



*F. ariel*. O estado das fragatas é crítico no momento. Ao longo da costa e das ilhas do litoral dos estados do Rio de Janeiro, São Paulo e Santa Catarina, aparecem diversas espécies de aves marinhas de ampla distribuição. Porém, apesar da recente descoberta de novas colônias no Espírito Santo, encontramos também nessa área, o trinta-réis *Sterna (sandvicensis) eurygnatha*, a espécie costeira mais ameaçada. Em toda a costa do Brasil, as aves marinhas sofrem com a retirada excessiva de ovos por pescadores, perturbação de colônias e poluição por petróleo. A mortalidade em aparelhos de pesca bem como a caça de aves para alimentação (ou adornos) é importante a nível local. De significância particular para as aves marinhas são os problemas causados pela introdução de animais, desde a predação direta por gatos e ratos até a destruição drástica do habitat de reprodução por cabras e porcos.

As prioridades para a conservação das aves marinhas no Brasil são: (1) erradicar os porcos e gatos em Fernando de Noronha e as cabras nas ilhas da Trindade e Santa Bárbara (Abrolhos); (2) pesquisar as aves marinhas endêmicas à Trindade/Martin Vaz, identificar as causas do declínio na população das fragatas e propor medidas para prevenir a sua extinção; (3) melhor manejo e implementação da lei nas reservas existentes e criar um núcleo de pequenas reservas regionais para proteger localmente as ilhas importantes para a reprodução de aves marinhas; (4) pesquisas básicas para identificar as principais colônias de reprodução na costa; (5) maior publicidade sobre os problemas da conservação das aves marinhas e maior envolvimento das autoridades locais e do governo federal.

## INTRODUCTION

The Brazilian coastline is the longest in South America (roughly one-third of the continent's), extending some 7,370 km from 40°N in French Guyana to 33°S in Uruguay. Geomorphologically, it can be subdivided in many sectors, but here it will be divided into a northern portion from French Guyana to Cabo de São Roque; an eastern part from there to Cabo Frio; and a southern portion from Cabo Frio to Uruguay.

Each sector has particular features of significance for seabirds. In the northern part there are no real marine islands, even over the continental shelf. This shelf is broad and every island here is, in fact, a portion of mainland surrounded recently (in geological time) by rivers or old river channels inundated by the sea. This portion contains the greatest estuary, the Amazon, which affects the sea both by large scale nutrient provision and also by preventing sea water approaching the mainland for long distances north of its mouth. The country's largest stands of coastal mangrove extend to the São Luís area, almost in the middle of the region. East from São Luís, the coast is dominated by sandy beaches (with intertidal rock platforms) with mangroves only at the mouths of the few major rivers. The climate is semiarid and most rivers flow only during the rainy season. The sea is, in general, poor in nutrients.

Off the eastern section are Brazil's oceanic islands, from São Pedro e São Paulo Rocks in the north to the Trindade/Martin Vaz group in the south. The continental shelf is narrower and has a few offshore islands, the most important being the Abrolhos Archipelago. South of the São Francisco river mouth, many estuaries appear, making important nutrient input to the sea. Rocky beaches, present from Cabo São Roque to the Abrolhos area, become less widespread in the southern part; mangroves stands reappear at the river mouths and in channels behind sandy beaches. Annual rainfall is over 1,500 mm on the coast and the south of this sector is almost the limit of tropical waters in Brazil.

The southern sector begins at Cabo Frio, the biggest cold-water upwelling of the Brazilian coast. From here south there is increasing influence of the cold southerly winds in winter. The continental shelf is narrow in the north, wider in the south, with coastal islands widespread in this section, except in Rio Grande do Sul state.

There is a varied coastline with sandy beaches and mangrove stands to 28°20'S; thereafter only sandy beaches occur. The Rio Grande do Sul coast is a long (c.580 km) sandy beach interrupted only in three places by mouths of coastal lagoons. The sea is colder in the south, under the influence of the Malvinas (Falklands) Current, which reaches its maximum extent during winter, aided by the southerly cold winds. The Cabo Frio upwelling is the northern resurgence of the Malvinas Current.

The other two oceanic currents important to Brazil's coastline are the Guianas and the Brazilian Currents, both of warmer waters formed when the Guinea Gulf Current splits near the Fernando de Noronha Archipelago. Some coastal countercurrents can also be important for recycling nutrients, but they are always of local significance.

With such a range of different coastal and oceanic features, Brazilian seas are used by a great diversity of seabirds. The oceanic islands, especially the Fernando de Noronha Archipelago, harbour important colonies. Coastal islands too have notable colonies as well as some parts of the mainland where lack of islands precludes safer nesting grounds. The species of special concern are Trindade Petrel *Pterodroma arminjoniana*, Lesser Frigatebird *Fregata ariel trinitatis*, Greater Frigatebird *F. minor nicollii*, and Cayenne Tern *Sterna (sandvicensis) eurygnatha*.

## SOURCE OF DATA AND METHODS

Perhaps because of the richness of Brazil's mainland avifauna and the few ornithologists living in the country until recent times, seabirds were only occasionally studied in the past. Published data are sparse, making it difficult to have any clear idea about historic trends of the various populations. Data for this paper came mainly from fieldwork done by the author or kindly sent by many individuals; the bulk of the information is being published for the first time. The distribution of Brazilian ornithologists is uneven, giving a better coverage of the southern sector than any other. Although Brazilian seas are important for various wintering seabirds, e.g. Manx Shearwater *Puffinus puffinus* or albatrosses *Diomedea* spp., this chapter refers primarily to breeding colonies. A major difficulty was deciding how to treat species whose major colonies are inland but also have coastal breeding grounds, e.g. Olivaceous Cormorant *Phalacrocorax olivaceus*, Yellow-billed Tern *Sterna supercilialis*, and Large-billed Tern *Phaetusa simplex*. In such cases, a general account is given with emphasis on the coastal colonies. Despite the inadequacies of the available information I believe that this review is timely and hope that it will act as a stimulus to interest more people within Brazil in seabird conservation and biology.

## SPECIES ACCOUNTS

### Trindade Petrel *Pterodroma arminjoniana*

The nominate race of this species is endemic to Brazil and breeds only at Trindade (the type locality) and Martin Vaz Islands, off Espírito Santo state coast. It breeds apparently year round in crevices and other cavities of the Trindade mountain peaks. Murphy (1936), based on a visit in 1913, and Sick (1984) recorded the species as abundant at Trindade, and Filippini (1986), on his February to April 1986 trip, considered it the commonest seabird on the island, although no population figure was given. He noted flocks flying around the Tunel, Pão de Açúcar, Farilhões and Crista de Galo peaks, and thought that most probable nest sites are

inaccessible without proper equipment. One particular concentration of nests may be in the Farilhões area.

