Observations on Fisheries Activities at Navassa Island

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Introduction

Despite extremely high rates of primary production in coral reef ecosystems, actual yield of coral reef fisheries is relatively low. In addition, the ecological complexity, richness, and specialized life histories of coral reef organisms and communities make them particularly susceptible to overexploitation (Birkeland, 1997). Results of such overexploitation in Caribbean islands are seen in the documented drastic declines in catch-per-unit-effort, size structure, and/or species shifts in the fisheries of Jamaica, Grenada, the U.S. Virgin Islands, and others (Koslow et al., 1988; Jeffery, 2000; Rogers and Beets, 2001). Indeed, subsistence fishing to support a single family has been described as impacting target populations on the scale of a whole bay in the U.S. Virgin Islands (Coblentz, 1997).

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ABSTRACT—Unmanaged and unquantified artisanal fishing is ongoing at Navassa Island, a small oceanic island about 70 km west of Haiti that is part of the U.S. Caribbean Islands National Wildlife Refuge. Concern has been expressed regarding the possible impact of these fishing activities on reef resources, and no quantitative catch or effort data are available. However, informal qualitative observations made during a cruise in November 2002 suggest that escalation in fishing activity (and impact) has occurred since previous observations made in April 2000. Namely, size structure of fish was markedly reduced and the adoption of net fishing has allowed the exploitation of queen conch, Strombas gigas*, and hawksbill turtles,* Eretmochelys imbricata.

Navassa Island is small and, although claimed by the United States as part of the Caribbean Islands National Wildlife Refuge, sovereignty is disputed by Haiti. Due to its isolation, uninhabited status (except for temporary squatters), and some preliminary quantitative visual fish census work, Navassa Island has been described as displaying a relatively pristine reef community (Anonymous, 2000; Grace et al., 2000; Miller and Gerstner, 2002). However, this interpretation has also been questioned due to the observation of ongoing fishing activity by migrant Haitians, the complete lack of quantitative information regarding the intensity of this fishing activity, and the potential for its rapid escalation (Collette et al., 2003; Grace et al., 2000; Miller and Gerstner, 2002)

Navassa Island is about 5 km^2 in area and is comprised of a raised plateau surrounded by cliffs which reach down to a submarine terrace at 23–30 m depth (Fig. 1). The primary fishery habitats are reef walls formed by the cliffs and large boulders (or "calves" as analogous to the chunks that fall off of icebergs) that have been dislodged from the cliffs, scattered patch reefs and hardbottom areas on the 25–30 m terrace, and deeper reef slopes and shelves (>30 m) farther offshore that have not been well described.

Navassa Island's oceanic position in the Windward Passage (Fig. 1) exposes it to substantial physical energy. The east coast, particularly, bears the brunt of persistent swells, regular storms, and hurricanes. Inshore and backreef habitats, which are important in the life history of several reef fish groups, are largely absent.

Despite its status as a National Wildlife Refuge, fisheries at Navassa Island are effectively unmanaged as regulations are not well publicized and enforcement is non-existent due to Navassa's remote location, surrounded by international jurisdictions. Fishing activities are undertaken by migrant Haitian artisanal fishermen, and these activities appear to have been ongoing since at least the 1970's. Anecdotal observations from a previous NMFS expedition[1] reported five Haitians fishing out of a 4.3 m sailboat along the north/northwest coast and "catching only small grunts [Haemulidae] and one small barracuda [*Sphyraena barracuda*]". Other anecdotal accounts suggest that some technological escalation in this fishery had occurred between scientific expeditions which had occurred in 1997 and 2000. That is, no motors were observed in 1997, while all the vessels observed during the 2000 expedition had 10–15 h.p. motors (Anonymous, 2000; Miller[2]).

