THE STATUS OF OILED WILDLIFE: RESEARCH AND PLANNING

Keith G. Hay
American Petroleum Institute
Washington, D.C.

ABSTRACT

The cleaning and rehabilitation of oiled wildlife, especially waterfowl, has been one of our most difficult environmental problems to solve. It is plagued by controversy, emotion, apathy, and a host of biological unknowns. Costs have been high and survival rates low. This paper discusses the efforts taken by organizations and individuals in recent years to reverse this trend. It assesses biological problems and outlines research results. It analyzes people problems and wildlife contingency planning and presents a review of recent accomplishments in the United States, Canada, and Great Britain.

The oil spill—the photographic symbol of today’s energy/environmental problems—has proved to be one of the toughest problems of all to solve. The rehabilitation of oiled wildlife is plagued with controversy, emotion, apathy, and biological unknowns. The costs have been high and the survival rates low. Recently, a few dedicated people working here and in Europe have reversed this trend. This paper will attempt to present a brief status report on their progress and the melange of problems involved.

The unfortunate encounter of spilled oil and wildlife is not new. It goes back to about the turn of the century when coal-burning steamships and sailing clippers were replaced by oil-fueled vessels. Since then thousands of seabirds have succumbed to floating oil, especially during World Wars I and II [3] and in recent spills here and off the coast of Europe [5].

With the current and projected demands for energy in the United States and with expanded tanker traffic and accelerated development of offshore petroleum reserves, the oiled bird is not going to go away. Periodically this ugly problem will arise despite the efforts of the petroleum industry to improve its safety practices, engineering, and navigational skills. Unfortunately, the problem is the product of the inherent fallibility of man and his imperfect machines.

We cannot ignore the situation. We must here, as elsewhere, improve our technology and mitigate the impact.

A study of more than 100 spills that occurred throughout the world between 1960 and 1971 revealed that about one in five (20%) involved birds (50 or more) [14]. Near-shore spills have a far greater impact on waterfowl than spills occurring several miles or more offshore.

In 1967 Torrey Canyon tanker spill, some 8,000 oiled birds were rescued. Six thousand were picked up alive in England and about 2,000 in France at a cost estimated at $160,000 [5,4]. Less than 5% of those treated by British authorities survived for release some months later. The survival of those rescued by France is unknown.

In 1969, the Santa Barbara spill resulted in the treatment of 1,575 birds of which 169 were eventually released. Many of those released were found dead within a short period of time [18].

In 1970, the tanker Delian Apollon was responsible for a spill in Tampa Bay, Florida. Thousands of seabirds were lost. No exact count was taken, but hundreds of birds were cleaned and farmed out for rehabilitation. Reports show that many of the birds were returned dead within a few days [20]. In 1971, under the Golden Gate Bridge at the mouth of San Francisco Bay, two tankers collided and the resulting spill involved some 4,686 oiled birds taken to cleaning centers [12]. Eight months later the last of 200 survivors (less than 5%) were released at a cost estimated at $900 per bird [19].

The most vulnerable species involved in spills have been the oceanic birds such as the alcids—murres, auklets, guillemots, and guillemots. Other species less affected include ruddy ducks, scaup, scoters, mergansers, old squaw, and goldeneyes. Grebes, eiders, loons, and cormorants are also frequently involved. The ruddy ducks and scaup are particularly vulnerable during winter on large river systems having heavy oil traffic. Fortunately, none of the above species has been reported in jeopardy as a result of spills in American waters.

In Europe and South Africa, however, it is believed that oil pollution is responsible for a steady decline in seabird colonies. For example, in the Baltic Sea (in known oil dumping areas) the mortality of old squaw ducks has been associated with surface oil and their number reduced to about one-tenth of the population level before World War II [2]. Other authors report that oil spills have reduced the number of scoters in the Baltic and off southeast England [1]. The auk populations off the coast of England have been reported substantially decimated by oil pollution [15].

