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Non-breeding seabirds in Brazil: a review of band recoveries

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ABSTRACT. Twenty-three species of seabirds banded abroad have been recovered in Brazil and nearby Uruguay. Northern migrants include *Calonectris diomedea borealis* from the Macaronesian Islands, *Puffinus puffinus* from the British Isles (mostly from Wales) and Ireland, *Catharacta skua* from Iceland and Shetland, *Stercorarius parasiticus* from Finland and Shetland, and *Larus delawerensis, L. atricilla, Thalasseus sandvicensis, Sterna hirundo, S. dougallii, S. paradisea, S. antillarum, S. fuscata*, and *Anous stolidus* from North America. Southern Migrants, most recovered south of 25°S, are *Diomedea epomophora* (breeding in Campbell Island, New Zealand), *D. exulans* (all records coming from South Georgia), *Diomedea dabbenena* (two records from Gough Island), *Thalassarche melanophrys* (several records of Falklands birds and one from South Georgia), *T. chlororhynchos* (birds from Tristan da Cunha, Gough and Inaccessible islands), *Macronectes giganteus* (birds from the South Orkneys, South Georgia, Cormorant and Elephant islands), *M. hallii* (seven Uruguayan records of birds from the Macquarie, Crozet and Kerguelen islands), *Daption capense* (two birds from the South Orkneys). Individuals of *Catharacta maccormicki* from Anvers and Cormorant islands have been recovered in northeastern Brazil (Maranhão to Alagoas), while *C. antarctica lonnbergi* from King George and Signy islands have been found in Rio Grande do Sul, Santa Catarina and Alagoas. Southern Brazilian waters influenced by the Subtropical Convergence are important for most southern migrants (especially albatrosses) and for wintering *Puffinus puffinus* and *Calonectris diomedea*, *Sterna hirundo* and *S. paradisea* occupying coastal habitats. Northeastern Brazil seems important to northern terns and holds most records of some transequatorial migrants such as *Calonectris diomedea* and *Catharacta maccormicki*.
KEY WORDS: banding, Brazil, *Anous stolidus, Calonectris diomedea, Catharacta* spp., *Daption capense, Diomedea* spp., *Larus* spp., *Puffinus puffinus, Stercorarius parasiticus, Sterna* spp., *Thalasseus sandvicensis, Thalassarche* spp., migration, natal areas, records, recoveries.

RESUMO. **Aves marinhas que não se reproduzem no Brasil: uma revisão de recapturas de aves anilhadas.** Vinte e três espécies de aves marinhas anilhadas em outros países já foram recapturadas no Brasil e areas vizinhas do Uruguai. Migrantes vindos do hemisfério norte incluem *Calonectris diomedea borealis* das ilhas Macaronésias; *Puffinus puffinus* das Ilhas Britânicas (a maioria vindo do País de Gales) e Irlanda, *Catharacta skua* da Islândia e das Shetland, *Stercorarius parasiticus* da Finlândia e das Shetland, e *Larus delawerensis, L. atricilla, Thalasseus sandvicensis, Sterna hirundo, S. dougallii, S. paradisea, S. antillarum, S. fuscata* e *Anous stolidus* da América do Norte. Migrantes meridionais, a maior parte encontrada abaixo de 25°S, são *Diomedea epomophora* (nidificando na ilha Campbell, Nova Zelândia), *D. exulans* (todas as recaptures sendo de aves das Geórgias do Sul), *Diomedea dabbenena* (dois registros de aves da ilha Gough), *Thalassarche melanophrys* (diversos registros de aves das Malvinas birds and um das Geórgias do Sul), *T. chlororhynchos* (aves de Tristão da Cunha, Gough e Inaccessible), *Macronectes giganteus* (aves das Orkneys do Sul, Geórgias do Sul e ilhas Cormorant e Elephant), *M. hallii* (sete registros uruguaios de aves das Macquarie, Crozet e Kerguelen), *Daption capense* (duas aves das Orkneys do Sul). *Catharacta maccormicki* vindas das ilhas Anvers e Cormorant foram recuperadas no nordeste do Brasil (Maranhão a Alagoas), enquanto *C. antarctica lonnbergi* das ilhas King George e Signy foram encontradas no Rio Grande do Sul, Santa Catarina e Alagoas. O sul do Brasil, especialmente as águas sob influência da Convergência Subtropical, é uma area importante para migrantes meridionais (especialmente albatrozes) e para *Puffinus puffinus* e *Calonectris diomedea*; *Sterna hirundo* e *S. paradisea* ocupando habitats costeiros. O nordeste do Brasil é uma area importante para diversos Sternidae, além de ter o maior número de recuperações de migrantes transequatoriais como *Catharacta maccormicki* e *Calonectris diomedea*.
PALAVRAS-CHAVE: anilhamento, áreas de reprodução, Brasil, *Anous stolidus, Calonectris diomedea, Catharacta* spp., *Daption capense, Diomedea* spp., *Larus* spp., *Puffinus puffinus, Stercorarius parasiticus, Sterna* spp., *Thalasseus sandvicensis, Thalassarche* spp., migrações, registros, recapturas.

The Brazilian coastline stretches along 8,000 km of the southwestern Atlantic, covering a wide array of habitats, from mangrove forests to coral reefs and extensive sandy beaches, being home to a diverse community of seabirds. This diverse coast is influenced by the warm Brazil Current along most of the northern shore, and by the cold, nutrient rich Falklands Current in the south. The discharges of large rivers like the Plate, Amazon, and São Francisco, and of the Patos Lagoon, are another factor with a strong influence on oceanographic conditions over the continental shelf (Vazzoler *et al*. 1999).

Besides resident skimmers, boobies, tropicbirds and frigates, the Brazilian seabird community is currently known to include at least 32 species of Procellariiformes, all but two being non-breeding visitors, including the recently recognized *Diomedea dabbenena*, *Procellaria conspicillata* and *Calonectris edwardsii* (Robertson and Nunn 1998, Ryan 1998, Sangster *et al*. 1998), eight Stercorariidae (none breeding in Brazil) and some 26 Laridae and Sternidae, ten of them being migrants breeding elsewhere (Sick 1997). In addition, locally breeding Brazilian populations of species like *Sterna fuscata*, *Sterna hirundinacea, Thalasseus eurygnatha* and *T. maximus* may be in contact with migrant individuals coming from other populations, what may have genetic, epidemiological and conservation implications.

