



Natural history on a little-known island: Cracking Navassa's oyster

ARTICLE AND PHOTOGRAPHS BY JIL M. SWEARINGEN

As an entomologist for the National Park Service, I recently participated in an expedition to survey the natural resources of Navassa Island (figure 1), a small U.S. territory in the Caribbean Sea (figure 2). Located about 35 miles west of Haiti and 100 miles south of Guantanamo, Cuba, Navassa had been under the administration of the U.S. Coast Guard, which operated a beacon there since the early 1900s (arrow, figure 1). In 1996, the Department of the Interior began to administer this 1.9-square-mile spot of land, and in 1998 requested a natural resources inventory in order to determine the island's future status. This was an exciting opportunity to participate in a historic, scientific expedition to document the natural history of a remote, Caribbean island, and a chance to make discoveries that would prove significant in the disposition of the island.

National parks, wildlife refuges, and other protected public lands are set aside, by and large, to preserve unique, uncommon, beautiful, and otherwise exceptional examples of natural landscapes, scenery, historic and cultural resources, geologic and hydrologic features, and biological resources, including large animals or "showy megafauna." While protection of a selected keystone species is sometimes the main purpose for land preservation, the decision is rarely based on good knowledge of the plants, insects, and other less conspicuous occupants of a site. These elements of biodiversity far outnumber vertebrate species and provide essential food and habitat for their mammoth cousins. Large, natural areas such as national parks, nature preserves, and wildlife refuges, are likely to contain significant biological diversity, requiring many years of scientific inquiry to reveal. Navassa Island was certainly an exception to this rule; it was proposed for designation as a U.S.-managed national wildlife refuge in June 1999,

Figure 1 (above). First sight of Navassa Island reveals the beacon (arrow), location of the "dry" team's camp.

Figure 2 (map). Shaped like an oyster, Navassa is located approximately 100 miles south of Cuba and 35 miles west of Haiti.

based primarily upon the results of our brief, but intensive natural resources survey.

Survey teams assembled

The Center for Marine Conservation in Washington, D.C., organized the expedition, which consisted of terrestrial (figure 3) and marine resources teams (table 1, page 6). The goal was to conduct as complete as possible inventories of the plants, invertebrates, herpetiles, birds, mammals, fish, corals, and other organisms during a 12-day visit. A geologist was included to sample rocks, soils, and other materials, for the purpose of determining the age and composition of the island and to attempt to unravel the island's geologic history. My role as part of the terrestrial team was to assist with the entomological surveys and to help photo-document the journey and survey activities.

Historical exploration of Navassa

Although our surveys of Navassa Island would be the most comprehensive, they were not the first. The island was discovered in 1504, when Christopher Columbus dispatched members of his crew from Jamaica to Hispaniola to get some badly needed supplies. They encountered Navassa en route and inspected it briefly, becoming the first known to set foot on it. Because the crew reported an apparent lack of water, Columbus had no interest in revisiting the island. Knowledge of the island's natural resources, particularly the flora, began accumulating in the late 1700s. Around 1785, Swedish botanist Olaf Swartz, sailing for Jamaica, passed by Navassa and recorded two cliff-dwelling plant species,



which he presumably could see from his ship. The island became U.S. property in 1857 when Peter Duncan, a U.S. citizen, claimed Navassa under the provisions of the newly passed (1856) Guano Act, which allowed any person to lay claim to uninhabited islands that contained large amounts of guano fertilizer. Mr. Duncan set up a mining operation and mined the phosphate guano from 1865-98, with the help of recently freed slaves from Baltimore, Maryland. In October 1928, E. L. Ekman, a second Swedish botanist, spent two weeks on Navassa and reported 102 plant species, 44 of which he believed to be native. He published the results of his survey in the journal "Arkiv for Botanik" in 1929. Fifteen



Figure 3. The terrestrial survey crew consisted of (clockwise from top row, right, ending in center) Robert Powell, Bill Buck, Tom Zanoni, Jil Swearingen, Warren Steiner, Robert Halley, James Oland, and Michael Smith.

"Navassa" continued on page 6

"Navassa" continued from page 5

months later, H. A. Rehder, from the Arnold Arboretum of Harvard University, collected about two dozen plants. He was followed by Dr. George Proctor, a botanist with the Institute of Jamaica, who visited the island for four days in 1956 and documented 38 species of plants.