Tankers traversing South Africa’s Cape of Good Hope are said to be responsible for the reduction of jackass penguins [16]. Oil pollution, especially sustained pollution, has thus been cited as a limiting factor on certain seabird populations.

Estimating seabird mortalities from an oil spill is a very imprecise science. Estimates may differ by thousands of birds. It is believed that only a fraction of the birds actually killed in a spill wash up on the shore. Some authors have even speculated that the death rate at sea may vary from 6 to 25 times more than the number washed ashore [23].

In contrast to terrestrial birds and semiaquatic species (e.g., ducks, geese, coots, or gulls), totally seaborne species have a restricted reproductive potential. Many, such as the alcids, do not breed until three or more years old and lay a single egg per year. Only one in five survives to go to sea.

Until about five years ago we knew little about seabirds. They are not game species (they taste quite fishy) and thus do not constitute an important economic resource. They have never been the subject of intensive waterfowl management or research by either state or federal governments.

During the last five years a small group of people here and in England have been studying marine birds—their distribution, population status, physiology, diseases, and husbandry in captivity. Four organizations have primarily been involved: the American Petroleum Institute, the Wildlife Rehabilitation Center at Upton, Massachusetts, England’s Advisory Committee on Oil Pollution of
The recuperation record for oiled seabirds in the past has admittedly been dismal. A few birds have been returned to nature, but only after a long and costly period of postcare. In the process, semi-domestication often takes place. The percentage of cleaned birds that actually survive after release is even smaller. One should not infer from this small percentage that rehabilitated birds cannot readjust to life in the wild. Several successful reintroductions have been documented. U.S. Fish and Wildlife Service bands were re-introduced to enable workers to devote more time and care to birds having a high rate of mortality in captivity before readmission to the wild. The recuperation record for oiled seabirds in the past has admittedly been dismal. A few birds have been returned to nature, but only after a long and costly period of postcare. In the process, semi-domestication often takes place. The percentage of cleaned birds that actually survive after release is even smaller. One should not infer from this small percentage that rehabilitated birds cannot readjust to life in the wild. Several successful reintroductions have been documented. U.S. Fish and Wildlife Service bands were reintroduced to enable workers to devote more time and care to birds having a high rate of mortality in captivity before readmission to the wild.

Survival rates have zoomed with the recent strides taken in cleaning technology and husbandry. The International Bird Rescue Research Center reported over a two-year period a survival rate of 41% on hundreds of birds and about 20 different species [19]. Rapid retrieval, relatively small groups of birds, and expert cleaning and husbandry techniques are largely responsible for this high success ratio. Rehabilitation success is measured not only in terms of percent survival but also in terms of median length of captivity and average cost per bird.

In South Africa, where powdered clay was used as a cleaning agent on jackass penguins, nearly 50% survived, although precise percentages have not been published [8,10]. Rescued oiled birds arrive at cleaning centers under a wide range of physical and mental conditions. Prior to capture they may have spent hours or days in water with a continuous energy drain. The oil destroys the bird's protective insulation, and a rise in metabolic rate is necessary to sustain body temperatures. Constant preening also takes energy. Food demands increase, but feeding attempts (especially for diving birds) are thwarted by oil-fouled plumage. A bird may arrive under stress, chilled, exhausted, dehydrated, starved, and ill from ingested oil. Cold weather accentuates these conditions. Often such birds are jammed together with other species, hauled long distances, and immediately put through a series of cleaning processes that will leave even a healthy bird weak and in a state of shock. One marvels at the stamina of the survivors.

In past spills, every bird was routinely cleaned regardless of its condition. Instead of attempting to reclaim all birds, a selective approach, particularly for inland spills, should be made. If a bird's physical condition makes its chances of survival nearly impossible, it should be humanely euthanized (rare or endangered species are an exception). This would enable workers to devote more time and care to birds having a reasonable chance at survival.

