Abstract: The aim of the study was to describe prey items in the diet of Imperial Shag through pellets analysis. The collection of pellets occurred in the breeding site during the austral summer of 2011/12 in Stinker Point, Elephant Island. A total of 34 pellets of Imperial Shag were analyzed and their frequency of occurrence was calculated. Fish remains were found in all pellets. Two families of demersal-benthic fish were identified through otoliths: Harpagiferidae and Nototheniidae. Nematodes occurred frequently. Other invertebrates such as molluscs and polychaetes occurred occasionally, so as vegetable matter (algae) and stones. These items are probably from stomach contents of ingested fish or were accidentally ingested by the bird while building the nest. Our preliminary analysis showed that Imperial Shags breeding on Elephant Island have a similar diet composition to other shag species which breed in the sub-Antarctic islands and in the Antarctic Peninsula, with some items absent. However, further analysis will present more concrete data on the mass, volume and taxonomic species level of each item.

Keywords: Pellets, Otoliths, Nototheniidae, Harpagiferidae

Introduction
Seabirds are great indicators of changes in the marine environment (Furness & Camphuysen, 1997). Their dietary data can be used to assess these modifications, such as fluctuation in fish stocks (Montevecchi, 1993; Barrett et al., 2007). The Imperial Shag (Phalacrocorax atriceps) breeds along the Antarctic Peninsula and the South Shetlands Islands during austral summer (Watson, 1975). The species is a potential indicator of diversity and abundance of populations of benthic-demersal fish which occur in the coastal waters of this region (Casaux & Barrera-Oro, 1993; Furness & Camphuysen, 1997).

The analysis of regurgitated pellets is a simple and non-invasive method to assess diet composition of shags. Fish, cephalopods, gastropods, bivalves and polychaetes are some of the benthic organisms known to be prey of the Imperial Shag (e.g., Schlatter & Moreno, 1976; Casaux & Barrera-Oro, 1993). Several studies on their diet were conducted in the South Shetland Islands and in the Antarctic Peninsula (Green et al., 1990; Casaux & Barrera-Oro, 1993; Coria et al., 1995; Casaux et al., 2002); nevertheless, only one study was performed on Elephant Island (Petry & Sander, 1987). Thus, the aim of this study is to provide data on the diet of the breeding Imperial shag on Elephant Island.

Materials and Methods
Pellets of Imperial Shags (Figure 1) were collected in a colony (20 breeding pairs) at Stinker Point (61°13′20.5″S, 55°21′35″W), Elephant Island, during austral summer on February 2012. Samples were frozen for conservation and subsequently defrost for the sorting of contents under a binocular stereomicroscope. Each item was identified to
Due to erosion of otoliths, they were only identified to family. We used the descriptions and illustrations in North et al., (1984) and Williams & Mc Eldowney, (1990). Then, the frequency of occurrence (FO) of each item was calculated.

**Results**

We identified 11 different items. Fish remains (bones) were found in all samples and usually constituted the bulk of the pellets, proving it to be the main prey of Imperial Shag in Elephant Island (Table 1). Two families of demersal-benthic fish were found: Harpagiferidae and Nototheniidae (Figure 2). Algae and nematodes were the second most frequent item (FO = 85.3% and 64.7% respectively). Two classes of Molluscs occurred occasionally: Gastropoda (snails) (FO = 29.4%) and Bivalvia (clams) (FO = 8.8%). Mandibles of polychaetes occurred in 10 samples (FO = 29.4%) while mites (FO = 8.8%) occurred only in three. We also found a pinniped’s tegument fragment (Figure 2) and the exoskeleton of one amphipod in different samples. Stones occurred in 94.1% of the pellets, but do not represent an energetic source to the bird.

**Discussion**

As previously observed fish were the most abundant prey of the Imperial Shag (Wanless et al., 1992; Casaux & Barrera-Oro, 1993; Casaux et al., 1997). As expected, we found otoliths from two families of demersal-benthic
fish in our samples: Harpagiferidae and Nothoteniidae. Octopod beaks were usually the second most frequent prey item in the previously mentioned studies (Wanless et al., 1992; Casaux & Barrera-Oro, 1993; Casaux et al., 1997), however, no evidence of beaks was found in the pellets of Elephant Island shags. Given that shags are opportunistic feeders, these differences could be explained by different prey availability around the colony (Casaux et al., 2002) or different marine relief, which could affect dive depths and fauna composition. Invertebrates such as polychaetes and molluscs and other items such as algae could be derived from fish stomachs which were ingested by the birds. In a feeding trial study, a captive Imperial Shag fed only with fish produced pellets which contained mandibles of polychaetes and algae (Casaux et al., 1995), thus supporting the hypothesis that these items could be from the prey’s diet. Though, shags use algae for nest building (Schlatter & Moreno, 1976) and it could have also been ingested accidentally during transport to the nest (Casaux & Barrera-Oro, 1993). This might have also been the reason to the occurrence of a fragment of pinniped’s tegument, since it is not an usual prey item and has not been found in any other study.

The presence of stones might be explained by the provenance from fish stomachs as well or by ingestion for pellet formation (Casaux & Barrera-Oro, 1993; Casaux et al., 1997). This hypothesis is supported by a study that compared Imperial Shags stomach content with pellets and observed that stones were present in the pellets but absent in stomach contents (Casaux et al., 1997). Feathers and mites are probably provenient from the environment or the bird itself.

Fish, algae, nematodes, gastropods, bivalves and polychaetes are some of the items which were also found in other studies conducted in the South Shetlands (Coria et al., 1995; Casaux & Barrera-Oro, 1993). Our preliminary analysis showed that Imperial Shags breeding on Elephant Island have a similar diet composition to other shag species which breed in the sub-Antarctic islands and in the Antarctic Peninsula, with some items absent. However, further analysis will present more concrete data on the mass, volume and taxonomic species level of each item.

Acknowledgements

This work integrates the National Institute of Science and Technology Antarctic Environmental Research (INCT-APA) that receives scientific and financial support from the National Council for Research and Development (CNPq process: n° 574018/2008-5) and Carlos Chagas Research Support Foundation of the State of Rio de Janeiro (FAPERJ n° E-16/170.023/2008). The authors also acknowledge the support of the Brazilian Ministries of Science, Technology and Innovation (MCTI), of Environment (MMA) and Inter-Ministry Commission for Sea Resources (CIRM).
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