

CURRENT KNOWLEDGE AND CONSERVATION OF CUBAN WATERBIRDS AND THEIR HABITATS

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Abstract: We analyzed the current knowledge on Cuban aquatic birds based on the published literature (181 publications). Most publications were after 1980 (91%) and the authors come from six major Cuban institutions that are conducting research on aquatic birds. Inventories and new records comprised 52% of the papers found and the rest focus on ecology and conservation issues. There were publications on at least eight of the ten threatened bird species, but three species had been the main subject of several research and conservation projects with a consequent improvement of their conservation status in the country. Key sites for breeding were established (Sabana–Camagüey Archipelago, Birama Swamp, and Río Máximo Fauna Refuge) among the 11 wetlands that were studied in the bibliography. These areas were crucial for winter migration, too, along with Zapata swamps, rice paddies, and several coastal belts throughout the country. The literature shows a growing interest in the topic in the last 20 yr but Cuban scientists remain challenged to continue working for improved management and conservation of aquatic birds and their habitat.

Key words: Cuban wetlands, reproduction, threatened species, waterbirds

Resumen: CONSERVACIÓN Y CONOCIMIENTO ACTUAL DE LAS AVES ACUÁTICAS CUBANAS Y SUS HÁBITATS. Se analiza el estado actual del conocimiento de las aves acuáticas cubanas a través del análisis de la bibliografía publicada (181 trabajos). La mayoría de las publicaciones (91%) se produjeron a partir de 1980 con la participación de 6 instituciones cubanas que realizan investigaciones en aves acuáticas. Las listas y nuevos registros de especies conforman 52% de la literatura encontrada, el resto aborda diferentes tópicos relacionados con la ecología y conservación. De las diez especies de aves amenazadas, en al menos ocho existen publicaciones y en tres de ellas se han realizado notables esfuerzos de investigación y conservación, lo que se refleja en una marcada estabilidad de sus poblaciones. Dentro de las 11 localidades que han concentrado los estudios de aves acuáticas en Cuba, se destacan por su importancia como humedales claves para la reproducción de las aves acuáticas el archipiélago de Sabana–Camagüey, el Refugio de Fauna Río Máximo y la ciénaga de Birama. Estas tres zonas son también cruciales para la migración invernal junto con la ciénaga de Zapata, las arroceras y numerosas franjas de costa. Aunque han existido notables avances en los últimos 20 años, se debe continuar trabajando para manejar y conservar mejor nuestras aves acuáticas y sus humedales.

Palabras clave: aves acuáticas, especies amenazadas, humedales cubanos, reproducción

Résumé : CONNAISSANCES ACTUELLES ET CONSERVATION DES OISEAUX D’EAU CUBAINS ET DE LEURS HABITATS. L’état actuel des connaissances sur les oiseaux d’eau cubains a été analysé à travers une étude bibliographique (181 publications). La plupart des publications (91 %) étaient parues après 1980 avec la participation de six grandes institutions cubaines qui mènent des recherches sur l’avifaune aquatique. Les inventaires et les données nouvelles concernaient 52 % des articles recensés, tandis que les autres traitaient de questions d’écologie et de conservation. Les publications portaient sur au moins huit des dix espèces menacées, et trois d’entre elles constituaient le sujet principal de projets de recherche et de conservation qui ont conduit à une stabilisation de leurs populations. Parmi les 11 sites étudiés pour leur l’avifaune aquatique, les zones humides les plus importantes pour la reproduction des oiseaux d’eau sont l’archipel de Sabana–Camagüey, les marais de Birama, et le Refuge de faune de Río Máximo. Ces trois zones sont cruciales pour la migration hivernale, tout comme les marais de Zapata, les rizières, et plusieurs zones côtières à travers le pays. Malgré des progrès remarquables sur le sujet au cours des 20 dernières années, il est essentiel de continuer à travailler pour une meilleure gestion et une meilleure conservation des oiseaux d’eau et des zones humides de Cuba.

Mots clés : espèces menacées, oiseaux d’eau, reproduction, zones humides cubaines

Cuba occupies a privileged position in the Caribbean, because migrating birds arrive from two North American corridors: the Mississippi and Atlantic (González 2002). Because about 15% of Cuba consists of wetlands (Vales *et al.* 1998), resident and migrant waterbirds comprise an important com-

ponent of biomass and perform a fundamental role in the functioning of the country’s ecosystems.

