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EFFECTS OF HUMAN ACTIVITIES IN THE MARINE ENVIRONMENT ON SEABIRDS ALONG THE COAST OF RIO GRANDE DO SUL, BRAZIL

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Resumo. – Avalição dos efeitos de atividades antrópicas em aves marinhas no litoral do Rio Grande do Sul, Brasil. – O litoral do Rio Grande do Sul serve como local de alimentação para diversas espécies de aves marinhas, as quais ocasionalmente acabam sendo vítimas das atividades do homem no mar. Visando avaliar em aves marinhas os efeitos da interação das aves com a pesca, da contaminação por petróleo e da ingestão de materiais sintéticos foram realizados monitoramentos mensais no período de Julho de1997 a Julho de 1998 afim de censar todas as aves encontradas mortas na orla do Rio Grande do Sul. Constatou-se 7690 carcaças de 18 espécies de aves marinhas; destas 81% eram Pinguims-de-Magalhães (*Spheniscus magellanicus*) e 19% eram Procellariiformes. Destas 7,5% eram Diomedeidae e 92,5% Procellariidae. Verificou-se que dos 7690 corpos censadas 4003 (52%) apresentavam estado de conservação passível de avaliação quanto a presença de sinais de ação antrópica, os quais foram verificados em 1319 (33%) carcaças. Entre os sinais mais evidentes 812 (61,5%) continham manchas de óleo na plumagem e 507 (38,5%) cortes provocados por objetos pontiagudos ou marcas de rede de pesca. Além disto foram coletadas 581 estômagos dos quais 339 (58%) apresentavam indícios de ingestão de materiais sintéticos.

Abstract. **–** Coastal areas of Rio Grande do Sul serves as a feeding place for many seabirds which occasionally end up victimized of human activities at sea. Aiming to evaluate the effects of fishery and crude oil contamination and ingestion of synthetic materials on seabirds, monthly monitoring visits were done from July 1998 to July 1999 in order to count dead birds found on the shore of Rio Grande do Sul. A total of 7690 carcasses of 18 seabird species were found; 81% were Magellanic Penguins (*Spheniscus magellanicus*) and 19% were Procellariiformes. Diomedeidae and Procellariidae counted for 7.5% and 92.5% of Procellariiformes, respectively. A total of 4003 (52%) carcasses were in condition allowing proper evaluation of causes of death, which were indeed verified in 1319 (33%) carcasses. Among the most clearly visible signs, 812 (61,5%) had crude oil stains on their feathers and 507 (38,5%) had cuts of sharp objects or marks of fishing nets. Besides that, 581 stomachs were extracted from which 339 (58%) showed signs of ingestion of synthetic materials. *Accepted 7 October 2001.*

Key words: Seabirds, Sphenisciformes, *Spheniscus magellanicus*, Procellariiformes, fishery effects, mortality.

INTRODUCTION

The south Brazilian continental platform is part of the western limit of the Subtropical Convergence formed by an interchange of cold and warm waters (Hubold 1980a, 1980b). During winter months, mainly due to Falklands tides, the coastal waters of Rio Grande do Sul support plenty of Teleostean fishes of commercial interest (Haimovici *et al.* 1996). At the same time, the nutrient rich waters are patrolled for food by various spe-

TABLE 1. Number of seabirds found dead per month, in Rio Grande do Sul, during monitoring expeditions from July 1997 to July 1998.

