length and weighed).

Parrotfishes (Scaridae) have become an important commercial fish group in Puerto Rico. In 1970, a total of 356, 305 pounds of parrotfishes were reported, representing 8% of the total catch reported of fish and shellfish. However, parrotfish landings have shown a decrease since 1980. In 1992, a total of 92, 136 pounds were reported in the landings, representing 5% of the total catch of fish and shellfish.

Parrotfishes are caught mostly by entanglement nets (trammel net and gill net) and Antillean fish traps. From 1988-1992, the stoplight parrotfish (*Sparisoma viride*) and redtail parrotfish (*Sparisoma chrysopterum*) were the most abundant parrotfish species reported in Puerto Rico. Analysis of the 1988-1992 biostatistical data showed that entanglement nets caught *S. viride* individuals with an average fork length (FL) of 279 mm ± 35mm (mean ± 1 s.d.). The corresponding figure for *S. chrysopterum* was 268 mm ± 30mm. During the same period, traps caught individuals with an average FL of 261 ± 36mm for *S. viride* and 249 ± 29mm for *S. chrysopterum*. Analysis of length frequency distributions (LFDs) using the Kolmogorov-Smirnov test for *S. viride* and *S. chrysopterum*, by gear type showed that traps caught significantly (P 0.05) smaller individuals than entanglement nets for both species.

Analysis of LFDs (Kolmogorov-Smirnov test), comparing the year 1988 versus 1992 for all gear types for *S. viride* and *S. chrysopterum*, showed that in 1988 commercial fishermen caught significantly ($P < 0.05$) larger individuals than in 1992.

KEY WORDS: Commercial Fishery, Scaridae, Entanglement nets, Traps; Biostatistics, Puerto Rico

INTRODUCTION

Since 1970, the Fisheries Research Laboratory (FRL) of Puerto Rico's Department of Natural Resources (DNR) has been collecting data (*e.g.*, landings estimates, biostatistics and fishery censuses) to evaluate the fishery resources being landed at 42 coastal municipalities. Fishery data analysis indicates that growth overfishing appears to be a major problem in Puerto Rico's fishery. One indication of overfishing is the large number of small fishes being landed, for example, high percentages of the grouper *Epinephelus guttatus*, the snappers *Lutjanus vivanus* and *Ocyurus chrysurus* and the spiny lobster *Panulirus argus* are caught before reaching minimum size of sexual maturity (Matos, 1999; Appeldoorn *et al.*, 1992). Another indication of overfishing is the recent decline in total landings, for example, 7.21 millions pounds in 1979 (Collazo and Calderón, 1987, decreasing to 2.04 million pounds in 1992 (Matos, 1993). Fishery managers need information that describe how each gear type exploits the resource in a different way, producing a different species composition and a different size distribution of individuals. To better evaluate resource status and monitor resource management, it is necessary to understand the effects of given gear type on the catch profile.

Parrotfishes (Scaridae) are tropical shallow water fishes that abound on coral reefs and adjacent areas (Reeson, 1983). During the decade of the 1970s, parrotfishes represented approximately 10% of the total landings reported in Puerto Rico (Suárez-Caabro, 1979). In 1979, 382,000 pounds of parrotfishes were reported, representing 5% of the total catch (Collazo y Calderón, 1987). In 1992, only 92,136 pounds of parrotfish were reported, but they represented 5% of the total catch (Matos, 1993). Market price for parrotfishes were low in the past because fish consumers considered that its meat was spiny, however, currently parrotfishes are easily sold at good prices. For example, in 1992 the average price was $1.35/pound (Matos, 1993). It is probable that the increase in the market has occurred due to the existing high demand for fresh fish, and fewer landings than in the past. Biostatistical records showed that the stoplight parrotfish *Sparisoma viride* and the redtail parrotfish *Sparisoma chrysopterum* are two of the most frequently caught parrotfish in Puerto Rico's fishery (Acosta, 1992; Rosario and Sadovy, 1991; Appeldoorn *et al.*, 1992). Traps and entanglement nets (trammel nets and gill nets) are the gear types that reported the highest catches of parrotfishes in Puerto Rico (Suárez-Caabro, 1979; Matos and Sadovy, 1990; 1991; Matos, 1992; 1993).

