

INGESTION OF ANTHROPOGENIC ARTICLES BY SEABIRDS AT MACQUARIE ISLAND

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Plastic particles and other anthropogenic debris are now common pollutants of the ocean surface (Pruter 1987). Plastic marine pollution is widespread, with debris washing up on sub-Antarctic and Antarctic beaches (Gregory *et al.* 1984, Gregory 1987, Ryan 1987a). Ingestion of plastics by seabirds has been reported for a number of species (for reviews see Day *et al.* 1985, Ryan 1987b). Recently, plastic ingestion has been reported from seabirds breeding off the coast of Antarctica (Green 1986, van Franeker & Bell 1988), and from sub-Antarctic seabirds off New Zealand and Southern Africa (Harper & Fowler 1987, Ryan 1987b). In this paper we report the first records of ingestion of anthropogenic material by seabirds at sub-Antarctic Macquarie Island (54 35 S, 158 55 E).

During the 1988-89 summer the diet of the Macquarie Island Cormorant *Phalacrocorax atriceps purpurascens* was investigated through the examination of regurgitated casts, and the presence or absence of plastic particles was recorded. In addition, any birds of other species which were found dead were collected, and their stomach contents examined for the presence of plastic or other man-made materials. Specimens examined were: Kelp Gulls *Larus dominicanus*, Subantarctic Skuas *Catharacta antarctica* and Southern Giant Petrels *Macronectes giganteus*, all of which were collected between April 1988 and February 1989. Other specimens (collected dead at Macquarie Island between 1968 and 1977) included Lightmantled Sooty Albatrosses *Phoebastria palpebrata*, Southern Giant Petrels, and a single Wandering Albatross *Diomedea exulans*.

The frequencies of occurrence of anthropogenic items in seven species of seabirds at Macquarie Island are shown in Table 1. Expanded polystyrene spheres, the result of the breakdown of blocks of expanded polystyrene, were recorded in five of 64 cormorant casts. Only a single sphere was found in each cast, and all casts contained the remains of food items. Two Subantarctic Skuas were found with small irregular shaped fragments of degraded plastic bottles (approximate dimensions 30 mm x 20 mm). One Southern Giant Petrel contained eight expanded polystyrene spheres, and a small Japanese plastic squeeze tube (60 mm length) was recovered from near a Southern Giant Petrel nesting colony. One Kelp Gull had three small flexible plastic rings (15 mm diameter) in the proventriculus, and two other Kelp Gulls each contained one of the same type of rings. These rings are used to seal plastic bags in some food items used on the Australian National Antarctic Research Expeditions (ANARE) station at Macquarie Island. An eleven-month old Wandering Albatross chick was found to have swallowed a metal nest marker (230 x 50 x 3 mm), which had perforated the stomach wall, and was probably the cause of death.

The increase in plastic load among Macquarie Island Cormorants since the late 1970s, when Brothers (1985) recorded no plastic material in 47 cormorant stomachs, suggests an increase in plastic pollution in the sector of the Southern Ocean around Macquarie Island over the last decade. The facts that cormorants are inshore feeders and that expanded polystyrene has a relatively short life-span in seawater (Andrady 1988), suggest that the

pollution may originate from highly local sources (i.e. the ANARE station). However, pieces of expanded polystyrene of about 1 litre volume or less are virtually ubiquitous on the west coast beaches of Macquarie Island (Slip & Burton in press). The source of some of these objects can be identified as being from foreign ships, and the prevailing wind and currents make it unlikely that the rest of this pollution would have originated from the ANARE station. Thus, the plastic pollution is of local and oceanic origin. Despite small sample sizes, the absence of plastic objects from the stomachs of Southern Giant Petrels collected before 1980, and their presence since 1980, further support this suggestion of greater levels of plastic pollution at, and around Macquarie Island. An increase in plastic load has been reported for prions (*Pachyptila* spp.) in New Zealand (Harper & Fowler 1987). A dietary study of the Heard Island Cormorant conducted at a similar time of year to the present study, in 1980, 1985, and 1987-88, revealed no plastics in the casts, despite the examination of over 400 pellets (Green *et al.* 1990a). Individual differences in diet or foraging area could account for much intraspecific variability in plastic loads (Ryan 1988). However, both subspecies feed on benthic organisms; fish at Macquarie (Green *et al.* 1990b), and fish and polychaetes at Heard Island (Green *et al.* 1990a). The relative density of plastic pollution may be higher in the foraging area around Macquarie Island than that around Heard Island, since Heard Island is south of the Antarctic Polar Front whereas Macquarie Island lies just north of this front, and floating marine litter is known to concentrate around the various frontal systems of the Southern Ocean (Gregory *et al.* 1984, Day & Shaw 1987). Geographical variation in plastic loads of seabirds has been demonstrated for a number of species, and is generally attributed to varying densities of plastic pollution at sea (Day *et al.* 1985, Furness 1985, Ryan 1988).

