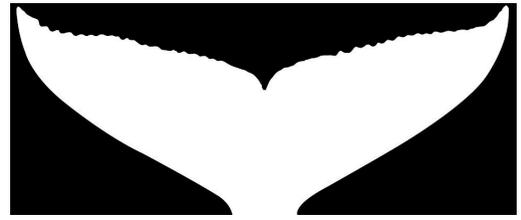


Soundings



American Cetacean Society – Monterey Bay Chapter
PO Box H E, Pacific Grove, CA 93950

APRIL 2014

**MONTHLY MEETING AT HOPKINS MARINE STATION,
LECTURE HALL BOAT WORKS BUILDING
(ACROSS FROM THE AMERICAN TIN CANNERY OUTLET STORES)
MEETING IS OPEN TO THE PUBLIC**

MEETING DATE:

Thursday, April 24, 2014

Time: 7:30 PM

PLEASE JOIN US AT 7:00 FOR REFRESHMENTS

Speaker: Milos Radakovich

Title: Sea Mammals: Flukes Are No Fluke

Our April speaker has been cruising the world – Alaska, Hawaii, Caribbean, Mediterranean, Norway, South America, Australia/New Zealand – for the past eight years. Milos Radakovich is an on-board naturalist for Celebrity Cruises/Royal Caribbean. He was an active marine biologist and educator around Monterey Bay for 30 years before that, and well known for his programs, classes and tours.

Milos will be talking to us about cetaceans and their ancestors and the genetic revelations of the past decade or so. “We’re a long way from knowing the whole story, but more chapters are being written all the time by researchers from all over the world,” he notes. “We know the ending as of today, but the tale of how their ancestors survived and even succeeded in a medium so inherently hostile to warm-blooded air breathers is truly fascinating and not just a fluke.”

A longtime member of the American Cetacean Society, Milos was president of our chapter in 1982-83. He also helped found a marine mammal stranding team and was co-founder and director of Bay Net, the shoreline docent group of the Monterey Bay National Marine Sanctuary. Before he left the mainland for his cruising career, Milos starred on a science show on KUSP, the NPR station in Santa Cruz.

He was awarded the Association of Monterey Bay Area Governments’ Citizen Award in 1996, the Monterey Bay National Marine Sanctuary’s Educator of the Year Award in 1998, and NOAA’s Environmental Hero Award in 2001. A native of Serbia, he immigrated to the U.S. with his family when he was 11.

Please join us for refreshments before the program begins. More information is available on our website, <http://www.acsmb.org/>.

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Coming in May: Our next program will be with Steve Palumbi at 7:30pm on Thursday, May 29, with refreshments at 7 p.m. Palumbi is Director of Hopkins Marine Station and will be speaking about his new book, “The Extreme Life of the Sea.”

CALENDAR

Apr. 10-17: 34th Annual Symposium on Sea Turtle Biology and Conservation, New Orleans, LA.

Apr. 24: Hopkins Marine Station Spring 2014 Lectures: Boris Worm, Dalhousie University. Status, Trends, and Prospects for Global Fisheries. 2pm-3pm on Thurs., April 24 at HMS Boatworks Hall.

Apr. 26: Monterey Bay National Marine Sanctuary Currents Symposium 2014 at CSUMB's University Center in Seaside, CA: Marine Debris: How Do You Pitch In? 9am-3:30pm.

May 2: The Rise of DNA in Conservation and Ocean Management. Lecture by Stephen Palumbi, Stanford University. 12pm-1pm on Friday, May 2 at HMS Boatworks Hall.

May 2-3: Southern California Academy of Sciences Annual Meeting at Cal State University Channel Islands. Scheduled Symposia will include programs on marine mammals and marine science. For more info go to scas.nhm.org

May 3-4: Moss Landing Marine Laboratories Open House, 9:00am-5:00pm both days

Friends of Hopkins Marine Station Lectures Tuesdays, 7:30pm

May 13: Dr. Jim Harvey, Director, Moss Landing Marine Laboratories
It's Not the Cheese: Why Predators Eat in Monterey Bay

Special Killer Whale All-Day Trips!