The objectives of this investigation were: 1) to compare the length frequency distributions (LFD) of *S. viride* and *S. chrysopterum* caught by traps versus those caught by entanglement nets in order to better understand how each gear type exploited each species 2) to compare the LFDs of *S. viride* and *S. chrysopterum* caught by all gear types in 1988 versus 1992, to determine if the resource has been significantly affected.

METHODS

From 1988-92, five port agents of the FRL visited landing areas around the 42 coastal municipalities of Puerto Rico including the municipality islands of Vieques and Culebra. Port agents visited different fishing centers four days per week and randomly selected fishermen landings to collect biostatistics data on fishes and lobsters. They proceeded to identify specimens to species level, and each individual fish was measured (fork length (FL) in millimeters) and weighed (grams). Only data from *S. viride* and *S. chrysopterum* were considered in this report. Port agents delivered the data to FRL statistics clerks, who checked and entered it in IBM PC format using DBASEIII+ (1988-91 data) and Trip Interview Program (1992 data). Data analysis was made using Lotus 1-2-3 and Microsoft Excel. The LFD were compared statistically using the Kolmogorov- Smirnov Two Sample Test (Sokal and Rohlf, 1981).

RESULTS

The mean FL by gear and by year for *S. viride* and *S. chrysopterum* from 1988-92 showed that entanglement nets tended to catch larger individuals than traps (Table 1 and 2).

The LFD for *S. viride* caught by traps during 1988-92 showed that the modal size class was 250 mm (Figure 1). The LFD for *S. viride* caught by entanglement nets during the same period showed a modal length of 260 mm (Figure 2). A Kolmogorov-Smirnov test demonstrated a significant difference in the LFD of *S. viride* caught by traps versus entanglement nets for the period 1988-92 (D_{max} = 0.2044, p 0.05). The LFD for *S. viride* caught by all gear types in 1988 showed that the modal size was 280 mm (Figure 3), although there appears to be a broad mode to 310 mm. The LFD for *S. viride* caught by all gear types in 1992 showed that the modal size was 260 mm (Figure 4). There were fewer large individuals in 1992. A Kolmogorov-Smirnov test demonstrated a significant difference in the LFD catch by all gear types in 1988 versus 1992 (D_{max} = 0.1696, p 0.05).

Figures 5 and 6 showed that there was a tendency to catch larger individuals of *S. chrysopterum* by entanglement nets (modal size was 270 mm) versus traps for the same period (modal size classes 250–260 mm). A Kolmogorov-Smirnov test demonstrated a significant difference in the LFD of *S. chrysopterum* caught by traps versus entanglement nets for the years 1988-92 (D_{max} = 0.3464, p 0.05). The LFD for *S. chrysopterum* caught by all gear types in 1988, captured more individuals in the higher size classes (300 mm - 350 mm) than in 1992 (Figure 7 and 8). A Kolmogorov-Smirnov test demonstrated a significant difference in the LFD catch by all gear types in 1988 versus 1992 (D_{max} = 0.1048, p 0.05).

