

# Status of the Groupers in Puerto Rico, 1970 – 1995

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## ABSTRACT

The Fisheries Statistics Project (FSP) has been monitoring Puerto Rico's fisheries uninterrupted since 1967. 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 the contiguous waters of the federal fishery conservation zone. When it is necessary, the scientific data will help to implement management plans to protect the fishery resources.

Groupers (Serranidae) are an important resource in Puerto Rico's reef fishery. Several western Atlantic grouper species are known to aggregate for spawning at specific time and locations. The exploitation of these resources during spawning aggregations makes them very vulnerable. Some of these aggregations are known from Puerto Rican waters and have been heavily fished. Fishermen thus easily find many of these spawning aggregations in both time and space, resulting in heavy exploitation.

Statistical data shows that during the 1970s landings of fish and shellfish increased gradually from 4.5 millions of pounds in 1970 to 7.2 millions of pounds in 1979. Groupers represented approximately 12% of the total landings reported, and Nassau grouper (*Epinephelus striatus*) was the species most landed during that period. On the other hand, statistical data during the 1980s shows a gradual decrease of landings. Total landings of fish and shellfish declined from 6.7 million pounds in 1980 to 2.3 million pounds in 1989. Groupers were approximately 8% of the total landings reported during that period. The red hind (*Epinephelus guttatus*) was the grouper species most landed during this period. Total landings of fish and shellfish increased from 2.05 million pounds in 1990 to 3.7 million pounds in 1995. Groupers were approximately 6% of the total landings reported during that period, with the red hind as the grouper species most landed. The Nassau grouper has been scarcely reported since 1990. The tiger grouper (*Mycteroperca tigris*) has been heavily fished during spawning aggregations in waters adjacent to the municipality of Vieques.

The Fisheries Statistics Project continues to collect data about the grouper fishery in Puerto Rico, and landings data and length frequency analysis are discussed. The grouper fishery resources of Puerto Rico are in decline but not exhausted. Effective management plans to protect the grouper fishery of Puerto Rico should be implemented immediately.

KEY WORDS: *Epinephelus*, *Mycteroperca*, groupers, serranidae

## INTRODUCTION

Puerto Rico's fishery has been monitored through the Fisheries Statistics Project (FSP) since 1967. The objective of the FSP is to provide data regarding the fishery resources in the territorial sea of the commonwealth of Puerto Rico and contiguous federal fishery conservation zone waters. This statistical information is used to promulgate management plans to protect fishery resources. Groupers (Serranidae) are an important resource in Puerto Rico's commercial and recreational fishery, but unfortunately, they share many life history characteristics that render them particularly vulnerable to human exploitation (Manooch, 1987). Sadovy (1994) reported that groupers are carnivores, have a relatively long life span, attain a large size at sexual maturation, and exhibit slow growth. Also, they 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 make them very vulnerable. This also is true in Puerto Rico, where grouper spawning aggregations are heavily exploited.

Nine species of the genus *Epinephelus*, and two species of *Mycteroperca*, are reported in Puerto Rico's commercial fishery. The Nassau grouper (*Epinephelus striatus*) has been 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 shallow water species in Puerto Rico's commercial fishery (Suárez Caabro, 1970). Now, this species is considered extinct for commercial fishery purposes (Sadovy, 1997). During 1986 – 1990, the FSP collected biostatistical data on approximately 100,000 fishes; only 236 were *E. striatus*.

Following the decline of *E. striatus*, the red hind, *Epinephelus guttatus*, has become the most important species of grouper taken commercially in Puerto Rico (Matos and Sadovy, 1990; Sadovy, 1993). Studies indicate that this species is over-fished (Appeldoorn, *et al.*, 1992; Sadovy and Figuerola, 1992; Rosario, 1996).

The coney, *Cephalopholis fulva*, is the second most important grouper species in Puerto Rico (Matos-Caraballo, 1995; Rosario, 1996). Appeldoorn, *et al.* (1992), reported that a decline in large specimens of *C. fulva* has occurred in Saint Croix, U.S.V.I. Rosario (1996), suggests that there are many factors indicating a rapid decline in *C. fulva* population in Puerto Rico.