Simmons (in Murphy 1936) provided the first record for the species as a breeder in the Martin Vaz Islands (three small islands 45 km east of Trindade), stating it was abundant on the middle island of the group. Despite frequent reference to the abundance of this species, there is no estimate whatsoever of its population size and trends. A species with so few known breeding places and so little information about its biology both during breeding and non-breeding seasons deserves careful attention. An estimate of current population size is essential before any realistic assessment can be made of the conservation status of this petrel in Brazil.

#### Red-billed Tropicbird *Phaethon aethereus*

This globally widely distributed tropicbird has its major Brazilian breeding colony at the Abrolhos Islands where it breeds between October and May. It also breeds in Fernando de Noronha, where it is rare, only two nests being found there since January 1987, both at Viúvinhas Island (A. Filippini pers. comm.). Oren (1984) saw only seven birds during 13 days of fieldwork in December 1982.

Breeding in the Abrolhos Archipelago has been known since last century (Goeldi in Murphy 1936). Coelho (1981) found it scarce and reported breeding on Santa Bárbara (the main concentration), Redonda, and Sueste Islands in October 1969. On April 1981 at least 40 nests were found in a three-day visit to Santa Bárbara Island, and one nestling in a very brief visit to Redonda Island (Antas unpubl. data). There are reports of similar numbers for visits in 1988 and 1989 (J. Gonchorosky pers. comm.; P. M. Pereira pers. comm.). Brown rats *Rattus norvegicus* were recently claimed to be damaging the Abrolhos colonies (J. Gonchorosky pers. comm.).

Its status in Brazil as a breeding species is thus potentially vulnerable, although the two known breeding colonies are within national parks. Accurate counts of the breeding population in the Abrolhos Archipelago and especially on Santa Bárbara Island are badly needed, together with an assessment of the threat posed by rats.

#### White-tailed Tropicbird *Phaethon lepturus*

The only breeding site of this species in Brazil and one of only two in the Atlantic outside the Caribbean is at the Fernando de Noronha Archipelago, where it breeds all year round. Its numbers, however, fluctuate throughout the year; the highest count (of 300 birds) is from October 1987. Counts in June 1987 of c.100 birds in the archipelago (Antas unpubl. data) and by Oren (1984) of around 200 birds suggests that numbers may be stable. On Viúvinhas Island 34 nests were found in December 1987 and 30 in March 1989 (A. Filippini pers. comm.). A total of at least five nests were found on Rasa Island, Meio Island, and the southern part of Rata Island. Nests have also been found on Sela Gineta, Atalaia, and Dois Irmãos Islands, and many cliffs on the main island had tropicbirds landing in possible (but mainly inaccessible) nesting sites.

When Fernando de Noronha was a penal colony, from 1700 until the 1940s (most intensively from 1870 through 1942), the convicts used tropicbirds for food, catching even adults with snares (Oren 1982). The recently created (September 1988) Fernando de Noronha National Park protects in full all known breeding sites except the Pico cliffs, whose rock walls are inaccessible even to introduced predators. Further counts of accessible nesting colonies would be the only suggestion for work on this species, more difficult to monitor than its congener on the Abrolhos Islands.

#### Musked Booby *Sula dactylatra*

A widespread breeder in the eastern sector of the Brazilian coastline occurring where offshore islands and its favourite food, flying fishes, occur together. Its breeding status on Trindade and Martin Vaz is uncertain because Murphy (1936) is the only source (under his species account). However, the same author (under the Trindade account) indicated its absence, together with Brown Booby *S. leucogaster*, as the major difference between Trindade and Martin Vaz Islands and other tropical Atlantic islands. It is only known from Trindade on the basis of skins collected by a Museu Nacional expedition in the 1910s (Miranda-Ribeiro 1919) but Sick (1984) did not find any evidence of breeding and Filippini (1986) during his two-month visit there did not see it.

Its southernmost known breeding colony in Brazilian waters is the Abrolhos Archipelago, although Sick (1984) suspected it occasionally breeds farther south in the islands off Macaé (22°30'S, 41°40'W), just north of Cabo Frio. The most important colony is at Atol das Rocas, where Simmons (in Murphy 1936) estimated 1,500 nests on one of the two small islands. A census carried out during three weeks in February/March 1982 gave a total of 5,000 adult birds on both islands, all in early stages of breeding (Antas unpubl. data).

In the Fernando de Noronha Archipelago, Meio Island harbours the main colony with around 180 nests in December 1988; other colonies were on Rata Island (15 nests on Macaxeira Point and ten nests on the southern point). Ovos Island harboured 70 nests in December 1988 (Antas & Mendes-Junior unpubl. data). Although slightly variable, the egg-laying season is from February to April, different from the year-round season of the other two booby species.

The Abrolhos Archipelago has breeding groups on all islands except the small, bare Guarita Islands. In April 1981, Santa Bárbara harboured the majority of the breeding birds, followed by Sueste, Siriba, and Redonda Islands; total numbers were c.500 breeders (Antas unpubl. data). Coelho (1981) counted 40 nests on Sueste Island. The recent removal of feral goats from Redonda has allowed vegetation to regenerate in the high plateau where the bulk of the boobies had nested. They had been driven away from this area, a few to the nearby beach, the remainder probably to colonies on other islands (J. Gonchorosky pers. comm.). Breeding dates are similar to Rocas and Fernando de Noronha populations.

The current status is stable, perhaps even increasing, despite recent illegal persecution of nestlings for lobster trap bait at Atol das Rocas. Some adults were occasionally killed for sale in northeastern Brazil as household ornaments.

At Fernando de Noronha, the species was greatly overexploited by the convicts. Apparently, the population has substantially recovered despite some hunting by local villagers until very recently. Feral cats, Black Rats *Rattus rattus*, feral Pigs *Sus scrofa* and, perhaps, the introduced Teju Lizard *Tupinambis teguixin* may prevent the recolonisation of some sites in the main island. Potential breeding space is still available on Meio Island. The species' absence from the geologically similar Rasa Island, where introduced predators are absent, is a puzzle. Its major breeding grounds in Brazil are included in conservation sites maintained by the federal government.

#### Red-footed Booby *Sula sula*

After *Anous minutus* the commonest bird at the Fernando de Noronha Archipelago (nowadays the only Brazilian breeding site), with 1,290 nests in June 1987 (Antas, Filippini & Mendes-Junior unpubl. data). Colonies are present on all islands with vegetation and protection from the southeast winds. The main island has the biggest colony starting on Dois Irmãos Island and continuing along the shore to



Ponta da Sapata, using the trees growing in the cliffs. Sela Gineta, Meio, and Rata Islands also have substantial colonies. Oren (1984) gave a total figure of 4,000 birds for all Fernando de Noronha's islands. Oren (1982) noted that the species was listed for Fernando de Noronha only in 1926. The likely explanation for this is the deforestation of the island around 1870, to prevent convicts escaping on tree-trunks, and the increase of prisoners from then until around the beginning of the current century. This booby was another probable source of food for convicts; exploitation, plus deforestation, could explain the lack of information prior to 1926 of this now very common seabird. The species presumably recolonised after the First World War, when the number of convicts decreased and their living conditions were improved. The species can be assumed to have been abundant in the past because it is the most likely source of the guano deposits on Rata Island, which were exploited from last century (when deforestation rendered the guano accessible) until 1954. This area is still kept cleared, by fires, for agriculture, but *S. sula* breeds on nearby forested hills.

