

Leptospirosis Surge Affects Sea Lions

The Marine Mammal Center Begins a New Study in the Wild Population



Left: Blood samples are collected from a California sea lion. Middle: A California sea lion rests on a dock at San Francisco's PIER 39. Right: A net is positioned near the sea lions. Photos: The Marine Mammal Center, NMFS Permit No. 932-1489-10

Every four to five years, the Center sees a surge in the number of sea lions that are admitted with symptoms of leptospirosis, a bacterial infection that can be lethal for patients. If not treated, the bacteria can cause irreversible kidney damage. This year, over 100 sea lion patients have been admitted with the condition. While numbers are not as high as in 2004, when over 300 sea lions were admitted to the Center with kidney failure, veterinarians and scientists are on alert and taking advantage of the surge to study the disease in wild populations.

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 distinctive symptoms the infection causes, including drinking water and folding the flippers over the abdomen.

Marine mammals generally do not need to drink water because they receive all of 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. When sea lions have leptospirosis they also often tuck their front and hind flippers in close to their bodies, most likely because they have abdominal pain due to the infection. 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 will die.

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



Above: Toaster, a California sea lion, drinks water as a result of leptospirosis. Photo: The Marine Mammal Center

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is necessary to determine the causes of cyclical outbreaks in the California sea lion 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 at 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 our 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 wild population."

One of the spots where the research team is obtaining samples is San Francisco's PIER 39, a popular tourist destination where

"The blood samples our team is collecting from wild California sea lions will help them determine kidney function and exposure rates among these animals"

large numbers of California sea lions haul out. In the very early morning hours, these specially trained, dedicated volunteers assist veterinary staff in catching sea lions to obtain the samples. It's an unusual site for early-rising passersby, so the Center's Stranding Department staff is on hand to explain the study to the public. They also take the opportunity to educate people to stay back from stranded marine mammals and keep their pets away because humans and pets can contract leptospirosis as well if they come in contact with urine from infected marine mammals. The Center asks the public to call its rescue line at 415-289-SEAL if they spot a stranded marine mammal so rescue teams with appropriate training and equipment can respond.

The study will build on previous leptospirosis studies. See this issue's "Science Update" section to learn about one such study.

Long Marine Lab Sea Lion Hearing Study



Above: An anesthetized California sea lion wears headphones for a hearing test. Photo: The Marine Mammal Center

The Marine Mammal Center often works in collaboration with other organizations and acts as a resource for scientists who study a range of subjects regarding marine mammal health. For example, the Center has been working with scientists from UC Santa Cruz' Long Marine Lab to study the sensitivity of sea lions' hearing to different frequencies. The study is a topical one, as the results of the study may be able to help broaden knowledge about the effects of underwater noise like commercial ships and sonar, issues which have been widely debated. Studies such as this one may shed some light on that debate, which is largely theoretical in the absence of empirical data.

The California sea lions whose hearing was tested were mainly animals undergoing other medical procedures at The Marine Mammal Center. When under anesthesia, Long Marine Lab researchers were able to test for activity in the brain showing sensitivity to a number of frequencies played through headphones placed over the animal's ears. The data gathered will show whether or not the sea lions can hear certain noises underwater, and advances marine mammal science to help understand the factors that affect the health of populations of marine mammals in the wild.



Letter from the Executive Director

Center will give the public better access to information about marine mammals, making use of interactive tools in our education building, and giving guests the opportunity to view animals and behind-the-scenes operations. Veterinarians, volunteers, and staff will also have improved technologies and work spaces. In addition, our patients will benefit from new pens and pools. To top it all off, the new facility has many eco-friendly design elements that we are very proud of. You can read this issue's article on our green construction for the details.

As June approaches and the new facility becomes more and more of a reality, I want to share both my excitement for this new phase in the Center's history, as well as my appreciation for all who have helped to make it possible. It is thanks to you that The Marine Mammal Center has grown from a bathtub and a vision, to the impressive rehabilitation, research, and education facility it is today. I look forward to celebrating our future with each one of you.

