Harbor Seals: Were They Injured and Will They Recover?

by Lloyd F. Lowry and Kathryn J. Frost

Some of the largest harbor seal haulouts in Prince William Sound and the waters adjacent to them were directly exposed to substantial amounts of oil when the *Exxon Valdez* ran aground. Oil affected seal habitat in the Gulf of Alaska at least as far as Tugidak Island. Some people had speculated that seals would avoid spilled oil and therefore would not be affected. However, in the early weeks of the spill, seals swam through oil and inhaled aromatic hydrocarbons as they breathed at the surface. On haulouts in oiled areas, seals crawled through and rested on oiled rocks and algae throughout the spring and summer. Pups were born in May and June, and in some cases both their haulouts and their mothers were covered with oil. Throughout the area, seals were exposed to greatly increased human activity as a result of cleanup projects.

An injury assessment study was initiated to investigate and quantify effects of the oil spill on the distribution, abundance, and health of harbor seals. Almost all of the work was done in Prince William Sound because seals and their habitats were heavily oiled there, and baseline information was available for comparison with data collected during and after the spill. The study included observations of seals in oiled and unoiled areas, examination and sampling of carcasses of seals found dead and collected, and aerial surveys of trend count sites during pupping and molting.

From April to July 1989, we saw no oiled seals in unoiled areas that were not close to oiled sites. However in oiled areas, 50 to 100% of the seals were oiled, most of them heavily. Many were coated over their entire bodies with thick, tarry oil to such a degree that people used to seeing clean harbor seals had difficulty recognizing them. Seal pups born in oiled areas became oiled shortly after birth. Most of the seals shed their oily coats during the August molt, and in 1990 there was no sign of external oiling observed on any seals.

About 20 seal carcasses were reported or turned in during the first few months after the oil spill. The number of dead animals found probably greatly underestimates the number that died because dead harbor seals do not float like sea otters and birds, but rather, sink to the bottom. As an example, two dead newborn pups we found in Herring Bay were underwater and could only be seen when the current moved the algae that was covering them. Most of the carcasses were too decomposed to examine and sample properly. Two seals had broken bones and other injuries that suggested they had been hit by boats. Some dead pups appeared to have suffered from malnutrition and stress.

Analysis of tissues from collected seals clearly showed that animals in oiled areas had been exposed to and assimilated hydrocarbons. Values for hydrocarbon metabolites in bile were 7 to 13 times higher in seals from oiled parts of Prince William Sound than in those from the unoiled areas of the Gulf of Alaska, and these high levels persisted at least through April 1990. This indicated that in spring 1990 seals were still encountering oil in the environment or that they were metabolizing stored fat reserves that had elevated levels of hydrocarbons. Because seals have enzyme systems that allow them to detoxify and excrete hydrocarbons, the levels found in most tissues were not very high. The levels in muscle, which is a staple in the diet of residents of Tatitlek, Chenega Bay, and some other villages, ranged from very low to undetectable. Highest levels of aromatic hydrocarbons occurred in the blubber of animals found dead and collected in Prince William Sound. Relatively high levels were also found in mammary tissue and milk.

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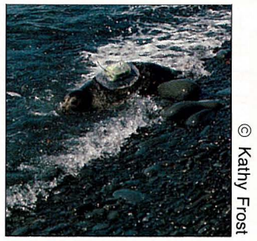
Harbor seals are known for being wary and difficult to approach. However, in the weeks immediately following the spill, oiled seals behaved very oddly and were reported as being sick, lethargic, or unusually tame. Seals often stayed on haulouts when aircraft flew over at low altitudes, and people were sometimes able to approach them to within a few yards. Not until we microscopically examined brain tissue did we have an explanation for this behavior. We found debilitating lesions within the brain tissues of many of the oiled seals collected. Exposure to aromatic hydrocarbons caused swelling and degeneration of the nerve axons, which would have interfered with nerve transmissions. The lesions were mostly in the thalamus, a region of the brain that serves as a primary relay center for incoming and outgoing nerve impulses. This brain damage would have made it very difficult for seals to perform normal tasks such as swimming, diving, feeding, and escaping from predators. It explains the unusual behavior of seals immediately after the spill, and probably made them more susceptible to drowning, being hit by boats, or being caught by predators such as killer whales. Injury that could have resulted from oil was also found in the eyes, skin, and liver of oiled seals.

