Agreement on the Conservation of Albatrosses and Petrels

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Anthropogenic solid residues as stomach content of stranded seabirds in Brazilian coast (Santos Basin)

Suelen Goulart, Cristiane K. M. Kolesnikovas, Marzia Antonelli, Marina Alcala, Janaina Lorenço, Emanuel Ferreira, André S. Barreto, Hugo Gallo Neto, Pedro V. de Castilho, Marta J. Cremer, Camila Domit, Daniela F. de Godoy, Karina R. Groch, Andrea Maranho, Rodrigo R. Valle, Patricia P. Serafini

SUMMARY

This brief report was prepared in order to present information about the presence of anthropogenic residues in stranded seabirds along the southern/southeastern Brazilian coast. Carcasses of 9149 seabirds were necropsied between August 2015 and October 2018. The group most threatened by the presence of anthropogenic solid wastes in our sample is the Procellariiformes. Beach monitoring programs can be useful if carcass data are recorded systematically over long periods, in specific geographic areas, providing baselines on mortality rates and causes of death. This is crucial to understand oceanic threats as well as to identify and manage anomalous mortality events. Stranded birds may reveal long-term spatial and temporal trends in chronic pollution in the marine environment and identify possible anthropogenic causes of environmental disturbances, providing guidelines to legislative and management actions.

PROJECT NEXT STEPS

Brazilian waters comprise an important feeding area to many seabirds including and resident and migratory groups as Procellariiformes. At least 37 species of *Procellariiformes*, with the greatest richness and abundance being found in its southern colder waters (Piola *et al.,* 2004) and that 8416 *Procellariiformes* found dead or debilitated in south Brazil during daily beach surveys within a 3 years' period (2015 August/2018 October) we recommend that:

1. Systematic beach monitoring continues in Santa Catarina state, Brazil, in order to assess patterns on marine animal's mortality, once they can be stablished only within long term monitoring programs.
2. Further analyses are necessary to evaluate the effect of presence of the anthropogenic solid residue found in Procellariiformes and other groups of seabirds stranded in in the Southern / Southeast Brazil, including microplastic analysis and standardization of protocols under ACAP guidelines. Project ongoing under Argentina collaboration.
3. Further analysis on causes of death for beached birds are accomplished and improved in the next years.

1. INTRODUCTION

Marine debris are a serious problem in the ocean and marine animals are mostly affected through entanglement and ingestion of plastic litter (Derraik, 2002). Studies show that the marine debris are a threat to seabirds, mainly to Procellariiformes including albatrosses, petrels, and shearwaters (Tourinho *et al*., 2010; Roman *et al.,* 2019). Albatrosses and petrels are migratory species of great international significance for marine ecosystems and may be indicators of what happens in terms of offshore threats (Birdlife International 2012). The Procellariiformes comprise one of the most endangered bird taxa, as many species have undergone substantial declines in recent times (Phillips *et al.,* 2016). A majority of petrel species and almost all albatrosses currently face a high risk of extinction. Habitat disturbance, nesting habitat degradation and loss, incidental bycatch in fisheries, changes in food supply, pollution and marine debris, invasive species, diseases, and other threats have had substantial adverse impacts on albatrosses and petrels worldwide (Carlile *et al.,* 2003, Bourgeois & Vidal 2007, Le Corre 2008).

Most of these birds migrate long distances to the Subtropical convergence zone to feed, including trans-Atlantic migrants such as the *Puffinus puffinus* and albatrosses nesting on the South Georgia and Falklands / Malvinas islands (Guilford *et al*., 2009, Phillips *et al.,* 2016). In addition, during winter, there is a penetration of cold and nutrient-rich waters from the south, which advance through the Brazilian continental shelf up to 23-24° S (Campos *et al.,* 1996, Piola *et al.,* 2004). The phenomenon coincides with the post-reproductive dispersion of species such as *Procellaria aequinoctialis* and *Thalassarche melanophris*, that become more abundant in Brazilian waters during this season.

Despite the scarcity of species breeding in that region, the Brazilian Economic Exclusive Zone (EEZ) is a feeding area used by at least 37 species of Procellariiformes, most ACAP species, with the greatest richness and abundance being found in the colder waters and resurgences, especially in the Subtropical convergence zone, off the coast of Rio Grande do Sul State, where the warm waters of the Brazilian current meet the cold waters of the Falkland current (Piola *et al.,* 2004).