The sources of some birds are easy to figure. *Procellaria conspicillata*, a threatened species easily seen off southern Brazil (Olmos 1997), is known to breed only in Inaccessible Island, while *Diomedea dabbenena* do so only in Inaccessible and Gough islands, all in the southern-central Atlantic (Ryan 1998, Croxall and Gales 1998). Most other seabirds have many breeding sites and assessing the natal areas of birds found in Brazil relies on recoveries of banded individuals.

Although the ecology of most seabirds is well-known in their breeding areas, the same is not true after they move to their wintering or foraging grounds. Protection of breeding colonies may not be enough to protect populations if their wintering grounds or foraging areas, located abroad, are under pressure from fisheries or oil exploration, or if the birds are themselves the target of exploitation. This is especially true for wide-ranging species such as albatrosses and petrels, which despite breeding mostly in remote and protected colonies are experiencing a worldwide decline due to incidental bycatch by fisheries in their foraging grounds (reviewed by Cooper 1999).

Most migratory species are protected by international agreements like the Convention on Migratory Species or Bonn Convention, although Brazil so far has failed to become a signatory. To formulate adequate conservation policies for those species it is necessary to know where they come from and where and when they migrate to, and to identify factors that may affect the birds during their voyage.

Despite a reasonable amount of information on migrant seabirds recorded in Brazil being available, this has not been put together except for a few species (e. g. Brooke 1990 on *Puffinus puffinus*, Prince *et al*. 1998 on South Georgia albatrosses). Here, I attempt to bring together available records of banded seabirds recovered in Brazil, as taken both from the literature and mostly unpublished files provided by foreign banding schemes. My main goal was to identify the areas where those birds come from and their seasonality, and also provide information on mortality factors and important areas for those species.

METHODS

Recoveries of seabirds banded abroad and recovered in Brazil were provided by the following institutions: Australian Bird and Bat Banding Scheme (ABBBS), Bird Banding Lab – USFWS (BBL), Bird Banding Office/ Canada, British Antarctic Survey (BAS), British Trust for Ornithology (BTO), Centro Nacional de Anilhagem – Portugal, CEMAVE – Brazil, CNRS – France, Copenhagen Bird Ringing Center – Denmark, Department of Conservation – New Zealand (DOC), Finnish Museum of Natural History, Gdansk Ornithological Station, Instituto Nacional Antartico Chileno (INACH), Icelandic Ringing Scheme, Instituto Antactico Argentino, Museu Oceanográfico de Itajaí (MOVISC), Institut fuer Vogelforschung, Oficina de Anillagem – Spain, and South Africa Ringing Lab (SAFRING).

Because southernmost Brazil shares with Uruguay one of the most productive areas in the western South Atlantic, dominated by the Subtropical Convergence (Seeliger *et al*. 1998) I chose to include some records made in Uruguayan waters, with the understanding those refer to an ecological region that includes the coast of southern Rio Grande do Sul. Including those records made the picture on the sources of some species (e. g. *Macronectes halli*) richer than if only Brazilian records were considered.

Brazilian recoveries of two species, *Sterna hirundo* and *S. dougalli*, have been subject of recent reviews (Cordeiro *et al.* 1996, Hays *et al*. 1997, 1999), thus they are not analyzed here. Albatross nomenclature follows Croxall and Gales (1998). Recovery locality coordinates are approximate, as the databases frequently did not have accurate information.

RESULTS

Wandering Albatross *Diomedea exulans.* Croxall and Prince (1990) and Prince *et al*. (1998) summarized Brazilian recaptures of Wandering Albatrosses banded in South Georgia. Here I present a more detailed account on the recapture localities and circumstances of those birds and add recent records.

BTO files list eight birds banded in Bird Island, South Georgia (54°S, 38°02'W) and recovered in Rio Grande do Sul. One, banded as a nestling on 17 November 1975, was found dead on the beach at Quintão (30°22'S, 50°19'W) on 15 April 1976. Another bird, also banded as a nestling on 29 October 1981, was caught by a tuna long-liner off Rio Grande on 26 August 1990 (33°49'S, 49°49'W) and later released alive on Cassino beach.

A bird caught by fishermen off Chuí (33°40'S, 52°40'W) on 15 January 1988 had worse fate, drowning in the long-line. It had been banded as a nestling on 23 October 1986. A female, over 3 years old when banded on 6 February 1989, was also killed in a tuna long-liner off Rio Grande (32°17'S, 49°46'W) on 14 October 1989.

A bird fledged at Wanderer Valley, Bird Island, South Georgia, in October 1989 was captured in a long-line set for swordfish at 28°30'S, 48°W in August 1999, and its band number handed to me. This bird drowned in the line. The same individual had been resighted at Wanderer Valley in March 1995 and 1997 (J. Croxall *in litt*. 1999).

The Museu Oceanográfico de Itajaí (MOVISC) has four *Diomedea exulans* originally banded in Bird Island, South Georgia (Soto and Riva 2000). Two males were banded as chicks on 1 November 1994 and 18 September 1996, respectively. Both were drowned between 3-7

January 1998 by a long-line set between 33-35°S, 49°30'-51°25'W. They had never returned to the island since fledgling.

An adult female banded on Bird Island on 23 November 1977 was also killed in a long-line on 11 December 1999 at 34°30'02"S, 50°18'08"W, while an unsexed bird, banded as a chick on 4 October 1990 met the same fate on 2 August 2000 at 35°17'52"S, 51°42'48"W.

Additionally, one (apparently) adult bird banded on 24 July 1966 off Bellambi, New South Wales, Australia (34°22'S, 150°56'E) was found beach-washed at Lagoa do Peixe, Rio Grande do Sul (31°10'S, 51°W) in 1976, about 12,371 km from its banding point (B. Dettmann *in litt*. 1999).

As inferred from banded birds, waters off New South Wales are a meeting point for Wandering Albatrosses coming from several breeding colonies in the southern ocean, including South Georgia, the latter population making a eastbound round the world migration (Sladen *et al*. 1968, Prince *et al*. 1998), so we can not be sure about the source of this bird.

Tristan Albatross *Diomedea dabbenena*. Two adult *Diomedea dabbenena* banded at Goney Dale, Gough Island (40°20'S, 09°55'W) were captured in the rich area under the influence of the Subtropical Convergence off Rio Grande do Sul and Uruguay. The first, banded on 15 January 1981, died on 13 October 1989 after getting entangled in fishing lines at 32°14'S, 49°52'W. The second bird, a male banded on 30 October 1992, had a similar death on 28 November 1995 at 34°07'S, 50°58'W (D. Oschadleus *in litt*. 1999). The latter specimen is now in the collection of the Museu de Zoologia da Universidade de São Paulo (MZUSP 74185), being one of the few documented records of the species in Brazil (Neves and Olmos 2001).