In spite of their importance, wetlands were underestimated historically because they were considered unproductive, of little economic value, and sources of disease. The indifference toward these important

ecosystems was reflected in their persistent and rapid destruction, as well as the poor understanding of the value of the biodiversity of wetlands. In the last 30 yr, there has been an awakening of interest within the Cuban scientific community, which is reflected in the increase in the number of studies dedicated to wetlands research. Most of the accumulated knowledge, however, has been published in Spanish in Cuban journals, with limited availability, until recently, to the international community.

To increase the level of knowledge of Cuban wetland ecosystems, it is fundamental to define strengths and weaknesses, and establish future goals for research and conservation strategies that work in concert to benefit resident species as well as North American migrants. Here we analyze the present state of knowledge of Cuban waterbird communities and the ecosystems they inhabit through the published literature, as well as aspects of waterbird conservation in Cuba.

METHODS

The Cuban archipelago (20°13'–20°52' N, 74°08'–78°08' W) is located in the western Caribbean, between North and Central America. It is bounded by the Strait of Florida, Bahamas Channel, and Atlantic Ocean in the north, Windward Passage in the east, the Caribbean Sea in the south, and Yucatan Strait in the west. The archipelago is comprised of two main islands, Cuba (105,007 km²) and the Isle of Youth (formerly Isla de Pinos, 2,200 km²), and about 4,195 islands, islets, and cays (3,715 km²) grouped in four archipelagos: Sabana–Camagüey, Canarreos, Jardines de la Reina, and Los Colorados.

The data that we analyze herein are derived from several sources, including published literature, personal communications, and unpublished reports.

Our bibliographic review included the scientific literature published since 1900 by Cuban researchers; we did not include earlier publications in the analysis because they were catalogues and general works on Cuban avifauna, and therefore not applicable to our efforts here. We found 181 publications related to the subject in national journals and magazines (*Ciencias Biológicas*, *Poeyana*, *Biología*, *Memorias de la Sociedad Cubana de Historia Natural Felipe Poey*, *Garciana*, *Torreia*, *Miscelaneas Zoológicas*, *Biodiversidad de Cuba Oriental*, *Investigaciones marinas CICIMAR*, *Revista Cubana de Ciencias Veterinarias*, *Trabajos Divulgativos del Museo Felipe Poey*, *Flora y Fauna*, and *Cuba Caza*) and international journals (*Colonial Waterbirds*, *Auk*, *Journal of Caribbean Ornithology* (formerly *Pitirre*), *Journal of Field Ornithology*, *Neotropical Ornithology*, *Avicennia*, *Cotinga*, *Caribbean Journal of Science*, *Bird Conservation International*, *The ICF Bugle*, *The Wild Time*, *El Volante Migratorio*, *Technical Report Series CWS*, among others). To facilitate the search for bibliographical materials, we examined the curriculum vitae of Cuban ornithologists who had worked with waterbirds and Cuban wetlands for more than 10 yr, as well as the ornithological bibliography prepared by Wiley (2000) for the West Indies.

We also included results published in proceedings of national and international congresses, 12 manuscripts in preparation, and all theses (five PhD, four MSc, and 22 Bachelor's) related to waterbirds in

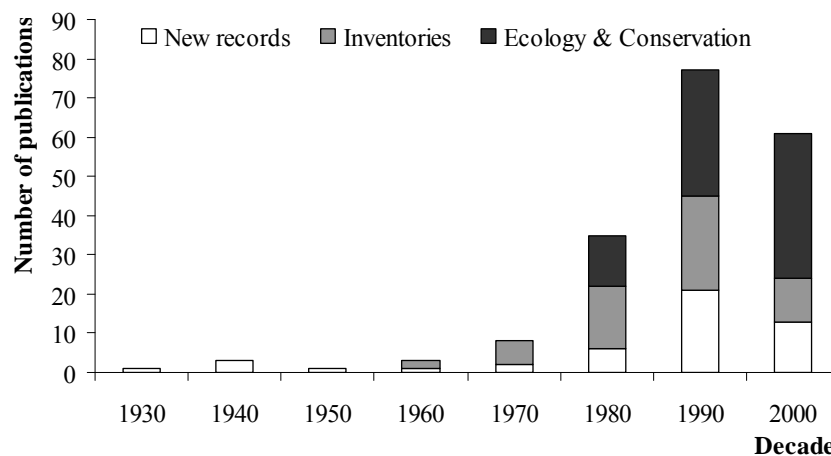


Fig. 1. Distribution of publications on Cuban waterbirds by decade, categorized by type of study.

