

# Fish Matters

## Center researchers are doing their own whale watching, with an eye toward solving some deadly problems

*Whales are fascinating, intelligent creatures.*

Which makes it all the more distressing when they sometimes strand themselves on the beach, a usually-fatal phenomenon often observed in other marine mammals such as porpoises and dolphins.

Why does this happen? No one knows for sure, but pollution may play a role. Strandings, though disturbing, at least give scientists at the Northwest Fisheries Science Center an

opportunity to study these animals, gain insight into why they died, and perhaps eventually devise solutions to help other marine mammals.

The Center's work is part of the Marine Mammal Health and Stranding Response Program, which comes under the Marine Mammal Protection Act. That law makes the National Marine Fisheries Service (the Center's parent agency) responsible for managing endangered species nationwide. The Center's specific responsibilities under this program include identifying possible causes of disease in marine mammals. A critical component of this work is a monitoring and contaminant database (*see related story*) for researchers to use to assess contaminant trends in selected marine mammals around the world.

Unusual strandings and other deaths of marine mammals in recent years, such as the deaths of an estimated 50 gray whales recently near Baja, Mexico, and of more than 25 stranded rough-toothed dolphins along the

Florida coast in late 1997, have heightened concern that pollution is contributing to disease and death in marine mammals. Many marine mammals live in or migrate through waters that are known to be contaminated, and most are believed to be at risk.

Whales and other marine mammals—such as seals and dolphins—may be among the marine mammals most vulnerable to the effects of pollution. Because they are high in the food web, they can accumulate higher levels of environmental contaminants in their tissues. Some toothed whales that eat mammals, such as transient killer whales, are even higher in the food web and thus more likely to accumulate higher levels of contaminants. A baleen whale like the gray whale, which migrates along the Pacific coast, can expose itself to contaminants by the way it eats (it filters and probably eats sediments, which tend to accumulate contaminants, to get at bottom-dwelling invertebrates).

It's hard, however, to understand how pollution affects



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National Oceanic and Atmospheric Administration

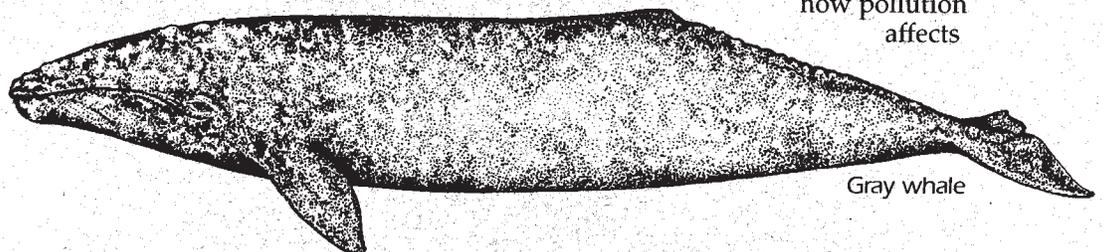
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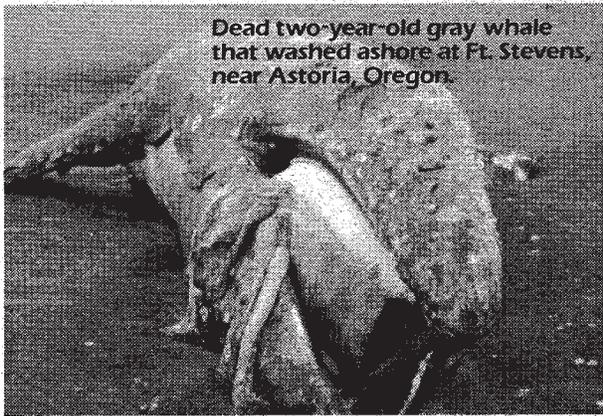
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marine mammal health: we don't know much about baseline contaminant concentrations and have only limited studies linking health factors with levels of toxic chemicals. (That's why the Center's database work is so important). Center researchers sample both stranded and living marine mammals in an effort to understand whether contaminants are affecting these compelling and mysterious animals and determine which contaminants are involved. Chlorinated hydrocarbons such as PCBs and DDTs are particularly insidious: they accumulate in fatty tissue (such as blubber) instead of being metabolized and excreted. Collaborative studies are also underway to determine the relationship between contaminant exposure and disease and immune function in certain marine mammal species.