Jeffrey R. Boehm
Executive Director,
The Marine Mammal Center

Bigger, Better, Greener The New Marine Mammal Center Opens in June!

In June of 2009, The Marine Mammal Center will proudly open its doors to a new, state-of-the-art facility located at the Sausalito headquarters, where it will be able to provide marine mammal patients with improved care, researchers and staff with improved equipment, and the public with better opportunities to learn about marine mammals through interactive learning tools and an improved education building. The new facility is spectacular, and places the Center on a world stage in marine mammal science and rehabilitation.

As The Marine Mammal Center sees the damaging effects of human activities on the marine mammals it treats every day, it is especially proud of incorporating environmentally friendly elements into the new center to minimize its impact on the

planet. Some of these "green" features throughout the new facility include:

- solar panels mounted on animal pen shade structures to generate the equivalent electricity consumption of 6-7 houses
- acoustic tiles made from seaweed
- low VOC (volatile organic compounds) paint and epoxy coatings
- low water consumption faucets and toilets
- landscaping with native plants that require no irrigation
- pervious concrete in the parking lot to prevent chemical runoff into the bay
- highly efficient water treatment systems that recycle water in patient pools
- energy-saving lighting systems to minimize electricity usage



Above: Solar panels cover the shade structures on the new facility's pens. Photo: The Marine Mammal Center



Above: The new facility, as photographed in early October. Photo: The Marine Mammal Center

Mark Your Calendars

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

1/8, 2/11, 3/10, 4/8

TMMC Volunteer Orientation, 1071 Fort Cronkhite 7-8:30 p.m. volunteer@tmmc.org for info.

1/16-1/18

Winter Bird Festival, Morro Bay Community Center www.morrobaybirdfestival.org

1/17, 2/21, 3/21, 4/25

TMMC Volunteer Orientation, 1071 Fort Cronkhite 11 a.m.-12:30 p.m. volunteer@tmmc.org for info

1/19

California sea lion anniversary at PIER 39 11a.m.-4 p.m.

1/24

Bay Area Environmental Education Resource Fair in San Rafael. www.baeerfair.org

2/19-2/22

San Francisco Ocean Film Festival. www.oceanfilmfest.org

2/22, 3/28, 4/19

Headlands Institute Family Open House 1-4 p.m. www.yni.org/summer

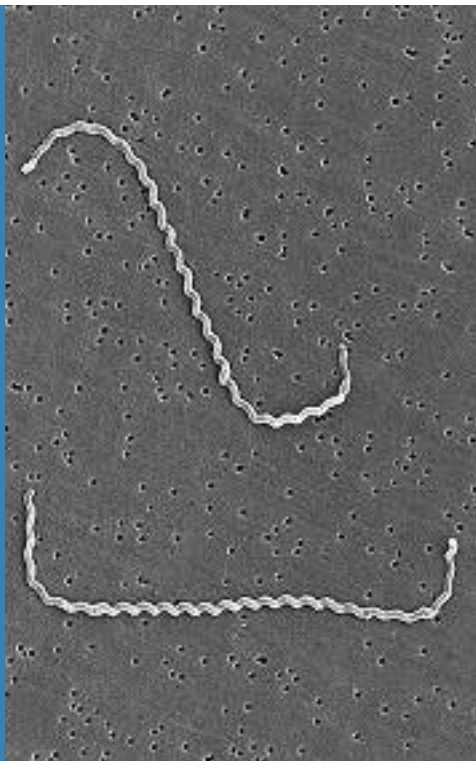
3/7-3/8

Mendocino Whale Festival. www.pointcabrillo.org

3/21-3/22

Ft Bragg Whale Festival. www.pointcabrillo.org

Science Update



Above: Leptospira bacteria under a microscope. Photo: Centers for Disease Control and Prevention

The Center's Dr. Frances Gulland and Denise Greig contributed to a 2007 paper that examines whether recurring epidemics of leptospirosis in sea lions are a result of repeated introduction of the pathogen from external reservoirs or part of a cycle of endemic disease.

