The Status of Stocks of Groupers and Hinds in the Northeastern Caribbean

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ABSTRACT

A survey was made of the status of stocks of groupers and hinds (Family Serranidae) in the northeastern Caribbean, principally in January and February 2003, coinciding with the principal spawning season of most species. The study area ranged from the U.S. Virgin Islands in the west to Antigua-Barbuda in the south-east and was based on interviews and correspondence with fishers, fisheries officers and other knowledgeable individuals and catches observed at fishing ports and landing sites. Supplementary information included previous personal observations and unpublished notes.

The survey revealed that stocks of the red hind, *Epinephelus guttatus*, appeared to be in relatively good condition in most areas and many spawning aggregation sites are known and are targeted by fishers. However, stocks of the larger groupers have been greatly reduced and spawning aggregations of the Nassau grouper, *E. striatus*, are now known only from the British Virgin Islands and the Antigua-Barbuda shelf. The other species of large groupers are seldom landed and form an insignificant part of the total reef fish catch in most areas.

Areas that are known to be ciguatoxic provide some degree of protection from fishing, and marine protected areas provide partial refuges, although the seaward boundaries are not in sufficiently deep water to protect groupers throughout their lives.

The relative economic status of fishers also affects grouper stocks. In countries with relatively small human populations and good spiny lobster stocks the fishers target lobsters with special traps that have entrances that are made sufficiently small to exclude large predatory groupers.

Recovery of depleted stocks of serranids will depend on known spawning aggregation sites being permanently closed to fishing and the development of effective marine protected areas that cover the known depth range of all species; effectively from the shoreline to 400 m.

KEY WORDS: Groupers, hinds, spawning stocks, MPAs

El Estado de los Poblaciones de Meros en el Caribe Nororiental

Un estudio se hizo del estado de poblaciones de meros (Familia Serranidae) en el Caribe nororiental en enero y febrero 2003, coincidiendo con el maxima epoca desovando de la mayoría las especies. El área del estudio fue de las Islas de la Virgen americanas en el oeste a Antigua-Barbuda en el este y como sur lejano como Monserrat y era basado en las entrevistas y correspondencia con pescadores, funcionarios de las pesquerías y otros individuos conocedor y capturas observaron a los puertos de pesca y los sitios aterrizando. La información suplementaria incluyó observaciones personales anteriores y las notas inéditas.

El estudio reveló eso poblaciones del cabrilla, *Epinephelus guttatus*, parecía estar en condición relativamente buena en la mayoría las áreas y muchos desovando sitios de agregación son conocidos y son buscar por pescadores. Sin embargo, las poblaciones de los meros más grandes han estado muy reducidas y desovar agregaciones del cherna criolla, *E. striatus*, son ahora sólo conocidos de las Islas de la Virgen británicas y el Antigua-Barbuda. La otra especie de meros grandes raramente se aterriza y forma una parte insignificante de la pesca de pez de arrecife total en la mayoría las áreas.

Areas que se conocen para ser ciguatoxic proporcionan algún grado de protección de pescar y las áreas protegido marinas proporcionan refugios parciales, aunque los límites no están en agua suficientemente profunda proteger meros a lo largo de sus vidas. El estado económico relativo de pescadores también afecta poblaciones del mero. En países con poblaciones humanas relativamente pequeñas y los inventarios de la langosta espinosos buenos los pescadores las langostas designado con nasas especiales que tienen entradas que se hacen suficientemente pequeño para excluir meros rapaces grandes.

La recuperación de poblaciones vaciadas de serranids dependerá de sitios de agregación desovando conocidos que se cierran permanentemente a pescar y el desarrollo de marino eficaz áreas protegido que cubren el rango de profundidad conocido de todas las especies; eficazmente del litoral a 400 m.

PALABRAS CLAVES: Meros, desovando poblaciones, MPAs

INTRODUCTION

Groupers and hinds (Family Serranidae) are amongst the most valued of marine food fishes. They are primarily inhabitants of tropical coral reefs or other reef areas. The flavor and texture of their flesh ensure that they feature prominently amongst the most expensive fish in fish markets, and the supply seldom exceeds the demand.