Fletcher [9] states that variables affecting bird survival include: weather conditions, the type and amount of oil in the bird, the species involved, the distance of the spill from the shore, the time lag from initial fouling until initial treatment, the degree of stress a bird is subjected to, the husbandry techniques used, the time of release (i.e., the sooner released, the higher the apparent survival), the number of birds being cared for (the fewer birds being handled, the higher the survival rate), the quality of the facilities available, and the training and experience of the people handling the birds. Many of the above biological problems are currently under study here and in Europe. They include research on:

1. The effect of ingested oil on the mucosal transport mechanism of marine birds. To utilize seawater, birds must be able to transport sodium ions through the gut and expel the excess salt through the nasal passages. Oil can block the mucosal ion transport mechanism resulting in dehydration and eventual death.
2. The development of a successful program of hormonal and electrolyte therapy to restore osmotic balance and the functioning of the salt glands in contaminated seabirds.
3. Treatment and prevention of aspergillosis (fungus infection), septic arthritis or “bumblefoot” (joint capsule infections), breast sores (especially in seabirds confined to hard surfaces), eye lesions (caused by ammonia fumes from unsanitary pens), dehydramin and hypoglycemia (low blood sugar), and lipid pneumonia and bacterial infections.
4. Treatment of stress after capture, including perfection of handling and cleaning techniques, proper steroids and their administration, crowding, light, temperature, noise levels, etc.
5. Development of proper nutritional regimes for certain species and feeding techniques to eliminate forced feeding.
6. The establishment of criteria for confident recognition of terminal pathological conditions in oiled birds.
7. Determination of optimum density of confined birds to insure healthy conditions and adequate room for preening.
8. Determination of proper time and conditions for reintroduction of the birds into their native habitat.

**People problems**

Handling an over-responsive and emotional army of bird-cleaning volunteers and training them to play constructive roles is a major undertaking. Prior planning, cooperation, understanding, patience, and clear direction must be developed. In the absence of these virtues, chaos can and has prevailed. The San Francisco spill of 1971 was a classic example. There was virtually no state or federal coordination. Splinter groups of volunteers established their own "treatment centers" and jealously guarded their patients. Some actually absconded with their pet patients to seek better care elsewhere. Long hours, fatigue, and frustrations led to dissension and bitter quarrels. Anti-establishmentism was rampant.

Instant experts on bird cleaning, avian medicine, and nutrition appeared or were developed overnight. Veterinarians volunteered their services, but their knowledge of oiled-bird treatment was very limited. A wide variety of food (from canned dog food to live shrimp) was given the birds. Forced feeding was routine. Medications and vitamins of all kinds were also administered. Needless to say, the state-of-the-art in treating oiled birds, as well as in handling volunteers, was in its infancy. In both cases, the success ratio was near zero.

To prevent such fruitless efforts and the frantic, unorganized response that prevailed, a well-designed wildlife-oil spill contingency plan was needed.

**Contingency planning**

It is only prudent to take reasonable measures to prepare for oiled-bird emergencies. This is especially true in those regions and seasons where bird concentrations and oil shipment traffic converge. Almost equal attention must be devoted to handling volunteers as to handling birds. Only in this manner can the sharp beaks of birds be dangerous, and cleaning solvents be flammable. A model state contingency plan should include:

