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Mercury, DDE, and PCBs in Eggs from a Norwegian Gannet Colony

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In 1972 eggs of five different species of seabirds were collected from various sites along the Norwegian coast and analysed for residues of mercury, DDE and PCBs (FIMREITE et al. 1974, 1977).

Among these were 10 gannet (Morus bassanus) eggs from a relatively newly established colony at Nordmjele in northern Norway. The residues in the latter were in contrast to the other species relatively high and, at least as far as mercury is concerned, within the range of those that had been related to reproductive impairment in pheasants (Phasianus colchicus) (FIMREITE 1971). Therefore the procedure was repeated for gannets in 1978 to see if any change in the residue levels had taken place, to the better or worse, during this six years period.

MATERIALS AND METHODS

In 1972 as well as in 1978 addled eggs were collected in July and kept frozen at -24° C until analyzed. The collection site, Nordmjele, is located at 69° 08' N in northern Norway.

The eggs were analyzed for DDE and PCBs by a gaschromatographic method described by BJERK & SUNDBY (1970) and by FIMREITE (1977). Analysis for total mercury by flameless atomic absorbtion spectrophotometry using a 150 x 10 mm quartz-windowed cuvette followed the procedure of HATCH & OTT (1968). The 1972 material was analyzed for methylmercury as well according to a method developed by MAGOS (1971).

RESULTS

Results presented in Table 1 show that the average total mercury level has increased from 0.58 to 0.80 ppm between 1972 and 1978. Analysis of the 1972 material for methylmercury revealed that practically all the mercury occurred in this form. In contrast to mercury the corresponding DDE and PCBs levels decreased substansially in the same period, from 2.1 to 0.66 and from 7.7 to 3.5 ppm respectively. All these changes were shown by t-test to be highly significant ($P < 0.01$).

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TABLE 1. Mercury, DDE and PCBs in Gannet Eggs (ppm, wet weight basis) in 1972 and 1978, respectively.

Compound	1972 (n = 10)		1978 (n = 11)	
	$\bar{X} \pm$ S.D.	Range	$\bar{X} \pm$ S.D.	Range
Mercury	0.58 ± 0.12	0.45-0.80	0.80 ± 0.09	0.66-0.94
DDE	2.1 ± 1.5	0.59-5.2	0.66 ± 0.27	0.26-1.2
PCBs	7.7 ± 4.6	2.1 -17	3.5 ± 1.7	1.8 -7.4

DISCUSSION

The high mercury levels in the eggs, and especially the increase in such levels between 1972 and 1978, are difficult to interpret. Except from a few fish processing plants there are no industrial activities in the vicinity of the gannetry and the population is scattered. Previous studies have revealed very low mercury levels in seabirds other than gannets in northern Norway (FIMREITE et al. 1977). Local sources are therefore not expected.

Since Norwegian gannets have their winterquarters in the southern and generally more contaminated European coastal waters (HAFTORN 1971) they may build up a body burden of toxic chemicals sufficient to account for the residues of the fat soluble organochlorines that easily mobilize. But transfer of mercury stored in tissues to the eggs is probably less significant as mercury is thought to be transported to the eggs via serum proteins to which it is bound and which are assumed to be dependent upon the level in the food (GILBERTSON 1974). The latter is supported by results of experiments conducted in chickens (TEJNING 1969) and pheasants (FIMREITE 1971).

The gannets are top-predators living on relatively large surface dwelling fish (CRAMP et al. 1974). As some of fish species observed frequently in the stomach of gannets from the present colony, such as coalfish (Pollachius virens), are roving widely, they could possibly bring pollutants from distant waters and thus be responsible for the present high mercury levels in the eggs. Unfortunately, however, such fish were not analyzed

The sharp decline in DDE and PCBs levels between 1972 and 1978 may reflect a corresponding tendency in fish the gannets feed on. A yet unpublished report by the present authors (continuation of the study by

KVESETH et al. 1979) indicates that both DDE and PCBs levels were significantly reduced between 1972 and 1977 in several fish species included in a study from western Norway.

With respect to adverse biological effects there is no indication of such in the present study. Gannets are sensitive to the shell thinning properties of DDE that reduces the eggs' vaterite cover (COOKE 1979), but the present DDE levels are well below those considered to be harmful (NETTLESHIP 1975). The mercury levels probably deserve most attention. The gannets reproduce normally, but since the levels are within the range of those associated with negative influence on hatchability in pheasants (FIMREITE 1971) and other sublethal effects in mallards (Anas platyrhynchos) (HEINZ 1979) any further increase in the mercury concentration is reason for concern.

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