Additionally an adult male banded in Gough Island (Tafelkopf colony) on 26 December 1989 (and seen there during the 1991/92, 1995/96 and 1988/99 breeding seasons) was killed on 10 November 2001 in a long-line set by a Brazilian vessel at 32°S, 32°58'W, far from Brazilian waters. It was also sent to the MZUSP.

The migration of *Diomedea dabbenena* is still poorly known. Up to 2000 there were only nine recoveries of banded birds away from Gough Island (Ryan *et al.* 2000), all in the convergence areas off South Africa and Uruguay/Brazil, but for a record from New South Wales, Australia.

Southern Royal Albatross *Diomedea epomophora*. Apparently there are only three recoveries of this highly migratory species in Brazil, all birds banded as nestlings in Campbell Island, New Zealand (55°S, 169°W). One bird, reported by Sander (1982), had been banded on 27 October 1976, and found dead on the beach at Tramandaí, Rio Grande do Sul (30°S, 50°11'W). Another bird, banded as a chick on 23 May 1962, was caught by a fishing boat at 32°10'S, 52°W in July 1965. The third bird was also banded as a chick on 16 August 1982, and found dead on the beach at 30°10'S, 50°10'W on 21 August 1983 (Rod Cossee *in litt*. 1999).

Campbell Island harbors 99% of the world population of Southern Royal Albatrosses, which seems to be increasing (7,800 pairs bred in 1996; Croxall and Gales 1998). The species is considered Vulnerable by the IUCN (Croxall and Gales 1998, Stattersfield and Capper 2000).

Diomedea epomophora migrates from its breeding areas in New Zealand across the Pacific and around Cape Horn to feed on the Patagonian shelf, where they stay for months before migrating across the Atlantic and Indian oceans back to their natal areas. The Patagonian shelf has long been recognized as an important area for this species, which probably reaches Brazilian waters following the winter push of the Malvinas Current (Robertson and Kinsky 1972, Enticott 1986, White *et al*. 1999).

Black-browed Albatross *Thalassarche melanophrys*. Sladen *et al*. (1968) and Prince *et al*. (1998) have discussed recoveries of this species in Brazil. Only one bird banded in Bird Island, South Georgia (54°S, 38°02'W) was recovered in Brazil, off Ilha Grande, Rio de Janeiro, (23°07'S, 44°16'W). Most birds of this population are known to migrate to waters off South Africa (Prince *et al*. 1998).

On the other hand, another 35 birds banded as nestlings with USFWS bands at Westpoint Island, Falklands (51°21'S, 60°41'W) between 1961 and 1963 were recovered within a maximum of two years along the Brazilian coast (figure 1). Most were recovered south of Arraial do Cabo, Rio de Janeiro (22°58'S, 42°02'W), but there are sole records from Ilha de Santana, Maranhão (02°20'S, 43°30'W), Maceió, Alagoas (09°40'S, 35°44'W), mouth of the Inhambupé river, Bahia (11°52'S, 38°22'W) and north of Salvador, Bahia (12°58'S, 38°29'W). All records were made between May and September, agreeing with the winter influx of individuals along the Brazilian coast (figure 2, Olmos 1997).

BBL lists an additional 17 recoveries of Falkland albatrosses besides the ones in Sladen *et al.* (1968), totaling 52 birds recovered in Brazil. The last recovery, of a bird banded as a chick, occurred in 1980. The analysis including all those birds strengthens the view that *Thalassarche melanophrys* is commonest in southern latitudes during the winter (figures 1 and 2) but is by no means restricted to those area and time. Most (61%) recoveries were of birds that had just fledged, with very few records of older birds (figure 3). At-sea observations have shown that juvenile *T. melanophrys* make an overwhelming majority of the records of this species off southern Brazil (e. g. Olmos 1997, Neves 2000), further suggesting that Brazilian waters are important for dispersing young birds from the Falklands.

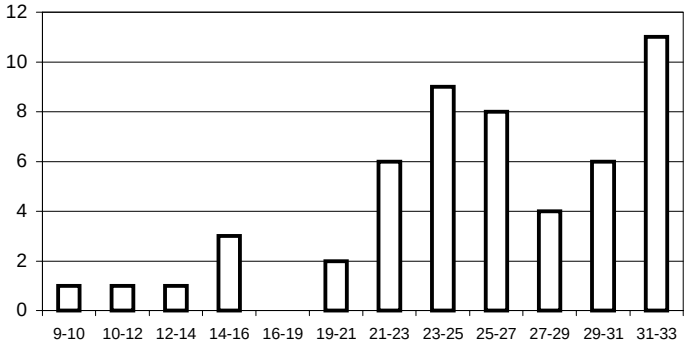

Figure 1. Recoveries of *Thalassarche melanophrys* from the Falklands in Brazil along the latitudinal gradient. N = 52 birds.

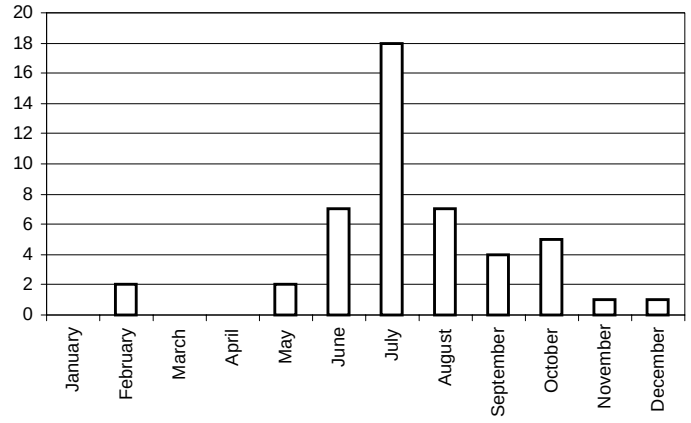

Figure 2. Recoveries of *Thalassarche melanophrys* from the Falklands in Brazil per month. N = 52 birds.

