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The seabirds of Las Islas Revillagigedo, Mexico.—Las Islas Revillagigedo comprise three volcanic islands (Socorro, Clarion, and San Benedicto, in decreasing order of size) and a rocky islet (Roca Partida). The archipelago lies in the tropical Pacific between 365 and 620 km south and southwest of the tip of Baja California. Most visitors have concentrated on the endemic landbirds, and data concerning the diverse and abundant seabirds are few. Brattstrom and Howell (1956) discussed the status of the birds on the Revillagigedos in 1953 and summarized the data of the few earlier visitors (Grayson 1872, Anthony 1898, Townsend 1890, Kaeding 1905, McLellan 1926). Jehl and Parkes (1982) reported new observations from Socorro and San Benedicto. Everett (1988) mentioned some records from Clarion in 1986.

During a cruise in February 1988, we visited all three islands and Roca Partida as follows. San Benedicto (19°18'N, 110°49'W) 9–11 February; Socorro (18°47'N, 110°58'W) 11–17 February; Roca Partida (19°00'N, 112°04'W) 18 February; and Clarion (18°22'N, 114°45'W) 19–22 February.

San Benedicto is still uninhabited by people, and we saw no introduced predators. A major volcanic eruption in 1952 radically altered the island and extirpated the two resident landbird species, but most seabirds have successfully recolonized. Due to the difficult nature of access, our observations were restricted to that portion of the island north of the saddle between the two volcanoes. However, the slopes of the 1952 (southern) volcano appeared almost devoid of life although a few boobies may have been nesting in the crater.

Socorro hosts a naval garrison as well as large numbers of introduced sheep (estimated by residents at 3000 animals), cats, and mice. More seabird species roost on Socorro than breed there, and by cruising around the island, we counted all roosting and visibly breeding seabirds.

We arrived at Roca Partida at about first light (0550), and with the probable exception of frigatebirds and perhaps noddies, we made an accurate census of the roosting birds. By 0715, only 30% of the initial number of birds remained on or about the rock.

Clarion, the remotest and least well-known of the Revillagigedos, was granted freedom from permanent human habitation until 1979 when a small naval garrison was established. Feral rabbits are now abundant on the island, as well as undetermined numbers of feral pigs (50+), chickens, and at least two sheep. We were able to census most of the island but did not reach the eastern end; however, much of this was surveyed from sea and most seabirds were probably detected.

Laysan Albatross (*Diomedea immutabilis*).—At least 11–14 were present on San Benedicto, including three displaying pairs and one bird that strongly defended an empty nest scrape. We saw one gliding over the cliffs at Cabo Henslow, Socorro, on 16 February. At least 30 birds were on land at Clarion, including two birds photographed on eggs and 12 displaying pairs.

Wedge-tailed Shearwater (*Puffinus pacificus*).—None was seen during two weeks in the Revillagigedos despite the fact they are known to breed on San Benedicto.

Townsend's Shearwater (*Puffinus auricularis*).—We saw 11 a few km from the northern end of San Benedicto but saw no nesting burrows on the island. We counted 32 between San Benedicto and Socorro. In the late afternoons of 15 and 16 January, up to 550 staged 1–4 km off the northwest side of Socorro. Eighty-one flew north and northeast as we approached Clarion. On land, all nesting sites were marked by severe pig rooting, and numerous shearwater remains littered the destroyed burrows. We found no occupied burrows.

Red-billed Tropicbird (*Phaethon aethereus*).—We counted 50–70 pairs at San Benedicto. At least seven birds were seen in, entering, or leaving crevices, but the majority were engaged

in courtship flights and nest prospecting. This species was present on Socorro as follows: 5–6 pairs courting and prospecting along the cliffs at Cabo Pearce and two pairs courting over Roca Oneal. At Clarion, we counted 40–50 pairs. The main concentrations were at the eastern end of the island (40+ birds) and along the northwest cliffs (42+ birds). Many birds engaged in courtship flights, and the breeding season seemed at a similar stage to that on San Benedicto.

Red-tailed Tropicbird (*Phaethon rubricauda*).—On San Benedicto we observed and photographed 2–5 birds, including 1–2 pairs in courtship flights. One pair made repeated landing passes at a cliff face near the northwest corner of the island, strongly suggesting the species was to breed there.

