



New record on the occurrence of Northern Giant Petrel (*Macronectes halli*) and analysis of stomach contents in Southern Brazil

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Abstract. This study aims to present the record of a living Northern Giant Petrel individual found in 2014 in Rio Grande do Sul coast, as well as analyze the stomach contents of this species. Stomach contents analyses were performed in two Northern Giant Petrel individuals (2011 and 2014), in which cephalopod beaks, feathers and synthetic materials were recorded in both stomachs. Twenty-four cephalopod beaks were registered. The cephalopods are extremely important items in the diet of the Northern Giant Petrel like in several other seabirds' species that occur off the coast of southern Brazil. In addition to the food items, the occurrence of synthetic material in the contents alert to anthropogenic pollution of the seas. The presence of Northern Giant Petrel off the coast of Rio Grande do Sul may be considered casual, even though the species has only been recorded twice over seven years of monitoring. Therefore, these records may be associated with weakened individuals, weather events, pelagic dispersion or food availability.

Key words diet; seabirds; anthropogenic impacts; Procellariiformes

Resumo. Novo registro de ocorrência do Petrel-gigante-do-norte (*Macronectes halli*) e análise do conteúdo estomacal no sul do Brasil. Este estudo tem como objetivo apresentar o registro de um indivíduo vivo de Petrel-gigante-do-norte encontrado em 2014 na costa do Rio Grande do Sul, bem como analisar o conteúdo estomacal desta espécie. Análise do conteúdo estomacal foi realizada em dois indivíduos de Petrel-gigante-do-norte (2011 e 2014), nos quais bicos de cefalópodes, penas e materiais sintéticos foram registrados em ambos os estômagos. Foram registrados 24 bicos de cefalópodes. Os cefalópodes são itens extremamente importantes na dieta de Petrel-gigante-do-norte como em diversas outras espécies de aves marinhas que ocorrem na costa do sul do Brasil. Além dos itens alimentares, a ocorrência de material sintético no conteúdo alertam para a poluição antrópica dos oceanos. Apesar de a espécie ter sido encontrada duas vezes ao longo de sete anos de monitoramento, a presença de Petrel-gigante-do-norte ao longo da costa do Rio Grande do Sul pode ser considerada casual. Desta forma, esses registros podem estar associados a indivíduos enfraquecidos, eventos climáticos, a dispersão pelágica ou a disponibilidade de alimentos.

Palavras-chave dieta; aves marinhas; impactos antrópicos; Procellariiformes

Introduction

The Northern Giant Petrel - NGP (*Macronectes halli*) breeds in Subantarctic Islands and regions of South America, while in the nonbreeding period both juveniles and adults spread along the South Hemisphere (Birdlife International

2012), as South America, Australia and New Zealand (Hunter 1984, Voisin 1990, Trivelpiece & Trivelpiece 1998, Patterson & Hunter 2000).

There are several coastal areas in South America that are important waypoints during the migratory routes of Antarctic and Subantarctic

pelagic seabirds (Costa *et al.* 2011), such as the cold Falklands Current and warm Brazil Current containing a high primary productivity in this region (Vasconcellos & Csirke 2011). However, in Brazil, a few records of NGP were documented. The oldest record in Brazil consists in a dead individual found in Sao Paulo state in 1994 (Martuscelli *et al.* 1995). Conversely, all other records were made to southern areas, mostly along the Rio Grande do Sul (RS) coast, in which a female in 1999 and an adult in 2000 were recorded (Bugoni *et al.* 2003). Also, there are three adult males at Fundação Universidade Federal do Rio Grande do Sul (FURG) museum, which were all found dead along the coast of Rio Grande do Sul (RS) (Carlos *et al.* 2005). Besides these, there is an individual of the species that were banded when captured by net (Bugoni *et al.* 2008, Bugoni & Furness 2009).

