

What's Cookin' In The Kitchen *Meals at The Marine Mammal Center*

With lots of hungry marine mammal mouths to feed and fishing lessons to conduct, The Marine Mammal Center's "fish kitchen" sees a lot of action.

Up to 4,000 pounds of frozen herring are delivered to the Center every week during pupping season. That's the equivalent weight of a VW Beetle every month! The herring stay frozen in the kitchen's large freezer until they are thawed for use and are either served whole to animals that are ready to "free feed", or ground by hard-working volunteers into "fish mash" for young or very ill patients that cannot yet eat whole fish. Harbor seal pups consume up to a liter a day of "fish milkshake". The volunteers whisk up this special mixture in industrial blenders, adding fish mash, milk replacement formula, salmon oil, and

vitamins to simulate a mother's high-fat milk. The "milkshake" is then fed directly into to the patients' stomachs through sterilized tubes. Elephant seal pups consume up to one and a half liters of the formula to gain the weight needed for their survival in the wild. Deliveries of squid, anchovies, sardines, and capelin are also made to supplement the diet. On some occasions, the Center is able to buy live fish to help teach patients how to catch the live prey they will encounter in the wild.

Meal times are a flurry of activity. Hard-working volunteers in the kitchen prepare meals according to veterinarians' orders. This often means having to make sure greedy pen-mates don't steal another animal's lunch. With wild marine mammals that often aggressively compete for food,



Hot Route, a California sea lion, learns to "free feed" on herring. Photo: The Marine Mammal Center

this isn't always an easy task for the volunteers, and meal times are filled with the din of sea lions barking, splashing, and snapping teeth. But like the best of restaurants, the servers provide top-notch service during the bustle!

Get Involved

- Help feed a hungry marine mammal by donating
- Report stranded marine mammals at 415-289-SEAL or on our website
- Visit Build-A-Bear Workshop at AT&T Park for a TMMC Vet Kit
- Become a volunteer by attending an orientation
- Visit tmmc.org

Climate Change and Marine Mammals

The Center's Dr. Frances Gulland co-authored a recent paper in *Ecological Applications* entitled "Effects of Climate Change on Arctic Marine Mammal Health". The paper explores probable direct and indirect effects of changes in habitat to marine mammals in the Arctic. These effects include:

- The loss of the sea ice habitat
- Elevations of water and air temperature
- Alterations in pathogen transmission
- Changes in toxicant exposures
- Effects of increased human activities in areas of decreased sea ice

The paper stresses a need for baseline data along with matched data on climate change trends to document the effects of climate change.

Inspiring The Next Generation



Two MSDP students from Oakland examine a marine mammal skull. Photo: The Marine Mammal Center

The Marine Mammal Center has a well-rounded education department which offers several programs to help people of all ages learn about marine mammals and their environment.

One such program is the Marine Science Discovery Program (MSDP), geared toward advanced high school science students. This year's MSDP programs once again proved a huge success. Students supplemented their science classes with a trip to the Center's facilities in Sausalito, where they got a behind-the-scenes tour of the hospital and participated in hands-on

learning activities in the classroom and in the lab. They were also introduced to a variety of marine science career opportunities, such as research, fieldwork, animal care, oceanography, teaching, and lab analysis.

To sign up for any of the Center's education programs, visit the website or e-mail edu@tmmc.org.

Special Thanks

The Center is grateful to the following generous donors who contributed gifts of \$500 and higher to the Center's annual operating fund. This list recognizes gifts received from January 1, 2008 through April 30, 2008.

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A Sea of Debris The Growing Threat of Pollution to Marine Mammals



Left: The Marine Mammal Center's necropsy team discovers 450 pounds of debris in a dead sperm whale's stomach. Right: The team sorts through debris pulled from the whale's stomach. Photos: Chris Whittier

On March 16, The Marine Mammal Center's Director of Veterinary Science, Dr. Frances Gulland, assisted in the necropsy of a 51-foot-long sperm whale that had washed up on a beach near Tomales Point in Point Reyes. When the necropsy team reached the animal's internal organs, they discovered nearly 450 pounds of fishing net, mesh, braided rope, plastic bags, and even a plastic comb in the whale's stomach.

