

The Snapper Fishery of Barbados: Present Status and a Preliminary Assessment of the Potential for Expansion

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ABSTRACT

The artisanal deep-water snapper fishery of Barbados which is estimated to land approximately 105 mt of fish a year and accounts for approximately 2% of the total fish catch in the island and 19% of the "off-season" catch, is described in detail for the first time. The fishery is a multispecies, multigear fishery, landing up to sixteen different species, using two gear types which appear to target different species. The dominant species taken by traps is the silk snapper (*Lutjanus vivanus*), and by handlines is the vermilion snapper (*Rhomboplites aurorubens*) and the queen snapper (*Etelis oculatus*). At present, fishing for deep-water snappers is traditionally concentrated during the "off-season" (July-October), the period when the migratory pelagic species are absent. However, preliminary catch per unit effort data indicate no distinct seasonality in availability of the snapper group around Barbados. This would indicate the potential for expansion of the fishery over a greater period of the year. Market demand for snapper is high, often driving the price up to US\$6.60/kg, making it the most expensive fish in Barbados, and a potentially lucrative venture for fishermen. With only minor improvements to gear, and availability of bait, the fishery would appear to have economic potential for development. Mean size (fork length; FL) of individuals of the target species (*L. vivanus*: 33.8 cm FL and *R. aurorubens*: 27.7 cm FL) in the July catch are below the size at first maturity reported for these species in Jamaica. Further study is therefore needed to determine the mean size of individuals in the catch in all months, the size at first maturity and the breeding seasonality for these species off Barbados before expansion of this fishery is encouraged.

KEY WORDS: Snapper, trap, handline, deep-water, "off-season" fishery, Barbados.

INTRODUCTION

In Barbados the most important fishery is the pelagic fishery which targets dolphinfish (*Corypheana hippurus*) and flyingfish (*Hirundichthys affinis*) and accounts for about 85% of the total landings at the three major markets (Oxenford and Hunte, 1987). However, the pelagic fishery is seasonal (mid-November to June) and there are a number of other fisheries that are particularly important in the off-season (July to October), accounting for

between 8% and 20% of the total landings at the three major markets (Mahon *et al.*, 1981). The most important of these are the nearshore trap fishery, which targets a wide variety of reef fish from shallow coral reef areas, and the snapper fishery (also known as the redfish or deepsea fishery), which targets deep-water demersal species, mainly snappers and groupers, from deep-water banks.

To date, most research efforts have focused on the pelagic fishery of Barbados, and little attention has been given to documenting the fishing practices of other fisheries, particularly the snapper fishery, despite its importance in providing fresh fish and employment in the off-season. It is generally felt that the deep-water demersal fisheries of the eastern Caribbean hold some potential for expansion (Carpenter and Nelson, 1971; Mahon, 1990).

Government catch records indicate that the snapper fishery lands around 35 mt of fish annually, and official Government estimates of actual catch are three times this figure. However, the numbers of boats and fishermen engaged in the fishery, the location of fishing grounds, the current fishing techniques, and the size of individuals and species composition of catches remain undocumented or unknown. Furthermore, there have been no biological studies on the snapper resource around Barbados, nor on its potential for development into a major fishery here. This study attempts to document the present state of the snapper fishery in Barbados and to comment on the potential for development.

METHODS

Information on the history of the snapper fishery and on the present fishing techniques used in this fishery was obtained largely from interviews with past and present fishermen and personnel from the Barbados Fisheries Division, and by accompanying snapper fishermen on fishing trips. Information on the species composition of catches by boat and by gear type was collected by daily sampling at one of several landing sites around the island (Oistins, Bridgetown, Pile Bay or Conset Bay; Figure 1), during the month of July 1991. Information on size (fork length, FL; total length, TL; and weight, WT) of individual fish was also collected at the landing sites during this period. Lengths were measured by flexible tape to the nearest mm and whole weights were measured by spring balance to the nearest 0.1 kg.

Monthly recorded landings for the primary landing sites around the island over the last 30 years (1961 - 1990) were obtained from the Barbados Fisheries Division. These were used to examine the interannual catch trends and changing seasonality of the fishery. Daily catch and effort records for the snapper landings at Oistins over the last ten years (1982 - 1991) were obtained from the cash registers at this market. Unlike the monthly record sheets which are collected for the purpose of permanent catch records and are stored at the Fisheries Division, the cash registers are kept for tax auditing purposes, are stored at the market, and may be destroyed after nine years. The cash registers