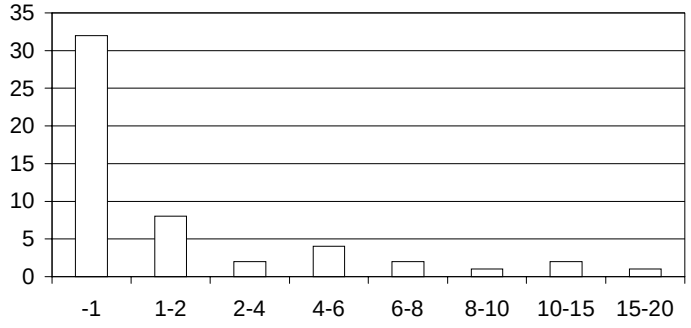

Figure 3. Age distribution of *Thalassarche melanophrys* from the Falklands recovered in Brazil. The eldest bird was 17 years old. N = 52 birds.

Atlantic Yellow-nosed Albatross *Thalassarche chlororhynchos*. BTO files record two adult albatrosses banded in Inaccessible Island (37°17'S, 12°40'W) in December 1982 and recovered in Brazil. The first, banded on 15 December, was found dead in the water in June 1984 at Araranguá, Santa Catarina (28°56'S, 49°30'W). The other bird, banded on 4 December, was found dead on the beach at Peruíbe, São Paulo (24°18'S, 47°01'W) on 7 September 1985 (see also Fraser *et al.* 1988).

SAFRING files record one adult albatross of this species banded on the nest at Tristan Island (37°05'S, 12°17'W) on 31 October 1991, being killed by a longline at 31°05'S, 44°47'W on 23 September 1993. The MOVISC collection has one bird banded as a chick in Goneydale, Gough Island (40°21'S, 09°53'W) on 4 March 1999 and killed in a long-line set at 30°25'S, 47°16'W on 6 November 2000 (Soto and Riva 2001). Additionally, I recovered the band of an immature, also banded as a nestling in Gough Island on 7 March 1997, and drowned on 12 July 1999 at 27°S, 46°W after being caught in a long-line set for swordfish (Dieter Oschadleus *in litt*. 1999).

Thalassarche chlororhynchos in the western South Atlantic is largely restricted to the north of the Subtropical Convergence or its northern edge (Murphy 1936, Olmos 1997, Neves 2000), a situation similar to that elsewhere (Murphy 1936, Fraser *et al.* 1988, Gales 1993). It seems to avoid colder waters, and was not recorded during extensive seabird censuses around the Falklands (White *et al*. 1999).

Southern Giant Petrel *Macronectes giganteus*. BTO files have four records of birds recovered in Brazil. Three birds were banded in Signy Island, South Orkneys (60°43'S, 54°36'W). One adult banded on 21 January 1962 was found decomposed on the beach 10 miles north of Rio Grande (32°03'S, 52°08'W) on 2 March 1970. Another bird, banded as a nestling in March 1972 was also found dead at Cassino Beach, Rio Grande do Sul (32°14'S, 32°10'W) on 10 June 1972.

Perhaps the northernmost recovery of a Southern Giant Petrel in Brazil was another Signy Island bird banded as a nestling on 4 March 1962 and found with a broken wing on 16 June 1962 off Cabo Frio, Rio de Janeiro (22°57'S, 42°01'W).

A bird too young to fly banded in Bird Island, South Georgia (54°S, 38°02'W) on 3 February 1962 was recovered in 25 August, six months later, in Garopaba, Santa Catarina (28°03'S, 48°40'W; Sladen *et al*., 1968). Another bird banded as a juvenile (> 1 year) in Bird Island, on 28 January 1969 was later found dead on the beach at Lagoa do Peixe, Rio Grande do Sul (31°10'S, 51°W) on 15 October 1991, about 2,742 km from its natal colony.

BBL files show two recoveries in Brazil, plus the one reported by Sladen *et al*. (1968). A juvenile banded before fledging in Cormorant Island, Antarctica, on 24 February 1984 was found near Tramandaí, Rio Grande do Sul, on 28 June 1985. Another one, banded on 2 March 1999, was found alive near Búzios, Rio de Janeiro, on 22 June 1999, from where it was sent to the Rio de Janeiro Zoo (J. F. Pacheco *in litt*. 1999).

Giant Petrels were a special interest of Brazilian researchers working in Antarctica, and several birds with CEMAVE bands have been recovered worldwide (Martim Sander, pers. comm. 2000). Nevertheless, only one juvenile

banded at Stinker Point, Elephant Island, on 17 September 1992 was recovered in Brazilian waters. This bird was found on 2 July 1992 at Cassino Beach, southern Rio Grande do Sul.

Additionally to Atlantic birds, one nestling banded at Langdon Point, Macquaire Island (54°35'S, 158°55'E) on 14 March 1970 was found sick at Buceo, Uruguay (34°55'S, 56°10'W) on 2 July of the same year (Belinda Dettmann *in litt*.).

Recoveries of banded *Macronectes* of both species show that fledglings tend to fly downwind to the east, often reaching medium latitudes in the process. As these birds do not breed until six or more years old and remain in the sea for most of this time before returning to their (mostly) natal colonies, banding data support the view they circumnavigate the world during this period (Warham 1990, 1996, Voisin 1990, Trivelpiece and Trivelpiece 1998).

Northern Giant Petrel *Macronectes halli*. Recorded in Brazil from only a handful beached derelicts from São Paulo and Paraná, two of which are in the MZUSP (Martuscelli *et al*. 1995, Tatiana Neves, *in litt*. 1999). Banded Northern Giant Petrels have been recovered in Uruguayan waters, where it is a rare visitor in fur seal colonies like Isla de Lobos (A. Stagi pers. comm., 2001) and the species is to be expected in southern Rio Grande do Sul. Five birds banded as nestlings at Macquarie Island (54°35'S, 158°55'E), were found beach-washed (three birds) or captured in Uruguay after periods ranging from six months to five years, eight months (Belinda Dettmann *in litt*. 1999).

Additionally, Weimerskirch *et al*. (1985) list one Uruguayan recovery each for *Macronectes halli* from the Crozet and Kerguelen islands, in the southern Indian Ocean, so birds from those populations may also occur in Brazilian waters.

Pintado Petrel *Daption capense*. BTO files show two recoveries of birds, both banded as nestlings at Signy Island, South Orkneys (60°43'S, 45°36'W). The first, banded on 20 February 1968, landed on a boat 70 miles off Santos, São Paulo (24°30'S, 45°W), being released alive without the ring on 15 September 1969. The second bird, banded in early February 1972, was found on the beach in São Francisco do Sul, Santa Catarina (26°17'S, 48°39'W).