The alarming discovery was evidence of an issue already at the forefront of many researchers' minds. Marine wildlife is being affected by debris discarded by humans into the ocean, much of it non-biodegradable plastic.

At The Marine Mammal Center, sea lions and seals suffering from entanglements in marine debris are treated regularly. Marine mammals can have items like netting, fishing line, and plastic embedded in their skin for weeks, months, or even years after becoming entangled. This debris does not fully biodegrade, but "photodegrades", which means it simply breaks down by sunlight into smaller and smaller pieces

over hundred of years, and it can continue to trap marine life for years after being left behind. The specially trained Marine Mammal Center's Water Rescue Team now monitors and conducts monthly rescues on a rotating list of animals that have been identified as entangled at popular haul-out areas. Embedded debris is painstakingly removed from the often infected skin of these animals, and the wounds treated.

However, the dramatic external effects of marine debris on marine mammals and other marine life may be easier to identify and treat than the less obvious internal effects of this pollution when it is ingested.

Researching the possible effects of the ingestion of debris particles in marine mammals may offer scientists a glimpse into the ramifications for both marine mammals and humans of pollutants in the world's oceans.

Collaborative research has begun to reveal the scope of the problem and address the issue in the North Pacific Gyre, an area where currents have caused plastic pollution in the ocean to accumulate in high concentration across a patch the size of Texas or larger, according to the most conservative estimates. This area of concentrated marine debris is now known as "The Great Pacific Garbage Patch", and

has prompted scientists to take a closer look at water quality, clean-up potential, and the effects on marine life.



A Guadalupe fur seal entangled in a fishing net. Photo: Ken Padilla, The Marine Mammal Center

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The majority of studies to date regarding the ingestion of plastics by marine life in the Great Pacific Garbage Patch have focused on birds like albatross, because their stomach contents can easily be regurgitated. But marine mammals like the sperm whale necropsied by The Marine Mammal Center prove that they too are consuming debris, including plastic. “The problem is not confined to birds. We see many marine mammals here with ingested foreign bodies,” explains Dr. Gulland.

A 2003 paper on Antarctic fur seals on Macquarie Island (Eriksson and Burton) reported multi-colored plastic particles in their scat, most likely ingested through the fish species that they feed on, and there are numerous documented cases of odontocete (toothed) cetaceans like sperm whales ingesting debris. It is hypothesized that certain odontocete cetaceans, including sperm whales, may ingest a larger amount of debris than other marine mammals due to their feeding habits. “Sperm whales may incur some incidental ingestion of debris along with their coastal sea-bottom prey,” says Dr. Gulland. “The latest sperm whale was far from an isolated case.”

While scientists are learning more about debris ingestion in marine mammals, even less is known about plastic consumption of small filter feeders like krill at the bottom of the food chain. However, samples taken as part of research studies reveal a ratio of up to six particles of plastic to every one plankton particle in areas of concentration

“This plastic may work its way up the food chain as fish eat smaller filter feeders, and humans and marine mammals eat those fish.”

like the Central North Pacific Ocean, which suggests that filter feeders most likely consume a great deal of plastic. This plastic may work its way up the food chain as fish eat smaller filter feeders, and humans and marine mammals eat those fish. The implications are alarming, as more is learned from ongoing research about the effect on mammals of plastic’s chemicals, which leech out as they photodegrade into smaller particles.

Various studies, such as those conducted by The Environmental Working Group, a Washington D.C. based research organization, have identified chemicals like Bisphenol A and PCBs in some plastics, as endocrine disruptors. These chemicals can affect hormone levels in mammals and, in sufficient levels, can influence the development of a number of reproductive functions, alter immune system function, and increase the likelihood of cancer development. The epidemiological studies that have been conducted to date have also shown links between chemical contaminants and health effects in marine mammals. As marine mammals can serve as indicator species, the results of these studies could have implications for human health as well.