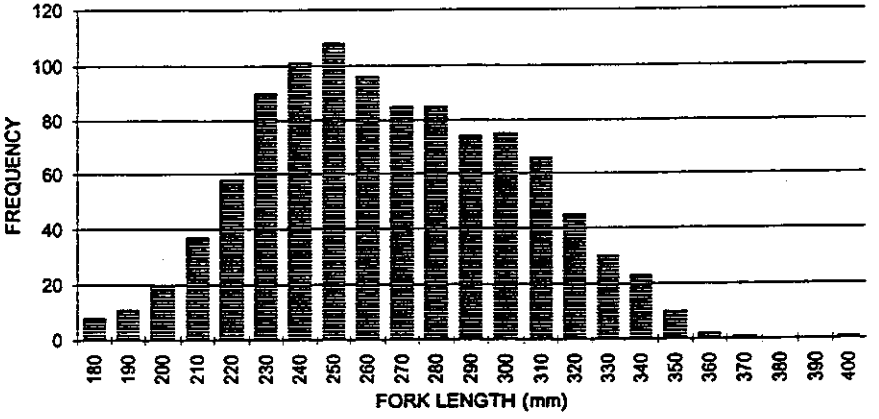

Figure 1. Length frequency distribution for *Sparisoma viride* caught by traps in Puerto Rico during 1988-1992 (n=1, 026).

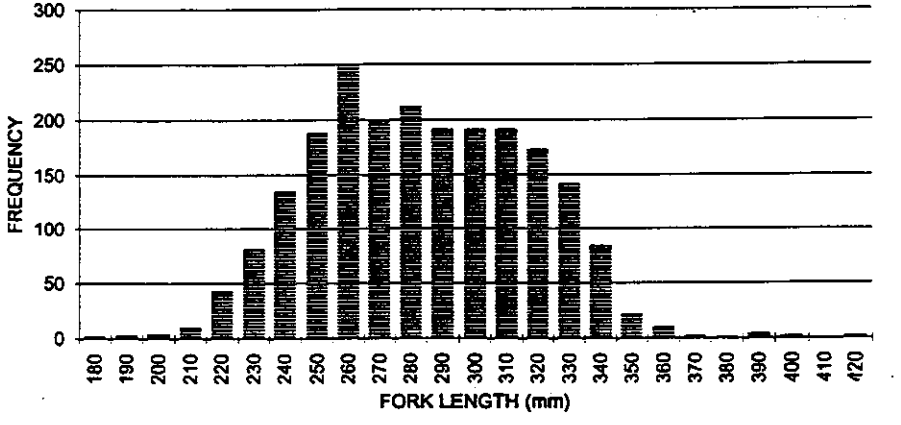

Figure 2. Length frequency distribution for *Sparisoma viride* caught by entanglement nets in Puerto Rico during 1988-1992 (n=2, 141).

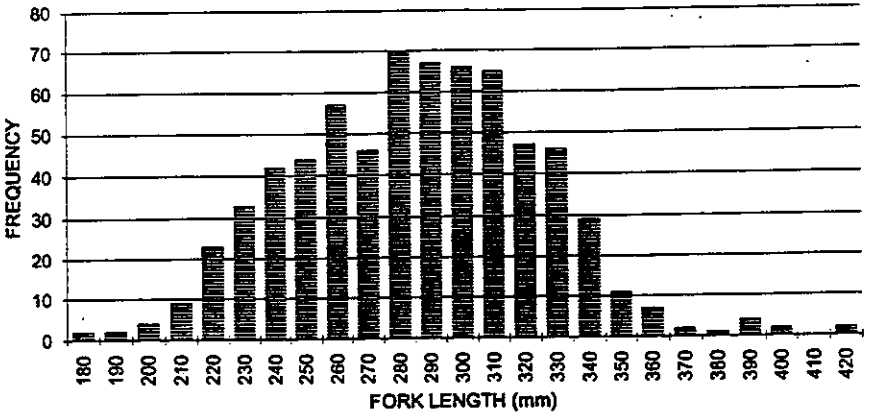

Figure 3. Length frequency distribution for *Sparisoma viride* caught by all gears in Puerto Rico during 1988 (n=681).