Join Monterey Bay Whale Watch on a quest for Killer Whales with California's Leading Killer Whale Experts (Nancy Black and Alisa Shulman Janiger). Trips depart from Monterey Bay Whale Watch at 7:00 am and will return sometime around 5:00 pm. Cost is \$145.00 per person. Dates include: Sun. Apr. 20, Mon. Apr. 21, Thurs. Apr. 24, Fri. Apr. 25, and Sat. Apr. 26. For more dates call Monterey Bay Whale Watch at 375-4658 or go to montereybaywhalewatch.com.

May 14: Whale Trail with Erich Hoyt (<http://thewhaletrail.org>). Orca Tour 2014: Along the Range of the Southern Resident Killer Whales. Kick-off event at the Museum of Monterey, 6-8pm. The goal of Whale Trail is to promote awareness of J, K and L pods throughout their range (Vancouver to Monterey, CA). MBNMS is placing new interpretative signs in Monterey and Santa Cruz, and ACSMB is a sponsor. Reception, followed by a talk on orcas by expert Erich Hoyt.

May 16: The Unorthodox Whales of Sri Lanka: Conservation through Science and Engagement. Lecture by Asha de Vos, University of California, Santa Cruz. 12pm-1pm on Friday, May 16 at HMS Boatworks Hall.

May 19-22: 65th Tuna Conference at UCLA Lake Arrowhead Conference Center: How Do Large Pelagics Work and What Do They Want? Contact Tuna Conference Coordinator Stephanie Flores at (858) 334-2877.

Sep. 22-26: The 5th Bio-logging Science Symposium, Strasbourg (France).

Nov. 7-9: American Cetacean Society 14th International Conference at the Hyatt Regency in Newport Beach, CA: Tuned in to Whales, Conservation, Research and Education.

**Monterey Bay Chapter
American Cetacean Society
Blue Whale Fundraiser**

Join expert Monterey Bay Naturalist and Biologists as we search Monterey Bay for the largest animal that has ever lived: 'The Great Blue Whale'.

When: Saturday June 28th 2014 from 9:00 am-1:30 pm

Boat: Sea Wolf Two, Monterey Bay Whale Watch, Monterey, CA

Cost: \$50.00

In addition to searching for blue whales there is a high probability that humpback whales and several species of dolphin will be feeding in Monterey Bay. We will also be on the lookout for killer whales, black footed albatross, and pinnipeds. Note: Last years trip was sensational. We observed 18 blue whales, 6 humpback whales and 2 fin whales. For reservations and more information please call Tony Lorenz at [831-901-7259](tel:831-901-7259).

40 Years of Evolution: Darwin's Finches on Daphne Major Island, by Peter R. Grant and Rosemary Grant. 2014 Princeton University Press

**CUVIER'S BEAKED WHALES SET NEW
BREATH-HOLD DIVING RECORDS**

WHALES DIVE TO NEARLY TWO MILES DEPTH,
FOR OVER TWO HOURS

Mar. 26, 2014 — Scientists monitored Cuvier's beaked whales' record-breaking dives to depths of nearly two miles below the ocean surface and some dives lasted for over two hours, according to results published March 26, 2014, in the open access journal *PLOS ONE* by Gregory Schorr from Cascadia Research Collective and colleagues.

Distributed throughout the world's oceans, the Cuvier's beaked whales' frequent dives deep into the ocean make them difficult for researchers to study. Previous studies using short-term tags (~ 215 hours of data) have indicated that this deep-diving species might be the most extreme breath-holding diver in the ocean. To better understand this behavior, scientists analyzed data from satellite-linked tags that recorded the diving behavior and locations of eight Cuvier's beaked whales off the Southern California coast. Researchers collected over 3,700 hours of diving data, including depth and time of each dive.

Researchers recorded 1100 deep-dives, averaging 0.87 miles deep, and 5600 shallow-dives, averaging about 0.17 miles deep. The deepest dives recorded was one that reached nearly two miles below the ocean surface, and the longest lasted 137 minutes. The dives captured by this study not only exceed the previous Cuvier's beaked whale diving records of ~1 mile deep and 95 minutes, but also the current mammalian dive record previously set by the southern elephant seal at ~1.5 miles deep and 120 minutes. One striking difference compared to other divers is that deep-diving elephant seals and sperm whales require an extended recovery period after long, deep dives, whereas Cuvier's beaked whales average less than two minutes at the surface between dives.

