

Description and Status of the Snapper-Grouper Fishery of Trinidad and Tobago

SHERRY C. MANICKCHAND-HEILEMAN and DAWN A. T. PHILLIP

Institute of Marine Affairs

P.O. Box 3160

Carenage Post Office

Carenage, Trinidad

West Indies

ABSTRACT

The fishery for snappers and groupers has traditionally been conducted at an artisanal level in the nearshore waters of Trinidad and Tobago. Antillean fishtraps and handlines are the main gears used, with vermilion snapper (*Rhomboplites aurorubens*), Caribbean red snapper (*Lutjanus purpureus*), dogtooth snapper (*L. jocu*), lane snapper (*L. synagris*), silk snapper (*L. vivanus*) and yellowedge grouper (*Epinephelus flavolimbatus*) being the major species caught. Although past fishing surveys indicated the potential for a snapper fishery in this country, substantial development has occurred only within the last six years. Annual landings have increased by almost 300% and lucrative export markets have been acquired for this group of fish. In 1991, about 500 mt of snapper and grouper, valued at almost US \$1 million were exported to 11 different countries. Although total landings have increased, those from the traditional fishing areas have decreased. In addition to the artisanal vessels which fish in nearshore areas, larger mechanized boats are being built to exploit the snapper and grouper resources on the shelf edge off the east coast of Trinidad. There are twelve mechanized vessels, each of which makes eight-day fishing trips and lands about 1.5 mt per trip. The resources are also being exploited by Venezuelan vessels through a fishing agreement between the two countries. The unregulated increase in fishing effort is cause for concern, especially since the target species are longlived and some show an alternate life history strategy. Preliminary yield per recruit analyses show that stocks in the traditional fishing areas are fully or overexploited, with a size at first capture below the size at first maturity for the major species.

INTRODUCTION

The marine fishing industry of Trinidad and Tobago is of great economic importance to the country, providing an important source of foreign exchange, employment and protein. In 1991, approximately 4000 mt of fish valued at US \$6 million (US \$1=TT \$4.25) were landed (Fisheries Division, Ministry of Agriculture, Land and Marine Resources) and exports were valued at US \$1.3 million (Central Statistical Office). It has been estimated that 11,700 people derive direct and indirect employment from these fisheries (FAO Country Fishery Profile 1989).

The fisheries of this country are diverse and include a trawl fishery for penaeid shrimp and groundfish, gillnet and beach seine fisheries for coastal pelagics such as flyingfish, spanish and king mackerel, and a trap and handline fishery for reef fish. Until recently, the major fisheries have been those for penaeid shrimps and coastal pelagic species. Over the last six years, fishing activities have expanded to offshore areas, mainly off the east coast of Trinidad. This expansion may be attributed to national efforts to diversify the oil-based economy, depletion of some inshore fish stocks, and a national thrust to exploit the resources of the recently declared 200 mile Exclusive Economic Zone.

One fishery that has undergone rapid development is that for snappers and groupers. In the past, this fishery has been an alternative fishery to that for flyingfish (*Hirundichthys affinis*) which operates seasonally from November to June in Tobago (Fabres, 1991). Traditionally, the fishery for snappers and groupers has been conducted at an artisanal level, mainly on the continental shelf in an area approximately 10°35' to 11°15' N latitude and 61°15' to 60°20' W longitude (Figure 1), although a few boats venture further offshore. These areas are fished by pirogues (traditional vessels made out of wood or glass reinforced plastic) which use mainly Antillean fish traps and handlines and make one-day fishing trips.

The potential for a snapper-grouper fishery in this country was demonstrated almost three decades ago. Exploratory fishing surveys conducted from 1965-1971 by the UNDP/FAO Caribbean Fishery Development Project indicated good potential for the development of a snapper fishery on the South American continental shelf (Carpenter and Nelson, 1971). Kawaguchi (1974) reported good catches of snappers and groupers (mainly Caribbean red snapper *Lutjanus purpureus*, vermilion snapper *Rhomboplites aurorubens*, and yellowedge grouper *Epinephelus flavolimbatus*) using handlines and longlines on the shelf edge east of Trinidad. Trap fishing explorations for snappers and groupers also showed good potential on the continental shelf off northeast South America (Wolf and Chislett, 1974). More recent surveys conducted by the Institute of Marine Research, Norway, showed several species of snappers to be among the main species caught in the waters to the north, south and east of Trinidad and Tobago (Bianchi, 1989).

