The attempted rehabilitation of oiled sea birds

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Introduction

Water birds nowadays risk pollution by crude oil, oily wastes and oil products. Böös (1964) estimated that the number of birds oiled each year ran into millions. Although in recent years some progress has been made towards controlling the discharge of oil at sea (Barclay-Smith 1967) the problem is still enormous, part of Man's attrition of the natural environment.

Marine birds are the most affected, and especially the auks. For instance, Tuck (in McCallum 1964) reports that an estimated 250,000 auks have been lost in two years from one important colony off Newfoundland and he considers it will be wiped out in a few years if pollution continues at the same rate. The numbers of auks in the southern parts of the British Isles have markedly declined during the last 20-30 years (Boyd 1956, Parslow 1967) and oiling was already thought of as an important factor before the Torrey Canyon disaster killed an estimated 30,000 birds, nearly all auks, off England and France (Bourne *et al* 1967). Divers are also frequent victims and among wildfowl, eiders *Somateria* spp., scoters *Melanitta* spp. and the Long-tailed Duck *Clangula hyemalis* have suffered losses in tens of thousands in some incidents (McCallum 1964; Harrison 1967). In March 1968, 1,300 Common Eiders and scoters were found oiled in the Firth of Tay in Scotland (J. J. D. Greenwood, pers. com.). In May 1968 in South Africa colonies of penguins were seriously affected by oil (D. Hey, pers. com.). The Canvasback *Aythya vallisneria* and the Mute Swan *Cygnus olor* provide examples of freshwater birds which often suffer destruction from oiling.

The world demand for oil is still increasing and tankers are already carrying more than the 119,000 tons in the 'Torrey Canyon'. International codes and legislation may reduce the amount of oil deliberately discharged, but massive accidental pollutions will occasionally occur and cause heavy damage. Thus pollution will be with us for some long time yet. Many people have attempted to rehabilitate oiled birds, but the success rate has almost invariably been very low. Looking after these birds is very expensive in terms of effort, time and money and it has been suggested that most if not all oiled birds should be humanely killed (Rook 1967).

The 'Torrey Canyon', carrying sour Kuwait crude oil, grounded on the Seven Stones reef off Land's End on 18th March 1967 and within days numerous oiled birds, many of them migrants, were found on the Cornish beaches. By 17th April over 8,000 birds had been picked up alive and taken to centres run by the R.S.P.C.A. and R.S.P.B. Over 2,000 were moribund, leaving 5,811 which were cleaned (R.S.P.C.A. 1967).

Although very little hope could be held out for these birds, the Wildfowl Trust offered to take some from the overcrowded centres in Cornwall and attempt to rehabilitate them, gleaning as much information as possible from their day to day management and treatment. In particular, post-mortem and pathological studies were to be carried out to determine the causes of death.

Cleaning

Some of the materials and methods used for cleaning at the various centres proved to be unsuitable for emaciated and highly stressed birds. The process took far too long, the detergents caused irritation, and often oil stains were still left. Towards

the end of the rescue operation Tremalon B, a cosmetic cleaning agent (mascara remover), became available. It was easier to use, removed all oil stains and did not affect the eyes or cause dermatitis. However the cleaning process was still too long and again left the bird without waterproofing.

Another method was to leave the bird to clean itself. This is probably not advisable since Hartung and Hunt (1966) have shown that a bird can quickly remove and ingest sufficient oil to cause serious internal damage. A variation was to coat the bird with cleansing agent and then prevent it from preening by enclosing its body in a sack. This also rests the bird and reduces stress. J. A. Griswold (pers. com.) has cleaned scoters by immersion in water through which ultrasonic vibrations were passed. This takes only a few minutes but as before the birds end up without waterproofing and there are some dangers to birds and operators to be guarded against. Odham (1968) has recently formulated a three-component cleaning agent, Larodan 127, which is said to clean and re-waterproof in one operation. The indications are that it is an improvement on previous materials.

After cleaning, the birds were partly dried with absorbent materials and then placed in a small pen with a hot air fan. When completely dry they were transferred to a larger pen. Sprats or in some cases sand-eels were used for food, often after initial force-feeding.

Two batches of cleaned birds were brought the 200 miles to Slimbridge by lorry: 13 Guillemots *Uria aalge* and 4 Razorbills *Alca torda* on 28th March, and 75 Guillemots, 2 Razorbills and 3 Shags *Phalacrocorax aristotelis* on 2nd April. A single Razorbill, also a 'Torrey Canyon' victim, came from another source on 1st June.