1. A listing of state and federal agencies to be alerted, including 24-hour, seven-day-a-week telephone numbers, naming the individuals to contact.
2. A clarification of the roles of the state and federal agencies under the Regional Response Plan of the National Oil and Hazardous Substances Pollution Contingency Plan.
3. A listing of state and federal laws pertaining to possession of birds and mammals.
4. A detailed roster of team members, assignments, and responsibilities for inland and marine spills including discovery and notification, record keeping, public information, containment, protection of biota, cleanup and restoration, and evaluation of effects on the biota.
5. A listing of individuals or organizations that possess skills and experience in oiled-bird treatment (locally and nationally).
6. Location of emergency wildlife reception and treatment centers.
7. A listing of the necessary supplies, equipment, and holding facilities for cleaning, treating, drying, and postcare operations. Such information may be obtained from:
   a. California Department of Fish and Game, Oil and Hazardous Materials Contingency Plan (July 1974)
The petroleum industry, through the American Petroleum Institute, took prompt steps to mitigate the problem after the first seabird mortalities were reported from Santa Barbara in 1969. At that time, they commissioned a young aviculturist, Philip Stanton, who has extensive experience working with wild waterfowl, to start with the help of API has been conducting research on oiled birds for seabird mortalities were reported from Santa Barbara in 1969. At that time, they commissioned a young aviculturist, Philip Stanton, who has extensive experience working with wild waterfowl, to start with the help of API has been conducting research on oiled birds for various distillation fractions derived from crude oil and the long-gut of a saltwater-adapted bird can affect the mucosal transport and agents being successfully used today. He has authored a how-to of Dr. W.N. Holmes, the studies are directed on the effects of the latest bird cleaning and care procedures. The center is currently evaluating various cleaning agents, testing the pressurized jet versus serial baths, and reestablishing feather waterproofing under a grant from the American Petroleum Institute. The center is also perfecting an audiovisual slide presentation that will illustrate how to select the proper cleaning agent together with the latest bird cleaning and care procedures. About five years ago, England’s Advisory Committee on Oil Pollution of the Sea established a research unit in the Department of Zoology at the University-Upon-Tyne. It was funded by a grant from the Royal Society for Preservation of Cruelty to Animals, the Royal Society for the Preservation of Birds, the World Wildlife Fund Seabird Appeal and the British Institute of Petroleum. Their efforts have also led to high survival rates. Focusing primarily on the efficiency of various detergents, they have found that the loss of waterproofing is largely due to soap and oil residues and to the disturbance of the normal excretion mechanisms in the cleaning processes. Consequently, they have devoted their efforts to selecting detergents that can be completely removed with a minimum disturbance of plumage [17].

In May 1974, the American Petroleum Institute in cooperation with the U.S. Fish and Wildlife Service convened a seminar on Oil Spill Wildlife Response Planning. The two-day workshop was held at the White House Conference Center in Lares, Puerto Rico. Some 70 state and federal government personnel in charge of oil-spill response plans involving wildlife participated. The program addressed itself to fish and wildlife considerations and the role of regional response teams under the National Oil and Hazardous Substances Pollution Contingency Plan. The workshop examined the actions of state wildlife departments, U.S. Fish and Wildlife

b. International Bird Rescue Research Center, 2701 Eighth Street, Berkeley, California 94710
c. American Petroleum Institute, 1801 K Street, Northwest, Washington, D.C. 20006
d. Wildlife Rehabilitation Center, 84 Grove Street, Upton, Massachusetts 01568.

What has been accomplished

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As a result of his research on cleaning techniques and agents, Stanton has recommended a nontoxic liquid cleaner called Polycomplex A-11. Although not perfect, it is one of several cleaning agents being successfully used today. He has authored a how-to guide for oiled-bird treatment entitled “Operation Rescue” and prepared a companion bibliography [22]. These booklets have been distributed throughout the United States to state and federal agencies and conservation organizations. He has provided consulting services at numerous spills and has worked to establish oiled-wildlife treatment centers in coastal states.

Since 1972 the API has sponsored an avian physiology study at the University of California at Santa Barbara. Under the direction of Dr. W.N. Holmes, the studies are directed on the effects of ingested crude oil and petroleum products on marine birds. Holmes has revealed that small quantities of crude oil introduced into the gut of a waterfowl-adapted bird can affect the mucosal transport and extrarenal excretory mechanisms resulting in acute dehydration and eventual death. Dr. Holmes is also examining the effects of various distillation fractions derived from crude oil and the long-term effects of ingested oil in mature birds. Incidentally, Alaska North Slope oil was found to be almost innocuous when administered to ducklings in amounts similar to the effective doses of other oils [11].

