

Soundings



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

OCTOBER 2017

**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**

Thursday, October 26, 2017

Time: 7:30 PM

PLEASE JOIN US AT 7:00 FOR REFRESHMENTS

Speaker: Dr. Patrick Robinson

Patrick Robinson is a UC Santa Cruz Lecturer and the Director of the Año Nuevo Island Reserve. He grew up in Colorado and moved to California to attend UC Santa Cruz. His research career started as a volunteer at Año Nuevo Island doing sea lion and elephant seal censuses. He was inspired to continue his education by obtaining a Ph.D. studying the foraging behavior of seals and sea lions using electronic tags such as time-depth recorders and GPS tags. This research has taken him all over the world, but to be leading research and outreach activities back at Año Nuevo, at the same place he started his own career!



His primary interest is understanding how marine predators make a living in the open ocean. To do this, he works with a variety of researchers to attach biologging instruments to free-ranging seals and sea lions. His research questions include: 1) How do these animals navigate accurately across thousands of kilometers of feature-less ocean? 2) Where do these animals find the best prey resources? and 3) Can oceanographic features be used to predict where animals will find prey? Patrick has worked on a variety of species to help answer these questions, including northern elephant seals, California sea lions, Weddell seals, crabeater seals, and Galapagos sea lions. He will be speaking about elephant seals, pinnipeds, and Año Nuevo restoration efforts.

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

Next month: Our November and December meetings are combined because of the seasonal holidays, so our final program this year will be on Thursday, Dec. 7. Please save the date and join us!

INSIDE THIS ISSUE

CALENDAR2

**RESOURCE PARTITIONING
FACILITATES COEXISTENCE IN
SYMPATRIC CETACEANS IN
THE CALIFORNIA CURRENT....2**

**IN A CHANGING CLIMATE,
CONSERVATIVE ELEPHANT
SEALS SUFFER.....3**

**STARVING KILLER WHALES
ARE LOSING MOST OF THEIR
BABIES.....4**

**SEA OTTER POPULATION
DECLINES SLIGHTLY OFF
CALIFORNIA COAST.....5**

**AS SEAS WARM, WHALES
FACE NEW DANGERS.....5**

SIGHTINGS.....7

MEMBERSHIP.....8

***Your local ACS chapter
needs you!***

***Consider serving on the
Board of Directors as
Membership Chair or
Publicity Chair.***

***Please talk to any board
member for more
information.***

Oct. 13: Hopkins Marine Station Friday Seminar by Karina Nielsen of San Francisco State University: "Diversity of Sandy Beach Ecosystem Structure and Function in Northern California." 12 – 1 PM.

Oct. 14: Leatherback Turtle Day and Talk at the Monterey Bay National Marine Sanctuary Exploration Center. This event will explore our state marine reptile, the Leatherback Sea Turtle. Activities will include a lecture by marine ecologist and Leatherback researcher Scott Benson and a film "The Pacific Leatherback: Ocean Ambassador with an Uncertain Future." 10 AM – 7:30 PM.

Oct. 22-27: 22nd Biennial Marine Mammal Conference in Halifax, Nova Scotia, Canada. Conference theme: "A Marine Mammal Odyssey, Eh!" This conference is about reflecting on the journey that marine mammals and the people who study them have taken together over the years! For more information please go to www.marinemammalscience.org.

Oct. 27: Hopkins Marine Station Friday Seminar by David Johnston of Harvard University: "Up, Up, and Away! Drones in Marine Science and Conservation." 12 – 1 PM.

Nov. 3: Hopkins Marine Station Friday Seminar by Jonathan Payne of Stanford University: "The Sixth Mass Extinction in the Oceans: A Deep Time Perspective." 12 – 1 PM.

Nov. 7: MBARI Lecture in the Pacific Forum by Elliot L. Hazen of NOAA/UCSC: "Managing Across Multiple Scales: A Case Study Using Blue Whales in the Northeast Pacific." 3 PM.

BOOK RECOMMENDATIONS

Junk Raft: An Ocean Voyage And A Rise Of Activism To Fight Plastic Pollution, by Marcus Eriksen. 2017 Beacon Press.

Darwin's Backyard: How Small Experiments Led To A Big Theory, by James T. Costa. 2017 W. W. Norton.

Encyclopedia of Whales, Dolphins and Porpoises, by Erich Hoyt. 2017 Firefly Books.

