

US EPA ARCHIVE DOCUMENT

Wildlife And Oil Spills

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INTRODUCTION

IN THE UNITED STATES there are more than 70 spills reported on an average day. When oil spills occur, plants and animals will be contaminated and some will be unable to survive. Whether they occur in oceans, estuaries, rivers, lakes, ponds, or on land, they can affect algae, plants, invertebrates, fish, amphibians and reptiles, birds, and mammals. These species and communities are at risk of smothering, hydrocarbon toxicity, hypothermia, and chronic long-term effects.

Planning ahead is one of the best ways to minimize the impacts of oil spills on wildlife. *Contingency planning* at the local area level helps both planners and responders identify protection strategies and response options for fish, wildlife, and sensitive environments. The following chapter describes how contingency plans are used to help prepare for oil spills.

EPA, along with other planners and responders, is working to develop a thorough understanding of how oil spills affect fish, wildlife, and environmental resources. Knowing the species and communities that might be affected by a spill and their susceptibilities to oil contamination helps planners choose the best response options. These response concerns are addressed in pre-spill response planning so that they can be implemented more easily during actual response efforts.

When a spill occurs, wildlife responders try to minimize injuries to fish, wildlife, and sensitive environments. By working with the response agencies that contain and clean up spills, wildlife responders can reduce the negative effects an oil spill has on natural resources.

WILDLIFE AND SENSITIVE ENVIRONMENTS' SUSCEPTIBILITY TO OIL SPILLS

MOST BIOLOGICAL communities are susceptible to the effects of oil spills. Plant communities on land, marsh grasses in estuaries, and kelp beds in the ocean; microscopic plants and animals; and larger animals, such as fish, amphibians and reptiles, birds, and mammals, are subject to contact, smothering, toxicity, and the chronic long-term effects that may result from the physical and chemical properties of the spilled oil. The primary effects of oil contamination include loss of the insulative capability of feathers and fur which can lead to hypothermia; dehydration resulting from lack of uncontaminated water; stomach and intestinal disorders and destruction of red blood cells resulting from ingestion of oil; pneumonia resulting from inhalation of oil vapors; skin and eye irritation from direct contact with oil; and impaired reproduction. Animals can also suffer during capture and rehabilitation operations; potential ailments include infectious diseases, skin problems, joint swellings, and lesions. In addition, eggs and juveniles are particularly susceptible to contamination from oil. Very small quantities of oil on bird eggs may result in the death of embryos.

EFFECTS OF OIL ON FISH, BIRDS, AND MAMMALS

Fish

Fish may be exposed to spilled oil in different ways. They may come into direct contact and contaminate their gills; the *water column* may contain toxic and volatile components of oil that may be absorbed by their eggs, larvae, and juvenile stages; and they may eat contaminated food. Fish that are exposed to oil may suffer from changes in heart and respiratory rate, enlarged livers, reduced growth, fin erosion, a variety of biochemical and cellular

changes, and reproductive and behavioral responses. Chronic exposure to some chemicals found in oil may cause genetic abnormalities or cancer in sensitive species. If chemicals such as dispersants are used to respond to a spill, there may be an increased potential for tainting of fish and shellfish by increasing the concentration of oil in the water column. This can affect humans in areas that have commercial and recreational fisheries. (*Chapter three discusses dispersants and other alternative oil spill response techniques.*)

Birds

Birds are very susceptible to oil spills. Seabirds, for example, spend a lot of time on the ocean's surface, dive when disturbed, and have low reproductive rates, making them particularly vulnerable to oil spills. In addition, the populations of species with small numbers of individuals, a restricted geographic range, or threatened and endangered species may be very adversely affected by oil spill contamination.

A bird's feathers overlap to trap air and provide the bird with warmth and buoyancy. Birds that contact an oil slick may get oil on their feathers and lose their ability to stay waterproof, they may ingest oil while trying to clean their feathers or when they try to eat contaminated food, and they may suffer long-term reproductive effects.



Birds can be smothered by oil.

Mammals

Mammals that may be affected include river otters, beavers, sea otters, polar bears, manatees, seals, sea lions, walrus, whales, porpoises, and dolphins. The sensitivity of mammals to spilled oil is highly variable. The amount of damage appears to be most directly related to how important the fur and blubber are to staying warm, which is called thermoregulation. River otters, beavers, sea otters, fur seals, polar bears, and land mammals need clean fur to remain warm.

Direct exposure to oil can result in temporary eye problems. Ingestion of oil can result in digestive tract

bleeding and in liver and kidney damage. Ingestion of oil is of greater concern for species that groom themselves with their mouth, such as sea otters and polar bears. Breathing hydrocarbon vapors can result in nerve damage and behavioral abnormalities to all mammals.

