



The Marine
Mammal Center

The Marine Mammal Center began doing research on marine mammal diseases almost from its inception in 1975. Because animals in the Center's care offer a unique opportunity to perform blood and tissue analyses, the team has discovered conditions that bear upon the work of the organizations we collaborate with including National Marine Fisheries Service, NOAA and a variety of universities, regarding the health of the ocean. The Marine Mammal Center has become, in a sense, one of the top resources for researchers and scientists to turn to for answers about marine mammal care, medicine, and scientific data.

Domoic Acid Toxicity – Toxic Algae Poisoning

The Marine Mammal Center, based near San Francisco, is on the front lines of research on this pandemic of toxic algae poisoning in marine mammals. While there are no conclusive results yet as to the definitive causes of increased growth of the toxic algae, various studies are currently being conducted, including several sponsored by the National Oceanic and Atmospheric Administration. Researchers hypothesize that rising temperatures in the ocean, as well as agricultural and urban runoff into the ocean, may be contributing factors¹. In 1998, The Marine Mammal Center diagnosed the first case of domoic acid toxicity in marine mammals on the West Coast, and has conducted extensive studies of the condition since then. Domoic acid produced by toxic algae accumulates in mussels, sardines, and anchovies which are then eaten by sea lions, otters, cetaceans, and humans, among others. Exposures to the biotoxin results in brain damage to sea lions, causing them to become lethargic, disoriented, and have seizures that sometimes result in death. In 2005, Center researchers showed that this toxin can also cross the placenta in pregnant females, affecting fetuses *in utero*.

The Center's most recent work in researching this condition has now revealed a chronic condition caused by previous low dose exposure to domoic acid. The new paper's study identifies chronic neurological consequences of domoic acid toxicosis, including epilepsy. The ingestion of domoic acid causes atrophy of the hippocampus in the brain. As the toxin is ingested by sea lions via fish that have fed on the algal blooms the implications of the study are far reaching for human health since humans eat these fish. In the past, domoic acid has caused deaths of people on the east coast of Canada who ingested affected shellfish. Health departments in the U.S. currently monitor shellfish sold for human consumption for high levels of the toxin. However, this alarming new study suggests that exposure at lower levels over time could eventually cause

¹ Lizzy Mos, *Domoic acid: a fascinating marine toxin*. **Environmental Toxicology and Pharmacology** , Volume 9, Issue 3, 1 January 2001, Pages 79-85



chronic neurological effects, data which have not yet been considered when setting seafood guidelines.

Leptospirosis – Kidney Damage in Sea Lions

Every four to five years, The Marine Mammal Center sees a surge in the number of sea lions that are admitted with symptoms of leptospirosis, a bacterial infection that affects the kidneys and can be lethal for patients. If not treated, the bacteria can cause irreversible kidney damage. In 2008, nearly 200 sea lion patients have been admitted with the condition, an increase over the previous year. While numbers are not as high as in 2004, when over 300 sea lions were admitted to The Marine Mammal Center in kidney failure, veterinarians and scientists are on alert, taking advantage of the surge to study the disease.

Leptospirosis is caused by spiral shaped bacteria called leptospira. Veterinarians and volunteers can usually identify leptospirosis in a patient even before laboratory tests confirm the diagnosis because of the infection's distinctive symptoms, which include drinking water and folding the flippers over the abdomen.

Marine mammals generally do not need to drink water because they receive all the moisture they need from food sources; but when they are infected with the leptospira bacteria, their kidneys, which filter toxins, stop functioning properly. The animals thus cannot regulate their hydration and need to drink water to compensate for that loss. Infected sea lions have even been spotted sucking sand in an attempt to extract water. If the disease is caught early enough and treated with antibiotics, patients may recover. However, leptospirosis is often fatal, as once the kidneys are damaged beyond repair, the animal will go into renal failure and die. Despite veterinarians' best efforts, approximately two thirds of the Center's leptospirosis patients die.

Many different animal species, including humans and dogs, can become infected with leptospira bacteria through contact with contaminated urine, water, or soil. In California sea lions, epidemics of the bacterial infection were first documented in the early 1970s. The reasons for repeated epidemics in sea lions are unknown, as it is still unclear whether the organism in sea lions is one only affecting these animals, or whether it could come from domestic species or terrestrial wildlife reservoirs. Recent studies suggest a combination of factors may be responsible, and more research is necessary to determine the causes of cyclical outbreaks in the population.



To further that research, The Marine Mammal Center has spearheaded a leptospirosis study in collaboration with the National Oceanic Atmospheric Administration, University of California Los Angeles, University of California at Davis, Penn State University, and the National Animal Disease Center in Ames, Iowa. In October, The Center's biologists and veterinary staff began taking blood samples, tagging, and releasing wild juvenile California sea lions at popular haul-out spots for the animals in the San Francisco and Monterey Bay areas.