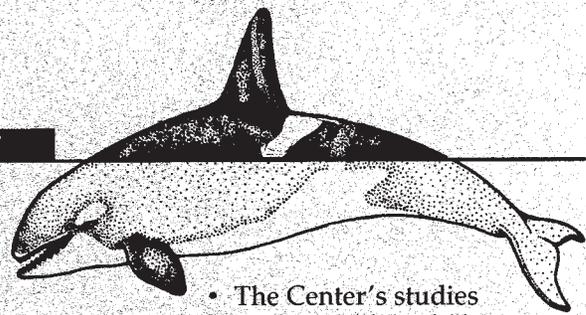


Dead two-year-old gray whale that washed ashore at Ft. Stevens, near Astoria, Oregon.

The marine mammal program's work encompasses a number of species; some recent work is summarized below.

- The endangered **bowhead whale** was severely depleted by commercial whalers. Now the potential of increased exploration in the Arctic (such as for oil and gas) means that long-lived mammals who live in the area, such as bowhead whales, are considered useful in assessing environmental changes. Information on contaminant concentrations for the bowhead whale is scarce, but Center researchers last year more than doubled that information, doing analyses of essential and nonessential metals in livers from subsistence kills (Native Alaskans are allowed to kill about 50 bowheads a year). Most findings were normal, but researchers did find relatively high concentrations of cadmium that may be related to diet.

Additional bowhead work this year will include analyses of blubber samples for distribution of lipids (fats) and contaminant levels as part of a study using the bowhead whale as a potential indicator species to monitor the health of the western Arctic/Bering Sea ecosystem.

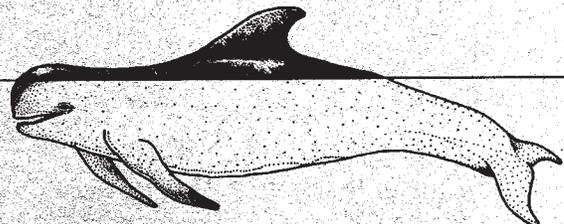


- The Center's studies of contaminant levels in **killer whales** (also called orcas) may help reveal links between the whales' life histories and contaminant levels. Researchers last year analyzed blubber samples from free-ranging killer whales from Prince William Sound in Alaska for selected chlorinated hydrocarbons, including PCBs and DDTs. They looked at two groups of whales: fish-eating residents (whales that live in the sound), and transient whales that eat marine mammals. As expected, average PCB and DDT concentrations were significantly higher in the mammal-eating whales (their diet is higher in the food web than the resident whales').

- **Gray whales** are perhaps the most familiar large whale along the Pacific Northwest coast, which is part of their migratory route from Alaska to Baja, Mexico. The gray whale has the distinction of being the first marine mammal to be removed from the endangered species list after its numbers, decimated by commercial whalers, grew back to more than 22,000 (close to their historical population). There's little information on chemical contamination levels in free-ranging gray whales, but Center researchers have added to important baseline data on contaminants, analyzing blubber samples acquired from biopsies for 3 consecutive years from whales off the Northwest Washington coast.

An earlier Center study of chemical contamination in gray whales noted that chemical pollution in coastal areas near urban centers may be responsible for some harmful biological effects in aquatic species, including reproductive problems in marine mammals. A disturbingly high number—5 out of 23—of gray whales seen in Puget Sound between 1986 and 1991 died. It wasn't clear, however, whether the whales came into the sound because they were sick, or if they were exposed to contaminants associated with urban coastal sediments while in the sound.