Matos and Padilla (in press) reported that in 1984 a local diver from Vieques discovered a tiger grouper (*Mycteroperca tigris*) spawning aggregation site. In 1988, Vieques commercial fishermen reported the aggregation to government officials. The aggregation period occurs near to the religious

tradition of Easter, when fish are heavily consumed. This increased demand may be one reason for the high exploitation of this species during its aggregation, with a good market for sale in Puerto Rico. In 1992, Sadovy *et. al.* (1992), described the biological aspects of the aggregation. During 1993 and 1994, personnel of the Department of Natural and Environmental Resources (DNER) tried to monitor the aggregations, but obtained scarce information. Finally, in 1995 and 1996, monitoring of the aggregation was undertaken obtaining significant data. The objective of this paper is to review the landings data collected by FSP, for the groupers from 1971 – 1995.

## METHODS

### Commercial Landings

Commercial fishery landings data were collected weekly by five port agents of the FRL. They collected the data voluntarily from fishers, fish buyers and fishing associations from around the forty-two coastal municipalities of Puerto Rico. Landing trip tickets were filled by fishers and include the following information: fishing dates, the municipality where catch was landed, fishing center (municipality fishing area), names of fishers, names of helpers (if any), hours spent fishing, number of trips, species caught and weight (in pounds), price per pound (U.S. Dollar), gear type and number of gears used. Confidentiality was maintained for all those that provided data to the program. Fish, as well as lobsters, oysters and octopus, are usually landed not eviscerated, with the exception of deep water snappers and large groupers. Conch weights included meat only. Port agents delivered commercial landings data to the FRL. Data was then entered in IBM PC format using DBASEIII+. Subsequently, data were revised, corrected, and analyzed using MicrosoftFoxPro, Lotus 123 and Microsoft Excel.

### Biostatistical Data

Port agents randomly visited the forty-two coastal municipalities of Puerto Rico to collect biostatistical data. During four days per week they visited different fishing centers and randomly selected commercial landings. With the fishers voluntarily cooperation, the port agents identified every individual caught at the species level. They measured (FL in mm) and weighed (g) every fish. Additionally, port agents collected information about fishing area, depth (fathoms), and effort (gear type, number of gear, fishing period) as well as total catch in pounds.

Port agents delivered biostatistical data to the FRL. Data were entered in IBM PC format using "Trip Interview Program (TIP)", a National Marine Fisheries Service software. Data were then revised, corrected using Residual Plot Method and analyzed using Lotus 123 and Microsoft Excel.

## RESULTS

### Commercial landings

The total commercial landings reported in Puerto Rico between 1971 and 1995 increased from 4.9 million pounds in 1971, to 7.2 million pounds in 1979 (Figure 1). During the 1980s, the total landings decreased from 6.7 million pounds in 1980, to 2.3 million pounds in 1989 (Figure 1). Total landings reported from 1990 - 1995 stabilized around 2.1 - 3.7 million pounds. In contrast, the number of active commercial fishers showed little variation between 1971 and 1995 (1,300 to 1,700; FSP census data), it is considered a symptom of overfishing (Matos-Caraballo, in prep A). The total landings of groupers showed a similar pattern. There is an increasing trend during the 1970s, with 425,000 pounds in 1971 and 985,000 pounds in 1979 (Figure 2). During the 1980s, a decreased trend is observed, 730,000 pounds in 1980 declining to 130,000 pounds in 1989 (Figure 2). Between 1990 and 1995, the total landings of groupers were stabilized around 120,000 pounds (Figure 2).

During the 1970s, groupers represented between 11% (1971) and 16% (1979) of the total reported landings. This percentage decreased during the 1980s, from 13% in 1980 to 6% in 1989. During the 1990s, the percentage of groupers reported was stabilized around 4% - 6%.

The west coast, the most productive area in fish and shellfish according to landings reported (Suárez-Caabro, 1970; Matos-Caraballo, in prep A), showed the same pattern observed for total catch and total groupers (Figure 3). The two most landed groupers in Puerto Rico during 1990 and 1995 were *Epinephelus guttatus* and *Cephalopholis fulva*. *Mycteroperca tigris* is heavily fished during its spawning aggregation in the municipality of Vieques Island (around the full moons of February and March). For groupers in general, bottom lines and fish traps caught the 52% and 19%, respectively, of the total reported landings. Catch per unit effort (CPUE for all groupers, and for *E. guttatus* and *C. fulva* were constant during this period (Table 1).