The serranids are all predators and are vulnerable to hooks, traps, nets and spears. Their predatory behavior ensures that they have a high catchability, because they will enter traps to prey on other fishes, approach fishes that are entangled in nets, aggressively compete for baited hooks, and provide a large

and somewhat foolish target for spearfishers. When caught concurrently with other species of reef fish this ensures that their populations are reduced at higher rates than those of other species.

Additionally, most species are protogynous hermaphrodites and most form spawning aggregations at particular places and at clearly defined times. Their aggregating behavior makes them highly vulnerable to intensive pulse fishing, and many aggregations have been extinguished as commercial targets throughout the tropics. Some particularly vulnerable and commercially desirable species, such as the Nassau grouper (*Epinephelus striatus*), have become extremely rare over much of their range (Sadovy 1992) and have been extirpated in some areas, such as the north coast of Jamaica (Sary et al. 2003).

The protogynous hermaphroditism exhibited by most species results in the relative abundances of males being greatly reduced in heavily exploited stocks (Thompson and Munro 1978), as the larger, usually male, individuals are selectively removed by fishing. It has been argued that sex change in serranids may be socially modulated (Shapiro 1987), but no convincing evidence of a reduction in the size of transformation of females to males has been forthcoming.

For the purpose of this paper, the northeastern Caribbean is defined as extending from the Puerto Rico-Virgin Islands shelf in the northwest, and to Antigua in the southeast (Figure 1). In this area, the question arises of whether or not the relatively short distances between island shelves and oceanic banks results in high connectivity of stocks? Do relatively good stocks in areas that are "sources" of propagules result in good recruitment in "sinks" that may be subjected to high levels of unregulated exploitation.

Twenty species of hinds and groupers that are of commercial importance are known from the Caribbean and Gulf of Mexico (Sadovy 1993) and 17 of these have been reported from the northeastern Caribbean (Froese and Pauly 2000) (Table 1). The basic biology and ecology of the species of greatest commercial interest in the Caribbean is well known. Most are reef dwellers ranging from the shallows to several hundred meters. All are predators, but details of their feeding preferences are largely unknown.

SURVEY METHODS

The information reported here is based on interviews and correspondence with fishers, fisheries officers and other knowledgeable individuals and catches observed at fishing ports and landing sites. Supplementary information includes previous personal observations and unpublished notes.

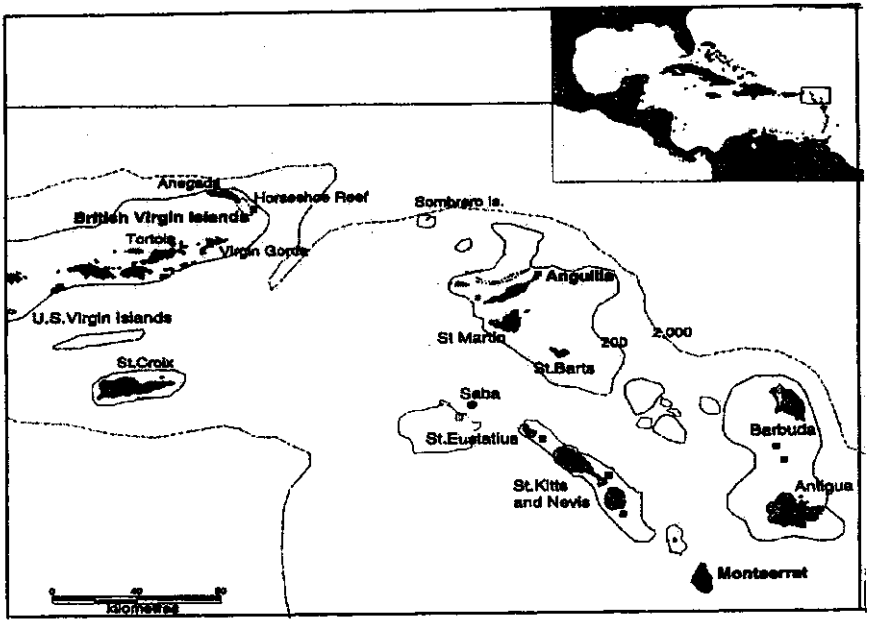

Figure 1. The northeastern Caribbean, showing the location and extent of island shelves and oceanic banks and known spawning aggregation sites (squares). Map redrawn from Gell and Watson (2000).