Quantification of catch or effort has not been undertaken for the Navassa Island fisheries, though 0–4 small boats per day were observed employing trap and handline fishing during the 2000 expedition (Miller and Gerstner, 2002). Because of this complete lack of quantitative fisheries information and inadequate quantification of reef fish status (particularly in the recent past), the impact of these ongoing subsistence fisheries is difficult to assess. Underwater visual transect census conducted in the western nearshore reef habitats (<20 m) in 2000 reported moderate to high density of large reef fishes (including larger species of Lutjanidae, Serra-

[1] Miller, G. C. 1977. Cruise results for *Oregon II* 77-08 (80), Navassa Island resource assessement survey. Unpubl. 12 p. rep. on file at NMFS Southeast Fisheries Science Center, Miami, FL 33149.

[2] Miller, M. W. NMFS Southeast Fisheries Science Center, 75 Virginia Beach Dr., Miami, FL 33149. Personal observ., 2000.

nidae, and Scaridae), suggesting minimal fishery impact in these nearshore habitats (Miller and Gerstner, 2002) though other reports suggest that large fishes had already been greatly reduced at least in the northwest (Collette et al., 2003). Miller and Gerstner (2002) also suggested that strong socioeconomic "push" factors in Haiti made it likely that fishing intensity and impact at Navassa would increase, possibly rapidly. It is well known that reef communities can be readily overfished (Coblenz, 1997).

There are many definitions of overfishing, most of which cannot be evaluated in the absence of quantitative fisheries statistics (e.g. growth overfishing, Malthusian overfishing). However, qualitative fisheries information can be suggestive of patterns indicating, for example, serial overfishing, (i.e. a progression where the largest and most vulnerable species are removed first, followed by shifts to smaller, less-desirable targets as each group is depleted). For Navassa Island, such qualitative observations are all that are available, and the following observations are offered as indicative of such a pattern.

Methods

Observations were made at Navassa from 29 October to 8 November 2002 based aboard the R/V *Coral Reef II* (Research Vessel of the John G. Shedd Aquarium, Chicago IL). The primary objective of the expedition was the assessment of reef condition (both benthic and fish assemblages (Miller, 2003)). Fishery observations were opportunistic, and each day, note was made of how many fishing boats were present around the island. In addition, direct interviews and observations were made with three different boats on different occasions. A small (~15 ft) boat from the R/V *Coral Reef II* was used to approach the Haitian fishing boats and engage the occupants in conversation. The interviews were conducted in French and designed to obtain information directly from the fishermen on their fishing practices and catch. Also, the interviews afforded an opportunity to observe the catch directly (species and approximate amounts and sizes) that was visible in each boat, though thorough unpacking or exact measurements were not undertaken.

