

GENERAL NOTES

Observations of Common Terns in Southern Brazil, 29 April-3 May 1984.—Although Common Terns (*Sterna hirundo*) range south to northern Argentina (A.O.U. 1983), little information exists on their seasonal status or abundance in southern latitudes. This note presents data from late April and early May from Rio Grande do Sul, the southernmost state of Brazil.

Surveys were made from the air and ground along the southern 582 km of the Rio Grande do Sul Atlantic coast and coastal lagoons, and on foot in the region of Lagoa do Peixe (31°20'S, 51°00'W). During beach surveys it was not possible to identify all terns due to the speed of our vehicles. Therefore terns were recorded as small (*Sterna hirundo*, *S. hirundinacea*, and *S. eurygnatha*) and large species, excepting *S. supercilialis* which was specifically identified.

Flock sizes were estimated, sometimes hastily during aerial surveys. Although ground-truthing of these estimates was not done, past experience with shorebirds has shown our estimates are within 20% of the true number.

Limited banding and molt studies of *S. hirundo* were made at Lagoa do Peixe. Terns were caught with mist nets between 29 April and 3 May as they flew low over the lagoon at night while en route to nearby resting areas. Plumage was inspected for flight feather molt, and measurements of wing, bill, and weight were recorded.

During daylight we saw few *Sterna* using Lagoa do Peixe, the major exception being less than 300 on sand bars of an erstwhile inlet that connected the lagoon and the ocean. Most terns sat in flocks on oceanside beaches above the wave-wash zone, or fished offshore. We did not count terns offshore.

At night no terns were on the oceanside beaches, but flocks roosted in the lagoon. One flock of 4000, virtually all *S. hirundo* judging from calls and size, was found on the night of 3 May; other flocks may have rested on small islets, and during the day near small ponds between the lagoon and the Atlantic beach.

We could not determine species ratios during aerial surveys. Common species were *S. hirundo*, *S. eurygnatha*, *S. hirundinacea*, and *S. maxima*; uncommon species were *Phaetusa simplex*, *Geochelidon nilotica*, *S. supercilialis*, and *S. trudeani*. Our impression was that *hirundo* comprised more than 90% of the terns at night, and they clearly were the most abundant species during the day.

The number of *Sterna* along 582 km of oceanside beaches between northern and southern Rio Grande do Sul are summarized in Table 1. Only one 18 km section was covered on every survey; numbers there were highly variable (3-190 per km on different dates, and 33-58 per km at different times on 1 May); nevertheless densities were consistently higher than along other sections of the coast (Table 1).

Terns caught in mist nets included 29 *S. hirundo* and 3 *S. hirundinacea*; 2 of the *hirundo* had been banded as chicks in New York and Massachusetts during June 1981. Most of the remaining *hirundo* were molting primaries, but two had nearly complete black caps, new primaries, long tail feathers, and did not have flight feather molt.

The 25 captured Common Terns averaged 145.5 ± 20.4 g (range = 120-200 g). Blokpoel et al. (1982) found that weights of Common Terns in Trinidad averaged 115 g (range = 100-125 g), and concluded they were in poor condition; average weights at colonies in New York and Massachusetts were 120.4 and 125 g, respectively (LeCroy and LeCroy 1974, Nisbet 1977). The higher weights at Lagoa do Peixe suggest the terns there were in good condition, and that some had substantial fat deposits.

Although *S. hirundo* from North America occur south to northern Argentina (A.O.U. 1983), the main wintering areas are commonly believed to be north of easternmost Brazil (e.g., Blokpoel et al. 1982). This understanding may have developed because of numerous band recoveries from this region. Austin (1953) noted only 6 recoveries south of the Amazon River versus 276 on the northern South American coast. More recently, however, Lara-Resende and Leal (1982) showed that banded Common Terns from North America have been recovered south of the Amazon; still only 3 were from Rio Grande do Sul—ours are the fourth and fifth. We believe that the good condition of the terns and the low human population on the southern Brazil coast could result in scarce reports of banded birds even though the species is abundant.

TABLE 1. Counts of *Sterna* terns (number/km) found on 6 sections of Rio Grande do Sul, Brazil.

Date (1984)	Kilometers south from C. da Canoa					373-582
	0-59	60-114	115-184	185-202	203-372	
19 April ^a	—	0	825 (11.8)	2560 (142.2)	2365 (13.9)	2 (0.0)
26 April ^b	0	0	84 (1.2)	60 (3.3)	—	—
1 May, 0930 ^b	—	—	—	1050 (58.3)	—	—
1100 ^b	—	—	—	600 (33.3)	—	—
4 May, 1530 ^a	—	—	—	2925 (162.5)	—	—
5 May ^a	—	69 (1.3)	4945 (70.6)	3415 (190.0)	—	—
8 May ^b	113 (1.9)	30 (0.5)	1050 (15.0)	150 (8.3)	—	—

^a Estimated cloud cover = 80-100% in the 115-184 and 185-202 km sections.