Within the last five or six years several larger, mechanized multipurpose vessels have been built to target the snapper and grouper resources off the east coast, and exports of this group have increased substantially. In addition, these resources are fished by Venezuelan vessels under a fishing agreement between the two countries.

Despite the economic and political importance of this fishery, documentation of its development is sparse and stock assessment studies of the major species was initiated only three years ago. The aim of this paper is to

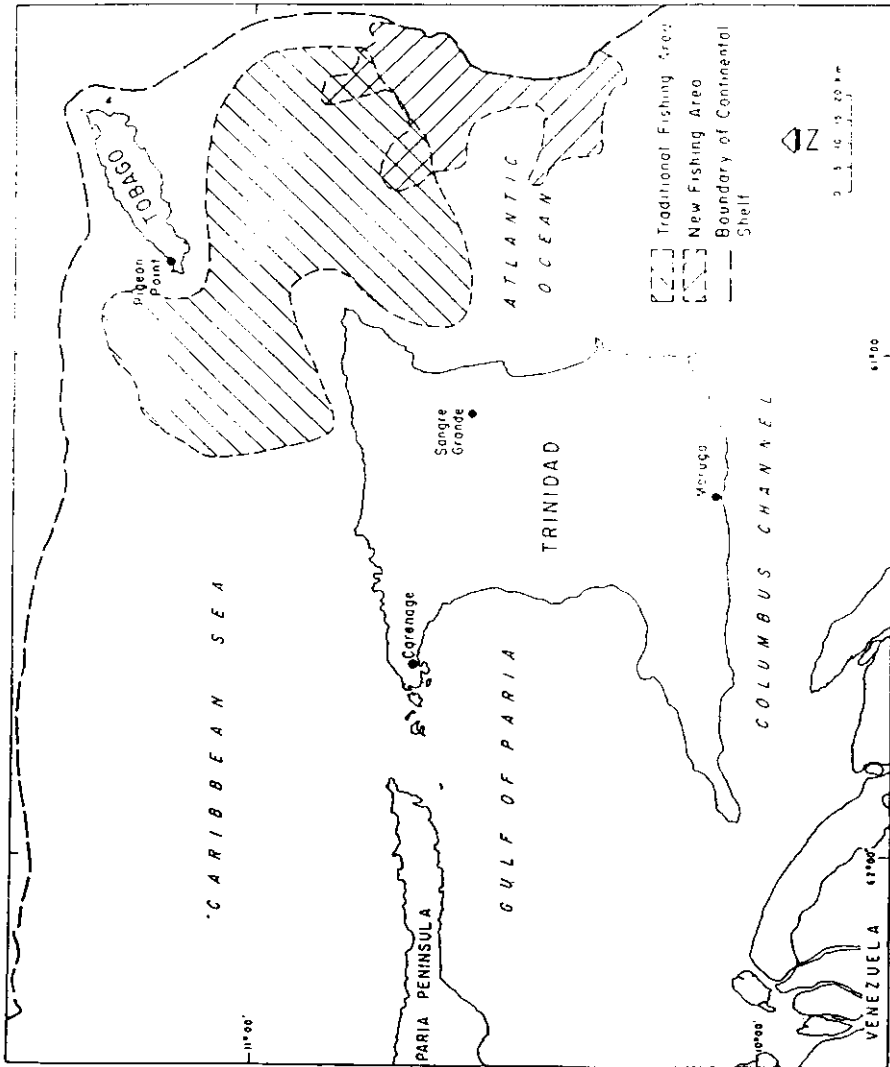


Figure 1. Fishing areas for snapper and grouper in Trinidad and Tobago.

describe the fishery for snappers and groupers and to report on its present status in Trinidad and Tobago.

METHODS

Fishing Fleet, Gear and Techniques

Fishing vessel statistics were obtained from a fishing survey conducted in 1991 by the Fisheries Division. In this survey, information was obtained by interviewing fishermen at 144 fishing beaches throughout Trinidad and Tobago. Information was also obtained by the authors through interviews with fishermen, boat owners and captains.

Species Composition

The species composition by weight of fish trap landings from the traditional areas was obtained from the records of the major snapper plant at Pigeon Point, Tobago (Figure 1). Only the vermilion snapper and red snapper are separated by species, while all species of groupers are combined into one category. Specimens of other incidental species caught were obtained for identification. Species composition of trap and handline catches from the continental shelf off the east coast of Trinidad was obtained from one fish plant operating in Sangre Grande in northeastern Trinidad (Figure1). Species composition of the catches from the shelf edge was obtained from the owners or captains of the mechanized vessels operating out of Carenage in northwestern Trinidad (Figure1).