According to the authors, the results of this study provide a better understanding of the unique diving capabilities of this species, which accounts

BOOK
RECOMMENDATIONS

Shaping Humanity: How Science, Art, and Imagination Help Us Understand Our Origins, by John Gurche. 2013 Yale University Press.

The Sibley Guide to Birds: Second Edition, written and illustrated by David Allen Sibley. 2014 Knopf.

Lost Animals: Extinction and the Photographic Record, by Errol Fuller. 2014 Princeton University Press.

The Amazing World of Flying Fish, by Steven N. G. Howell. 2014 Princeton University Press

for 69% of recorded marine mammal strandings associated with military sonar operations. However, all eight whales were tagged on a Navy sonar training range off the west coast of California and spent significant portion of their time there, suggesting that these animals may have learned to cope with anthropogenic disturbances that cause stranding in Cuvier's beaked whales elsewhere. "It's remarkable to imagine these social, warm-blooded mammals actively pursuing prey in the darkness at such astounding depths, literally miles away from their most basic physiological need: air," added Greg Schorr.

<http://www.sciencedaily.com/releases/2014/03/14/0326182037.htm>



An adult female Cuvier's beaked whale swims off the Big Island of Hawaii in 2008. (Credit: Photo by Robin Baird, Cascadia Research Collective)

NEW REPORT REVEALS U.S. FISHERIES KILLING THOUSANDS OF PROTECTED AND ENDANGERED SPECIES THROUGH BERING STRAIT

A NEW REPORT BY OCEANA EXPOSES NINE U.S. FISHERIES THAT THROW AWAY HALF OF WHAT THEY CATCH, AND KILL DOLPHINS, SEA TURTLES, WHALES, AND MORE IN THE PROCESS.

Mar. 23, 2014 — These fisheries are even fishier than they smell.

A new study released this week called *Wasted Catch: Unsolved Bycatch Problems in U.S. Fisheries* reveals the nine dirtiest fisheries in the United States. It's a dirty bunch indeed, the waste between them accounting for nearly half a billion wasted seafood meals in the U.S. alone.

Culled by Oceana, the largest international organization for ocean conservation, the fisheries

are ranked based on bycatch—the amount of unwanted creatures caught while commercial fishing. Combined, they're responsible for 50 percent of reported bycatch nationwide.

At the dirtiest fishery, Southeast Snapper-Grouper Longline Fishery, 66 percent of the animals caught are discarded—a number that includes more than 400,000 sharks in just one year. Close behind is California Set Gillnet Fishery, where 65 percent of animals caught are thrown away. The other seven dispensaries, spanning from coast to coast, are death traps for thousands of sea organisms each year.

"We're allowing the capture and death of whales, dolphins, porpoises, turtles, and more," Dominique Cano-Stocco, campaign director for Oceana tells *The Daily Beast*. While it's technically a pro-ocean conservation organization, Oceana stresses that it's pro-fishing too—but the safe kind. In the interest of bringing in huge quantities, commercial fishing techniques have turned grisly. "Gillnets," or as Cano-Stocco refers to them "walls of death" are nets that can be as long as two miles. Meant to capture fish by the gills (hence the name), they snare anything from sea turtles to dolphins. "Trawls," which Cano-Stocco has nicknamed "the bulldozers of the ocean," are long nets that are dragged along the ocean floor, taking no prisoners in their path. "No matter if you're looking at animal conservation, ecosystems, or just waste in general—at all nine fisheries, it's a bad story," she says.

With wide-reaching nets, catches are unintentionally trapping and killing thousands of unwanted bait. It's a problem that is crippling the efforts of ocean conservationist nationwide. "If we don't clean up these particular fishing gears then we're continuing to throw away millions of pounds of fish every year as waste," says Cano-Stocco. "It's absurd."

The gut-wrenching data, retrieved from the National Marine Fisheries Service, exposes bycatch as the dark and deadly underbelly of commercial fishing. "It's still the largest threat to maintaining fish populations and ecosystems," says Cano-Stocco. While scientists and the government (NOAA) have known about bycatch for a long time, their efforts to combat it have not been effective. "We've made great progress in the fight against this, but not enough."

For the ocean conservation community it's the knowledge that the senseless deaths could be

avoided that is most infuriating. Banning gill nets and trawls, enforcing a system of accurate counting, and capping the number of waste, has the potential to completely change the world of commercial fishing.