At Atol das Rocas in February 1982 about 50 birds were recorded landing on the lighthouses or in the planted coconut or casuarina *Casuarina* sp. trees (Antas unpubl. data). A small colony could be established there if the trees are still alive.

The species is apparently extinct as a breeder on Trindade Island, principally due to overgrazing by feral goats. Although Olson (1981) found two small colonies totalling 87 nests, Filippini (1986) saw none breeding during his two-month visit in 1986.

With present numbers at Fernando de Noronha, this species is out of danger in Brazil and could readily recolonise other sites providing suitable nesting vegetation is present.

#### Brown Booby *Sula leucogaster*

Widespread over the southern portion and, to a lesser extent, the eastern portion of the coast, it breeds on almost every island north to the Abrolhos Archipelago. Further north it occurs only on the oceanic islands and is uncommon in the coastal waters of the eastern part of Brazil. It is absent from coastal waters of the northern sector.

It breeds year-round, with a peak from October to December, in the southern region. There are few estimates of breeding numbers. The southern region has the highest population, in the order of tens of thousands. There are 500 breeding pairs at Moleques do Sul Island, Santa Catarina state (Antas unpubl. data; Bege & Pauli 1989), 300 breeding pairs on Currais Island (25°40'S, 48°20'W) off Paraná state (Scherer Neto 1986), 100 adults on Alcatraz Island, off Santos, São Paulo state, in October 1920 (Luederwaldt & Fonseca 1922), at least 2,000 breeding pairs on the islands in front of Rio de Janeiro city in January 1982 (Antas aerial survey, unpubl. data), unknown numbers on the many small islands off Guanabara Bay, pairs on islands in the Cabo Frio area, pairs on Santana Island off Macaé, Rio de Janeiro state (E. P. Coelho pers. comm.). Islands off Espírito Santo state (where the species begins to be less common) have fewer than 500 breeders. In the Abrolhos Archipelago (the last near-mainland breeding colony), Coelho (1981) counted 113 nests on Sueste Island. The next colony is Atol das Rocas, where 100 nests were counted in 1982 (Antas unpubl. data). Fernando de Noronha has a breeding population of 870 adults on all islands except the main island and Rasa Island.

At São Pedro and São Paulo Rocks estimates of adults present have varied from 163 in November 1960 (Mackinnon 1962), c.500 in March 1966 (Masch 1966), c.200 in May 1971 (Smith *et al.* 1974), 439 in September 1979 (Edwards *et al.* 1981), and 200 with 35 nests in May 1989 (A. Filippini pers. comm.). The most

comprehensive survey (Edwards *et al.* 1981) recorded 266 birds and 104 nests on Belmonte Island, 133 (and nests) on Challenger Islet, 25 (and nests) on Cabral Islet, six on Pillar Rock, and nine on Coutinho Rock, the last two being roosts only. Given the different dates and probably times (there is strong diurnal variation in adult attendance at nest sites) of the records, it is probable that the population is essentially stable.

This species is perhaps the most familiar seabird to the general public, due to its nearshore fishing behaviour. Due to its plunging dive, sometimes performed near surfers or swimmers, there is a sympathetic public feeling for the species. Young birds are hand-reared when found after storms and even fishermen do not appear to take action against this ship-following species, which eats sardines *Sardinella* sp. when nets are catching them.

In view of the public knowledge of and sympathy for this species, it could easily be used in environmental education programmes concerning seabirds.

#### Olivaceous Cormorant *Phalacrocorax olivaceus*

This cormorant frequents marine habitats in the central portion of the northern region and in Santa Catarina state. The only known marine colony is Alfavaca Island in front of Rio de Janeiro city where birds fish in the brackish waters of Lagoa da Tijuca. The flight lines from the island suggest that around 1,000 birds roost there (Antas unpubl. data).

The main breeding concentrations are in the Pantanal region of central Brazil, with many colonies of over 1,000 nests. In the Amazon Basin, big numbers occur seasonally. This cormorant is a really common species, quickly colonising new dams and temporary waters. There is no significant conservation problem in any part of its Brazilian range.

#### Magnificent Frigatebird *Fregata magnificens*

Its range overlaps with that of *Sula leucogaster*, although its breeding requirements are narrower. A common species in the southern region, it is rare north of Abrolhos but reappears in numbers west of São Luís in the coastal mangrove forests.

Its preferred breeding sites are forested slopes with continuous wind. The southernmost colony is Moleques do Sul Island (28°00'S, 48°30'W), Santa Catarina state, with some 150 nests (Bege & Pauli 1989). Other islands in this state may have breeding concentrations, although precise information is lacking. The next known colony to the north is Currais Island in Paraná state, where 4,000 birds roost with 700 breeding pairs (Scherer Neto 1986). This colony is second in size only to the Cagaras/Redonda Islands off Rio de Janeiro, where some 2,000 nests were estimated in January 1982 (Antas aerial survey, unpubl. data). Breeding also occurs at Alcatraz Island, off Santos; no current population estimate is available (Sick 1984) but in October 1920, 1,000 adults used the island with 250 nests (Luederwaldt & Fonseca 1922). No numbers are available for colonies on Cabo Frio Island and on islands in front of Macaé (Sick 1984).

Coelho (1981) found it a common breeder on Redonda Island in the Abrolhos Archipelago but no population estimate is available. Vegetation cover on Santa Bárbara Island after goat removal has allowed recovery to a population of 60 nests nowadays (J. Gonchorosky pers. comm.).

The next colony to the north is at Sela Gineta Island, Fernando de Noronha Archipelago. There, 100 nests were active during visits in May/June and October/November; Oren (1984) estimated numbers at Fernando de Noronha as c.300 birds. Similar numbers are recorded nowadays suggesting a stable population.

In the other colonies, breeding occurs from October until February, although

Currais Island colony could have active nests in other months (Scherer Neto 1986).

Along the north coast *F. magnificens* is regularly seen but breeding records are lacking, though it may nest in the mangrove forests, as in the Caribbean (Halewyn & Norton 1984). It is almost completely absent from the eastern region. Although the Brazilian populations are disjunct, this is a wide-ranging species with considerable powers of dispersal, evidenced by a young banded in Currais Island being found at Dominica Island in the Caribbean Sea (Scherer Neto 1987).