Ingestion of plastic objects by seabirds can occur at sea or on land, depending on the foraging behaviour of that species. Some of the birds

examined feed both at sea and on land (Harper *et al.* 1985). The Macquarie Island Cormorant feeds only at sea (Brothers 1985), and would probably have ingested the small polystyrene beads while feeding. These may have been accidentally ingested during a foraging bout or mistaken for food and deliberately ingested. It is also possible that secondary ingestion may have occurred where these objects were ingested by, for example fish, which were in turn ingested by the cormorants. Southern Giant Petrels feed both at sea and on land (Johnstone 1977). It seems likely that the Japanese squeeze tube was ingested by the Southern Giant Petrel while at sea, possibly when scavenging from garbage dumped from a ship. This object may have been regurgitated while feeding young. The ingestion of plastic rings by Kelp Gulls is likely to have occurred on Macquarie Island. These birds were regularly observed feeding around the rubbish dump on Macquarie Island, and could easily have ingested these items there. Similarly, Subantarctic Skuas and Southern Giant Petrels scavenge food scraps from about the station, and in doing so could accidentally ingest small plastic fragments.

It is not possible to attribute the ingestion of plastic items as the cause of death of any of the birds we examined. There were no signs of physical damage (such as lesions or scar tissue) or of impairment to the digestive systems. Apart from the plastic objects, the digestive tracts of dissected birds were empty. However, the Wandering Albatross chick apparently died from ingesting a metal nest marker which had been used to identify the nest site. Upon dissection, the stomach wall was torn, and the nest marker was protruding into the abdominal cavity. Adjacent body tissue exhibited damage attributable to stomach acids, and damage to internal organs was sufficient to cause death. Ingestion of anthropogenic material by seabird chicks generally occurs when objects are passed to chicks from adults during feeding (Pettit *et al.* 1981, Ryan 1988). However, direct ingestion of indigestible material from around the nest by chicks has been reported for a few species including the Laysan Albatross *Diomedea immutabilis* (Fry *et al.* 1987). It seems

likely that the nest marker was ingested directly by the Wandering Albatross chick, which demonstrates the potential hazard to seabirds of litter and other anthropogenic material in the vicinity of seabird nest sites.

Thus, the problem of ingestion of anthropogenic material by Southern Ocean seabirds is twofold; the major problem appears to be the large scale dispersal of rubbish from ships at sea, with small scale dispersal of plastics also occurring around sites of human activity. This secondary problem is one which could increase dramatically with increased human activity unless particular care is taken in new developments and tourist activity.

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TABLE 1

PROPORTIONS OF ANTHROPOGENIC ITEMS INGESTED BY SEABIRDS COLLECTED AT MACQUARIE ISLAND. DATA FOR MACQUARIE ISLAND CORMORANTS (1975-70) FROM STOMACH CONTENTS OF HEALTHY BIRDS, MACQUARIE ISLAND CORMORANTS (1989) FROM REGURGITATED CASTS OF HEALTHY BIRDS, ALL OTHER SPECIES FROM BIRDS FOUND DEAD

Species (years of collection)	No.	Frequency (%)	Items per bird
Wandering Albatross (1974)	1	100	1
Lightmantled Sooty Albatross (1968-75)	3	0	-
Southern Giant Petrel (1977)	2	0	-
Southern Giant Petrel (1988)	5	40	2,8
Subantarctic Skua (1988)	3	67	1,1
Kelp Gull (1988)	5	60	1,1,3
Macquarie Island Cormorant (1975-79)*	47	0	-
Macquarie Island Cormorant (1989)	64	8	1,1,1,1,1
Heard Island Cormorant (1988)**	400	0	-

* from Brothers 1985

** from Green *et al.* 1990a for comparison