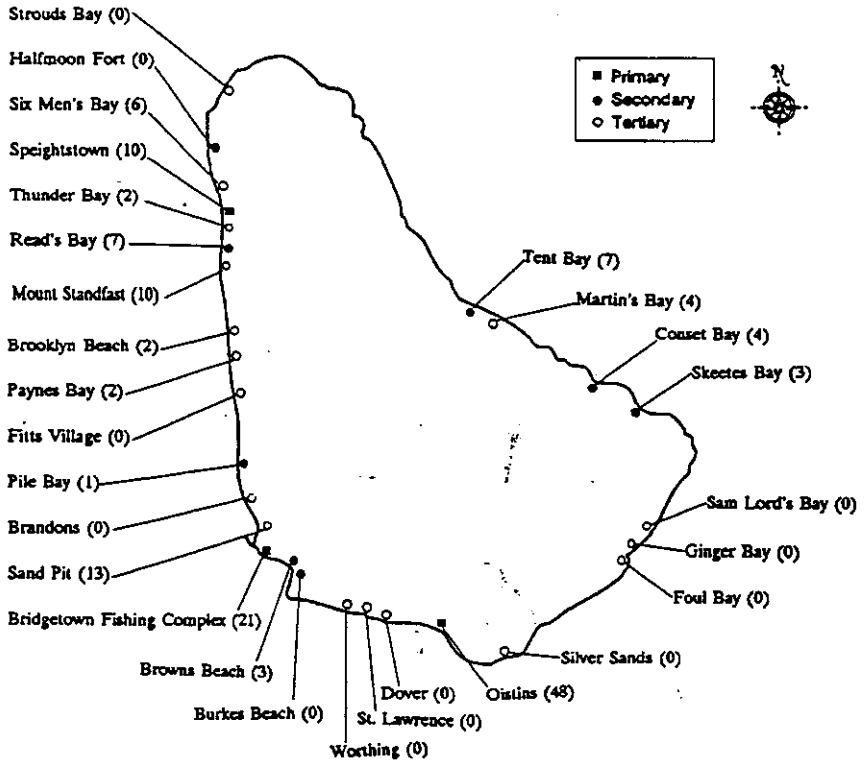


Figure 1. Fish landing sites around Barbados showing the location and number of boats involved in the snapper fishery.

record for each named boat the catch of each species group by weight. Boat names were checked in the Fisheries Division boat register to obtain information on the type of boat, its length and engine horsepower, and catch rates were then compared between different vessel categories. Catch per fishing trip was used as a crude index of abundance to examine the seasonality of the snapper resource around Barbados.

RESULTS

Fishing Fleet

A survey of all landing sites around Barbados revealed that at least 194 boats and approximately 776 fishermen are presently involved in the snapper fishery during the July to October off-season (Figure 1, Table 1). Three types of fishing vessels are used; moses, day-boats and ice-boats. Moses are small (3 - 6 m in length) open wooden boats powered by oars, or by gasoline outboards (25 - 40 hp). Day-boats are larger (6 - 12 m in length) partially covered wooden boats, powered by inboard diesel engines (10 - 108 hp). Ice-boats are slightly larger than the day-boats (12 - 18 m in length), although of similar design, with inboard diesel engines (80 - 225 hp), of wooden or fibreglass construction, fitted with 8 - 10 mt ice holds, and are capable of spending several days at sea.

Day-boats are the most numerous (128 boats) in the snapper fleet during the July to October pelagic off-season. However, the great majority of these boats haul up for repairs during early November and revert to pelagic fishing from mid-November to June, leaving only five day-boats snapper fishing year-round. Forty-seven moses are involved in the snapper fishery from July to October, and five (11% of the moses fleet) target snapper year-round, whilst the remainder revert to nearshore handlining for reef fish or trolling for nearshore pelagics. Eighteen ice-boats target snapper from July to October, and like the other snapper boats, all but one of these fishes on a daily basis, returning to port every evening. Only one ice-boat fishes year-round for snapper and the remainder revert to the pelagic fishery.

Fishing Gear and Techniques

Two gear types (handlines and traps) are used in the snapper fishery, although handlines appear to be the preferred gear (Table 1). Handlines are made of monofilament line with a breaking strain of 90 kg, and carry between three and fifteen (usually three to five) brass or steel hooks which are either attached in a staggered fashion near the end of the main line by short lengths of line, or are held away from the main line by a pillar stick (Figure 2). The bait preferred by fishermen is squid or "inkfish" (*Loligo* sp). Squid are caught with the use of attracting lights and long handled dipnets at night, or castnet during the day. However, catching squid is often difficult and time consuming and a number of alternative baits are also used, including strips of bonito (*Thunnus*

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Table 1. Barbados snapper fishing fleet showing the location of boats and gear types used. (See Figure 2 for location of landing sites).

Landing Sites boats	Moses Day boats		Ice		Line		Trap
	Total Line	Trap	Lines	boats			
Six Men's Bay	0	0	0	6	0	0	6
Speightstown	0	3	1	6	0	0	10
Thunder Bay	0	2	0	0	0	0	2
Read's Bay	0	6	0	1	0	0	7
Mount Standford	1	9	0	0	0	0	10
Brooklyn	0	0	0	2	0	0	2
Paynes Bay	0	1	0	1	0	0	2
Pile Bay	1	0	0	0	0	0	1
Sand Pit	0	13	0	0	0	0	13
BFC	0	0	0	55	1	1	57
Burkes Beach	0	0	0	3	0	0	3
Oistins	1	6	3	36	0	2	48
Skeetes Bay	0	0	0	0	3	0	3
Conset Bay	0	0	1	3	0	0	4
Martins Bay	0	4	0	0	0	0	4
Tent Bay	0	0	1	6	0	0	7

atlanticus), flyingfish (*Hirundichthys affinis*) or jacks (*Selar crumenophthalmus*), and soldier crabs (*Coenobita clypeatus*). Bonitos are caught on the same fishing trips by trolling whilst travelling to and from the snapper fishing grounds, or on separate fishing traps by live-bait fishing with short handlines. Flyingfish are caught by gillnet but are only available from November to June. Jacks are taken by castnet nearshore, and soldier crabs are gathered at night from littoral woodland areas.

Handlining is believed to be done between depths of 60 - 250 m on 'bars' or 'shallows' usually between 5 - 8 km from shore all around the southwest, west, north and east coasts of the island. The fishing grounds are not mapped, but known to local fishermen by name and are located by memorized triangulation land marks, since none of the boats carry position fixing or depth sounding equipment.

