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# EFFECTS OF OIL AND DISPERSANTS ON BIRDS

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## Effects of Oil on Birds

The effects of oil on birds have been reported in detail during the past 20 years. Plumage oiling disrupts feather structure and causes matting of feathers; birds die from exposure and drowning (Bourne 1968, Vermeer and Vermeer 1975). Oil ingestion can cause a variety of sublethal changes in avian physiology and behavior (Albers 1983; Leighton et al. 1983), although the changes observed in different studies have not been consistent. Small amounts of petroleum transferred to eggs from plumage or nest material can be lethal to bird embryos; field observations (Gordon 1929, Rittinghaus 1956) and experiments (Albers 1977, White et al. 1979, Albers 1980, and others) have shown that both crude and refined oils can cause mortality in a variety of species. The short-term disruption of bird habitat can displace birds from their normal sites of activity (Buck and Harrison 1967, Hope Jones et al. 1978). Probable causes of disruption are petroleum fumes, contaminated prey items, lack of available prey, and cleanup activities. Long term disruptions, such as several years of altered vegetation and reduced populations of some prey items, could have a concurrent extended impact on bird populations. Interpretation of the previously mentioned effects of oil on birds is a difficult matter involving species differences, circumstances of the oil spill, and uncertainties about the seriousness of some of the sublethal effects (Albers 1983).

Population changes are the final measure of the impact of oil pollution on any organism. Determinations of bird population changes require

consideration of reproductive potential, movement between population centers, and the pre-spill status of species populations. Simulation modelling studies of colonial Alaskan seabirds (Wiens et al. 1979, Ford et al. 1982) have shown that long-lived seabirds with low reproductive potential [e.g., Cassin's auklet (*Ptychoramphus aleuticus*), common murre (*Uria aalge*)] are more seriously affected by adult mortality than by occasional decreases in reproductive success. The recovery time for a colony of these birds would be greatly increased in a location where birth rates were already slightly decreased or death rates were already slightly increased by chronic oil pollution. Movement of individuals from an unaffected area to the oil-impacted site can compensate for some mortality and reduced reproduction. However, rare species or species at the edge of their range do not have this compensatory potential and will only exhibit the recovery ability of the survivors (Bourne 1978).

The biological meaning of the impact of an oil spill on bird populations depends on the level of evaluation. An examination of local populations might reveal significant changes due to reduced numbers of birds, interrupted reproduction, and an altered distribution of birds. If we examine the impact at the species or regional level, the local changes could be lost among the natural population fluctuations of a much larger number of birds. The latter appears to be the case for western European seabird populations (Dunnett 1982).

A non-biological aspect of oil-induced avian mortality and stress is the reaction of humans to it. The sight of distressed or dead birds triggers strong emotions that are not easily dispelled with arguments about "population effects" or "reproductive compensation". The only satisfactory action is a meaningful effort to aid the disabled birds and reduce the potential for future oil spills.

All birds that frequent water areas can be affected by surface oil. However, species that spend much of their time on or in the water are especially vulnerable. Central and southern California have a number of high-risk species that either breed or winter in coastal areas. These include:

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| Alcid | common murre<br>pigeon guillemot, *Cepphus columba*<br>marbled murrelet, *Brachyramphus marmoratus*<br>Xantus' murrelet, *Synthliboramphus hypoleucus*<br>ancient murrelet, *Synthliboramphus antiquus*<br>Cassin's auklet<br>rhinoceros auklet, *Cerorhinca monocerata*<br>tufted puffin, *Fratercula cirrhata* |
| Cormorant | double-crested cormorant, *Phalacrocorax auritus*<br>Brandt's cormorant, *Phalacrocorax penicillatus*<br>pelagic cormorant, *Phalacrocorax pelagicus* |
| Grebe | horned grebe, *Podiceps auritus*<br>eared grebe, *Podiceps nigricollis*<br>western grebe, *Aechmophorus occidentalis*<br>pied-billed grebe, *Podilymbus podiceps* |
| Loon | common loon, *Gavia immer*<br>Arctic loon, *Gavia arctica*<br>red-throated loon, *Gavia stellata* |
| Merganser | red-breasted merganser, *Mergus serrator* |
| Duck | mallard, *Anas platyrhynchos*<br>northern pintail, *Anas acuta*<br>green-winged teal, *Anas crecca*<br>American wigeon, *Anas americana*<br>northern shoveler, *Anas clypeata*<br>redhead, *Aythya americana*<br>ring-necked duck, *Aythya collaris*<br>canvasback, *Aythya valisineria*<br>lesser scaup, *Aythya affinis*<br>common goldeneye, *Bucephala clangula*<br>bufflehead, *Bucephala albeola*<br>oldsquaw, *Clangula hyemalis*<br>harlequin duck, *Histrionicus histrionicus*<br>white-winged scoter, *Melanitta fusca*<br>surf scoter, *Melanitta perspicillata* |