Daption capense is a very common bird attending long-liners fishing both on the shelf and in deeper waters during the winter (pers. obs.) but is too small to be captured by the hooks, suffering almost nil incidental capture and, consequently, few bands are recovered.

Cory's Shearwater *Calonectris* (*diomedea*) *borealis*. Atlantic *Calonectris* (*d*.) *borealis* has been considered specifically distinct from the Mediterranean *C. d. diomedea* (Sangster *et al*. 1998) based on their different morphology and calls (Bretagnolle and Lequette 1990; Granadeiro 1993). The migrations of this transequatorial migrant have been reviewed by Mougin *et al*. (1988).

Jouanin *et al*. (1977) presented the first recoveries of Cory's Shearwaters banded in the Selvagem islands (30°09'N, 15°52'W), with two Brazilian recoveries. Later, Belton (1994) mentions a bird from Selvagem Grande Island found in Tramandaí, Rio Grande do Sul, on 16 February 1971. In addition, Lima (1996) mentions birds from Madeira and Azores islands found in Bahia, but without details.

Most (28) of 31 Brazilian recoveries made between May 1990 and January 2001 sent to me by the Portuguese and Spanish banding agencies came from Selvagem Grande Island (30°09'N, 15°52'W), where birds are banded between September and November. Additionally, there is one recovery of a bird from Ferro Islet, off Madeira (33°03'N, 16°21'W), three birds from the Azores [two from Graciosa Island (39°05'N, 28°W) and one from Vila do Porto Islet, Santa Maria Island (36°55'N, 25°10'W)] and three birds from Gran Canaria, Canaries (28°08'N, 15°32'W).

Twenty-two birds were found in Bahia, where researchers regularly comb the beaches for stranded seabirds (Lima 1996), with two recoveries from Rio Grande do Norte and one each from Paraíba, Pernambuco, Alagoas, Sergipe, Rio de Janeiro, São Paulo and Paraná. Most birds (25) were recovered less than one year after banding, while five were found 1-2 years after banding. As most birds are banded just before fledging, there is a high dominance of immatures. The oldest bird was banded in Selvagem Grande 16 years before being found in Itamaracá (07°06'S, 34°53'W).

Calonectris d. borealis is known to migrate across the Atlantic towards the Subtropical Convergence off southern Brazil, Uruguay and Argentina, being common there during the austral summer (Vooren and Fernandes 1989, Veit 1995), and most records seem to be of young dying during their first migration. It is interesting to notice that most birds (22 out of 31) were recovered in June-July 1994, when a massive wreck of Cory's and Great Shearwaters *Puffinus gravis* occurred over most of the Brazilian coast (Olmos *et al*. 1995, Lima 1996).

Manx Shearwater *Puffinus puffinus*. Manx Shearwaters *Puffinus puffinus* occur along most of the Brazilian coast as these northern migrants pass to and from their wintering quarters off southernmost Brazil, Uruguay and Argentina (Brooke 1990, Sick 1997). Brooke (1990) also presents a detailed survey of breeding localities.

On 11 November 1953 a Manx Shearwater banded in Skokholm Island, Wales (51°21'N, 05°08'W) was found dead on the beach in southern Rio de Janeiro, near Angra dos Reis. This bird had been banded as a fledgling 71 days before and was the first banded Manx Shearwater

recovered in Brazil. Since then, BTO accumulated 150 Manx Shearwater recoveries from Brazil.

There is no Brazilian recovery of a Manx Shearwater from populations nesting outside the United Kingdom and Ireland. Most birds (110) came from islands in Dyfed, Wales. These include at least 55 birds originally banded in Skokholm and 15 in Skomer Island (51°21'W, 05°09'W). There are also records from the Copeland Islands, northern Ireland (15), Gwynedd, Wales (9 birds, 8 from Bardsey Island), Scotland (15, including 2 from Sanda Island), and one record from south-western Ireland.

The mean age of birds recovered in Brazil was 2.63±4.06 years. Birds with less than one year made 53.3% of all recoveries. Birds between one and two years made a further 12.7%, older categories accounting for 1-6%. The oldest bird had been originally banded as a yearling in Bardsey, and was found dead 20 years and 5 months later in southern Rio Grande do Sul (around 31°S). The youngest bird was recovered in northern Santa Catarina (around 26°S) 17 days after being banded as a chick in Skokholm. Another was recaptured 35 days after being banded, and another nine between 40 and 50 days. Three birds were 14-15 years, and another three 15-20 years old when recovered.

Figure 4 shows the number of shearwaters recaptured along the Brazilian coast. Two sectors hold most records. The area between 20-25°S, corresponding to the coasts of Espírito Santo, Rio de Janeiro and São Paulo, account for 50 birds (33.3% of all records), while the sector from 25 to 30°S (Paraná to Rio Grande do Sul) had 53 birds (35.3%).

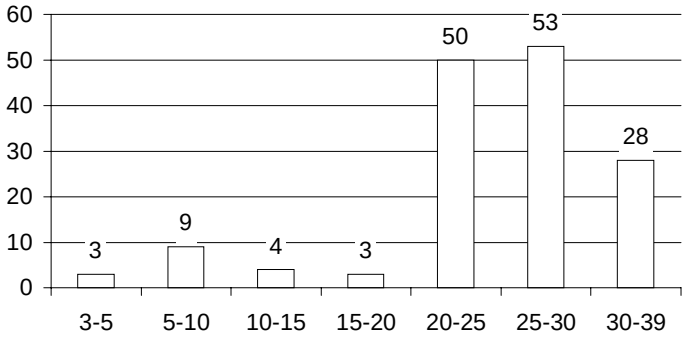

Figure 4. Number of recoveries of *Puffinus puffinus* in Brazil along the latitudinal gradient.

There are 19 recoveries north of 21°S, including nine in northeastern Brazil between 3 and 9°S. The northern-most record is a bird found on 7 July 1969, 315 days after banding, in northern Ceará around 03°S,40°W. The concentration of recaptures between 20 and 30°S agrees with Brooke's (1990) view that most birds (especially the youngsters) arrive in South America along this latitudinal band after crossing the Atlantic. This region also includes some of the most popular beaches in Brazil, used by millions of people, so banded birds lying on the sand are likely to pick the attention of someone and be reported.

I found no correlation between age and latitude both for the whole dataset and for the group made of the recaptures made between September and December (all $p > 0.2$) suggesting both birds of the year and older ones use the same routes along the Brazilian coast.