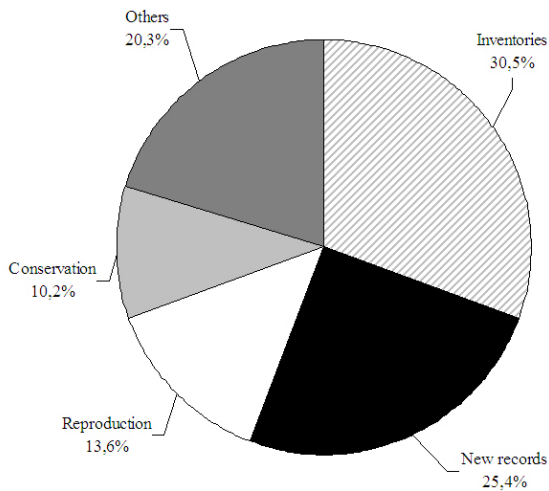


Fig. 2. Number of published reports on Cuban waterbird communities classified by research topics from 1930 through 2006.

Cuba. Other materials examined included four technical reports, three final reports for research projects, two management plans for protected areas, and the World Bird Database for Cuba (WBDB). The database was compiled by Cuban ornithologists, drawing on the forms for Important Bird Areas (IBAs).

For our analysis of the state of knowledge of aquatic bird communities in Cuba, the consulted

materials were categorized into lists of species, new records, and reports on ecology and conservation. Also, published reports were divided by decades, subjects, institutions involved, and localities. In addition, those publications containing related information were categorized as having data on major breeding sites, and on the state of conservation of threatened aquatic birds and their habitat in Cuba.

RESULTS

GENERAL ANALYSIS OF THE BIBLIOGRAPHY

Scientific publications focused on waterbirds began in 1930, but the number of available references on waterbirds and related subjects were scarce until 1970 (Fig. 1). Beginning in 1980, the number of scientific publications on Cuban waterbirds increased notably, tripling the levels observed in the previous decades. Also, investigations focused on the ecology and conservation of Cuban waterbirds began in the 1980s. Unsurprisingly the greatest number of conservation and ecological studies has been conducted since 2000.

Most of the literature on Cuban waterbird communities has been published in scientific journals (158 scientific reports), with 55% of these in national journals (87) and the remainder in international publications (71). The national publications were distributed among 14 journals, magazines, and conference proceedings with the majority in Poeyana (18 publications), Ciencias Biológicas (14), Bi-

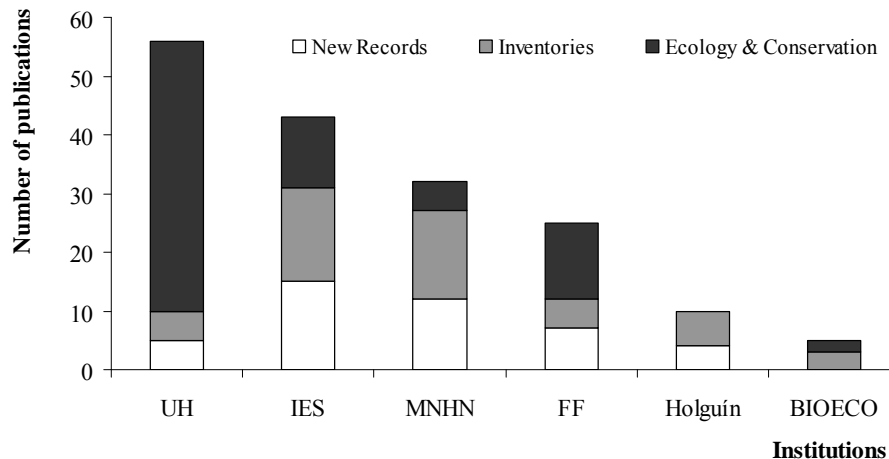


Fig. 3. Numbers of publications on Cuban waterbird communities by Cuban institution and subject category, 1930–2006. UH = Universidad de la Habana, IES = Instituto de Ecología y Sistemática, MNHN = Museo Nacional de Historia Natural de Cuba, ENPFF = Empresa para la conservación de la Flora y la Fauna, Holguín = several institutions in Holguín province, BIOECO = Centro Oriental de Ecosistemas y Biodiversidad.

