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BIRDS OF VIEQUES ISLAND, PUERTO RICO: STATUS, ABUNDANCE, AND CONSERVATION.—Gemmill, Daphne. 2015. Special issue of the Journal of Caribbean Ornithology, BirdsCaribbean; Scholarly & Specialized Publishing, Charlottesville, Virginia. 252 pp. ISBN: 978-0-9821057-1-9. $21.95.

This monographic treatment summarizes the history, status, abundance, and distribution of an island's birds and increases our understanding of island biogeography by recording examples and circumstances of colonization and extinction or extirpation on islands. Furthermore, by documenting avian responses to disturbances such as habitat changes, extreme weather events, as well as responses to predators, competitors, and parasites, thorough monographs such as this one can provide insights into species-specific behavior and ecology. In addition, carefully documented historical observations are useful not only for providing baseline for future comparisons, but they can also help us predict avian responses to future changes in habitats and climate. While Daphne Gemmill's thorough monograph is specific to the 137 km^2 island of Vieques, it also contributes to our general understanding of avian biology and conservation on other Caribbean islands.

As the largest satellite island under Puerto Rico's jurisdiction, Vieques lies 13 km southeast of the main island and 35 km southwest of the island of St. Thomas in the U.S. Virgin Islands. It is elongate (35 km long × 7 km wide) with maximum elevation of 330 m on Mt. Pirata, situated in the western part of the island. The subtropical moist forest life zone covers 21% of the island, in the western portion where most rain falls. In contrast, the subtropical dry forest life zone covers 40% of the island, primarily in the dry eastern sector. Within the two Holdridge life zones, the author describes six vegetation land cover types based on The International Classification of Ecological Communities System. She further describes six bird habitats that incorporate this system including (with percent areal extent) forests (63%), scrub (17%), inhabited areas (15%), mangrove lagoon (3%), shoreline (2%), and streams and ponds (0.1%).

As the author recounts in the introduction, the history of human occupation and natural resource and land use on Vieques is in many respects similar to most other Caribbean islands. The early Amerindian inhabitants appeared to have consumed a variety of the island's bird species as identified in a study of middens dating to 35–65 CE, which is summarized in a section on paleornithology. Following the arrival of Europeans, Vieques was heavily deforested for farming, mostly for sugar cane, which was replaced by livestock grazing after WWII. More recently, tourism, including ecotourism, has become the main economic activity on the island. As on other Caribbean islands with declining agriculture, Vieques' abandoned agricultural lands have reverted to second growth forests. Unique to Vieques' history, however, is the control of two thirds of the island by the U.S. Navy from 1942 to 2003. During this period the Navy denied public access to both the eastern portion of the island (and associated islets), which was used as a bombing range, and the western portion, which was used for munitions storage. In 2003, the Navy lands were transferred to the U.S. Fish and Wildlife Service and Puerto Rican Conservation Trust to remain as protected areas.

The monograph's species accounts summarizing avian status, abundance, breeding records, arrival and departure dates, and habitat use are to a large extent based on the author's annual bird surveys on Vieques from 1983 to 2012. In addition, 414 literature references beginning in 1705 provide more than 300 yrs of observations derived from the primary literature and unpublished Navy biological assessments as well as reference to 404 museum specimens. A thorough review of the various collectors and observers on Vieques is provided in a section on ornithological history. Banding records from 1980 through 2006 are also cited along with relevant Christmas Bird Count (CBC) and eBird reports. In total, the monograph's database comprises over 14,000 records from 1705 to 2012 including the author's own field data, literature, museum collections, and banding records. Based on this substantial database, the author concludes that 174 species are adequately documented for Vieques, one observation of a potentially new species was under review in 2012, presence could not be adequately confirmed for another 20 species, and an escaped cage bird was erroneously recorded as a wild bird. Thus a total of 196 species have been reported for Vieques and the status and potential conservation concern for each species are summarized in the book's species accounts.

In the zoogeography section the author attributes Vieques' geographic position in the northeastern Caribbean and its protected habitats as factors contributing to the relatively high proportion of bird species that visit the island (only 40% of the species are resident) either as summer visitors (5%), winter visitors (20%), passage migrants (10%), or vagrants (25%). Further supporting her geographic crossroads theme, she cites Bond's (1966) classification of geographic sources for 34 native (or formerly native) landbirds, some which are derived from South (29%), Central (12%), and North America (16%) and 12% are of uncertain origin. Bond's evaluation also indicates that the resident waterbirds with the exception of White-cheeked Pintail (*Anas bahamensis*) are of North American origin as are the two resident raptor species. However, recent molecular genetic studies have called some of Bond's species origin assignments into question as the author notes. Two different routes have been used by birds colonizing Vieques as evidenced by the author's review of the arrival histories of five resident species. The Greater Antilles served as a colonization route for two species of presumed North American origin (Mourning Dove [*Zenaida macroura*] in 1967 and White-winged Dove [*Z. asiatica*] in 1971), whereas others arrived via the Lesser Antilles from South Amer-

ica (Green-throated Carib [*Eulampis holosericeus*] in 1912, Shiny Cowbird [*Molothrus bonariensis*] in 1966, and Bridled Quail-Dove [*Geotrygon mystacea*] in 1972).

