



Effects of Oil Spills on Wildlife and Habitat



Sediment plume and sheens of re-floated oil, Prince William Sound, AK. NOAA

Alaska Region



The U.S. Fish and Wildlife Service is the federal agency responsible for many of the nation's fish and wildlife resources. Having this responsibility has established the agency as one of the primary trustees for fish, wildlife and habitat at oil spills.

Oil spills affect wildlife and their habitats in many ways. The severity of the injury depends on the type and quantity of oil spilled, the season and weather, the type of shoreline, and the type of waves and tidal energy in the area of the spill.

Oil can be categorized into five groups, ranging from very light to very heavy oils. Most oil has a density less than water, so it floats. Oil tends to spread into a thin layer on the water surface as a sheen. Once in the water, oil undergoes weathering, a process that describes the physical, chemical, and biological changes that occur when oil interacts with the environment.

Weathering reduces the more toxic elements in oil products over time, as exposure to air, sunlight, wave and tidal action, and certain microscopic organisms degrades and/or disperses oil. Weathering rates depend on factors such as type of oil, weather, temperature, and the type of shoreline and bottom that occur in the spill area.

Types of Oil

Very light oils (jet fuel, gasoline) are highly volatile and evaporate quickly. Very light oils are one of the most acutely toxic oils and generally affect

aquatic life (fish, invertebrates, and plants) that live in the upper water column.

Light oils (diesel, light crude, heating oils) are moderately volatile and can leave a residue of up to one third of the amount spilled after several days. Light oils leave a film on intertidal resources and have the potential to cause long-term contamination.



Pool of oil on a heavily impacted beach, Prince William Sound, AK. NOAA

Medium oils (most crude oils) are less likely to mix with water and can cause severe and long-term contamination to intertidal areas. Medium oils can also severely impact waterfowl and fur-bearing marine mammals.

Heavy oils (heavy crude, No. 6 fuel oil and Bunker C) do not readily mix with water and have far less evaporation and dilution potential. These oils tend to weather slowly. Heavy oil can cause severe long-term contamination of intertidal areas and sediments. Heavy oils have severe impacts on waterfowl and fur-bearing marine mammals. Cleanup of heavy oil is difficult and usually long-term.

Very heavy oils can float, mix, sink, or hang in the water. These oils can become oil drops and mix in the water, or accumulate on the bottom, or mix with sediment and then sink.

Wildlife and Habitat

Oil causes harm to wildlife through physical contact, ingestion, inhalation and absorption. Floating oil can contaminate plankton, which includes algae, fish eggs, and the larvae of various invertebrates. Fish that feed on these organisms can subsequently become contaminated. Larger animals in the food chain, including bigger fish, birds, terrestrial mammals, and even humans may then consume contaminated organisms.

Initially, oil has the greatest impacts on species that utilize the water surface, such as waterfowl and sea otters, and species that inhabit the nearshore environment. Although oil causes immediate effects throughout the entire spill site, it is the external effects of oil on larger wildlife species that are often immediately apparent.

Plants

Marine algae and seaweed responds variably to oil, and oil spills may result in die-offs for some species. Algae may die or become more abundant in response to oil spills. Although oil can prevent the germination and growth of marine plants, most vegetation, including kelp, appears to recover after cleanup.



Oily sheen in the intertidal habitat with aquatic plants following the Exxon Valdez spill.

Invertebrates

Oil can be directly toxic to marine invertebrates or impact them through physical smothering, altering metabolic and feeding rates, and altering shell formation. These toxic effects can be both acute (lethal) and chronic (sub-lethal). Intertidal benthic (bottom dwelling) invertebrates may be especially vulnerable when oil becomes highly concentrated along the shoreline. Additionally, sediments can become reservoirs for the spilled petroleum. Some benthic invertebrates can survive exposure, but may accumulate high levels of contaminants in their bodies that can be passed on to predators.

Fish

Fish can be impacted directly through uptake by the gills, ingestion of oil or oiled prey, effects on eggs and larval survival, or changes in the ecosystem that support the fish. Adult fish may experience reduced growth, enlarged livers, changes in heart and respiration rates, fin erosion, and reproductive impairment when exposed to oil. Oil has the potential to impact spawning success, as eggs and larvae of many fish species, including salmon, are highly

sensitive to oil toxins.

Birds and Mammals

Physical contact with oil destroys the insulation value of fur and feathers, causing birds and fur-bearing mammals to die of hypothermia. In cold climates, an inch diameter oil drop can be enough to kill a bird. Heavily oiled birds can lose their ability to fly and their buoyancy, causing drowning.

In efforts to clean themselves, birds and sea otters ingest and inhale oil. Ingestion can kill animals immediately, but more often results in lung, liver, and kidney damage and subsequent death. Seals and sea lions may be exposed to oil while breathing or resting at the water's surface or through feeding on contaminated species.

Long-term or chronic effects on birds and marine mammals are less understood, but oil ingestion has been shown to cause suppression to the immune system, organ damage, skin irritation and ulceration, damage to the adrenal system, and behavioral changes. Damage to the immune system can lead to secondary infections that cause death and behavioral changes may affect an individual's ability to find food or avoid predators. Oil also affects animals in non-lethal ways such as impairing reproduction.



Oiled loon, Prince William Sound, AK.

Avian and mammalian scavengers such as ravens, bald eagles, and arctic foxes are also exposed to oil by feeding on carcasses of contaminated fish and wildlife. Direct mortality and reduced reproduction in bald eagles were

attributed to the *Exxon Valdez* oil spill.

Habitat

Oil has the potential to persist in the environment long after a spill event and has been detected in sediment 30 years after a spill. Oil spills may cause shifts in population structure, species abundance and diversity, and distribution. Habitat loss and the loss of prey items also have the potential to affect fish and wildlife populations.



Oiled sea otter, Prince William sound, AK USFWS

Oil remains in the environment long after a spill event, especially in areas sheltered from weathering processes, such as the subsurface sediments under gravel shorelines, and in some soft substrates. However, pelagic and offshore communities are fairly resilient and rebound more quickly than inshore habitats. Although oil is still present in the sediment and coastal areas 15 years after the *Exxon Valdez* oil spill in Prince William Sound, Alaska, some wildlife populations have recovered. It is believed that continued effects will most likely be restricted to populations that reside or feed in isolated areas that contain oil.

The U.S. Fish and Wildlife Service responds to spills to minimize impacts to trust resources and continues its work long after a spill event. The Service continues assess and monitor the damage to habitat and wildlife and attempts to minimize the long-term effects on new generations of wildlife.