**Proceedings of the 49th Gulf and Caribbean Fisheries Institute**

**Table 1.** Catch per unit effort for the most common groupers in Puerto Rico, 1992 - 1995.

<b>Species</b>	<b>Year</b>	<b>Number</b>	<b>Landings (lb/trip)</b>	<b>Standard Deviation</b>
<b><i>Cephalopholis fulva</i></b>	1992	113	14	18
	1993	122	26	12
	1994	118	15	19
	1995	233	10	9
<b><i>Epinephelus guttatus</i></b>	1992	389	23	36
	1993	480	26	42
	1994	808	20	22
	1995	1192	20	35
<b>G r o u p e r s C a t e g o r y</b>	1992	698	26	44
	1993	1023	27	97
	1994	1069	38	122
	1995	1613	39	134

**Biostatistical data**

Length frequency distribution (LFD) for *Epinephelus guttatus* (in 1985 and 1995 resulted in a mean of 338 mm FL ( N = 741; S.D. = 207) and 292 mm FL (N = 434; S.D. = 58), respectively. A 11% of the individuals sampled in 1994 were below 275 mm FL, the size at which 50% of the females mature (Sadovy *et al.*, 1994). Similar results were observed in 1995 (Figure 4).

Length frequency distribution for *Cephalopholis fulva* in 1985 and 1995 resulted in a mean of 209 mm FL (N = 601; S.D. = 222) and 236 mm FL (N = 218; S.D. = 37), respectively. No length frequency data for *Mycteroperca tigris* was available before 1995. Most of the males caught in 1995 ranged between 460 mm and 610 mm FL, with a mean of 518 mm FL (N = 773; S.D. = 51) (Figure 5). The mean fork length in 1996 was 520 mm ( N = 583; S.D. = 48). Most of the females caught in 1995 ranged between 400 mm and 500 mm FL, with a mean of 446 mm FL (N = 183; S.D. = 46) (Figure 6). The mean fork length in 1996 was 424 mm (N = 151; S.D. = 50).

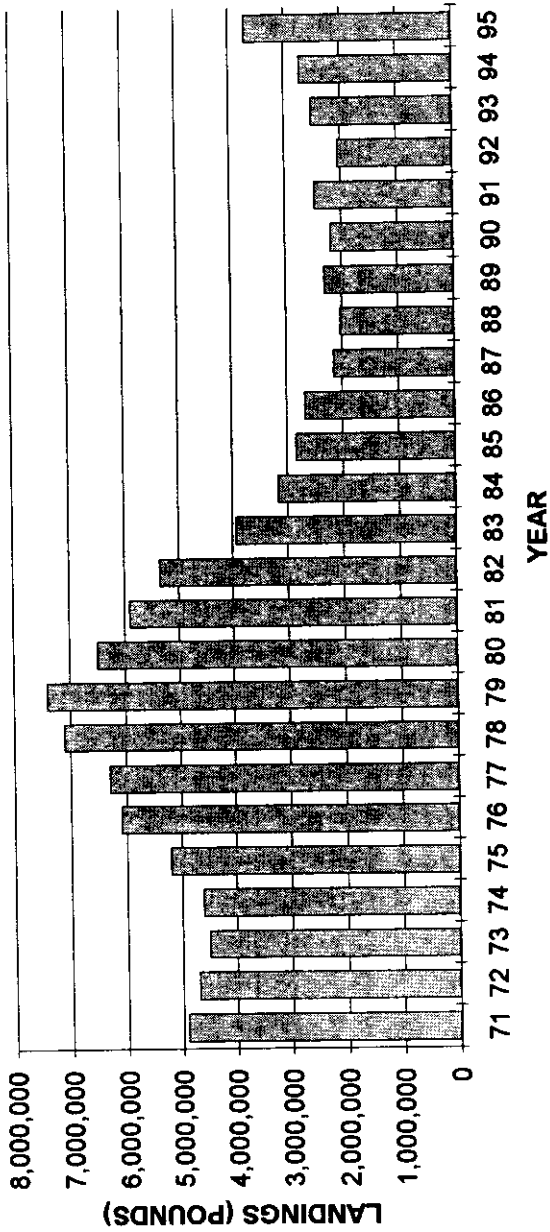


Figure 1. Total landings of fish and shellfish reported in Puerto Rico during 1971 - 1995.