Masked Booby (*Sula dactylatra californica*).—On San Benedicto we estimated 585–600 pairs on territory. Of 59 nests, 34 had chicks and 25 had eggs but our overall impression was that about 70% of pairs had young. The majority (65%) nested on the floor of the old crater. We also photographed four individuals with the deep orange bills and gray feet characteristic of *S. d. granti*, the Galapagos subspecies. Two were attending chicks, and at least one was paired with a *californica*. We saw 40–50 adults on Roca Partida and the main group, all *californica*, soon headed out to sea. However, four birds remained (all *granti*), three on the south pinnacle (including a displaying pair) and one on the north. The minimum population of Masked Boobies at Clarion was 380–470 pairs at five sites. Many were displaying, but none appeared to be on eggs. Three *granti* were seen at two sites, but many birds were too distant for subspecific determination.

Red-footed Booby (*S. sula*).—On San Benedicto, we found two colonies, one of 50 nests and the other of four nests. The larger colony included 35 birds on eggs, nine with small chicks, three fledglings, and three juveniles. Of 36 adults at nests, 35 were white morph and one brown. Tail color of the 35 white morphs at nests varied; six had white tails, 14 intermediate, and 15 black. One brown and three white adults were at the second site, plus four recently fledged juveniles. We did not visit the lava delta where Jehl and Parkes (1982) reported a Red-footed Booby colony. Two immatures roosted with the Brown Boobies on Socorro, 16 February. On Clarion there were 3010–3210 pairs at five sites, all on the eastern half of the island, the largest colony being 1500–1600 pairs. 60–70% of the nesting birds had a single egg, the rest had empty nests. We saw one dead newly hatched chick. Ninety-nine percent of the adults were white morphs, 0.5% brown morphs and 0.5% intermediate. Of the white morphs, 85–90% were black-tailed, 5% intermediate, and only 5% white-tailed.

Brown Booby (*S. leucogaster*).—We counted 45–50 pairs on San Benedicto, all but one scattered on the slopes of the valley below the raised northern part of the island. Of 41 nests examined, 21 had young and 20 had eggs. At least 30–40 recently fledged juveniles were flying around the island, and we suspect the actual breeding population was closer to 75–100 pairs. On Socorro, up to 120 birds roosted along the cliffs between Grayson Cove and Cabo Henslow. At Roca Partida, the total of 320–350 included 12–15 immatures, 25–30 juveniles, and at least 20 displaying pairs. By 0630, only 140 birds remained on the rock. At Clarion, we saw at least two adults on the island and suspect a few pairs may nest at the eastern end.

Great Frigatebird (*Fregata minor*) and Magnificent Frigatebird (*F. magnificens*).—On San Benedicto, we photographed both species nesting together in a north-facing valley near the northeast corner of the island. The Great Frigatebirds had nearly finished nesting: of 98+ young, only eight were guarded by adults although 48 others still had extensive white down on the head, back, and chest. The Magnificent Frigatebirds were only beginning to breed, all at the periphery of the colony: a single male and female were incubating at two nests, and a pair was courting on the ground. We saw at least 6–8 other Magnificents nearby (one male, three or four females, two or three immatures). 80–90 frigatebirds (most if not all

TABLE 1
STATUS OF THE SEABIRDS OF LAS ISLAS REVILLAGIGEDO, MEXICO

Species	San Benedicto	Socorro	Roca Partida	Clarion
Laysan Albatross	P	—	—	B
Wedge-tailed Shearwater	B	—	—	—
Townsend's Shearwater	F	B	—	B
Red-billed Tropicbird	B	B	?	B
Red-tailed Tropicbird	P	—	—	—
Masked Booby	B	—	P	B
Brown Booby	B	—	B	?
Red-footed Booby	B	—	—	B
Magnificent Frigatebird	B	?	—	—
Great Frigatebird	B	—	—	?
Sooty Tern	—	B	B	—
Brown Noddy	—	B	?	—

B—confirmed breeding; P—probable/imminent breeding (displaying/courting birds); F—formerly bred; ?—possible breeding (adults present).

Great) roosted on a steeply sloping face at the northwest corner of the island. On Socorro up to 18 Magnificents (three males, eight females, two sub-adult females, five immatures) roosted on Punta Tosca, up to six (five females, one immature) at Cabo Henslow and six (four males, one female, one immature) at Bahia Academy. The only Great Frigatebird we identified at Socorro was a female near Bahia Braithwaite, 12 February. At Roca Partida, we saw at least 15 frigatebirds, including two or three Great (one female, one to two immatures) and seven or eight Magnificent (two males, three females, one sub-adult female, one to two immatures). On Clarion, 80–90 Great Frigatebirds (10 males, 20 females, 50+ immatures) roosted on a stack at the base of the high northern cliffs. We also saw up to three or four Greats daily around Sulphur Bay but found no evidence of nesting. We identified no Magnificent Frigatebirds at Clarion.

