CRUDE OIL INGESTION BY SEABIRDS: POSSIBLE METABOLIC AND REPRODUCTIVE EFFECTS

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Previous laboratory and field studies have shown that small amounts of ingested crude oil reduce growth and alter endocrine balance in young seabirds (Miller, et al., Science, 199: 315, 1978; Butler and Lukasiewicz, Auk, 96: 809, 1979; Peakall et al., Ambio 9: 28, 1980; Peakall et al., Environ Res., in press). We present here the results of initial experiments concerned with two problems related to oil toxicity in birds. First, does ingested oil affect metabolism? Second, does oral dosing of adult seabirds affect the growth and survival of their young?

In laboratory studies, nestling herring gulls (Larus argentatus), of about 1000 g body weight, were collected, brought to MDIBL and maintained as before (Miller et al. op. cit). After a 3 day acclimation period, birds were assigned to control or experimental groups and experimentals were given a single 1 ml dose of a Prudhoe Bay crude oil (PBC) or of a 9/1 PBC/dispersant (Corexit) emulsion by intubation; controls were sham dosed. Following dosing, both groups were given seawater to drink, but were deprived of food. Birds were weighed daily and 0.2 ml blood samples were taken (wing vein) periodically for determination of plasma hormones, carbohydrates, lipids and ketone bodies (plasma analyses not yet available). As shown in Fig. 1, dosed and starved experimentals lost weight at a

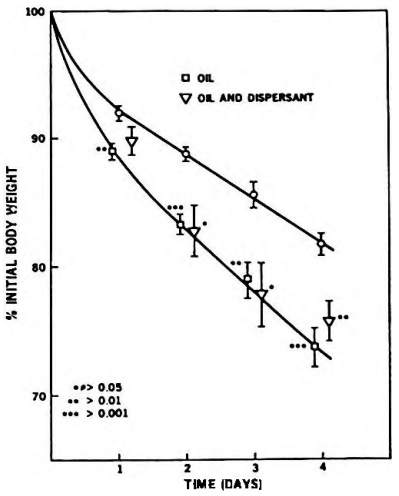

Figure 1.--Effect of oil or oil plus dispersant dosing on body weight loss of starved herring gulls. Birds were dosed once and food removed on day zero; control values given by open circles. Data given as mean ± SE for 5-8 birds.

rate that was nearly twice that of starved controls. Dosing with oil/dispersant emulsion had no greater effect on weight loss than oil alone. Since birds were not fed during the experimental period, the data suggest that oil dosing caused a change in metabolic rate and/or the adaptive pathways. This change in metabolism may be one underlying cause of the reductions in growth rates observed in previous oil dosing studies. Interestingly, lightly oiled, adult mallard ducks have shown increased basal metabolic rates 4-10 d after a single brief exposure period (Lambert, unpublished data). This elevation in metabolic rate is most likely due to oil ingested during preening, rather than chronically oiled plummage.

In a field study (conducted on Little Duck Island), Leach's Petrel (Oceanodroma leucorhoa) burrows were assigned to a control or one of two experimental groups. For one experimental group, one adult bird was given a single 0.1 ml dose of PBC by intubation; for the other, both adults were dosed. Controls were sham dosed. Experimental burrows were further divided into those with adults dosed when their chicks were 3-5 days old and those with adults dosed when their chicks were about 15 days old. Dosing the adults caused a significant decrease in survival among the 3-5 day chicks (16 of 16 controls survived; of the 23 chicks from burrows with 1 dosed adult, 16 survived; and of the 21 chicks from burrows with 2 dosed adults, 11 survived), however, the weight gain of the survivors was little affected. With 15 day chicks, no mortality was found in experimental or control chicks, but weight gain was significantly reduced for 3-6 days after adults were dosed (Fig. 2). Eventually experimental

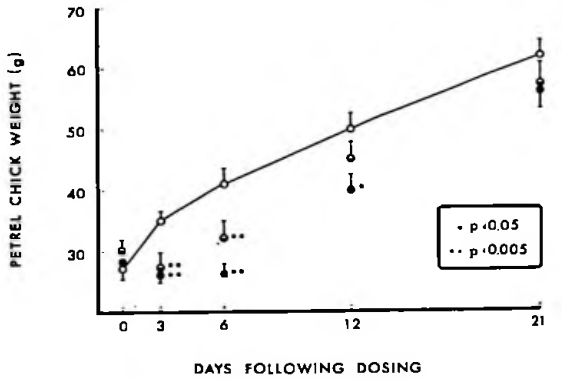

Figure 2.--Weight gains for petrel chicks (15 day old when adults dosed) from burrows in which adults were either sham-dosed (controls) or fed 0.1 ml of PBC. Data given as mean + SE for 8 (control, open circles), 8 (1 adult dosed, half-closed circles) or 9 (2 adults dosed, closed circles) chicks.

chicks appeared to recover; however, even after 21 days, the growth rates (for the entire experimental period) were slightly, but significantly lower than controls. In this experiment, we measured nest visitation by adults and found no differences between any of the groups, indicating that adults were not deserting after they were dosed. We also dosed 15 day old petrel chicks directly and found no reduction in weight gain; taken together, the data suggest that the adult's ability to provide food for their young is impaired by oil dosing. In support of the hypothesis that oil affected adults, we have found that when adults were given 0.1 ml of PBC, released and then recaptured 2 weeks later, nasal and adrenal gland weights and plasma thyroxine levels were increased over controls (Butler et al., Bull. MDIBL, 19: 33, 1979; Peakall et al., op. cit.). These findings point to a previously unsuspected mechanism of oil toxicity in seabirds. Further studies are clearly needed to determine the environmental significance of the observed effects. (Supported by USPAS Grant ES 00920.)

EFFECT OF INFUSIONS OF SALINE IN THE DOGFISH IN VIVO ON THE RATE OF SECRETION BY THE RECTAL GLAND

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While considerable advances in our understanding of the physiology of the rectal gland have been made in recent years, a number of important questions remain unanswered. In particular, little is known about the hemodynamic, neural and hormonal agents that control rectal gland secretion. One hormone, vasoactive intestinal peptide, has been identified by Stoff in the plasma of the dogfish shark and has been shown to stimulate rectal