RESOURCE PARTITIONING FACILITATES COEXISTENCE IN SYMPATRIC CETACEANS IN THE CALIFORNIA CURRENT

Abstract of Publication by Sabrina Fossette, Briana Abrahms, Elliott L. Hazen, Steven J. Bograd, Kelly M. Zilliacus, John Calambokidis, Julia A. Burrows, Jeremy A. Goldbogen, James T. Harvey, Baldo Marinovic, Bernie Tershy, and Donald A. Croll.

Oct. 3, 2017 — Resource partitioning is an important process driving habitat use and foraging strategies in sympatric species that potentially compete. Differences in foraging behavior are hypothesized to contribute to species coexistence by facilitating resource partitioning, but little is known on the multiple mechanisms for partitioning that may occur simultaneously. Studies are further limited in the marine environment, where the spatial and temporal distribution of resources is highly dynamic and subsequently difficult to quantify. We investigated potential pathways by which foraging behavior may facilitate resource partitioning in two of the largest co-occurring and closely related species on Earth, blue (*Balaenoptera musculus*) and humpback (*Megaptera novaeangliae*) whales. We integrated multiple long-term datasets (line-transect surveys, whale-watching records, net sampling, stable isotope analysis, and remote-sensing of oceanographic parameters) to compare the diet, phenology, and distribution of the two species during their foraging periods in the highly productive waters of Monterey Bay, California, USA within the California Current Ecosystem. Our long-term study reveals that blue and humpback whales likely facilitate sympatry by partitioning their foraging along three axes: trophic, temporal, and spatial. Blue whales were specialists foraging on krill, predictably targeting a seasonal peak in krill abundance, were present in the bay for an average of 4.7 months, and were spatially restricted at the continental shelf break. In contrast, humpback whales were generalists apparently feeding on a mixed diet of krill and fishes depending on relative abundances, were present in the bay for a more extended period (average of 6.6 months), and had a broader spatial distribution at the shelf break and inshore. Ultimately, competition for common resources can lead to behavioral, morphological, and physiological character displacement between sympatric species. Understanding the mechanisms for species coexistence is both fundamental to

maintaining biodiverse ecosystems, and provides insight into the evolutionary drivers of morphological differences in closely related species.

<https://hopkinsmarinestation.stanford.edu/news/resource-partitioning-facilitates-coexistence-sympatric-cetaceans-california-current>

IN A CHANGING CLIMATE, CONSERVATIVE ELEPHANT SEALS SUFFER

By Rebecca Heisman

Sep. 27, 2017 — West Coast elephant seals have one of two broad dispositions: some are traditionalists and some are explorers.

Every summer and fall, female elephant seals leave the beaches of California and travel thousands of kilometers into the open water of the North Pacific. There they gorge on fish, squids, and other marine animals, packing on weight that will, hopefully, see them through the late fall and winter breeding season when they spend months on land tending to their pups. But as new research shows, seals have two main approaches to picking their autumn feasting grounds. The traditionalists return to the same site year after year, while the explorers venture into parts unknown.

The research also shows that when conditions are normal, traditionalists are better off—there's value in knowing where the eating is good and sticking to what you know. But when the climate is thrown into disarray, it's the explorers that thrive. It's a showcase of how behaviors that are maladaptive in the short term could actually be beneficial in the long run.

Briana Abrahms, a researcher at NOAA and the University of California, Santa Cruz, and her colleagues spent the past 10 years tracking 30 female elephant seals with satellite tags, which revealed that roughly two-thirds of the animals are traditionalists. They also weighed the seals each year, charting how much they'd fattened up. This gave them a sense of how the differently behaved seals fared under changing ocean conditions.

The researchers found that under typical conditions, traditionalist elephant seals are more successful—they tend to put on more weight. But as a natural climate cycle sent water temperatures awry, it was the explorers that put on more weight.

In recent years, the frequency of these natural oscillations between warm and cold water has been picking up, shifting every two to four years instead of every 10, which scientists agree is due to anthropogenic climate change. And as ocean conditions become less predictable, it is the exploratory seals that may be the species' best hope.

The idea that seemingly maladaptive behaviors could pay off in the future isn't new. Think of migratory birds: in many populations, a few individuals opt to stay put for the winter instead of heading south. When winters are harsh, those homebodies tend to die. But if the winter is mild, skipping the stress of a transcontinental flight could be worth it.

Even though the concept is well known, Abrahms's study is one of the first to provide data on the benefits of different behavioral strategies under changing climate conditions.