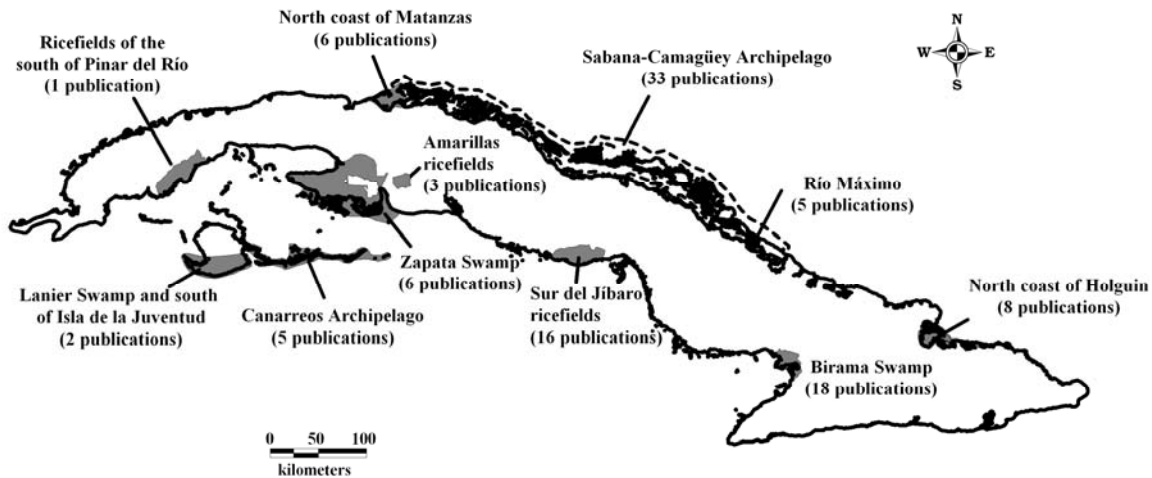


Fig. 4. Numbers of publications on waterbirds in 11 Cuban wetlands, 1930–2006.

ología (13), *Misceláneas Zoológicas* (13), and *Garciana* (9). In the first half of the 20th century, the only journal publishing subject articles was the *Memorias de la Sociedad Cubana Felipe Poey*, whereas in the second half of the century, publications were distributed among 11 scientific journals and two magazines. The *Journal of Caribbean Ornithology* (formerly *El Pitorre*) contained 72% of the international publications. The remaining international journals contained a range from one to three articles published by Cuban authors.

In our analysis of the variety of topics in published research reports on Cuban waterbirds, we found that the highest proportion of publications was inventories (59) and new records (48) for various localities in Cuba, both comprising 52% of the examined literature (Fig. 2). On the other hand, the remaining topics concerned an improved understanding of the biology of Cuban waterbirds, with each topic having less than 25 references (reproduction, conservation, and others including migration, distribution, morphometrics, and general ecology).

The literature published to date represents work conducted mainly by six Cuban scientific institutions: Universidad de La Habana (UH), Instituto de Ecología y Sistemática (IES), Museo Nacional de Historia Natural de Cuba (MNHN), Empresa Nacional para la Protección de la Flora y la Fauna (ENPFF), various institutions of CITMA in Holguín province, and Centro Oriental de Ecosistemas y Biodiversidad (BIOECO). The Universidad de La Habana was the institution with the greatest number of publications and investigations in the fields of

ecology and conservation of Cuban waterbirds (56; Fig. 3). The IES and MNHN are the two other institutions with more publications (43 and 32, respectively), with more of a focus on inventories and new records of waterbirds. Conversely, scientific studies published by ENPFF (25) focused mainly on ecology and conservation.

Most of the examined publications are based on 11 Cuban wetlands (Fig. 4). The most important area with respect to number of publications was the Sabana–Camagüey archipelago. Four of the localities represented areas of natural wetlands combined with wetlands that had been modified for rice cultivation (Birama, Sur del Jíbaro, Amarillas, and Los Palacios). Of these, Birama and Sur del Jíbaro are the two most-studied localities in Cuba. Only four of the six Cuban wetlands of international importance (Ramsar sites; Zapata, Birama, Río Máximo, and Lanier swamps) were sites of published studies on waterbird communities

MAJOR BREEDING SITES OF CUBAN WATERBIRDS

Among the 11 most-studied Cuban wetland localities, three were most important as key reproductive sites for waterbirds. Two of these (Sabana–Camagüey archipelago and Río Máximo Fauna Refuge) are along the northern coast of Cuba, whereas the third (Birama Swamp within the National System of Protected Areas as the Delta del Cauto Wildlife Refuge) is on the southern coast. We evaluated the number of species and reproductive sites of waterbird orders recorded in these three areas, finding that the Sabana–Camagüey archipelago was the region of greatest importance in terms of numbers

Table 1. Numbers of species and breeding sites of the principal orders of waterbirds resident in three Cuban wetlands.

Orders	Sabana-Camagüey Archipelago ^a		Río Máximo ^b		Birama ^c	
	Species	Sites	Species	Sites	Species	Sites
Ciconiiformes	11	46	10	3	12	12
Charadriiformes	10	18	4	4	6	6
Pelecaniformes	5	38	5	3	4	6
Phoenicopteriformes	1	11	1	1	1	5

^aBlanco (2006), Rodríguez *et al.* (2003), Hernández (2006).