General management

Many species of water bird are difficult to keep in captivity and auks, healthy and oiled, have only survived in zoos for an average of two months and a maximum of 11 months (J. Yealland, pers. com.). Auks brought in for rehabilitation are usually already in poor condition. They preen and ingest oil which damages the gut, the effect being worsened by the surfactants used to disperse the oil. Waterproofing and insulation is largely lost and the body temperature tends to fall. To maintain their temperature the birds should increase their food intake but instead they spend a disproportionate amount of time preening (Hawkes 1961). They therefore become emaciated, as were the Tay Eiders. Hartung (1967) has shown experimentally that the energy metabolism of oiled ducks does increase markedly to make up for the extra heat loss. As this would require twice the normal food intake to maintain, their body fats are used up instead. Only if internal damage is not severe and body fats are still present may a bird survive. Hartung and Hunt (1966) also showed that many internal organs were affected by oil. His birds had enlarged adrenals, indicative of stress conditions. The lethal dosage of oil was lower for birds further stressed by overcrowding and by cold.

Eighty-seven of the 97 birds arrived alive and were put in four concrete pens with a covered heated area with a raised wire-mesh floor. Outside, the birds had a small freshwater pond in which to bathe. Washing and preening often had to be stimulated by giving the birds showers on the warmer days. The floors were regularly hosed down and periodically disinfected with 'Erasan 125' a disinfectant with a very low avian toxicity. At first the birds were shut in at night but as their condition improved this restriction was gradually removed, completely so by the end of May.

In June the survivors were transferred to a much larger grassed pen with a covered heated area with a raised floor of P.V.C. coated Weldmesh ($\frac{1}{2}''$ square). In the open part there was an oval freshwater pond (12′ × 8′ × 20″ deep) fed by tapwater. Artificial cliffs were constructed of blocks, covered in soft-board and polythene sheeting to reduce leg and wing abrasion.

Diet

Initially the birds were fed sliced coley fish but after two weeks they were given thawed deep-frozen sprats, in a $3\frac{1}{2}\%$ weight to volume solution of sea-salt. Every effort was made to keep the food fresh, for even hungry birds would refuse tainted fish. The two surviving Shags ate sprats for three weeks but ignored them once they became used to taking live eels from the pond. In the late summer sprats were no longer available and small chopped eels were alternated with coley fish.

Supplements were added to the food to compensate for probable deficiences in the diet. Vitamins A and D (Scott's Emulsion), B (in Abidec) and B_{12} (Cytacon) were initially added to the fish. Later it was found easier to give the additives in

a capsule placed inside a sprat: each bird was thus given daily ¾ gm. of 'Bloom', a multivitamin and mineral food supplement, with additional vitamins B_1, B_2 and B_{12}.

Mortality and Pathology

The pattern of mortality and post-mortem findings are described in detail elsewhere (Beer 1968). The rate of loss of the auks followed approximately an exponential curve and can be divided into four phases.

Phase 1 (94 live birds, 14 deaths, mean mortality rate 20% per day) was the day of the journey from the Cornish centres. The additional stresses of a long journey, handling and new quarters, acting on birds that were already very sick, probably caused this high mortality rate.

Phase 2 (80 live birds, 33 deaths, 13% per day) lasted from arrival at Slimbridge to the 4th day, by which time half the original birds were dead. In general the post-mortem picture was similar in phases 1 and 2. The birds were emaciated, weighing at death an average of 640 gm. compared with a fat, rehabilitated bird of between 800 and 1,000 gm. The gut was severely affected by enteritis, with coagulative necrosis and haemorrhage in many cases. The lungs were often congested and the air-sacs clouded. Gross renal changes were more frequent in phase 2.

Phase 3 (47 live birds, 11 deaths, 1.4% per day) lasted from the 4th day until 3 weeks and was characterised by a transition from the acute conditions of phases 1 and 2 to the chronic conditions of phase 4.

Phase 4 (36 live birds, 25 deaths, 0.4% per day) started at 3 weeks and was terminated at 28 weeks, when most of the survivors were released. The acute enteric conditions were no longer important but aspergillosis, a secondary condition frequently found in stressed and debilitated birds, predominated. Another serious disease was infective arthritis. The feet and 'ankles' of auks are not adapted to long periods on land. The skin becomes calloused and cracked by contact with a hard surface while the joint develops arthritis, often becoming infected with *Staphylococcus* and other organisms. Renal disease was common, reflecting stress and the early toxic effects of oil and detergents.