Cameron Ghalambor, a Colorado State University evolutionary biologist who was not involved in the research, says it's very difficult to predict which behaviors might become beneficial in the future.

"What ultimately matters most is that variation is maintained within populations," he says. "So even if we can't say with a lot of confidence whether a particular behavior or trait is likely to be adaptive, we can say that if environments change, those populations that have maintained variation are more likely to



The field research team, led by University of California, Santa Cruz biologist Dan Costa, used satellite tags to track elephant seals as they ventured out to sea to feed. (Credit: Jason Bradley/NMFS 19108).

persist.”

Natural selection, after all, can only work if there is a range of behaviors to select from.

Abrahms and her colleagues are continuing to track the elephant seals. If the explorers become more common, they can watch this adaptive response to climate change play out. Not every species has the flexibility to cope when their environment shifts, but it seems that, just maybe, elephant seals do.

<https://www.hakaimagazine.com/article-short/changing-climate-conservative-elephant-seals-suffer>

STARVING KILLER WHALES ARE LOSING MOST OF THEIR BABIES

By Danielle Beurteaux

Sep. 18, 2017 — The southern resident killer whales of the northeast Pacific are in trouble. Despite having special protections from both the Canadian and American governments, there are only 78 of these salmon-eating whales left. And as recent research shows, the southern resident population is set to slowly atrophy and ultimately disappear. On top of habitat degradation, climate change, and other challenges, the whales have another problem: they’re not having enough babies.

In a recently published paper, University of Washington biologist Samuel Wasser and his colleagues report that from 2008 to 2014, nearly 70 percent of southern resident killer whale pregnancies failed, either in miscarriage or with the calves dying immediately postpartum.

Normally, killer whales give birth roughly every five years. With 30 reproductive females in the group, that should mean six births a year on average. But in the six years studied, there were only two or three a year, or none at all.

In general, it’s difficult to say how common miscarriages are. For humans, many miscarriages go undetected and unreported, because they occur very early. Of known pregnancies, however, about 20 percent (maybe even a third) end in miscarriage, with most failing in the first trimester. Miscarriage rates in wild animals are even more difficult to track. For a marine mammal comparison, scientists monitoring a group of wild bottlenose dolphins from 1998 through 2013 in Sarasota Bay, Florida, detected two miscarriages out of 13 pregnancies.

The southern resident whales’ high miscarriage rate, and the fact that up to a third of the miscarriages occurred late in the term, makes their situation particularly concerning.



Southern resident killer whales live off the west coast of North America, near the border between the United States and Canada. (Credit: Doug Perrine/Minden Pictures).

Wasser and his colleagues collected nearly 1,000 fecal samples deposited by whales throughout the Salish Sea, which they analyzed for concentrations of progesterone and testosterone to determine if a whale was pregnant. The scientists also measured the fecal samples’ concentrations of thyroid and glucocorticoid hormone metabolites, which gave them a picture of the animals’ health and levels of stress. Later, the researchers followed up to see which whales gave birth to live calves.

Based on their findings, Wasser and his colleagues think they’ve hit on a likely explanation for the killer whales’ plight.

Over the years, killer whales accumulate toxins from their food in their fat. Normally, these pesticides and chemicals, such as PCBs or DDT, have chronic effects on the whales. But in recent years something else has happened: chinook salmon—one of the whales’ most important food sources—have dwindled.

When the whales don’t get enough to eat, they start to burn their fat reserves, which releases the stored toxins into their bloodstreams. This hurts the health of the developing calf, and the effect is particularly pronounced late in the pregnancy when the fetus is growing rapidly.

“The cumulative effects of loss of food and release of toxins are the best predictors of whether or not a pregnant female will take a fetus to term or abort it,” Wasser says.

For the southern resident killer whales, the future is bleak. This past summer, Wasser was forced to halt his team’s study because the whales were nowhere to be found. Despite searching for two months, they only saw the whales for five days.

“It’s terrible,” Wasser says. Late summer, when his team was on the water, should have been peak killer whale season. “There are no southern resident killer whales here at all, and that has never happened before. Never. We’re about to lose them.”

<https://www.hakaimagazine.com/article-short/starving-killer-whales-are-losing-most-their-babies>

SEA OTTER POPULATION DECLINES SLIGHTLY OFF CALIFORNIA COAST

By Steve Rubenstein

Oct. 3, 2017 — The number of sea otters swimming off the California coast this year dwindled by 86 from last year, a 3 percent decline in the animal's population, according to a census released by federal sea otter nose counters.

