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Avifauna and Human Disturbance Observations on Navassa Island

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ABSTRACT.—Navassa Island and waters surrounding it were designated a National Wildlife Refuge (NWR) in 1999, becoming the eighth unit of the Caribbean Islands NWR Complex. Five expeditions to the island between July 1998 and October 2006 yielded 18 new records of birds, bringing the species list to 58. Winter mist netting allowed for the banding of several new species. Five seabird species roost and nest on Navassa Island including hundreds and thousands of magnificent frigate birds, *Fregata magnificens*, and red-footed boobies, *Sula sula*, respectively. Several grassland-associated bird species are now common, suggesting that this habitat has become more dominant during the last century. Habitat disturbance appears to primarily be the result of human caused fires. Future management efforts will focus on regulation of unauthorized hunting, fishing, and other public use, as well as control of nonnative invasive species and restoration of subtropical dry forest.

KEYWORDS.—ashy-faced owl, brown booby, disturbance, Haiti, magnificent frigatebird, Navassa, red-footed booby, white-necked crow

Navassa Island and its 12-nautical-mile radius of marine habitat was designated the 517th National Wildlife Refuge on 22 April 1999. Administered by the US Fish and Wildlife Service, Navassa is part of the Caribbean Islands National Wildlife Refuge Complex. The island is located approximately 55 km west of Haiti and 130 km northeast of Jamaica in the Jamaica Passage. Approximately 5.2 km^2 in size, it is a dolomitized limestone reef uplifted and exposed by sea level drop between 2.5 and 5 mya (Burne et al. 1974; Halley 1999; Powell 1999). Ringed by sheer cliffs 10-20 m high, its overall topography is nearly flat, though some of its karst potholes are >10 m deep. The island has two distinct terraces approximately 20 m and 60 m above sea level. A well developed submerged terrace also surrounds the island. While no climatological records are available, low-lying islands in the Caribbean basin typically receive 500-1000 mm of precipitation per year, with average summer highs around 33° C, and winter lows around 20° C (Holdridge 1967).

Ekman (1929) describes the plant life and provides the first list of birds. The island's subtropical dry forest is dominated by four tree species (*Metopium brownei, Ficus populnea, Coccoloba diversifolia, Sideroxylon foetidissimum*) that, along with a few scattered savanna grasslands, provide habitat for nesting seabirds, Neotropical migrants, and resident land birds. Land cover as of the most recent expedition is estimated to be 50-70% forests, 5-20% grasslands (including forest burned within the last decade), and 10-30% rocky shelves and cliffs. These sparsely vegetated limestone cliffs are known to provide nesting habitat for white-tailed tropicbirds and brown boobies. Until recently, few expeditions to Navassa had occurred subsequent to those of Ekman (1929) and Wetmore and Swales (1931), and with the exception of a debate over the island's geological origins (Burne et al. 1974; Proctor 1959) little new information had been published. Our objectives in this report are to compile and update the

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published list of birds for Navassa, and discuss the importance of the island to nesting seabirds and Neotropical migrants.

Avian species were documented during five expeditions to Navassa. Expeditions took place from 25 July to 5 August 1998, 29 April to 12 May, 1999, 16-21 March 2000, 5-10 December 2001, and 8-12 October 2006. Our observations were mostly made opportunistically while hiking or conducting other inventory work. For this reason, and with the exception of highly observable and abundant species such as the boobies (*Sula sp.*) and frigatebirds (*Fregata magnificens*), we provide only general relative abundance figures for each species we recorded. We use the system of Raffaele et al. (1998) to describe relative abundance: **common** (five or more individuals seen daily), **fairly common** (up to four individuals seen daily), and **uncommon** (only one seen during a trip). Due to the small number of trips conducted we do not use the terms **rare, vary rare,** or **vagrant**. We reached consensus on relative abundance for each species through discussions and review of field notes. We did not attempt to determine relative abundance for those species recorded in the literature but not seen by us. For bird species captured in mistnets, we provide the number of individuals captured as well as catch per unit effort (number of birds caught per 100 hours per mistnet).