Handlining is done by day and night, although day fishing is much more common. Most boats anchor on the fishing ground. An innovative anchor retrieval system has been adopted by these snapper boats which considerably decreases the man power required to lift the deep-set anchor. The system involves the use of a buoyed car tyre which encircles the anchor line and is

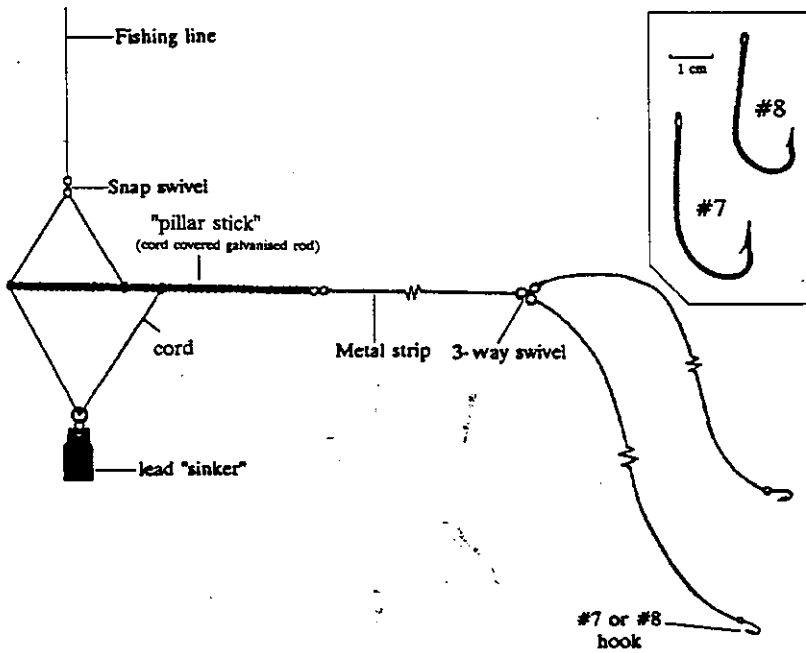


Figure 2. A typical handline terminal tackle used for snapper fishing in Barbados.

dragged down the anchor line by driving the boat forward at high speed, to lift the anchor to the surface with minimal effort.

Two types of fish traps are being used in this fishery, the z-trap and the rectangular trap. These traps may vary in size, but typically measure around 3 x 2 x 1 m and are constructed of 3 cm mesh chicken wire on a wood (*Leucaena* sp.) frame. The traps are preferably baited with “sprats” (*Harengula* spp.) caught by castnet nearshore, or with flyingfish (*H. affinis*) pieces. However, when preferred bait is scarce, “conger” (*Gymnothorax moringa*) or “sea-cat” (*Octopus* sp.) may be used. The bait is either strung throughout the trap or tied in a bait basket near the centre of the trap. Multistrand polyethylene rope is used to lower and retrieve fish traps and to mark their position since the rope remains attached to the trap when it is set on the bottom, and the free end is held at the surface by one or more large buoys. The traps are set on the shallower of the ‘bars’ used for handlining, in 60 to 100 m of water. Again, since the boats carry no specialized position fixing or depth sounding equipment, the fishing grounds and the traps themselves are located by landmarks. Trap setting and retrieval is therefore only done during day-trips. The traps are either set and hauled by hand, or in a few instances a simple mechanical winch is used. Traps may be hauled every one to three days soak time, and as long as a reasonable catch is obtained, they are rebaited and replaced at the same location.

Catch Composition

The snapper catch is multispecies, with at least sixteen different species being taken occasionally (Table 2). However, the catches are dominated by only three species, the “yelloweye” or silk snapper (*Lutjanus vivanus*) which accounted for 39.8% of the total catch, the “plumphead” or vermilion snapper (*Rhomboplites aurorubens*) which accounted for 37.9%, and the “brim” or queen snapper (*Etelis oculatus*) which accounted for 12% (Table 3).

The two gear types appear to target differently (Table 3), the most marked difference being the absence of queen snapper from trap catches. Furthermore, a comparison of the proportion of silk snappers and vermilion snappers taken by trap and handline showed a significant difference between them (Chi-squared 2 x 2 contingency test: $X^2 = 44.39$, $v = 1$, $P < 0.001$).

The mean sizes of the three dominant species are given in Table 4, length frequency distributions are shown in Figure 3, and length weight relationships in Figure 4. The two gear types not only show different species selectivity, but also different size selectivity, with handlines taking larger fish on average than traps (Mann-Whitney tests: by FL, $U = -7.34$, $P < 0.0001$; by Wt: $U = -7.31$, $P < 0.0001$). Even when species are considered separately, handlines were found to take larger fish of both dominant species (Mann-Whitney tests: for *Lutjanus vivanus* by FL, $U = 4.19$, $P < 0.0001$; by Wt, $U = 5.58$, $P < 0.0001$; for

Proceedings of the 44th Gulf and Caribbean Fisheries Institute

Table 2. List of species observed in the Barbados commercial snapper fishery catches from July to October 1991.