"The blood samples The Center's team is collecting from wild California sea lions will help them determine kidney function and exposure rates among these animals," says Dr. Jeffrey Boehm, Executive Director at The Marine Mammal Center. "The data also help us to understand more about the susceptibility of sea lions in the population during an epidemic and clarify the relationship between the stranded sea lions with leptospirosis we see here at the Center, and those that are susceptible in the population."

Cancer – High Prevalence in California Sea Lions

A specific cancer of epithelial origin was first diagnosed in California sea lions at The Marine Mammal Center in 1979. Approximately 17% of adult stranded sea lions are diagnosed with cancer. The Center collects samples from each of these patients to measure environmental carcinogen exposure. It has also discovered that these sea lions are infected with a herpes virus similar to that which causes Kaposi's sarcoma in humans. Future research will determine the factors, such as pollutants or genetics, which allow the virus to invade sea lion tissues and cause cancer.

This is a very high prevalence for a population of wild animals. Cancer development is a multi-step process during which damage to the genetic material of cells (DNA) arises from the interaction between a number of factors. These may include environmental factors such as chemical contaminants, infection by tumor-promoting viruses and the animals' own genetic predisposition to develop the disease. People with this type of cancer generally have been smokers or exposed to toxins. The latter may apply to marine mammals. High levels of persistent organic pollutants such as DDT and PCBs have been found in the blubber of California sea lions.

The research The Center conducts on post mortem sea lions with cancer is invaluable as this kind of work is not possible with human subjects. The Center's findings show that sea lion pups are exposed to PCBs while in utero, a factor that has important health effects later in their lives as PCBs can alter organ development.



Hawaiian Monk Seal – An Ongoing Conservation Project

The Hawaiian monk seal is the most endangered pinniped in the U.S., with populations estimated at around 1,100 and decreasing at 4% per year. Researchers believe the low survival rates of juvenile monk seals are attributed to predation and malnutrition. In 2008, The Marine Mammal Center collaborated with National Oceanic Atmospheric Administration (NOAA) Fisheries and Pacific Islands Fisheries Science Center to help rehabilitate an abandoned neonate Hawaiian monk seal that was found on May 2, 2008 on the island of Kauai. A rescue team attempted to reintroduce the one to two days old pup to its mother but she appeared to have no interest. This pup's mother abandoned another pup last year and it died a week later. Rescuers determined that the neonate would die if left alone, so with the help of the U.S. Coast Guard, the young seal was transported to Oahu for rehabilitation. Two trained personnel from The Marine Mammal Center were dispatched to the island to help care for the pup, which weighed 32.5 lbs. They are currently feeding him a diluted milk formula and hope to graduate him to solid fish in the coming weeks.

Hawaiian monk seals are nearly on the brink of extinction. Conservation efforts to help this animal are crucial to the long-term survival of the species. The Center's 33 years of expertise in working with young harbor seals and elephant seals which have similar animal husbandry and medical needs was a key component in the recent success of a captive care project in 2006. The project was an effort to provide nutritional supplementation to juvenile female Hawaiian monk seals in hopes of improving their chances of surviving in the wild in order to reproduce. Six seals in the project were rehabilitated and released, including twin female monk seals, the fourth known occurrence of twins in this species ever documented. The Center, along with NOAA Fisheries, hopes to repeat those successes with this young pup as well as other Hawaiian monk seals in the future.



Harbor Seal Health – Testing for Exposure to Contaminants

The harbor seal habitat of Bay Area coastal waters is influenced by several human-produced factors, including sewage, agricultural and surface runoff, chemical pollution and watercraft. Not only is it important to protect the seal population from toxic exposure that could threaten its survival, but the seals also serve as good gauges for the safety of the marine environment in relation to human beings. In 2007, The Marine Mammal Center began a study looking at the prevalence and health effects of marine contaminants in the San Francisco Bay Area. Two harbor seal pup patients, Melissa and Nigel, were rescued by the Center because they were abandoned by their mothers. They were treated for umbilical infections and fed by staff and volunteers at The Marine Mammal Center until they were big enough to fend for themselves in the wild. During rehabilitation, The Center tested the seals for exposure to various pathogens and contaminants. Once healthy, the two seals were released wearing specially designed orange hat tags, making it easier for scientists to chart their progress in the wild. The Center hopes to better understand the effects of this exposure on harbor seal survival. Ultimately, if seals, which feed at the same trophic level as humans, are affected by pathogens and contaminants in the marine environment, people could be too.