Dead seabirds	1997						1998							Total
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Magellanic Penguin (*Spheniscus magellanicus*)	959	842	436	780	2721	54	3	0	0	0	0	28	28	6249
Royal Albatross (*Diomedea epomophora*)				1								1	1	2
Black-browed Albatross (*Thalassarche melanophris*)	24	6	5	17	3	4	1	2	1		8	5	5	85
Yellow-nosed Albatross (*T. chlororhynchos*)	3	2	1	1	4		4		1	1	1			20
Grey-headed Albatross (*T. chrysostoma*)											1			1
Southern Giant Petrel (*Macronectes giganteus*)	4			8	1									14
Antarctic Fulmar (*Fulmarus glacialoides*)	481	33	3	13	16	8						2	2	562
Cape Petrel (*Daption capense*)	3	3		6	2							1	1	16
Atlantic Petrel (*Pterodroma incerta*)				1	1			1			2			5
Soft-plumaged Petrel (*P. mollis*)				1							1			2
Thin-billed Prion (*Pachyptila belcheri*)	6													6
Antarctic Prion (*P. desolata*)				1										1
White-chinned Petrel (*Procellaria aequinoctialis*)	19	10	10	24	6	9	6	3	2	1	8	4	4	114
Cory's Shearwater (*Calonectris diomedea*)	1					1	6	19	51	1	178			257
Cape Verde Shearwater (*C. edwardsii*)											3			3
Great Shearwater (*Puffinus gravis*)		1		15	6	19	37	14	41	4	99	2	2	238
Sooty Shearwater (*P. griseus*)	36	3	2	2	1			1	4		3			54
Manx Shearwater (*P. puffinus*)		4	3	8	36	4	3		2		1			61
Total	1536	904	460	878	2797	99	60	40	102	7	305	43	43	7690

cies of seabirds (Vooren & Fernandes 1989, Sick 1997). The distribution of seabirds, in places of high marine productivity, often overlaps commercial fishing area (Furness 1982), and interactions between birds and anthropogenic activities frequently result in the death of many birds. Bird carcasses are often found on the beaches of southern Brazil with visible signs of injuries resulting from fishery activities (Neves & Olmos 1998, Vooren & Fernandes 1989) and crude oil contamination and its derivates (Vooren & Fernandes 1989). Oil contamination usually originates from small spills and from the washing of tanker vessels. In addition, garbage of all sorts (cans, bottles), hooks and fishing lines are thrown to the sea and result in injuries, illness, and death of seabirds. For instance, seabirds accidentally swallow all kinds of plastic particles which can, among other effects, block up the digestive tract, resulting in sub-lethal effects, and even death (Laist 1987). In addition to those factors that can cause the death of seabirds, the oceanic waters of Brazil suffer several kinds of pollution, the effects of which still remain to be evaluated (Antas 1990). This paper aims to document the effects of fisheries, crude oil contamination and ingestion of synthetic materials upon Sphenisciformes and Procellariiformes found dead on the beaches of Rio Grande do Sul.

METHODS

From July 1997 to July 1998, a series of 13 monthly visits were carried on between Pinhal (30°15'S, 50°15'W) and the lagoon outlet of the Parque Nacional da Lagoa do Peixe (31°20'S, 51°05'W). Each visit covered 150 km of coastline. Two visits covered from Torres (29°20'S, 49°44'W) to Chuí (33°45'S, 53°22'W). Summing up all 13 censuses, 3000 km of beach were covered. The coastline of Rio Grande do Sul features one of the largest continuous sandy plains of the world, extending over 622 km without any rocky shore, and with only two outlets: the mouth of Rio Tramandaí and the channel of Laguna dos Patos. The coastline was censused by driving a car at low speed (30 km/h) so that it was possible to search for the carcasses on the sandy beach close to the tide line. Bird carcasses were identified to species and, when the *post mortem* conditions permitted, the birds were examined to search for signs of interactions with fishery activities or crude oil contamination. Some specimens were randomly selected and had their stomachs removed and preserved in alcohol 70% for later analyses. The stomachs were opened in the laboratory and their contents were extracted. The items of anthropogenic origin were grouped by similarity and quantified.

RESULTS

During the 13 months of data collecting, 7690 seabirds (18 species) were found dead. Most of them (81%) were Magellanic Penguins (*Spheniscus magellanicus*), 19% were Procellariiformes. Diomedeidae with four species and Procellariidae with 13 species counted for 7,5 and 92,5% of Procellariiformes, recpectively (Table 1). The species with lesser occurrence were the Royal Albatross (*Diomedea epomophora*) and the Soft-plumaged Petrel (*Pterodroma mollis*) with two new records each, the Grey-headed Albatross (*Thalassarche chrysostoma*) and the Antarctic Prion (*Pachyptila desolata*) with one single record each, and the Cape Verde Shearwater (*C. edwarsii)* with the very first record for Rio Grande do Sul (Petry *et al*. 2000).