Sooty Tern (*Sterna fuscata*).—Up to 14 associated with the flocks of Townsend's Shearwaters off Socorro but we saw none at Roca Oneal. Of 40–50 adults at Roca Partida, at least two or three probably were on eggs and several pairs were displaying.

Brown Noddy (*Anous stolidus*).—Many of the 90–100 initially present at Roca Partida left by 0630; a few remained on the southern pinnacle during our visit but none appeared to be nesting. We saw none at or near Socorro.

Discussion.—We herein clarify the status of the seabirds of the Revillagigedos. Table 1 provides a quick reference to the status of all breeding seabirds of the islands through February 1988.

Laysan Albatrosses were first recorded around the Revillagigedos when two were seen between Socorro and San Benedicto, 4 March 1979 (Pitman 1985). The next report was of three displaying behind the beach at San Benedicto, May 1987 (Pitman 1988). Everett (1988) did not see any on Clarion in January 1986 but may have missed them (W. T. Everett pers. comm.). Our data from the Revillagigedos and other sites (to be published separately), plus those of Pitman (1985) and Dunlap (1988), indicate this species is undergoing an unprecedented colonization of islands off western Mexico.

Wedge-tailed Shearwaters breed only on San Benedicto and apparently leave the island

between at least November and February. McLellan (1926) reported "thousands nesting" in May 1925. Following the 1952 eruption, Brattstrom and Howell (1956) reported Wedge-taileds as "common" in March 1953 and found their burrows in November 1953 although no birds were then present. Jehl and Parkes (1982) reported 1000 burrows in April 1978 and concluded that dark morphs comprised more than 90% of the San Benedicto population. S. F. Bailey (pers. comm.) and R. L. Pitman found the species conspicuous around San Benedicto and Socorro in mid March 1988 and, on San Benedicto, noted burrows with fresh footprints on 13 March.

Townsend's Shearwater, endemic to the Revillagigedos, breeds on Socorro and Clarion. Jehl (1982) estimated the Socorro population at 1000 pairs, but how much predation by feral cats has affected numbers is unknown. The population on Clarion has never been censused, and its existence there is threatened by pigs. Everett (1988) found "numerous unoccupied burrows" in 1986 but noted no pig rooting; presumably the pigs wait until shearwaters are on land before beginning their destruction. Small numbers bred on San Benedicto prior to the 1953 eruption (Jehl 1982), but apparently none has recolonized. We recommend the populations be censused as soon as possible and the full impact of predation evaluated.

Anthony (1898) reported Red-billed Tropicbird as "common" at San Benedicto and Clarion. McLellan (1926) reported the species as "not common on either Socorro or Clarion but . . . more numerous on San Benedicto." Brattstrom and Howell (1956) reported the species common at San Benedicto and, in March, saw three at Socorro and two at Roca Partida but none at Clarion. Jehl and Parkes (1982) reported 2-4 pairs at Roca Oneal, Socorro, and ten at San Benedicto in April 1978. Our data indicate the Red-billed Tropicbird breeds commonly on San Benedicto and Clarion and locally on Socorro. It may be only a visitor to Roca Partida which, in 1988, appeared unsuitable for nesting. Available data indicate nesting between February and November.

The only previous records of Red-tailed Tropicbird near the Revillagigedos are those of Pitman (1986). The species is known to breed no closer than Hawaii (AOU 1983), although it may breed on Clipperton Atoll (R. L. Pitman pers. comm.). Its presence on San Benedicto represents a major range extension.

The Masked Booby is known to breed on San Benedicto and Clarion. Brattstrom and Howell (1956) saw it at Roca Partida, but our observations are the first indication it might breed there. The earliest population estimates for San Benedicto are 1500-2000 nests in April 1978 and about 1000 nests in April 1981 (Jehl and Parkes 1982). Brattstrom and Howell (1956) estimated the Clarion population at 150 birds in March 1953, and Everett (1988) reported at least 200 birds "nesting" there in January 1986 but saw no eggs. Whether our counts of 600 pairs on San Benedicto and 400 pairs on Clarion represent, respectively, a true decline and increase is unclear. Interestingly, Anthony (1898) noted Masked Booby as "much more abundant" on Clarion than San Benedicto. Only one of the 1988 sites on Clarion corresponded with the three in January 1986 (W. T. Everett pers. comm.). Pigs may interfere with ground-nesting species and cause colonies to move around.