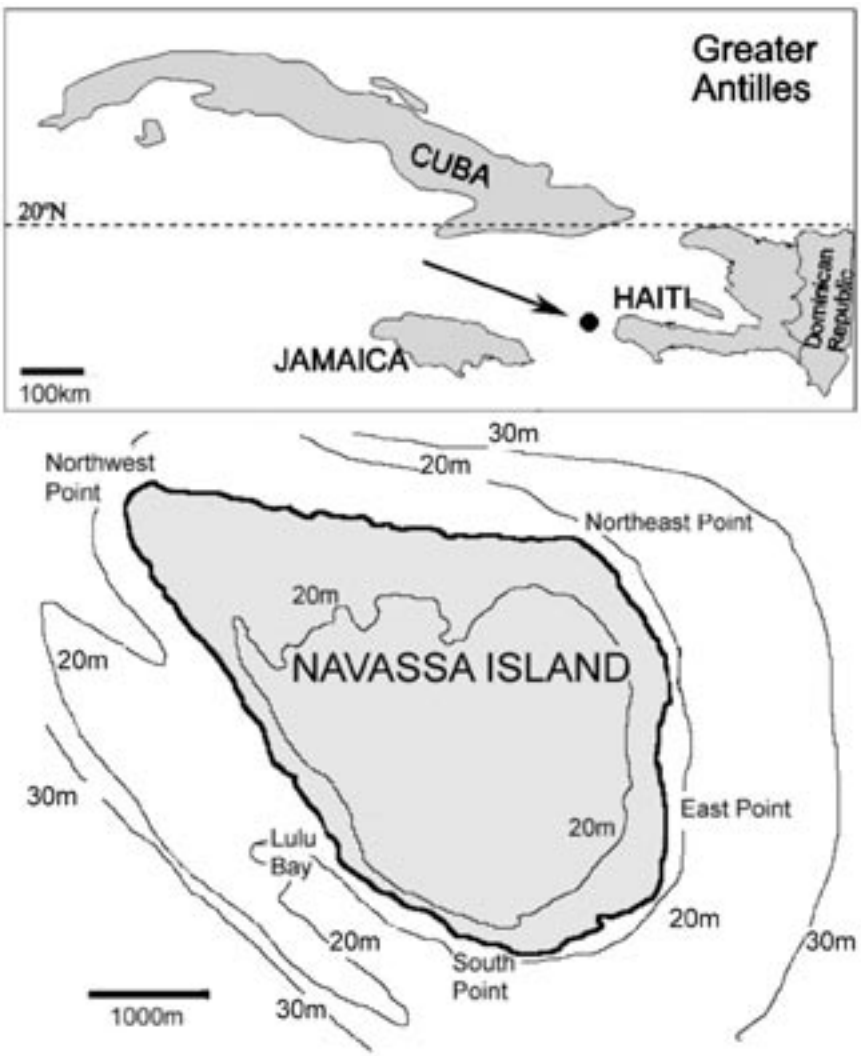

Figure 1.—Map of Navassa Island and its position in the Greater Antilles

Results and Observations

Boat Presence and Characteristics

Upon arrival on 29 October, one expansion of fishing activity impact (since the observations in April 2000) was immediately apparent: the presence of an extensive temporary mooring system in the relative shelter of Lulu Bay with four fishing boats moored there. Moorings consisted of bottle floats tied to a large rock anchor (Fig. 2) on the bottom to hold the sterns while the bows of the boats were secured with lines to the island cliff. These four boats were present for the next 2 days, but apparently they all left on the morning of 1 November. A new group of boats began arriving on 5 November, and four boats were again present at the end of our observations.

The open boats are wooden and about 6–9 m in length. One of the boats we observed was powered only by sail and paddles (Fig. 3), but each of the others had a 10–15 h.p. outboard motor (Fig. 4). The motors are used only intermittently to conserve fuel, and several fishermen told us that they had run out of fuel. Thus, they would be sailing home. One of the interviewed boats had an ice box for holding the catch, but the rest did not.

Fishermen were observed smoking and salting fish both in their boats and on the island. Fishing boats had between 3 and 6 persons aboard with 4 being the mode.

Fishing Practices

Three boat crews were interviewed and gave consistent information regarding their fishing practices. They travel from Haiti (~ 1 day each way), navigating by the sky (sun/stars) and their trips last 8–10 days. They indicated that they did not fish in any other areas, either in Haiti or in transit. One crew indicated that there were 10 boats from a single Haitian village that fish Navassa Island in groups of four boats at a time (consistent with our direct observation). One crew also indicated that they ceased trips for some seasonal periods, "after November," but this is not clear, and fishing activities have resumed at least by April based on observations from the 2000 cruise (Miller and Gerstner, 2002).

Fishing activities were concentrated along the north slope and around the more protected southwest coast terrace, and involved hand lines, traps, and nets (described below). No in-water fishing activities (e.g. via free diving or hookah) nor any tendency for the fishermen to swim were observed, with the exception of a direct transit from one boat to another.

The traps used were modified Antillean Z-traps constructed of bamboo with 3–4 cm mesh size (Fig. 5) and were deployed without bait. The bamboo is most likely transported to Navassa Island and traps are constructed on site as the finished traps were larger than the beam of the boats (Fig. 4). Hand lines were monofilament rigged with 2–4 small hooks and a small rock tied to the bottom for weight. Bait was anything not consumed by the fisherman; sand tilefish, *Malacanthus plumieri,* was most commonly observed being cut up for bait. Nets were some sort of entangling net such as a trammel, trawl, or purse, but we did not directly observe net use practices.