*F. magnificens* may be able to establish itself as a breeder on Atol das Rocas. In 1982, around 50 adults and juveniles perched together every afternoon on the various introduced trees there. *F. magnificens* has no conservation problem in Brazil, being common and widespread in the south. Confirmation of breeding status in the northern region is desirable.

#### Greater Frigatebird *Fregata minor*

The Atlantic race of this species (*F. m. nicolli*) is now confined to Brazil, where it is an endangered species without recent positive breeding records. Olson (1981) found no nesting on Trindade and suggested Martin Vaz as the possible origin of the occasional birds (up to four at a time) which he saw feeding on hatchling turtles. Similarly, Filippini (1986) saw a maximum of six *F. minor* hunting hatchlings on Trindade from 18 February to 12 April 1986.

Both observations suggest the Atlantic population of *F. minor* is in great trouble and the status of the species at Dom Pedro Segundo Islet in the Martin Vaz group, listed by Simmons (in Murphy 1936) as a breeding site, needs urgent investigation. There is no clear reason for its decrease, besides the effects of introduced alien predators, unless there is human persecution by naval personnel protecting turtle nests because the frigatebirds eat hatchling turtles. This latter possibility, still hypothetical, needs investigating. Whatever the cause, its current status is highly endangered and action must be taken to save the Atlantic population, if there is still time. [No birds were seen at Martin Vaz between 9-21 March 1990 (J. Goerck pers. comm.).]

#### Lesser Frigatebird *Fregata ariel*

The race *F. a. trinitatis* is now restricted to Trindade Island, Brazil, where its status is endangered. Olson (1981) found 25 to 50 pairs breeding at Ponta do Sul during his December 1975-February 1976 visit; these are the most recent data for Trindade. The species is also recorded for Martin Vaz, but its breeding status there is uncertain (Murphy 1936), and no birds were seen there in March 1990 (J. Goerck pers. comm.).

Reasons for the low numbers are unknown. An investigation of the current status of and existing threats to, both frigatebird species at Trindade and Martin Vaz, is a high priority so that appropriate action to promote population recovery can be taken.

#### Kelp Gull *Larus dominicanus*

A common seabird of the southern parts of the southern region, it is a cold water species associated with upwelling areas reaching Cabo Frio and occasionally Espírito Santo state. Few breeding sites are specifically recorded but it breeds in small scattered colonies along most of the sandy Rio Grande do Sul coastline. It was omitted by Belton (1984) as a breeding species for the state.

In Santa Catarina state it breeds (June-August) on the Moleques do Sul Islands (Bege & Pauli 1989) and on islands around Florianópolis. In Paraná state, about 500 gulls frequent the Paranaguá Bay area, although the only known colony is of five nests in September 1980 on Currais Island, although Castilho Island is a

possible major colony (Scherer Neto 1986). Further north, there are scattered breeding groups around Cabo Frio (Sick 1984). Overall, it is a common species without any current conservation threats.

#### Grey-headed Gull *Larus cirrocephalus*

There are a few records of this species in Rio Grande do Sul, the southernmost state of Brazil (Belton 1984), with sightings north to Rio de Janeiro and inland near the border with Paraguay. A disjunct population occurs in the north of Maranhão state reaching coastal areas around São Luís. Breeding has not yet been confirmed, although the isolated Maranhão population must include breeding birds. The species favours marshy habitats rather than maritime ones. The status of the Maranhão population needs investigating.

#### Brown-headed Gull *Larus maculipennis*

An abundant gull in Rio Grande do Sul state (Belton 1984; pers. obs.), the northern limit of its breeding range, where it frequents beaches and brackish and freshwater lagoons and is common in upland habitats. Further north it is scarce and only stragglers occur north of Rio de Janeiro.

Only two breeding colonies are known, in marshlands in Rio Grande do Sul state. One site, at the Taim Ecological Station, was used from November 1980 to January 1981 but not subsequently, although there was no evidence of disturbance. There are certainly many other colonies in the state, but these are probably small and scattered; the lack of records of breeding colonies in an ornithologically fairly well-covered state, such as Rio Grande do Sul, suggest that the species may have low site fidelity and/or only breed in small numbers at the edge of its breeding range. There are no special conservation concerns.

#### Gull-billed Tern *Gelochelidon nilotica*

A species of coastal marshes and lagoons occurring in all regions but with major concentrations near the Amazon mouth (Sick 1984) and the adjacent Maranhão coastline where it frequents coastal beaches. No numerical data are available, except for a breeding colony of 50 nests in November 1986, near the mouth of the Lagoa do Peixe, Rio Grande do Sul (Antas unpubl. data). The northern region undoubtedly has other colonies in the huge sandy areas behind the beaches. No known conservation concerns.

#### South American Tern *Sterna hirundinacea*

*S. hirundinacea* breeds from April to August, during the austral winter, from Santa Catarina to Espírito Santo state. The breeding schedule in Brazil is thus different from Uruguay and Argentina, where it is a late spring-early summer breeder. It breeds in many habitats from grassy islands to man-made structures such as the Rio de Janeiro-Niterói bridge pillars or wooden boat ramps (Crud-Maciel 1987a,b). Moleques do Sul Island, in Santa Catarina state, is the southernmost colony, with a maximum of 100 nests (pers. obs. 1981). Rocky islands in the vicinity of Santa Catarina Island (e.g. Ilha Deserta, Ilhota de Fora) are used intermittently for breeding (Bege & Pauli 1989). Such breeding distribution may be linked with the movements of small fishes (primarily anchovies *Engraulis* sp.) in the Malvinas Current waters. Further north, Figueira Island, on the Paraná/São Paulo state border, had 15 nests in 1986 (Scherer Neto 1986). There are large colonies on inshore islands in Guanabara Bay and off the Espírito Santo state coastline. A species without known conservation problems.

**Trudeau's Tern *Sterna trudeaui***

A species with a restricted range in South America (uncommon in central Chile (Schlatter 1984); relatively common in north and central Argentina (Narosky & Yzurrieta 1987)), in Brazil it inhabits coastal lagoons and, occasionally, ocean beaches in the southern region. Although common and known to breed in Brazil, there are no published reports of specific breeding localities. Adults were seen carrying fishes to possible colony sites in Canal de São Gonçalo, Pelotas or Rio Grande county, at the end of November-early December (Belton 1984) and copulations were observed in a sandy area in Lagoa do Peixe National Park, Rio Grande do Sul in early November 1986 (pers. obs.), but breeding colonies were not located. No obvious conservation threat exists.

