Part 41
Birds in Coastal and Marine Environments

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Group of brown pelicans (*Pelecanus occidentalis*) off Pacific Costa Rica (Photo: Ingo S. Wehrtmann)

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Abstract In Costa Rican coastal and marine environments (e.g., estuaries, mudflats, islands, open ocean) 96 bird species have been recorded, 11% of the total avifauna in the country. This high diversity is primarily explained by the complex topography of the coasts, the large variety of habitats available for coastal and marine birds, and Isla del Coco, a volcanic island that includes a particular marine avifauna. The Pacific coast, including Isla del Coco, possesses a much higher diversity of birds (93 species) than the Caribbean coast (54 species). This difference is likely explained by higher fluctuation in tides, larger extension, and greater topographical complexity on the Pacific coast. There are only 15 coastal or marine birds that reproduce (but not exclusively) in the country. From a conservation perspective, coastal and marine birds have received little attention in Costa Rica. Consequently, contamination, caused by pesticides, sewage, and solid trash, and habitat destruction, due to the construction of tourist infrastructure, seriously threaten the coastal and marine avifauna in Costa Rica.

Introduction

A total of 857 species of birds have been recorded from Costa Rica (Barrantes *et al.* 2002). Of these, we consider 96 (11%) as coastal and marine species. This group includes the typical sea birds (Slud 1967; Harrison 1983; Stiles 1984), shorebirds, and their relatives (Stiles & Smith 1977; Barrantes & Pereira 1992; Table 41.1 and Species List 41.1 which are included on the CD-Rom). There is only a small number of coastal and marine species that reproduce in Costa Rica (15 species, Table 41.2); the rest of them are wintering and transient species, or regular and occasional visitors (Stiles & Skutch 1989). In marine environments, we include a variety of habitats such as open-ocean, seashores, mudflats, estuaries, mangroves, islands, and islets. These habitats serve as feeding and/or nesting grounds for coastal and marine avifauna.

The world marine avifauna is relatively well represented at the family level in Costa Rica. There are only three families of typical marine birds that are absent from the country: Spheniscidae (penguins), Gaviidae (loons), and Alcidae (auks and puffins). Other families, like Hydrobatidae, Procellariidae, and specially Scolopacidae and Laridae have large numbers of species in Costa Rica (Table 41.1 and Species List 41.1 which is included on the CD-Rom). The high diversity of coastal and marine birds is primarily explained by the topographical characteristics of the coasts, diversity of habitats, and a pelagic site, Isla del Coco.

The littoral in Costa Rica extends 212 km on the Caribbean (east) coast and 1,254 km on the Pacific (west) coast. The topography of the Caribbean coast is regular with a few river mouths that dissect the sandy beaches that characterize this seashore, and two small nearshore islands. The simple topography and almost absence of tides result in a landscape with few habitats available for coastal and marine birds (Stiles 1984). Contrarily, the complex topography and high tidal fluctuations of the Costa Rican Pacific coast have resulted in numerous habitats appropriate for

Table 41.1 Orders of birds that include species using marine habitats in Costa Rica. Number of families, genera, and species are given

Order	No. of families	No. of genera	No. of species
Procellariiformes	3	7	18
Pelecaniformes	5	5	11
Charadriiformes	8	28	67

Table 41.2 Coastal and marine birds that reproduce in Costa Rica. Coast and specific habitats for breeding activities are included

Species	English name	Coast	Habitat
Pelecanus occidentalis	Brown Pelican	Pacific	Islands
Sula dactylatra	Masked Booby	Pacific	Isla del Coco
Sula leucogaster	Brown Booby	Pacific, Caribbean	Islands
Sula sula	Red-footed Booby	Pacific	Isla del Coco
Phalacrocorax brasilianus	Neotropical Cormorant	Pacific	Freshwater swamps
Fregata magnificens	Magnificent Frigatebird	Pacific	Islands
Fregata minor	Great Frigatebird	Pacific	Isla del Coco
Himantopus mexicanus	Black-necked Stilt	Pacific	Sandy beaches
Charadrius wilsonia	Wilson's Plover	Pacific	Sandy beaches
Charadrius collaris	Collared Plover	Pacific, Caribbean	Beaches
Sterna anaethetus	Bridled Tern	Pacific	Small grassy islands
Sterna fuscata	Sooty Tern	Pacific	Isla del Coco
Anous stolidus	Brown Noddy	Pacific	Islets, Isla del Coco
Anous minutus	Black Noddy	Pacific	Isla del Coco
Gygis alba	White Tern	Pacific	Isla del Coco

different groups of coastal and marine birds (Stiles 1984). For example, great extensions of mudflats that serve as breeding and stopover grounds for a large number of shorebirds, terns, and seagulls are exposed during low tides, particularly on the shore of the Golfo de Nicoya (northwestern region of Costa Rica) and around the numerous river mouths (Stiles & Smith 1977). The varied topography of the Pacific coast also includes estuaries, mangroves, sandy beaches, and several small islands. These habitats are used for feeding and/or reproducing by pelicans, frigatebirds, boobies, shorebirds, gulls, and terns. Pelagic seabirds (e.g., petrels, shearwaters) are often observed mostly along the Costa Rican west coast (seldom in embayments) during their migration or when tropical storms occur (Stiles 1984).