As it stands now, the commercial fishing industry is eclipsing even the most advanced efforts to preserve the ocean's natural habitat and protect endangered species. Cano-Stacco, for one, hopes that the study highlights not simply the problem, but the urgency for a solution. "If you don't get bycatch under control, the other government programs won't work," says Cano-Stacco. "If you do, you not only save the ocean, you provide a potential solution to the human overpopulation crisis in the process."

<http://www.thedailybeast.com/articles/2014/03/23/new-report-reveals-u-s-fisheries-killing-thousands-of-protected-and-endangered-species.html>

JAPAN HALTS WHALING PROGRAM IN RESPONSE TO INTERNATIONAL COURT RULING

JAPAN'S PROGRAM TO TAKE MINKE, FIN, AND HUMPBACK WHALES IN THE SOUTHERN OCEAN IS NOT BASED ON SOUND SCIENCE, SAYS COURT.

by Jane J. Lee

Mar. 31, 2014 — Japan says it will abide by a Monday ruling from the United Nations' International Court of Justice ordering the nation to stop hunting whales off Antarctica.

Japan had long claimed that its program to take minke, fin, and humpback whales in the waters surrounding Antarctica (referred to in the ruling as the Southern Ocean) was aimed at collecting scientific data.

But the International Court of Justice (ICJ), headquartered at the Hague in the Netherlands, found that the program was not scientific in nature and that it could be considered commercial whaling.

The International Whaling Commission (IWC) banned commercial whaling in 1986, and most countries participating in the IWC, including Japan, have said they will follow that ban.

"Japan is disappointed and regrets" today's ruling, according to a statement by the chief cabinet secretary of Japan. "However, Japan will abide by the Judgment of the Court."

Until now, Japan had continued taking whales



Crew members hoist a minke whale, captured near Kushiro, Japan, aboard a ship. (Credit: Photo by Kyodo Via AP)

under a provision of the 1986 ban known as Article Eight, which allowed the killing of whales for scientific purposes.

"It's a huge victory," Leigh Henry, senior policy advisor for wildlife conservation at the World Wildlife Fund (WWF), said of Monday's ruling, which goes into effect immediately. "We've been fighting this battle for over three decades with little results."

"Essentially, [Japan] was exploiting this loophole" in the whaling ban, Henry said.

A Nonscientific Hunt

The suit, brought before the UN court by Australia—with support from New Zealand—alleged that Japan's whaling program was not based on sound scientific principles.

The court ruled in favor of Australia, finding that Japan had failed to address a variety of Australia's concerns, including whether nonlethal methods could be used to collect data rather than lethal methods.

Japan has said it needs to kill whales to obtain basic biological information about the animals, such as data on pregnancy rates and age at first reproduction, said Leah Gerber, a marine mammal biologist at Arizona State University in Tempe.

But "we don't need to keep killing them to do science," she said. Blubber biopsies can give researchers plenty of information on reproductive status and diet. That just requires shooting a small dart at a whale to take a plug of skin and blubber.

Once a Japanese ship lands a whale, there is some semblance of scientific activity, including collecting organs for use in research, Gerber said.

But the bulk of the whale goes to market, she said, where it's sold for consumption.

The court said that Japan also failed to justify their sample sizes—850 minke whales, plus or minus 10 percent; 50 fin whales; and 50 humpbacks.

"Other aspects of JARPA II also cast doubt on its characterization as a programme for purposes of scientific research," the court said, referring to the name of the Japanese program, "such as its open-ended time frame, its limited scientific output to date, and the absence of significant co-operation between JARPA II and other related research projects."

Should Japan later decide not to abide by the ICJ's ruling, enforcement options are limited. But enforcement measures could include pressure from other governments in the form of economic sanctions.

Smaller Marine Mammals Still Hunted

This decision affects Japan's taking of big whale species—which include humpbacks, fins, and minke whales—since the 1986 whaling ban applies only to medium-size and large whales.

Smaller relatives, like dolphins and porpoises, are still subject to hunting. Thus Japan's controversial take of dolphins in Taiji Cove can continue.

Japan is not the only country that has continued its whaling practices. Norway, also part of the IWC, opted out of the 1986 moratorium on commercial whaling.

Called "taking a reservation," Norway continues to hunt whales, but does so according to sustainability guidelines provided by the IWC, said Henry.

