STATUS OF CORAL REEFS OF NAVASSA

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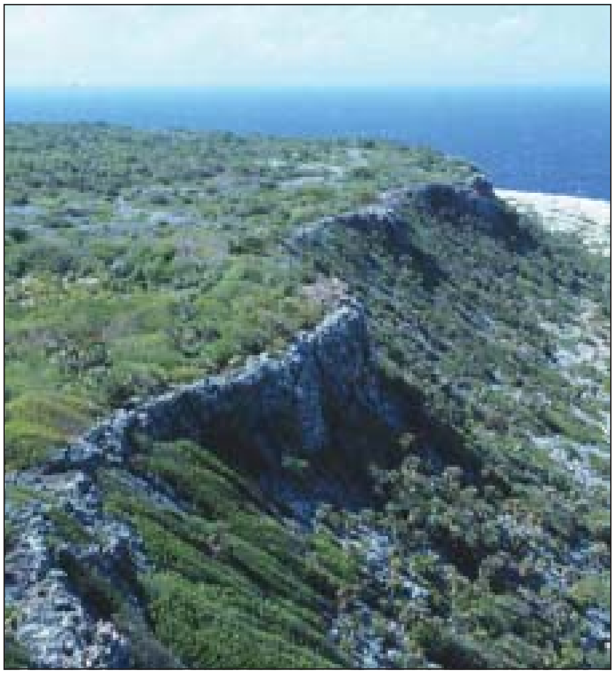
Introduction

Navassa Island is a small, uninhabited island located 55 km west of Haiti and 137 km northeast of Jamaica. A U.S. Protectorate, Navassa is currently administered by the USFWS as part of the Caribbean Islands National Wildlife Refuge. This covers an area from the shoreline to 19 km out, with entry by permit only.

All quantitative reef community structure information contained in this report results from The Ocean Conservancy's (formerly the Center for Marine Conservation) sponsored expedition in March 2000. This information, obtained from SCUBA activities at 11-23 m, was confined to the west and northwest coasts. Additional information was obtained from two other expeditions (The Ocean Conservancy, July-August 1998; NMFS September 1998), which involved ROV, stationary video, and longline sampling. Only recently have there been scientific observations at Navassa, so little is known regarding the disturbance history of the reefs.

Figure 216. Cliffs on the eastern coast of Navassa Island (Photo: Bob Halley and Don Hickey, USGS).



Condition of Coral Reef Ecosystems

There are currently no good estimates of the reef area at Navassa. Its topography does not conform to the normal zonation of Caribbean reefs (Goreau 1959, Goreau and Goreau 1973), which has protected back reef/sea grass communities near-shore, reef crest, and fore-reef habitats.

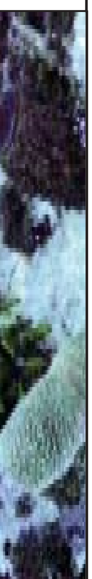
Instead, Navassa has cliffs surrounding the island, extending straight down to about 23 m of water (Fig. 216). Then there is a largely sand/rubble shelf at about 22-25 m, with patch-reef type habitats dispersed throughout. Because there is little shallow water, seagrass and mangrove habitats are essentially absent and most of the shallow reef surface is vertical rather than horizontal. The horizontal reef surfaces are largely confined to a small shelf area at the Northwest Point (10-14 m), indentations along or at the base of the wall, and on pinnacles. These were apparently formed as chunks of the wall broke off, since the pinnacles appear to be geologically based, not accreted biogenic structures.

Rugosity of the reefs at Navassa was quite high with mean rugosity indices ranging from 1.4 to 1.9. West Pinnacles had the highest rugosity index. Reefs with high rugosity have high value as fish habitat and a high potential for reef metabolism and nutrient uptake. While rugosity index data is not commonly collected in reef rapid assessments, Atkinson (1999) argues that it should be because it allows inferences regarding the nutrient uptake and hence, reef metabolism. Szmant (1997) suggested that topographic complexity is a vital determinant of a reef's capacity to metabolize nutrient input without undergoing a 'phase shift' to macroalgal dominance. Not surprisingly, at Navassa the site with highest coral cover also had highest rugosity index.