Isla del Coco is a small (24 km^2) single volcanic island with extremely rainy climate and covered with a dense evergreen vegetation (Slud 1967; Grant 1986). It is located 500 km offshore Costa Rican mainland and 630 km from Galapagos in the Pacific Ocean. The island has a seabird fauna distinct from that of Costa Rican coast. *Oceanodroma markhami*, *Sula sula*, *Fregata minor*, and *Gygis alba* are some of the species sighted on this oceanic island (Figs. 41.1–41.3).

Fig. 41.1 Red-footed booby (*Sula sula*) from Islote Manuelita, Isla del Coco, Pacific Costa Rica (Photo: Felipe López Pozuelo)

Fig. 41.2 Brown booby (*Sula leucogaster*) from Islote Manuelita, Isla del Coco, Pacific Costa Rica (Photo: Felipe López Pozuelo)

The high diversity of habitats available for coastal and marine birds on the Pacific seaside, including Isla del Coco, is likely to be the main factor determining the higher species richness (93 species) compared to the avifauna present on the Caribbean side (54 species). Of these, 42 species of coastal and marine birds have been recorded exclusively on the Pacific coast, whereas, only three in the Caribbean side (Species List 41.1 is included on the CD-Rom). A representative of the Caribbean bird fauna of Costa Rica is shown in Fig. 41.4.

Fig. 41.3 White tern (*Gygil alba*) from Isla del Coco, Pacific Costa Rica (Photo: Felipe López Pozuelo)

Fig. 41.4 Whimbrel (*Numenius phaeopus*) from the Caribbean coast of Costa Rica (Photo: Jeffry Ortiz)

Most coastal birds are migrants that reproduce in North America and winter in Costa Rica or other tropical areas. Practically all shorebirds, terns, and gulls have this migratory pattern. Few of these species have migratory and resident populations in Costa Rica, e.g., *Charadrius wilsonia* and *Hymantopus mexicanus*. Similarly, pelagic seabirds visit Costa Rican coasts during their regular migration or erratic long-distance movements, which are likely determined by environmental conditions (e.g., storms) or following changes in food resource availability. Few typical seabirds

have breeding colonies in Costa Rica, e.g., *Sula leucogaster* (Fig. 41.5), *G. alba* (Table 41.2). Therefore, relatively few species are year-around residents in the country, and there are no endemic coastal or marine birds in Costa Rica.

The large majority of species included in Species List 41.1 (on CD-Rom) have either wide distribution or extensive migratory ranges (Harrison 1983; Hayman *et al.* 1986; Morrison & Ross 1989). Consequently, there are few differences in species richness and composition with changes in latitude as shown for five families in Table 41.3. Thus, the number of species as well as the species composition (using Jaccard index) vary little between Costa Rica, Mexico (Peterson & Chalif 1973), and Ecuador (Ridgely & Greenfield 2001). Procellariidae is the family that varies most among the three countries. In Mexico, this family has almost twice as many species as Costa Rica, possibly because of the extensive shoreline, the large number of islands, and the latitudinal range that Mexico covers.

The wide distributions of most marine and coastal species are not related to their abundances. Probably some of these species have been naturally scarce, however

Fig. 41.5 Brown boobies (*Sula leucogaster*), a typical visitor of shrimp trawlers along the Pacific coast of Costa Rica (Photo: Ingo S. Wehrtmann)

Table 41.3 Species richness of five marine and coastal bird families in Costa Rica, Mexico, and Ecuador. In parentheses are included the comparison of species composition between Costa Rica and Mexico, and Costa Rica and Ecuador, using Jaccard index (0–100% of similarity). Species that do not use coastal or marine habitats were excluded from the analysis