Table 1. Species of hinds and groupers reported from the northeastern Caribbean (Froese and Pauly 2000). Maximum total lengths in cm and weights in kilograms.

Latin name	Common name	L_{max}	W_{max}
Alphestes afer	Mutton hamlet	33	0.6
Cephalopholis cruentata	Graysby	32	0.6
C. fulva	Coney	33	0.6
Dermatolepis inermis	Marbled grouper	90	10
Epinephelus adscensionus	Rock hind	60	3
E. flavolimbatus	Yellowedge grouper	115	14
E. guttatus	Red hind	76	8
E. itajara	Jewfish	250	320
E. morio	Red grouper	90	15
E. mystacinus	Misty grouper	115	54
E. striatus	Nassau grouper	100	25
Mycteroperca acutirostris	Comb grouper	80	4
M. bonaci	Black grouper	133	65
M. interstitialis	Yellowmouth grouper	74	7
M. tigris	Tiger grouper	100	10
M. venenosa	Yellowfin grouper	90	15
Paranthias furcifer	Creole fish	35	0.5

RESULTS AND OBSERVATIONS

U.S. Virgin Islands (USVI)

Fisheries in the U.S. Virgin Islands are closely regulated by the U.S. Fish and Wildlife Service. The reef fishery in the USVI has always been more developed than that in the neighboring BVI, and the over-harvesting and subsequent decline in grouper catches was seen at least a decade prior to declines in the BVI.

Grouper aggregations in USVI waters were heavily exploited from the early 1960s through the 1980s, with the greatest effort having started north of the Puerto Rican island of Culebra. Aggregations on the Barracouta Bank, north of St. Thomas, were fished to extinction by the late seventies, producing as much as 2.3 mt (metric tons) (5,000 lb) of grouper per day at its peak (K. Turbe, Pers. comm.).

The Grammanik Bank south of St Thomas was a well-known grouper spawning site and was heavily fished until the early 1980s, when catches declined dramatically. Fishing activity then ceased until the late 1990s, when it produced large numbers of grouper before again collapsing. In 2001 the site produced over 5 mt (12,000 lb) of predominately Yellowfin grouper (*Mycyeroperca venenosa*) before being protected by the Caribbean Fisheries Management Council (K. Turbe, Pers. comm.). Research conducted on the bank during the spawning season of 2002/03 by UVI scientists has shown that there are Nassau (*E.* striatus) and Red grouper (*E. morio*) on the bank but not in significant numbers.

The Red Hind Bank, south of Water Island and east of Grammanik, has been a Management Conservation District for several years, with the red hind aggregations described by Beets and Friedlander (1999) fully protected during their spawning cycle. This closure has seen a five–fold population increase in the area and an average size increase of 4 - 8 cm (R. Nemeth, Pers. comm.). It is reported that there are Red hind aggregations south of both St. John and St. Croix but details have not been published. The Lang Bank, east of St. Croix, is a known red hind spawning area and there are plans for further research in this area (R. Nemeth, Pers. comm.)

Nassau grouper (*E. striatus*) are protected in the USVI and it is illegal to land these fish throughout the year. Grouper other than Red hind are not a significant part of the reef fishery catch and it is thought that the apparent abundance of Red hind might be a result of their effectively filling the niche left open by the decimation of larger grouper species. In areas such as the Barracouta Bank, where the hind are still heavily targeted, smaller coneys now predominate in the serranid catch (K. Turbe, Pers. comm.).

Information on grouper landings is difficult to obtain in the USVI due to the legalities of grouper fishing. However, the filleting of prohibited species is increasing amongst the commercial and recreational sectors (K. Turbe, pers. comm.)