Quantitative reef assessments (fish and benthic communities) were done at four sites (11-23 m) during the March 2000 expedition. There is no established or ongoing reef monitoring or research program at Navassa.

Coral and Benthos – Average live scleractinian coral cover at the four sampled sites ranged from 20-26%. Other major cover were sponges (7-27%) and algae (10-23%), primarily brown algae and fleshy brown algae. There were no large differences in community composition between sites. However, the highest coral and sponge cover were measured at West Pinnacles, while the highest brown algal abundance was at Northwest Point, the site with the greatest expanse of horizontal reef area.

Figure 217. Encrusting elkhorn coral (Photo: Bob Halley and Don Hickey, USGS).



Abundance of the long-spined sea urchin averaged over the 14 transects where they were counted was 2.9 (0.84 SE) urchins/30 m^2. Elkhorn coral was observed at 5 of the 7 dive sites. At several sites, most notably the Northwest Point, a preponderance of the colonies did not have the characteristic arborescent branching form, but instead, were encrusting (Fig. 217). Several encrusting colonies were small and appeared to be sexual recruits (rare for this fragmenting species), while others were fairly large (e.g., 60-100 cm diameter) and in some cases were overgrowing other corals (e.g., symmetrical brain coral).

Elkhorn coral appeared to be vigorously growing and healthy with no white-band disease and almost no observeable predation scars. One small encrusting colony was observed growing at 21 m which is extremely deep for this species. It normally ranges 1-10 m. Staghorn coral was observed, but at much lower abundance than the elkhorn coral. The largest thicket, about 2 m^2 north of Lulu Bay, had a high density of three-spot damselfish (*Stegastes planifrons*) which bite at the coral to create algal lawns.

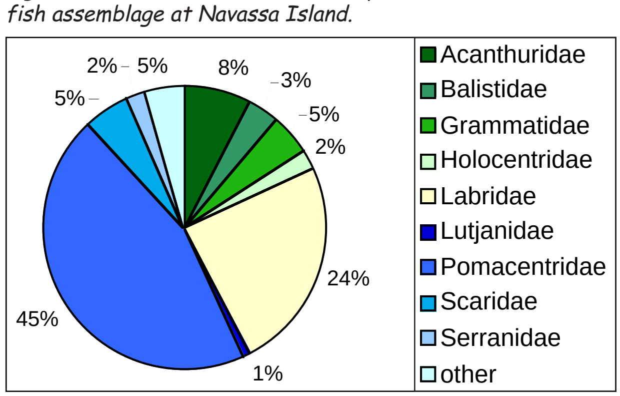
Other qualitative observations of interest around this island include coral species that were unusually abundant at Navassa, including smooth flower coral (*Eusmilia fastigiata*), maze coral (*Meandrina meandrites*), and rough star coral (*Isophyllastrea rigida*).

A noticeable occurrence of partially dead colonies, particularly at the Northwest Point site (13-15 m), could have resulted from past bleaching or disease events, but the cause could not be ascertained. Observations in July-August 1998, during a major global beaching event, reported no coral bleaching at Navassa (Littler *et al*. 1999).

Overall, the reef is healthy, with little active coral disease. The only obvious active disease which resembled white plague and was observed on 3 colonies of *Agaricia* spp. at the base of the wall north of Lulu Bay (approximately 21 m). Many of the *Montastraea* spp. colonies, particularly at the Northwest Point, appear to have suffered partial mortality at some point (i.e., the living tissue is fragmented with intervening organisms in some cases overgrowing it). The source of this mortality was not identifiable, but it could be a result of the 1998 bleaching event. However, researchers on the July-August 1998 cruise reported observing no bleaching (Littler *et al*. 1999).