To understand how this rich biodiversity of albatrosses and petrels species interacts with potential threats within Brazilian waters, as anthropogenic residues, is an important task that the National Action Plan for the Conservation of Albatrosses and Petrels (PLANACAP) has

focused in the last years. Thus, one of the tools available to this purpose was implemented through the oil and gas exploration licensing process, as a systematic beach survey was implemented in 2015, allowing to describe and analyze trends in stranded Procellariiformes and other marine animals. Here, we present a summary of results from necropsies performed on seabirds found along the Southern / Southeastern Brazilian coast, focusing on the occurrence of anthropogenic residues found on the digestive tract.

2. METHODOLOGY

2.1. Data

The data present in this study were obtained from the *Sistema de Informação de Monitoramento da Biota Aquática* (SIMBA) which is an information management system that integrates data collected by the different institutions that are part of the Santos Basin Beach Monitoring Project (*Projeto de Monitoramento de Praias da Bacia de Santos* - PMP-BS). This is one of the monitoring programs required by Brazil's federal environmental agency, IBAMA, for the environmental licensing process of oil production and transport by Petrobras at the pre-salt province (25^0 05'S 42^0 35'W a 25^0 55'S 43^0 34'W), between 2100m and 2300m isobaths. To evaluate the possible impacts of these activities on marine turtles, marine mammals, and seabirds, the main activity of the PMP-BS is to monitor approximately 1040km of coastline.

The SIMBA information system is online and can be accessed anonimously or with an username. This research used only records available to anonymous users,referring to animals collected until October 2018. From August 2015 to October 2018, all bird carcasses detected from the waterline to foredunes were recorded, counted, identified based on literature information (eg, Onley & Scofield 2010; Howel 2012), and also were removed from the beach or marked to avoid recounting. The carcasses and animals found debilitated are evaluated for the presence of lesions, external markings, interactions with fishing gears, nylon and/or oil, stains to identify the possible anthropogenic causes of stranding from fisheries activities. Animals removed from beaches were sent to rehabilitation centers, where treatment was carried out for the debilitated animals and necropsies of the dead individuals. The stomach content was identified and separated during or after the necropsies procedures. It was considered as anthropogenic residues any plastic and other non-organic structures.

2.2. Study area

The coastline monitored in this study is located in the Southern / Southeastern Brazil between 23°22´S and 28°30′S covering three Brazilian states (São Paulo, Paraná, and Santa Catarina). The coastal region is under the influence of the subtropical convergence between the southward and northward flowing Brazil and Malvinas Currents. The confluence of water masses and the high volume of continental runoff provide physical and chemical conditions for high biological production on the shelf (Seeliger *et al*., 1998, Piola *et al*., 2004). The opportunity generated for the fishing industry by this high biological productivity makes the southern regions an area that demands attention on bycatch and also debris deposited within the ocean. It is the industrial fisheries who provides most of the landings, accounting for approximately half of the total Brazilian catches (IBAMA, 2005). Historically, it was in the south and southeast that industrial fisheries were mostly developed through a series of government incentives, and this is where fisheries data were best documented.

3. RESULTS AND DISCUSSION

A total of 9149 birds necropsies were performed in rehabilitation bases of PMP-BS in Brazilian Coast, 4028 of these seabirds were Procellariiformes. The total of 508 individual showed interactions with anthropogenic residues (wastes). The Procellariiformes (N = 268) and Sphenisciformes (N = 133) were the orders that most presented individuals with anthropogenic solid residues in the stomach contents (Table 1). The other orders that had waste were Charadriiformes (n = 63), Suliformes (n = 41), Pelicaniformes (N = 1) e Podicipediformes (N = 1).

The species of Procellariiformes that had the highest prevalence of solid residues were *Puffinus puffinus* (N = 128) e *Procellaria aequinoctialis* (N = 32) followed to *Thalasarche melanophris* (N = 21) and *Puffinus gravis* (N = 12). Among the anthropogenic items found in the stomach contents of Procellariiformes are plastic fragments (hard or malleable of different sizes and shapes) from packaging and plastic bags, nylon threads and strings (probably from fishing nets) and styrofoam.