Treatment

Infra-red heating was provided to reduce chilling and resultant respiratory conditions. Scott's Emulsion was given for six weeks to ameliorate toxic effects of oil and detergents on the gut, and Neomycin liquid was given for one week to control bacterial invasion of the gut wall (100 cc. and 10 cc./3 kg. fish respectively). At one station an intestinal disinfectant, Dianimal, was used (J. Hughes, pers. com.).

Aspergillosis cannot at present be successfully treated. Pimaricin (Royal Dutch Fermentation Industries) has been used in man with some response but preference was given to an experimental drug. Injected intramuscularly, the drug did not stop the deaths but the lesions were small and the form of the mycelium suggested some inhibition of the fungus. Griseofulvin was used at one centre but there is no evidence that it is of any value against *Aspergillus fumigatus*. The use of Erasan 125 or Polysan as general disinfectants or in aerosol form can do much to reduce the number of fungal spores in the bird's environment and thus improve the chances of its avoiding the disease.

Prevention of arthritis poses a serious problem and it is evident that an ideal type of flooring for maintaining large numbers of auks has yet to be devised. Possibly the best at the moment is Weldmesh with a soft plastic coating. This also lets the droppings through and avoids contamination of the feathers. Had this been used from the start, it is possible that the incidence of arthritis in our birds would have been lower. If, despite general hygienic measures, the ankle joints became infected, Ampcillin, ½ ml. 2 days, was injected intramuscularly. If tests showed the staphylococci to be resistant, streptomycin (Dimycin) was also used. When the webs became involved antibiotic powders and antiseptic creams were rubbed into the lesions. Even bland creams may help by keeping the foot supple.

Restoration of waterproofing

The rapid restoration of waterproofing is the crux of the whole problem of rehabilitation. Experience to date shows that birds have to be kept for many months before this is achieved and they can be returned to the sea.

When the birds arrived at Slimbridge their feathers were mostly oil-stained, sticky, disarranged and no longer waterproof. It was felt that the additional stress involved did not warrant removal of this staining by further cleaning. The amount of oil that the bird could still ingest by preening was too small to cause significant additional internal damage. The survivors were in fact free of oil stain in

about two months but were still not fully waterproof.

For a feather to be waterproof its components must have a regular structure (Elder 1954) of certain dimensions (Rijke 1968) and a water-repellent surface. It is possible that, as in some plants, a micro-rough surface is needed for strong water repellency (Amsden and Lewins 1966). Oiling, handling and cleaning disarrange the feathers and probably damage their fine structure. The bird's attempts to preen its feathers back into their normal form may cause further damage. Little is known about the rate of preening in wild auks, but the captives readily accepted opportunities to bathe and preen. Large pools are preferable in this connection to trays of water.

Even if a bird is able to preen its feathers back into a reasonable shape they are not fully waterproof until the water-repellent substances in or on the keratin of the feathers are replaced. The preen gland produces secretions which contain a great variety of ester waxes (Odham 1967). These compounds are spread, by preening, on to the feathers. Besides increasing water-repellency they probably keep the feathers more pliable and generally in better shape. Commercial ester waxes (Purcellin) sprayed in aerosol form on to the feathers improved waterproofing temporarily. Too large a dose clogs the feathers and the value of the waxes is then largely lost.

Despite cleaning, bathing, preening, and the application of waxes, in many cases full waterproofing is not regained until a new set of feathers has been grown. This may not be for a long time and meanwhile the birds die of secondary conditions. Thus anything that hastens moult would be of considerable value. Changing daylength is thought to be one factor controlling moulting. Our birds were therefore given artificial light at night, to simulate a 24 hr. day, until mid-June when the day was reduced by one hour per week until the end of July. Comparison with birds at one centre which did not use any artificial light suggested that the Slimbridge birds' moult was but slightly advanced. Another possible future approach might be to use hormones or drugs such as the commercial product I.C.I. 33828 which precipitates and shortens the moult period of female chickens (Sykes 1964).