From the 7690 birds carcasses, 4003 (52%) were in condition allowing determination, when present, of signs of interaction with fishery activities or oil contamination. Signs of direct or indirect interaction with human activities were found in 1319 (33%)

TABLE 2. Total of birds found dead, total of carcasses in proper conditions for the evaluation of evidences of anthropogenic effects, number of species with oil stains, number of species with signs of interaction with fishing and total number, per species, of affected individuals. For scientific names, see Table 1.

Dead seabirds	N	N evaluated	Anthropogenic effects		
			Oil	Fishery	Total
Magellanic Penguin	6249	3376	573	424	997
Royal Albatross	2	2		—	—
Black-browed Albatross	85	44	7	4	11
Yellow-nosed Albatross	20	10	1	—	1
Grey-headed Albatross	1	1		—	—
Southern Giant Petrel	14	7	1		1
Antarctic Fulmar	562	292	6	6	12
Cape Petrel	16	8	2		2
Atlantic Petrel	5	5	—	—	—
Soft-plumaged Petrel	2	2	—	—	—
Thin-billed Prion	6	6	—	—	—
Antarctic Prion	1	1	—	—	—
White-chinned Petrel	114	59	1	4	5
Cory's Shearwater	257	137	30	6	36
Cape Verde Shearwater	3	3	—	—	—
Great Shearwater	238	124	11	14	25
Sooty Shearwater	54	29	2	2	4
Manx Shearwater	61	32	8	4	12
Total	7690	3687	812	507	1319

carcasses, including 812 (61,5%) cases with oil contamination and 507 (38,5%) with injuries by sharp objects or fishing nets (Table 2). Of the 18 registered seabird species, 42% had oil stains in their feathers, 57% showed signs of interaction with fishery activities, 1% showed no evidence of anthropogenic injuries, and 42% suffered both effects of oil and fishery activities. During the 13 months of the study, the company responsible for the extraction and transport of crude oil provided written technical reports only on two occasions, although contaminated animals were found during all visits.

The contents of 581 stomachs were analyzed and 339 (58%) contained materials of anthropogenic origin (Table 3). Among the most common items were fishing lines, polyethylene particles (plastic cylinders "*in natura*"), particles of hard manufactured plastic, fragments of plastic bags, polystyrene, parts of different packagings, and hooks. The species with the highest incidence of plastic materials were the Magellanic Penguin with 800 plastic pellets, the Great Shearwater (*Puffinus gravis*) with 180, and the Antarctic Fulmar (*Fulmarus glacialoides*) with 123 pieces, each in one single stomach. Although in smaller quantities per stomach, 87% of the 17 species of birds that had their stomachs examined had swallowed some kind of anthropogenic particles.

DISCUSSION

The fact that Magellanic Penguins suffered

TABLE 3. Total number of collected stomachs, total number of stomachs with synthetic materials and frequency of occurrence (FO) of synthetic materials. For scientific names, see Table 1.

Dead seabirds	Collected stomachs	Stomachs with synthetic materials	FO (%)
Magellanic Penguin	144	115	80
Royal Albatross	2	1	50
Black-browed Albatross	35	7	20
Yellow-nosed Albatross	7	1	14
Grey-headed Albatross	1	—	—
Southern Giant Petrel	10	4	40
Antarctic Fulmar	49	25	51
Cape Petrel	10	4	40
Atlantic Petrel	4	—	—
Soft-plumaged Petrel	1	1	100
Antarctic Prion	5	12	40
White-chinned Petrel	36	12	33
Cory's Shearwater	112	112	100
Cape Verde Shearwater	3	1	33
Great Shearwater	110	77	70
Sooty Shearwater	27	10	37
Manx Shearwater	25	8	80
Total	581	339	58,35

