



Portrait of the Fishery of Mutton Snapper *Lutjanus analis* 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 over fishing symptoms (e.g. decrease in landings pounds, changes in catch composition, decrease in the size of some important species).

Snappers (Lutjanidae) are the most important fish family in the Puerto Rico's fishery market, in pounds landed and prices. Many snappers are red color that is preferred by local customers. Mutton snapper (*Lutjanus analis*) has a red color and is often sold as deep water snapper (silk snapper *Lutjanus vivanus*). The mutton snapper is found in the western Atlantic Ocean from Massachusetts to Brazil, but is most common in the tropical waters of the Caribbean Sea. Mutton snapper's spawning aggregations exhibits site fidelity and are related to the full moon phase of the month of February. In Puerto Rico, commercial fishers reported that mutton snapper aggregation occurs in many places around the island near the full moon of April, May and June. That characteristic in the life history of the mutton snapper makes this species particularly vulnerable to human exploitation, resulting the declining of this population. Main methods to catch this mutton snapper in Puerto Rico are bottom lines, fish traps and SCUBA divers.

The objective of this study is to describe the fishery of mutton snapper 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, beach seine, bottom line and SCUBA divers will be analyzed.

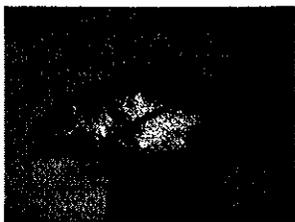
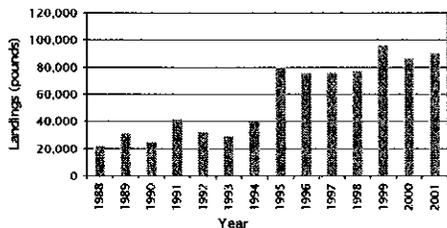
METHODS

- 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.

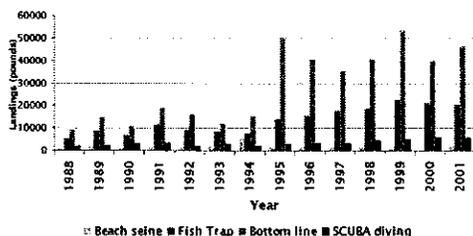
CONCLUSIONS

- Commercial fishers informs that spawning aggregations had been exploited since 1980's, also they mentioned that the harvest of this activity have decreased.
- The CPUE (Catch per unit effort) data show high fishing pressure for bottom line, fish trap and SCUBA divers.
- Bigger individuals were caught by bottom line and during 1995-2001. Fish trap, beach seine and SCUBA divers caught smaller individuals.
- Males of mutton snapper reach sexual maturity at 330mm FL and females at 414mm FL, no sex was determined in this study, 42% of them did not reach the 330mm FL.
- Percent of individuals by gear before reaching sexual maturity:
 - Bottom line 19%
 - SCUBA divers 26%
 - Fish Traps 54%
 - Beach Seine 90%
- The DNER fishing regulations create a closed season during April 1- May 31 of every year when occurs the first two spawning aggregations. The last spawning in June will be opened for fishers.
- The DNER will prohibit the use of the beach seine beginning in 2007, this gear is responsible for mortality of juveniles.
- This is another symptom of the P.R.'s over exploited resource, this study shows the urgent need of the mentioned fishing regulations to help improve the mutton snapper population.

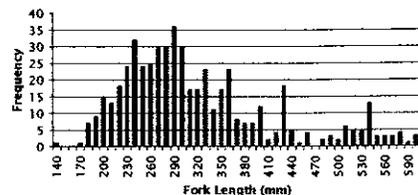
Landings reported of mutton snapper in Puerto Rico during 1988-2001



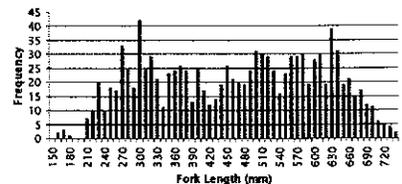
Landings reported of mutton snapper by beach seine, fish trap, bottom line and SCUBA diving in Puerto Rico during 1988-2001.