Bencke (2001) considered the occurrence of NGP insufficient for inclusion in the RS state of species list, but on the review carried out in 2010, the species was included on the list due to new documented records (Bugoni *et al.* 2003, Carlos *et al.* 2005, Carlos & Voisin, 2008, Bencke *et al.* 2010). Despite NGP has more pelagic habits and does not reach the South American coast, unlike Southern Giant Petrel - SGP (*M. giganteus*) (Montalti & Orgeira 1998), even so, a NGP juvenile has already been registered together with other SGP individuals feeding on a whale carcass on the coast of RS (Petry *et al.* 2010, Petry *et al.* 2012). Moreover, the NGP's foraging distribution in breeding period were reported as male mainly forage close inshore (feeding in carcasses), while females forage offshore (preying in live marine organisms, such as squid, fish and krill) (Hunter 1983, González-Solís *et al.* 2000). On the other hand, the NGP foraging distribution in non-breeding period is poorly unknown.

According to the new list of endangered species of RS (Decree 51,797/14), the species has insufficient data to its assessment regarding the risk of extinction. So, in order to contribute to the knowledge of this species, this study aims to present the record of a living individual of NGP found on the coast of RS, besides to describe the stomach contents of both NGP *post-mortem* and another NGP found along the study period.

Materials and Methods

The monitoring of the RS coast has been conducted monthly since 2007, with automotive vehicle at an average speed of 30 km/h, traveling

120 km of coastline, between Balneário Pinhal (30°14'55"S/50°13'47"W) and Mostardas (31°10'52"S/50°50'03"W). Once in every season of the year, another 30 km until Lagoa do Peixe National Park (LPNP) (31°21'S/50°02'W) is included. During this transect all living and dead seabirds are counted. Carcasses in good condition are collected, their biometric measurements are taken and their stomachs are removed for further analysis. In laboratory, cephalopods were identified through chitin beaks using specific guides (Clarke 1986, Santos & Haimovici 2002). The number (N) of both NGP stomach content was counted and shape and color of synthetic material were documented. Since the low number of individuals was recorded, the frequency of occurrence of items were not calculated.

Results

On 23 April 2014, around 9 am it was registered the presence of a specimen of NGP apparently debilitated toward the LPNP (Figure 1). At the time it was performed only an approach to photographing records and to verify the band in order to avoid further stress to the animal. Later that day, around 5 pm, another record of the specimen was made at the same location where it was registered the individual death. Biometric data was taken as length (105 mm) and width of the bill (35.2 cm), length of the wing (510 mm), tail (157 mm) and tarsus (105 mm). The specimen's skin was taxidermized and it was listed under the number 933 in the collection of the University of Vale do Rio dos Sinos (Unisinos).



Figure 1. Northern Giant Petrel found alive on 23 April 2014 in Rio Grande do Sul state, Brazil.

The stomach contents analysis of this individual was made along with another stomach contents of NGP also found dead on RS during the

coast monitoring in 2011. In both stomachs were verified the presence of cephalopod beaks, feathers and synthetic material; while only in the 2014 individual it has been verified the presence of algae and nematodes (Table I, Figure 2).

Table 1. Stomach contents (proventriculus and ventriculus) items (N) of the two Northern Giant Petrel (NGP) individuals found in 2011 and 2014 along the coast of Rio Grande do Sul, Brazil.

Items	Collected years	
	2011	2014
Nematoda	-	7
Cephalopoda (beaks)	23	1
Feather	10	+/-100
Algae ¹	-	10
Synthetic material ¹	12	1

¹ Fragments were counted to these categories.



Figure 2. Synthetic material found in Northern Giant Petrel stomach content. These materials were collected from the 2011 individual in Rio Grande do Sul coast, Brazil.

Twenty-four cephalopod beaks were found in the stomach of the 2011 individual, two belonging to the genus *Galitheutis* and two to genus *Histotheutis*. In addition to these, *Gonathus antarcticus* (n = 2), *Psychroteuthis glacialis* (n = 1), *Benthoctopus thielei* (n = 1), *Loligo gahi* (n = 1), have been identified in specific level (Table 1). The others cephalopod beaks were not identified to the specific level due to fragmentation. Synthetic materials were recorded in both specimens; however in 2011 individual different types of plastics were documented, but asymmetrical shapes and beige color were the predominant types of plastics particles found (Figure 2).

Discussion

The individual found alive in RS coastline

was identified as a juvenile, due to the dark coloring of the feathers, probably in its first year of life. According through the analysis of the gonads and biometric measures, the animal was identified as a male, corroborating with biometric measures established by Carlos & Voisin (2008).