^b Estimated cloud cover = 0-20% in the 115-184 and 185-202 km sections.

— Not surveyed.

Our observations suggest that *S. hirundo* are abundant in southern Brazil, but are unevenly distributed, with the highest densities near Lagoa do Peixe. Densities more than 372 km south of C. da Canoa, on the other hand, were virtually nil (Table 1, the 373-582 section), suggesting that our surveys may have been near the southern limit of the normal range.

The variation of our counts in the same areas on different days was high (Table 1). Comparisons of concurrent surveys in the 115-184 and 185-202 km sections (Table 1) showed fewer terns on the beaches on sunny than on cloudy days ($\chi^2 = 4752$, $P < 0.001$), perhaps causing the high daily variation of numbers.

Although our counts were at a season when *Sterna hirundo* might be migrating northward, we did not see evidence of northward migration. We never found more than an average of 1.9 terns per km in the northern 90 km of the survey area (Table 1), while densities near Lagoa do Peixe remained high. Nevertheless, the high weights of many birds suggests pre-migratory fattening.

Our observations indicate that the central coast of Rio Grande do Sul is an important area to non-breeding *Sterna hirundo*. Because our survey occurred when breeding adults were in North America, we cannot assess whether Rio Grande do Sul is important to breeding *S. hirundo* as well as non-breeding birds; nevertheless it appears that Rio Grande do Sul, particularly near Lagoa do Peixe, may be of unusual importance to young stock, and hence a critical part of the species' Atlantic basin range.

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Corrections for the Underestimation of Brood Parasitism Frequency Derived from Daily Nest Inspections.—Intraspecific brood parasitism may be an important mode of reproduction in some species (Brown 1984, Emlen and Wrege 1986, Gowaty and Karlin 1984, Yom-Tov 1980). However, the frequency of intraspecific brood parasitism is difficult to measure because parasitic eggs are difficult to detect. Barring direct observations (Brown 1984, Emlen and Wrege 1986), or the use of electrophoretic identification techniques (Gowaty and Karlin 1984), researchers are often left to identify parasitic eggs through deviations from a normal egg laying schedule, from a larger than normal clutch size, or from contrasting intra-clutch egg coloration or measurements (Fetterolf and Blokpoel 1984, Yom-Tov 1980).

Of the latter methods, identifying deviations from a normal egg laying schedule is probably the most accurate. Two eggs appearing in a nest in the same day is unambiguous evidence of two females laying eggs in that nest (type 1). For alternate day layers, the appearance of one egg in a nest on each of two consecutive days (type 2) is less reliable evidence, since this could be explained by nest owners occasionally laying more often than expected. But if type 1 evidence is discovered along with type 2 evidence, the latter is quite likely to also be reliable evidence of brood parasitism (Frederick and Shields 1986).

However, even daily nest checks will consistently underestimate the frequency of brood parasitism because parasitic eggs laid one normal inter-egg interval before or after a host's clutch are indistinguishable to the observer from normally laid host eggs.

Here we present a simple method to conservatively correct this underestimation. For any specific clutch size, the probability of detecting a parasitic egg can be assigned as the number of theoretically detectable cases divided by the total number of possible cases. The number of cases actually discovered can then be corrected to a more realistic value by dividing it by the probability of detection.

Several important assumptions are necessary to enumerate the types of theoretical detections and the number of possible cases. We assume that all host species are determinate layers, that only one parasitic egg is laid in any clutch, that parasites do not remove host eggs as they parasitize, that parasitic eggs are equally likely to be laid on any given day of a host's egg laying schedule, and that the total period considered extends only one normal inter-egg interval before or after the host's egg laying period. Parasitic eggs appearing outside this time could not be confused with normally laid host eggs, and no correction is needed. Finally, we assume that evidence of both types 1 and 2 (above) is indicative of parasitic eggs in the case of alternate-day layers.

An example will be instructive. Under the above assumptions, if a host lays a total of three eggs on alternate days, there are nine different days on which one parasitic egg could be deposited. The parasitic egg is undetectable only when laid two days before the first host egg is laid, or two days following the host's last egg. Thus, the probability of detecting a randomly laid parasitic egg is $7/9$, or 0.778 (see Table 1).

It should be noted that nearly all consistent mistakes due to the above assumptions would lead to conservative estimates of the frequency of intraspecific brood parasitism. The exception is the assumption that evidence of both types 1 and 2 are always indicative of a parasitic egg, which could lead to overestimation.

Probabilities of detection are presented in Table 1 for species that normally lay eggs every day and those that lay on alternate days. Note that daily nest checks underestimate