Size Composition

Total lengths of individual fish in a sample of the major species were recorded at the fish plants in Pigeon Point and Sangre Grande. Size composition was recorded separately for traps and handlines.

Seasonality

Data to determine the seasonal variation of the species composition of landings and abundance of snappers and groupers were available only from the records of the fish plant at Pigeon Point. These data were from the traditional areas fished using fish traps only and included the weight of fish landed by each fisherman at the plant on a daily basis. The monthly mean percentage occurrence of vermilion snapper, red snapper and groupers in the landed catch was computed for the period January 1988 to September 1990. An index of abundance (catch per man/trip) was derived by dividing the total weight landed by the total number of fishermen landing fish at the plant each month.

Economic Importance

Since data on the quantity of snappers and groupers landed annually were unavailable, landings were estimated from the quantity exported. Exporters and

fishermen indicated that at least 75% of the landings of this group is exported. The quantity and value of this group exported annually from 1986 to 1992 and the countries to which these products were exported were obtained from the Export Development Corporation and the Central Statistical Office of Trinidad and Tobago.

RESULTS

Fishing Fleet

In 1991 there were approximately 300 fishing vessels and 900 fishermen involved in the snapper-grouper fishery of Trinidad and Tobago (Table 1). The vessels are of two distinct types: the small traditional pirogues (4 -10 m long) and the mechanized multipurpose vessels (15 m long). Pirogues are open vessels powered by one or two 40 - 75 h.p. outboard, gasoline engines. The hull is usually constructed of wood with a glass reinforced plastic (GRP) overlay although an increasing number of vessels are being constructed out of GRP. Some of the pirogues are fitted with hydraulic winches for hauling the traps which are otherwise hauled by hand. Pirogues operate with a crew of three in shallow inshore waters to depths of up to 115 m during one-day fishing trips. Maximum operating costs of pirogues are estimated to be US \$195 per trip.

There are 12 multipurpose vessels operating. These are constructed out of GRP and powered by a single 165 h.p. inboard diesel engine. There is a hydraulic winch for hauling traps, two fuel tanks with a total storage capacity of 3,600 litres, a 6 tonne ice and fish hold, and a live-bait well. These vessels usually operate with a five man crew in depths of 55-115 m and remain at sea for eight days during each fishing trip. Operating costs range from US \$700-\$1000 per trip.

The multipurpose vessels and a few of the pirogues carry global positioning systems and/or depth sounding equipment for locating their traps, otherwise the traps are located either through triangulation using landmarks or from the distance and direction travelled by the vessel. In some cases, the position of each trap at the surface of the water is marked by a buoy.

In addition to the vessels from this country, the snapper-grouper resources are fished by Venezuelan vessels, through a fishing agreement between the two countries. Licences are available for 46 Venezuelan vessels no longer than 12 m to fish between 3-19 km off the north coast of Trinidad, and for 30 vessels no longer than 25 m to fish between 19-322 km off the north and east coasts of Trinidad. These vessels use both longlines and handlines for demersal and pelagic species.

Fishing Gear and Techniques

Snappers are caught mainly by handlines and fish traps. The main types of traps used in the fishery are the arrowhead, rectangular, V-, and Z-shaped

Table 1. Number of fishing vessels and fishing persons by fishing type, by home coast.

Area or Coast	No. of Vessels		No. of Fishermen	
	Traps	Line	Traps	Line
North	4	18	11	53
East	9	16	41	47
South	2	31	6	90
West	31	139	8	426
Tobago	21	29	67	76
TOTAL	67	233	208	692

Antillean traps, with maximum dimensions of 2 x 1.5 x 0.6 m. Traditionally, the traps are made of 30 mm hexagonal wire mesh over a wooden frame. In recent times, a number of innovations in the design and construction of fish traps have appeared: the wooden frame has been replaced by steel rods, an anode made of electrical cable has been added to the traps to retard rusting of the wire mesh, and most recently, the wire mesh has been replaced by multifilament nylon netting. The multipurpose vessels use collapsible traps constructed of rubber mesh over a steel frame, enabling as many as 50 traps to be transported during each fishing trip.

