PORTRAIT OF THE COMMERCIAL FISHERY OF THE RED HIND *Epinephelus guttatus* IN PUERTO RICO DURING 1992-99

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ABSTRACT

Puerto Rico' s fishery has shown symptoms of overfishing for the last fifteen years. Groupers (Serranidae) represented 4% of the total catch reported in Puerto Rico. The red hind, *Epinephelus guttatus*, is the grouper most reported in the landings of the commercial fishery and also is a very important component of the first class fish. *E. guttatus* is a protogynous hermaphrodite and forms spawning aggregations. This event occurs around the full moon of December, January and February. The spawning aggregation sites are well known by commercial fishermen, leading to a high exploitation rate of *E. guttatus*. This activity affected negatively the reproduction of this species.

Since 1995, three *E. guttatus* spawning aggregation sites off the west coast of Puerto Rico have been closed to all fishing activity. This paper analyze the landings, catch per unit effort (CPUE), and length frequency distributions during 1992-99 to evaluate the status of *E. guttatus*.

Key words: Commercial Fisheries, *Epinephelus guttatus*, Fishery Management

INTRODUCTION

Puerto Rico's fishery has been monitored through the Fisheries Statistics Project (FSP) uninterrupted since 1967. The FSP is a program of the Puerto Rico's Department of Natural and Environmental Resources (DNER). FSP is located at the DNER's Fisheries Research Laboratory (FRL). The objective of the FSP is to provide data to know the conditions of the fishery resources found in the Territorial Sea of the Commonwealth of Puerto Rico and contiguous Federal Fishery Conservation Zone waters. The scientific data obtained by the FSP helps to implant management plans to protect the fishery resources.

Groupers (Serranidae) are an important resource in the Puerto Rico's reef commercial and recreational fishery. Grouper species share a number of life history characteristics believed to render them particularly vulnerable to human exploitation (Manooch, 1987). Sadovy (in prep A) mentioned that groupers are carnivores, have a relatively long life span, large size of sexual maturation, slow growth, and appear to be relatively easy to catch, being susceptible to a wide range of sizes and types of fishing gear. Many exhibit a sexual pattern

incorporating adult sex change. Several western Atlantic grouper species are known to aggregate for spawning at specific times and locations. The exploitation of these resources during the aggregation making them very vulnerable. In Puerto Rico, some grouper species spawn in large numbers at well-defined times and locations each year.

Nine species of the genus *Epinephelus* and two species of the genus *Mycteroperca* had been reported in Puerto Rico's commercial fishery. The Nassau grouper (*Epinephelus striatus*) was reported as one of the most common grouper caught in Puerto Rico since 1900 (Everman, 1900). In 1970, *E. striatus* was reported as the fourth most commonly landed of all shallow water species in the Puerto Rico's commercial fishery (Suárez Caabro, 1970). This species was heavily fished during the period of spawning aggregations. Now the species is considered to be extinct for commercial fishery purposes (Sadovy, in prep B). During 1992-99, the FSP collected biostatatiscs data of approximately 75,000 fishes measured, less than 100 were *E. striatus* (Matos-Caraballo, 2000).

The red hind *Epinephelus guttatus*, has become the most important species of grouper taken commercially in Puerto Rico, following the decline of *E. striatus* (Matos-Caraballo and Sadovy, 1990; Sadovy, 1993; Matos-Caraballo, 1997)). Studies indicated that this species it is overfished (Appeldoorn, et. al., 1992; Sadovy and Figuerola, 1992; Rosario, 1996). The red hind is the grouper most reported species in the landings of the commercial fishery and also is a very important component of the first class fish. The red hind is a protogynous hermaphrodite and forms spawning aggregations. This event occurs around the full moon of December, January and February. The spawning aggregation sites are well known by commercial fishermen, leading to a high exploitation rate of red hind. This activity affected negatively the reproduction of this species.

Since 1995, three red hind spawning aggregation sites off the west coast of Puerto Rico have been closed to all fishing activity (Tourmaline Bank, Abrir la Sierra Bank and Bajo de Sico Bank). The Caribbean Fishery Management Council and the DNER worked together to enforce this action. To evaluate the status of red hind this paper analyze the landings, catch per unit effort (CPUE), and length frequency distributions during 1992-99. Also, data analysis to evaluate if the closed areas are improving this fishery resource in Puerto Rico.