Although Manx Shearwaters have been found in every month of the year (figure 5), most records were made between September and December, with October alone accounting for 36.7% of all records. This pattern shows that most recoveries are of birds moving from the breeding colonies to their wintering grounds, with far fewer records of birds making the return trip.

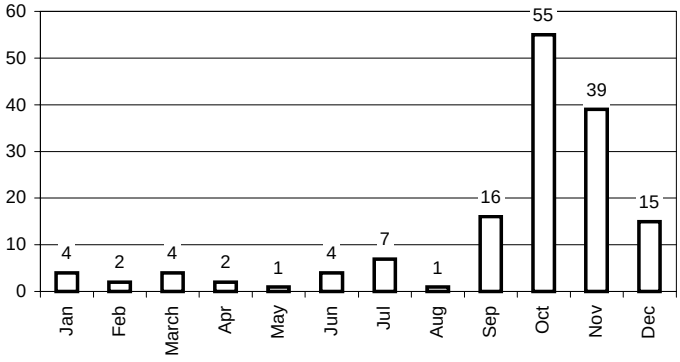

Figure 5. Recaptures of banded *Puffinus puffinus* in Brazil along the year.

This pattern can be explained by the strain put on the birds during the final leg of their trans-equatorial migration. It is also interesting to point that while birds of the year made 19% of the September records, that increased to 43.6% in October, 79.5% in November and 60% in December, suggesting that older birds (perhaps failed or non-breeders), which probably are less prone to die on migration, arrive earlier than the youngsters.

Crossing the latitudinal and temporal data it is clear that Manx Shearwater records in Brazil are concentrated in the area between 25 and 30°S, most being made when the younger birds are arriving in October and November. There is no similar peak when the birds are migrating back to their natal areas, although recoveries made during this period do occur (figure 6). It is interesting that there is little variation in the number of recoveries along the year in the area north of 15 °S. Of 16 records made in this area, seven (43.8%) were of birds with less than one year.

Overall my results agree with the analyses made by Brooke (1990), and reinforce the view that the Brazilian coast south of the 20°S is an important area for Manx Shearwaters on the way to their wintering grounds. It is interesting that in this area the shearwaters were not seen

to feed around fishing boats during October and November, but rather to ignore them, flying hurriedly to the south (Olmos 1997, pers. obs.).

Lara-Resende and Leal (1982) plotted a shearwater recovery at the Aripuanã River, Mato Grosso. There is no evidence supporting this record in the BTO files.

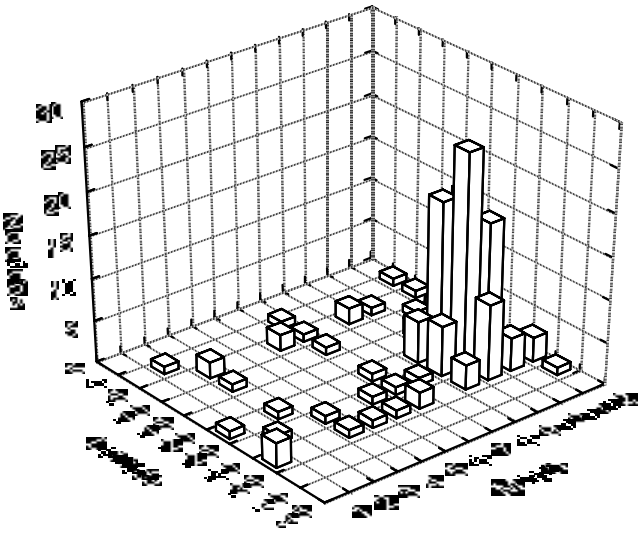

Figure 6. Monthly number of *Puffinus puffinus* recoveries along the latitudinal gradient of the Brazilian coast.

Great Skua *Catharacta skua*. The migration of Great Skuas was reviewed by Furness (1987) and Olsen and Larsson (1997). Sick (1997), who lumped all larger skuas as one species, reports an Icelandic bird banded in July 1973 and recovered in Piauí in March 1974, and two Scottish birds caught in Maranhão (February 1974) and Ceará (March 1970).

BTO files record four recoveries of Scottish Great Skuas in Brazil, including the above, all found dead. All birds were yearlings banded as nestlings, three in Foula, Shetland (60°06'N, 02°06'W) and the fourth in Unst, also in the Shetlands (60°48'N, 0°54'W). Two Foula birds and the one from Unst were recovered in Maranhão between 01°48'S, 44°54'W and 02°36'S, 45°W in January 1976, February 1974 and September 1978, respectively, having been banded in July of the previous year. Another Foula bird, banded on 04 July 1969, was found in northern Ceará (03°30'S, 39°03'W) on 21 March 1970.

There is only one recovery of an Icelandic *Catharacta skua* in Brazil (Sick 1997). This bird was banded as a chick on 20 July 1973 at Kvisker, Oraefi, A-Skaft (63°59'N, 16°26'W), and shot near Parnaiba, Piaui, (03°S, 41°W), being reported on 14 March 1974. The number of recoveries is quite small since nearly 19,000 Great Skuas were banded in Iceland up to 1995 (Aevar Petersen *in litt*.).

Furness (1987) states that most fledgling Shetland *C. skua* winter around the Iberian peninsula (including the Mediterranean) south to the Canaries, while Icelandic birds migrate both to Iberia and northeastern North America and Greenland. Records from outside these regions are uncommon, although they do occur. Apparently, Brazil is not a regular wintering area for Great Skuas, a view supported by the lack of more recent recoveries.

Southern Skua *Catharacta antarctica*. Sick (1997) mentions a skua from Tristan da Cunha (the very distinctive *C. a. hamiltoni*, Olsen and Larsson 1997) captured in October in Pernambuco. Furness (1987) ignored this record, and I was not able to track its original source despite the help of former collaborators of Sick (L. P. Gonzaga, G. Coelho and J. F. Pacheco *in litt*.) and checking with ringing schemes that have been active in Tristan.

Brown Skua *Catharacta* (*antarctica*) *lonnbergi*. This taxon is sometimes considered as a full species (Sibley and Monroe 1990) and I opted to consider its records separately from other *Catharacta* skuas. Records are not always clear about which skua species they refer to, so I used the known breeding range of the several species to infer specific identity.