- **Pilot whales** is a common name that includes two species of dolphin: the short-finned pilot whale, which occurs in tropical and warm temperate oceans, and the long-finned pilot whale, which occurs in the North

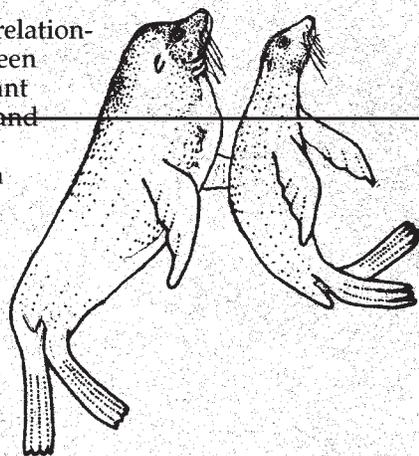


Atlantic and Antarctic waters. Pilot whales run aground more often than other cetaceans (whales and porpoises); the reason isn't known, but it is clear that pilot whales are so close knit that when several strand themselves, others will do the same. Center researchers analyzed tissue samples from pilot whales stranded on the Massachusetts coast for organochlorines and found indications of organochlorine transfer from mothers to their fetuses. They also found, as has been found in other species, significantly higher contaminant levels in males than in females, perhaps in part because mothers transfer the contaminants to offspring during gestation and lactation.

- **Hawaiian monk seals**—the only endangered marine mammal entirely within U.S. waters—are a highly endangered species. There are now only about 1,400 now, the NMFS estimates, their birth rate is lagging. The stranding program's research indicates that monk seals have lower chlorinated hydrocarbon levels than do pinnipeds studied in Alaska, Washington, California, and other eastern Pacific sites. There were also indications of significant differences in DDT and CB levels among the monk seals studied by the stranding program. While not high compared to other pinnipeds, the levels warrant caution because of the monk seal's fragile status.

- Is there a relationship between contaminant exposure and cancer in **California sea lions**?

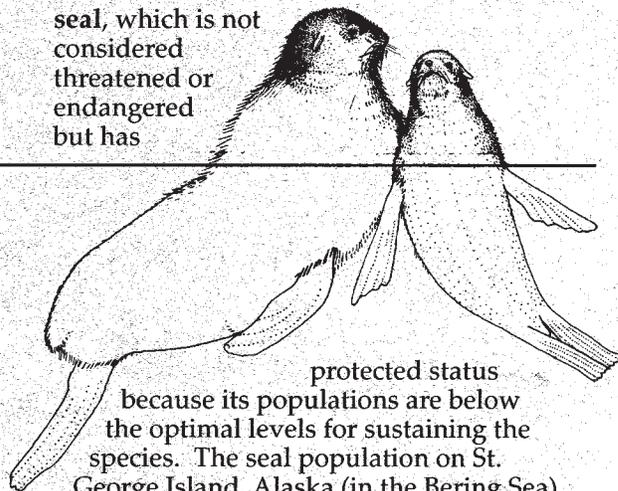
For the past 5 years, Center researchers have worked with the Marine



Mammal Center in Sausalito, California to assess differences between contaminant levels in stranded adult sea lions that died from a form of cancer (transitional cell carcinoma) and in those that were killed (for example, were shot or fatally injured). Preliminary analyses showed significantly higher levels of PCBs and DDTs in the sea lions with cancer. Sample analysis continues this year in efforts to determine whether there is a relationship between contaminant levels and disease. The data gathered thus

far is extensive: it includes chemical analyses of man-made compounds, detailed pathologic examinations and life-history information for a stable population that includes both healthy and diseased sea lions, thus allowing reliable comparison of data.

- Possible links between contaminants and immune response are also being examined in the **northern fur seal**, which is not considered threatened or endangered but has



protected status because its populations are below the optimal levels for sustaining the species. The seal population on St. George Island, Alaska (in the Bering Sea) has been declining for the past 25 years despite a stop to controversial commercial pelt hunts, while populations on a nearby island (St. Paul) are stable. Why? The answer may involve contaminant-induced immune system suppression. Earlier studies suggested that the two populations may eat different prey, caught in different areas, which could mean that the declining St. George seals are encountering different contaminants that can produce immune system problems, greater susceptibility to pathogens, and death. Work with the University of Alaska-Fairbanks and the National Marine Mammal Laboratory in Seattle is focusing using the fur seal as an indicator species for identifying pathways and extent of organochlorine contamination in the Bering Sea ecosystem.