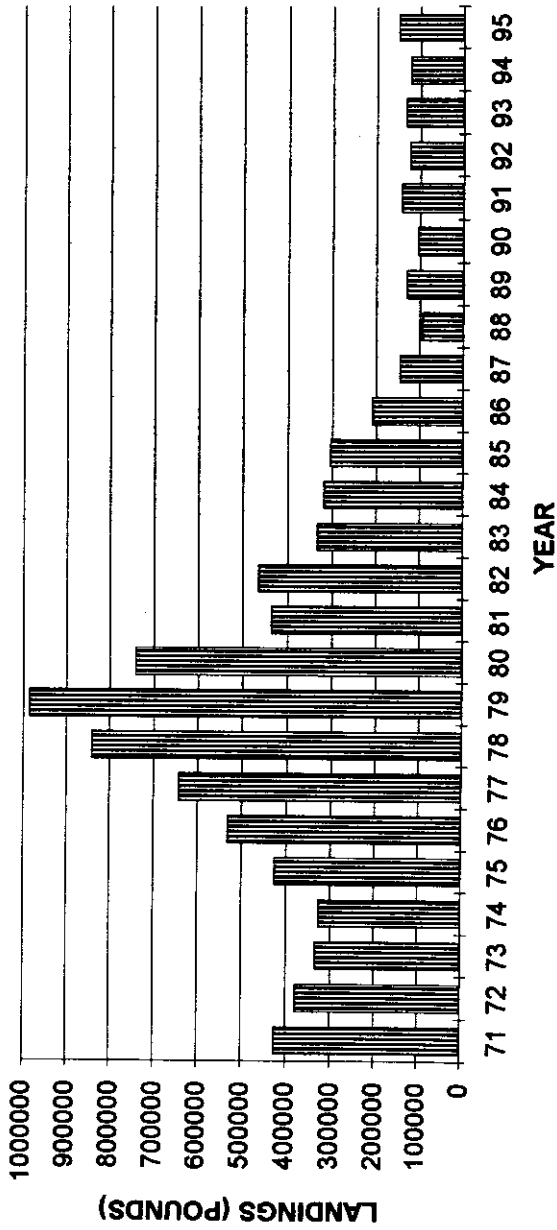


Figure 2. Total landings of groupers reported in Puerto Rico during 1971 - 1995.