SCIENTIFIC NAME	COMMON NAME	LOCAL NAME
<i>Alectis ciliaris</i>	African pompano	silverfish
<i>Caranx lugubris</i>	Black jack	Black jack
<i>Caulolatilus cyanops</i>	Blueline tilefish	Backer / Grey gurnet
<i>Epinephelus mystacinus</i>	Misty grouper	Moss grouper
<i>Epinephelus nigritus</i>	Warsaw grouper	Rock grouper
<i>Etelis oculatus</i>	Queen snapper	Brim
<i>Gymnothorax moringa</i>	Spotted moray eel	Conger
<i>Haemulon chysargyreum</i>	Smallmouth grunt	Xmas grunt
<i>Holocentrus marianus</i>	Longjaw squirrel fish	Goggle-eye cook
<i>Holocentrus rufus</i>	Squirrel fish	Cook
<i>Lutjanus vivanus</i>	Silk snapper	Yellow-eye snapper
<i>Ocyurus chrysurus</i>	Yellow-tail snapper	Yellow-tail snapper
<i>Rhomboplites aurorubens</i>	Vermilion snapper	Red snapper / Plumphead Red gurnet
<i>Seriola dumerilii</i>	Green amber jack	Amber fish
Unidentified	Unidentified	Sand bank
Unidentified	Unidentified	Wormhead

Table 3. Species composition of snapper fishery catches sampled during July 1991.

SPECIES	TRAP		HANDLINE		TOTAL	
	# caught	% caught	# caught	% caught	# caught	% caught
Brim	0		45	31.0	45	12.5
Yellow-eye	122	57.0	21	14.5	143	39.8
Plumphead	65	30.3	71	49.0	136	37.9
Wormhead	2	0.9	1	0.7	3	0.8
Cook	0		5	3.4	5	1.4
Goggle-eye cook	0		1	0.7	1	0.3
Amber fish	1	0.5	0		1	0.3
Black jack	4	1.9	0		4	1.1
Grey gurnet	0		1	0.7	1	0.3
Moss grouper	6	2.8	0		6	1.7
Sand bank	1	0.5	0		1	0.3
Xmas grunt	13	6.1	0		13	3.6
Totals	214	59.6	145	40.4	359	100

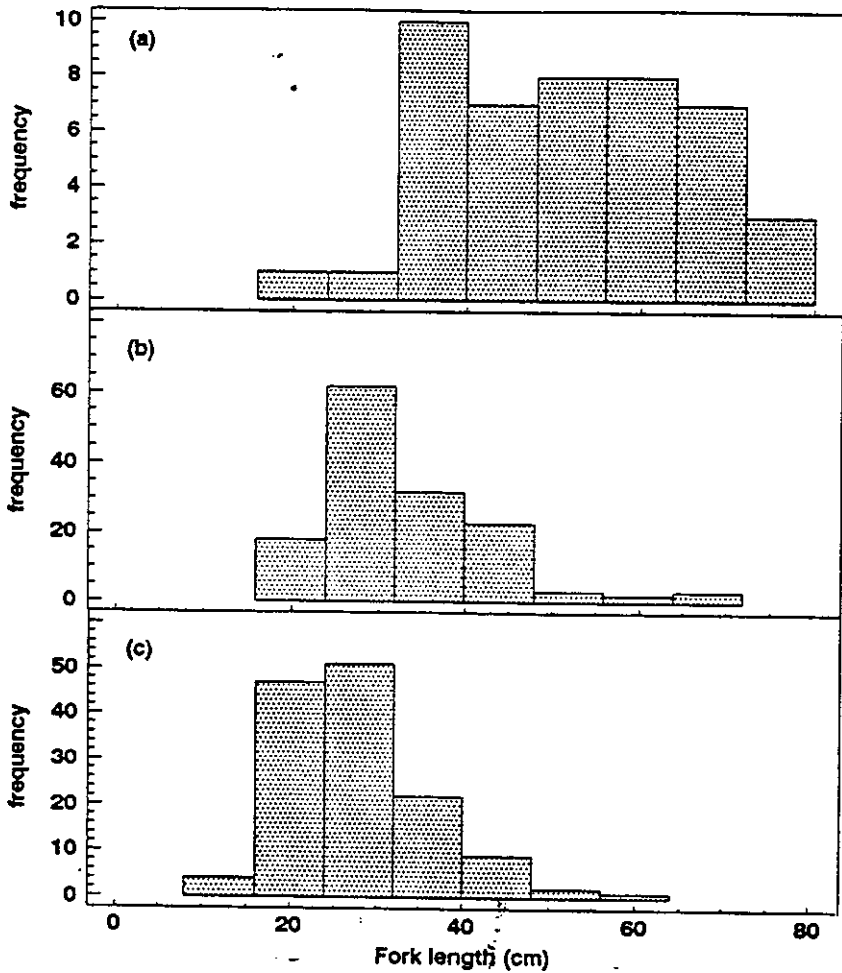


Figure 3. Length frequency distribution for the three dominant species, *E. oculatus*, *L. vivanus* and *R. aurubens*, taken by the snapper fishery in Barbados during July 1991.