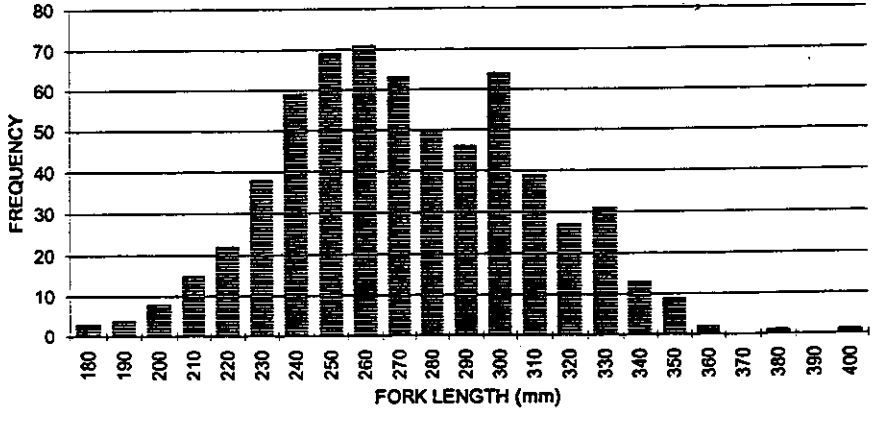

Figure 4. Length frequency distribution for *Sparisoma viride* caught by all gears in Puerto Rico in 1992 (n=635).

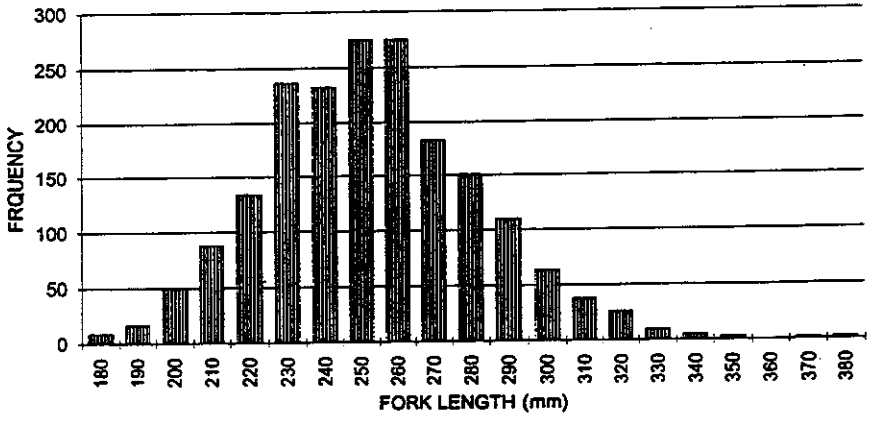

Figure 5. Length frequency distribution for *Sparisoma chrysopterum* caught by traps in Puerto Rico during 1988-1992 (n= 1, 912).

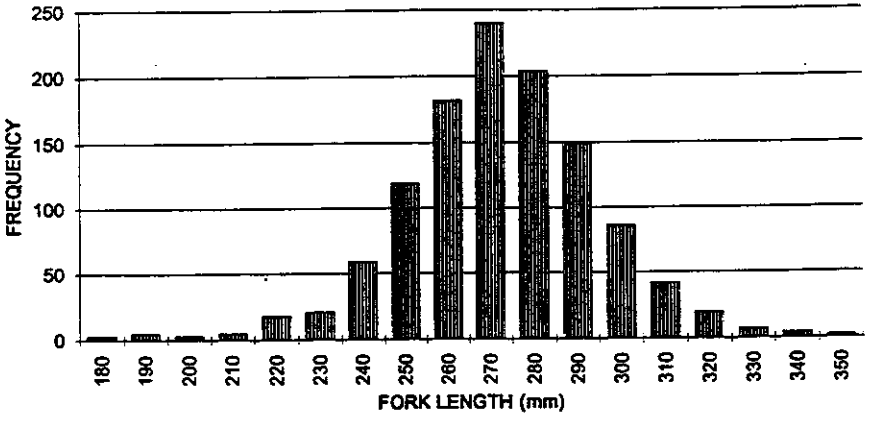

Figure 6. Length frequency distribution for *Sparisoma chrysopterum* caught by entanglement nets in Puerto Rico during 1988-1992 (n= 1, 170).