Traps are baited with bonito, spanish sardine, tuna, halfbeak or flying fish depending on availability. Small fish are hung in a bait basket from the center of the trap while larger fish are usually strung through the trap. Soak time averages 24 hours for traps set from pirogues and 12 hours for traps set from the multipurpose vessels.

Handlines consist of a weighted line with 1-20 hooks attached by short branch lines in a staggered fashion either to the main line, or to another line held away from the main line. The main line is made of monofilament nylon with a breaking strain of 55 kg. Handlines are deployed from pirogues which make one-day fishing trips and from the multipurpose vessels between setting and hauling of traps.

Species Composition of Landings

Fish traps

The species composition (by weight) of fish trap landings varied according to the areas from which the catch was taken. Data were available from the traditional areas fished, the shelf edge off the east coast and from the south coast of Trinidad. Four species comprised the bulk of fish trap landings from the traditional fishing areas: the vermilion snapper *Rhomboplites aurorubens*

(44.8%), the Caribbean red snapper *Lutjanus purpureus* (40.7%), the yellowedge grouper *Epinephelus flavolimbatus* and the yellowmouth grouper *Mycteroperca interstitialis* (2.9%). Although groupers were not separated by species, the yellowedge grouper was more commonly caught than the yellowmouth. These two species, though not numerically important, contributed significantly to the weight landed because of their large size. The rest of the catch was made up of miscellaneous species, mainly the cottonwick *Haemulon melanurum* and the triggerfish *Balistes vetula*.

Landings from the shelf edge, where the mechanized vessels operate, were dominated by the red snapper (75.6%), the vermilion snapper (16.6%), the yellowedge grouper (2.9%) and the yelloweye snapper *L. vivanus* (1.8%).

Landings from the south coast were dominated by the lane snapper *Lutjanus synagris* (86.2%), the dogtooth snapper *L. jocu* (12%), and the mutton snapper *L. analis* (1%). Groupers made up less than 1% of the landings in this area. Data were not available on a monthly basis to analyse the seasonal variation in species composition of the landings from the south coast.

Handlines

The species composition of handline catches was recorded during the months of August and September at the fish plant in Sangre Grande. These catches were taken by pirogues fishing on shallow banks off the east coast and on the southeast and northeast coasts of Trinidad. The lane snapper again predominated, comprising up to 35.7% of the landings from this gear. This was followed by the red snapper (26.8%) and the vermilion snapper (21.5%). The rest of the landings consisted of mutton snapper (8.4%), miscellaneous species of grunts (3.1%), dogtooth snapper (2.5%) and grouper (1.9%).

Size Composition

Length frequency distributions of the main species caught are shown in Figures 2-6. The size of red snapper caught by traps is generally larger (modal length 400 mm) than that caught by handlines (modal length 275 mm)(Figure 2). For the vermilion snapper, traps caught smaller individuals (modal length 250 mm) than handlines (modal length 300 mm)(Figure 3). Length frequency distributions of yellowedge grouper were obtained from traps only and showed a modal length of 575 mm (Figure 4). The length frequency distributions of the lane and dogtooth snappers caught by handlines indicated modal lengths of 275 mm (Figure 5) and 300 mm (Figure 6) respectively.

Seasonality and Abundance Trends

Monthly variation in the species composition of the landings in Tobago is shown in Figure 7. Snappers and groupers were caught all year round but landings were generally higher from June to August. The vermilion snapper comprised the greater part of the catch from June to November, while the red