Iceland dropped out of the IWC after the 1986 ban, but rejoined two years later and opted out of the moratorium. The country has continued to hunt whales and doesn't follow sustainability guidelines, Henry said.

A coalition of wildlife groups have submitted a formal request, called a Pelly petition, to the U.S. government to cite Iceland for its whaling activities.

Some IWC member countries take whales as part of subsistence hunts. "That's allowed by the IWC and is very well managed and overseen by the IWC," said Henry. Canada participates in the subsistence hunts, but is not part of the commission.

<http://news.nationalgeographic.com/news/2014/0>

3/140331-whaling-japan-international-court-ocean-animal-conservation/

CORE SKIN BACTERIAL COMMUNITY IN HUMPBACK WHALES

Mar. 26, 2014 — Bacteria are invisible to the naked eye, but they reside on nearly every surface humans encounter -- including the skin. Uncovering the role these microorganisms play in human health is a major focus of research in skin microbiology, but little is known about the identity or function of skin bacteria in other mammals.

In a paper published in the open access journal *PLOS ONE*, researchers at Woods Hole Oceanographic Institution (WHOI) and colleagues identified a core skin bacterial community that humpback whales share across populations, which could point to a way to assess the overall health of these endangered marine mammals.

"The skin is the interface between the animal and the ocean it lives in," said lead author Amy Apprill, a microbiologist at WHOI. "By studying the bacterial species on the skin of humpbacks, we might be able to learn more about their health and the status of their environment."

Apprill collected 56 skin samples from humpback whales from the North Atlantic, North Pacific and South Pacific oceans with the help of scientists at the Provincetown Center for Coastal Studies, Hawaiian Islands Humpback Whale National Marine Sanctuary and University of Hawaii at Hilo. The samples were obtained from



This is a humpback whale entangled in fishing gear off New England. Health assessment techniques can improve our understanding of human impacts on endangered whales. (Credit: Photo by Provincetown Center for Coastal Studies under NOAA permit 932-1489)

biopsy collecting darts that bounce off the whales' skin and also from skin that naturally sloughs off when whales breach. Detailed population studies in these areas provided important details about the individuals involved, such as their age class and sex.

The research team sequenced and identified over 500,000 small-subunit ribosomal RNA genes from bacteria obtained from humpback whale skin and also compared the data to bacterial sequences found on the skin of deceased whales and whales with injuries and compromised health, such as those entangled in fishing line.

Analysis of skin samples revealed an abundance of two core groups of bacteria specific to humpbacks -- *Tenacibaculum* and *Psychrobacter*. The overall composition of the bacteria differed by geographical location and metabolic state, as well as in stressed and deceased individuals. In stressed and deceased whales, researchers found less of the two core bacteria and more potential pathogens present.

"There always seems to be this core group of bacteria that attach to the whale skin," said Tracy Mincer, a microbiologist at WHOI and coauthor of the study. "When that core group starts to shift, such as in the case of individuals with compromised health, we saw other bacteria -- potentially harmful bugs such as anaerobes, which are common in human skin diseases -- showing up."

Humpback whales are oceanic nomads that travel thousands of miles during their seasonal migration, also coming into contact with numerous bacteria and other microbes along the way.

"As very large animals, they have a huge skin surface with a lot of nutrients for microbes to live on and attach to," Mincer said. "How do they control their skin from looking like a ship hull? How do they stay smooth and shiny?"

Researchers aren't sure yet how the core bacteria are interacting with the whales or each other. "The next step is to figure out what the core bacteria are doing -- and if they're doing anything that benefits the whales," Apprill said. "There's a spectrum of things they could be doing, such as keeping the whale clean of fouling organisms or producing antibiotics to fend off potential pathogens."

Figuring out the specific role of the core bacteria will be the next step in this important research that could eventually aid in efforts to

monitor population health and conservation status of threatened or endangered marine mammals.

"Large whales are difficult to study in the wild, and assessing their health is both important and challenging," said Jooke Robbins, a coauthor and director of humpback whale research at Provincetown Center for Coastal Studies. "This study provides the first baseline on the 'normal' composition of skin bacteria across ages, sexes, populations and habitats. It is an important step toward a quantitative tool for assessing whale health and, potentially, impacts from human activities."