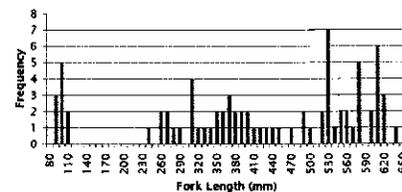
Length frequency distribution for Mutton Snapper caught by Fish Trap in Puerto Rico during 1998-2001. (n=539)



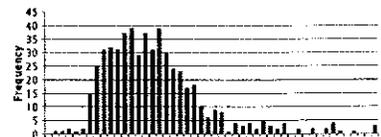
Length frequency distribution for Mutton Snapper caught by Bottom line in Puerto Rico during 1988-2001. (n=1,122)



Length frequency distribution for Mutton Snapper caught by SCUBA divers in Puerto Rico during 1988-2001. (n=83)



Length frequency distribution for Mutton Snapper caught by Beach Seine in Puerto Rico during 1988-2001. (n=543)



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The objective of this study is to describe the fishery of mutton snapper 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, beach seine, bottom line and SCUBA divers will be analyzed.

Key words: Fisheries Statistics, Mutton Snapper, Puerto Rico

RESUMEN

El Departamento de Recursos Naturales y Ambientales de Puerto Rico (DRNA) es el responsable de conservar y administrar todos los recursos naturales de la Isla, incluyendo los recursos pesqueros. El Programa de Estadísticas Pesqueras Comerciales del DRNA se encarga de recolectar y analizar los datos dependientes de la pesca comercial. El PEP ha estado recolectando datos desde 1971. Estos datos muestran que durante la década de 1980, la pesca comercial en Puerto Rico mostraba indicios de sobre pesca (Ej. disminución en las libras desembarcadas, cambios en la composición de la captura, disminución en el tamaño de especies importantes).

Los pargos (*Lutjanidae*) son la familia más importante en el mercado pesquero de Puerto Rico, en libras desembarcadas y precios. Muchos pargos son de color rojo, que es el preferido por los consumidores locales. La sama (*Lutjanus analis*) es de color rojo y a menudo es vendida como pargo de aguas profundas (chillo, *Lutjanus vivanus*). La sama se encuentra en el Océano Atlántico Occidental desde Massachusetts hasta Brasil, pero es más común en las aguas tropicales del Mar Caribe. Las agregaciones de apareo de la sama exhiben fidelidad de ocurrir en los mismos lugares y están relacionadas con la fase de la luna llena en el mes de febrero. En Puerto Rico, los pescadores comerciales han reportado que las agregaciones de la sama ocurren en muchos lugares alrededor de la Isla al acercarse la luna llena de abril, mayo y junio. Esta característica en la historia de vida de la sama hace que esta especie sea particularmente vulnerable a la explotación por el ser humano, resultando en la disminución de esta población. Los métodos principales para capturar la sama en Puerto Rico son líneas, nasas y buceo.

El objetivo de este estudio es describir la pesquería de la sama utilizando los datos recolectados por el PEP (desembarcos y datos bioestadísticos) durante 1988-2001. Se analizó la distribución de frecuencia de tallas de esta especie por año y método de captura (nasas, chinchorro de arrastre, línea y buceo).

Palabras Claves: Estadísticas Pesqueras, Puerto Rico, Sama

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, changes in catch composition, decrease in the size of some important species). Species considered in the market as trash during the 1970's, today are considered a second class market species (Matos-Caraballo, in press a and b).

Seepargos (*Lutjanidae*) are the most important fish family in the Puerto

local customers. Mutton snapper (*Lutjanus analis*) has a red color and is often sold as deep water snapper (silk snapper *Lutjanus vivanus*). The mutton snapper is found in the western Atlantic Ocean from Massachusetts to Brazil, but is most common in the tropical waters of the Caribbean Sea (Allen, 1985). In Bermuda this species had been introduced (Randall, 1996). Large adults are found in or near offshore reef and rock rubble habitats, and around coral reefs, while the juveniles live in inshore areas as mangrove and marine grass bottom (Allen, 1985). The mutton snapper has an average length of 500mm, although has maximum length of 900mm, reaching a maximum age of 14 years (Allen, 1985). The mutton snapper form large, transient spawning aggregations. It has been reported that in the northeastern Caribbean, these spawning aggregations exhibits site fidelity and are related to the full moon phase of the month of February. However in other eastern and southeastern Caribbean the spawning aggregations have been reported during the summer (Allen, 1985). In Puerto Rico, commercial fishers reported that mutton snapper aggregation occur in many places around the island near the full moon of April, May and June. That characteristic in the life history of the mutton snapper make this species particularly vulnerable to human exploitation (Mannoch, 1987). Allen (1985) also mentioned that because of high fishing pressure on the mutton snapper spawning aggregation the population has been declining. Main methods to catch this mutton snapper in Puerto Rico are bottom lines, fish traps, SCUBA divers and beach seine.

The objective of this study is to describe the fishery of mutton snapper 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, beach seine, bottom line and SCUBA divers.

METHODS

This report will discuss the mutton snapper 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 trip ticket system.