Refined products (diesel oil, #2 fuel oil, and Bunker C) are known to be more toxic than crude oil. For example, the relatively small spills of Bunker C at Tampa, Florida, in 1970 and in San Francisco in 1971 caused approximate mortalities of 90 and 20 birds per ton of spilled product respectively. The crude oil spills of the Torrey Canyon and at Santa Barbara, however, resulted in mortalities of only 0.5 and 0.6 birds per ton of oil [6].

Dr. Holmes is now testing measured amounts of the above refined oils on adult birds. He is determining the degree of dehydration incurred, the resulting pathological changes, and the replacement (hormonal and electrolyte) therapy necessary to rehabilitate the birds. His studies will be concluded at the end of this year.

It is obviously important to keep as many birds away from an oil slick as possible. This was the objective of an API contract with the Av-Alarm Corporation of Santa Maria, California. Their objective was to determine the feasibility of repelling aquatic birds from an area using an acoustical jamming device as the stimulus.

The flocking instinct in birds provides mutual protection through their almost constant communication with one another. When this audio communication is prevented by jamming with high frequency sounds, the birds immediately leave the area to seek relief. This harmless technique has been used successfully for years to repel agricultural pest birds.

The Av-Alarm device was tested on waterfowl at the Grizzly Island Game Refuge some 30 miles north of San Francisco Bay and in the bay itself over a two-year period (1972-1973). Using a single, fixed-location system covering a 3/4 square mile area, 82% of the ducks and 92% of the shorebirds were repelled on the wildlife refuge [7]. The intrepid coot was found to be relatively indifferent to the sounds. Immediately upon activation, there was a sudden drop in the bird count. This was followed by a continual decline in numbers.

In tests using the device from a cruising boat in ocean and bay waters, the degree of effectiveness varied by species. Ducks were repelled 100%; pelicans 92%; common egrets 85%; gulls 42%; cormorants 75%; shearwaters 29%; and murres 51%.

Grebes and murres dived away from the stimuli, then surfaced and dived again if the threat was still present. To prevent driving the diving species deeper into the center of a slick, buoyed repelling equipment was recommended to be placed within the spill area. When the alarm system was used in conjunction with the occasional firing of a rocket or shellcracker, an even greater percentage of birds was repelled.

The International Bird Rescue Research Center (a nonprofit corporation) in Berkeley, California, was an outgrowth of the Richmond Bird Care Center that played an active role in the 1971 San Francisco Bay spill. Since that time, a small group of individuals has continued research efforts on developing bird cleaning techniques, testing cleaning agents, perfecting husbandry methods, and alleviating stress. Their 41% survival rates speaks for itself. A paper describing their work is being presented at this conference [19].

The center is currently evaluating various cleaning agents, testing the pressurized jet versus serial baths, and reestablishing feather waterproofing under a grant from the American Petroleum Institute. The center is also perfecting an audiovisual slide presentation that will illustrate how to select the proper cleaning agent together with the latest bird cleaning and care procedures.

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9. A slide lecture or film to instruct volunteers in the correct techniques for handling, cleaning, and postcare of oiled birds.

10. A selected bibliography of key references on oiled-bird cleaning and care.

11. Appendices to the plan should include maps of the major coastal oil terminals, bays, and estuarine areas having heavy oil traffic. Map overlays would depict the location of resident species as well as the seasonal migratory patterns of waterfowl, their species composition, relative abundance, and winter concentration areas. Additional overlays would locate commercially important demersal seafood areas (e.g., oyster and abalone beds, lobster, and crabbing locales) and marine mammal habitats. Further refinement of an atlas could include information on tides, prevailing winds, ocean currents, and water mass movements to assist in predicting spill trajectories.

Service, the Environmental Protection Agency, U.S. Coast Guard, and the oil industry in handling spills involving wildlife. The latest oil-spill cleanup technology was reviewed and the workshop ended with actual cleaning demonstrations of oiled waterfowl. Similar seminars are planned for the Gulf of Mexico and the West Coast in 1975.