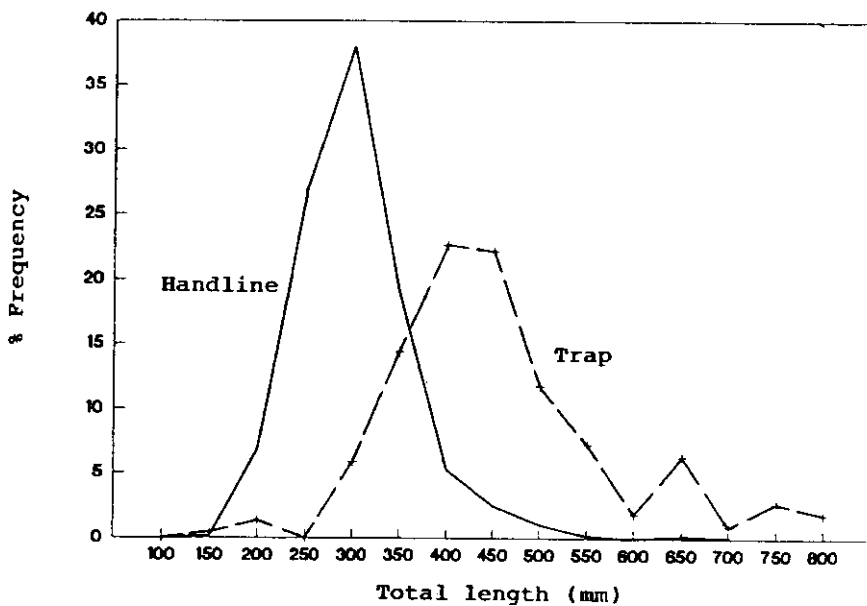


Figure 2. Length frequency distributions of *L. purpureus* caught by fish traps and handlines.

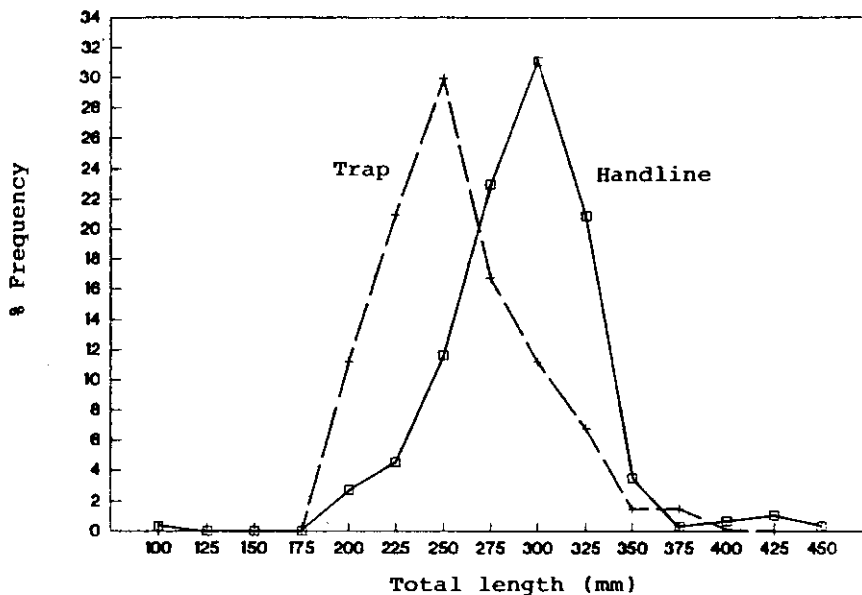


Figure 3. Length frequency distributions of *R. aurubens* caught by fish traps and handlines.

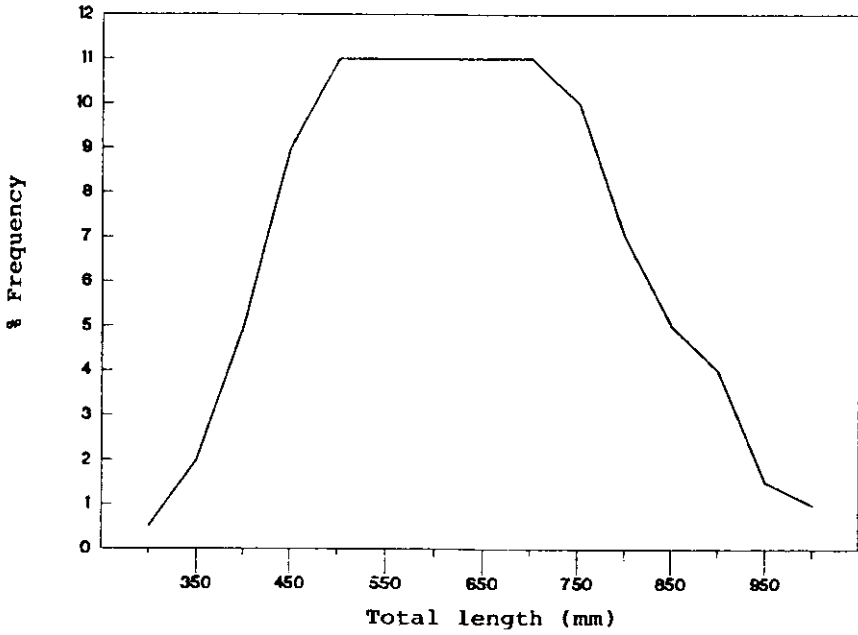


Figure 4. Length frequency distributions of *E. flavolimbatus* caught by fish traps.