British Virgin Islands (BVI)

The BVI occupy the eastern portion of the Puerto Rico-Virgin Islands shelf and the fishery extends over 3,130 km^2 of shelf area. Traditionally, BVI fishers used outboard-driven wooden skiffs to fish inshore areas. As the fishery developed during the late 1970s and 1980s fishers started using larger fiberglass vessels capable of fishing further offshore. This development also saw the gradual switch from the traditional Antillean arrow-head trap to the rectangular steel frame trap. Some fishermen make minor modifications to the trap entrance depending on whether they are targeting lobsters, large or small reef fish.

Landings in 1998 were estimated to be around 820 mt (Pomeroy 1999). Data supplied by the Department of Conservation and Fisheries show that the total fishery landings at the BVI Fisheries Complex for 2002 was 102 mt, with 6 mt attributed to groupers and hinds, down from the 8 mt reported for 2001. With a large proportion of the high value fish such as grouper and snapper going directly to the hotels and no standard data collection system in place, it is likely that these estimates are imprecise. Spiny lobsters are the most important component of fishery landings in economic terms (Pomeroy 1999).

During the period from the 1960s to the 1980s, when grouper stocks were declining in the USVI, fishing effort was increasing in the BVI. Grouper aggregations were fished on the banks north of Jost Van Dyke to Anegada, off Horse Shoe Reef to the south-east of Anegada and on the sea mount south-east of Virgin Gorda. Towards the end of this period grouper were also targeted on the numerous small banks between the eastern tip of Virgin Gorda and Horse Shoe Reef and on Barracuda Bank, southeast of Virgin Gorda. Many large Red grouper (> 60 cm) were caught on this bank during the peak aggregating period between January and March in the mid-1980s. These aggregations were targeted through that period and although numerous fishermen suggest that these aggregations still exist in BVI waters, they are not presently exploited.

Aggregations of Red hind still exist in BVI waters. Discussions with fishers suggest that the proliferation of the hind resulted from the over-fishing of the large groupers, which are now only an incidental part of the reef fish catch.

Relatively rapid development in the reef fishery has seen a general decline in the size of the fish being caught as well as a change in the catch composition, with fewer large predators such as grouper being caught. In the past decade it has been noted that fishers no longer actively target large grouper, which is likely the combined result of catch declines and of numbers of fishers retiring from this fishery.

Some large Red and Nassau grouper were being still caught east of Pajaros Point, Virgin Gorda in the mid-1990s, but these were incidental catches. Fishers report that medium-sized Nassau grouper are still quite common but that aggregations are not actively targeted. Only a few Nassau grouper were landed at the BVI Fisheries Complex during the winter months of 2003. There are still reports of spearfishers catching grouper around Horseshoe Reef in the winter months, and in March of 1998, 8 to 12 60 cm Nassau grouper were observed at 50 m on a ridge south of Horseshoe Reef (L. Blok, Pers. obs.).

Although some large grouper are still caught, the largest proportion of serranids appearing in the market are Red hind. These are caught year round, predominately on hand lines. Recent research conducted by the Department of Conservation and Fisheries has pin-pointed several hind aggregations on banks south of the "southern" cays, between Salt and Ginger Islands.

Mechanisms are in place for the protection of grouper spawning sites. The Horseshoe Reef Fishery Protected Area protects the reef southeast of Anegada. However, the legislation is not enforced. The BVI National Parks Trust controls several small areas where fishing is prohibited. Prime dive sites and yacht anchorages are avoided by fishers, because divers release the fish and damage the fish traps. There is a closed season for landing Red hind between January 1 and March 31 and for Nassau grouper between March 1 and May 31. However, this is largely ignored, and hinds and groupers can be seen in the BVI Fisheries Complex and in supermarkets during these periods.

Anguilla

The shelf area under the control of Anguilla encompasses all of the Anguilla Bank to the north of the island and the area running eastwards from the Anguilla Channel to the shelf edge, totaling about 1000 km^2 (300 nm^2). Additionally, the Sombrero Bank is under Anguillan control.