We made counts of seabirds from the R/V Mago de Mar, the R/V Coral Reef II, and an inflatable boat with outboard motor, as well as from the top of the lighthouse. When seabirds were very abundant, estimates were developed by counting birds in a small area, then extrapolating to the total area, sometimes repeatedly to improve precision. When few individuals were present, all birds were counted until agreement was reached. In all cases, estimates were developed independently by two or more persons. For those species we provide abundance as orders of magnitude (1s, 10s, 100s, etc), but provide specific numbers when they were recorded. Birds were also documented from the lighthouse, and at dusk one evening we used a flashlight to look along the cliffs near Lulu Bay for shearwaters and petrels. During the last two expeditions (2001 and 2006), mistnets were deployed in a second-growth forest area along an abandoned railway. Measurements taken for each bird included wing, tarsus, bill and tail lengths, and weight. Birds were sexed, checked for a brood patch, banded, and released.

We added a total of 18 species of birds to the list of 40 compiled in the literature, as well as providing further documentation of 8 species noted only by Keith (2003; Table 1). Seabird abundance and species composition varied markedly with each trip, and in some cases was correlated with nesting.

Numbers of juvenile and adult *Sula sula* combined ranged from 100s to 5000, with peak numbers observed during nesting in April and May. During this period, roughly half of the estimated 5000 were hatchlings in approximately 2500 nests. Adults and juveniles continued to roost on the island in the 1000s through the summer, and numbers dropped to the 100s during the winter.

Fregata magnificens was the other seabird observed throughout the year, with peaks of 500-900 individuals noted during March. Some of the birds had nests and young in March, though nest numbers were not estimated. Numbers dropped to approximately 100 during late spring and were in the 10s during other visits.

Adult brown booby, *Sula leucogaster*, abundance was estimated at 50-90 in March, with one nest confirmed. Numbers increased to the hundreds during late spring and summer, but no active nests were seen. The species was not observed in October or December.

Twenty brown noddies, *Anous stolidus,* were seen on a single day in a flock during April/May, with a peak in the 100s during mid-summer. Young were seen but not quantified during this visit; the species was not recorded during other expeditions.

Bridled terns, *Onychoprion anaethetus,* numbered in the hundreds during July/August, with some young noted, but were not observed during the other three visits.

Eight to 12 adult white-tailed tropicbirds, *Phaethon lepturus,* were seen during March and April/May, and courtship flights were

TABLE 1. Birds reported on recorded expeditions to Navassa. Breeding status based on observations: C = confirmed, S = suspected. Relative abundance as recorded during the five expeditions: C = common, F = fairly common, U = uncommon. Other publications documented presence, but did not record abundance (NR). Numbers refer to individuals banded. Numbers in parentheses indicate capture rate per 100 hrs per mistnet. Asterisks indicate new records for the island. W & S = Wetmore and Swales (1931). USMNH = birds collected by the Smithsonian Museum of Natural History. NMFS = Grace et al. (2000).