^bJiménez *et al.* (2003), World Bird Database.

^cDenis *et al.* (2005), World Bird Database.

of species and breeding colonies (Table 1).

Detailed information is available on the number of reproductive sites for species in the orders Ciconiiformes, Pelecaniformes, and Phoenicopteriformes (Rodríguez *et al.* 2003, Table 2), but no population estimates exist for these species. On the other hand, Blanco (2006) reported the number of pairs per species of those seabirds of the family Laridae that use cays as breeding localities (Table 3). The Sabana-Camagüey archipelago has a particular importance to nesting species of this family, which contains some 72% of the colonial nesting sites reported for the order Charadriiformes, with an estimated 4,250 pairs of nine species of the genera *Larus*, *Sterna*, and *Anous* (Blanco 2006). Also, the last three reports of new species of waterbirds nesting in Cuba were from this archipelago, including Gull-billed Tern (*Gelochelidon nilotica*; Barrios *et al.* 2001), Audubon's Shearwater (*Puffinus lherminieri*; Rodríguez *et al.* 2008), and American Oystercatcher (*Haematopus palliatus*; Hernández 2006). Nevertheless, the other two sites (Río Máximo Fauna Refuge and Birama Swamp) are important in terms of abundance of some species or groups of waterbirds. For example, Río Máximo is of great importance among Cuban wetlands for harbouring the major reproductive colony of Greater Flamingo (*Phoenicopterus ruber*), with approximately 50,000 pairs (Morales 1996, WBDB). The Birama Swamp is also a key reproductive site for flamingo reproduction, with a population of more than 20,000 pairs distributed in several reproductive sites within these complex wetlands (Denis *et al.* 2005). Observations made during 13 visits from 1997 to 2005 revealed that Birama Swamp contained the second greatest concentration of flamingos in Cuba (Denis *et al.* 2005).

Some published reports exist on estimated population sizes of breeding aquatic birds in the Birama Swamp. Denis (2002) reported interconnected local systems of reproductive colonies of herons, some of which were greater than 15,000 pairs, and these colonies depend in large measure on the annual hydrological conditions and the general quality of the wetlands. We observed the growth of a breeding colony of Glossy Ibis (*Plegadis falcinellus*) at Leonero Reservoir (within the Birama Swamp) throughout a 4-yr period (2001–2005), when the population increased from 500 to 5,000 nests. Published information for Birama Swamp demonstrates the importance of the site for another 22 species of waterbirds, including American Coot (*Fulica americana*), Anhinga (*Anhinga anhinga*), West Indian Whistling-Duck (*Dendrocygna arborea*), Wood Duck (*Aix sponsa*), Clapper Rail (*Rallus longirostris*), Purple Gallinule (*Porphyrio martinica*), and Northern Jacana (*Jacana spinosa*) (Denis *et al.* 2005).

STATUS OF CONSERVATION OF THREATENED CUBAN WATERBIRDS

Ten species of waterbirds have been classified as being at some risk; four of these on an international scale and six on a regional scale. At least eight of them have been the subjects of Cuban investigations in the last 15 yr and the main focus has been on three species: West Indian Whistling-Duck, Piping Plover (*Charadrius melodus*), and Sandhill Crane (*Grus canadensis*) (Table 4). These have been the species with more stable populations, perhaps influenced by the conservation measures taken into account (e.g., environmental education campaigns, legal hunting not allowed for the West Indian Whis-

Table 2. Species and number of breeding sites for colonial waterbirds (Ciconiiformes, Pelecaniformes, and Phoenicopteriformes) that nest in the Sabana-Camagüey Archipelago (Rodríguez *et al.* 2003).

Species	Order	Sites
<i>Ajaia ajaja</i>	Ciconiiformes	10
<i>Ardea alba</i>	Ciconiiformes	7
<i>Ardea herodias</i>	Ciconiiformes	4
<i>Bubulcus ibis</i>	Ciconiiformes	1
<i>Egretta caerulea</i>	Ciconiiformes	1
<i>Egretta rufescens</i>	Ciconiiformes	5
<i>Egretta thula</i>	Ciconiiformes	2
<i>Egretta tricolor</i>	Ciconiiformes	5
<i>Eudocimus albus</i>	Ciconiiformes	8
<i>Mycteria americana</i>	Ciconiiformes	2
<i>Nycticorax nycticorax</i>	Ciconiiformes	1
<i>Anhinga anhinga</i>	Ciconiiformes	3
<i>Fregata magnificens</i>	Pelecaniformes	1
<i>Pelecanus occidentalis</i>	Pelecaniformes	5
<i>Phalacrocorax auritus</i>	Pelecaniformes	28
<i>Sula leucogaster</i>	Pelecaniformes	1
<i>Phoenicopterus ruber</i>	Phoenicopteriformes	11