"This work represents a productive blend of fundamental and applied research," said Michael Moore, director of the WHOI Marine Mammal Center, which funded the work. Researchers from the Marine Biological Laboratory, The Dolphin Institute, and the International Fund for Animal Welfare also contributed to the study.

<http://www.sciencedaily.com/releases/2014/03/14/0326182236.htm>

FORM OF EPILEPSY IN SEA LIONS SIMILAR TO THAT IN HUMANS, RESEARCHERS FIND

by Ruthann Richter

Mar. 18, 2014 — California sea lions exposed to a toxin in algae develop a form of epilepsy that is similar to one in humans, according to a new study led by Stanford University School of Medicine researchers.

Every year, hundreds of sea lions wash up along the California coast, suffering seizures caused by exposure to domoic acid, a neurotoxin that can produce memory loss, tremors, convulsions and death. Domoic acid is produced by algae blooms that have been proliferating along the coast in recent years, accumulating in anchovies and other small fish that the sea lions feed on, said Paul Buckmaster, PhD, DVM, professor of comparative medicine at Stanford.

Buckmaster and his colleagues studied the brains of affected sea lions and found they had a pattern of damage in the hippocampus — the brain's memory center — much like that in humans with temporal lobe epilepsy.

"We found there was a loss of neurons in specific patterns that closely matched what is found

in people,” he said. “And there is synaptic reorganization — a rewiring of surviving neurons. This also matches what is found in humans with temporal lobe epilepsy.”

He said further studies in the animals could help in developing better treatments for them, as well as for their human counterparts.

Buckmaster is lead author of the study, which was published online March 19 in the *Journal of Comparative Neurology*.

Epilepsy in humans

Temporal lobe epilepsy is one of the most common forms of epilepsy in humans and has no cure. It typically begins with a seizure caused by an insult to the brain, such as head trauma, high fever or lack of oxygen. Months or years later, it progresses into epilepsy, with periodic seizures that may be treated with anti-convulsive medication or, in some cases, surgery.

There is one documented case of a patient who was found to have developed temporal lobe epilepsy following exposure to domoic acid. The 84-year-old Canadian was one of more 250 people who became ill in 1987 after eating mussels from Prince Edward Island that were found to be contaminated with domoic acid. The man, who suffered nausea, vomiting, coma and convulsions, initially recovered but was diagnosed a year later with temporal lobe epilepsy; he died some two years later of pneumonia. Three other Canadians died in the mussel incident as a result of domoic acid poisoning.

In sea lions, the first link between domoic acid and epilepsy was established in 1998, when some 400 animals washed ashore in California’s Monterey Bay on Memorial Day weekend. Some had died, while others were in the throes of seizures, weaving their heads, flailing about and scratching themselves in an odd way. About 100 of the animals were rescued by the Marine Mammal Center in Sausalito, where experts were at a loss to explain the animals’ bizarre behavior, said Frances Gulland, PhD, DVM, senior scientist at the center and co-author of the current study.

She contacted Christopher Scholin, PhD, now president of the Monterey Bay Aquarium Research Institute, who discovered the bay waters had the highest levels of domoic acid ever recorded, she said. Blood and urine samples from the sea lions confirmed they had domoic acid poisoning. The

researchers documented their findings in a 2000 *Nature* paper.

Treating the sea lions

Since then, Gulland said a few hundred sea lions with epilepsy have been rescued every year by the mammal center, and about half respond to treatment with anti-convulsive therapy. But some suffer from seizures that may continue for hours, causing extensive brain damage. These animals have no hope for recovery and have to be euthanized.



Marine Mammal Center workers attend to a sea lion that suffered seizures caused by exposure to a toxin in algae. (Credit: Marine Mammal Center)

In these cases, mammal center officials turn to Buckmaster, a veterinarian who is an expert in epilepsy in animals. For the past four years, he has been working on studies of the epileptic sea lions, examining samples of their brain tissue to better understand what underlies the disease.

In the current study, he and his colleagues retrieved samples of tissue from the hippocampus, which they cut into thin slices and then stained so that the neurons could be viewed under a microscope. They collected tissues from 14 sea lions with epilepsy and compared them with similar samples from nine without epilepsy who had died of other causes, such as cancer, infection or shark bite wounds.