METHODS

Commercial Landings

Commercial fishery landings data were collected weekly by four port agents and the principal investigator of the FSP. They collected the data from voluntarily fishermen, fish buyers and fishing associations from 42 coastal municipalities of Puerto Rico. Landing trip tickets were filled by fishermen. Thru the landing trip tickets system, fishermen reported the following information: fishing date, municipality where catch was landed, fishing center (municipality fishing area), name of fishermen, name of helper (if any), hours spent fishing, number of trips, species caught, weight in pounds of each species

caught, price per pound (U.S. Dollar), gear type and number of gears used. Confidentiality is maintained for individual fishermen or businesses that cooperate by providing data to the program. Fishes were usually landed in the round (not eviscerated).

Port agents delivered commercial landings data to the FRL. Data were then entered in MS-DOS PC using Microsoft FoxPro. Afterwards, data were revised, corrected and analyzed using Microsoft FoxPro and Microsoft Excel. Catch per unit effort of the red hind has been calculated using the landings data.

Biostatatistical Data

Four port agents and the principal investigator of the FSP visited randomly the 42 coastal municipalities of Puerto Rico to collect biostatistical data. They visited different fishing centers three days per week, and randomly selected commercial landings. If the fishermen voluntarily cooperated, the port agent proceeded to identify at the species level every individual of fish and lobster caught. Fish were measured in fork length (FL) in millimeters, and weighed in grams. FSP's personnel collected information for each sample about fishing area, fishing depth (fathoms), fishing effort (gear type, number of gear, time spent fishing) and total catch in pounds. They delivered biostatistical data to the FRL. Data were entered in MS-DOS PC using "Trip Interview Program (TIP)", a National Marine Fisheries Service (NMFS) software. Data were then revised, corrected and analyzed using Microsoft Excel. The data was divided by all Puerto Rico samples and west coast only. The last category is due to the fact of the closed areas to protect the red hind are in the west coast. This category includes the landings of the municipalities of Cabo Rojo, Mayagüez, Añasco, Rincón, Aguada and Aguadilla.

RESULTS

Commercial Landings

Due to market limitations the red hind is reported by fishermen mostly in the red hind category and grouper category. Figure 1 shows the reported landings in pounds during 1992-99 and the sum of red hind and grouper is the total landings reported for those categories. This Figure shows a decrease in landings reported for the red hind from 1992 (42,015 pounds reported) to 1994 (28,738 pounds reported). On the other hand, a trend to increase the landings of red hind during 1995 (42,383 pounds) to 1999 (66,065 pounds).

To observe how the closed areas for the protection of the red hind have affected the resource it was compared the landings reported of the red hind for the all Puerto Rico and for the west coast only (Figure 2). In this figure it is observed that the west coast shows a drastic decrease the landings from the year 1993 (21,620 pounds) to 1994 (11,312 pounds). The landings reported continued a similar for years 1995-97. An increase trend was observed for years 1998 (22,903 pounds) and 1999 (26,441 pounds). Another similar trend is observed for the all Puerto Rico sample of this species.

Catch per unit effort has been estimated in the red hind average pounds

reported per trip. Figure 3 shows small differences among years 1992-99 in the CPUE for the all Puerto Rico's red hind. On the other hand, for the west coast sample the CPUE shows an increase for years 1996-99. Another interesting fact observed in this figure is that the west coast sample caught higher average pounds landed per trip than the all Puerto Rico.

Biostatistical Data

Average FL for red hind from years 1992-99, for all Puerto Rico and for the west coast only is shown in Figure 4. This figure shows that the average length for both categories ranged from 269mm to 330 mm FL. For the years 1997, 1998 and 1999 both categories show a trend to increase the average reaching the peak of each category (330mm for the all Puerto Rico and 319 for west coast only).

