ANTARCTIC AND SUB-ANTARCTIC SEABIRDS IN SOUTH AMERICA: A REVIEW

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ABSTRACT

We analyzed reports of Antarctic and Sub-Antarctic seabirds with migration routes over seven South American countries (Argentina, Brazil, Chile, Ecuador, Peru, Uruguay, and Venezuela). Forty-eight species were reported, observed over oceanic and/or coastal areas. Chile presented the highest number of Antarctic seabird species (39), followed closely by Brazil (38). Diomedea exulans, D. epomophora, Thalassarche melanophris, Macronectes giganteus, Fulmarus glacialoides, Pachyptila desolata and Oceanites oceanicus were the most common species, recorded in six of the seven searched countries. The least reported species were Pygoscelis adeliae, Thalassoica antarctica, Pagodroma nivea, Pachyptila salvini and Pterodroma inexpectata, observed in one country each. According to the IUCN, the species with migration routes over the South American countries are considered endangered (three species), vulnerable (eight species) and near threatened (eight species). Consequently, it is important to protect not only breeding habitats in the Antarctic environment, but their entire migration routes over South America.

Keywords: Pelagic seabirds; conservation areas; biodiversity.

RESUMO

AVES MARINHAS ANTÁRTICAS E SUB-ANTÁRTICAS NA AMÉRICA DO SUL: UMA REVISÃO. Foram analisados registros de aves marinhas Antárticas e Subantárticas nos países da América do Sul (Argentina, Brasil, Chile, Equador, Peru, Uruguai e Venezuela) com base em artigos e resumos científicos, dissertações, teses e livros. Quarenta e oito espécies foram registradas, ocorrendo em áreas oceânicas e/ou costeiras dos países analisados. O Chile apresentou o maior número de espécies de aves migratórias que nidificam na Antártica e em ilhas Sub-Antárticas (39), seguido pelo Brasil (38). Diomedea exulans, D. epomophora, Thalassarche melanophris, Macronectes giganteus, Fulmarus glacialoides, Pachyptila desolata e Oceanites oceanicus foram as aves marinhas mais registradas, encontradas em seis dos sete países amostrados. As espécies menos frequentes foram Pygoscelis adeliae, Thalassoica antarctica, Pagodroma nivea, Pachyptila salvini e Pterodroma inexpectata, observadas em um país cada. Entre as espécies reportadas, três são consideradas ameaçadas de extinção, oito vulneráveis e outras oito classificadas como quase ameaçadas de extinção, de acordo com dados da IUCN. Consequentemente, é importante proteger não apenas as áreas de nidificação no ecossistema Antártico, mas toda a rota de migração destas aves marinhas sobre os países da América do Sul.

Palavras-chave: Aves marinhas pelágicas; áreas para conservação; biodiversidade.
RESUMEN

Aves marinas antárticas y sub-antárticas en América del Sur: una revisión. Analizamos registros de aves marinas antárticas y sub-antárticas en países de América del Sur (Argentina, Brasil, Chile, Ecuador, Perú, Uruguay y Venezuela) en publicaciones científicas, disertaciones, tesis y libros. Se registraron cuarenta y ocho especies, observadas sobre áreas oceánicas o costeras de los países estudiados. Chile presentó el mayor número de especies migratorias que anidan en la Antártida (39), seguido por Brasil (38). Las especies observadas con mayor frecuencia fueron Diomedea exulans, D. epomophora, Thalassarche melanophris, Macronectes giganteus, Fulmarus glacialisoides, Pachyptila desolata y Oceanites oceanicus; las cuales fueron reportadas en seis de los siete países analizados. Asimismo, las especies con menor frecuencia fueron Pygoscelis adeliae, Thalassoica antarctica, Pagodroma nivea, Pachyptila salvini y Pterodroma inexpectata, observadas apenas en uno sólo de los países analizados. Entre las especies registradas, tres son consideradas especies amenazadas, ocho vulnerables y otras ocho clasificadas como casi amenazadas de acuerdo con IUCN. Consecuentemente, es importante proteger no sólo las áreas de nidificación en el ecosistema Antártico, sino también toda la ruta de migración de estas aves marinas sobre los países de América del Sur.