Aerial surveys showed that pup production was lower in oiled areas in 1989 than in 1990 or 1991, while in unoiled areas the ratio of pups to non-pups was the same in all three years. Together with the dead fetuses and pups found following the spill, this suggests that pup mortality was higher than normal in oiled areas in 1989.

Largely because of their wide distribution, the actual number of harbor seals in Alaska has never been accurately estimated. As a means of keeping track of population trends, the Alaska Department of Fish and Game (ADF&G) has made repetitive counts of seals at locations such as Tugidak Island and Prince William Sound. By 1988 the trend counts were indicating a major decline in harbor seal numbers. Analysis of counts made in Prince William Sound from 1983 through 1992 show that the only year in which there was a statistical difference in trend between oiled and unoiled sites was 1989, immediately after the oil spill. Calculations indicate that there were about 345 fewer seals at the oiled sites we studied than would have been expected if the spill had not occurred. Our calculation of the number of missing seals provides some indication of the number that were killed, but it is very conservative because it includes only animals that disappeared from parts of Prince William Sound.



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Restoration

It is difficult to assess whether or when harbor seals will recover from the effects of the oil spill. We do not know why their numbers were dropping before the spill and therefore cannot predict how the additional mortality may affect the ongoing decline. The trend in Prince William Sound since 1989 is equivocal: pupping counts show continued declines, but molting counts appear to have stabilized. Seal numbers have increased somewhat in the oiled area and decreased in the unoiled area. However, molting counts in 1992 were still 34% lower at oiled sites than they were in 1988 before the spill, while counts at unoiled sites were only 18% lower. At Tugidak Island the count for 1992 was 44% lower than in 1988.

As part of monitoring natural recovery, we have suggested annual aerial surveys of harbor seals at trend count areas in Prince William Sound both during pupping and molting, at least through 1994. In addition, we have proposed continuation of a study using satellite-linked transmitters to investigate distribution, movements, habitat use, and behavior of harbor seals in Prince William Sound. Preliminary results from eight seals satellite-tagged in 1991 and 1992 showed that, at least during the summer and early autumn, some seals range much more widely than we had expected. One tagged seal swam from Herring Bay on Knight Island to the Yale Glacier in College Fiord, then back to Herring Bay, a minimum distance of 110 miles. Another moved from Applegate Rocks to the Copper River Delta and back, a minimum round trip of 225 miles. The tags also provided the first information on when, where, and how deep harbor seals dive to feed. This type of information can be used to interpret results from injury assessment and population monitoring, and to help design programs for the protection and management of important habitats.

If marine ecosystems are healthy and being properly managed, it should be common for people to see harbor seals along Alaska's coast. However, many areas that appear to be good seal habitat are now very sparsely populated. Harbor seals, like other marine mammals, are covered by the federal Marine Mammal Protection Act. Reduced and declining populations are causing national as well as local concern and may result in restrictions on commercial fishing or other activities important to Alaskans. It is critical that we learn what factors have been and are now affecting seal numbers and do whatever is possible to restore the population.

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Harbor seals occur throughout northern temperate waters, ranging in the North Pacific from southern California, through Alaska, to Japan. They feed mostly in coastal waters on fishes, octopus, and squid. They haul out to rest, to bear and care for their young, and to molt on intertidal reefs, rocky shores, mud bars, beaches, and floating glacial ice. Unlike fur seals and sea lions, harbor seals do not form rookeries during the pupping and breeding season, and pups are born at virtually all of the haulouts.

Far left: A satellite-linked transmitter is attached to a seal for better identification of the seal's range.

Left: A tagged harbor seal re-enters the water.

