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NOTES ON THE SEABIRDS OF SALA Y GOMEZ[1]

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The Chilean Island of Sala y Gomez (26°27'S, 105°28'W) lies approximately 1,500 km WNW of Mas Afuera (Alejandro Selkirk) of the Juan Fernandez Islands and 300 km ENE of Easter Island. It is the crest of a volcanic spire, which measures only 700 m long by 450 m wide at its greatest dimensions (Figs. 1, 2). The western half, which rises ca. 8 m above the sea, consists of rough lava interspersed with a series of small tide pools or inlets. It is connected to the eastern half by a narrow causeway, which has been tunneled through by wave action in several places. The eastern half, flatter and less rugose, is bordered on the north by a rocky beach, to the northeast by a sandy beach, and to the south by steep-sided rocks that rise to a maximum elevation of 10 m. In its west-central sector lies a sandy depression approximately 70 m in diameter; the sand is dry at the surface but gives way to water-laden sediment within several cm. Bordering this area and to the south are many boulders ranging up to 1 m in diameter.

Owing to its remoteness and sometimes difficult access, the island is rarely visited. On 3 March 1985, one of us (PH) was able to land for 40 min, and on 3 March 1986 we both were ashore for 90 min. Although our observations were hurried and limited to the late morning, we were able to survey most of the island and to extend the findings of P. Scott, which were reported by Schlatter (1984), who has provided the only previous summation of the avifauna. These opportunities arose when we were serving as naturalists aboard the *Society Explorer*.

ANNOTATED LIST OF SPECIES

CHRISTMAS SHEARWATER (*PUFFINUS NATIVITATIS*)

In 1985, 2,500 pairs were nesting, mostly among boulders or in small rock crevices. The breeding season was well advanced, many chicks being three-quarters grown; a few were ready to fledge. In 1986 we estimated only 300 to 400 pairs. Chicks were at the same stage of development, but many were very thin and seemed unlikely to fledge. Schlatter (1984) estimated the population at 1,000 individuals.

WHITE-THROATED STORM-PETREL (*NESOFREGETTA FULIGINOSA*)

Schlatter (1984) suggested that this species might nest. We confirmed this by finding the remains of two nearly-fledged chicks of the light morph in 1986 (Fig. 3), plus the wing of a bird of indeterminate age. All remains were found near boulders in the sandy depression on the eastern side of the island; under several of these were short, 0.5-m tunnels that might have been used for nesting. The nearest current breeding areas are the Gambier Islands, 2,400 km to the west, and the Rarapai and Torakoi islets off Rapa in the Austral Islands, 3,400 km to the west (W.R.P. Bourne, pers. comm.). The species has also been reported from prehistoric sites on Easter Island (600 to 200 years B.P.; Carr 1980) and Henderson Island (800 to 500 years B.P.; Steadman and Olson 1985), Ua Huka (Steadman, pers. comm.) and Mangaia (maximum age several thousand years; Steadman 1985).

RED-TAILED TROPICBIRD (*PHAETHON RUBRICAUDA*)

In 1985 ca. 30 were flying over the island. Four chicks, all about to fledge, were found, but shortage of time precluded a thorough search. In 1986 we found no live chicks, only the remains of 13 young of that season, which ranged from half-grown to nearly fledged. On 17 November 1986, J. Reinhard landed briefly and

FIGURE 1. Sala y Gomez from the south.

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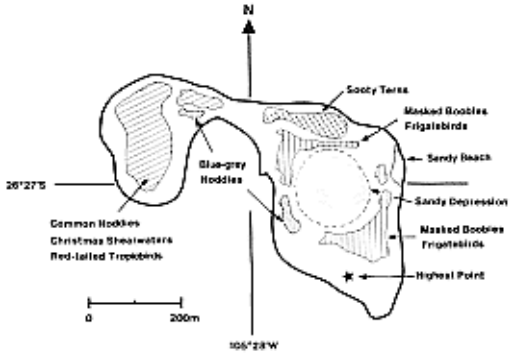

FIGURE 2. Sketch map of Sala y Gomez.

FIGURE 3. Nesting White-throated Storm-Petrels, *Nesofregetta fuliginosa*.

found several pairs with eggs and others attending nearly-fledged chicks. Schlatter (1984) reported that ">1 pairs" bred.

MASKED BOOBY (*SULA DACTYLATRA*)

Schlatter (1984) estimated the population at 1,500 pairs. Ca. 2,500 pairs were present in 1985, most in two loose colonies on the eastern half of the island. All chicks were in down and most were about half-grown. The phenology of the nesting season was similar in 1986, but the colony numbered only ca. 100 pairs.

RED-FOOTED BOOBY (*SULA SULA*)

One juvenile was seen with Masked Boobies in 1985. Not reported by Schlatter (1984).