Before our expedition in 1998, only one invertebrate (a spider) was known for the island and no published records of any insects existed, although two beetle specimens (different species) were located in the Museum of Comparative Zoology, Harvard University. Beyond these, any invertebrates we collected would be new records for the island.



Figure 4. A Coast Guard helicopter, on board the cutter, ferried the survey participants to the island.

Getting there

Against this historical backdrop the terrestrial, or "dry team," met for the first time in Ft. Lauderdale, Florida, on July 21 1998, and began final preparations for the intensive 12-day survey of the natural resources of Navassa Island. We departed early the next morning by charter plane (Fandango Air) for Guantanamo Bay, Cuba, where we spent the night on base and had one morning to purchase all of our food and other perishables for the expedition. In Guantanamo Bay, we were loaded onto a 270-foot Coast Guard cutter (figure 4) for a 12-hour, overnight journey to the island. We were extremely well looked after while under the care of the Coast Guard, whose outstanding logistical support made the terrestrial survey possible. Getting onto the beachless, cliff-rimmed island is treacherous and requires a helicopter for most purposes. A rusted, part-rope, part-steel ladder hangs from a cement slab at Lulu Bay and is used by Haitian fisherman who frequent the island. However, from the cutter anchored offshore, we were ferried to the island by helicopter, along with our supplies and six, 50-gallon barrels of water, requiring nine sorties.

Once on the island, we were impressed and surprised by the vast expanse of forest (figure 5) and highly eroded and pitted limestone rock base. Several grassy savanna-like clearings in the vicinity of the lighthouse were

welcome openings. We set up camp at the base of the dismantled lighthouse and in an adjacent roofless building, the base of which, we discovered, held two large cisterns of water. We deemed this water clean enough to use for washing, which greatly reduced the demands placed on our limited drinking water supply. During the following week and a half, we explored the island using limited remnant paths from the mining operations, and otherwise made our way slowly through the dense vegetation with the help of global positioning system units, to prevent our getting lost and also to obtain digital location points.

The surveys

The surveys revealed that Navassa's terrestrial and marine environments have significant biological and cultural values in need of protection. The surface terrain and geology reveal an ancient and isolated island, estimated to be between 2 and 5 million years old, and the island's biota includes a rich diversity of plants and animals, including some that occur nowhere else. The human history of the island is equally interesting and deserves separate attention.

Plants

About 120 plants are known to occur on the largely forested island, dominated by four species of tropical-subtropical trees: *Sideroxylon foetidissima*, *Ficus populnea* var. *brevifolia*, *Coccoloba diversifolia*, and the highly toxic poisonwood, *Metopium brownei*, that plagued the group with blistering poison ivy-like skin rashes. Two endemic palms occur on the island, one found commonly, and the other barely hanging on as a single live specimen. A number of exotic plants occur on Navassa, including the popular ornamental Madagascar periwinkle (*Catharanthus roseus*), almost certainly introduced by people visiting or residing on the island during the past hundred or more years.

Invertebrates

In attempting to collect as many different species of insects and other invertebrates as possible during our visit, we employed a wide array of collecting techniques and placed traps in a variety of habitat types and zones. Trap methods included pitfall cup traps (figure 6) and Malaise traps (vertical flight intercept nets) fitted with yellow pans of soapy water set on the ground to catch insects that fall

Table 1.
Navassa expedition participants

Terrestrial Resources Team

Expedition Coordinator	Michael Smith	Center for Marine Conservation
Botanists	Bill Buck & Tom Zanoni	New York Botanical Garden
Entomologist	Warren Steiner	Smithsonian Institution (Dept. Entomology)
Entomologist	Jil Swearingen	U.S. National Park Service
Geologist	Robert Halley	U.S. Geological Survey
Herpetologist	Bob Powell	Avila College (Kansas City, MO)
Ornithologist	James Oland	U.S. Fish and Wildlife Service

Marine Resources Team*

Marine Mammalogist	Nina Young	Center for Marine Conservation
Phycologist	Barrett Brooks	Smithsonian Institution (Dept. Botany)
Submersible Technician	Ian Griffith	Deep Ocean Exploration & Research (CA)
Phycologist	Diane Littler	Smithsonian Institution (Dept. Botany)
Phycologist	Mark Littler	Smithsonian Institution (Dept. Botany)
Ichthyologist	Lena San	CEBSE & National Mus. of Natural History (Santo Domingo, Dominican Rep.)