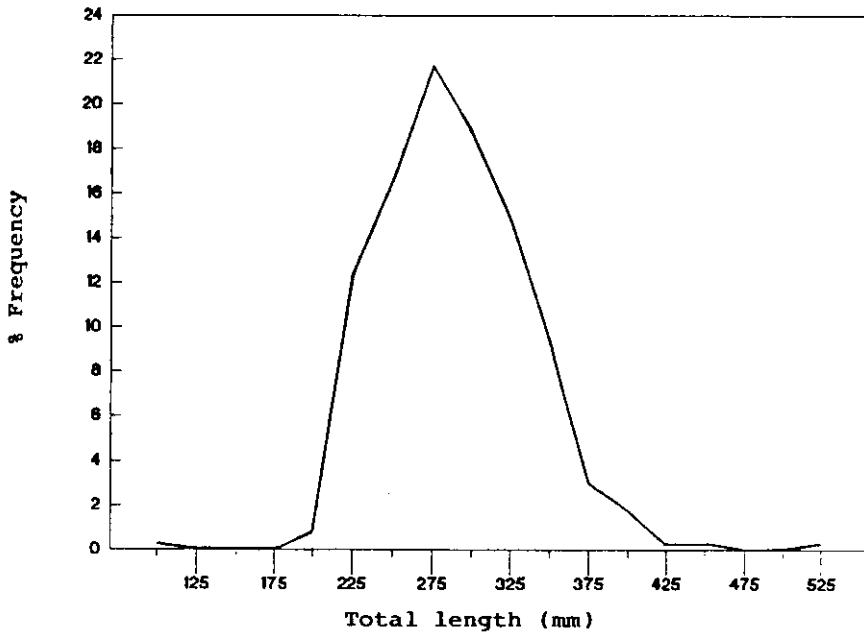


Figure 5. Length frequency distributions of *L. synagris* caught by handlines.

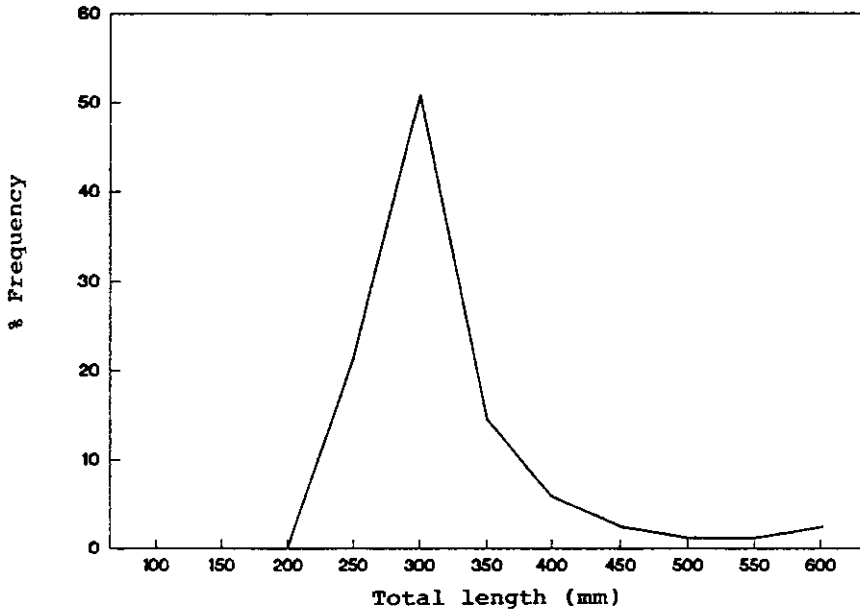


Figure 6. Length frequency distributions of *L. jocu* caught by handlines.