Catch Observations

A diverse array of taxa appeared in the fishermen's catch, as observed in their boats and in underwater refuse piles at the mooring site at Lulu Bay (Table 1, Fig. 6–9). The dominant species observed in the catch were queen conch, ocean triggerfish, schoolmaster snapper, and bar jacks. Other common taxa included juvenile hawksbill turtles, spiny lobster, yellow stingrays, squirrelfish, surgeonfish, trunkfish, barracudas, and black durgons (see Table 1 for scientific names). Some snapper and red hind were observed, but most were smaller than 30 cm and many were less than 20 cm. Only one parrotfish was observed.

Figure 2.—Rock anchor in Lulu Bay used in temporary mooring system for fishing boats.

Figure 3.—Single sail-powered boat observed.

Discussion

Several qualitative differences in the fisheries activities at Navassa Island were noted between the expeditions in April 2000 and November 2002. First, the use of nets was not observed in 2000. Fisheries studies in Papua New Guinea have found a pattern of adoption and increased reliance on net fishing (compared to spearfishing, hook and line, and traps) as larger fishes are depleted (Lock, 1986, cited in Jennings and Lock, 1996). Thus it is plausible to interpret this observed

shift in Navassa Island fishing activity as a possible indicator of depletion.

However, a more direct indicator of depletion is the qualitative observation of relative finfish sizes between the two sets of observations. Large red-colored snappers were observed in the catch in 2000 (>40 cm) while the vast majority of caught fish observed in 2002 (excluding barracuda) were less than 30 cm. This small size structure of the reef fish assemblage at Navassa Island is also born out in extensive reef fish visual censuses conducted during the expedition (McClellan and Miller, 2003).

The adoption of net fishing appears to have had great impacts on the nature of the catch, allowing the exploitation of new species. Fishermen reported that both queen conch and sea turtles were caught by net, and this report is consistent with direct observations in 2000 (Miller[2]) when neither net fishing nor queen conch and sea turtle harvest were observed. In contrast to the finfish catch, the abundant queen conch catch observed in 2002 was composed of large, mature animals (25–30 cm TL) estimated to be 6 to 9 years of age (Glazer[3]), suggesting that queen conch exploitation is in the early phases.

Figure 4.—Typical Haitian fishing vessel with 10–15 hp motor.

Figure 5.—Typical Antillean Z-trap used at Navassa Island.

While the hawksbill turtles observed were not large, it is likely that Navassa Island serves as a juvenile habitat similar to other offshore islands in the Caribbean such as Buck Island (St. Croix, USVI) or Mona Island (Puerto Rico). We observed about 8 captured hawksbill turtles and a total of <10 live hawksbill turtles in the water (in over 300 individual dives). Evidence that the sea turtle harvest is ongoing was observed in the underwater trash piles at Lulu Bay where several (~ 10) piles of turtle bones/plates were observed, but no carapaces, which may have been taken to Haiti for the curio trade (Fig. 9).

The actual method by which queen conch and turtles are harvested with nets is not clear, and we did not directly observe net fishing activities. Shallow coastal habitats are absent at Navassa Island and the only conch habitat we observed is on an interspersed sand/patch reef terrace surrounding the island at 25–30 m depth. It is not clear how these small boats could tow nets in a way to snag conch from such a depth and habitat. Queen conch were captured by fish traps off south Florida (Sutherland and Harper, 1983). However, the fish traps we observed at Navassa Island did not appear to have openings that would accommodate the size of conch we observed in the fishing boats. We hypothesize that the nets are baited and laid horizontally on the substrate for a period of time to attract foraging conch and fishes onto the net before being

[3] Glazer, Robert. Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute 2796 Overseas Highway, Ste. 119, Marathon, FL 33050. Personal commun., 2004.