Palabras clave: Aves marinas pelágicas; áreas para conservación; biodiversidad.

INTRODUCTION

Seabirds are important components of the marine ecosystems and are the most studied taxa in relation to long-term demographic studies on land (Weimerskirch 1997, Péron et al. 2010a, 2010b). However, ecological studies in open ocean areas are rare, since logistic procedures to support field works are exceedingly difficult (Tasker et al. 1984, Weimerskirch 1997).

Consequently, the available data on seabirds distribution at sea have been limited in space and time, as well as historical reports on their global occurrence. On the other hand, counting pelagic seabirds at sea from vessels or ships can present some problems, such as the absence of standardization methods to become data comparable (Tasker et al. 1984).

Approximately 300 avian species feed mainly at sea (Harrison 1983). Of the 43 species breeding south of the Antarctic Convergence (~60°S), seven species of penguins, twenty four of albatrosses and petrels, two of cormorants and five species of gulls, skuas and terns live and feed only in the sea, while other five live entirely on land (Shirihai 2008).

Joining scientific data on distribution and occurrence of seabirds in remote areas far from breeding sites can provide some initial but important information about seabirds ecology. This information is needed to the establishment of monitoring networks, expanding study areas and elucidating unclear points on migration routes. The Antarctica environment and the Sub-Antarctic Islands are well-known sites for seabirds breeding and/or feeding. Many species are long-range migrants, with their routes over the South American countries still under studied by marine ornithologists. Long-term demographic studies have recently shown that climate change, together with direct impacts of human activities (such as overfishing, bycatch, and pollution), are affecting population dynamics of marine top predators, including seabirds (Ormerod 2003, Ramos et al. 2009, Péron et al. 2010a, 2010b). Consequently, studies on seabirds migration routes over oceanic areas and coastal lands are very important for conservation and management plans. Negative impacts at migration routes far from breeding sites can be even more dangerous to some species, such as the accidental capture of albatrosses and petrels by longline fisheries which can cause considerable mortality and population decline (Tuck et al. 2001).

This paper presents an up to date review of Antarctic and sub-Antarctic breeding seabirds reported over the coastline of seven South American countries (Argentina, Brazil, Chile, Ecuador, Peru, Uruguay, and Venezuela), all members of the “South American Network on Antarctic Marine Biodiversity” project (BioMAntar; see further information in Costa et al. 2009). This information is useful for seabird’s management aiming at international conservation.
plans, since temporary feeding areas and routes are as important as breeding sites to the biology, ecology and survival of seabirds.

**MATERIAL AND METHODS**

The scientific literature related to Antarctic and Sub-Antarctic seabirds (Shirihai 2008, Woehler 2006), with migration routes over the coastline of the BioMantar countries, was searched, analyzed and linked in a cooperation study among researchers from all countries (Table 1). First priority was given to articles published in international journals, primarily in English. Then, scientific abstracts, dissertations, theses and books were also considered.

### Table 1. Countries members of the “South American Network on Antarctic Marine Biodiversity” project (BioMantar), researchers responsible for data compilation for each country and references analysed.