Given her thorough review of the historical literature and specimens combined with her annual surveys over a 30-yr period, Gemmil has nicely documented status changes on Vieques as populations of various species have waxed and waned over time. For instance, she cites early visiting ornithologists who found Antillean Mangos (*Anthracothorax dominicus*) to be the most common hummingbird on Vieques in the early 1900s, at the time of the arrival of the similarly sized Green-throated Carib. However, by 1957 the mango became rare on the island, as it remains to this day, whereas the Green-throated Carib, formerly absent, is now common. As the author indicates, this inverse abundance change in the two hummingbird species is consistent with Lack's (1973) observation that competition structures Caribbean hummingbird communities, such that small islands support only two species—a large and a small-sized hummingbird—and not two similar-sized species because limited floral diversity of small islands results in competitive exclusion. Lack (1973) also suggested that the colonizing Green-throated Caribs favored human-disturbed habitats, in contrast to the Antillean Mango, which is a forest species and could not compete in disturbed habitats. Thus as second growth forests mature on Vieques we expect that the Antillean Mango abundance will increase at the expense of the Green-throated Carib.

A total of 10 non-native or introduced species have occurred on Vieques, but only 4 species have become established breeders and still reside on the island. Two of these introduced species, the Bronze Mannikin (*Spermestes cucullata*; native to Africa) and Nutmeg Mannikin (*Lonchura punctulata*; native to Southeast Asia), have shown opposite population trends on Vieques. The Bronze Mannikin arrived in 1970 and Vieques CBCs indicate that they declined 39% between 1997 and 2007. In contrast, Nutmeg Mannikins arrived in 1988 and increased in CBCs by more than 200% between 1997 and 2007. The author postulates that the opposite population trends of the two mannikin species may be due to competition or responses to habitat changes that favor one species over the other. Habitat change is also cited for the increase in Adelaide's Warblers (*Setophaga adelaidae*) since 1989 as land use changed from pastures and agriculture to second growth forests and scrub. This recent reversion to second growth accounts for the rarity of Shiny Cowbirds, and is the basis of her concern that pasture-breeding Grasshopper Sparrows (*Ammodramus savannarum*) and Short-eared Owls (*Asio flammeus*) may be lost as breeders on the island.

Gemmill documents the loss of six former breeding species on the island, although some may still visit periodically. Introduced Northern Bobwhite (*Colinus virginianus*) have disappeared as well as Brown-throated Parakeets (*Eupsittula pertinax*) believed to have colonized Vieques from the Virgin Islands where they were introduced from South America. As mentioned previously, Antillean Mangos no longer breed, and the same is true for Antillean Euphonias (*Euphonia musica*) despite a re-introduction attempt. Habitat loss may have been a major factor in these extirpations as well as a factor in the loss of American Flamingos (*Phoenicopterus ruber*) and Puerto Rican Parrots (*Amazona vittata*) as breeders, both of which also suffered direct human persecution.

Conservation is a theme that runs through all sections of the monograph as well as having separate sections specifically devoted to birds of conservation concern, conservation governance, and conservation challenges. The conservation focus is also evident in the section on research needs for the Vieques avifauna, which alerts residents and visitors to important questions remaining for future work. The author notes that 62% of Vieques' bird species are of conservation concern, by at least one of the various organizations that assess species' conservation status. Although Vieques historically underwent some of the same land use changes as other islands, the island remained relatively undeveloped due to the Navy's control of two thirds of the island for over 60 yrs. Military activities during this period caused habitat loss and degradation besides the obvious damage in the bombing range including loss of wetlands, particularly mangrove lagoons. On the other hand, the Navy restricted access to their lands, which prevented deforestation in some areas, and in the case of small islands and islets within restricted zones, the Navy's protection allowed some seabird colonies to flourish. Brown Pelicans (*Pelecanus occidentalis*) especially benefited from restricted access to their main breeding site on Cayo Conejo. Now many of these areas are in protected reserves, although recreational boaters and other visitors may pose a threat. The author concludes that the main conservation concern remains human disturbance, both direct (hunting and disturbance of nesting, feeding, and roosting areas) and indirect (invasive introduced species and environmental pollution). She expresses concern for climate change and associated extreme weather events and reviews observations on hurricane and drought effects on Vieques' birdlife. Gemmill concludes on a positive note by stating that the tools that successfully mitigated conservation threats in the past (better public education, laws, enforcement, and protected areas) can also be used to mitigate future threats to Vieques' birdlife.

The book is attractively illustrated with over 160 illustrations, most in color, including maps, observers, habitats, and birds, the majority of which were photographed by the author. Two tables are provided: the first summarizing the geographic source of Vieques' breeding landbirds and the second is a bird list for the island with abundance per month based on likelihood of observance. Appendices include a watch list (i.e., evaluation of conservation status) for Vieques birds; a gazetteer; maps of the primary areas and routes surveyed by the author from 1983 to 2012; and a summary and key to symbols, acronyms, and abbreviations. An index is provided for avian scientific names, common English names, and very importantly, common Puerto Rican names (which are also provided in each species account). Overall, the book is well written with very few typographical or other errors. The only potential error I found was under the account for the Pin-tailed Whydah (*Vidua macroura*), an escaped cage bird of African origin, in which the first breeding record for Vieques was attributed to an observer who reported a pair nesting in a palm. I'd encourage re-assessment of this observation, given that the whydah is a brood parasite with a preference for laying its eggs in the nests of estrildid finches, particularly waxbills. Other than this suspect record (and it is unfair to expect the author to be familiar with breeding systems of African birds), I

found no other instances that attracted my skepticism. In summary, this monograph is an outstanding contribution based on years of the author's own fieldwork and substantial scholarship, which together thoroughly document Vieques' birdlife. This monograph will be of interest to residents and visitors alike. Not only does this fine work contribute to a better understanding of avian biology in the Caribbean and provide a baseline for future comparisons, but it also provides important guidance for conservation of Vieques' birds, which will make it invaluable for the stewards of the island's environment.

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