Capturing and cleaning oiled marine mammals generally is not feasible. While procedures for dealing with oiled birds have been developed, no such procedures have been developed for marine mammals except for sea otters and, to a more limited extent, polar bears.

Procedures for capturing, treating, and releasing animals may hurt them more than the oil does. For example, manatees are particularly susceptible to secondary fungal and bacterial infections following capture or transportation.

OIL SPILLS EFFECTS ON SPECIFIC TYPES OF MAMMALS

Pinnipeds and Cetaceans

The most common *pinnipeds* are harbor seals, fur seals, sea lions, and walrus. The most common *cetaceans* are porpoises, dolphins, and whales. Except for fur seals, both the pinnipeds and the cetaceans have blubber for insulation and do not groom or depend on fur to stay warm. This characteristic makes them less susceptible to oil spills than other mammals. The pinnipeds are associated with coastal environments, as they must venture onto land to reproduce and often inhabit beaches and rocky shores at various times of the year. This may make them more at risk to oil spills than cetaceans, which are generally more nomadic and migratory. Contact with oil has similar effects on both pinnipeds and cetaceans. When they come to the surface to breathe they may inhale *hydrocarbon* vapors that may result in lung injuries; oil that comes in contact with the animals' sensitive mucous membranes and eyes may produce irritations. Young pinnipeds and cetaceans may be injured due to ingestion of oil from contaminated teats when nursing. There may be long-term chronic effects as a result of migration through oil-contaminated waters.

Manatees

The effects of discharged oil on adult manatees' body temperature as a result of direct contact with oil is negligible because they have a layer of blubber for insulation. Also, they exhibit no grooming behavior that would contribute to ingestion. However, manatees may be affected by inhaling volatile hydrocarbons while they are breathing on the surface, and it is very likely that exposure to petroleum would irritate sensitive mucous membranes and eyes.

As with most animals, the young are the most at risk. Nursing pups may be injured due to ingestion of oil from contaminated teats. There may be long-term chronic effects

as a result of migration through oil-contaminated waters, and there is a substantial possibility of consuming contaminated plant material and other incidental organisms. Manatees may not be severely affected by the oil spill through direct contact, but they are sensitive to habitat disturbances and injury, such as collisions with boats and barges and propeller strikes, that may occur during response actions.

Sea Otters

Because sea otters spend a great deal of time on the ocean's surface and depend exclusively on their fur for insulation and buoyancy, they are highly susceptible to oil contamination. Sea otters are considered vulnerable to oil spill contamination during their entire life cycle. The most harmful effect from direct exposure to oil is the fouling of fur, which may lose its ability to insulate. In addition, breathing hydrocarbon vapors and ingesting oil as they groom themselves or feed on contaminated prey can damage their lungs, cause digestive tract bleeding, and result in liver and kidney damage. Indirect effects may include loss of habitat and food resources.

Polar Bears

Polar bears rely on blubber, guard hair, and a dense underfur for thermoregulation and insulation. Polar bears may groom oil-contaminated fur; swallowing oil during grooming has killed several bears in Canada. There is some evidence that oil's toxic effects on polar bears include an inability to produce red blood cells and kidney damage.

RESPONSE OPTIONS TO PROTECT WILDLIFE

WHEN A SPILL OCCURS, the severity of injuries to fish, wildlife, and sensitive environments depends on the location and the quantity and type of oil. Oils tend to spread rapidly whether spilled on land or water, but the spreading will be enhanced if the spill reaches groundwater, lakes, streams, rivers, and the ocean. Currents, winds, and temperatures may complicate response efforts. Once the spill reaches the environment, fish, wildlife, and sensitive environments are at risk. Three categories of response options have been developed to meet the needs of responders trying to minimize injuries to the environment.

Containing Spilled Oil

The first response strategy for fish, wildlife, and environmental protection emphasizes controlling the release and spread of spilled oil at the source to prevent or reduce contamination of potentially affected species, their habitats, and sensitive environments. In addition, primary response strategies include the removal of oiled debris, including contaminated fish and wildlife carcasses, in water and on land.

These response options are often limited in their application and effectiveness, making it necessary to try to maneuver healthy wildlife out of the path of the spill.

Keeping Animals Away from Spilled Oil

The second response option for protecting wildlife emphasizes keeping unoiled wildlife away from oiled areas through the use of deterrents and pre-emptive capture. Like first response options, second response options also prevent healthy and clean wildlife from becoming oiled, but they may not be effective unless conditions are nearly perfect. The techniques, often called hazing, use a variety of visual, auditory, and experimental sensory deterrent methods. Visual deterrents include shiny reflectors, flags, balloons, kites, smoke, scarecrows, and model predators. Auditory methods often rely on loud noises generated from propane cannons, alarms, model wildlife distress calls, predator recordings, and other noise makers. These techniques have been used with mixed success by airport personnel to keep flocks of birds away from runways. A combination of visual and auditory devices may be used, including herding with aircraft or helicopters, and boats. One promising experimental deterrent is the use of the chemical that produces grape flavoring. When the grape flavoring is used in conjunction with bird feed, it appears to effectively deter birds from landfills and public parks where birds pose a health threat to humans. It might be used to create a buffer around the slick to preclude birds from swimming into it. The application would only have an effect on birds that swim on the surface and less so on diving birds, which continue to present extensive operational problems for recovery during spill response.