| Country   | Researchers                          | References                                                                 |
|-----------|--------------------------------------|----------------------------------------------------------------------------|
| Argentina | N. Coria                             | Cooke & Mills 1972; Brown *et al.* 1975, Orlog 1979, Prince *et al.* 1997, Montalti & Orgeira 1998, Schiavini *et al.* 1998, Montalti *et al.* 1999, Yorio & Caille 1999, Orgeira 1995a, 1995b, 2001a, 2001b, Favero & Silva-Rodriguez 2005. |
| Brazil    | E.S. Costa                           | Novaes 1959, Sander 1982, Teixeira *et al.* 1986, Vooren & Fernandes 1989, Petry *et al.* 1991, 2001, 2006, 2008, 2010, Roman & Soto 1996, Roman 1998, Sampaio & Castro 1998, Fonseca *et al.* 2000, 2001, Omos 2000a, 2000b, 2001, Bencke 2001, Lima *et al.* 2001, Telino-Júnior *et al.* 2001, Ross & Picentin 2003, Mohr 2004, Oliva 2004, Sander *et al.* 2004, Carlos *et al.* 2005a, 2005b, Colabuono *et al.* 2006, Barquete *et al.* 2006, Bugoni 2006, 2008, Bugoni *et al.* 2007, Dènes *et al.* 2007, Costa & Sander 2008, Scherer *et al.* 2010, Tourinho *et al.* 2010. |
| Chile     | P. Piedrahita                         | Schlatter 1973, 1974, 1975, 1976, 1977, 1984, 1987, Brown *et al.* 1975, Venegas 1978, 1998, Oyarzo & Cekalovic 1981, Prince *et al.* 1997, Schlatter & Simeone 1999, Moore & Battam 2000, Lawton *et al.* 2003, Narosky & Yzurieta 2003, Weichler *et al.* 2004, Spear *et al.* 2005, Post 2007, Nicholls 2009 |
| Ecuador   | E.S. Costa                           | Harris 1973, 1974, 1975, Castro & Philips 1996, Ridgely & Greenfield 2001, Wiedenfeld 2006. |
| Peru      | L. Ayala                             | Plengue 1974, 2005, Hughes 1982, Prince *et al.* 1997, Clements & Shany 2001, Schulenberg *et al.* 2007, Spear & Ainley 2008. |
| Uruguay   | E.S. Costa                           | Prince *et al.* 1997, Aspiroz 2003, Narosky & Yzurieta 2003, Domingo *et al.* 2007 |
| Venezuela | E.S. Costa                           | Ascanio 2007 |

Seabird species breeding in Argentinean oceanic and coastal islands (such as Malvinas and Georgias) were also analysed and included here. In acquiring data from the other six countries, all seabirds found in the surrounding areas were included in their lists.

All species had their Threatened Category status defined (IUCN 2007). Albatrosses and petrels also had their status defined by the Agreement on the Conservation of Albatrosses and Petrels (ACAP), which aimed to protect Procellariiformes species from anthropogenic impacts. Thirty countries, including Argentina, Brazil, Chile, Ecuador, Peru and Uruguay had signed the ACAP. In Brazil, Procellariiformes are also protected by a national Law, the National Plan for the Conservation of Albatrosses and Petrels.
RESULTS

Forty-eight species were recorded over oceanic and/or coastal areas of the South American countries surveyed (Table 2). Chile was the main flyway route, presenting the highest number of seabird migrant species (39), followed closely by Brazil (38). *Diomedea exulans*, *D. epomophora*, *Thalassarche melanophris*, *Macronectes giganteus*, *Fulmarus glacialisoides*, *Pachyptila desolata* and *Oceanites oceanicus* were the most observed species, reported in six of the seven studied countries (Table 2). The least reported species were *Pygoscelis adeliae*, *Thalassoica antarctica*, *Pagodroma nivea*, *Pachyptila salvini* and *Pterodroma inexpectata*, recorded in one country each (Table 2). Many of these species have migration routes over oceanic areas, hampering records by researchers on land. Registers are then restricted to lost individuals far from their original routes.