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 fish's fork length (FL) in mm. If it is possible the whole catch was individually measured. 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 was recorded.

Port samplers delivered the landings and biostatistics data to CFSP and statistical clerks edited and entered 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, beach seine, bottom line and SCUBA divers. LFD for both species by years and by gears were analyzed. Kolmogorov-Smirnov Two Sample Test, $P \leq 0.05$ (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 807,363 pounds of mutton snappers were reported to the CFSP during 1988-2001 (Figure 1). During late 1980's started the process to educate commercial fishers to reports the mutton snapper, because before this species was reported as snappers. However, it is known by the CFSP' personnel that a significant percentage of the pounds reported as first class were also mutton snapper. For this paper only the mutton snapper data were used. Since 1988-94, mutton snapper reported represented 1.4% of the total pounds reported of fish and shellfish. Since 1995-2001, mutton snapper reported represented a total of 2.4% of the total pounds reported of fish and shellfish. During 1988-2001, mutton snapper reported represented a 2.0% of fishes and shellfish. For this period the mutton snapper were in the first 15 categories of fish and shellfish landed reported.

Figure 2 shows the trend of landings reported by beach seine, fish trap, bottom line and SCUBA divers during 1988-2001. Landings reported by the mentioned gears show that fish traps caught 28.3% of the 807,363 pounds of mutton snapper reported during 1988-2001. For the same time period bottom lines caught 60.4%, beach seine caught 3.6% and SCUBA divers caught 7.6% of the total landed pounds of mutton snapper reported. Figure 2 shows that reported landings increased for fish trap, bottom line and SCUBA divers for years 1995-2001. On the other hand, beach seine shows a decreased in landings reported during 1995-2001.

Biostatistics data show that from 1988-2001, a total of 2,308 individuals of mutton snappers were measured by CFSP's port samplers. Mutton snappers measured during 1988-94, had a FL mean of 381mm (Figure 3) and during 1995-2001 was 396.5mm (Figure 4). Kolmogorov-Smirnov Test shows a significant difference in the LFD among both periods of time ($D_{max} = 0.0602$).

The mean FL for mutton snapper caught by fish traps during 1988-2001 was 324mm (Figure 5). For the same time period mutton snapper caught by bottom line had a mean FL of 464mm (Figure 6). SCUBA divers for the same period had a FL mean of 480mm (Figure 7) and beach seine had a FL mean of 282mm (Figure 8). Kolmogorov-Smirnov Test shows a significant difference in the mutton snapper LFD among beach seine and fish trap ($D_{max} = 0.0822$). Also the same test shown a significant difference among LFD of fish trap and bottom line ($D_{max} = 0.4502$). Bottom lines LFD and SCUBA divers shown a significant difference too ($D_{max} = 0.1580$).

A total of one-hundred biostatistics interviews were randomly selected to obtain mutton snapper CPUE estimates data analysis. All interviews include reports of mutton snapper and other reef fishes. However the mutton snapper 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 34 pounds/trip. During this period of time fishing trips had an average of hauling 24.5 fish traps and the average soak time was 4.3 days. It was estimated that fish trap catch 0.32 pound/trap/day. On the other hand, for the period of

1995-2001, fish traps shows a landings increase obtaining an average of 69.6 pounds/trip. Fishing trips shown a decrease in the average of fish traps hauling to 21.6 and the average soak time increased to 5.8 days. For this period of time it was estimated that every fish trap catch 0.56 pound/trap/day. During 1988-94 bottom line fishing trips had an average of 49 pounds/trip. During this period of time fishing trips had an average of 2.5 hooks and the average fishing time was 9.9 hours. It was estimated that bottom lines catch 1.94 pound/hook/hour. On the other hand, for the period of 1995-2001, bottom lines shows a landings increase obtaining an average of 56 pounds/trip. During this period of time reef fishes fishing trips had an average of 2.1 hooks per trip and the average fishing time was 9.4 hours. It was estimated that bottom lines catch 2.88 pound/hook/hour. CFSP SCUBA divers data shows that during 1988-94, had an average catch of 65 pounds/trip. During this period of time fishing trips had an average of 2.3 divers with an average fishing time was 5.0 hours. It was estimated that a SCUBA diving catch 5.57 pound/diver/hour. On the other hand, for the period of 1995-2001, SCUBA divers shows a landings decrease in the pounds/trip obtaining 48 (17 less). During this period of time reef fishes fishing trips had an average of 1.33 SCUBA divers per trip and the average fishing time was 4.2 hours. It was estimated that SCUBA diving catch 8.75 pound/diver/hour. CFSP beach seine data shows that during 1988-94, had an average catch of 304 pounds/trip. During this period of time fishing trips had an average of 220 fathoms length with an average fishing time was 4.6 hours. It was estimated that a beach seine catch 0.30 pound/fathom/hour. On the other hand, for the period of 1995-2001, beach seine shows a landings decrease in the pounds/trip obtaining 166 (138 less). During this period of time reef fishes fishing trips had an average of 6.4 hours and 200 fathoms length. It was estimated that beach seine catch 0.13 pound/fathom/hour.