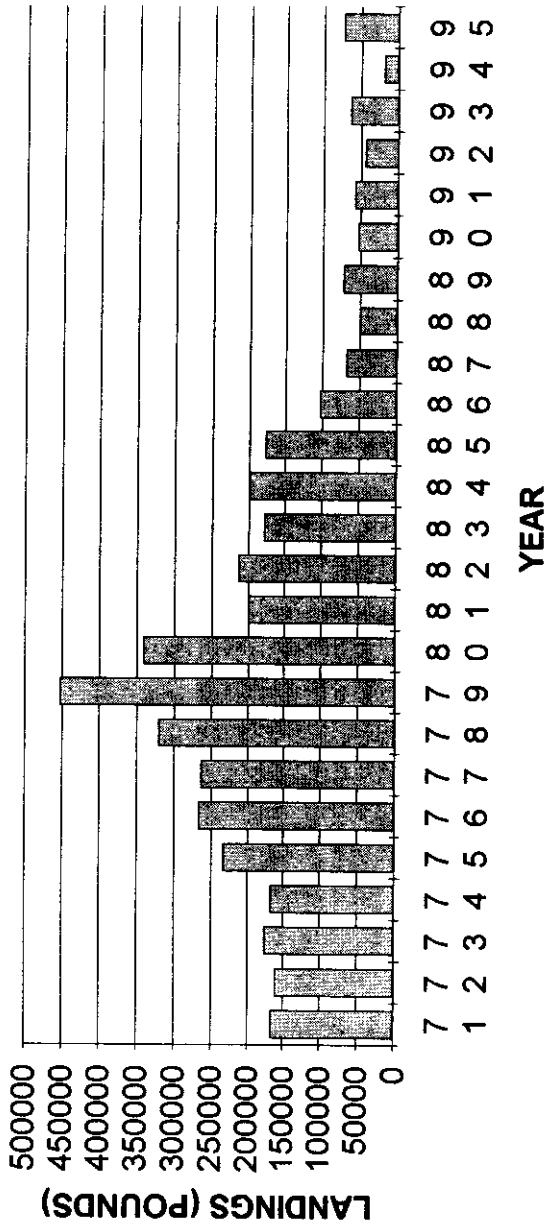
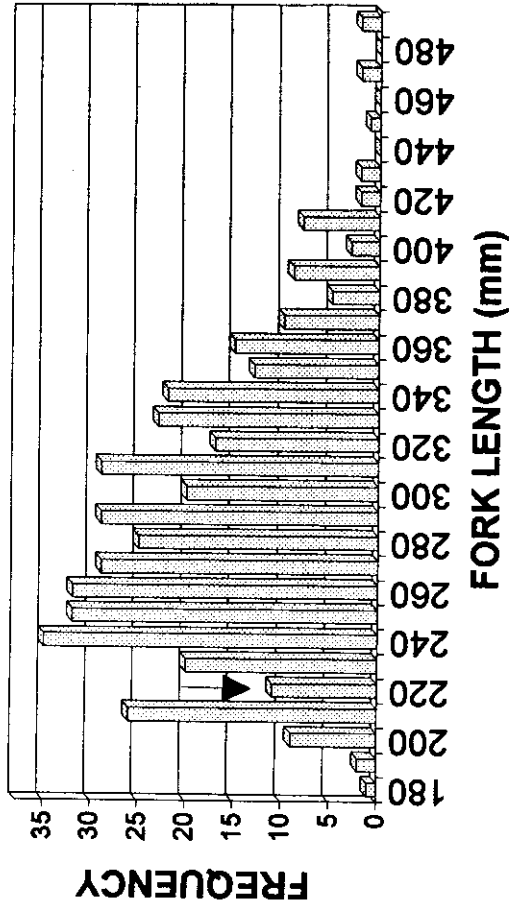
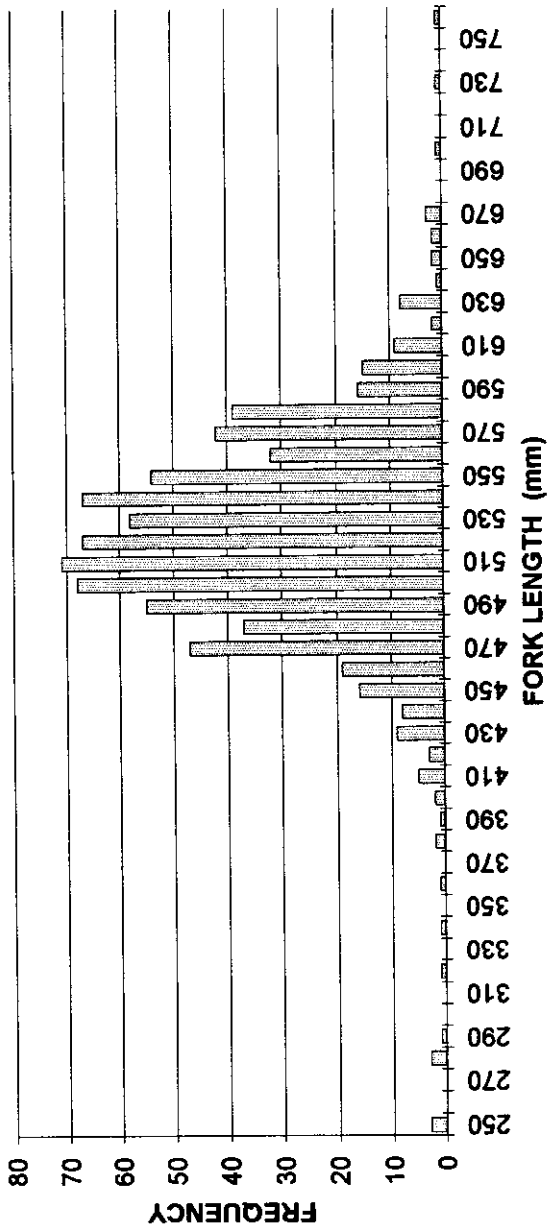


Figure 3. Total landings of groupers reported in the west coast of Puerto Rico during 1971 - 1995.





**Figure 4.** Length frequency distribution of *Epinephelus guttatus* sampled in Puerto Rico's commercial fishery during 1995 (N = 434).



**Figure 5.** Length frequency distribution of *Mycteroperca tigris* males, sampled in Vieques, Puerto Rico, during the aggregations of February and March, 1995.