	Costa Rica	Mexico	Ecuador
Procellariidae	9	15 (26)	9 (29)
Hydrobatidae	8	9 (70)	10 (64)
Charadriidae	6	8 (75)	10 (45)
Scolopacidae	26	27 (77)	23 (88)
Laridae	24	28 (62)	28 (48)

populations of these species have declined and continue declining as a result of habitat destruction and contamination in breeding and wintering areas (Roca *et al.* 1996). In Costa Rica, the construction of large tourist infrastructures on the Pacific coast has eliminated extensive areas of mangrove forests and mudflats. The contamination in habitats of coastal and marine birds in Costa Rica comes from three main sources: (1) wash down of pesticides mainly from banana and rice plantations, (2) solid material, and (3) sewage that pollute many feeding and breeding areas of coastal birds (Hidalgo-Calderón 1986; Burger *et al.* 1993; Burger & Gochfeld 1995). The elimination and contamination of such natural habitats threaten many species that use coastal habitats for feeding and reproducing. Shorebirds are most affected when mudflats are eliminated in northwestern Costa Rica, since the coasts along this region constitute one of the most important stopover areas in the Neotropics (Stiles 1983). Possibly, millions of individuals from different shorebird, gull, and tern species winter or stop during migration on the mudflats of northwestern Costa Rica (Smith & Stiles 1979; Barrantes & Pereira 1992).

Additionally, a large proportion of marine birds (e.g., Sulidae, Fregatidae) nest in colonies. This behavior makes these birds more susceptible to changes in their environment, since these nesting sites are scarce, and colonies are commonly on small islands, frequently located in regions with high risk of hurricanes and other environmental disturbances. Furthermore, recent invasions or introductions, e.g., rats and cats, in islands and other sites used by colonial birds have decreased the breeding success of these species (Harrison 1990). Therefore, it is imperative to monitor the destruction and contamination of the habitats used by marine and coastal birds to preserve this portion of our biological diversity (Croxall *et al.* 1984; for a more extensive discussion on these topics).

Specialists and Collections

The diversity of marine birds has been relatively well studied in Costa Rica. For more than 20 years F. Gary Stiles devoted a considerable amount of effort completing the list of marine birds of Costa Rica, as well as collecting these species for the Museo de Zoología of the Universidad de Costa Rica. In general, we consider that the list of marine species of the country is nearly complete. However, the presence of at least seven species that occur only offshore (e. g. Procellariidae, Hydrobatidae) needs to be confirmed (for examples see Stiles & Skutch 1989 and Barrantes *et al.* 2002). Even taking into account that the list of pelagic species is not complete, the occurrence of at least six species of seabirds in Central America is known only from their presence in Costa Rica (Species List 41.1 which is included on the CD-Rom). This indicates the lack of information on marine birds in other countries of Central America.

Most of the species recorded in Costa Rica have specimens deposited in two national museums (Museo Nacional and Museo de Zoología). Nevertheless, these species are generally poorly represented in terms of number of specimens. The

Museo de Zoología of the Universidad de Costa Rica and the Natural History Department of the Museo Nacional of Costa Rica have at least one individual of most species recorded in the country. Plovers and sandpipers are relatively well represented in the national collections, but other groups, in particular pelagic species, are represented by only one or two specimens. Furthermore, 21 species of marine birds that certainly occur in Costa Rica do not count with an official voucher, e.g., museum specimen deposited in national museums, song record, or photo (Barrantes *et al.* 2002). Some of the species without official voucher may be deposited in museums of other countries, but no information is available (J.E. Sánchez personal communication, 2002). Thus, it is necessary to improve the collection of marine and coastal birds in national museums, especially for future studies in systematics, evolution, and conservation of these groups.

Past publications on marine and coastal birds focused mainly on the addition of new species to the list of Costa Rica (Slud 1967, 1979; Dickerman 1971; Stiles & Smith 1977; Carr 1979; 1980; Stiles 1988). However, new studies on coastal and marine birds are focused on reproductive biology, ecology and conservation (Burger *et al.* 1993; Burger & Gochfeld 1995; Spear *et al.* 1995; Barrantes 1998; Chaves-Campos & Torres 2002), with few papers describing new records from Isla del Coco (Acevedo-Gutiérrez 1994; Dudzik 1996). Most studies in Costa Rica have been conducted with shorebirds (Fleischer 1983; Pereira 1990; Alvarado-Quesada & Moreno 1997), or seabirds that feed and breed close to the shore (e. g. pelicans; Orians 1969; McCoy & Vaughan 1981; Arnqvist 1992; and boobies; Chaves-Campos & Torres 2002). Few studies have dealt with offshore species (Duffy & Hoch 1995; Spear *et al.* 1995).

Currently, there are no specialists studying seabirds in the country. Nevertheless, C.J. Ralph and M. Widdowson have been conducting migration censuses of diurnal migrants along the coast of Tortuguero National Park during the last six years. This project will probably provide valuable information on the taxonomic composition and distribution of some migrant marine birds on the Caribbean coast of Costa Rica.

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