DISCUSSION

Puerto Rico's commercial fishery of mutton snapper has shown that marketing and demand for this species continues to be one of the most important during the last 15 years. The data analyzed in this report show that a high fishing pressure occurred on mutton snapper during 1988-2001. The landings data show trends of increase in mutton snapper landings during 1995-2001. However, it is necessary to mentioned that before 1987 mutton snapper was reported as snapper category. Also started in 1995, more fishers participate in the CFSP, probably that explain the increasing landings reported during the 1995-2001. Commercial fishers mentioned that the mutton snapper spawning aggregation has been exploited since the early 1980's. Commercial fishers whom participated in the mutton snapper spawning aggregation fishery during the early 1980's mentioned to CFSP that the harvest of this activity had been decreased significantly. This situation it is compatible with Florida and Cuba, where fishing pressure on the spawning aggregation caused a decrease in fishing harvest and the total collapse of some spawning aggregations (Mueller, 1995). The CPUE data shows an increase in the fishing pressure on the mutton snapper for bottom lines, fish traps and SCUBA divers. The beach seine had shown a decrease in the CPUE. Bottom lines are more efficient gears to catch mutton

seine (3.6). It is important to comment that fish trap gear shown a decrease in landings during 1989-95, during this time a decrease in the use of fish trap was observed, also an increase in the bottom line (Matos-Caraballo, *in press c*).

This study shows that the mutton snapper were caught bigger during 1995-2001 than 1988-1995. The CPUE data shows that bottom lines caught the bigger individuals. Both trends probably occur due to the fishing exploitation of the spawning aggregations, where the bigger individuals were caught and sampled by the CFSP. Also the fish trap, beach seine and SCUBA divers caught significant smaller individuals because these gears were not active during the mutton snapper spawning aggregations areas. In addition many commercial fishers have claim that they fish these species only during the spawning aggregations. All these facts are symptoms that indicate that mutton snapper's population is over exploited.

Figuerola Fernández and Torres Ruiz (2001) determine that 50% of male mutton snappers reach sexual maturity (SM) at 330mm FL. They also determine that 50% of female mutton snappers reach SM at 414mm FL. Although no sex was determined for the individuals measured in this study, 42% of them did not reach the 330mm (Figure 3 and 4). That means a very high percentage of the mutton snapper caught by commercial fishers in Puerto Rico did not reach maturity before were caught. The LFD by gear shows that bottom line caught approximately 19% of individuals that not reach SM. On the other hand, the SCUBA divers caught 26% of individuals before reach SM, the fish traps caught 54% and beach seine caught 90%. Mutton snapper is heavily fished during their spawning aggregations resulted in the removal of the larger individuals before they spawn. This activity resulted in a reduction of the population. Fish traps and beach seine mostly caught mutton snapper before reach the sexual maturity.

The DNER fishing regulations will help to conserve the mutton snapper fishery resource creating a close season during April 1st – May 31st of every year, when occurs the first two spawning aggregation. The last spawning aggregation in June will be open for fishers. This regulation assists to stop the collapse of the mutton snapper fishery in Puerto Rico. To support this regulation Muller (1995), Figuerola-Fernández and Torres-Ruiz (2001), mentioned that the exploitation of mutton snapper spawning aggregation resulted in the decrease of landings and the collapse of the fishery in some locations of Florida and Cuba. Also the DNER will prohibit the use of beach seine in Puerto Rico since year 2007. The beach seine is responsible for the fishing mortality of many juvenile mutton snapper and other species in Puerto Rico. CFSP's personnel observed and sampled beach seine catching juvenile yellowtail snapper *Ocyurus chrysurus*, various species of groupers (Serranidae), king mackerel *Somberomorus cavalla*, cero *S. regalis* and various species of jacks (Carangidae). During 1987-1992, most of the mentioned juvenile species were discarded at the beach. However, during 1998-2004, CFSP's personnel observed marketing for this juvenile species. This is another symptom of the Puerto Rico's over exploited fishery resource. This study shows the urgent need of the mentioned fishing regulations to help to improve the mutton snapper population.

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