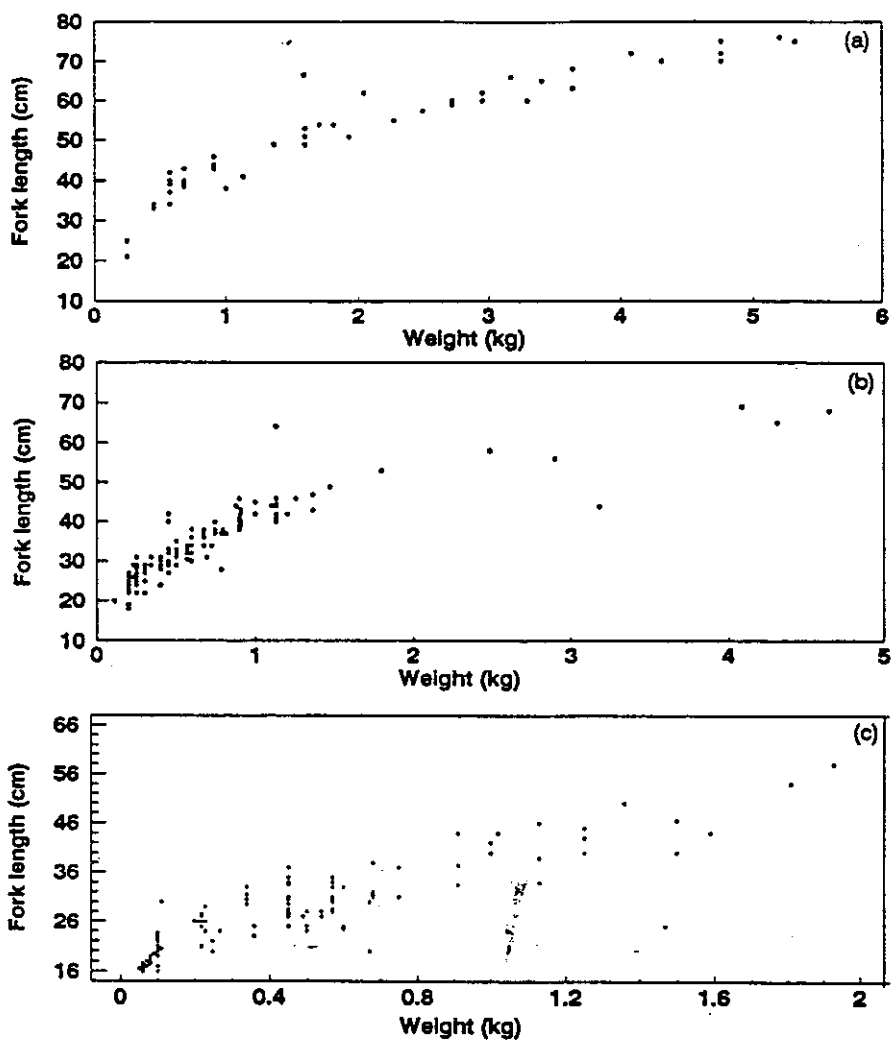


Figure 4. Fork length - weight relationships for the three dominant species *E. oculatus*, *L. vivanus* and *R. aurubens* taken by the snapper fishery in Barbados during July 1991. Relationships are : for *E. oculatus*, $Wt = 2.34 \times 10^{-11} L^{2.82}$; for *L. vivanus*, $Wt = 3.67 \times 10^{-10} L^{2.52}$; and for *R. aurubens*, $Wt = 1.84 \times 10^{-11} L^{2.91}$.

Rhomboplites aurorubens by FL, $U = 6.40$, $P < 0.0001$; by Wt, $U = 5.58$, $P < 0.0001$; Table 4).

Table 4. Mean size of the dominant snapper species taken by the snapper fishery in Barbados for July 1991, shown separately by gear types.

SPECIES	HANDLINE			TRAP			OVERALL		
	Wt (kg)	FL (cm)	N	Wt (kg)	FL (cm)	N	Wt (kg)	FL (cm)	N
<i>L. vivanus</i>	1.47	44.14	21	0.56	31.98	122	0.69	36.40	143
<i>R. aurorubens</i>	0.58	31.41	71	0.32	23.54	65	0.45	27.70	136
<i>E. oculatus</i>	2.06	51.80	45	-	-	-	2.06	51.80	45

CatchTrends

Government catch records for the snapper fishery are listed under three separate categories, namely 'Brimms' (which refers to the queen snapper, *Etelis oculatus*), 'Other Snappers' (which refers to any other red coloured snappers), and 'Other Deep Water Species' (which refers to all other species landed by this fishery). However, since queen snappers were not reliably separated from other red snappers at all markets, and the other two categories represent multispecies groups, the data were pooled and the catch simply referred to as 'snapper'.

Annual landings of snapper recorded at the three primary landing sites (Oistins, Speightstown and Bridgetown) show that large interannual fluctuations in catch are a characteristic of this fishery with total landings ranging from 12.6 to 62.2 mt per year (Figure 5). The relative importance of snapper as a percentage of the total fish catch (by weight) also fluctuates annually ranging from 1.4 to 13.6 % (Figure 5).

Monthly landings of snapper indicate that the fishery is highly seasonal, with approximately 85% of the annual catch being landed from July to October (Figure 6), the period when the pelagic species are not available. The main fishing season for snapper (July - October with a peak in August) has changed very little over the last 30 years (Figure 6).

AbundanceTrends

A comparison of snapper catch per fishing trip by moses (199 trips), day-boats (1,599 trips) and ice-boats (330 trips) landing at Oistins during the main snapper season (July - October) over the last ten years (1982 - 1991) showed that there was no significant difference between them (Kruskal-Wallis test: $H = -2.797$, $P = 1$). Catch per trip data for all boat types were therefore pooled for all subsequent analyses. The overall mean for this period was 40.4 kg