Hungry sharks, skimpy kelp cover, algae blooms and disease are combining to keep the otters from staging a comeback to population numbers before fur traders practically drove them to extinction in the 19th century.

According to data released Friday by the U.S. Geological Survey, there were 3,186 southern sea otters paddling the Pacific off California. Researchers pay particular attention to how sea otters are doing because they are considered a "keystone species" that reflect the overall health of an ecosystem.

"The lower mainland count this year could be due to poorer counting conditions and very sparse kelp canopies," said ecologist Tim Tinker, who leads the survey's sea otter program. "However, we cannot rule out the possibility that increased mortality also played a role."

Sharks have been killing off sea otters in large numbers for a decade, the biologists said. Also, the sea otter baby boom of past years, fueled by a bumper crop of tasty sea urchins, seems to be slowing.

Biologists have been counting southern sea otters for four decades. They said it would take an additional 5,000 sea otters for them to reach an "optimum sustainable population level."

If there was good news from the kelp bed, it was that the otter population continued — just barely — to remain on track to lose its endangered species status. If there are at least 3,090 sea otters in next year's census, the sea otter might be removed from the federal blacklist.

One area where sea otters seem to be thriving is San Nicolas Island off the Ventura County coast, where their numbers have been growing by 10 percent every year for a decade.

Conservation efforts helped the otter population rebound from a low of 50 animals in the 1930s, scientists said.

"That growth has been encouraging," said Lilian Carswell, federal sea otter recovery coordinator, who said she hoped to see the otters venture into new



Hungry sharks, skimpy kelp cover, algae blooms and disease are blamed for keeping sea otters from an 'optimal sustainable population level' along the California coast. (Credit: Auscape, UIG Via Getty Images).

territory that she called "essential for the long-term resilience" of the animal.

The census takers did their otter counting using telescopes mounted along the shore and through low-flying airplanes.

At the Monterey Bay Aquarium, scientists said the animals need to move into their old stomping grounds in order to fully recover.

"What we really want to see is the population reinhabiting areas of its historical range," said Andrew Johnson, the aquarium's sea otter research and conservation manager. "We've seen how positively coastal ecosystems respond to the presence of sea otters — from the return of thriving kelp beds along the rocky coast, to renewed productivity of wetlands like Elkhorn Slough. We know that many other areas along the California coast would benefit significantly from the sea otters' return."

<http://m.sfgate.com/bayarea/article/Sea-otter-population-takes-a-dip-off-California-12242037.php>

AS SEAS WARM, WHALES FACE NEW DANGERS

By Karen Weintraub

Oct. 2, 2017 — From the top of the six-story lighthouse, water stretches beyond the horizon in every direction. A foghorn bleats twice at 22-second intervals, interrupting the endless chatter of herring gulls. This chunk of rock, about 25 nautical miles from Bar Harbor, is part of a global effort to track and learn more about one of the sea's most majestic and endangered creatures. So far this year, the small number of sightings here have underscored the growing perils along the East Coast to both humpback whales and North Atlantic right whales.

This past summer, the numbers of humpback whales identified from the rock were abysmal — the team saw only eight instead of the usual dozens. Fifty-three humpbacks have died in the last 19 months, many after colliding with boats or fishing gear. Scientists worry that the humpbacks may have been forced elsewhere in a search for food as the seas grow rapidly warmer and their feeding grounds are disturbed.

“Food is becoming more patchy and less reliable, so animals are moving around more,” said Scott Kraus, vice president and chief scientist at the Anderson Cabot Center for Ocean Life at the New England Aquarium. “The more you move around, the higher the chance of entanglements.”

The North Atlantic right whales, which prefer colder waters, are also on a changed course — with even more dire consequences. Fifteen of the animals have died since mid-April in a population that has now slipped to fewer than 450.

The aquarium maintains a catalog of images of North Atlantic right whales, in part to track their population levels. The pictures, spanning decades, are crucial to understanding these elusive leviathans.

From the office computer in Mount Desert Rock’s only house, researchers use 36,000 images depicting some 9,500 animals to track whales. It was on this island in the 1970s that scientists first confirmed that each whale’s fluke pattern is unique. A humpback’s tail is an unchanging signature and as distinctive as a face — except if it’s been struck by a ship, bitten by a shark or slashed by a fisherman’s gear.