Cases involving endangered species may warrant the use of unusual or heroic secondary response options. Two unique applications involving fish employ a visual method and an auditory method.

1. Many fish have a sensitivity to bright lights. For example, walleyes in Lake Michigan collide with rocks or beach themselves in an attempt to escape automobile floodlights at close range. Lighting may be manipulated to restrict fish movement in specific areas.
2. Most bony fish have the ability to detect vibrations. High frequencies have been used to keep fish away from the turbines at hydroelectric dams. While these methods have not been proven successful for all species, the method does hold promise for some.

If a spill occurs on land, a combination of deterrent devices might be employed to keep wildlife from entering the spill area. Deterrence is more difficult if a spill occurs on water and the slick is moving. It is very difficult to keep the devices actively scaring wildlife from the area. Untended or misdirected hazing of wildlife could result in accidentally moving them into oiled areas. Noises and visual deterrents work best in a smaller, well-defined spill area, which may

Volunteers wash a seabird coated with a mixture of vegetable oils.

Photo courtesy of Marine Wildlife Veterinary Care & Research Center



be ringed with devices to make it unappealing for wildlife to enter. Often, just the activities of oil spill cleanup workers on beaches, in boats, in vehicles, or in aircraft provide good deterrent effects for as long as they are in the area.

Another way to keep wildlife from becoming oiled is to capture clean animals before they come in contact with oil. However, this approach is complex and requires good planning. The capture, handling, transportation, and release of uncontaminated wildlife is labor and equipment intensive and should be reserved for animals that can be captured easily and species of particular concern. Preemptive capture should only be attempted when the threat of oiling is very high. Small populations of endangered or critically sensitive wildlife may be captured with nets or traps that do not hurt the animals. Careful consideration must be given to finding clean release sites, which should be determined before capturing animals.

Rescuing Oiled Animals

The third response option is capturing and treating animals that have already been oiled; this option is used only as a last resort. Typically only a small percentage of wildlife that are highly sensitive to the effects of oiling will be captured. Even very oiled animals are often able to evade capture until they are very ill. Of those captured, only a portion will survive the treatment process and be released back into the wild. Some will survive, but their injuries will require them to live under the care of aquariums and zoological parks.

The fate of animals released back into the wild has been questioned and requires additional investigation to determine if these efforts are warranted. The decision to capture and treat oiled wildlife, and the decision to release them back to the wild or retain treated wildlife in captivity

must be based on spill-specific criteria. The criteria must be based on the best available science and focus on the protection and maintenance of healthy wild populations of the species affected or potentially affected by the spill.

Major Considerations in Oiled Animal Rescue

It is necessary to locate facilities that are capable of handling the water, sewage, and solid waste requirements of the operation. It is particularly important to ensure that the facility, personnel, and operations are in compliance with all laws, regulations, and permit requirements prior to initiating operation of the facility.

In addition, responders must ensure that facilities operate within established guidelines and that all wildlife operations are conducted under qualified veterinary supervision.

Finally, in order to have the best chance for success, the capture effort must be initiated rapidly and efficiently, using trained and qualified managers and responders, including rehabilitation workers.

OILED WILDLIFE CARE: A VETERINARIAN'S OVERVIEW

MANY GOVERNMENT AGENCIES, universities and private organizations help rescue animals and birds that have been exposed to oil pollution. While the government is responsible for animal rescue efforts, many private organizations assist in rescuing injured wildlife. Before any person or organization can handle or confine birds or mammals for rescue, however, they must get special permits that are issued by state and federal officials. It is unlawful for any person or organization to capture and handle oiled wildlife without training or permits. This training prepares them to capture, handle, and treat injured wildlife without causing pain and suffering to the animals or causing injury to themselves as they treat wildlife.

Rescue parties usually will contact rehabilitation workers even before they arrive to make sure that they are prepared to care for the captured birds immediately. This ensures that the birds are treated as quickly as possible. Birds that are most likely to be affected by oil spills are those that remain in, dive in, or feed in the water, such as ducks, loons, grebes, cormorants, gulls, terns, herons, murre, pelicans, coots, auklets, bald eagles, and ospreys.