Table 2. Antarctic and Sub-Antarctic seabirds recorded in the “South American Network on Antarctic Marine Biodiversity” project (BioMAntar) countries (Argentina, Brazil, Chile, Equador, Peru, Uruguay and Venezuela). ¹-Seabirds breeding in Antarctic and Sub- Antarctic regions; ²- Seabirds breeding in Sub-Antarctic regions only (Shirihai 2008, Woehler 2006). X = confirmed species; ? = species that needs confirmation; * = species breeding in land ; ! = species that occurs (but not breed) in the country. EN = Endangered, VU = Vulnerable, NT = Near Threatened, LC = Least Concern. Common names are in accordance with Shirihai (2008). Species with both oceanic and coastal migration routes are presented.

| ORDER, FAMILY and Scientific name | Common name | IUCN | Countries |
|-----------------------------------|-------------|------|-----------|
| SPHENISCIFORMES                   |             |      | Argentina Brazil Chile Ecuador Peru Uruguay Venezuela |
| SPHENISCIDAE                      |             |      |           |
| A. forsteri²                      | Emperor Penguin | LC  | X | X | X | X |
| A. papagonicus²                   | King Penguin | LC  | X | X | X |
| *Pygoscelis papua¹                | Gentoo Penguin | NT  | X |
| *P. adeliae¹                      | Adélie Penguin | LC  | X |
| P. antarctica¹                    | Chinstrap Penguin | LC  | X |
| Eudyptes chrysocome²              | Rockhopper Penguin | VU  | * | X | X | X |
| E. chrysolophus¹                  | Macaroni Penguin | VU  | * | X | X | X |
| PROCELLARIIFORMES                |             |      |           |
| DIOMEDEIDAE                       |             |      |           |
| *Diomedea exulans²                | Wandering Albatroz | VU  | X | X | X | X | X |
| *D. epomophora²                   | Southern Royal Albatroz | VU  | X | X | X | X |
| *Thalassarche melanophris²        | Black-browed Albatroz | EN  | X | X | * | X | X | X |
| T. cauta²                         | Shy Albatroz | NT  | X | X | X | X |
| T. chrysolophus²                  | Grey-headed Albatroz | VU  | X | X | * | X | X |
| T. chlororhynchos²                | Atlantic Yellow-nosed Albatroz | EN  | X | X | X |
| Phoebetria fusca¹                  | Sooty Albatroz | EN  | X | X | X |
| P. palpebrata²                    | Light-mantled Sooty Albatroz | NT  | X | X | X | X |
| MACRONECTIDAE                     |             |      |           |
| *Macronectes giganteus¹           | Southern Giant Petrel | NT  | * | X | X | X | X | X |
| M. halli                          | Northern Giant Petrel | NT  | X | X | X | X | X | X |
| Fulmarus glacialisoides¹          | Southern Fulmar | LC  | X | X | X | X | X | X | X | X |
| ORDER, FAMILY and Scientific name | Common name | IUCN | Countries |
|-----------------------------------|-------------|------|-----------|
| *Thalassoica antarctica*<sup>1</sup> | Antarctic Petrel | LC | Argentina | Brazil | Chile | Ecuador | Peru | Uruguay | Venezuela |
| *Daption capense*<sup>2</sup> | Cape Petrel | LC | X | X | X | X | X | X |
| *Pagodroma nivea*<sup>1</sup> | Lesser Snow Petrel | LC | X |
| *Pterodroma macroptera*<sup>2</sup> | Great-winged Petrel | LC | X | X | X |
| *P. lessonii*<sup>2</sup> | White-headed Petrel | LC | X | X | X |
| *P. inexpectata*<sup>2</sup> | Antarctic Prion | LC | X | X | X | X | X | X | X |
| *P. fuscata*<sup>2</sup> | Slender-billed Prion | LC | X | X | X | X |
| *P. turtur*<sup>2</sup> | Fairy Prion | LC | X |
| *Oceanites oceanicus*<sup>1</sup> | Wilson’s Storm-petrel | LC | X | X | X | X | X | X |
| *Fregata tropica*<sup>1</sup> | Black-bellied Storm-petrel | LC | X | X | X | X | X | X |
| *Puffinus assimilis*<sup>2</sup> | Little Shearwater | LC | X | X | X | X |