ling-Duck, habitat management for the Sandhill Crane). We found only published results on the distribution and population estimates of West Indian Whistling-Duck (determined during interviews with the members of the Federación Cubana de Caza Deportiva in 2006), Piping Plover, Snowy Plover (*Charadrius nivosus*), Roseate Tern (*Sterna dougallii*; Blanco 2006), and Sandhill Crane (Gálvez 2002) (Table 4).

CONSERVATION OF CUBAN WETLANDS

The importance of Cuban wetlands has been recognized internationally through the establishment of six Ramsar Sites: Zapata Swamp (established 2001) and the Birama, Río Máximo-Cagüey, Lanier, Buenavista, and Norte de Ciego de Avila swamps (all established 2002). On the other hand, 13 Important Bird Areas (IBAs) proposed to Birdlife International are associated with the most important Cuban wetlands (Mugica *et al.* 2006).

At the national level, the National System of Protected Areas has identified 14 areas partially or totally in wetlands habitat as of national significance (five as protected areas for resource management, two as national parks, five as fauna refuges, and two as ecological reserves); 94% of these are in the western and central regions of Cuba (Mugica *et al.* 2006). A series of laws, ordinances, and agreements that afford legal protection of Cuban natural re-

sources exist; e.g., Law 81 of 1997, which established the legal authority of the National System of Protected Areas, and Ordinance 201 (1999) for the protection of coastal areas. Ordinance 201 is of great importance to wetlands because it establishes the means for conservation and ensuring sustainable use of Cuban coastal habitats (Vales *et al.* 1998).

DISCUSSION

In Cuba, as in other Caribbean and Latin American countries, research on waterbird communities was essentially non-existent until the latter half of the 20th century, in mainly because the habitats used by waterbirds were in remote and inaccessible localities, and there were no local biologists dedicated to their study. Before the 1950s, only general catalogues of the birds were produced by foreign authors (e.g., Gundlach 1876, Barbour 1923, Bond 1947), whereas Cuban authors published new records of waterbirds in Cuba (Aguayo 1937, Moreno 1946a, 1946b, 1953, Sánchez 1940).

The increase in the number of publications reporting results of studies of birds associated with Cuban wetlands was the result of the creation of new research centers at the end of the 1960s (IES, the former Instituto de Zoología; MNHN; and ENPFF). The most remarkable increase in related publications occurred beginning in 1980, when research topics also became more diverse. Nevertheless, reports of species inventories and records for various localities continued to be the most numerous publications. The concentration of interest in these two topics is indicative of the degree of historical ignorance of Cuban waterbirds and emphasizes the need for knowing the species composition of these bird communities. Consequently, to the degree that this need has been addressed, efforts have been made to cover aspects of the ecology and conservation of Cuban waterbirds, such as the distribution and abundance of natural wetlands and those modified by man (Acosta and Godínez 1984, Acosta *et al.* 1992, 2002a, Berovides and Gálvez 1995, Blanco 1996, Mugica 2000), feeding ecology (Acosta *et al.* 1988, 1990, 1994, 1996, 1999, Denis *et al.* 2000), breeding biology (Berovides and Smith 1983, Acosta *et al.* 1989, Blanco *et al.* 2001, Denis 2002), other aspects of ecology (Acosta and Mugica 1999, Acosta *et al.* 2002b, 2003, Mugica *et al.* 2003, Jiménez 2004, Rodríguez 2004), and conservation (Gálvez 2002, Mugica *et al.* 2002, Denis 2003, Acosta *et al.* 2004).

The numbers of investigations and published reports in the past 30 yr reflect a substantial effort by

Table 3. Number of reproductive pairs by species of seabird (order Charadriiformes) recorded in colonial nesting sites in the Sabana–Camagüey archipelago, 1989-2003 (Blanco 2006).