The animals with epilepsy had lost about 50 percent of the neurons in the hippocampus, similar to what is seen in people with temporal lobe epilepsy, Buckmaster said. The researchers observed another striking similarity: In most cases, the hippocampus on only one side of the brain in the sea lions showed any signs of damage.

“That was really surprising,” Buckmaster said. “That is what you find in people — 80 percent of the time the damage is just on one side.”

In rats and mice, which are the models typically used in epilepsy studies, injury is seen in the hippocampus of both sides of the brain, he said.

Damage on only one side

The results are curious, as sea lions ingest the toxin throughout their bodies, he said. “Why would there be damage only on one side?”

He speculated that it could be related to the size and structure of the brain. Like the human brain, the sea lion brain is significantly larger than a rodent brain — 700 times larger than a mouse brain and 180 times larger than a rat brain — and contains many more neurons. However, the average number of synapses — connections between nerve cells — per neuron is roughly the same in rodents and humans. Without more synapses for each neuron, the probability of any two neurons in the large brain being connected must be lower than it is in the small brain, Buckmaster surmised. So this relative lack of interconnectivity in human and sea lion brains could be why damage remains localized to a specific area, he said. (The number of synapses hasn’t been measured in sea lions, though it seems reasonable to speculate that they would have a similar ratio of synapses per neuron, he said.)

The researchers also noticed a pattern of rewiring in the brains of the epileptic sea lions that is similar to that in humans with temporal lobe epilepsy. Among the neurons that survived the assault by domoic acid, some of the axons — the nerve fibers that carry electrical impulses away from the neuron — extended into a region of the hippocampus where they don’t normally grow. That creates a kind of positive feedback loop in which the cells are exciting themselves, which might contribute to more seizure activity, Buckmaster said.

“We see this in people with temporal lobe epilepsy,” he said. “It’s one of the key neuropathological features of the disease.”

Hopes for new treatments

Because of these similarities, he said the sea lions could serve as good models for developing new treatments for the disease. Patients typically are treated with daily, anti-convulsive drugs, or in some cases with surgery in which doctors remove a portion of the hippocampus — an invasive procedure that often causes some memory loss.

The ultimate goal, he said, is to develop a therapy that could be used early on to forestall brain damage and prevent further seizures.

“What we need is an interventional treatment — both in humans and sea lions,” he said. “You’d give the treatment right after the brain injury, and that would prevent them from developing epilepsy. That’s the dream, but we are not there yet.”

Gulland said the research has been a valuable contribution to the field. “For us, the work Dr. Buckmaster has done is really important because it shows the sea lions are really epileptic,” she said. “We used to think if they had just a small amount of the poison, they could recover and be fine. But if the seizure has gone on for any length of time, they become permanently affected. It’s very distressing to the animals and to the people who work with them to see them coming back having seizure after seizure.”

Buckmaster is now planning new studies of the sea lions using the entire brain, fully preserved right after the animals’ death so the “beautiful anatomy” of various structures is visible.

“We will be able to see areas of brain damage we have never seen before,” he said. “Based on the hippocampus results, there’s a good chance it will be similar to people.”

He also has a grant to study the effects of in utero exposure to domoic acid. Some of the sea lions in the study were younger animals thought to be exposed before birth, as domoic acid can concentrate in amniotic fluid at a time when the nervous system is developing, Buckmaster said. The mammal center has treated three pups from mothers that were exposed to domoic acid in pregnancy, two of whom developed epilepsy later in life. It’s believed that humans could be susceptible to in utero damage from the toxin as well, he said.

Meanwhile, the problem of marine mammal exposure to domoic acid is not likely to go away anytime soon. The harmful algae blooms, believed to be produced by micronutrients contained in agricultural runoff, have been increasing in

frequency along the California coast and are lasting longer, sometimes for months at a time, Gulland said.

And while sea lions may be the most visible victims, it's believed that other marine mammals, such as whales and dolphins, are affected by the toxin and may have seizures and drown in the open ocean, though the extent of the problem isn't known, Gulland said. William van Bonn, DVM, formerly of the Marine Mammal Center and now at the Shedd Aquarium in Chicago, was senior author of the paper.