**Continuation of Table 2**

**PROCELLARIFORMES**

**HYDROBATIDAE**

| Order, Family and Scientific name | Common name | IUCN | Countries |
|-----------------------------------|-------------|------|-----------|
| *Phalacrocorax bransfieldensis*<sup>1</sup> | Antarctic Shag | LC | X | X |
| *Chionis alba*<sup>1</sup> | Pale-faced Sheathbill | LC | ! | X | X | X |

**CHARADRIIFORMES**

**STERCORARIIDAE**

| Order, Family and Scientific name | Common name | IUCN | Countries |
|-----------------------------------|-------------|------|-----------|
| *Charadrius brachyrhynchos* | Kelp Gull | LC | X | X | X | X | X | X | X | X |

**Sternidae**

| Order, Family and Scientific name | Common name | IUCN | Countries |
|-----------------------------------|-------------|------|-----------|
| *Sterna vittata*<sup>1</sup> | Antarctic Tern | LC | X | X | X | X |
According to the IUCN, three species with migration routes over the South American countries are considered endangered (all albatrosses), eight vulnerable (two penguins, two albatrosses and three petrels), and other eight are categorized as near threatened (Table 2). According to the ACAP, albatrosses species (*Phoebetria fusca*, *Thalassarche chlororhynchos* and *T. melanophris*) are classified as endangered. Other Procellariiformes (*Dionysia exulans*, *D. chrysostoma* and *P. conspicillata*) are categorized as vulnerable. Two species of albatrosses (*Phoebetria palpebrata* and *T. cauta*) and one petrel (*Procellaria cinerea*) are classified as near threatened.

**DISCUSSION AND CONCLUSIONS**

South American countries house important migration route areas to Antarctic and Sub-Antarctic seabirds. These areas are primarily used for feeding on local oceanic and/or coastal resources during migration, being extremely important to seabirds conservation and protection. Adult seabirds are very frequent in the winter while young individuals are common throughout the year (Vooren & Fernandes 1989).

Brazil presented the most diverse literature (32 articles) related to the occurrence and distribution of seabirds along the coast, when compared with the other South American countries (Table 1). The majority of the articles recently (last decade) published are reporting new registers of species on diverse coastal regions in Brazil (e.g., Fonseca et al. 2000, 2001, Lima et al. 2001, Telino-Júnior et al. 2001, Mohr 2004, Soto et al. 2004, Carlos et al. 2005a, 2005b, Barquete et al. 2006, Bugoni 2006, Costa & Sander 2008), as well as new feeding habits found through the analyses of death specimens (e.g., Petry et al. 1996, 2010). Other studies also reported behavioural interactions between seabirds and other marine predators, such as mammals (Scherer et al. 2010), and interactions between seabirds and marine pollution (e.g., Tourinho et al. 2010), among others.

Countries with least records in relation to Antarctic and sub-Antarctic seabirds in their coastal and marine areas (Ecuador, Peru, Uruguay, Venezuela) had also fewer published articles (Table 1). Possible, this is a consequence of logistic problems since field campaigns are very expensive and marine ornithologists from different countries do not have the same opportunities to make campaigns systemically.

Further international collaboration is necessary to the development of accurate studies related to population structures and dynamic patterns of seabird species along their coastal migratory flyways over the South American countries. Moreover, the evaluation of anthropogenic impacts (Omerod 2003, Tourinho et al. 2010) and climate changes (e.g., Péron et al. 2010b) over seabird populations would be of paramount importance, improving the elaboration of international management and conservation plans. Species with wide dispersion, such as White-chinned Petrel, Black-browed Albatross and Wandering Albatross, are being incidentally caught by longline fisheries in Brazil, Chile, Uruguay and Argentina (Nel & Taylor 2003). In this way, the establishment of conservation measures limited to Antarctic and Sub-Antarctic environments are insufficient to protect seabirds since they migrate (Weimerskirch et al. 1999), when they will be exposed to innumerous threats.

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