The paper, entitled "Cyclical changes in seroprevalence of leptospirosis in California sea lions: endemic and epidemic disease in one host species?", was published in the

journal *BMC Infectious Diseases*. It serves as one piece of research in an ongoing study to determine the possible causes of periodic leptospirosis outbreaks in California sea lions. The paper calls into question a traditional model which maintains a distinction between chronic leptospirosis in the sea lion population, and epidemics caused by the recurring introduction of the disease from outside carriers. The paper's findings suggest that a combination of the two probably contributes to periodic epidemics.

Article Abstract:

Background: Leptospirosis is a zoonotic disease infecting a broad range of mammalian hosts, and is re-emerging globally. California sea lions (*Zalophus californianus*) have experienced recurrent outbreaks of leptospirosis since 1970, but it is unknown whether the pathogen persists in the sea lion population or is introduced repeatedly from external reservoirs.

Methods: We analyzed serum samples collected over an 11-year period from 1344 California sea lions that stranded alive on the California coast, using the microscopic agglutination test (MAT) for antibodies to *Leptospira interrogans* serovar Pomona. We evaluated seroprevalence among yearlings as a measure of incidence in the population, and characterized antibody persistence times based on temporal changes

in the distribution of titer scores. We conducted multinomial logistic regression to determine individual risk factors for seropositivity with high and low titers.

Results: The serosurvey revealed cyclical patterns in seroprevalence to *L. interrogans* serovar Pomona, with 4-5 year periodicity and peak seroprevalence above 50%. Seroprevalence in yearling sea lions was an accurate index of exposure among all age classes, and indicated on-going exposure to leptospires in non-outbreak years. Analysis of titer decay rates showed that some individuals probably maintain high titers for more than a year following exposure.

Conclusion: This study presents results of an unprecedented long-term serosurveillance program in marine mammals. Our results suggest that leptospirosis is endemic in California sea lions, but also causes periodic epidemics of acute disease. The findings call into question the classical dichotomy between maintenance hosts of leptospirosis, which experience chronic but largely asymptomatic infections, and accidental hosts, which suffer acute illness or death as a result of disease spillover from reservoir species.

The Holidays are Right Around the Corner. Give a Gift That Keeps on Giving!

This holiday season, make your gifts to loved ones do double duty, and help save a marine mammal! Proceeds from the purchase of any one of The Marine Mammal Center's unique gifts will support the Center and its patients.



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A. 2009 Wall Calendar



B. Ladies Fleece Logo Jacket



C. Decade T-shirt



D. Plush Sea Otter Backpack



E. Holiday Cards



F. Sea Lions DVD

A. 2009 Wall Calendar

The Marine Mammal Center's 2009 wall calendar features full-color photographs of marine mammals as well as educational facts and inset photos with information about the Center's work.

B. Ladies Fleece Logo Jacket

This flattering and cozy Ladies microfleece jacket has 2 zippered side pockets and drawstring closure. It comes in light blue with black side insets, or tan with brown insets. The Marine Mammal Center's new logo is embroidered on the front.

C. Decade T-shirt

Created for our 10 year anniversary, this design still remains our most popular! The 100% cotton short and long sleeve t-shirts are available in adult and youth sizes.

D. Plush Sea Otter Backpack

This adorable plush 18" backpack is the perfect gift for a child to tote items and snuggle!

E. Holiday Cards

15 beautiful ocean holiday cards are printed on recycled paper. Inside greeting: Let Heaven and Nature Sing.

F. Sea Lions DVD:

This award-winning documentary is narrated by Sean Astin. Dive into the cool, clear waters off the coasts of California and Mexico, where inquisitive sea lions live, play, and give birth to their pups.

You can make your purchase on our web site, by calling 415-289-7373, or by visiting our gift shops at Pier 39 San Francisco or building 1049 in the Marin Headlands. Place your order by December 14 to ensure delivery by Christmas, December 10 for delivery by Hannukah. Visit our website for our full catalogue of items.