A skua, which had been twice (in 1960 and 1962) caught as an adult at Signy Island, South Orkneys (60°43'S, 45°36'W) was captured alive by fishermen at Macucos Island, near Itajaí, Santa Catarina (26°53'S, 48°39'W) on 13 July 1963. The bird was apparently released alive.

BBL files report a *C. a. lonnbergi* banded as a nestling in King George Island (~62°14'S, 58°38'W) on 17 January 1988 and recovered in Maceió, Alagoas, on 6 November of the same year. This is the same male bird reported by Teixeira *et al*. (1988) as captured in Recife, Pernambuco, on 26 July 1979 (D. Teixeira *in litt*. 2001), suggesting some mistake was made in the records.

Soto (2000) reported the recapture, in May 1992, of a Brown Skua banded as a chick on 22 January 1988 at Bellingshausen, King George Island (62°12'S, 58°58'W). The bird was caught by fishermen at Capão da Canoa, Rio Grande do Sul (29°45'S, 49°50'W).

From this meager information it can only be said that this species is a rare visitor to southern Brazil, although the MZUSP has a female from Santos, São Paulo, with measurements and color agreeing with *C. a. lonnbergi* (reported as *C. maccormicki* by Olmos *et al*. 1995).

South Polar Skua *Catharacta maccormicki*. This is the southern skua with the largest number of recoveries in Brazil, probably due to its trans-equatorial migrations that may reach Greenland (Furness 1987, Olsen and Larssom 1997). Bourne and Curtis (1994) reviewed recoveries in the tropics. See also Coelho (1977).

Probably attributable to this species is a bird banded on 18 February 1971 as a nestling in the Argentine Islands, Graham Land, Antarctica (65°15'S, 64°16'W), and taken by fishermen on 12 December 1974 at Camocim, Ceará (04°27'S, 37°46'W).

BBL records 11 recaptures of nine individual South Polar Skuas in Brazil, all between 2° and 9°30'S. Six birds had been banded in Antarctica at Palmer Station, Anvers Island (64°45'S, 64°05'W) and two at nearby Cormorant Island, while a lone bird was banded in Baltimore, Maryland (39°10'N, 76°30'W, see below).

South Polar Skuas have been recovered in Maranhão (December and January), Rio Grande do Norte (October and April), Pernambuco (June, October and December) and Alagoas (April and September). Additionally, a nestling banded on 19 January 1986 at Admiralty Bay, King George Island (62°S, 58°20'W) with a CEMAVE band, was found on 20 October 1994 at Praia de Galinhos, Rio Grande do Norte (05°S,36°10'W).

One Palmer Station bird banded before fledgling on 23 February 1980 was captured alive in Rio Grande do Norte on 30 October of the same year, and released. On 26 April 1984 it was captured again in the same locality and was being kept in captivity. A Cormorant Island skua had a similar story. After being banded on 23 February 1984 it was captured in Alagoas on 14 September, being released. It was captured again, and sent to captivity, in Pernambuco on 9 October of the same year.

A most interesting tale was reported by Coelho (1977). A skua from Ross Island (77°35'S, 166°20'E) was transported to the Baltimore Zoo in Maryland, USA, from where it escaped in January 1970. This banded bird got entangled in fishing line 15 miles east of Recife, Pernambuco, and taken to captivity, where it finally died.

All recoveries, including the Baltimore bird (which was apparently heading home) show the highly migratory habits of the juveniles of this species, reported to make a still poorly understood clockwise circuit of the Atlantic (Newell *et al*. 1997). It is apparent this species is regular as a passage migrant off the northeastern Brazilian coast, probably occurring farther offshore elsewhere. The concentration of recoveries in northeastern Brazil is probably due to birds following the southern branch of the Equatorial Current, which originates the Brazil Current around 05°30'S (see Vazzoler *et al*. 1999), and the narrow shelf. That makes the region a likely place to find beached southbound migrants like the skuas.

Arctic Skua *Stercorarius parasiticus*. Sick (1997) mentions a *S. parasiticus* from Finland recovered in Rio de Janeiro. This bird was banded as a nestling (the second in the brood) on 28 June 1969 near Foglo, Ahvenanmaa, Finland (60°N, 20°30'E), and found dead on 2 June 1970 at Ilha do Governador (22°54'S, 43°12'W; Jukka Haapala *in litt*. 2000).

BTO files show three recoveries of *S. parasiticus* in Brazil. One bird banded in Foula, Shetland Islands (60°06'N, 02°06'W), on 1 July 1992 was found in on 20 February 1995 near Guarapari, Espirito Santo (20°20'S, 40°30'W). Two recoveries refer to birds from mainland Shetland (59°30'N, 01°18'W). One, banded on 22 June 1992, was found still alive near Itaúnas, northern Espírito Santo (18°20'S, 39°21'W) the following 27 November. The other, banded 9 July 1963, was found freshly dead north of Maceió, Alagoas (09°12'S, 35°30'W) on 17 May 1965. This last bird was mentioned by Sick (1997), who cited Scotland as its source.

Stercorarius parasiticus is a known trans-equatorial migrant wintering off the coasts of southern Brazil to Tierra del Fuego in the western south Atlantic (Furness 1987, Vooren and Chiaradia 1990, Olsen and Larssom 1997).

Ring-billed Gull *Larus delawerensis*. Sick (1997) reports a specimen collected near Tefé, Amazonas, on 23 November 1968, which had been banded on the Canada-U.S. border. This was the first, and apparently remains the sole, Brazilian record of this species.

Black-headed Gull *Larus atricilla*. BBL files list one recovery from near Tefé, Amazonas, captured in December 1979. It had been banded in 23 July of the same year before fledging in Delaware Bay, New Jersey (39°40'N, 74°00'W).

Larus atricilla has been recorded as a northern visitor around the Amazon estuary to Maranhão, with an exceptional record from Lagoa do Peixe, Rio Grande do Sul (Sick 1997).

Sandwich Tern *Thalasseus sandvicensis*. Two Sandwich Terns with U.S. bands have been recovered in Brazil. The first was banded as a nestling in Mississippi, USA, in December 1964, being recovered in Rio Grande do Norte in May 1966. Another bird, also banded as a nestling in North Carolina in June 1994, was found close to the Alagoas/Sergipe border in February 1996.

Arctic Tern *Sterna paradisaea*. This species is considered mostly pelagic when migrating along eastern South America, what may account for the few Brazilian recoveries. One live bird was found in 1977 (letter dated May 1977) at Macaúbas, Bahia (13°S, 42°41'W) but subsequently died. Macaúbas is far inland, so the bird was quite lost. It had been banded as a chick on 17 August 1974 at Issotursoq, Upernavik district, Greenland (72°15'N, 55°42'W; Kaj Kampp *in litt*.).

