

EVIDENCE FROM SEABIRDS OF PLASTIC PARTICLE POLLUTION OFF CENTRAL CALIFORNIA

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Pollution by plastic particles is well documented in the Atlantic Ocean and has recently been reported from the Pacific Ocean (Colton et al. 1974; footnotes 11 and 12). Small polyethylene cylinders are used in the fabrication of plastic products and have been found in the effluent of plastic manufacturing plants (Colton et al. *ibid.*). Ingestion of plastic particles has been reported for eight species of fishes and one chaetognath by Carpenter et al. (1972); for Atlantic species of petrels, terns and gulls by Rothstein (1973) and by Hays and Cormons (1974); and for unidentified seabirds by Colton et al. (*op. cit.*). Bond (1971) found whitish or orange synthetic spheres in 20 Red Phalaropes (*Phalaropus fulicarius*) found dead on beaches of the San Diego area.

We have found polyethylene cylinders, styrofoam, synthetic sponge, small pieces of flexible food wrap, and pieces of rigid plastic in the stomachs of nine seabird species collected on Monterey Bay, California in 1974 and 1975. The most common items were polyethylene cylinders and other plastic items. Most of the cylinders recovered from the seabirds occurred as singles, but several agglomerations of two to four cylinders were found. The cylinders were buoyant in sea water, and the most common colors were white, brown, yellow, green and red. They ranged in size from 1 to 4 mm in diameter and 1 to 3 mm in depth. Most of the cylinders had rounded rather than sharp edges, indicating considerable wear (Colton et al. *op. cit.*). The wear may have occurred on the beach or in the stomachs of the birds. We did not find polyethylene cylinders or other plastic items in neuston samples from Monterey Bay, but pieces of flexible food wrap and styrofoam were regularly observed on the surface waters. The absence of polyethylene cylinders in the neuston samples and the rounded edges of the cylinders recovered from the seabirds indicate that the cylinders were probably not ingested in the Monterey Bay area. However, polyethylene cylinders have been found on beaches at Kalaloch, Washington and from seabird gizzards in the Aleutian Islands (Colton et al. *op. cit.*).

Potential problems for seabirds include intestinal blockages and toxic effects. Carpenter et al. (*op. cit.*) speculated that plastic particles might cause intestinal blockages. The high incidence of naturally occurring indigestible items such as cephalopod beaks, fish otoliths, and pebbles in the stomachs of seabirds suggests that plastic particle pollution does not present an immediate problem; however, the abundance of plastics on the oceans will continue to increase for some time even if control measures are implemented immediately (Colton et al. *op. cit.*). Surface feeding species may be mistaking buoyant plastic particles for food, or the birds may be acquiring the plastic particles in place of pebbles which were commonly found, as well (Table 1). The continued accumulation of buoyant plastics in oceanic waters may eventually have a deleterious effect—possibly by mechanical interference with digestion; however, concentrations of 5 parts per million of polychlorinated biphenyls (PCBs) have been extracted from surface film on plastic spherules (Carpenter et al. *op. cit.*). The presence of toxic materials in or on plastics is probably the most serious potential hazard to seabirds.

NOTES

Table 1. Number and frequency of occurrence of polyethylene cylinders, other plastic items, and pebbles in the stomachs of seabirds collected on Monterey Bay, California in 1974 and 1975.

	N	POLY-ETHYLENE CYLINDERS		OTHER PLASTIC ITEMS		PEBBLES	
		Num-ber	Fre-quency	Num-ber	Fre-quency	Num-ber	Fre-quency
Short-tailed Shearwater							
<i>Puffinus tenuirostris</i>	6	119	100	11	71	24	29
Sooty Shearwater							
<i>P. griseus</i>	21	106	43	39	24	6	19
Pink-footed Shearwater							
<i>P. creatopus</i>	5	11	20	1	20	2	20
Northern Fulmar							
<i>Fulmarus glacialis</i>	3	23	100	11	100	16	67
Black-legged Kittiwake							
<i>Rissa tridactyla</i>	8	2	13	2	13	—	—
Glaucous-winged Gull							
<i>Larus glaucescens</i>	8	—	—	1	13	10	50
Heermann's Gull							
<i>L. heermanni</i>	15	1	7	1	7	27	13
Mew Gull							
<i>L. canus</i>	4	—	—	1	25	—	—
Rhinoceros Auklet							
<i>Cerorhinca monocerata</i>	26	—	—	3	4	1	4

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