Digital algorithms make identifications a little easier, dividing the photos into categories of fluke patterns, mainly by determining how much of the tail is white or black. But researchers, including Lindsey Jones, a graduate student at the College of the Atlantic, which runs the station, must still look through several thousand images one by one to match by eye. Luckily, some matches are easy. Researchers on the island see many Gulf of Maine whales often enough that they recognize them on sight.

The high number of humpback deaths from January 2016 to Sept. 1 of this year led the National Oceanic and Atmospheric Administration to declare an “unusual mortality event.” No one knows exactly what’s going on, but the agency’s investigations attributed half of the deaths to ship strikes.

The Gulf of Maine is warming rapidly — at one of the fastest rates on earth — and the temperature change might be causing shifts along the food chain, said Dan DenDanto, station manager at Mount Desert Rock’s Edward McC. Blair Marine Research Station.

As the whales follow food sources into new areas, they wander into the paths of ships and into fishing gear.

Mr. DenDanto and several investigators with Allied Whale, a group affiliated with the College of the Atlantic, plan to begin a research project next year, analyzing bits of skin from humpbacks, collected using biopsy darts, to determine what the animals are eating and how that affects their health.

Steven Katona, a co-founder of Allied Whale, was one of the first researchers to begin identifying whales here in the 1970s. Dr. Katona and his collaborators took pictures for the humpback whale catalog, which later confirmed their hunches that fluke patterns were consistent across a whale’s lifetime.

In 1975, they named one of the first North Atlantic humpbacks na00008, or Number 8. The whale has been spotted three times since: in Canada’s Gulf of St. Lawrence in the 1980s, off the coast of the Dominican Republic in 1993, and earlier this year off the coast of New Jersey.

“We have only a handful of sightings of this whale, yet these link together the efforts of collaborators spanning much of the North Atlantic,” Peter T. Stevick, a senior scientist with the North Atlantic Humpback Whale Catalog, said in an email.

The sightings occurred in four distinct humpback habitats, providing insights into where these giants feed, breed and migrate. Another sighting matched a whale in Brazil to one observed in Madagascar — a distance of about 6,500 miles — proving that an animal the length of a school bus can travel a quarter of the way around the world.

Right whales are generally seen in the Gulf of Maine, the coast of the Canadian Maritimes and the Gulf of St. Lawrence in the summer. In the winter, pregnant females and others migrate along the Eastern Seaboard to the Southeast.

They don’t have distinctive flukes; their bodies are wider, and they’re less graceful than their humpback cousins. So researchers identify them using the pattern of each animal’s “callosity” — the roughened skin patches on their heads. Because these formations can only be seen from the top, scientists must use planes and boats to track them.

The North Atlantic Right Whale Catalog, managed by the New England Aquarium, includes images of 722 whales, chronicling the population since the early 1970s. The work has been particularly crucial this year, when there have been so many unexplained deaths.

Twelve carcasses have turned up so far this year in Canada and three more in American waters; only five

calves were born, as far as researchers can tell. The latest estimates, released by the New England Aquarium, put the population of North Atlantic right whales at 458 — but that was before this year's deaths, Dr. Kraus said.

Flying 750 to 1,000 feet over the animals also allows researchers to check on their health, making sure they are not dragging fishing ropes or bearing new scars, said Charles “Stormy” Mayo, director of the Right Whale Ecology Program at the Center for Coastal Studies in Provincetown, Mass.

Despite federal protection efforts, about 80 percent of right whales bear scars from past entanglements or ship strikes. “They are remarkably built for a life in an ocean, which unfortunately is changing,” Dr. Mayo said. He worries that “they’re not finding what they need where they ought to.”

Cape Cod Bay, one of the first places that right whales were hunted — eventually nearly to extinction — is now a favorite hangout. After routinely seeing up to 100 per winter field season, researchers have cataloged 200 to 300 most years since 2009, Dr. Mayo said.

Researchers at the Center for Coastal Studies are now trying to determine how plankton levels, temperature, currents, and salinity might affect the whales’ movements. It’s not even clear how right whales find their food. Christy Hudak, a research associate at the center, said she thinks the whales probably use a combination of senses.

Amateurs also participate in whale catalogs, both to help researchers and for their own pleasure. Ted Cheeseman maintains an online public catalog of humpback sightings, linking Allied Whale’s database with others around the country.

He lets people know when a whale they once photographed has been sighted again. In the two years he’s been collecting images, 1,400 people have submitted more than 60,000 shots of more than 10,000 identifiable whales.