Additionally, BBL files show one bird from New Hampshire, U.S., banded as a nestling in July 1957 and found in Rio de Janeiro on 2 March 1960, and another, banded in New Brunswick, Canada, in July 1950 and recovered in northern Santa Catarina on 2 November 1966.

Least Tern *Sterna antillarum*. Two *Sterna antillarum* with U. S. bands were recovered in southern Alagoas (10°20'S, 36°30'W) on 10 January 1992. One had been banded in Florida (28°20'N, 80°40'W) on 23 May 1970, while the other was first caught near Boston (41°50'N, 70°30'W) on 2 July 1988.

Sooty Tern *Sterna fuscata*. Two *Sterna fuscata* banded at Fort Jefferson National Park, Dry Tortugas, Florida

(24°38'N, 82°52'W) on 18 June 1974 and 20 June 1975, respectively, were recovered on 29 April 1975 near 08°00'S, 34°50'W, and on 26 February 1976 near 07°50'S, 36°40'W; localities are in Pernambuco. Both were found dead. Juvenile terns from this population regularly migrate to the Gulf of Guinea Intertropical Convergence, while adults remain in the Caribbean area (Robertson 1969).

Brown Noddy *Anous stolidus*. One *Anous stolidus* banded in Fort Jefferson National Park, Dry Tortugas, Florida (24°38'N, 82°52'W) on 5 December 1992 was recovered dead at Maria Farinha beach, Pernambuco (07°40'S, 3450'W) on 8 February 1992.

DISCUSSION

"Recoveries of ringed birds can be very interesting and illuminating if considered carefully, but can be misleading if listed uncritically" (Furness 1987, p. 76). In this spirit, I tried to make more extensive analyses only for species with the larger databases, and to only point the natal areas of species with few records. Banding is an inherently chancy and selective methodology and can give us only a partial picture of the non-breeding seabirds occurring in Brazil. For example, there is no recovery of banded *Procellaria aequinoctialis* from Brazil, despite its abundance during the winter (Olmos 1997, Vooren and Fernandes 1989, Neves 2000), but this gap has been filled by satellite-tracking, which has shown that South Georgian birds feed on the Patagonian shelf and can reach southern Brazil (Weimerskirch *et al*. 1999, Berrow *et al*. in press).

So far, there is no Brazilian record of pelagic birds from the French Antarctic Territories (Isles Crozet, Kerguelen and Amsterdan or Adélie Land, Henri Weimerskirch, *in litt*.), or Chile (Daniel Torres Navarro, *in litt*.). That may reflect genuine scarcity of birds coming from those areas, or simply chance events inherent to banding recoveries. For example, I have seen banded Pomarine Skuas *Stercorarius pomarinus* at sea off southern Brazil (Olmos *in press*), but there is no reported Brazilian recovery of this species.

Brazilian waters and coast are a melting pot for seabirds from widely different sources. Common to abundant migrants from the northern hemisphere, like *Puffinus puffinus, Calonectris diomedea* and *Sterna hirundo* occur in Rio Grande do Sul together with birds from Antarctica or the Southern Ocean. Only recently the status of many species has become better known and we are realizing that seabirds once considered to be rare or mere accidentals, like *Calonectris diomedea, Sterna dougalli* and *Procellaria conspicillata*, are regular members of the our fauna (Pacheco and Maciel 1995, Lima 1996, Hays *et al*. 1999, Olmos 1997). The same is probably true for passage migrants like *Catharacta macckormicki* (this work) and *Stercorarius* spp. (Olmos 2000).

The Subtropical Convergence and the cold waters of the Malvinas Current have long been known as the destination of northern migrants like *Calonectris diomedea* (Mougin *et al*. 1988) and *Puffinus puffinus* (Brooke 1990), while *Sterna hirundo* has one of its main wintering areas in the southern coast of Rio Grande do Sul (Hays *et al*. 1997), a high-productivity area due both to discharges of the Lagoa dos Patos estuary and the Subtropical Convergence (see Seeliger *et al*. 1998). On the other hand, northern Brazil from Maranhão to Bahia, with their estuaries and near-shore shelf break, is important for migrant terns from the northern hemisphere, like the threatened *Sterna dougalli* (Hays *et al*. 1999), and is where most *Catharacta maccormicki* have been recovered in Brazil. Quite surprisingly part of the Azorean population of *Sterna hirundo* winters in the important Mangue Seco area, Bahia, thus making transatlantic migrations (Hays *et al*. 1997, 1999).

Band recoveries show that southern Brazilian waters are an important feeding area for threatened *Diomedea exulans, D. dabbenena* and *D. epomophora*, and for young Falkland *Thalassarche melanophrys*. Most or all *Diomedea exulans* recovered in Brazil belong to the population breeding in South Georgia, as already pointed by Prince *et al*. (1998), and capture by long-liners has been the most important source of recaptures, which in Brazil occur throughout the year. Incidental bycatch is considered the main reason for the decline of the South Georgian population of *Diomedea exulans* (which has declined by 30% since the 1960's; Croxall and Gales 1998) and the Brazilian fishing fleet very likely has its share in this decline.

The same is probably true for *D. dabbenena* and *Thalassarche chlororhynchos* breeding in the Tristan da Cunha and Gough groups. *Diomedea dabbenena* has been unable to recover their population at Inaccessible, where only 2-3 pairs nest each year, being largely restricted to Gough Island (Ryan *et al.* 2000), where *Thalassarche chlororhynchos* has low population recruitment that may spell a sudden and sharp decline in the near future (Croxall and Gales 1998). Again the Brazilian fleet is probably responsible for a fair share of their decline, especially of *Thalassarche chlororhynchos* (Neves and Olmos 1998, Neves *et al.* 2001). Interestingly, the few documented captures of *D. dabbenena* in Brazil are concentrated in October-November (Neves and Olmos 2001).

It is important to notice that the people most likely to find banded seabirds are fishermen, and few are literate enough to understand what the metal rings mean. Little effort has been made to educate these people, especially the ones working on pelagic long-liners, who are the ones responsible for most recoveries of banded albatrosses, petrels and skuas. This should be a priority action for the Brazilian banding program (CEMAVE), which could use technicians in charge of gathering fisheries statistics at the fishing ports to retrieve the data.

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