Plastic debris in rivers such as the L.A. River, above, carry debris to the ocean. Photo: Algalita Marine Research Foundation



A water sample taken in the North Pacific Gyre shows photodegraded plastic particles. Photo: Algalita Marine Research Foundation

The Marine Mammal Center continues to study the ways in which various ocean pollutants affect marine mammals. One recent study co-authored by Dr. Gulland and the Center’s marine biologist Denise Greig showed an association between PCBs and cancer in sea lions (see Science Update). Greig also heads the Center’s Harbor Seal Health Study, which investigates the effects of contaminants on harbor seals in the San Francisco Bay. “The harbor seal’s coastal habitat is influenced by human-produced pollutants including sewage, agricultural and surface runoff, and industrial pollution,” says Greig. “We are hoping 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.”

While The Marine Mammal Center strives to treat and learn from animals affected by marine debris, prevention is better than a cure. Education and behavior modification is crucial in treating the problem. An estimated 80% of the ocean’s plastic debris comes directly from the land (with 20% coming from watercraft and fishing activities). Human beings can make a difference in the amount of debris that ends up in the marine ecosystem by disposing of plastics properly so that they don’t end up in waterways, and reducing the amount of plastic used. These two measures alone would help decrease the entanglement and ingestion hazards that marine mammals face in the ocean, and begin the difficult task of treating this complex problem.

Letter from the Executive Director



I am delighted to introduce myself as the new Executive Director of The Marine Mammal Center. Returning to Marin this June has been a wonderful homecoming for me. I feel I am coming full circle, as I was first inspired to go into a career working with marine mammals in 1980, as a volunteer right here at the Center.

I now join the Center after 16 years at the John G. Shedd Aquarium in Chicago, where I served as the Senior Vice President for Animal Health and Conservation Science. I am a graduate of the University

of California, San Diego, and the University of California, Davis, where I received a degree in veterinary medicine. Prior to employment at Shedd, I worked in private practice in Los Angeles and as a zoo veterinarian at the Los Angeles Zoo. My career has been shaped by a personal passion for conservation, a love of wildlife and wild places, and the very firm belief that our individual and collective actions can have very real and positive impacts in this world.

Joining the Center now is especially exciting. I’m thrilled to be overseeing the completion of the nation’s premiere marine mammal hospital and rehabilitation center, and will help usher in the next stage of growth for this wonderful organization. I look forward to meeting and working with the Center’s rich group of staff, volunteers, and supporters in the coming months and getting to know you all as we achieve our goals together.

Jeffrey R. Boehm
Executive Director,
The Marine Mammal Center

Marine Mammals in Unusual Places A Dramatic Sea Lion Rescue



The Center’s rescue team pull the netted sea lion from the murky aqueduct. Photo: The Marine Mammal Center

On Monday, July 7, seven trained rescue volunteers from The Marine Mammal Center successfully rescued a female California sea lion from the Santa Clara aqueduct where the animal had been trapped for over a week, nearly 3 miles inland from the ocean. The Center had attempted two other rescues unsuccessfully before capturing the 6-foot-long and nearly 200-pound sea lion, nicknamed “San Tomas,” in front of a crowd of onlookers and media. The rescue team waded in to about 4 feet

of murky water and after a 20-minute game of cat-and-mouse with the quick animal, they were able to safely capture her with a net and load her into a carrier. She was transported to The Marine Mammal Center’s hospital headquarters in Sausalito, where veterinarians gave her a medical check-up, and animal care teams provided treatment for her. Pending results of diagnostic tests, the goal is to release her back to the wild if she is otherwise healthy.

Mark Your Calendars

To learn more about these events, go to www.tmmc.org and click on the "Events" button.

7/27

San Francisco Museum of Modern Art's Animal Estates Project. 415-357-4000

8/2

Seaflow Vessel Watch trip to the Gulf of the Farallones National Marine Sanctuary. www.vesselwatchproject.org

9/13-10/1

TMMC Education Volunteer Training. 415-289-7361

9/20

Coastal Cleanup Day, 9am-12pm at Rodeo Beach

9/21-9/27

Sea Otter Awareness Week

9/27-9/28

California Academy of Sciences Public Opening Weekend. 415-379-8000

10/5

Romberg Tiburon Center's Discovery Day. 415-338-3757

10/7

McCormick & Kuleto's 15th Annual Shuck & Swallow Oyster Challenge Benefit for the Center - Ghirardelli Square 6pm. 415-929-1730

10/14

12th Annual Gala Benefit for the Center. Visit www.tmmc.org for tickets.