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|---|---|
| Goose | Canada goose, *Branta canadenis*<br>brandt, *Branta bernicla*<br>greater white-fronted goose, *Anser albifrons* |
| Endangered species | brown pelican, *Pelecanus occidentalis* |

Effects of Dispersants on Birds

Three basic procedures exist to protect birds from spilled oil: (1) remove the oil before it reaches the birds, (2) move the birds out of the path of the oil, and (3) alter the physical nature of the oil so that its impact on birds is decreased. The first two procedures are often inadequate, particularly in large spills or during bad weather. Dispersants, if properly used, offer an important alternative that is faster and easier than removing oil or moving the birds. Dispersant use has been promoted as a method of protecting birds because it moves oil from the water surface into the water column. The minute particles of oil are kept beneath the surface by wave action. It is assumed that the particles of oil, unlike nondispersed oil, will not adhere to bird feathers. It is further assumed that the presence of the chemical dispersant in the water will have no significant negative effect on birds.

So much for the theory, but how have dispersants done in actual use? Published descriptions of the consequences of dispersant use seldom contain anything other than a general reference to the numbers of birds thought to be killed (e.g., Dixon and Dixon 1976, Bourne 1979) by the oil. Field evidence relevant to the question of whether dispersants can protect birds from oil is absent from scientific literature. The only published study (Lambert et al. 1982) to evaluate the ability of a dispersant to protect birds from the effects of oiling produced some negative results. Mallard ducks exposed to dispersant in water were less bouyant and stayed wet longer than control birds or oil-exposed birds. Ducks exposed to dispersed oil were just as soaked as

birds exposed to dispersant alone and had plumage that was just as matted as the oil-exposed ducks. Oil-exposed and dispersed-oil-exposed ducks exhibited significantly increased basal metabolic rates when placed in a cold chamber immediately after 1 hour of exposure. Dispersant-exposed ducks did not exhibit an increase but the authors were concerned that if the ducks were exposed longer than 1 hour to the dispersant in water, the observed wetting of feathers would increase. Dispersant concentration in the water was about 6.7 ppm and the oil:dispersant ratio was 30:1. The results of this study are partially subjective and certain aspects of the experimental protocol are debatable, but the results do imply that the chemical dispersant tested (Corexit 9527) might not be as beneficial as previously assumed, particularly if the dispersant is sprayed on or near the birds being protected. Additional work similar to the efforts of Lambert et al. (1982) is necessary.

A small number of experiments dealing with the effects of dispersants (mostly Corexit 9527 or unidentified Corexit dispersants) on birds have produced information on a variety of relations. Studies using wild birds [herring gulls (*Larus argentatus*), Leach's storm-petrel (*Oceanodroma leucorhoa*)] showed that ingested dispersant or dispersed crude oil had no greater impact on weight gain, organ weights, corticosterone levels, or plasma thyroxine levels than did crude oil alone (Butler et al. 1979, Miller et al. 1980, Peakall et al. 1981). Studies with wild-strain mallards in captivity showed that ingested dispersant and ingested dispersant mixed with crude oil had less of an effect on the weight gain and blood chemistry of young birds than crude oil alone (Eastin and Rattner 1982). In an egg-oiling experiment, dispersant alone or mixed with crude oil was at least as toxic to mallard embryos as crude oil (Albers 1979). Dispersant sprayed on water did not affect mallard incubation or egg hatching, and mallards exposed to partially dispersed crude

oil had about the same hatching success as those exposed to undispersed crude oil (Albers and Gay 1982). A study using pekin mallard ducklings showed that dispersed crude oil caused a greater reduction in mucosal water and $Na^+$ transfer in the intestines than did undispersed crude oil (Crocker et al. 1974). The previously described studies indicate that dispersants should not be sprayed on breeding colonies and that ingested dispersed oil might cause some negative effects on salt water tolerance.

## Considerations for Use of Chemical Dispersants

The following considerations for dispersant use are based on the fundamental assumption that surface oil is more of a hazard to birds than oil dispersed in the water column. The previously discussed information gathered from scientific publications has also been incorporated.

1. If a chemical dispersant is to be used, priority should be given to using it before the oil enters important bird habitats, i.e., breeding sites, wetlands, migration and wintering areas, heavy use sites, or endangered species habitat.
2. The use of dispersants on breeding sites is undesirable because of the threat to bird eggs and the disturbance potential of dispersant application. Dispersants are not desirable for use in coastal marshes because of a great deal of concern within the scientific community about the ecological consequences of such action (e.g., Cowell 1978).
3. Use of dispersants in migration and wintering areas, heavily used coastal sites, and endangered species habitat should be considered as a possible option if the potential exists to save significant numbers of birds.

4. Avoid unnecessary spraying of birds; i.e., birds near an oil slick or birds in light oil that poses only a minimal threat.
5. The cleanup of shorelines or islands, with or without the use of dispersants, should not be undertaken if breeding birds will be disturbed or if mechanical damage will be extensive.

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