*The marine surveys were conducted from the ship Mago del Mar, operated by Captain Rafael Castellanos and four crew, and owned by the Dominican Ministry of Fisheries.



Figure 5. The mostly forested landscape of Navassa Island conceals its rugged terrain of pitted limestone, which required care to safely negotiate during the expedition.



Figure 6. The entomologists used pitfall traps, shown here, and other survey techniques to collect insects and other invertebrates.



Figure 7. Preliminary results from the terrestrial survey indicate over 500 new insect species records for the island, including an unidentified bee species that was found pollinating a prickly pear cactus (*Opuntia nashii*).

when they hit the nearly invisible screening. Night-flying insects were attracted using black (ultraviolet) lights against white sheets that were hung at different locations. Various manual methods were used to sample leaf litter, soil, rotten wood, fungi, foliage, air, and water.

A preliminary examination of our collections reveals 650 species of invertebrates, including over 500 new insect species records for Navassa (figure 7), 30% of which may be endemic. Over 100 non-insect arthropods, mostly spiders, make up the rest. Many specialists will be needed to work on this diverse material to get it to final species-level identifications.

Vertebrates

Vertebrate surveys confirmed the existence and abundance of four endemic herpetiles, two lizard species (*Celestus badius* and *Anolis longiceps*) and two gecko species (*Aristelliger cochranae* and *Sphaerodactylus becki*), all previously reported for the island. Four other known species, including a large endemic iguana that may have been eaten to extinction, and a boa, could not be relocated. Several dozen species of tropical birds inhabit the island, and are dominated by the highly vocal white-crowned pigeon, red-footed booby, and brown booby. A number of cliff-nesting birds including the bridled tern, added to the diversity. No endemic mammals are known to occur on Navassa, and the group is now represented exclusively by introduced species such as the black rat, goat, dog, and possibly cat.

Reflections

This expedition was valuable to me as a scientist and NPS employee, and on a personal level. It was the first "rapid bioassessment" project I had participated in and, while exciting for me, came with some sources of anxiety. First, I was the only female on the terrestrial team and would be living very closely with seven men I had not previously known (except for my husband, the other entomologist on the team) on an isolated, exposed speck of land in the middle of the Caribbean Sea. Secondly, the terrain was extremely difficult to negotiate and the climate was uncomfortably hot and humid. Each of us was keenly aware that a single, serious injury could jeopardize the entire effort and require emergency rescue by helicopter, which was not readily available until the completion of our survey. And, I was selected to join the expedition with only five days' advance notice. Due to the complicated logistics, careful preparation and planning were required before and throughout the course of the trip. Fortunately, the eight of us got

along swimmingly. We worked very hard, shared camp duties equitably, learned a lot from each other, and had a lot of fun despite the heat, sweat, and unrelenting poisonwood rashes.

The experience also got me thinking about the general lack of information about invertebrates in most of our national parks and other preserves and the great need for surveys to illuminate this information. Rapid bioassessment-type surveys, such as the one conducted on Navassa, attempt to collect comprehensive information on the biodiversity of an area in a short period of time. Surveys conducted under the NPS Inventory and Monitoring (I&M) Program attempt to identify 90% of the vertebrates and vascular plants in a given park over a longer period of time. Invertebrates, non-vascular plants, fungi, and other critical elements of diversity are not currently included in these surveys. In addition to species lists, the I&M inventories also compile information about the distribution of species in a park (at least for threatened and endangered species or other species of concern), their relative abundance, and their association with habitats. Both approaches to species inventorying, while limited, provide information that helps us better understand the ecological value of our natural resources and can direct us in our land protection efforts. Ideally, biological surveys should be as inclusive as possible and be continued over an extended period of time to document short-lived or highly seasonal species. **P**

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Editor's Note: Visitation to Navassa Island requires permission from the U.S. Department of the Interior, Fish and Wildlife Service.