3/7/2009

Plan ahead! 26th Annual Run for the Seals.



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Science Update



Cancerous masses discovered during necropsy in the spleen of Keiki, a California sea lion. Photo: The Marine Mammal Center

A 2005 paper co-authored by The Marine Mammal Center's Dr. Frances Gulland and Denise Greig links PCB exposure to cancer in sea lions.

The paper, entitled "The role of organochlorines in cancer-associated mortality in California sea lions (*Zalophus californianus*)" which was published in the *Marine Pollution Bulletin*, shows that California sea lions that died of cancer had significantly higher levels of PCB concentrations in their blubber than those that did not die of cancer.

PCBs are a group of chemicals which were used in the production of things like coolants, flame retardant, plasticizers, and lubricating oils, among other things, in common household products. They have now been banned, but PCB contamination in the ocean has occurred due to improper disposal of products containing the chemicals.

Article Abstract:

Wild California sea lions (*Zalophus californianus*) have an unusually high prevalence of neoplasms (18% of stranded dead adults) and high levels of contaminants. The contribution of organochlorine (OC) tissue burdens to the probability of sea lions dying from carcinoma was explored using a logistic regression model. Levels of PCBs and DDTs were determined in blubber of sea lions diagnosed with metastatic carcinoma and animals that had died from non-carcinoma-related incidents (e.g., gunshot, domoic acid poisoning). Animals with carcinoma had higher mean concentrations (based on wet weight) of PCBs and DDTs (more than 85% and 30% higher, respectively) in blubber than

did sea lions without carcinoma; the highest concentrations of OCs in the sea lions affected with carcinoma were measured in the males. Blubber thickness was significantly different between the two groups of sea lions, but after controlling for this difference, there was still a significant effect of PCBs, but not DDTs, on the probability of sea lions dying with carcinoma. Age, sex, mass and length did not affect the probability of dying from carcinoma.

Would you like to ensure the protection of marine mammals and their ocean environment for generations to come?

You can do so by making a legacy gift to The Marine Mammal Center. The Center's planned giving society, The Steller Circle, is a caring group of people who have included the Center in their will or estate plans.

In recognition of such thoughtfulness, the Center honors members of The Steller Circle with special recognition and invitations to special events, such as private donor releases of rehabilitated animals back to their ocean home and the annual gala.

A bequest can easily be included in your will or living trust. A bequest may be a gift of a specific sum of money, a piece of property, a designated percentage of your estate, or the residual value of your estate after all other gifts are designated.

For more information, please contact the Development Office at 415-289-7335.

Hawaiian Monk Seal Rescue Effort

The Marine Mammal Center is working in collaboration with NOAA Fisheries and The Pacific Islands Fisheries Science Center to help rehabilitate a neonate Hawaiian monk seal that was abandoned by its mother and found on May 2, 2008 on the island of Kauai.



The abandoned Hawaiian monk seal pup, KP2, prior to his rescue. Photo: Wendy McIlroy

The U.S. Coast Guard transported the young male pup to Oahu for rehabilitation. With a population at 1,100 animals and declining at 4 percent a year, Hawaiian monk seals are nearly at the brink of extinction. The conservation efforts to help this animal are crucial to the long-term survival of the species. Two trained personnel from The Marine Mammal Center

are on site caring for the pup, nicknamed KP2, by feeding him a diluted milk formula. The Center's expertise in working with young harbor seals and elephant seals was a key factor in the success of a recent captive care project which provided nutritional supplementation to female juvenile monk seals to improve their chances of surviving in the wild and ultimately to reproduce. Six seals in the project were rehabilitated and released back to the wild. 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. As he gains weight, hopes for KP2's survival are increasing. See our website to learn how you can help save the Hawaiian monk seal.