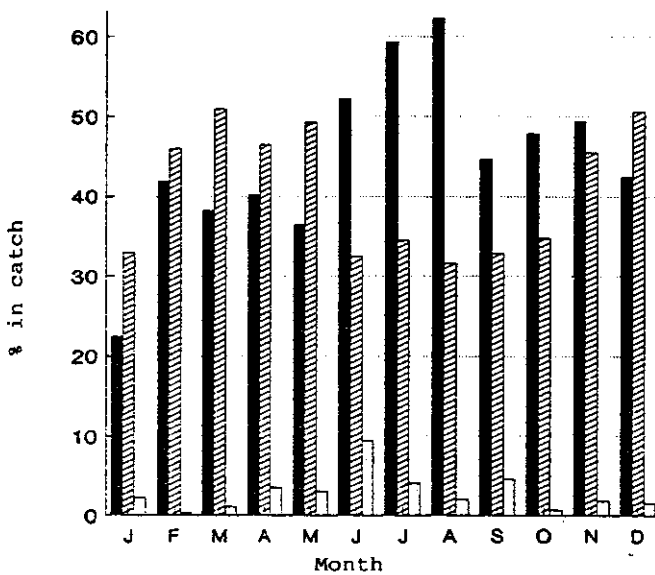


Figure 7. Monthly variation (% by weight) in species composition of landings from traditional fishing areas.
 ■ Vermilion snapper ▨ Red snapper □ Grouper

snapper dominated from February to May and in December. The percentage of groupers increased in June, July and September.

The catch rate of all species combined also showed seasonal variation, being higher around the middle of the year from July to September (Figure 8). In 1988, catch rate increased from July to September; in 1989 it increased from May to October; and in 1990, it increased from March to September, with a slight decline in June and July.

Economic Importance

Snappers and groupers fetch a retail price of US \$4 per kg regardless of species. In 1991, exports of this group increased to 509.8 mt (Table 2) (Export Development Corporation), which amounted to 66% of total fish exported by this country (Central Statistical Office). In 1991, the value of exports was \$846,000 (Table 2) (Export Development Corporation). For the first six months of 1992, 298.5 mt were exported and, assuming that the same quantity will be exported for the remainder of the year, the total for 1992 will be 597 mt. Approximately US \$1 million will be earned from exports of snappers and groupers in 1992, if export trends continue as expected. Countries to which this group is exported include the CARICOM (Caribbean Community) countries, Martinique, Guadeloupe, the United States and Canada.

Catch Trends

Data on the total quantity landed or catch rates of snappers and groupers in Trinidad and Tobago were unavailable. Based on interviews with fishermen and exporters, it is estimated that at least 75% of all snappers and groupers landed are exported. By extrapolation, it is estimated that at least 680 mt were landed in 1991. In 1986, which is the earliest year for which an export figure is available, 1.8 mt were exported. This reflects an increase of almost 300 percent.

There were wide intra- and interannual fluctuations in landings per man/trip from the traditional fishing areas (Figure 8). The mean annual catch per man/trip showed a decline from 55 kg in 1988 to 43 kg in 1989 and a further decline to 34 kg in 1990.

Landings from the multipurpose vessels average about 1.5 mt per vessel per trip. The Data to analyze seasonal fluctuations in the catch rate of these vessels were not available at the time of preparation of this manuscript.

DISCUSSION

The snapper-grouper fishery of Trinidad and Tobago has undergone rapid development over the last six years, mainly due to the lucrative export markets for these species which, in 1991, comprised 66% of total fish exported. This development involved both an expansion in the geographical areas fished and the construction of larger, mechanized vessels capable of undertaking fishing

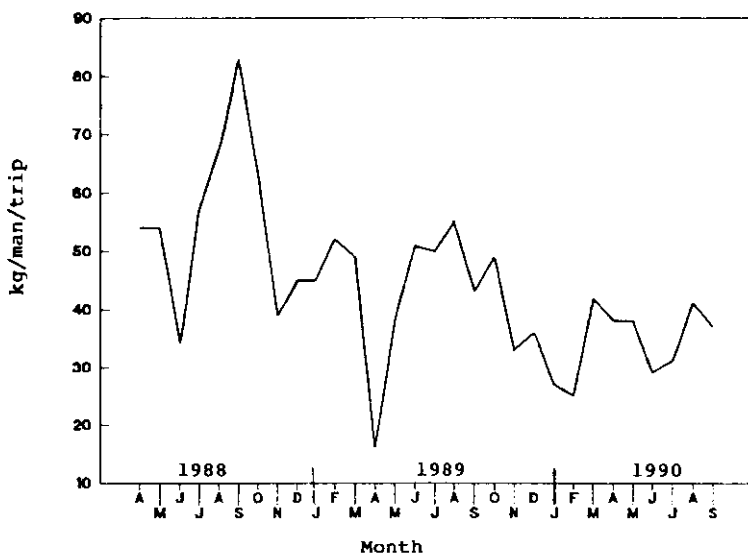


Figure 8. Monthly variation in the catch rate (kg/man/trip) from traditional fishing areas.