Length frequency distribution (LFD) for red hind for all Puerto Rico (Figure 5) and for the west coast only (Figure 6) during 1992-95, show that the peak of the frequencies occurred between 280-320 mm. LFD for red hind for all Puerto Rico (Figure 7) and for the west coast only (Figure 8) during 1996-99, shows that the peak of the frequencies occurred very similar to the 1992-95 (among 270-320 mm). The average FL of the red hind for the all Puerto Rico for the years 1992-95, was 305 mm. The average for the individuals caught during 1996-99 was 320 mm. Although it was observed a tendency to catch larger individuals during 1996-99, the t-Test Two Sample Assuming Unequal Variances shows no significant difference between 1992-95 and 1996-99 ($t = 8.49$ and $p = 1.65$, alpha 0.05).

On the other hand the average FL of the red hind for the west coast only for the years 1992-95, was 301 mm. This average for the individuals caught for 1996-99 was 314 mm. The t-Test Two Sample Assuming Unequal Variances shows a significant difference between 1992-95 and 1996-99 ($t = -4.00$ and $p = 2.3$, alpha 0.01).

DISCUSSION

Commercial Landings

The FSP landings data collected from 1992-99, indicates that more landings of the red hind were reported in Puerto Rico for years 1998 and 1999. The west coast CPUE shows an increasing trend in the average pounds landed/trip. Some commercial fishers of the west coast mentioned to the author that they noted that the size of the red hinds are larger after the closing of the spawning areas. The mentioned tendencies probably are a result of the management action. It is necessary to continue the collection of the data in the future years to observe if this trend continues.

Biostatistical Data

Results of LFD of the red hind indicate that the individuals of this species were bigger for the years 1996-99 (average FL of 320mm) than for

1992-95 (average FL of 304mm). The statistical analysis confirmed this fact for the west coast during 1996-99. Probably this fact is also linked with the three closed areas in the west coast. Again this data collection must be realized for the following years to observe if this trends will continue.

CONCLUSION

The red hind fishery resource of Puerto Rico seems to be improving for the years 1996-99. The three spawning aggregations closed areas for this species in the west coast of Puerto Rico. are helping to stop the decline of this resource. However, more studies are necessary in the near future to see if this trend will continue. If this trend continues, the DNER must consider the action to close other areas in the east or south coast of Puerto Rico to help this important resource.

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LIST OF FIGURES

FIGURE 1. LANDINGS REPORTED (POUNDS) OF RED HIND AND GROUPER CATEGORY IN PUERTO RICO DURING 1992-99.

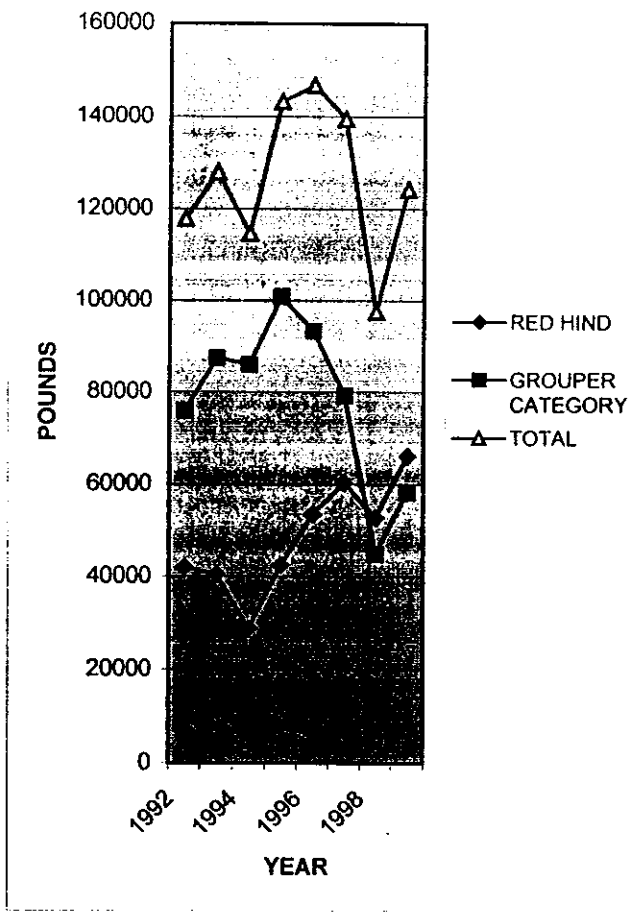

FIGURE 2. LANDINGS REPORTED (POUNDS) OF RED HIND FOR ALL PUERTO RICO AND FOR THE WEST COAST ONLY DURING 1992-99.