Name	Brdg.	Rel. abund.	1929 Ekman	1931 W & S	US MNH	1998 NMFS	1998 FWS	1999 FWS	2000 FWS	2001 FWS	2003 Keith	2006 FWS
Cory's Shearwater, *Calonectris diomedea*		NR	—	—	—	✓	—	—	—	—	—	—
Audubon's Shearwater, *Puffinus lherminieri*		NR	—	—	—	—	—	—	—	—	✓	—
White-tailed Tropicbird, *Phaethon lepturus*	S	C	—	—	—	—	—	✓	✓	—	✓	—
Masked Booby, *Sula dactylatra*		NR	—	—	—	✓	—	—	—	—	—	—
Brown Booby, *Sula leucogaster*	C	C	✓	✓	—	✓	✓	✓	✓	—	✓	—
Red-footed Booby, *Sula sula*	C	C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Brown Pelican, *Pelecanus occidentalis*		U	—	—	—	—	—	—	—	—	✓	—
Magnificent Frigatebird, *Fregata magnificens*	C	C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Great Blue Heron, *Ardea herodias**		U	—	—	—	—	—	✓	✓	—	—	—
Cattle Egret, *Bubulcus ibis*		F	—	—	—	—	✓	✓	✓	—	✓	✓
Osprey, *Pandion haliaetus*		U	—	—	—	—	—	—	✓	—	✓	—
Red-tailed Hawk, *Buteo jamaicensis*		U	—	—	—	—	✓	—	—	✓	✓	—
American Kestrel, *Falco sparverius**		U	—	—	—	—	—	✓	—	—	—	✓
Peregrine Falcon, *Falco peregrinus anatum*		U	✓	✓	—	—	✓	✓	✓	✓	✓	✓
Ruddy Turnstone, *Arenaria interpres**		U	—	—	—	—	—	—	—	✓	—	—
Sanderling, *Calidris alba**		U	—	—	—	—	—	—	—	✓	—	—
Bonaparte's Gull, *Larus philadelphia*		NR	—	—	—	✓	—	—	—	—	—	—
Brown Noddy, *Anous stolidus*	C	U	—	—	✓	—	✓	—	✓	—	✓	—
Sooty Tern, *Onychoprion fuscatus*	S	U	—	—	—	—	✓	—	—	—	✓	—
Bridled Tern, *Onychoprion anaethetus*	C	U	✓	✓	✓	—	✓	—	—	—	✓	—
Pomarine Jaeger, *Stercorarius pomarinus*		NR	—	—	—	✓	—	—	—	—	—	—
Scaly-naped Pigeon, *Columba squamosa*	S	U	✓	✓	—	—	✓	✓	—	✓	✓	✓
White-crowned Pigeon, *Columba leucocephala*	S	MN	✓	✓	✓	—	✓	✓	✓	3 (0.85)	✓	5 (4.6)
Common Ground-dove, *Columbina passerina*	S	MN	✓	✓	✓	—	✓	✓	✓	21 (6.0)	✓	3 (2.8)
Yellow-billed Cuckoo, *Coccyzus americanus*		U	✓	✓	—	—	✓	—	—	—	✓	✓
Smooth-billed Ani, *Crotophaga ani*		F	✓	✓	✓	—	✓	✓	✓	—	✓	—
Barn Owl, *Tyto alba*		U	—	—	✓	—	—	—	—	—	✓	—
Ashy-faced Owl, *Tyto glaucops*	S	U	—	✓	—	—	✓	✓	✓	✓	✓	—
Belted Kingfisher, *Ceryle alcyon*		U	✓	✓	—	—	—	—	—	—	✓	✓

TABLE 1. (*Continued*) Birds reported on recorded expeditions to Navassa. Breeding status based on observations: C = confirmed, S = suspected. Relative abundance as recorded during the five expeditions: C = common, F = fairly common, U = uncommon. Other publications documented presence, but did not record abundance (NR). Numbers refer to individuals banded. Numbers in parentheses indicate capture rate per 100 hrs per mistnet. Asterisks indicate new records for the island. W & S = Wetmore and Swales (1931). USMNH = birds collected by the Smithsonian Museum of Natural History. NMFS = Grace et al. (2000).