Figure 6.—Miscellaneous finfish catch from hook and line in the only ice chest observed.

hauled to the surface (i.e. trammel netting). While it is not certain if harvest of queen conch and sea turtles was intended by the adoption of net fishing, the quantity of conch caught and this seeming need for such specialized net usage to procure conch suggest that they are specifically targeted by the Haitian fisherman. Similarly, the ratio of our observations of live and caught sea turtles (10:8 in 300 dives versus 3 boat interviews) suggests that sea turtles are targeted to some extent, possibly by deploying nets around a turtle after it is observed surfacing.

Ruddle (1996) notes that the intensity of reef fisheries is often determined by the availability of alternative economic activities or employment outside the fisheries sector. The poor economic conditions in Haiti may thus imply that fishery exploitation at Navassa is bound to increase. This paper adds to a growing information base of qualitative observations regarding fishing activities at Navassa which, though not yet adequate for clear documentation of the fishing regime, represents the only insight available.

Table 1.—Summary of taxa and approximate number in the catch that was exposed and visible in Haitian fishing boats observed at Navassa Island during 29 Oct–9 Nov 2002.

Common name	Scientific name	Catch
Spiny lobster	*Panulirus argus*	<10
Hawksbill turtle	*Eretmochelys imbricata*	<10
Black durgon	*Melichthys niger*	<10
Yellow stingray	*Urolophus jamaicensis*	<10
Scrawled filefish	*Aluterus scriptus*	<10
Schoolmaster	*Lutjanus apodus*	<10
Sand tilefish	*Malacanthus plumieri*	<10
Snappers	*Lutjanus* spp.	<10
Great barracuda	*Sphyraena barracuda*	<10
Squirrelfish	*Holocentrus* sp.	<10
Queen conch	*Strombas gigas*	10–100
Trunkfish	*Acanthostracion quadricornis*	10–100
Ocean triggerfish	*Canthidermis sufflamen*	10–100
Surgeonfish	*Acanthurus* spp.	10–100
Bar jack	*Carangoides ruber*	10–100
Stoplight parrotfish	*Sparisoma viride*	1
Queen trigger	*Balistes vetula*	1
Stingray	*Dasyatis* sp.	1
Sharks, small	unknown	1
Coney	*Cephalopholis fulvus*	1
Red hind	*Epinephelus guttatus*	1

Although quantitative analysis is precluded by the lack of historical populations estimates, comparison with recent observations in a protected marine reserve at Little Cayman Island in December 2002 shows much greater snapper and grouper numbers and sizes than observed at Navassa (Schull et al., 2003). Smaller grouper such as coney, *Cephalopholis fulva*, and graysby, *C. cruentata*, are now targeted by Haitian fishermen. If local stocks are necessary for repopulating these fishes, it is likely that the vast majority of settling juveniles are caught before they reach sexual maturity. It is also highly likely

Figure 7.—Large gravid lobster.

Figure 8.—Mixed catch including small hawksbill turtle, queen conch, and finfish.

Figure 9.—Underwater refuse pile observed at Lulu Bay containing turtle bones and ventral plates, fish skin, and bamboo.

that substantial shifts in species composition have already occurred in the Navassa Island fishery.

These observed patterns (reduced abundance and size structure of highly desirable target stocks such as snapper and grouper, coupled with exploitation of new stocks with novel gear such as queen conch with nets) are consistent with expectations under a scenario of serial overfishing. Hence, any future attempts at fishery management or regulation for Navassa need to take into account the likelihood of an already-shifted baseline.

Concerted effort must be applied to collecting quantitative catch and effort data. Such fishery information is a prerequisite for beginning to think about a possible fishery management strategy for Navassa or for understanding the relationship between fishing pressure and reef status.

Acknowledgments

These observations were made possible by the NMFS Southeast Fisheries Science Center via the coral reef program. The expedition was performed under Special Use Permit #2002-10 from the U.S. Fish and Wildlife Service, Caribbean Islands National Wildlife Refuge. Hearty appreciation goes to the Captain and crew of the R/V *Coral Reef II* of the John G. Shedd Aquarium, Chicago, Ill., for making the 2002 Navassa mission fruitful and enjoyable.

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