Release

In mid-October 5 Guillemots, 3 Razorbills and 2 Shags, all considered to have regained good condition, were ringed and released on the north Somerset coast. Four birds were held back because of their poor plumage condition and arthritis. One of these died at 44 weeks of renal failure. The other three are alive after 18 months in captivity but their condition does not yet warrant their release. Of those birds which were released, long-term survival is not proven. Two were recovered within $2\frac{1}{2}$ weeks. Conder (1968) reports that of 60 birds ringed and released 16 were found dead within a month. Obviously success is only really achieved when the bird returns to a colony and breeds. Watching a bird out to sea for an hour or two and noting that it is still buoyant is not a very adequate measure.

Conclusion

Regretfully it must be concluded that it is better to kill humanely all but the lightly oiled birds, at least until improved rehabilitation techniques are available. The knowledge we have gained from our attempt, particularly with regard to mortality factors and restoration of waterproofing, may serve as a beginning to the research needed into all aspects of the problem. This should cover the toxicology of oils and detergents, the causes, effects and control of emaciation, stress and relevant acute and chronic diseases; the mechanism of waterproofing and methods of restoring it; nutrition; aspects of behaviour and the general management of the species most frequently oiled.

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Summary

Following the Torrey Canyon oiling disaster a number of sea birds, mostly auks, were cared for at Slimbridge. Methods of cleaning, management and feeding are described. The acute and chronic diseases developing in captivity were investigated, as were methods of treatment. The rapid restoration of waterproofing is considered the crux of the problem. Despite much effort, few birds could be returned to the sea and their long-term survival is in doubt. More research is needed before attempted rehabilitation can be considered a satisfactory alternative to humane destruction.

References

AMSDEN, R. C. and C. P. LEWINS. 1966. Assessment of wettability of leaves by dipping in crystal violet. *World Rev. Pest Control* 5 : 187-94.

BEER, J. V. 1968. Post-mortem findings in oiled auks dying during attempted rehabilitation. *Suppl. Field Studies.* In press.

BARCLAY-SMITH, P. 1967. Oil pollution. An historical survey. *Suppl. J. Devon Trust Nature Cons.* : 3-7.

BÖÖS, G. 1964. Oil on the seas. *Bird Notes* 31 : 185-8.

BOURNE, W. R. P., J. D. PARRACK and G. R. POTTS. 1967. Birds killed in the Torrey Canyon disaster. *Nature* 215 : 1123-5.

BOYD, H. J. 1956. Results of ringing Guillemots and Razorbills on Lundy, 1947-56. *Lundy Field Soc. 10th Ann. Rep.* : 19-25.

CONDER, P. 1968. To clean or kill. *Birds* 2 : 56.

ELDER, W. H. 1954. The oil gland of birds. *Wilson Bull.* 66 : 6-31.

HARRISON, J. 1967. *A Wealth of Wildfowl.* London : Andre Deutsch.

HARTUNG, R. 1967. Energy metabolism in oil-covered ducks. *J. Wildl. Mgmt.* 31 : 798-804.

HARTUNG, R. and G. S. HUNT. 1966. Toxicity of some oils to waterfowl. *J. Wildl. Mgmt.* 30 : 564-70.

HAWKES, A. L. 1961. A review of the nature and extent of damage caused by oil pollution at sea. *Trans. 26th N. Amer. Wildl. Nat. Res. Conf.* : 343-55.

MCCALLUM, G. E. 1964. Clean water, and enough of it. In *Waterfowl Tomorrow*, pp. 471-8. Ed. Linduska, J. P. Washington : U.S. Government Printing Office.

ODHAM, G. 1967. Studies on feather waxes of birds. VI. Further investigations of the free flowing preen gland secretion from species within the family of Anatidae. *Arkiv för Kemi* 27 : 263-88.

ODHAM, G. 1968. Oiled water birds—new possibilities for rehabilitation. In press.

PARSLOW, J. L. F. 1967. Changes in status among breeding birds in Britain and Ireland. *Brit. Birds* 60 : 177-202.

RIJKE, A. M. 1968. The water repellency and feather structure of Cormorants, Phalacrocoracidae. *J. Exp. Biol.* 48 : 185-9.

ROOK, D. 1967. To clean or kill? *Birds* 1 : 209-10.

R.S.P.C.A. 1967 More dead birds. *Nature* 215 : 1119.

SYKES, A. H. 1964. Some actions of an anti-fertility compound in the fowl. *Vet. Rec.* 76 : 393-4.

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