Locality	Species ^a								
	1	2	3	4	5	6	7	8	9
Cayo Mono Grande	1	–	–	11	–	49	2223	51	–
Cayo Galindo	4	3	–	–	6	–	–	–	–
Cayo Cinco Leguas	5	1	–	–	–	–	–	–	–
Cayo La Vela	–	1	–	4	8	–	120	10	–
Cayos Monos de Jutías	–	–	–	–	6	–	–	–	–
Cayo Borracho	2	–	–	–	–	–	14	3	–
Cayo Fragoso	–	–	–	–	67	–	–	–	–
Cayo Tío Pepe	–	–	–	–	30	–	–	–	–
Cayo Caimán Sotavento	50	4	–	–	–	40	63	30	–
Cayo Felipe Grande	250	6	11	–	–	130	50	20	–
Cayo Felipe Chico	90	12	7	–	–	120	20	25	–
Faro La Jaula	70	4	–	–	–	42	102	–	–
Cayo Cruz	–	–	–	–	20	–	–	–	–
Cayo Paredón de Lado	200	2	–	–	–	34	30	10	–
Cayo Fogón	10	–	–	–	–	–	–	–	–
Cayo Guajaba	6	–	–	–	2	–	–	–	–
Cayo Sifontes	–	–	–	–	–	–	–	–	8
Cayo Sabinal	60	–	–	–	33	–	–	–	70
Totals	748	33	18	15	172	415	2622	149	78

^aSpecies: 1 = *Leucophaeus atricilla*, 2 = *Thalasseus maximus*, 3 = *Thalasseus sandvicensis*, 4 = *Sterna dougallii*, 5 = *Sternula antillarum*, 6 = *Onychoprion anaethetus*, 7 = *Onychoprion fuscata*, 8 = *Anous stolidus*, 9 = *Gelochelidon nilotica*.

Cuban ornithologists, which has resulted in an increase in the general knowledge of aquatic birds in Cuba. However, because 87% of the examined publications were in Spanish language and regional journals (e.g., Journal of Caribbean Ornithology), they have not been widely available to foreign workers or libraries. As a consequence these publications are underrepresented in reports, such as the seabird publication edited by Schreiber and Lee (2000), which analyzed the effort for conservation of seabirds in the West Indies, but no data were included for Cuba, although several pertinent reports were available (García and Garrido 1965, Valdés 1984, García *et al.* 1989, Berovides and Smith 1983, Morales *et al.* 1991).

In the major Cuban institutions that have undertaken studies of waterbirds, investigations related to species inventories, new records, and ecology and conservation have not been equally represented. These differences in areas of research focus among institutions have resulted in complementary

knowledge of our waterbird fauna in different regions of Cuba. The Universidad de La Habana has not only contributed to the knowledge of waterbirds, but has served as the center for development of new generations of ornithologists interested in this group. To date, the university has graduated five doctoral students, four master of science students, and 22 undergraduate students whose thesis topics concerned the ecology of aquatic birds. On the other hand, the IES has produced ecological studies in the Sabana–Camagüey archipelago, whose main research results are focused on the distribution and important breeding areas for birds of the order Charadriiformes (Blanco 2000, 2006, Rodríguez *et al.* 2003). The investigators of the ENPFF have made their principal contribution in their studies of ecology of the Cuban Sandhill Crane, which have been applied to a substantial conservation program (Gálvez 2002).

Among those wetland areas where investigations have focused to date are those along the southern

Table 4. Threatened species at national, regional (*) and international levels (**), population size, population trend, number of publications, and projects focused in their study are shown. NA = not accessible, PhD = PhD dissertation, D = declining, S = stable, I = increasing, E = endangered, V = vulnerable.

Species	Population Size	Trend	Publications	Status	Distribution
<i>Pterodroma hasitata</i> **	NA	D	2	E ^a	1 population in SE Cuba
<i>Phaethon lepturus</i> *	±100	NA	3	E ^a	1 population in SE Cuba
<i>Dendrocygna arborea</i> **	±14,000	E	4, PhD	V ^b	Throughout Cuban archipelago
<i>Anas bahamensis</i> *	NA	NA	0	V ^c	Reported in 5 Cuban localities
<i>Nomonyx dominicus</i> *	NA	NA	0	E ^b	Throughout Cuban archipelago
<i>Cyanolimnas cerverai</i> **	NA	NA	1	E ^a	1 population in Ciénaga de Zapata
<i>Grus canadensis</i> *	550	41% S 25% I	9, PhD	E ^b	12 populations in 6 provinces
<i>Charadrius alexandrinus</i> *	≤150	NA	2, PhD	V ^a	17 localities in N Cuba, 2 in S Cuba
<i>Charadrius melodus</i> **	≤140	E	8	V ^a	Sabana–Camagüey archipelago
<i>Sterna dougallii</i> *	≤100	NA	PhD	V ^c	18 records in N and S coasts of Cuba

^aGarrido and Kirkconnell (2000)

^bBirdlife Internacional (2000)

^cRaffaele *et al.* (1998)

coast, which includes the most extensive wetlands (Zapata and Birama swamps), the lowest zones with a prevalence of coastal lagoons and mangrove forests, the more extensive rice cultivations in Cuba (Sur del Jíbaro, Los Palacios, and Amarillas), and the second most important archipelago of Cuba, the Canarreos.