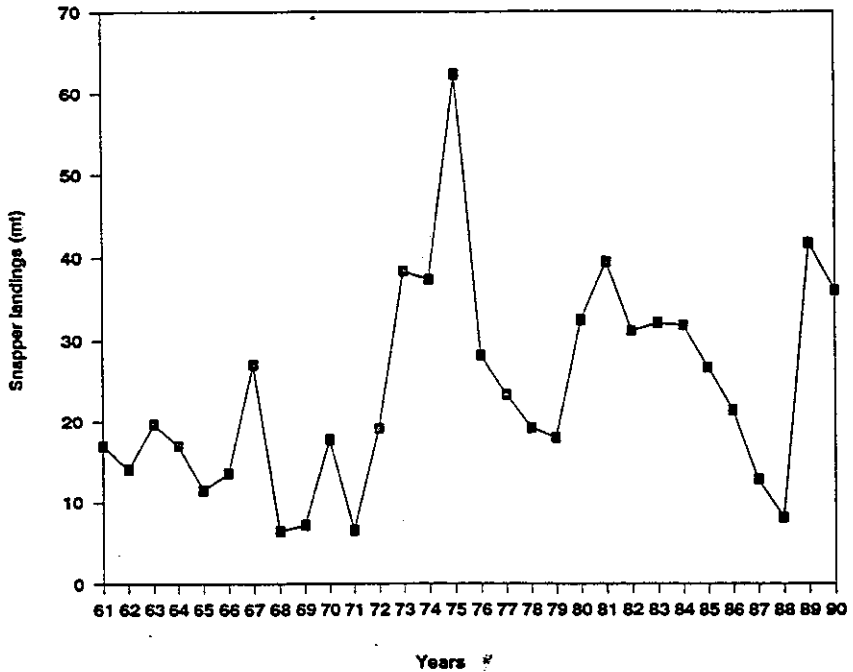


Figure 5. Recorded annual landings of snapper (a), and relative importance to the total fish catch (b), at the three major markets (Oistins, Speightstown, and Bridgetown) in Barbados from 1961-1990.

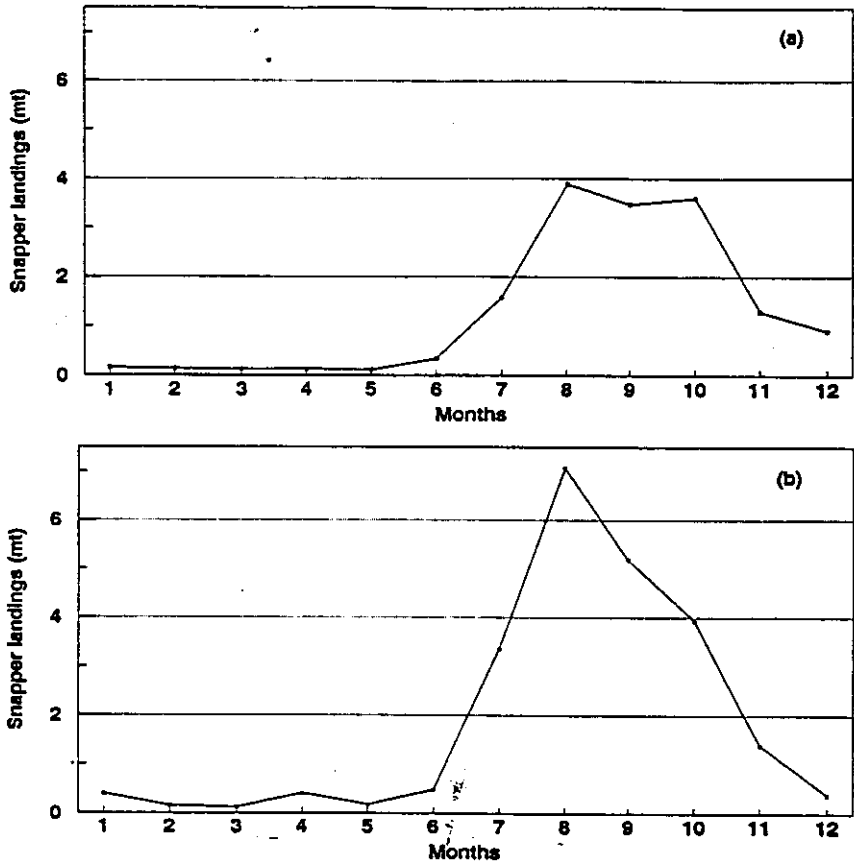


Figure 6. Five-year mean monthly landings of snapper recorded at Oistins, Speightstown, and Bridgetown, Barbados, shown separately for the periods 1961 - 1965 and 1986 - 1990.

snapper per trip. Annual mean catch per trip of snapper for Oistins boats is shown for eight years (1983 - 1990) in Figure 7. If catch per trip is taken as an index of snapper abundance, then interannual fluctuations in the abundance or availability of snapper are apparent, with lowest abundance occurring in 1987 and highest abundance in 1983 and 1988. Monthly fluctuations in abundance or availability of snapper also appear to be characteristic, but do not appear to have any consistent seasonal pattern (Figure 8).

Economic Importance

Snapper typically retails for US \$5.50 to 6.60 per kg, regardless of species. Recorded snapper landings for the whole island over the last few years average 35 mt (Table 5), actual landings are officially estimated by Government to be as much as three times the recorded weight. As such, the snapper resource could be worth in excess of half a million US dollars per year (*i.e.*, between US \$577,500 - 693,000).

Furthermore, snapper accounts on average for 19% of the off-season catch (Table 5), provides summer employment for an estimated 776 fishermen and revenue for approximately 194 boats (Table 1) which would otherwise be laid up between pelagic fishing seasons.

Table 5. Annual and seasonal recorded landings of snapper and total fish for all markets and sheds around Barbados, showing the relative importance of snapper as a percentage of all fish landings.