GREAT FRIGATEBIRD (*FREGATA MINOR*)

In 1985, ca. 350 were circling over the island, and 24 chicks were found in ground nests constructed of one or both of the two types of succulent plants that grow on the island. Chicks ranged from one-third grown to nearly fledged. At least 40 corpses were lying within the colony, which is situated around the sandy depression. In 1986, ca. 200 birds were in the vicinity of the island. Schlatter (1984) reported similar numbers. Breeding had been attempted, as we found the remains of ca. 20 chicks, but there were no survivors. An adult male regurgitated two squid (length 140 to 156 mm) and three small flying fish (length 125 to 145 mm) before flying off.

SOOTY TERN (*STERNA FUSCATA*)

Approximately 100 pairs were breeding in 1985 and 50 pairs in 1986. In each year many chicks had already fledged and the colony might have been larger. Schlatter (1984) considered the species "common."

WHITE TERN (*GYGIS ALBA*)

Two seen flying over the island in 1985. Not reported by Schlatter (1984).

BLUE-GREY NODDY (*PROCELSTERNA CERULEA*)

Ca. 40 pairs bred in 1985; one adult was still incubating. In 1986 we estimated 30 pairs and saw one flying juvenile, but no eggs. Schlatter (1984) noted its presence without estimating its abundance.

BROWN NODDY (*ANOUS STOLIDUS*)

Approximately 700 pairs were nesting in 1985, compared to 200 in 1986. The stage of nesting was not determined in 1985; in 1986 ca. 10 pairs had eggs, the rest were attending chicks, some of which had fledged. Considered "common" by Schlatter (1984).

BLACK NODDY (*ANOUS MINUTUS*)

Two adults were seen and photographed standing on a driftwood log on the eastern part of the island. We could not determine whether they were paired. This represents the first record for Chile.

DISCUSSION

In 1986 birdlife was much scarcer than that noted in 1985 by Harrison or, historically, by Schlatter (1984). Not only was breeding greatly reduced, but dead chicks of several species were conspicuous. Indeed, frigatebirds and tropicbirds suffered complete nesting failure and the few Christmas Shearwater chicks were in poor condition and seemed unlikely to fledge. Chicks of Brown Noddies, though not numerous, seemed to be in good condition and some were flying, as were a few young Sooty Terns, which had finished nesting.

The sparseness of birdlife extended into the pelagic zone as well, numbers being much reduced from 1985. Indeed, in nearly 3 days at sea prior to reaching Sala y Gomez in 1986, we saw very few birds (mainly Juan Fernandez Petrels, *Pterodroma externa*) and encountered no flying fish until we were within 30 km of the island, and then saw a few small schools. All of these conditions suggested the onset of an El Niño, which had just been predicted (e.g., Kerr 1987). Localized nesting failures of penguins at several locations in the southern oceans (South Africa, Falklands, New Zealand) in 1986 were speculatively associated with oceanic warming (Boersma 1987, Bourne 1987).

In addition to documenting seasonal and annual changes of interest to biologists, regular censuses of marine life along replicable transect routes, when combined with standard oceanographic data, can provide essential groundtruth data to oceanographers and climatologists.

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ADDITIONAL EVIDENCE OF NOCTURNAL MIGRATION BY YELLOW-RUMPED WARBLERS IN WINTER[1]

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Migration is a response to changing environmental conditions (Gauthreaux 1982). Migratory behavior spans a continuum from highly fixed behavior (obligate migration) to very flexible behavior (facultative migration). Whereas facultative migration occurs in response to deteriorating environmental conditions, obligate migration appears to be fundamentally a result of an endogenous, circannual program (see Gwinner 1986 for a recent review). Even obligate migrations, however, are not performed entirely without integration of environmental information. For example, migrants make daily decisions to migrate or not to migrate based upon environmental factors such as weather conditions, food and water availability at stopover sites, and competition (e.g., Rappole and Warner 1976, Richardson 1978, Mehlum 1983, Biebach 1985, Gwinner 1986, Biebach et al. 1986).

The degree to which migratory behavior is subject to environmental influence appears to be quite variable (Terrill and Ohmart 1984). There is evidence that at least some species of annual, migrant passerines facultatively extend migration after the fall migratory period if environmental conditions become unfavorable for overwinter survival at a particular locality (Perdeck 1964, Niles et al. 1969, Moreau 1972, Lack 1983; Terrill and Ohmart 1984; Terrill 1987, in press). Presumably, the ability to perform facultative migrations enables these birds to respond to relatively unpredictable winter environments by migrating in an appropriate direction if conditions necessitate it.

Patterns of migration and distribution of Yellow-rumped Warblers (*Dendroica coronata*) indicate that they switch from an obligate phase to a facultative phase over the course of fall migration (Terrill and Ohmart 1984). Winter populations shift southward if conditions become unusually severe. When placed in Emlen funnels (Emlen and Emlen 1966), Yellow-rumped Warblers showed southerly nocturnal orientation into early January (after which no birds were tested). While the orientation data support the hypothesis that winter movements like fall movements are nocturnal, the evidence is indirect.

Here we present direct evidence that winter movements by Yellow-rumped Warblers are in fact noctur-

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