“The vision is that it becomes a regular thing that people understand these whales are out there, they are to be respected and valued and really appreciated,” said Dr. Cheeseman, a wildlife photographer and safari company operator.

“We’ve had a few cases of, ‘Hey, this known whale is entangled.’ People react very differently when it’s ‘my’ whale.”

<https://mobile.nytimes.com/2017/10/02/science/humpbacks-right-whales.html>

SIGHTINGS

Sightings are compiled by Monterey Bay Whale Watch. For complete listing and updates see <http://www.montereybaywhalewatch.com/slstcurr.htm>

Date	#	Type of Animal(s)
9/30 9 am	5 15 Thousands	Humpback Whales Risso’s Dolphins Moon Jellies
9/29 8 am All Day	32 10	Humpback Whales Blue Whales
9/28 8 am All Day	30 6 150 5	Humpback Whales Blue Whales Risso’s Dolphins Harbor Porpoise
9/27 8 am	36 60 2	Humpback Whales Risso’s Dolphins Harbor Porpoise
9/26 8 am	10 5 15	Humpback Whales Killer Whales Risso’s Dolphins
9/25 8 am	9 4 150 2	Humpback Whales Killer Whales Risso’s Dolphins Mola Mola (Ocean Sunfish)
9/24 8 am	30 20 150	Humpback Whales Common Dolphins Risso’s Dolphins
9/23 8 am	20 5 100 20	Humpback Whales Killer Whales Risso’s Dolphins Dall’s Porpoise
9/22 8 am	20 5 100 35	Humpback Whales Killer Whales (feeding) Long-beaked Common Dolphins Risso’s Dolphins
9/21 8 am	17 5 500	Humpback Whales Killer Whales (hunting) Long-beaked Common Dolphins
9/20 8 am	25 5 8	Humpback Whales Killer Whales (hunting) Harbor Porpoise
9/19 8 am	30 6 100 1	Humpback Whales Killer Whales Pacific White-sided Dolphins Mola Mola (Ocean Sunfish)
9/18 8 am	31 30 20	Humpback Whales Risso’s Dolphins Harbor Porpoise
9/17 9 am	30 1	Humpback Whales Black-footed Albatross
9/16 8 am All Day	33 26 150 300	Humpback Whales Blue Whales Pacific White-sided Dolphins Risso’s Dolphins
9/15 8 am	10 15	Humpback Whales Harbor Porpoise
9/14 8 am All Day	25 8 1	Humpback Whales Blue Whales Mola Mola (Ocean Sunfish)

American Cetacean Society
Monterey Bay Chapter
P.O. Box H E
Pacific Grove, CA 93950



RETURN SERVICE REQUESTED

Nonprofit
Organization
U.S. Postage
PAID
Monterey, CA
Permit No. 338

**MONTEREY COUNTY HOTLINES for
Marine Mammals**

**Strandings / Entanglements / Distress
24-hour toll-free
877-767-9425**

**Harassment
NOAA Enforcement, Monterey
831-853-1964**

American Cetacean Society Membership Application Chapter#24

Membership/Subscription Type: New ____ Gift ____ Renewal ____

Name _____

Address _____ Email _____

City, State, Zip _____

Membership Level _____

Membership Levels and Annual Dues

Lifetime \$1000	Patron \$500	Contributing \$250
Supporting \$85	International \$55	Family \$55
Individual \$45	Student \$35	Teacher \$35
Senior (62 plus) \$35		

Subscription only * \$15/11 issues (*not entitled to membership benefits)

Check ____ Mastercard ____ Visa ____ Expiration date _____

Signature _____

**Make checks payable to: ACS/Monterey Bay Chapter
Return to: Membership Secretary, ACS Monterey Bay Chapter
P.O. Box H E Pacific Grove, CA 93950**

**Monterey Bay Chapter
Officers & Chairs, 2017**

Melissa Galieti, *President*
Katlyn Taylor, *Vice President and Events*
Katy Castagna, *Treasurer*
Sally Eastham, *Membership*
Jennifer Thamer, *Secretary*
Tony Lorenz, *Programs*
Emilie Fiala, *Education*
Art Haseltine, *Grants*
David Zaches, Debbie Ternullo,
Members at Large
Diane Glim, *ACS National Secretary*
Randy Puckett, Jerry Loomis, *Emeriti*

Evelyn Starr, *Webmaster*
Tony Lorenz, Oren Frey, *Editors*
Email: tonylorenz@bigbluebay.com
soundingsnewsletter@gmail.com