Anthropogenic solid waste interactions with seabirds have been the focus of studies in many regions (Laist, 1997; Cadée, 2002; Brandão *et al*., 2011; Van Franeker, *et al.,* 2011; Tanaka *et al.,* 2013). The present results corroborate with data in the literature showing that albatrosses and petrels have ingested debris (Colabuono *et al.,* 2009). In some cases, Procellariiformes ingest greater extent than other seabirds such as the Sphenisciformes and Charadriiformes orders (Tourinho *et al.,*2010). Among the orders cited here there are birds with different prey, feeding strategies and habitat use, suggesting that regardless of the individual's number and which group it belongs, many marine species have been affected by plastic and others solid residues (Tourinho *et al.,* 2010).

The needed implementation of measures such as environmental education for society as a whole regarding the consumption and production reduction of disposable materials like plastic and recycling of waste can help reversing environmental and animals contamination in the marine ecosystems. The present study showed that migratory or not, coastal or oceanic species in Brazil are being threatened by the presence of anthropogenic residues in the marine environment and to Procellariiformes, this is an alarming reality. Further analysis and assessment of the cause of death of stranded animals are needed to broadly understand the physical and toxicological damage that this kind of residue has caused to seabirds. .

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ANNEX 1

Table 1. Seabirds with highest interaction rates with anthropogenic residues in the stomach contents per data collection area in southern/southeasthern Brasil coast (PMP-BS).

Species	**R3**	**UDESC**	**UNI**	**UNE**	**UFPR**	**Arg**	**Bio**	**Ipec**	**GRE**	**T**
Procellariiformes										
Procellariiformes										**268**
Diomedea epomophora	1	1	-	-	-	-	-	-	-	2
Diomedea sp.	-	-	-	-	1	-	-	-	-	1
Thalassarche chlororhynchos	1	4	3	1	-	1	-	-	-	11
Thalassarche melanophris	2	3	2	2	1	5	1	5	-	21
Thalassarche sp.	-	-	-	-	-	1	-	-	-	1
Oceanites oceanicus	-	-	1	-	-	-	1	-	-	2
Oceanites sp.	-	1	-	-	-	-	-	-	-	1
Calonectris diomedea	-	6	-	-	-	1	1	6	2	16
Calonectris sp.	-	-	-	-	2	1	-	-	-	3
Daption capense	-	1	-	-	-	-	1	1	-	3
Macronectes giganteus	1	2	3	1	1	1	-	-	-	9
Pachyptila desolata	1	-	-	-	-	1	-	1	-	3
Procellaria aequinoctialis	1	6	4	5	1	4	5	5	1	32
Procellaria conspicillata	-	-	-	-	1	1	-	-	-	2
Procellaria sp.	-	-	1	-	1	2	-	-	-	4
Puffinus gravis	1	1	-	3	1	-	2	-	4	12
Puffinus griseus	1	-	-	-	-	-	-	3	-	4
Puffinus puffinus	3	19	35	6	17	10	12	12	14	128
Halobaena coerulea	-	-	-	1	-	-	-	-	-	1
Pterodroma mollis	-	-	-	-	-	-	2	-	3	5
Pterodroma incerta	-	-	-	-	-	-	-	-	1	1
Pachyptila belcheri	-	-	-	-	-	-	-	1	-	1
Pachyptila vittata	-	-	-	-	-	-	-	-	1	1
Sphenisciformes	-	-	-	-	-	-	-	-	-	-
Spheniscus magellanicus	23	56	12	10	3	5	4	15	5	133
Charadriiiformes										
Larus dominicanus	6	14	24	3	4	2	-	-	-	53
Larus sp.	-	-	-	1	-	-	-	-	-	1
Himantopus melanurus	1	-	-	-	-	-	-	-	-	1
Stercorarius sp.	-	-	1	-	-	-	-	-	-	1
Haematopus paliatus	-	1	-	-	-	-	-	-	-	1
Stercorarius chilensis	-	-	-	-	1	-	-	-	-	1
Sterna hirundo	-	-	1	-	1	-	-	1	1	4
Pluvialis dominica	-	-	-	-	-	-	-	1	-	1
Pelecaniformes										
Ardea cocoi	-	-	-	-	-	1	-	-	-	1
Suliformes										
Sula leucogaster	-	3	3	2	1	4	7	6	-	28

Fregata magnificens	-	-	1	-	1	1	2	1	-	6
Phalacrocorax brasilianus	-	1	2	-	2	1	-	1	-	7
Podicepediformes										
Podicephorus sp	-	1	-	-	-	-	-	-	-	1