Year	Annual Landings (kg)		Off-season (July-Oct) %	Landings (kg)		%
	Total Snapper	Total Fish		Total Snapper	Total Fish	
1984	43730	1929329	2.2 7	31634	161274	19.6 2
1985	39924	1305279	3.0 6	26355	134937	19.5 3
1986	29306	1409049	2.0 8	21418	114735	18.6 7
1987	21131	1234055	1.7 1	18336	112948	16.2 3
1988	14358	1048920	1.3 7	11911	102720	11.6 0
1989	46013	1135670	4.0 5	39614	206524	19.1 8
1990	47453	2297497	2.0 7	41024	146661	27.9 7
Means	34559	1479971	2.3 7	27185	139971	18.9 7

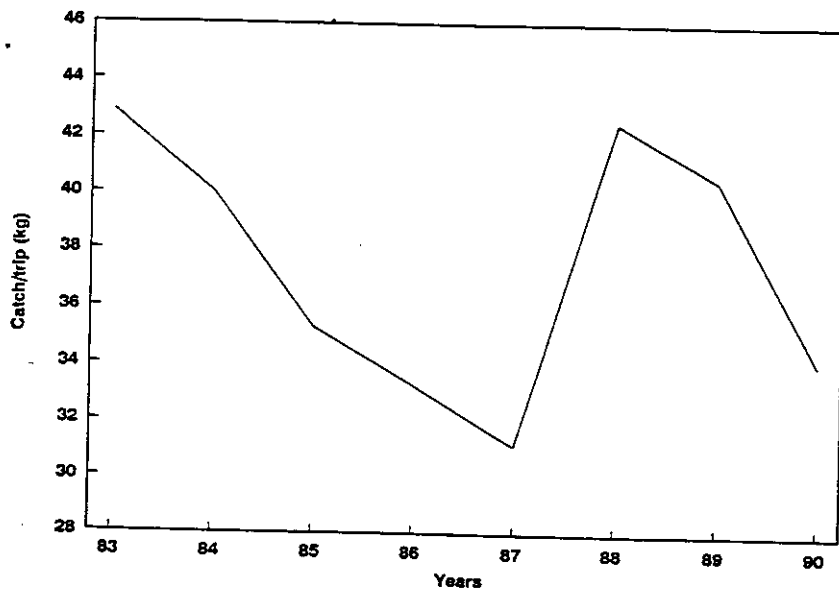


Figure 7. Annual mean snapper catch per trip for snapper boats at Oistins, Barbados from 1983-1990.

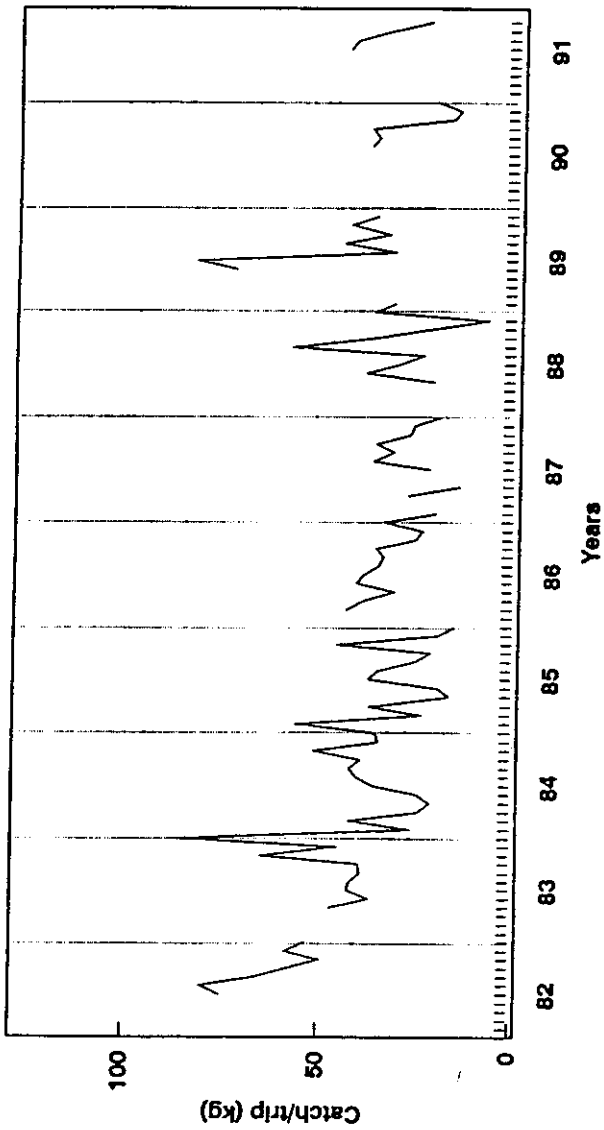


Figure 8. Monthly mean snapper catch per trip for snapper boats landing at Oistins, Barbados from 1982 - 1991.

DISCUSSION

The Barbados deep-water snapper fishery is typical of snapper fisheries in the region (see Mahon, 1990), being an artisanal, off-season, multispecies fishery which uses traps and handlines, and which has undergone little change in the last 40 years. Most fishermen agree that snappers are probably available off Barbados outside the present snapper fishing season. They cite seasonal availability of the preferred bait (squid), and a dislike for the hard work involved in handling the gear, as the two main reasons for reverting to pelagic fishing as soon as the pelagic species become available. There is no evidence that the snapper resource off Barbados is only seasonally abundant. This is further supported by the fact that a few boats land snapper in all months. Furthermore, the snapper fisheries of several other Caribbean territories are practiced year-round (Appeldoorn *et al.*, 1987; Mahon and Rosenberg, 1988).