No previous observers reported *S. d. granti* on the Revillagigedos. This distinctive subspecies comprised less than 1% of the breeding Masked Boobies on San Benedicto but perhaps as much as 3% of the Clarion population. On Roca Partida, *granti* may be the only form breeding.

In recent years, the Brown Booby appears to have been the least common booby on San Benedicto. The maximum number of nests reported was only four in April 1978 (Jehl and Parkes 1982), although Anthony (1898) considered Brown about as common as Masked Booby. Our apparently high estimate, by recent standards, may simply reflect the timing of our visit. The only reference to Brown Boobys breeding at Roca Partida is of "some . . .

nesting" in March 1953 (Brattstrom and Howell 1956); its current status there is unknown though our data suggest it probably still breeds on the rock.

The Red-footed Booby breeds on San Benedicto and Clarion. For a summary of its status on the former island see Jehl and Parkes (1982); our data apparently represent the first colonies in the interior of the island since the 1952 eruption and may indicate that the vegetation has only recently returned to a level acceptable to the species. Anthony (1898) termed Red-footed "very abundant" on Clarion and McLellan (1926) reported "large colonies" there. Brattstrom and Howell (1956) reported only 150--200 birds in March 1953, which apparently led Nelson (1978:680) to state that Red-footed "used to nest abundantly . . . on Clarion." Everett (1988) counted "at least 800 active nests" on Clarion in January 1986. Our data indicate that Clarion still constitutes a major breeding ground for the species. Black-tailed white morphs have been reported only from the Galapagos (Nelson 1978:655) but made up the majority of Revillagigedo birds in 1988.

Jehl and Parkes (1982) were the first authors to report Magnificent Frigatebird from the Revillagigedos; all frigatebirds they saw on Socorro were this species, as were some on San Benedicto. Our discovery of Magnificent and Great frigatebirds nesting together on San Benedicto is the first report of their sympatric breeding away from the Galapagos. Magnificent Frigatebirds are known only to roost on Socorro, but we agree with Jehl and Parkes (1982) that the species may nest on the slopes above Bahia Academy. Our observations of Magnificent Frigatebirds are the first from Roca Partida which seems to be a roost site for wide-ranging individuals of both frigatebird species.

Great Frigatebirds have long been known to nest on San Benedicto. Brattstrom and Howell (1956) also cited nesting on Clarion (see below). In addition, Brattstrom (in Jehl and Parkes 1982) reported frigatebirds sp. nesting on Roca Partida; the habitat seems most unsuitable. Brattstrom and Howell (1956) were the first to estimate the San Benedicto population and reported 150+ birds in November 1953. Jehl and Parkes' (1982) reports of Great Frigatebirds include the following: in 1978 Pitman (Jehl and Parkes 1982) recorded 50 birds roosting on the steep slope at the northwest corner of the island, but in 1981 Jehl and Parkes reported "about 50 pairs" which were apparently nesting there. In 1988, this site was again occupied by roosting birds which we studied carefully with a telescope to ascertain that they were not nesting; the cliff seems an improbable nesting site. Our data indicate the breeding population was about 100 pairs.

Visitors to the Revillagigedos prior to Brattstrom and Howell referred all frigatebirds from the coasts of Baja California and the Revillagigedos to "*Fregata aquila*" = *magnificens*, but it has since been shown that specimens from the Revillagigedos are referable to *minor*. Townsend (1890), the first naturalist ever to visit Clarion, reported that "large communities of these birds (*Fregata aquila*) occupy the bushes and rocks in some parts of the island and doubtless breed there." Anthony's (1898) sole comment on the species at Clarion was "Abundant," although he described in some detail the species' nesting on San Benedicto. Anthony was accompanied by Kaeding, who later (Kaeding 1905) summarized the avifauna of the Revillagigedos and stated "The frigate bird breeds commonly on San Benedicte and Clarion Island, full grown young and fresh eggs . . . being found during May." Unfortunately, no eggs or young were taken from Clarion, and all evidence for Great Frigatebird breeding on Clarion rests on Kaeding's statement. Although we see no reason why it should not breed there, we suggest that the breeding status of Great Frigatebird on Clarion should, at present, be considered hypothetical.