Once a bird has been brought to a rehabilitation center, certain basic procedures are followed. First, birds are given complete physical exams, including checking body temperature, respiratory rates, and heart rates. Birds are examined for broken bones, skin burns and abrasions. Oil is flushed from birds' eyes and nares. Heavily oiled birds are wiped with absorbent cloths to remove patches of oil. Pepto Bismol™ or Toxiban™ is administered orally to

prevent additional absorption of oil inside the bird's stomach and to help remove internal oil from the bird. The bird is then warmed and placed in a quiet area. Curtains, towels, and sheets are often hung to limit visual contact with people.

Nutrition is essential for the recovery of oiled birds. Birds are fed and rehydrated using a rehydration solution (Pedialyte™) and gruel (fish, vitamins, minerals) until they are washed. Birds need up to five days to rehydrate and strengthen themselves before being washed.

After a bird is alert, responsive, and stable, it can be washed. Dawn™ dishwashing detergent diluted with water has been found to be the most effective washing agent for oiled birds. Beads of water will roll freely from the feathers, and down will begin to fluff up and appear dry when a bird has been acceptably rinsed. Failure to properly rinse birds is one of the most common causes of unsuccessful rehabilitation.

After its feathers are completely rinsed, the bird is placed in a clean holding pen lined with meshed nets and a ceiling made of sheets or towels. The pen is warmed with pet dryers, and, again, minimizing human contact is important. If behavior appears normal and a bird's condition remains stable, it is placed in a recovery pool and allowed to swim. The bird then begins to preen and realign its feathers to restore them to their original structure, helping the bird to become waterproof again.

Before a bird is released, it must pass the waterproofing test; it must demonstrate buoyancy (the ability to float) and water-repellency (the ability to keep water away from its body). Once a bird passes this test, it is slowly exposed to temperatures comparable to outside weather. Its weight should be close to the average for the species, and it should show no signs of abnormal behavior. Rehabilitated birds

After extensive washing, birds still have oil coated feathers.



Photo courtesy of Marine Wildlife Veterinary Care & Research Center

GOVERNMENT AGENCIES RESPONSIBLE FOR PROTECTING WILDLIFE

THE U.S. FISH and Wildlife Service (FWS) has management authority for fish species that live in both freshwater and marine environments, coastal fishes, and inland threatened or endangered species.

The National Oceanic and Atmospheric Administration (NOAA) has management authority over marine and estuarine fishes. It is authorized to manage or protect marine fish during oil discharges and releases of hazardous materials.

Individual states have responsibility for all wildlife within their state boundaries unless federal law gives the authority to another agency (such as NOAA or FWS).

are banded by the U.S. Fish and Wildlife Service, and are released early in the day into appropriate habitat. Release location is a very important element in rehabilitation. Birds must not be allowed to return to oiled areas nor should they be released into an unsuitable habitat.

Post-release Survival Studies

In the past, oil spill success has been measured by release rates. However, it has become apparent that release does not mean that birds will necessarily survive. In order to evaluate survival after release, several techniques have been used. In the United States, birds are routinely banded with federal stainless steel bands. If birds die and they are recovered, or if birds are recaptured at a later date, based on banding records maintained by the Bird Banding Laboratory (National Biological Survey, Department of the Interior), it is possible to know the duration of survival. Unfortunately, many banding studies rely on recovery of very few banded birds.

Outside the US, and with different species of birds (penguins), color bands are attached to the wings of birds making them visible from long distances even when birds are in large congregations. Through resighting of wing placed color bands, some of the best information on long-term survival and breeding success has been documented.

More recently, technological advances in radio-marking aquatic avian species has made radio-tracking a valuable tool for post-release survival monitoring. In these studies, oiled and rehabilitated birds are radio-marked upon release and both their survival and behavior can be evaluated. This technique can provide daily, weekly or monthly information on habitat use, movement patterns, and survival, as well as determine survival rates of oiled and rehabilitated birds.

SUMMARY

OIL SPILLS can harm wildlife in a number of ways. The toxic effects of inhaling vapors and ingesting oil when grooming or feeding can make animals sick. Oil can also coat an animal's fur or feathers, leading to hypothermia and a loss of buoyancy. Preventing spills is the best way to protect wildlife from oil spills. When oil is spilled, however, responders try to (1) prevent it from reaching animals and sensitive environments, (2) keep animals away from the oil, and (3) capture and rehabilitate oiled animals.

Spill responders have learned a great deal since the *Exxon Valdez* ran aground in Prince William Sound, Alaska, in 1989. There are new laws providing additional protection for natural resources that may be affected by oil spills. Area contingency planning is becoming the primary tool for preparing for an effective spill response. Wildlife and sensitive environmental resources must be identified and prioritized. Communication and cooperation between response agencies and other agencies that protect wildlife will ensure that when a spill occurs the fish and wildlife response operations will effectively minimize injuries to natural resources.