Name	Brdg.	Rel. abund.	1929 Ekman	1931 W & S	US MNH	1998 NMFS	1998 FWS	1999 FWS	2000 FWS	2001 FWS	2003 Keith	2006 FWS
Gray Kingbird, *Tyrannus dominicensis*		C	✓	✓	—	—	✓	✓	✓	—	✓	✓
White-eyed Vireo, *Vireo griseus**	U	—	—	—	—	✓	—	—	—	—	—	
Red-eyed Vireo, *Vireo olivaceus*		MN	✓	✓	—	—	—	—	—	—	✓	8 (7.4)
Black-whiskered Vireo, *Vireo altiloquus*		U	—	—	✓	—	✓	✓	✓	—	✓	—
White-necked Crow, *Corvus leucognaphalus*		U	—	—	—	—	✓	—	—	—	✓	—
Caribbean Martin, *Progne dominicensis**		U	—	—	—	—	—	—	✓	—	—	—
Cliff Swallow, *Hirundo pyrrhonota*		U	—	—	—	✓	—	—	—	—	✓	✓
Cave Swallow, *Petrochelidon fulva*	S	C	—	✓	—	—	✓	—	—	✓	✓	✓
Barn Swallow, *Hirundo rustica**		C	—	—	—	—	✓	✓	✓	—	—	—
Gray Catbird, *Dumetella carolinensis**		MN	—	—	—	—	—	—	—	2 (0.57)	—	—
Nashville Warbler, *Vermivora ruficapilla**		MN	—	—	—	—	—	—	—	—	—	3 (2.8)
Northern Parula, *Parula americana**		MN	—	—	—	—	—	✓	✓	3 (0.85)	—	—
Cape May Warbler, *Dendroica tigrina**		MN	—	—	—	—	—	—	—	16 (4.5)	—	8 (7.4)
Black-throated Blue Warbler, *Dendroica caerulescens**		MN	—	—	—	—	—	—	—	6 (1.7)	—	3 (2.8)
Black-throated Green Warbler, *Dendroica virens**		MN	—	—	—	—	—	—	—	—	—	1 (0.93)
Pine Warbler, *Dendroica pinus**		MN	—	—	—	—	—	—	—	—	—	2 (1.8)
Prairie Warbler, *Dendroica discolor**		MN	—	—	—	—	—	✓	✓	3 (0.85)	—	5 (4.6)
Palm Warbler, *Dendroica palmarum*		C	✓	✓	—	—	—	✓	✓	—	✓	—
Black-and-white Warbler, *Mniotilta varia*		MN	✓	✓	✓	—	—	✓	✓	✓	✓	4 (3.7)
American Redstart, *Setophaga ruticilla*		MN	✓	✓	—	—	—	—	—	6 (1.7)	✓	4 (3.7)
Ovenbird, *Seiurus aurocapillus*		MN	✓	✓	—	—	—	—	—	6 (1.7)	✓	9 (8.3)
Northern Waterthrush, *Seiurus noveboracensis**		MN	—	—	—	—	—	—	—	—	—	3 (2.8)
Louisiana Waterthrush, *Seiurus motacilla*		U	—	—	—	—	✓	—	—	—	✓	—
Mourning Warbler, *Oporornis philadelphia**		F	—	—	—	—	—	—	—	2 (0.57)	—	—
Common Yellowthroat, *Geothlypis trichas*		MN	✓	✓	—	—	—	—	—	✓	✓	3 (2.8)
Bananaquit, *Coereba flaveola**		U	—	—	—	—	—	✓	—	—	—	—
Yellow-faced Grassquit, *Tiaris olivacea*	S	MN	—	—	—	—	✓	✓	✓	12 (3.4)	✓	19 (18)
Black-faced Grassquit, *Tiaris bicolor*	S	U	—	—	—	—	—	—	—	✓	✓	—
Nutmeg Mannikin, *Lonchura punctulata*	S	F	—	—	—	—	✓	✓	✓	—	✓	—

observed on several occasions. The species was not observed from land or during circumnavigation of the island during the other expeditions, thus nesting has not been confirmed.

The remains of a single emaciated sooty tern fledgling, *Onychoprion fuscatus,* were recovered from a mined pit along the island's lower terrace during the July/August trip. The species was later confirmed by a seabird expert. This was our only documentation for the species.

Shearwaters and petrels were not recorded during our expeditions, despite an evening search for shearwaters along the cliffs near Lulu Bay in December.

Landbirds whose numbers were quantified included white-crowned (*Patagioenas squamosa*) and scaly-naped (*Patagioenas leucocephala*) pigeons, which were considered common. The former was estimated to number in the 100s, and the latter in the 10s during mid-summer. A total of 80 birds and 11 species were banded in two full days of netting (Table 1) during the December 2001 trip and a total of 80 birds and 15 species during the October 2006 trip. Eight of the banded species were new records for the island, and two others were species that we had documented on earlier visits.

The ashy-faced owl, *Tyto glaucops*, and white-necked crow, *Corvus leucognaphalus*, are species of special interest on Navassa. The former is not included in the US Migratory Bird Treaty Act (MBTA), but is likely a species that should be of conservation concern for the United States, given that it is otherwise restricted to the island of Hispaniola. *C. leucognaphalus*, now extirpated from Puerto Rico and St. Croix, is listed under the MBTA and is considered endangered under the Endangered Species Act throughout its range. It remains unknown whether this species is a permanent resident on Navassa, or whether individuals move back and forth from Hispaniola.

Navassa Island appears to be an important breeding and roosting site for a number of seabird species. At least five species used the island for nesting, and have peak numbers in the hundreds and thousands. The combination of suitable cliff habitat and relative lack of disturbance also suggests that the masked booby, *Sula dactylatra,* and Audubon's shearwater, *Puffinus iherminieri*, could use the island for breeding. Recent work has documented the presence of the masked booby around the island (Grace et al. 2000), though further surveys during the breeding season are needed to confirm breeding activity.