higher mortality than Procellariiformes might have been a consequence of their distribution pattern which make them more exposed to crude oil contamination as well as to more interaction with fishery. The species is one of the few that migrates to areas with intense crude oil traffic (Gandini *et al.* 1994). As a consequence, the species stays for longer periods of time in contaminated waters, thus increasing the chances for oil contamination. However, our results show that crude oil contamination is a chronic problem in Rio Grande do Sul, not only for penguins, but also for other seabird species. The birds are not exposed to large oil spills, but get contaminated by small drifting spots that end up soaking feathers, skin, muscles and bones, besides being ingested when seabirds try to clean their feathers with their bill.

The industry of bottom trawl fishing on the continental platform of southern Brazil can impact young fish of commercial interest (Haimovici *et al.* 1996), and can thereafter result in starvation of seabirds that feed on them. The interaction with fishermen can also result in injuries as evidenced by the 507 carcasses found with injuries by sharp objects or fishing nets.

Another problem that affects seabirds is the ingestion of anthropogenic materials. According to Laist (1987), not long ago the ingestion by sea animals of plastic products drifting over the ocean was considered of little relevance when compared to other kinds of contamination such as heavy metals, organochlorines and oil spills. However the ingestion of plastic products by seabirds has become an increasing problem which demands maximum attention because resulting in sub-lethal effects. Out of 581 stomachs analyzed, 339 (58%) contained materials of anthropogenic origin (see above). Besides a

large number of species contaminated with plastic materials, there were also large quantities of plastic pieces per stomach, confirming their sub-lethal effect.

Our results bring up information about the death of seabirds in the coastal region of Rio Grande do Sul resulting from fishery activities, contamination by crude oil and ingestion of synthetic materials. We hope this information can contribute to reduce seabird mortality. Investment for the preservation of migrating birds must not be limited only to their breeding places.

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REFERENCES

Antas, P. T. Z. 1990. Status and conservation of seabirds breeding in Brazilian waters. Publ. Tec. 11: 141–158.

Furness, R. W. 1982. Competition between fisheries and sabird communities. Adv. Mar. Biol. 20: 225–307.

Gandini, P., P. D. Boersma, E. Frere, M. Gandini, T. Holi, & V. Lichtschein. 1994. Magellanic Penguins (*Spheniscus magellanicus*) affected by chronic petroleum pollution along coast of Chubut, Argentina. Auk 111: 20–27.

Haimovici, M., A. M. Silva, & P. C. Vieira. 1996. Distribuição e abundância de peixes teleósteos demersais sobre a plataforma continental do sul do Brasil. Rev. Bras. Biol. 56: 27–50.

Hubold, G. 1980a. Hidrography and plankton off southern Brazil and Rio de La Plata, August-November 1977. Atlantica 4: 1–22.

Hubold, G. 1980b. Second report on hidrography and plankton off southern Brazil and Rio de La Plata, autumm-course: April–June 1978. Atlantica. 4: 23–42.

Laist, D. W. 1987. Overview of the biological effects of lost and discarded plastic debris in the marine environment. Mar. Poll. Bull. 18: 319–326.

Neves, T., & F. Olmos. 1998. Albatross mortality in fisheries off coast of Brasil. Pp. 214–219 *in* Robertson, G., & R. Gales (eds.). Albatross: biology and conservation. Chipping Norton, Surrey Beatty & Sons, Sydney, Australia.

Petry, M. V., L. Bugoni, & V. S. S. Fonseca. 2000. Occurrence of the Cape Verde Shearwater *Calonectris edwardsii* on the Brazilian Coast. Bull. Br.Ornithol.Club 120: 198–200.

Sick, H. 1997. Ornitologia brasileira. Ed. Nova Fronteira, Rio de Janeiro, Rio de Janeiro, Brasil.

Vooren, C. M., & A. C. Fernandes. 1989. Guia de albatrozes e petréis do Sul do Brasil. Sagra, Porto Alegre, Brasil.