**Yellow-billed Tern *Sterna supercilii***

This widespread freshwater tern has coastal populations in various parts of the country. Its major breeding grounds are the sandy beaches exposed when river levels in the interior drop during the dry season. On the coast, although sporadically present in between, it occurs mainly in the northern region and in the southernmost part of the southern region. A small colony (20 nests) was found in November 1986 just south of Lagoa do Peixe mouth, Rio Grande do Sul (pers. obs.). Belton (1984) found one nest on a sandy beach 200 km north and it may have small, scattered colonies throughout the Rio Grande do Sul coastline, where it is a frequent inhabitant of both coastal and river waters. It faces no conservation threat other than human disturbance at colonies in the interior.

**Royal Tern *Sterna maxima***

Present throughout the Brazilian coast, common in the northern and southern regions but scarce in the eastern region. In the southern region, numbers increase from the end of February onwards (Belton 1984; Crud-Maciél 1987a; pers. obs.). Birds are in breeding plumage in April (pers. obs.), July and September (Belton 1984) in Rio Grande do Sul state coast; no breeding colony has been found. The northern region population may mainly comprise Caribbean or North American birds, as suggested by Escalante (1985). However, breeding may well occur in the sand dunes of this huge, ornithologically poorly-known area. No apparent conservation problems but investigations are needed to locate and monitor breeding populations.

**Cayenne Tern *Sterna (sandvicensis) eurygnatha***

The most vulnerable coastal species in Brazil. The northern region population is apparently of Caribbean origin and, like *S. maxima*, no breeding colony has been reported. The species is uncommon in the eastern region. Until recently the only known breeding site in Brazil was a colony of 500 adults on Papagaios Island, off Macaé, Rio de Janeiro state. The colony was discovered in July 1963 but absent in 1964 (Sick & Leão 1965). In 1981 the terns were again breeding but in unknown numbers (E. P. Coelho pers. comm.). Due to disturbance by fishermen, the site was not used in 1982. In May 1981, Crud-Maciél (1987a) found a small colony (no numbers given) mixed with *S. hirundinacea* in Casa de Pedra Island, Guanabara Bay, Rio de Janeiro state. Subsequently, apparently due to disturbance, this site was deserted. Before 1985, the only other active colony known was on Figueira Island, off southern São Paulo state (Scherer Neto 1985).

In 1985, major nesting sites were found in Espírito Santo state, on coastal rocky islands in mixed colonies with *S. hirundinacea*. In 1988, breeding colonies were as follows:

Itatiaia Is. : hundreds in June, breeding  
 Pacotes I. : 35 near-fledglings and some breeding in August  
 Branca I. : 4 nestlings, August  
 Escalvada I. : tens, breeding not proved

The breeding habitat (low cactus cover) and the disturbance risk prevented a better assessment of colony sizes (Musso *et al.* 1988).

In 1987, a mixed colony with *S. hirundinacea* (numbers not given) was found on Deserta Island (27°16'S, 48°20'W) (Escalante *et al.* 1988). In 1988, the colony was also active and 24 nestlings were banded there (Schultz-Neto 1988).

The Espírito Santo colonies have suffered from extensive egg collection by fishermen. Eggs are probably also lost to Black Vultures *Coragyps atratus* and Black Rats *Rattus rattus*. The numbers of dead adults and chicks found in the 1988 nesting season showed high mortality from unknown sources (Musso *et al.* 1988). This tern is apparently more sensitive to human disturbance than others and its population needs protecting at its few known breeding grounds.

**Sooty Tern *Sterna fuscata***

This tropical tern breeds only in the eastern region, Rocas Reef being its major breeding site. There Simmons (in Murphy 1936) found hundreds of thousands nesting in April. In March 1979, some 30,000 adult *S. fuscata* were estimated during a 48-hour visit (Antas unpubl. data). A more detailed census in late February-early March 1982 gave around 115,000 birds breeding there (Antas unpubl. data).

At Fernando de Noronha, this tern has five colonies on islets around the main island. They are: Viúvinhas Island with 120 nests, Morro do Leão Island with 500 nests, Cuzcuz and Viúvinhas Islands (at the port), both with 100 nests, and Frade Island with 40 adults flying around (landing was impossible here and breeding was not confirmed) (Filippini, Antas & Mendes-Junior unpubl. data). *S. fuscata* is not known to breed on São Pedro and São Paulo rocks and was not present in May 1989 (A. Filippini pers. comm.).

On Guarita Island, Abrolhos Archipelago, there is a small colony of 20 nests (Antas unpubl. data). On Trindade and Martin Vaz Islands there are scattered small colonies (Murphy 1936; Filippini 1986). Olson (1981) estimated a total of some 1,500 pairs in Trindade, with the main concentration (450 pairs) at the eastern end of the island.

The species faces no conservation threats at present.

**White Tern *Gygis alba***

In Brazil, this widespread tropical tern only breeds on oceanic islands of the eastern region, e.g. the main island and Frade Island of the Fernando de Noronha Archipelago, and Trindade and Martin Vaz Islands.

At Fernando de Noronha it uses *Erythrina mulungu* trees and also the rocky cliffs of Ponta da Atalaia in front of Frade Island, and Frade Island, where it is also a ground nester. On the main island, its major concentrations are around the peak and in the Ponta da Sapata forested region. The forest breeding habitat of this tern prevented a good census and rough estimates in June and November 1987 were of fewer than 1,000 adults in the whole Fernando de Noronha Archipelago (Antas unpubl. data). During the dry season (August-December) it appeared more common than in the rainy season, but this could simply be an effect of improved visibility due to seasonal leaf fall (pers. obs.). Oren (1984) estimated a total of 250 adults in December 1982.



Murphy (1936) quoted it as abundant at both Trindade and Martin Vaz. From February to April 1986, few *G. alba* were observed in Trindade (Filippini 1986), similar to Olson's (1981) account. Whether this is a real decline or just a result of census difficulty is uncertain. This species certainly increased in numbers at Fernando de Noronha after the first quarter of the 1900s, due to forest regrowth following closure of the penal colony. The use of thorny *Erythrina* trees gives protection against introduced cats and rats. The general picture for this tern is stable, but more data are needed for the Trindade population.

#### Brown Noddy *Anous stolidus*

In Brazil, restricted to the tropical waters of the eastern region where its major breeding ground is at Rocas Reef. Simmons (in Murphy 1936) reported some 1,200 nests. This population had increased to 10,000 adults by March 1979 and to 17,700 breeders in February–March 1982 (Antas unpubl. data). It is generally a seasonal breeder and such numbers must indicate a substantial increase in the Rocas Reef breeding population since the early twentieth century.

At Fernando de Noronha, it occupies almost the same islands as *S. fuscata*. Oren (1984) estimated a total of 2,000 non-breeders in December 1982, similar to our total of breeding birds in October 1987 (Antas & Mendes-Junior unpubl. data).

At the Abrolhos Islands there were 1,000 pairs in April 1982 occupying Guarita Island, some 150 pairs on the southern cliff, near the lighthouse, on Santa Bárbara Island (Antas unpubl. data). Coelho (1981) reported 20 nests on Santa Bárbara in October 1969; this low total may be due to the species' seasonal nesting.