Spiny lobsters dominate the fishery and reef fish are a secondary target. Open boats with outboard motors predominate. There are said to be several hundred boats in the fishery, but this needs to be verified as much lower numbers were in evidence at the main landing sites. No catch statistics are available. Ciguatera is relatively rare and is usually attributed to barracuda and not to reef fish.

Red hind are relatively common. No grouper species is abundant. Yellowfin grouper, *M. venenosa*, are commonest, followed by Red grouper, *E. morio*. Misty grouper, *E. mystacinus*, are taken in conjunction with red snappers along the shelf edge. Nassau grouper are rare.

Three spawning aggregation sites for Red hind are known, all in relatively shallow water. One is north of Seal Island and two are east and west of Scrub Island. It has been proposed to close the Scrub island sites in alternate years, but this has not yet been implemented. No marine protected areas exist.

Sint Maarten/ Saint Martin and St. Barthelemy

The shelf on which these islands are located is shared with Anguilla, to the north. The waters of the eastern side of the bank are controlled by French St. Martin and St. Barthelemy, while Dutch Sint Maarten, controls only a small portion of the southwestern shelf. There appears to be no published information on the fish stocks controlled by these islands, which encompasses around 1,400 km^2 (400 nm^2) of shelf.

No catch statistics are maintained. While fishing effort on the Dutch side is relatively high, as evidenced by the size and quality of fish in the market, fishing effort within French waters appears to be very low. Few fishing craft of any description are to be seen and the island is a major local importer of seafoods.

All of the Dutch waters within the 30 m (100 foot) isobath are controlled

by the National Parks Foundation of Sint Maarten. This includes two no-take areas, but much difficulty is encountered in enforcing the exclusion of fishers. A marine protected area covering nearly 3,000 ha is located off the northeastern shore, administered by the Reserve Naturelle de Saint Martin. However, this only encompasses relatively shallow areas.

Two spawning aggregation sites for Red hind are known; one south of Sint Maarten and the other at the edge of the St. Bathhelemy Channel, to the southeast.

About 12 nm east of St. Barthelemy, a ridge about 18 nm long in a north-south direction rises from shelf depths of around 50 m to around 30 m. This area is reputed to harbor ciguatoxic fish.

Saba

There are a total of 21 fishers operating from Saba, of which 11 fish on Saba Bank using decked boats (9 - 10 m) and the remainder operate small craft around the narrow island shelf. No catch statistics are maintained.

The entire Saba shelf is a marine park to the 60 m (200 foot) isobath and thus does not encompass the ontogenetic depth range of any major species. Occasional Nassau grouper, *E. striatus,* and Yellowfin grouper, *M. venenosa,* are reported from within the park and hinds and other small serranids are relatively common. No spawning aggregations are known within the park.

Until fairly recently, the Netherlands Antilles had a territorial sea of only 12 nautical miles. As a consequence, most of the Saba Bank was in international waters and was subjected to uncontrolled fishing by vessels from many nations. The entire bank, totaling about 2,250 km^2, is now encompassed by the 200 nm EEZ of the Netherlands Antilles (Dilrosan 2000) and foreign fishers are excluded by regular patrols. Although the bank harbored substantial stocks of groupers in earlier years, as documented by the FAO exploratory fishing vessel, M.V. Calamar (UNDP/FAO 1971), these have disappeared. Fishers report occasional catches of Yellowfin grouper, but Nassau grouper and other large species are extremely rare. In contrast, they claimed that 15 - 20 years ago they would take 20 - 40 Nassau grouper per day; many more than they could use or sell.

Most Saba Bank fishers focus on spiny lobsters, using box traps of specific design. These take fish as an incidental catch, of which the less desired species are used to feed the lobsters when they are stored in holding cages prior to export to St. Maarten. The entrance funnels of the traps are of restricted size, principally to reduce escapement of lobsters but also to prevent the ingress of large groupers and nurse sharks that would prey upon the lobsters. Their impact on grouper stocks is thus somewhat limited. Other fishers target "red snappers" (Lutjanidae) in deeper water on the western side of the bank and only a few fish the shallower parts of the bank for reef fish.