Our Adopt-a-Seal package also makes a unique and thoughtful gift! Visit our website to order.

12th Annual Gala—A Smashing Success!

On Tuesday, October 14, 2008, The Marine Mammal Center held its 12th Annual Gala at the Ritz Carlton Hotel in San Francisco. Thanks to nearly 300 guests, including board members, volunteers, donors, staff, and new friends, the Center raised over \$160,000 toward its annual operating fund!

The Center Featured on Nova

The Center was recently featured on PBS' *Nova* episode "Ocean Animal Emergency". You can watch a clip from the hour-long show at www.pbs.org/wgbh/nova/ocean911.

The Marine Mammal Center is Blogging!

Have you checked out The Marine Mammal Center's new blog? The blog provides the public with a behind-the-scenes peek at what's going on at the Center and often includes exclusive photos and videos of rescues and patients! Visit the blog from the link on our homepage or at marinemammalcenter.blogspot.com.

Coastal Cleanup Day

As in years past, The Marine Mammal Center hosted another successful Coastal Cleanup Day at Rodeo Beach on Sept 20th, 140 volunteers collected a record 335 lbs. of trash and 21 lbs. of recyclables. Thanks to concerned citizens as well as staff and volunteers at the Center, all of that garbage was prevented from entering the ocean eco-system! Items removed included:

- 2,775 food wrappers/containers
- 1,882 cigarettes/cigarette filters
- 686 styrofoam/foam pieces
- 480 plastic caps
- 20ft. electrical cable
- 12'x 5' black plastic tube
- A 4'x4' blue plastic side of a shipping container from Canada



1. Karen Johnson-McKewan and Betty Hasler (Gala Co-Chairs) 2. Kristen Arkush and Marco Calavetta (Bodega Marine Laboratory) 3. Cinnie Magowan and Merrill Magowan (Chair, Board of Directors) 4. Martin Richards (Board of Directors) and Julie Richards 5. Frances Gulland (Director of Veterinary Science), Jeff Boehm (Executive Director) 6. Marie Kazan-Komarek (Volunteer), Cathy Kruttschnitt (Board of Directors and Volunteer) Tera Killip (Volunteer), and Jane Hansen (Volunteer) Photos: Drew Altizer

Upon arrival, guests were interviewed by Marybeth La Motte of RedCarpetSF.com, a webzine that features photo and video content about fashion and philanthropy in San Francisco (visit the RedCarpetSF.com website to watch a video about the gala!). During the reception and dinner, guests were treated to the beautiful music of solo guitarist Freddy Clarke.

After remarks from Chairman Merrill Magowan and Executive Director Jeff Boehm, an informative and inspirational

video about the Center was shown. Guests then enjoyed a scrumptious three-course meal paired with wines donated by Heitz Cellars and Spring Winery.

A live auction followed dinner. Guests bid on packages including a week in Carmel (with gift certificates to Tiffany & Co. and Wilkes Bashford!), a romance-filled weekend at the Ritz Carlton, vet-for-a-day at The Marine Mammal Center, a fabulous weekend in Las Vegas, and two limousine-chauffeured trips to Napa Valley!

The Fund-A-Need, in which guests place bids ranging from \$100 to \$5,000, was the most successful ever, raising over \$35,000 to help the Center purchase new animal carriers and other rescue supplies!

The Center is pleased to dedicate the "Special Thanks" section of this issue to all of our 2008 sponsors and donors!

The 13th Annual Gala will take place on Thursday, October 15, 2009 at the Ritz Carlton Hotel in San Francisco. Stay tuned to the website for more details!

Special Thanks

The Marine Mammal Center proudly recognizes the generous supporters of its 2008 Gala. Thanks to you, we raised over \$160,000!

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This was the most successful Fund-A-Need to date! The Center raised \$35,000 toward the purchase of new animal carriers and other rescue supplies for our patients!

Fund-A-Need Donors

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