Murphy (1936) quoted it as abundant on Trindade Island. However, Olson (1981) reported it present in fair numbers but not particularly abundant from December to February 1975 and Filippini (1986) saw small groups and two near-fledged young between February and April 1986. Seasonal breeding could explain these differences in numbers. However, Murphy (1936) found it in "enormous numbers" in early April 1914 in the waters near Trindade, which suggests that the species may be less abundant nowadays.

At São Pedro and São Paulo Rocks, estimates of adult populations are 480 birds in November 1960 (Mackinnon 1962), 200 in May 1971 (Smith *et al.* 1974), 213 in September 1979 (Edwards *et al.* 1981), and 300 in May 1989 (A. Filippini pers. comm.). These numbers do not suggest any significant population trends. Edwards *et al.* (1981) recorded nests on Belmonte Island (five), Challenger Islet (50), and Cabral Islet (seven); the main roost was on Belmonte Island.

Overall, the species is common in Brazilian waters, but detailed information is needed for the Trindade/Martin Vaz Islands.

#### Black Noddy *Anous minutus*

The main Brazilian site is Fernando de Noronha, where it is the commonest seabird, as it was when Murphy (1936) visited in October 1912. Using crevices, trees and bushes, this noddy occupies almost every place protected from trade winds. Oren (1984) counted a total of 5,000 birds in December 1982. Data from June 1987 gave a grand total of 10,630 nests for the whole archipelago. The most important colonies are located from Sancho Beach to Ponta da Sapata (on the main island), on Viuvinhas and Morro do Leão Islands, and the islands in the port area (Antas, Filippini & Mendes-Junior unpubl. data). The species breeds from March–April to July–August, numbers decreasing afterwards (pers. obs.).

At São Pedro and São Paulo Rocks, population estimates are 165 birds in November 1960 (Mackinnon 1962), 150 in May 1971 (Smith *et al.* 1974), 481 in September 1979 (Edwards *et al.* 1981), and 300 (nests) in May 1989 (A. Filippini

pers. comm.). Edwards *et al.* (1981) recorded nesting on Belmonte Island (15), Challenger Islet (173), and Cabral Islet (105). These figures, and particularly the more recent counts of nests, suggest an apparently stable population.

At Rocas Reef, a small colony (six nests) was found in the walls of the abandoned lighthouse in February 1982 (Antas unpubl. data). There is scope for the species to colonise the introduced trees. Neither Olson (1981) nor Filippini (1986) found this species breeding at Trindade Island.

The major breeding site is protected within the Fernando de Noronha National Park and there are no evident threats.

#### Large-billed Tern *Phaetusa simplex*

A freshwater tern with coastal populations on the northern coast and in Rio Grande do Sul state. The only known coastal nesting record is of two pairs in a mixed colony with *Sterna supercilialis* and *Gelochelidon nilotica* in Lagoa do Peixe, Rio Grande do Sul in early November 1986 (pers. obs.).

Its major colonies are in the hinterland on sandy beaches exposed in the dry season. Breeding occurs on every major river with such features and the terns move elsewhere during the rainy season. Some colonies are affected by egg collection and disturbance by fishermen but, so far, without apparent negative effect.

#### Black Skimmer *Rynchops nigra*

Basically a freshwater species, though often feeding on small fish in coastal waters. As with *Sterna supercilialis* and *Phaetusa simplex*, breeding occurs mostly inland on sandy islands in rivers, sometimes in mixed colonies. Coastal breeding, if it occurs, probably happens on the Rio Grande do Sul coast or on the long sandbars of the northern region. A common species without conservation threats.

### THREATS

#### Direct

On all coasts, direct persecution of seabirds is a scattered threat, perhaps reaching local importance and impact at some sites. Although there is no continuous use of seabirds or their eggs as a main source of human food, egg collection is of known importance at the Espírito Santo state's *Sterna (sandvicensis) eurygnatha* and *S. hirundinacea* colonies, where fishermen can severely affect the nesting success of both species. Similar concerns have been expressed for colonies in Rio Grande do Sul state (W. L. Bacelar *in litt.*) and at Currais Island, Paraná state (Scherer Neto 1986). The extent of eggging in other parts of the country is probably irregular and rather less serious. Thus although fishermen on the northern coast, for instance, have long practised eggging, they concentrate on herons and other mangrove species, rather than seabirds.

Occasional killing of nestlings is reported from Rocas Reef, mostly of boobies by fishermen who use their meat to bait lobster traps. The extent of the problem is uncertain, but each lobster boat carries over 1,000 traps. At Fernando de Noronha, nestlings were an important source of food for the convicts and this persisted as an island tradition until recent times. Nowadays such use is banned. Although adult boobies were sometimes killed by fishermen at Currais Island (Scherer Neto 1986), this is probably uncommon and unlikely to pose a major threat. Lobster fishermen used to kill adult boobies at Rocas Reef and sell them stuffed as house ornaments in northeastern Brazil, but this is unusual nowadays. At sea, fishermen occasionally kill seabirds, with *Phalacrocorax olivaceus* and the boobies being the main target.

Fishing nets, however, have much greater impact, especially in the southern region. The netting of sardines *Sardinella* sp. and other small fishes attracts boobies which are frequently caught and killed in the net mesh. *P. olivaceus* is caught in the large coastal fish traps. Boobies and albatrosses are also hooked by fish lures towed near the surface by boats engaged in commercial or recreational fishing. These effects are probably chiefly of local impact, if any.

Human disturbance in colonies is more frequent and dangerous for species like *Sterna (sandvicensis) eurygnatha*. A history of site abandonment after disturbance is evident in the Rio de Janeiro colonies. Disturbance also affects nesting success. Coastal islands in the populous southern region are overused by fishermen and tourists during the austral summer, decreasing fledging success. Adults at breeding colonies are also disturbed by photographers, e.g. at Currais Island (Scherer Neto 1986).

#### Indirect

Habitat destruction and modification and the effect of introduced predators deserves more attention. House Mice *Mus musculus* have passively colonised every oceanic island. Black and Brown Rats are a real danger to seabirds everywhere they have established themselves. This is particularly so at the Abrolhos Archipelago, where *Phaethon aethereus* has been affected and at Fernando de Noronha, where ground-nesting species are unable to recolonise the main island. At Trindade, although conclusive evidence is lacking, rats may have played a role in the decrease of some seabirds there.

Cats were introduced to Fernando de Noronha and with rats and perhaps the introduced Teju Lizard are a severe problem for ground-nesters on the main island. The lizard alone is probably of minor impact, as its presence on Rata Island does not affect the *Sula dactylatra* colonies.