Interannual fluctuations in the snapper catch per trip may result from differences in availability of snapper to the gear caused by local spawning or feeding migrations, rather than fluctuations in actual abundance of snapper off Barbados. Wicklund (1969) and Starck (1971) report that Lutjanids typically aggregate for spawning. Grimes (1987) reports that insular snapper populations reproduce year-round with pulses in spring (February-April) and fall (September-December). The apparent dips in snapper abundance off Barbados in March and November, may result from spawning aggregations occurring away from the present fishing grounds. Reliable separation of species in the catch recording system will be required to examine this more critically.

Although the multispecies nature of the catch is typical of this fishery in other Caribbean locations, the target species appear to differ. Appeldoorn *et al.* (1987) report that *Lutjanus vivanus*, *L. buccanella* and *Epinephelus mystacinus* are the most common species landed by the snapper (deep demersal) fisheries of Puerto Rico. Munro (1983) reports that *L. vivanus* and *E. mystacinus* are the most common species taken by the Jamaican deep snapper line fishery. The species composition of catches in Barbados however, needs to be examined in all months to determine if certain species are seasonally common and to see if the observed difference in overall species composition between Barbados and other territories is real.

The absence of *E. oculatus* in trap catches and its dominance in handline catches suggests either that *E. oculatus* are present but do not enter traps, or that they are not found at the slightly shallower depths at which the traps are set. In contrast, *L. vivanus* is considerably more common in trap catches than in handline catches, whilst *R. aurorubens* is common in both. The most probable explanation is an interspecies difference in the preferred depth range. This view is also shared by the local snapper fishermen who maintain that *E. oculatus* are only found on the "second bar", whilst *L. vivanus* are only plentiful on the slightly shallower "first bar". Trap fishing is presently restricted to the "first

bar". The apparent selectivity of traps for smaller sized fish than handlines may also be a result of different depth preferences by snapper of different ages. Thompson and Munro (1983) reported that juvenile snappers tend to live in shallow water and move to deeper water as they mature. It is therefore likely that gear used in shallower water will catch younger (smaller) individuals than gear set in slightly deeper water.

Very little is known about the reproductive biology of the deep-water snappers in the Caribbean (Thompson and Munro, 1983). Reports on size at first sexual maturity for two of the three target species (*L. vivanus* and *R. aurorubens*) vary considerably in the literature (for *L. vivanus*: range is 24 cm FL in the Virgin Islands (Bownell and Rainey, 1971) to 52.5 - 57.5 cm FL in Jamaica (Thompson and Munro, 1983); for *R. aurorubens*: range is 14 cm FL for males in Puerto Rico (Boardman and Weiler, 1980) to 30.8 cm FL in Jamaica (Thompson and Munro, 1983). The mean size of individuals in the July catch are below the sizes at first sexual maturity reported for these two species in Jamaica. Further study is needed to determine the mean size of individuals being taken in all months and to determine more precisely the size at first sexual maturity of the target species off Barbados, before any firm conclusions can be drawn about whether the present gear is appropriate for use in an expanded fishery.

The snapper fishery is of economic importance to Barbados providing employment and contributing substantially to the island's gross domestic product. It appears to be economically attractive with a high market demand for the target species and a mean catch per trip of 40 kg fetching as much as US \$264.00 at the landing site. It is a particularly attractive venture in the off-season when the majority of the pelagic boats would otherwise be idle and the fishermen in search of alternative employment. There appears to be economic potential for expansion of the fishery across all months since market demand for snapper particularly by the restaurant trade, is always higher than the supply. Whilst snapper fishing may not be more profitable than pelagic fishing from mid-November to June for day-boats and ice-boats, it is almost certainly more profitable than the nearshore trap fishing and handlining practiced by the mooses for much of the year. Further study is required however, to properly compare the economics of the different fisheries and comment on the true economic potential of the snapper fishery for each boat type.

The major development constraints at present appear to be the seasonal availability of preferred bait, the frequency with which traps are lost, and the heavy physical work required to handle the gear. These constraints could be addressed fairly easily with storage of bait and small additions to the gear. Squid could be frozen for use throughout the year, or purchased from the new longline fleet in Barbados which is considering importation of squid bait on a regular basis for use in the longline fishery. Trap loss could probably be substantially

reduced by the introduction of degradable "pop-up" devices which hold surface marker buoys below the surface for a predetermined length of time and then dissolve and release the buoy to the surface. This would prevent loss of surface markers in ships' propellers and reduce theft. Depth sounding equipment, at least on the larger, partially covered boats, and the use of a geographical positioning system (GPS) would allow easier placement and relocation of traps on suitable fishing grounds. Electric snapper reels and small mechanised winches, which are widely used in the southeastern USA (Mahon, 1990) could be introduced to the Barbados fishery to minimise the physical effort required to haul deep lines and traps.

However, before expansion of the snapper fishery in Barbados is encouraged, the potential of the snapper resource to withstand increased fishing mortality must be carefully examined. This is particularly important given that snappers have relatively limited reproductive capacity and may form dense spawning aggregations at predictable locations, and are therefore vulnerable to overfishing (Ralston, 1987; Luckhurst and Ward, this volume). Considerably more information is needed on the reproductive biology, growth and mortality rates of the deep-water snappers, and on the location and extent of snapper banks around the island, before any firm conclusions can be made regarding the potential for expansion of a sustainable snapper fishery.

ACKNOWLEDGEMENTS

Funding for the research was provided in part by an International Center for Oceanic Development (ICOD) scholarship to SP. The Barbados Fisheries Division of the Ministry of Agriculture Food and Fisheries, particularly Stephen Willoughby and Ralph Jones are gratefully acknowledged for access to catch records and for assistance. Dr Robin Mahon is acknowledged for provision of computerized data.

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