A spawning aggregation site is known on Saba Bank, at Moon Bank, which is about 4 nm southwest of Saba, where Red hind, *E. guttatus* and Queen triggerfish, *Balistes vetula*, aggregate in January and February. A separate aggregation of squirrelfish, *Holocentrus ascencionus*, occours elsewhere on Saba Bank, possibly in the shallow area known as Poison Bank or Copper Bank. These aggregations are targeted by some fishers. Others

abstain for conservation reasons.

St. Eustatius

Fishing around this island is very limited. The shelf is very narrow and is contiguous with that of St. Kitts to the southeast. There are reported to be only about 10 full-time fishers, using small open boats with outboard motors, all operating from a single artificial harbor. Some occasionally venture to the Saba Bank. Most catches are sent to St. Maarten, where prices are higher. No catch statistics are compiled.

Divers reported that Red hind and Rock hind, *E. adsencionus,* are fairly common and that around ten will be seen on any dive. Only Yellowfin grouper are seen with any frequency and Nassau grouper are very scarce. A spawning aggregation occurs off the southeast side near an area called the "White Wall". This is the same site reported by the St. Kitts fishers.

The entire island is surrounded by a marine park, managed by the St. Eustatius National Parks Foundation (STENAPA). However, the seaward boundary is the 30 m (100 foot) isobath, and thus, covers only the shallow portion of the ranges of most species of reef fish, particularly of mature stock. Two no-take zones are located on the northwestern and southern shelf but likewise extend to only 30 m.

St. Christopher (St. Kitts) – Nevis

The two islands in this Federation have separate fisheries administrations but fishers have access to all areas. The island shelves are very narrow , with extensions to the southeast and northwest, the latter shared with St. Eustatius. The total shelf area is about 770 km^2 Some fishing is also done on Redonda and on oceanic banks to northeast and on Saba Bank. Ciguatera is a problem but such areas, generally on eastern, windward edges, are usually avoided.

Groupers are quite rare. Red hind are the commonest serranid, and three aggregation sites are known, on the southern edge of the bank to the south of Nevis, northeast of the southern tip of St. Kitts and between St. Kitts and St. Eustatius, in St. Eustatius' waters. Squirrelfish (Holocentridae) are reported to aggregate between St. Kitts and Nevis. No conservation measures are implemented.

The total reported catch for St. Kitts has trebled since 1995, and the statistics for 2002 (not including December) indicate a total catch of 323 mt, including 9.1 mt of serranids. Grouper landings peaked at 17.8 mt in 1996, declined to 3.4 mt in 2002 and then recovered. However, it was reported that landings might have been included in the tally of "mixed" fish. Pelagic species, particularly gars (*Stronglura* sp.), are more than a third of the catch.

Antigua-Barbuda

Antigua has a well-developed fishery, with quite a large number of decked 10-12 m commercial fishing vessels plus smaller open artisanal boats, mostly around 7 m, with outboard motors. There are two principal landing sites, at St. Johns and at Urlings, and 29 other regular sites. However, landings at these sites, particularly of quality fish such as groupers, are often pre-sold and do not appear on the market. Fishing is quite selective, and trash fish is often used as

bait. Owing to its relatively small population, the demand for finfish in Barbuda is relatively low, and the fishers concentrate their efforts on harvesting spiny lobsters. Most fishing is done quite close to shore and the outer edges and central portions of the 3,360 km^2 Antigua-Barbuda Bank are lightly exploited. However, foreign vessels are known to poach in the area.