Feral goats were of great impact on Trindade Island, where they were an important cause of forest removal. They also degraded the vegetation on Redonda and Santa Bárbara Islands in the Abrolhos Archipelago. Nowadays, a feral herd persists only on Santa Bárbara Island. Feral pigs exist only on Fernando de Noronha main island, where they are another significant factor impeding recolonisation by ground-nesters.

Oil spills are of potentially serious importance and seabird colonies in Rio de Janeiro and São Paulo states, where major oil terminals are located, can be severely affected. Small spills are frequent on São Sebastião Terminal, São Paulo state. In addition to breeding species, wintering seabird populations are also at risk. The major Brazilian oil field is off Rio de Janeiro state coast, just north of Cabo Frio. Accidents there easily reach the coast and affect the waters of the Brazil Current. Oil spills are also of serious impact on the Rio Grande do Sul coast, where wintering penguins and albatrosses, among other seabirds, are regularly affected. Unfortunately, environmental laws and their financial penalties are not severe enough to prevent either spills or tankers cleaning their tanks in coastal waters.

Another major indirect human impact comes from Sardine and other (mainly anchovy) fisheries on the southern region. Figures are not available but overfishing appears to have reduced the commercial stocks off São Paulo and Rio de Janeiro states, driving the trawlers to more southerly waters. In the northern region, shrimping (for *Penaeus brasiliensis*) also damages fish stocks because shrimps only represent c.20 per cent of all prey caught and the rest is discarded. The large shrimp fleets may have a significant effect on the prey of some seabirds, especially on the northern coast where prey distribution is patchy.

Other types of pollution undoubtedly have negative effects but few data are

available. Given current air and water pollution indices on the coast of the southern region, the sea here must have been suffering a high level pollution for many years. Only one project has tried to measure the extent of heavy metal pollution in seabirds, using nestlings of *S. hirundinacea* from Guanabara Bay, but results are not yet available (Coelho *et al.* 1985).

### CONSERVATION ACTION AND REQUIREMENTS

#### Existing action

Since 1967 Brazilian law has afforded protection to seabirds by forbidding persecution, killing, colony disturbance, and the use of birds' byproducts. As in many other countries, law enforcement is poor and the law is often not fully applied. The same is true even for most Brazilian national parks and biological reserves. However, creation of parks and reserves is still very beneficial as it avoids, or minimises, other greater impacts such as resort development and other large-scale tourist-oriented projects.

Most of the Fernando de Noronha Archipelago was created as a National Park in September 1988, saving the islands from further adverse impacts. Also under nominal protection are Rocas Reef (Biological Reserve - created in 1979) and the Abrolhos Archipelago (National Park - created in 1981). São Pedro and São Paulo Rocks are under federal protection as an Environmental Protected Area, preventing major human impact but permitting various human activities. Their isolation is, however, their best protection. At the state level, Santa Catarina was the first to protect a colony, when Ilhas Moleques do Sul were created a Parque Estadual do Tabuleiro (1975). In 1989, the Secretaria do Meio Ambiente of Espírito Santo state prohibited landings on islands in the state during seabird breeding seasons.

Recently, efforts were made to improve the environmental education of the coastal human population, aiming to increase environmental awareness, at least in parts of the country. A good example is the work done in Espírito Santo state for protection of *S. (sandvicensis) eurygnatha* colonies using posters, videos, TV campaigns, and discussions with fishermen. Although progress is slow, such action should produce beneficial results in time; local involvement is an essential part of such approaches.

Within the Brazilian Ornithological Society there is a Sea Bird Specialist Group publishing a newsletter called "Atobá". Its action is positive in terms of seabird conservation and conservation awareness among seabird enthusiasts. One of its goals is to improve knowledge of Brazilian seabird colonies by mapping them and monitoring their populations. Basic surveys are still needed for huge areas of coast, especially in the northern region and parts of São Paulo state.

#### Requirements

**PREDATOR ERADICATION.** The feral pigs on Fernando de Noronha main island are a significant influence preventing recolonisation by ground-nesting seabirds. Pig eradication is relatively straightforward and would be a major step forward in conservation terms.

Cats are also present on Fernando de Noronha main island, where they are probably the most serious threat (both in terms of direct predation and of preventing recolonisation in other areas) to the remaining seabird populations, even in relatively inaccessible sites. Control or, ideally, eradication is a high priority. Cats are also present on other coastal islands but evidence of their effect on seabird populations



there is not available.

A strong recommendation should be made to the Brazilian Navy to control, fence or, better, eradicate the feral goat herd on Trindade Island. Such a measure, which would not be difficult to implement, would be of great benefit to seabirds and also to the remaining endemic vegetation. Fortunately, at the Abrolhos Islands, feral goats were eradicated from Redonda Island and remain currently only on Santa Bárbara Island. This herd should also be removed as soon as possible, although it is a lower priority than action on Trindade Island.

Rats need controlling at the Abrolhos Archipelago, where *Phaethon aethereus* has been affected by their activities. Control of *Rattus rattus* and *R. norvegicus*, is also needed in the Fernando de Noronha Archipelago and at Trindade Island.

**ESTABLISHMENT OF RESERVES.** Despite the problems of management and law enforcement in Brazilian reserves, they still offer seabirds important protection from disturbance and habitat degradation. What is needed are more small regional reserves to protect locally important seabird breeding islands, such as Currais Island or islands off Macaé. Federal reserves are appropriate for sites like Trindade Islands and perhaps also for the main islands used by *Sterna (sandvicensis) eurygnatha*.

**PUBLIC EDUCATION.** The public needs to have proper information from seabird specialists in order to give useful support for conservation. Appropriate activities and research should be properly covered by the media and should involve relevant local governmental conservation bodies as much as possible. The situation in Trindade, Abrolhos and Fernando de Noronha seabird colonies should be widely publicised. Focusing on rare or endangered species such as *Sterna (sandvicensis) eurygnatha* has been successful in Espírito Santo state. However, common species should also be used in campaigns because they are usually more easily recognised by the people.

**SURVEY.** Surveys of breeding seabirds are needed for the majority of the coastline, especially in the northern region and parts of the southern region, particularly São Paulo, Rio Grande do Sul islands and coastline. Colonies already known also need surveys throughout the year in order to understand timing in occupation and changes in population size. The presence of introduced predators (and their effects on seabirds) need properly recording for most colonies.

**RESEARCH.** Basic studies on breeding timetables are needed, especially for tropical seabirds which often have prolonged breeding seasons. Breeding success data and knowledge of causes of post-fledging mortality are also relevant to conservation efforts. The feeding habits and prey of most Brazilian seabirds are unknown, which makes it difficult to assess the effect of fisheries. Monitoring to detect trends in breeding population size and breeding success needs to be established at selected sites. Overall, the first priority for research and conservation action must be studies at Trindade and Martin Vaz colonies. The status of the endemic taxa needs determining and the nature and severity of existing threats identifying. The situation is particularly critical for the frigatebirds but, because there are threats to all seabirds there, a comprehensive research and conservation programme, covering all species, needs establishing.