The occurrence of Procellariiformes in land is strongly associated with breeding events, feeding - through carcasses or fishing discards (Copello & Quintana 2009, Bartumeus *et al.* 2010, Dias *et al.* 2010, Petry *et al.* 2010) - and when they are debilitated (Bugoni *et al.* 2007, Carvalho *et al.* 2010). Therefore, we emphasize that the presence of a NGP found alive on the beach of the Brazilian coast is probably because it was weakened.

Through the synoptic analysis performed on days prior to specimen registered was observed the presence of a frontal system positioned in the Atlantic and an extra tropical cyclone at sea (INPE 2014). Extra tropical cyclones from Antarctica are common in the southern hemisphere during the winter, reaching more frequently East of South America at latitudes between 30° and 50° S (Sinclair 1994, Sinclair 1995, Croxall *et al.* 2002, Bugoni *et al.* 2007). Thus, the occurrence of these events can disorient several individuals who are in migratory period and/or juveniles' individuals performing their first journey, as the NGP recorded by us.

The cephalopods are considered extremely important items in the diet of the NGP (Rey *et al.* 2012), as well as in several other species of seabirds that occur off the coast of southern Brazil in non-breeding periods (González-Solís 2004, Petry *et al.* 2007, 2008, 2009, Rey *et al.* 2012). The squid *Gonathus antarcticus* is generally found in studies on stomach contents of birds, like *Diomedea exulans* (Clarke *et al.* 1981) and *D. chrysostoma* (Rodhouse *et al.* 1990) indicating that this is an important food resource to seabirds. While *P. glacialis* appears to be a common prey of Giant Petrel, once it has also been identified in Southern Giant Petrel chicks' regurgitation (Rey *et al.* 2012). It is known that many Procellariiforme species realize foraging trips during the night, in order to capture cephalopod species that display bioluminescence behavior during its vertical displacement (Moiseev 1991, Cherel *et al.* 2002). Although Giant Petrels do perform night foraging trips, they appear to be less active during night (González-Solís *et al.* 2002).

However, Vaske (2011) mentioned that many of cephalopods found in stomach contents of seabirds may be coming from intake of fish, as well as through the consumption of other prey. Despite

not have been found evidence of fish in NGP stomach contents in this study, this category is also important in the seabirds' diet (Hunter & Brooke 1992, Copello *et al.* 2008). The other food items such as nematodes and seaweed are commonly found in seabirds' stomach content, as well as feathers – all items can be accidentally ingested.

Most seabirds and shorebirds found dead off the coast of Rio Grande do Sul have been showing the presence of synthetic materials in its stomach contents (Petry & Fonseca 2002, Petry *et al.* 2007, 2008, 2009, Barbieri, 2009, Colabuono *et al.* 2009, Petry *et al.* 2010). Generally, the plastic is ingested along with food floating on the ocean surface or when they are mistaken for prey item. Barbieri (2009) documented that beige color and asymmetric shape were the most predominant plastics particles found in seabirds stomach content, corroborating with our study. Such event has been increasing over the years, reaching several species of Procellariiformes (Ryan *et al.* 1988, Copello & Quintana 2003) among others. These foraging areas are related to the abundance of food resource, being possible the exploitation both at sea and on shore. In this case, the birds have greater contact with pollution of anthropogenic origin (González-Solis *et al.* 2000, Roscales *et al.* 2011). On the other hand, large-scale changes in marine environments such as prey availability, human disturbances, among other factors, may be causing changes in foraging patterns of several seabirds' species (Hunter 1984, Patterson *et al.* 2008).

The presence of NGP off the coast of Rio Grande do Sul is casual, seen only twice over the past seven years. These records may be associated with weakened individuals, weather events, pelagic dispersion or food availability. The pollution of beaches and marine environments cause damage to several species of birds that end up ingesting manufactured materials apart from possible contamination by other types of pollutants causing impact on the food chain of many important sites for conservation as the Subantarctic Islands and Antarctica. Any kind of evidence must be understood as an important tool to explain this and other gaps regarding the biology of marine species.

Acknowledgments

The authors are grateful for Wildlife Conservation Society - WCS due to its financial support for the implementation of research during the period of 2008 to 2010, and Fundação de Amparo à Pesquisa do Estado do Rio Grande do Sul

– FAPERGS.

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Received: July 2015

Accepted: November 2015

Published: January 2016