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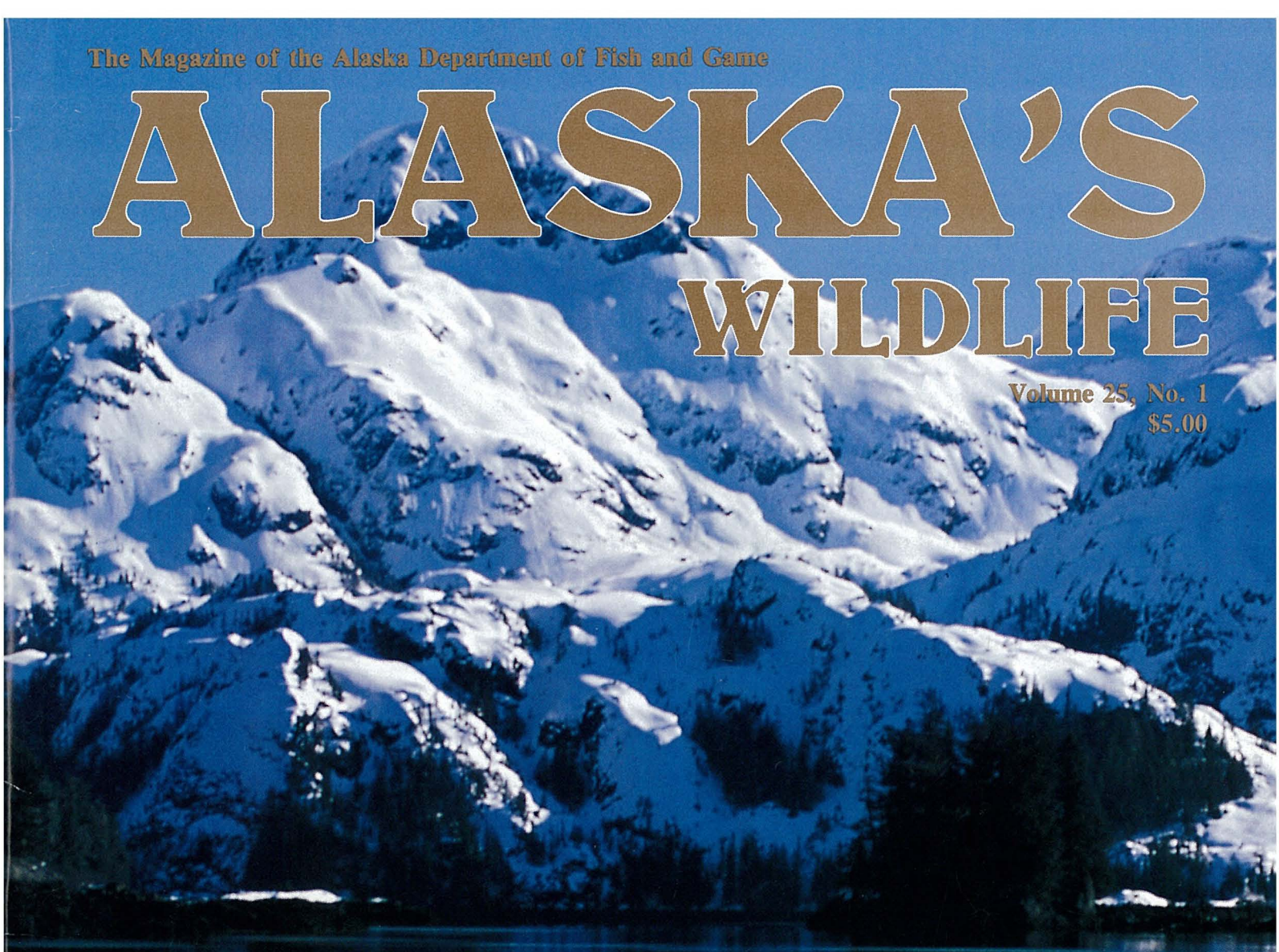

The *Exxon Valdez* Oil Spill

What Have We Learned?

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Special Issue