Aside from the urchin data given before, no quantitative population data is available on large mobile invertebrates. During the March 2000 cruise, there was extensive sampling of the invertebrates to determine diversity, particularly in the echinoderm, crustacean, and molluscan groups. Collections are under analysis at the Los Angeles

Figure 218. Taxonomic (familial) composition of shallow reef fish assemblage at Navassa Island.



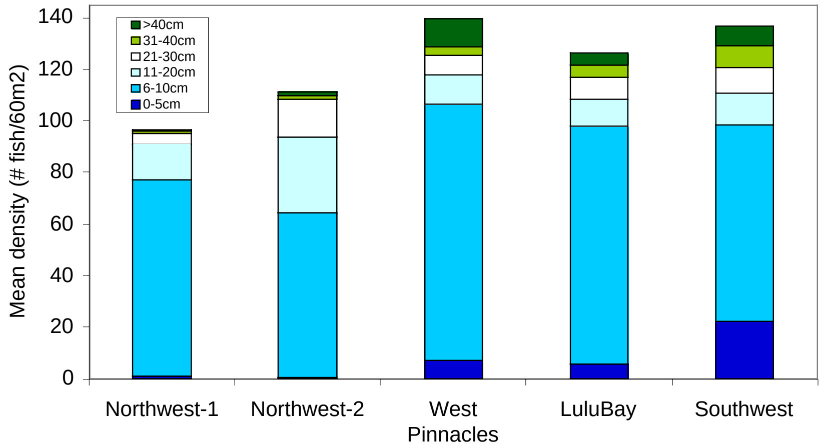


Figure 219. Fish density and size structure quantified via visual transects.

County and University of Michigan museums. Anecdotal observations of large animals from dives during the March 2000 expedition included 4 lobster, 1 large spotted eagle ray, 5 stingrays, 2 octopi, 3 small hawksbill turtles, and 1 large reef crab (*Mithrax* sp., about 25 cm carapace length).

Fish – Quantitative visual transect sampling of shallow reef fish communities counted between 36 and 41 species at each of five sites (Fig. 218). Average (standard error) total fish density for these sites ranged from 97 (9.4) to 140 (16.5) fishes/60 m^2 (Figs. 4-5). Average snapper plus grouper density was 2.5 fishes/60 m^2. Average herbivore density (surgoenfishes plus parrotfishes) was 15.9 fishes/60 m^2 (Fig. 219).

Perhaps more importantly, individual fish sizes were relatively large – 92% of snapper and 23% of parrotfishes were longer than 40 cm. One extremely large grouper was observed (likely a jewfish over 1 m), but it was not in the quantitative transects. Grunts and some wrasses (slippery dicks and hogfish) were absent, perhaps due to the lack of appropriate seagrass nursery habitat.

Five longline sampling stations for pelagic fishes were set around Navassa over a 24-hr period in September 1998 (Grace 1998, 100 hook-hours per station, 120-150 m depth). Total catch included a bull shark (300 cm), seven scalloped hammerhead sharks (170-275 cm), two smooth dogfish (*Mustelus canis*), a great barracuda (*Sphyranca barracuda*, 178 cm), a silk snapper (*Lujanus vivanu*, 72 cm), and a misty grouper (*Epinephelus mystacinus*, 78 cm). Hence, pelagic predators are also large and fairly abundant.

Water Quality – Since the island is uninhabited and far from any modern human development, the water quality at Navassa appears to be quite good (zero land development, and low turbidity). The only quantitative water quality data was obtained during a 24 hour visit by the NMFS Coastal Shark Assessment cruise in September 1998 (Grace 1998), indicating at 15-30 m, temperature of 29.5^{o} C, salinity of 36.1 ppt, dissolved oxygen 4.8 mg/l, turbidity 0.05% transmittance, and chlorophyll *a* concentrations of 0.015 mg/m^3.