Work this year will include analyses of milk and blubber samples to determine whether seals from the two islands have different contaminant levels, and whether those levels threaten either the seals or the natives who kill them for food. Additional work will try to shed light on the transfer of contaminants from mother to offspring; tissues from stillborn fetuses will be analyzed for chlorinated hydrocarbons to clarify the *in utero* transfer of selected chlorinated hydrocarbons, and a food web analysis will try to clarify how chlorinated hydrocarbons move from pregnant and nursing mothers to their offspring.

## Meticulous data is a sophisticated weapon in the fight to protect marine mammals



Analyzing marine mammal tissue samples are Gladys Yanagida, Gina Ylitalo, Jon Buzitis, and Larry Hufnagle.

The fight to protect whales and other marine mammals requires two powerful weapons: a comprehensive database, and advanced analytical techniques applied by experienced researchers.

As part of that fight, the National Marine Fisheries Service's Marine Mammal Health and Stranding Response Program is building a national database on contaminants found in marine mammals and related biological information. The valuable data compiled thus far are used by researchers nationwide who are working to identify what levels of contaminants are harmful to marine mammals, and what the effects of those contaminants are. Unacceptable levels will be determined in part by information from the Center's studies. Compiling the data critical to understanding contaminant levels and effects. A reliable and readily accessible database (with information that has gone through the rigors of professional publication) is key. Accessibility will be greatly enhanced by the Center's development of an Internet website with a searchable database that currently has more than 200 samples from about 80 animals. Providing a user-friendly web interface will also make these data more accessible to researchers.

In related work from specimen bank research last year, nearly 100 samples from healthy seals, whales, dolphins, sea lions, and polar bears were analyzed for baseline data. These samples will be useful for comparison in assessing contaminant effects in stranded animals, or in animals from other regions.

Analytical work is obviously the key to building a reliable data set. Researchers with the stranding

program are improving widely accepted analytical techniques (such as gas chromatography and gas chromatography with mass spectrometry) and developing and improving new techniques (such as high-performance liquid chromatography with ultraviolet photodiode assay detection). Researchers are also developing biomarker indices, which can be used to assess contaminant exposure and to predict biological effects before animals become visibly affected.

Studies to develop or improve highly specific techniques are increasing the quantity and quality of data that can be collected. For example: determining effects from chemical contaminants requires data from healthy animals for comparison. However, marine mammals are protected and thus difficult to sample for this purpose. If contaminant levels could be measured in tissues collected without killing or injuring an animal, more animals could be sampled, and better baseline data obtained. A blood-partitioning study in progress at the Center could further these efforts. Blood is drawn from marine mammals in the field without injuring them, and the samples used to assess the animals' health.

### Contaminant descriptions

**Chlorinated hydrocarbons** are among the most widespread and persistent chemical contaminants. Elevated levels of these compounds, such as DDTs and PCBs, are toxic to many animals and can concentrate in lipid-rich tissues, cause cancer, cause hormonal and behavioral problems, suppress immune and respiratory systems, and cause abnormal development.

**DDT (dichlorodiphenyltrichloroethane)** is an organochlorine insecticide banned from use in the U.S. in 1972. DDT caused the eggshells of some birds, such as the peregrine falcon, to be so thin that they broke when the adult tried to sit on, or brood, the eggs.

**PCBs (polychlorinated biphenyls)** were used as industrial chemicals in the U.S. and in other parts of the world until manufacture was banned in the mid-1970s. Substantial concentrations are still frequently detected. Adverse effects identified thus far include weight loss, birth defects, reproductive and immune system impairment, and perhaps cancer.