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## REFERENCES

- BEGE, L. A. DO R. & PAULA, B. T. 1988. *As aves nas Ilhas Moleques do Sul, Santa Catarina: aspectos da ecologia, etologia e anilhamento de aves marinhas*. Florianópolis: Fatma.
- BELTON, W. 1984. Birds of Rio Grande do Sul, Brazil. Part I: Rheidae through Furnariidae. *Bull. Amer. Mus. Nat. Hist.* 178, 371-631.
- COELHO, A. G. M. 1981. *Observações sobre a avifauna do Arquipélago dos Abrolhos, Bahia, Pernambuco: Universidade Federal de Pernambuco, Centro de Ciências Biológicas (Publicação Avulsa no. 1)*.
- COELHO, E. P., ALVES, V. S. & SONECHET, M. 1985. Anilhamento de trinta-réis como apoio ao estudo de contaminação por metais pesados em aves na Baía de Guanabara - RJ. *Anais II Encontro Nacional de Anilhadores de Aves*, pp. 227-228. Rio de Janeiro: Universidade Federal do Rio de Janeiro.
- CRUD-MACIEL, N. 1987a. Breeding biology of the South American Tern (*Sterna hirundinacea*) with some notes about Cayenne Tern (*Sterna eurygnatha*) in Guanabara Bay, State of Rio de Janeiro. Fundação Estadual de Engenharia do Meio Ambiente. Unpubl. report (in Portuguese).
- CRUD-MACIEL, N. 1987b. Nidificação de *Sterna hirundinacea* Lesson, 1831, Laridae, na Baía de Guanabara, Rio de Janeiro, Brasil. *Anais do II Encontro Nacional de Anilhadores de Aves*, pp. 207-209. Rio de Janeiro: Universidade Federal do Rio de Janeiro.
- EDWARDS, A. J., WILSON, K. & LUBBOCK, H. R. 1981. The seabird populations of St Paul's Rocks. *Ibis* 123, 233-238.
- ESCALANTE, R. 1985. Taxonomy and conservation of austral-breeding Royal Terns. In: Buckley, P. A., Foster, M. S., Morton, E. S., Ridgely, R. S. & Buckley, F. (eds.) *Neotropical ornithology*, pp. 935-942. Washington, D.C.: American Ornithologists' Union (Ornithological Monogr. 36).
- ESCALANTE, R., AZEVEDO, T. R. & FREYSLIBEN, A. 1988. Nidificación del Gaviotín de Cayena o de Brasil (*Sterna sandvicensis eurygnatha*) y del Gaviotín Sudamericano (*Sterna hirundinacea*) en "Ilha Deserta" (Santa Catalina, Brasil). Programa y Publicación de Resúmenes, V Reunión Ibero-Americana de Conservación y Zoología de Vertebrados, Montevideo, Uruguay, V-GL-30.
- FILIPPINI, A. 1986. Relatório sobre a visita à Ilha da Trindade. Centro de Estudos de Migrações de Aves. Unpubl. report.
- HALEWYN, R. & NORTON, R. L. 1984. The status and conservation of the seabirds in the Caribbean. In: Croxall, J. P., Evans, P. G. H. & Schreiber, R. W. (eds.) *Status and conservation of the world's seabirds*, pp. 169-222. Cambridge, U.K.: International Council for Bird Preservation (Techn. Publ. 2).
- LUERDERWALDT, H. & FONSECA, J. P. 1922. A Ilha dos Alcatrazes. *Rev. Mus. Paul.* 13, 441-513.
- MACKINNON, R. S. 1962. Bird life on St Paul's Rocks. *Sea Swallow* 15, 53-55.
- MASCH, D. 1966. Life on the Rocks. *Oceanus* 12, 5-7.
- MIRANDA-RIBEIRO, A. 1919. A fauna vertebrada da Ilha da Trindade. *Arch. Mus. Nac.* 22, 171-

- 194.
- MURPHY, R. C. 1936. *Oceanic birds of South America*. New York: MacMillan.
- MUSSO, C. M., NEVES-NETO, G. S., COMARELLA, L. F., BERREDO, S. & FILHO, S. M. 1988. Relatório de atividades – projeto de proteção às andorinhas do mar. Centro de Estudos de Migrações de Aves. Unpubl. report.
- NAROSKY, T. & YZURETA, D. 1987. *Guía para la identificación de las aves de Argentina y Uruguay*. Buenos Aires: Asociación Ornitológica del Plata.
- OLSON, S. L. 1981. Natural history of vertebrates on the Brazilian islands of the mid South Atlantic. *Natn. Geog. Soc. Res. Rep.* 13, 481-492.
- OREN, D. C. 1982. A avifauna do Arquipélago de Fernando de Noronha. *Bol. Mus. Paraense Emílio Goeldi* 118, 1-21.
- OREN, D. C. 1984. Resultados de uma nova expedição zoológica a Fernando de Noronha. *Bol. Mus. Paraense Emílio Goeldi* 1, 19-44.
- SCHERER NETO, P. 1985. Anilhamento de aves marinhas na Ilha dos Cutrais, Estado do Paraná. Anais do I Encontro Nacional de Anilhadore de Aves. Minas Gerais: Universidade Federal de Viçosa.
- SCHERER NETO, P. 1986. Aves marinhas no litoral do Estado do Paraná. Centro de Estudos de Migrações de Aves. Unpubl. report.
- SCHERER NETO, P. 1987. Nota sobre aspectos migratórios de *Fregata magnificens* Mathews (1914) (Fregatidae, Aves). Anais do II Encontro Nacional de Anilhadore de Aves. Rio de Janeiro: Universidade Federal do Rio de Janeiro, pp. 202-203.
- SCHLATTER, R. P. 1984. The status and conservation of seabirds in Chile. In: Croxall, J. P., EVANS, P. G. H. & SCHREIBER, R. W. (eds.) *Status and conservation of the world's seabirds*, pp. 261-269. Cambridge, U.K.: International Council for Bird Preservation (Techn. Publ. 2.).
- SCHULTZ-NETO, A. 1988. Centro de Estudos de Migrações de Aves. Unpubl. report.
- SICK, H. 1984. *Ornitologia brasileira, uma introdução*. Brasília: Universidade de Brasília Press.
- SICK, H. & LEAO, A. P. 1965. Breeding sites of *Sterna eurygnatha* and other seabirds off the Brazilian coast. *Auk* 82, 507-508.
- SMITH, H. G., HARDY, P., LEITH, I. M., SPAULL, V. W. & TWELVES, E. L. 1974. A biological survey of St Paul's Rocks in the equatorial Atlantic Ocean. *Biol. J. Linn. Soc.* 6, 88-96.