Groupers are harvested with traps and handlines and during the spawning season, particularly with handlines. Total landings for 2001 amounted to 1,824 mt, of which 217 mt consisted of serranids, with Red hind, *Epinephelus guttatus*, accounting for 70 %. A further 65 mt consisted principally of Nassau grouper, *E. striatus*, plus smaller amounts of Warsaw grouper, *E. nigritus*, and Misty grouper, *E. mystacinus*. These species are seldom ciguatoxic. In contrast, Yellowfin grouper, *Mycteroperca venenosa* and Yellowmouth grouper, *M. interstitialis*, are often ciguatoxic. Most of the other species listed in Table 1 are not uncommon, but Black grouper, *M. bonaci,* and Tiger grouper, *M. tigris,* were not mentioned in any discussions. No particularly ciguatoxic areas were identified other than Redonda Bank.

A spawning aggregation site for Red hind is are known off Green Island, off the east coast, and Nassau grouper are known to aggregate at knolls in the central area of the shelf. Aggregations are at less than 20 m. The spawning season for Red hind is believed to have shifted progressively from a November start to January-February. No conservation measures are applied to the aggregation sites or during the spawning season. There is a single marine protected area and marine fishery reserve at Code Reef, off the southeast coast.

In late January, 2003, landings at St. Johns fish market were observed to comprise around 60 % Red hind and 20 % Queen triggerfish, *Balistes vetuala,* suggesting that spawning aggregations were being targeted. The Red hind observed included large fish up to ~45 cm TL, many apparently in spawning condition with distended abdomens. However, no ripe running fish were seen. A wide range of other common reef fish comprised the remainder of the catch, including some terminal phase male parrotfish, which is indicative of a relatively low rate of exploitation. No acanthurids were observed and are presumably used as bait.

Oceanic Banks

A group of six or seven poorly charted oceanic banks lie between Barbuda, St. Barthelemy and St. Christopher, with least depths of 20 - 70 m. It is not clear which jurisdiction has responsibility for the banks, and exploitation of the banks was not mentioned by any of the agencies that were interviewed. Boats from Guadeloupe are reported to range throughout the area but this could not be substantiated.

DISCUSSION AND RECOMMENDATIONS

The survey revealed that stocks of the red hind, *Epinephelus guttatus*, appeared to be in relatively good condition in most areas, and many spawning aggregation sites are known and are targeted by fishers. However, stocks of the larger groupers have been greatly reduced, and spawning aggregations of the Nassau grouper, *E. striatus*, are now known only from the Antigua-

Barbuda shelf and might possibly still exist in the British Virgin Islands. The other species of large groupers are seldom landed and form an insignificant part of the total reef fish catch in most areas.

A general observation is that the status of reef fish stocks, particularly hinds and groupers is inversely related to high population densities and relative poverty (e.g. Antigua, St. Kitts, Nevis), low levels of development (St. Eustatius, St. Kitts, Antigua) and is positively related to low population densities (BVI, Barbuda, Anguilla), active governance (Anguilla, St. Martin, St. Barthelemy, Saba), and tourism development (Saint Maarten, St. Barthelemy, BVI).

Additionally, the presence of good spiny lobster stocks clearly removes pressure from the fish stocks. Spiny lobster fisheries are important money earners in Saba, Barbuda and Anguilla, all islands with small populations and limited markets for fish. In Saba and Anguilla it was observed that lobster traps have small entrance funnels to reduce escapement. This means that groupers will eventually become too large to get into lobster traps and will be safe from capture as incidental catch.

Possible management strategies that will protect serranids include the seasonal (e.g. USVI) or permanent (e.g. Belize) protection of spawning aggregations, closed seasons (e.g. BVI), restricted sizes of trap entrances (e.g. Saba, Anguilla) and minimum and maximum sizes for fish that are speared or caught on lines (e.g. Florida). Banning the use of fish traps (e.g. Bermuda) would not be practical in areas with important lobster fisheries.

Although the closure of spawning aggregation sites will assist in the conservation of serranids and other aggregating species, their vulnerability to capture dictates that marine protected areas are an essential adjunct to their conservation. These MPAs must be large and cover the full depth range of all species. Areas that are known to harbor ciguatoxic fishes might be candidate sites for MPAs, because they are avoided to some degree by fishers and their closure will, presumably, meet less opposition than if non-ciguatoxic areas were chosen.

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