It was obvious from this seminar that the most comprehensive wildlife oil-spill contingency plan had been developed by the State of California. Copies of this plan (Oil and Hazardous Materials Contingency Plan, California Department of Fish and Game, July 1974) were subsequently distributed by API to all coastal states as a prototype or model plan.

The U.S. Fish and Wildlife Service has been conducting experiments on various bird cleaning agents and techniques at its Migratory Bird and Habitat Research Laboratory near Laurel, Maryland. They are also working with the API in developing information on migratory patterns and winter waterfowl concentration areas on the East Coast as they relate to petroleum traffic and oil terminals.

In Canada, the Petroleum Association for Conservation of the Canadian Environment has employed the services of a consulting firm to make a comprehensive review on dispersal and rehabilitation of waterfowl associated with oil spills. The intent is to codify what is known to date, identify research needs, and develop effective wildlife oil-spill contingency plans for critical areas on Canada’s east and west coasts, the Great Lakes, and the Arctic. The report should now be complete.

The Florida Game and Fresh Water Fish Commission has initiated a program for the rehabilitation and treatment of oiled birds. It is being organized by Harold F. Albers, D.V.M., of St. Petersburg. He is working in cooperation with the Florida Associated Marine Institutes, the Shell Oil Company, Clean Gulf Associates, and the American Petroleum Institute.

The Standard Oil Company of California provided a grant to Dr. James Naviaux of Pleasant Hill, California, to develop bird-cleaning technology including the testing of various cleaners. Dr. Naviaux had treated birds from the 1971 San Francisco spill. Dr. Naviaux’s work, in collaboration with Dr. Alan Pittman, a research chemist of the U.S. Department of Agriculture’s Western Waterfowl Research Laboratory, has resulted in the recommendation of Shell Sol 70 as a cleaning agent, as well as publication on the aftercare of oil-covered birds [13].

The lack of readily available supplies of cleaning agents has hindered bird restoration efforts in the past. The Shell Oil Corporation is currently supplying 50-gallon drums of cleaning solvent (Shell Sol 70) to oil-spill control centers at major ports and harbors throughout the nation. The centers (or Harbor Cooperatives, e.g., Clean Bay, Clean Seas) will now be able to supply this cleaning agent in future emergencies. Costs of replacement will be borne by the users.

API is also looking into the field of avian olfaction and the feasibility of using repulsive odorants to keep marine waterfowl away from an oil slick.

Marine mammals

Most sea mammals are relatively resistant to oil slicks and tend to avoid contaminated waters. As a result, very little research has been conducted on cleaning and treatment techniques except for experiments on live beavers and on the carcasses and pelts of sea otters and beavers.

No sea otter or seal has ever been oiled and subsequently cleaned in an oil-spill situation. It is possible, however, that a spill could have significant adverse effects on sea otters and on fur seals especially at a rookery during the pupping season. These animals depend upon an air blanket trapped in their dense underfur for warmth and buoyancy. Any form of pollutant, especially oil, could penetrate the outer guard hairs and underfur. Water consequently reaches the skin with disastrous effects.

Seals and otters are powerful animals and the larger males and females can be quite aggressive and dangerous. Only professional wildlife specialists and consulting veterinarians should be permitted to handle and treat them. A guide to the cleaning and care of oiled sea otters can be found in the California Oil and Hazardous Materials Contingency Plan.

CONCLUSION

The above status report reveals that substantial efforts and progress have been made in oiled-wildlife research. We are developing new techniques that are leading to higher survival rates. We are devising preventive measures to keep birds from entering a spill area. We are developing wildlife contingency plans and stockpiling materials to handle future emergencies. We are continuing basic research on the difficult problems inherent in achieving (1) high survival levels, (2) a rapid return to the wild, and (3) a reasonable cost.

We have a good deal more to do, but these pioneering efforts both within and outside of industry reflect a difficult problem yielding to the time and attention of dedicated men and women.

REFERENCES