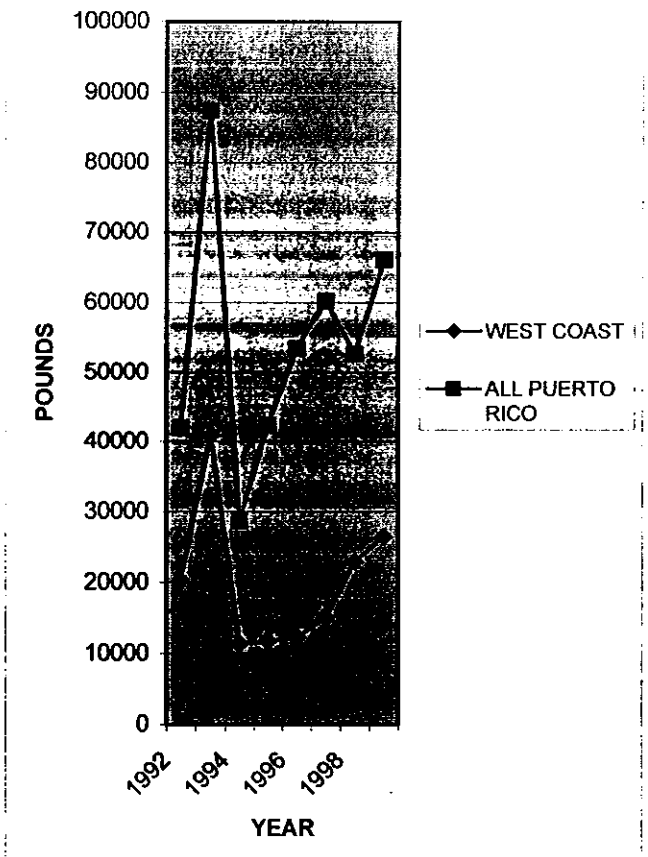

FIGURE 3. CATCH PER UNIT EFFORT (AVERAGE POUNDS/TRIP) OF RED HIND FOR ALL PUERTO RICO AND WEST COAST ONLY DURING 1992-99.

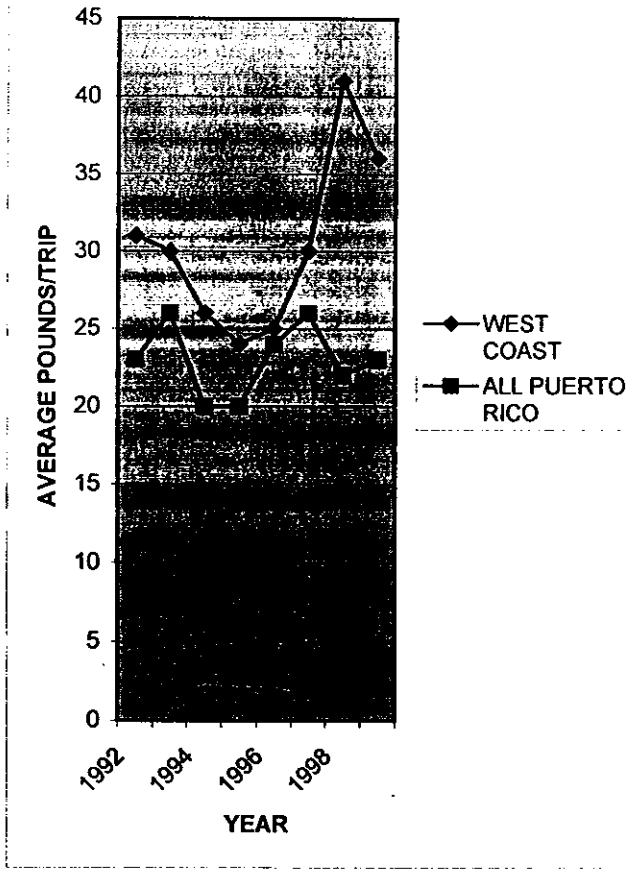

FIGURE 4. RED HIND AVERAGE FORK LENGTH FOR ALL PUERTO RICO'S SAMPLES AND FOR PUERTO RICO'S WEST COAST DURING 1992-99.