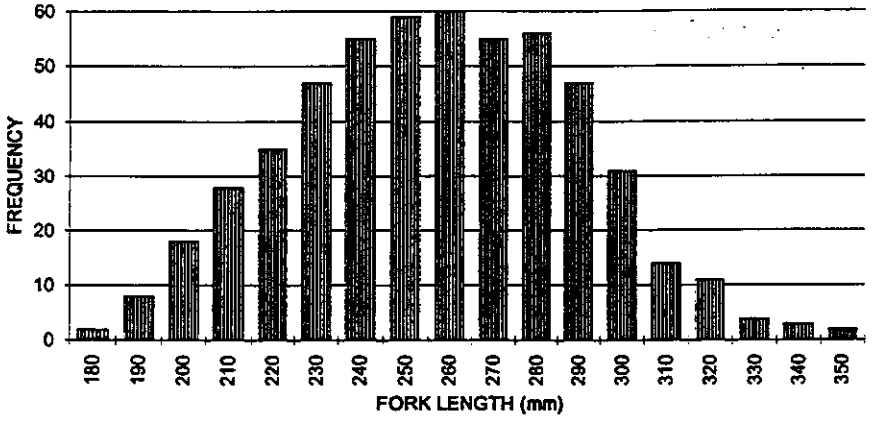

Figure 7. Length frequency distribution for *Sparisoma chrysopterum* caught by all gears in Puerto Rico during 1988 (n= 535).

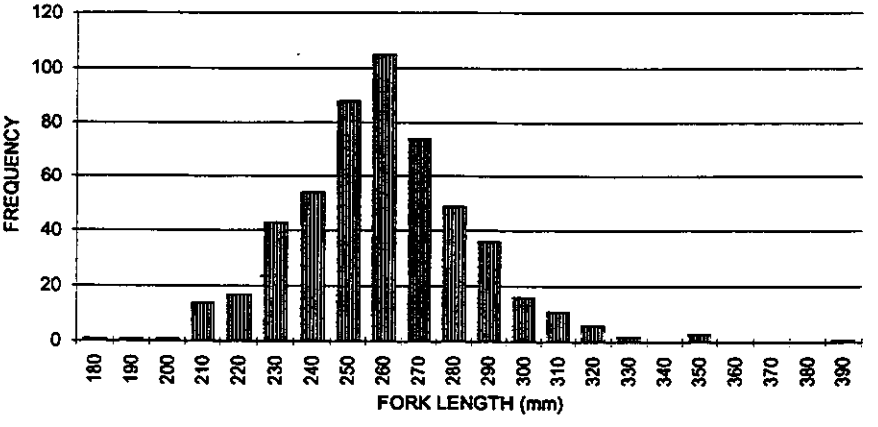

Figure 8. Length frequency distribution for *Sparisoma chrysopterum* caught by all gears in Puerto Rico during 1992 (n= 522).

DISCUSSION

Significantly larger individuals of *S. viride* and *S. chrysopterum* were caught by entanglement nets than fish traps (Table 1 and 2; Figures 1, 2, 5 and 6). Traps were the most frequently used and productive gear in Puerto Rico's fishery from the 1970's (Collazo y Calderón, 1987) to the late 1980s (Matos, 1993). In 1982, traps reportedly caught approximately 71% of the total catch (all species of fish and shellfish) in the Island (Collazo and Calderón, 1987) but in 1992, the trap catch declined to only 27% (Matos, 1993). Commercial fishermen explained that traps are less efficient today than they were in the past years. Independent data of the FRL reported that in 1991 average catch per trap haul (1.25 inch mesh size) per haul was 0.5 lbs (Rosario and Sadovy, 1991). On the other hand, in 1970 the average catch per trap haul (1.25 inch mesh size) was 6.0 lbs (Juhl and Suárez-Caabro, 1975).

Puerto Rico's fishermen are increasing the use of entanglement nets. In 1982 all nets (beach seine, gill net, trammel net, and cast net) contributed approximately 12% of the total catch (Collazo and Calderón, 1987) and in 1992 this figure increased to 24% (Matos, 1993). Traps tend to select smaller individuals than entanglement nets of both of these species. A similar trap tendency was observed for the grouper *E. guttatus*, and the snappers *O. chrysurus* and *L. vivanus* .