The Birama Swamp and the rice cultivation at Sur del Jíbaro, the two best-studied sites on the southern coast, are of critical importance as feeding areas for aquatic birds (Acosta 1998, Acosta *et al.* 1988, 1996, Denis *et al.* 2000), as well as for breeding (Birama: Denis *et al.* 1999a, 1999b, 1999c, 2001a, 2001b, 2003, 2004, Denis 2002, 2003, Jiménez *et al.* 2002). In addition, both sites are of major importance during winter migration (Montañez *et al.* 1985, Acosta and Mugica 1994, Blanco *et al.* 1996, Mugica 2000, Mugica *et al.* 2001, 2003, 2005, 2006, Acosta *et al.* 2002a, Denis *et al.* 2005, Labrada and Cisneros 2005).

Among the small islands to the southeast of Cuba, Cayo Ballenatos is of greatest importance to breeding seabirds (Garrido and Silva 1990, Blanco 2006). The San Felipe cays, west of Isla de la Juventud, have also been identified as breeding sites for seabirds (Blanco 2006) but, in general, the islands off southwestern Cuba do not have well-developed wetlands (with the exception of Lanier Swamp which, despite its importance, is poorly known, with only

basic information on the species composition of the swamp (Garrido 1980a, Forneiro 2000).

In the vast Zapata Swamp, information consists predominantly of bird inventories (Garrido 1980b, Llanes and Acosta 1994, Blanco 1996, Kirkconnell *et al.* 2005). The Zapata wetlands have the greatest number of waterbird species recorded for Cuba (92 species) and is the Cuban wetland best known internationally. Nevertheless, investigations have concentrated on forest birds and information is lacking for waterbirds and the roles they play in their different habitats.

The wetlands of the northern coast of Cuba are less extensive than those along the southern coast, but are no less important. The best-studied region, the Sabana–Camagüey archipelago, embraces an extensive chain of cays that are of great importance to birds of the order Charadriiformes (Blanco 2006). Of all Cuban archipelagos, the Sabana–Camagüey group is best known and the most important for waterbirds. This archipelago has the greatest number of cays (2,517 islands and islets), the largest total area (60% of all cays that surround Cuba), and occupy a strategic location for birds migrating to and from North America (from Punta Hicacos [19°53' N, 77°18' W] in Matanzas province, to Bahía de Nuevitas [21°32' N, 77°11' W] in Camagüey). The project in Sabana–Camagüey financed by GEF/PNUD provided great advances in the studies of the

fauna of the archipelago and has resulted in a good understanding of the species composition of 15 major cayes. The region is of obvious importance to waterbird reproduction as well as winter migration, given the high representation and abundance of colonial seabirds using the large areas of coastal habitat suitable for breeding and feeding among the islands and islets (Garrido 1973, 1976, Acosta and Berovides 1984, ACC and ICGC 1990a, 1990b, 1990c, Morales *et al.* 1991, 1996, González *et al.* 1992, Kirkonnell *et al.* 1993, Kirkonnell 1998, Shaffer *et al.* 2000, Sánchez and Rodríguez 2001, Barrios *et al.* 2003, Rodríguez *et al.* 2003, Blanco 2006).

The coastal fringes to the north of Matanzas, Camagüey, and Holguín also have attracted the attention of Cuban ornithologists because of their important roles in the migration and breeding of waterbirds (Rodríguez *et al.* 1991, Blanco and González 1992, Blanco *et al.* 1993, Blanco 1994, 1995, 1997, Goosen *et al.* 1994, Morales 1996, Peña *et al.* 2000a, 2000b, Pérez and Blanco 2002, Jiménez *et al.* 2005).

In the last two decades, Cuban ornithologists have made notable advances in the study of wetland birds, having contributed at a national as well as international level. Although the identification and legal acknowledgment of Cuban wetlands is an important step toward their conservation, these efforts are not sufficient to achieve effective management. For several nationally and internationally known wetlands, only the most basic of information has been collected and these wetlands' values may not be suitably appreciated for lack of adequate information.

We believe that priority should be given to investigations that lead to the collection of reliable data in relation to population size, long-term population trends, and threats within each of the areas. In addition, we recommend studies that offer sufficient information to allow the effective implementation of biologically sound management, appropriate to each area, and those that lead to the establishment of laws and regulations that protect the Cuban environment.

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