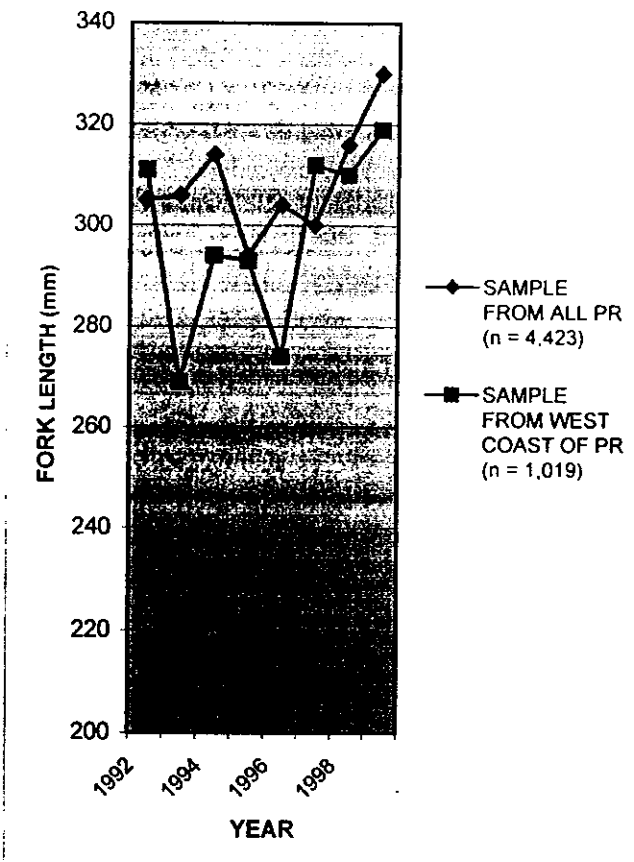

FIGURE 5. LENGTH FREQUENCY DISTRIBUTION OF RED HIND IN ALL PUERTO RICO DURING 1992-95 (n = 2,463).

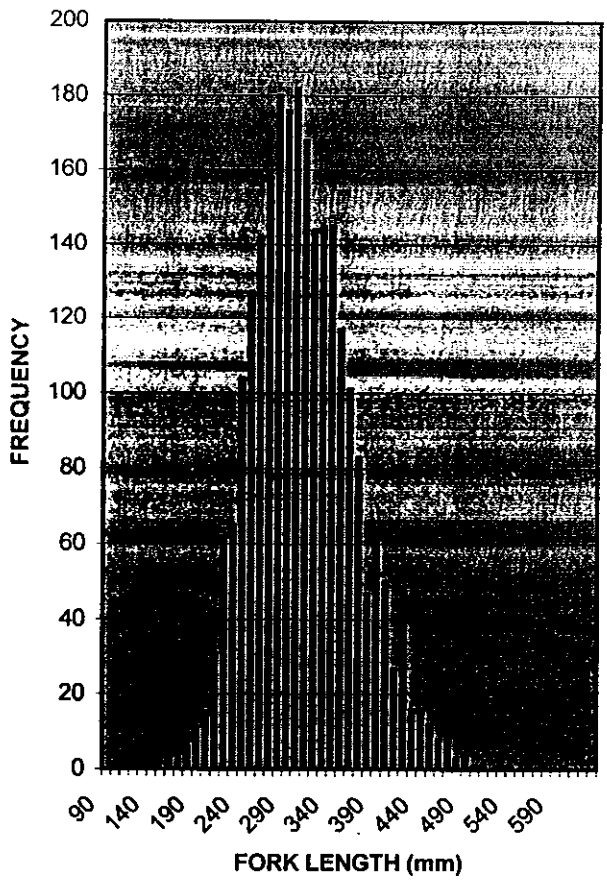

FIGURE 6. LENGRH FREQUENCY DISTRIBUTION OF THE RED HIND IN THE WEST COAST OF PUERTO RICO DURING 1992-95 (n = 336).