Individuals of *S. viride* and *S. chrysopterum* caught during 1988 were significantly larger than those in 1992 (Figures 3, 4, 7 and 8). When modal size declines in a species under exploitation, it is probable that the resource is being overexploited (Bohnsack, 1993). During the last six years, it has been observed that Puerto Rico's fishery has shown signs of overfishing. It is then necessary to consider the probability that these species could be overexploited. However, more data is necessary to reach a more precise conclusion.

The ecological and economic importance of Scaridae (Gygi, 1975; Reeson, 1983) demonstrates the need for more studies to understand the real status of this resource. It is also necessary to know more about the life history (*e.g.*, minimum size of sexual maturation, reproduction strategies, dispersal, growth, etc.) of *S. viride*, *S. chrysopterum* and other scarid species.

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LITERATURE CITED

Acosta, A. 1992. A preliminary study of gill net, trammel net, and beach seine catches from southwest Puerto Rico with notes on length-frequency. *Proc.Gulf Carib. Fish. Inst.* **41**: 123-149

Appeldoorn, R., J. Beets, J. Bohnsack, S. Bolden, D. Matos, S. Meyers, A. Rosario, Y. Sadovy and W. Tobias. 1992. Shallow water reef fish stock assessment for the U. S. Caribbean.NOAA Technical Memorandum NMFS-SEFSC-304, 70 pp.

Bohnsack, J. A. 1993. Marine reserves: they enhance fisheries,reduce conflicts, and protect resources. *Oceanus* **36**(3):63-72

Collazo, J. and J. Calderón. 1987. Status of the fisheries in Puerto Rico 1979-82. Technical Report. CODREMAR **1** (2): 1-30.

Gygi, R.A. 1975. *Sparisoma viride*, a major sediment producer in coral reefs of Bermuda. *Ecoalgae Geol. Hely.* **68**: 327-359.

Juhl, R. and J. A. Suárez-Caabro. 1975. La pesca en Puerto Rico, 1970. Reporte TÇcnico. *Cont. Agrop. Pesq.* **3**(1): 1-32.

Matos, D. 1999. Comparison of size of capture using trap and diving of spiny lobster (*Panulirus argus*) in Puerto Rico, 1988-91. *Proc. Gulf Carib.Fish. Inst.* **45**.809-819.

Matos, 1992. Commercial fisheries statistics: Puerto Rico/StateFederal Cooperative Statistics Program. Department of Natural Resources Annual Report to the National MarineFisheries Service. Mayaguez. PR 55 pp. MS.

Matos, 1993. Commercial fisheries statistics: Interjuris-dictional Fisheries Program. Department of Natural Resources Annual Report to the National Marine Fisheries Service. Mayaguez. PR 64 pp. MS.

Matos, D. and Y. Sadovy. 1990. Overview of Puerto Rico Small-Scale Fisheries Statistics. Technical Report. CODREMAR **1**(4): 1-17.

Matos, D. and Y. Sadovy. 1991. Commercial fisheries statistics: PuertoRico/State Federal Cooperative Statistics Program. Department of Natural Resources Annual Report to the National Marine Fisheries Service. Mayaguez. PR 53 pp. MS.

Reeson, P. H. 1983. The biology, ecology and bionomics of the parrotfishes, Scaridae. Pages 166-177 *in* J. L. Munro ed. *Caribbean coral reef resources*. ICLARM.

Rosario, A. and Y. Sadovy. 1991. Trap mesh selectivity off thewest coast of Puerto Rico. Puerto Rico Department of Natural Resources. Mayaguez. PR 60 pp. MS.

Sokal, R. R. and F. J. Rohlf. 1981. *Biometry*. 2nd ed. W. H. Freeman and Co. San Francisco CA. 859 pp.

Suárez-Caabro, J. A. 1979. *El mar de Puerto Rico*. Primera edicion. Editorial Universitaria, San Juan PR 259 páginas.