Table 2. Quantity and value of snappers and groupers exported (by Trinidad and Tobago, 1986-1992.)

Year	Quantity (MT)	Value (US\$)
1986	1.8	3,116
1987	71.3	286,443
1988	365.3	674,586
1989	425.6	569,600
1990	337.3	421,526
1991	509.8	846,628
1992 (6 mos.)	298.5	525,689

trips of a longer duration to offshore areas. The fishery itself is well organized, with a well- established network of fishermen, purchasers and exporters.

In the past this fishery was conducted as an alternative to the pelagic fishery (Potts *et al.*, 1988), which is also the case in other Caribbean islands, for example, Barbados (Prescod *et al.*, 1996), Grenada (Finlay *et al.*, 1988) and St. Lucia (Murray *et al.*, 1988). Landings of snappers and groupers also fluctuated

seasonally due to the climatic conditions which prevail at certain times of the year. During the months of July to November, there is a weakening and northward shift in the north-east trade winds (Gade, 1989), resulting in calmer seas. During the other months, when the sea is rough and ocean currents stronger, some fishermen confine their fishing activities nearer to shore or enter the pelagic fishery which is seasonal from November to June, or take up other forms of employment e.g. agriculture. With the introduction of larger boats and the year-round demand for the export market, the fishery for snappers and groupers is now being conducted throughout the year.

Unlike the northern islands of the Caribbean, the landings in this country are comprised of a larger number of species. In Barbados, landings are dominated by the silk snapper, the vermilion snapper and the queen snapper *Etelis ocellatus* (Prescod *et al.*, 1996). In the Lesser Antilles, the main species caught are the blackfin snapper *L. buccanella*, the silk snapper, and the grouper *E. mystacinus* (Appeldoorn *et al.*, 1987). The latter two species, as well as *Apsilus dentatus* dominated the landings from line catches in Jamaica (Munro, 1983). The landings in Trinidad and Tobago consist of at least five main species of snappers and two species of grouper. This variety reflects the diversity of habitat types ranging from shallow estuarine areas to coral reefs and a wide continental shelf and slope which exist around these two islands (Kenny and Bacon, 1981).

The effect that the present expansion of the fishery will have on the stocks is cause for concern. It has been found that slow-growing, longlived species such as snappers and groupers are easily susceptible to overfishing and that the maximum sustainable yield is attained with low levels of fishing effort (Matheson *et al.*, 1986). Furthermore, heavy fishing is potentially more severe on protogynous species such as groupers than on gonochoristic species (Bannerot *et al.*, 1987; Huntsman and Waters, 1987).

Several stocks of snappers have already been overfished: *L. campechanus* in the Gulf of Mexico (Goodyear, 1988; Futch and Bruger, 1976); *L. purpureus* in Brazil (Ivo and Hanson, 1982); *L. purpureus*, *L. buccanella* and *R. aurorubens* in Puerto Rico (Boardman and Weiler, 1979); *L. synagris* in Cuba (Carrillo and Albornoz, 1979). Sadovy (1994) gives an overview of information on grouper stocks in the region, several of which have already shown signs of being overfished.

Preliminary yield per recruit analyses showed that the red snapper and vermilion snapper in the traditional fishing area are fully exploited while the yellowedge grouper is overexploited (Manickchand-Heileman and Phillip, 1992). Furthermore, the age at first capture for the red snapper and yellowedge grouper is below their respective size at first maturity. The size at first capture by traps for the red snapper was found to be 270 mm and the size at sexual maturity 330 mm. For the yellowedge grouper the size at first capture was 435

mm while that at sexual maturity was 528 mm (Manickchand-Heileman and Phillip, 1992).

It is imperative that the present expansion in the snapper-grouper fishery of Trinidad and Tobago be controlled through an appropriate fishery management program. Bohnsack (1987) proposed some possible actions for the management of reef fisheries in the Caribbean: increasing mesh sizes in traps, limiting entry to the fishery, establishing permanent marine refuges, and the use of pulse fishing by temporarily closing some areas to fishing. Even though the data required for the development of a comprehensive management program for the snapper-grouper fishery of Trinidad and Tobago are just becoming available, it is obvious that the mesh sizes used in traps must be increased and that the rate of entry into the fishery must be controlled, as immediate measures.

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