Fires may be affecting the passerine community composition. The first record of the yellow-faced grassquit, *Tiaris olivacea,* for Navassa is found in an unpublished report by Griffis (1982), who notes seeing only two pairs that were "limited by habitat availability." This species was very abundant in grassy areas during our visits. Also recently arrived are the grassland associates black-faced grassquit, *Tiaris bicolor*, *T. olivacea*, and the nonnative nutmeg manikin, *Lonchura punctulata,* all of which feed primarily on grass seed (Raffaele et al. 1998).

Small fires occurred before and during each of our trips to the island. These are likely illegal campfires set by itinerant fisherman that are not extinguished and spread to an acre or more after abandonment, as well as fires set to clear vegetation to facilitate the cutting of *Coccoloba uvifera* for boat construction. Frequent fires effectively destroy dry forest habitat, replacing it with savanna grasslands (Wadsworth 1950). Regeneration occurs extremely slowly due to the lack of rainfall that typifies this island habitat type, as well as feral goat, *Capra hircus*, grazing and the presence of black rats, *Rattus rattus*, which exacerbates the lack of an abundant seed source. We speculate that these fires may benefit the growth and spread of the nonnative grasses, thus providing a niche for these grassland bird species. This theory is corroborated by the fact that Ekman (1929) reported no native grasses on the island.

Human disturbance on Navassa, while apparently not as intense as the phosphate mining of the 1800s, appears to be decreasing the availability of forest habitat and increasing grassland habitat. During our visits, we observed cucumber, *Cucumis savitus*, watermelon, *Citrullus vulgaris*, squash, *Cucurbita sp.,* and corn, *Zea mays,* plants that were presumably planted by itinerant fishermen. Humans may also have an effect on

populations of some seabird species. During our 2001 visit, we communicated with Haitian fishermen using an illustrated bird guide, sign language and broken French. The fishermen indicated they captured and ate *Fregata magnficens*, *Sula sula* and *S. leucogaster*, but not *Tyto glaucops, Pelecanus occidentalis, Phaethon lepturus, Columba leucocephala or C. squamosa*. Besides humans, nonnative species posing a potential threat to the avifauna include *R. rattus*, feral dogs, *Canis domesticus*, and *C. hircus*.

Navassa's importance in the future hinges upon effective management as a National Wildlife Refuge. Management priorities will include conservation and restoration of the dry forest, control and/or eradication of invasive, nonnative animal species, and a quantitative assessment of the direct and indirect impacts of the artesanal fishermen and other unauthorized visitors to the island.

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LITERATURE CITED

Burne, R. V., W. T. Horsfield, and E. Robinson 1974. The geology of Navassa Island. *Caribb. J. Science* 14: 109-114.

Ekman, E. L. 1929. Plants of Navassa Island, West Indies. *Arkiv for Botanik* 22A(16): 1-12, plates 1-2.

Grace, M., M. Bahnick, and L. Jones. 2000. A preliminary study of the Marine Biota at Navassa Island, Caribbean Sea. *Marine Fisheries Review* 62:43-48.

Griffis, J. D. 1982. *The vegetation of Navassa Island.* Buffalo, NY, Institute of Jamaica.

Halley, R. B. 1999. *The geology of Navassa II: Field report from the 1999 CMC expedition.* St. Petersburg, FL. USGS.

Holdridge, L. R. 1967. *Life zone ecology.* Tropical Science Center. San Jose, Costa Rica. 206 pp.

Keith, A. R., J. W. Wiley, S. Latta, and J. Ottenwalder. 2003. *The Birds of Hispaniola: Haiti and the Dominican Republic.* British Ornithologists' Union, Checklist No. 21, Tring, Hertfordshire, U.K.

Powell, R. 1999. Herpetology of Navassa Island, West Indies. *Caribb. J. Sci.* 35: 1-13.

Proctor, G. R. 1959. Observations on Navassa Island. *Journal of the Geological Society of Jamaica (Geonotes)* 2: 49-54.

Raffaele, H., J. Wiley, O. Garrido, A. Keith, and J. Raffaele. 1998. *A Guide to the Birds of the West Indies.* Princeton, NJ. Princeton University Press.

Wadsworth, F. H. 1950. Notes on the climax forests of Puerto Rico and their destruction and conservation prior to 1900. *Caribbean Forester* 2: 38-47.

Wetmore, A., and B. H. Swales. 1931. The Birds of Haiti and the Dominican Republic. *United States National Museum Bulletin* 155:1-483.