Both Sooty Tern and Brown Noddy reportedly breed on Roca Oneal off Socorro and on Roca Partida (Brattstrom and Howell 1956). At Roca Oneal, both have been recorded in April and May, in "large" colonies (Anthony 1898), with Brown Noddy "if anything more numerous" than Sooty Tern (Kaeding 1905). Based on our observations, some Sooty Terns

return to the vicinity in February. S. F. Bailey (pers. comm.) and R. L. Pitman saw 1000-1500 Sooty Terns at Roca Oneal, 15 March 1988 but only one Brown Noddy around Socorro, 14 to 19 March 1988.

At Roca Partida, McLellan (1926) reported a juvenile Sooty Tern on 2 May 1925 which, with our data, indicates a breeding span of at least February to May, somewhat earlier than at Roca Oneal. However, Brattstrom and Howell (1956) made no mention of either species at Roca Partida in March 1953, so breeding chronology may vary annually. McLellan (1926) also reported that Brown Noddies were "believed to be breeding" at Roca Partida, apparently the basis for the breeding cited by Brattstrom and Howell (1956). Our data also suggest Brown Noddy may breed on Roca Partida, but this is not yet proven.

In addition to the species mentioned above, Brattstrom and Howell (1956) reported "several" Blue-footed Boobies (*S. neboxii*) from San Benedicto in November 1953, and Parkes tentatively identified one there in April 1981 (Jehl and Parkes 1982). However, the species is fairly sedentary in western Mexico (Pitman 1986, S. N. G. Howell pers. obs.), and we consider its presence at San Benedicto hypothetical.

A colony of White Terns (*Gygis alba*) has been reported from Roca Oneal, Socorro (Friedmann et al. 1950); however, the species appears to be no more than a vagrant to the Revillagigedos, as clarified by Brattstrom and Howell (1956).

Las Islas Revillagigedo constitute a unique mixing ground of seabird faunas. The preponderance of dark-tailed white morph Red-footed Boobies, the presence of *S. d. granti*, and the sympatric breeding of Great and Magnificent frigatebirds suggest the Galapagos Islands, while the newly arrived Laysan Albatross and Red-tailed Tropicbird add an element recalling Hawaii. Hopefully, future surveys can be undertaken on a more regular basis than the total of fewer than ten in the past 112 years, so that a greater understanding of the islands' seabird fauna can be achieved.

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Nearctic passerine fall migration in central Belize.—Although migration across the Gulf of Mexico is now an accepted phenomenon for many birds that breed in the Nearctic (Lowery 1951, Stevenson 1957, Buskirk 1980), little is known about specific routes, landing areas in fall (Paynter 1955, Rogers et al. 1986, Bossong 1988), staging areas in spring (Rogers et al. 1982), wintering areas, or habitat corridors for transients. Paynter (1951) estimated the minimum number of birds that arrived on the Yucatan peninsula during fall migration at over one million. Many of the species that cross the Gulf of Mexico pass through or winter on the Yucatan peninsula (Paynter 1951, 1953, 1955, Rogers et al. 1986, Bossong 1988). The landing areas for many species on the Yucatan peninsula have not been identified (Paynter 1955, Rogers et al. 1986, Bossong 1988). Therefore, we present data concerning migrant arrival times and weights during fall migration in central Belize.

We captured migrants on a citrus plantation (BGMC Limited) at mile 36 on the Western Highway, Cayo District, in central Belize, Central America (17°10'N, 88°40'W). We operated 15 mist nets (12 m × 2.6 m, 36 mm mesh) from 0600 to 1200 h during fall migration (25 August-18 November 1986). We weighed migrants with Pesola spring scales (to the nearest gram), banded each with a Fish and Wildlife Service band, and measured unflattened wing chord. Capture rates are reported as birds/net-h. The amount of fat remaining in migrants arriving in Belize was estimated by subtracting live weight from the mean fat-free weights given by Connell et al. (1960), Rogers and Odum (1964), Rogers (1965), and Hicks (1967). This region of Belize receives approximately 3500 mm of annual rainfall (129 mm during the fall study period) and is a transition zone from pine savannah to hardwood forest. The plantation is bordered by the Sibun River, and the surrounding vegetation has been described as semi-rainforest (Lundell 1945). Many areas within the plantation support successional growth, and other agricultural products are grown adjacent to the orange orchards.

We captured 1170 migrants of 47 species (0.33 birds/net-h) during fall migration, and 23 warbler species (Parulinae) accounted for 79% of the total number of individuals. Three