Phosphate mining operations during the latter part of the 19th century may have created some phosphate enrichment of the surrounding reef waters, but no nutrient data is available.

A freshwater seep in a cave along the west wall (approximately 11m) was observed during the March 2000 expedition. This water was warmer than the ambient ocean water. Nutrient input from this seepage is under analysis.

Environmental Pressures on Coral Reefs

Given the lack of even recent historical observations of the reefs, the influence of natural threats (climate/bleaching, storms, and disease), is impossible to assess. Fishing is, and likely will remain the sole human threat to Navassa reefs (Fig. 220).

Figure 220. Dense population of reef fish on Navassa Island. (Photo: Bob Halley and Don Hickey).

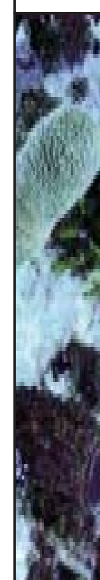


Figure 221. Haitian fishermen (Photo credit: Margaret Miller).

The only form of fishing exploitation on Navassa reefs are the Haitians (Fig. 221). These are subsistence fishers using traps in the deeper waters offshore and hook and line fishing over the reef. Again, no quantitative data is available on the level of effort or harvest, either now or in the past. One to four boats per day with 3-5 men per boat were present at Navassa during the March 2000 cruise. They appeared to be non-selective regarding species or size.

Casual observations suggest that increases in the technological level of these subsistence fishers (e.g., boat motors, ice chests) may have increased rapidly since the 1998 Ocean Conservancy cruise. Given the population pressures and poor fish resources in Haiti, fishing pressure may increase.

Current Conservation Management

The jurisdictional management of Navassa Island passed from the U.S. Coast Guard to the DoI in 1996, and was transferred to the USFWS as part of the Caribbean Islands National Wildlife Refuge in April 1999. A 12-mile fringe of marine habitat around Navassa (estimated at 340,000 acres) is under USFWS management. Navassa is the only component of the Caribbean Islands Refuge where USFWS jurisdiction extends into the ocean.

The USFWS is developing a Comprehensive Conservation Plan for the entire Caribbean Islands Refuge (eight separate units) beginning in 2002.

Gaps in Current Monitoring and Conservation Capacity

There is some ambiguity of refuge management policy and its execution. For example, refuge regulations allow subsistence fishing and as a result, persistent fishing activities are ongoing by small boats from Haiti. Intermittently, the U.S. Coast Guard patrols, and sometimes exclude the fishermen, even though the USFWS policy allows it. The development of a management strategy to keep subsistence fishing impacts attheir current, apparently minimal level is an important but difficult goal.

The other persistent gap which hinders the developing and implementing an effective management plan is the total lack of monitoring of either the reefs or the subsistence fishery. The Ocean Conservancy has made a large contribution toward an assessment of reef status, but no data is available on the subsistence fishery, nor are there plans for collection in the near future. Given the challenge management of this fishery presents, monitoring is a vital tool, but currently unavailable for the development and adaptive evaluation of a management strategy.

Conclusions and Recommendations

Because the condition of reef and fish communities at Navassa appears to be good, especially relative to neighboring Caribbean nations, it is desirable to keep human impacts at their current levels, perhaps through licensing current users. The presence of a relatively intact Caribbean reef provides a unique opportunity for research on Caribbean reefs and could aid in 1) functional understanding these reefs and 2) development of effective management and restoration policies for other areas of the Caribbean.

However, given the strong push-and-pull factors in the fishery industry and the difficulty of enforcement in a remote place, the goal of maintaining the status quo will not be easy. No matter what fishery management strategies are adopted, it is plausible or perhaps even likely that fishing effort and reef impacts may escalate at Navassa. This could occur very rapidly. Quickly implementing a rigorous reef and fishery monitoring program could give important information on what the threshold levels of subsistence fishery are and how they impact the rest of the Caribbean reefs.