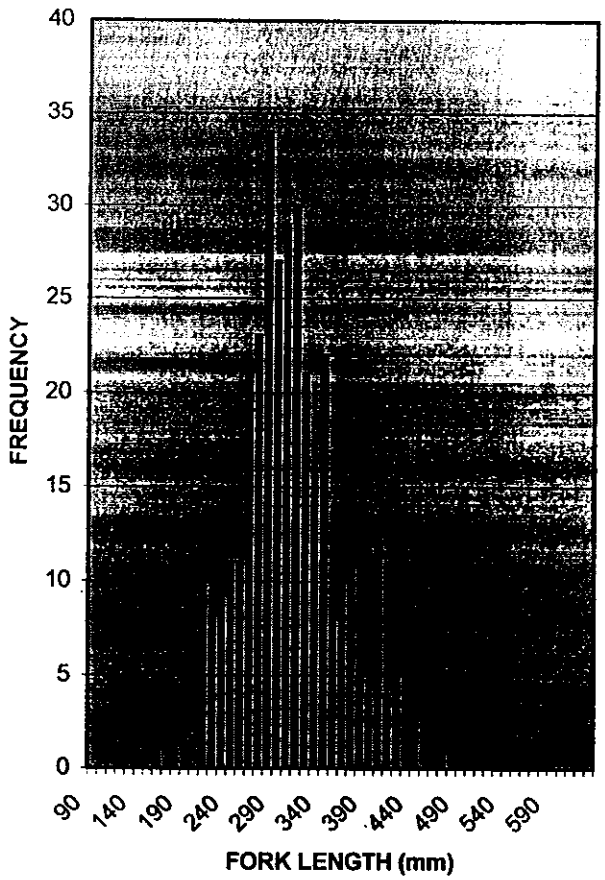

FIGURE 7. LENGTH FREQUENCY DISTRIBUTION OF RED HIND IN ALL PUERTO RICO DURING 1996-99 (n = 1,960).

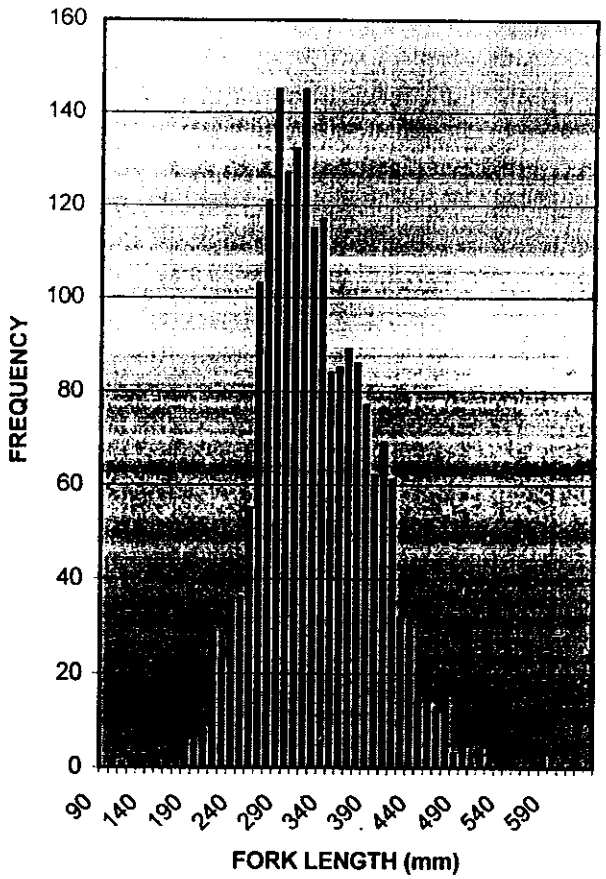

FIGURE 8. LENGTH FREQUENCY DISTRIBUTION OF RED HIND IN THE WEST COAST OF PUERTO RICO DURING 1996-99 (n = 683).