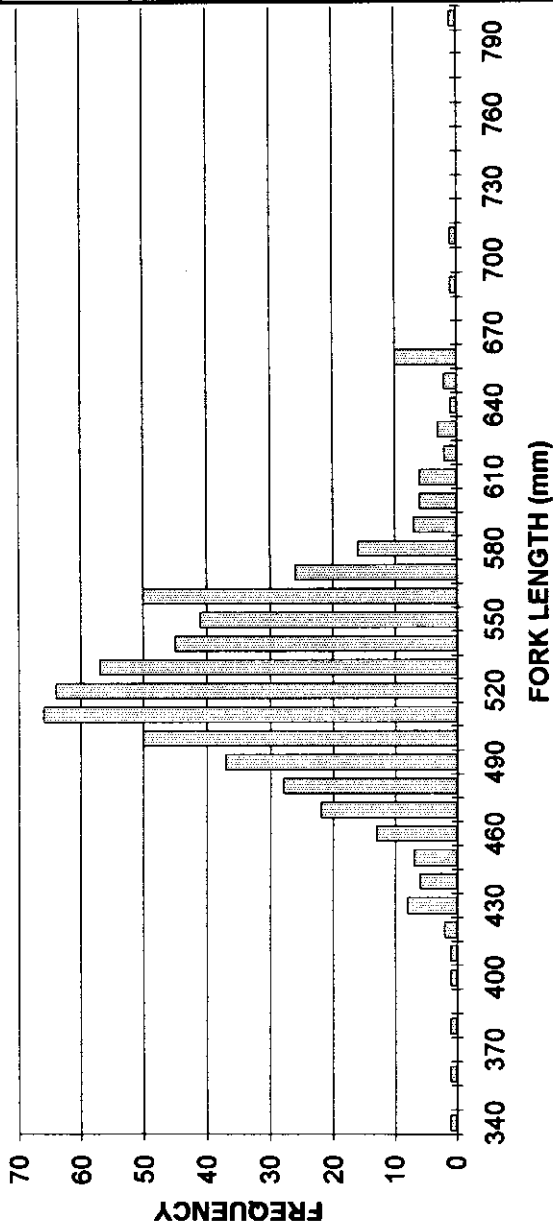


Figure 6. Length frequency distribution of *Mycteroperca tigris* females, sampled in Vieques, Puerto Rico, during the aggregations of February and March, 1995 (N = 183).

## DISCUSSION

### Commercial landings

Landings data collected between 1971 and 1995, indicated that fishery resources in Puerto Rico have been overfished. The percentage of groupers landed has decreased from 16% to 6% during this period, while other reef fish species increased their percentages. For example, parrotfishes and squirrelfishes, species that during the 1970s and 1980s commanded a very low price, now are selling at higher prices. Also, the percentages of their landings has increased (Matos-Caraballo, in press A). Independent data from the Fisheries Research Laboratory confirm the decrease in grouper landings Rosario (1996). The status of the grouper fishery obligates the fisher to use more bottom lines, gill nets and trammel nets (Matos-Caraballo, in press A).

It was observed that a decrease of 5,280 pounds in the landings of *Mycteroperca tigris* occurred during the spawning aggregations of 1995 and 1996. In 1996 sexual aggregations of *M. tigris* were landed 5,280 pounds less than in 1995. FSP personnel mentioned that rough weather during the aggregation of 1996 might have had an effect of fishing activities. On the other hand, it could be symptomatic of overfishing. Collecting more data before reach any conclusion is necessary.

### Biostatistical data

Length frequency data for *Epinephelus guttatus* and *Cephalopholis fulva* between 1985 and 1995 indicated symptoms of overfishing. Biostatistical samples collected between 1988 and 1990 showed that 30% of *E. guttatus* were caught below the minimum maturation size (Matos, 1997). Sadovy (1993) reported that heavy fishing pressure on the *E. guttatus* aggregations diminish the reproductive success, probably causing a poor recruitment into the population over the last few years. In 1993, a federal regulation to protect one *E. guttatus* aggregation area was put into effect off the west coast of Puerto Rico. This area will be closed to all fishing pressure from December 1 – March 30 of each year.

Although *Cephalopholis fulva* is not reported to aggregate, Rosario (1996) mentioned that this species spawn close to the *Epinephelus guttatus* aggregation areas. The mean size of *C. fulva* from 1985 was smaller than in 1995. Appeldoorn *et al.* (1992), mentioned that this increase resulted primarily from poor recruitment and the absence of small individuals, coupled with the relative abundance of now large individuals from earlier dominant year classes. The biostatistical data collected on the aggregations of *M. tigris* in 1995, and 1996, showed no significant changes. Collecting more data in the following years is necessary.

### CONCLUSION

Groupers landing data and length frequency analysis discussed in this paper suggest that grouper resources in Puerto Rico are declining. Overfishing of these resources was discussed by Sadovy (1994), Rosario (1996) and Matos (in press). Fishery resources should be protected through effective management plans as soon as possible. The federal government protect some *Epinephelus guttatus* aggregation areas along the west coast of Puerto Rico, and the government of Puerto Rico has initiated studies to develop marine reserves. If government conduct these efforts properly, it will help to improve the status of the groupers in Puerto Rico.

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