<http://www.sciencedaily.com/releases/2014/03/14/0318113725.htm>

SIGHTINGS

Sightings are compiled by Monterey Bay Whale Watch. For complete listing and updates see www.gowhales.com/sighting.htm

Date	#	Type of Animal(s)
4/4 am	16 200	Humpback Whales Pacific White-sided Dolphins
4/3 pm	9 2 10	Humpback Whales Gray Whales Risso's Dolphins
4/3 am	5 3 50	Humpback Whales (breaching) Gray Whales Risso's Dolphins
4/2 pm	2 10 20	Humpback Whales Pacific White-sided Dolphins Risso's Dolphins
4/2 am	3 20 300	Humpback Whales Pacific White-sided Dolphins Risso's Dolphins
4/1 am	10 400	Humpback Whales Risso's Dolphins
3/31 am	7	Humpback Whales
3/30 pm	10	Humpback Whales
3/30 am	9 1 150	Gray Whales Humpback Whales Risso's Dolphins

3/29 pm	4 30	Humpback Whales Risso's Dolphins
3/29 am	6	Humpback Whales
3/28 pm	8 75	Humpback Whales Risso's Dolphins
3/28 am	2 4 1 20	Gray Whales Humpback Whales Killer Whale (Fat Fin) Risso's Dolphins
3/27 pm	5 40	Humpback Whales Risso's Dolphins
3/25 pm	8	Humpback Whales
3/25 am	4 9 25	Gray Whales Humpback Whales Risso's Dolphins
3/24 pm	2 9	Gray Whales Humpback Whales
3/24 am	11 3 60	Gray Whales Humpback Whales Risso's Dolphins
3/23 pm	7 5	Gray Whales Humpback Whales
3/23 am	7 3 25	Gray Whales Humpback Whales Risso's Dolphins
3/22 pm	8 6	Gray Whales Humpback Whales
3/22 am	2 4 500	Gray Whales (friendly) Humpback Whales Risso's Dolphins
3/22 early am	7 4 500	Gray Whales Humpback Whales Risso's Dolphins
3/21 pm	16 200	Gray Whales (3 mating/social whales) Risso's Dolphins
3/21 am	5 4 7	Gray Whales Humpback Whales Killer Whales (transient type)
3/20 pm	7 3	Gray Whales Humpback Dolphins
3/20 am	6 1	Gray Whales Humpback Whale
3/19 pm	6 4	Gray Whales Killer Whales

3/19 am	15 200	Gray Whales Pacific White-sided Dolphins
	75	Risso's Dolphins
3/18 am	6	Gray Whales
3/17 am	49	Risso's Dolphins
3/16 pm	1 150	Humpback Whale Risso's Dolphins
3/16 am	4 150 3	Gray Whales Risso's Dolphins Bottlenose Dolphins
3/15 am	16 2	Gray Whales Humpback Whales
3/15 early am	18 2 1 600	Gray Whales Humpback Whales Killer Whale (Stumpy) Pacific White-sided Dolphins
	400	Risso's Dolphins
3/14 pm	3 200	Gray Whales Risso's Dolphins
3/14 am	14 350 200	Gray Whales Pacific White-sided Dolphins Risso's Dolphins
3/13 pm	10	Gray Whales
	2 300	Humpback Whales Pacific White-sided Dolphins
	50	Risso's Dolphins
3/13 am	11 900 100	Gray Whales Risso's Dolphins Northern Right Whale Dolphins
3/12 pm	20 70	Gray Whales Risso's Dolphins
3/12 am	25 10 40	Gray Whales Killer Whales Risso's Dolphins
3/11 pm	12 50 60	Gray Whales Pacific White-sided Dolphins Risso's Dolphins
3/11 am	8 2 100 200	Gray Whales (northbound) Humpback Whales Pacific White-sided Dolphins Risso's Dolphins

3/10 am	2 50	Gray Whales Risso's Dolphins
3/9 pm	23	Gray Whales
3/9 am	14 3 75	Gray Whales Humpback Whales Pacific White-sided Dolphins
	120	Risso's Dolphins
3/8 pm	3 140	Gray Whales Risso's Dolphins
3/8 am	12 250	Gray Whales Pacific White-sided Dolphins
	1300 20	Risso's Dolphins Northern Right Whale Dolphins
3/7 am	8 150 200	Gray Whales Pacific White-sided Dolphins Risso's Dolphins



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Humpback Whale lunge feeding. (Credit: Photo by Daniel Bianchetto)

American Cetacean Society
Monterey Bay Chapter
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