



THE TERN TIDE

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Have a Question about the Ocean? Ask the Expert!

By Kate Mackey

Editor's note: The Amigos de Bolsa Chica is excited to have the ear of oceanographer Kate Mackey who wants to answer your questions about the ocean. Please read about Kate's work below and send your questions for her in an email titled "Question for Kate" to info@amigosdebolsachic.org. The answers will be shared in future editions of the Tern Tide and on social media.

Have you ever wondered how wetlands support so many different types of plants and animals, or what happens to pollutants when they make it into the coastal ocean, or how global change will affect the ocean in the future? These are the types of questions I love to answer! I am Kate Mackey, an Assistant Professor of Earth System Science at the University of California, Irvine.



Kate Mackey (top), Clare Boothe Luce Assistant Professor of Earth System Science, consults with doctoral researcher Raisha Lovindeer about their phytoplankton cultures. Photo by Steve Zylius / UCI

I study marine phytoplankton, the microscopic “plants of the sea,” that do half of all photosynthesis on Earth. They directly influence global climate and make half the oxygen you breathe, yet how they will respond to future global change is unknown. As an oceanographer who takes an integrative, interdisciplinary approach to research, I study the biological and chemical activity of phytoplankton from the cellular level up to global distributions of species. I use culture studies in the laboratory to characterize cells, and use field work to verify lab findings, identify the range of responses from natural populations, and determine their implications in nature.

I lead a large, dynamic lab of talented graduate and undergraduate students who work together and share

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President's Tern

Important Partnerships Help Bolsa Chica

By Charles Falzon

My most recent visit to the Bolsa Chica Wetlands was with my youngest daughter. It's always wonderful to share with her the history of the Amigos, and there is much to be excited about in the present moment as well, most of which you will read about on the following pages. To highlight a few things: In partnership with the Department of Fish and Wildlife, the Bolsa Chica Conservancy and the Bolsa Chica Land Trust, we are bringing additional Interpretive Panels to various points along the trails at the Bolsa Chica, providing yet another avenue for visitors to access information on the ecosystem we've worked so hard to protect.

We are fortunate to be working with Dr. Katherine Mackey, Clare Booth Luce Assistant Professor of Earth System Science at the University of California, Irvine, who begins her column, "Ask the Expert," in this issue of the Tern Tide. The Amigos' board of directors had the privilege of touring her lab at UCI earlier this year. Her research on factors influencing phytoplankton mercury uptake is particularly relevant to our FLOW program, where citizen scientists collect water samples from the Bolsa Chica for analysis of their salinity levels, pH levels, and – you guessed it – phytoplankton concentrations.

We have also been fortunate having Thomas Pfeifer and his students from Segerstrom High School's Environmental Science Program participate in everything from native plant gardening at the Bolsa Chica State Beach Visitor Center, to the FLOW classes, to wetland cleanups, to assisting the Amigos at Huntington Beach Unified High School District's recent STEAM Fair. These students are the next generation of environmental leaders, and the Amigos are lucky to be associated with them.

We hope these partnerships will continue to provide opportunities for local citizens to enhance their knowledge of the Bolsa Chica. As always, many thanks to our incredible team working to continue our programming, and to you – our fellow Amigos – for your ongoing support.

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a passion for research, teaching, science outreach, and promoting diversity in academia. We travel the world studying the ocean, but we also do a lot of work right here in Southern California (check out some of our projects on the lab's website, www.katemackey.com). We study everything from mercury cycling in lagoons to assessing the impact of ash from fires on our coastal ecosystems – and we want to answer your questions about the ocean.

Kate Mackey (left), graduate student Johann Lopez (middle), and undergraduate student Araceli Serrano (right) setting up an experiment on mercury cycling in San Elijo Lagoon. Photo by Priya Ganguli / CSUN



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First Saturday of the Month Tour

Free tours of the Bolsa Chica Ecological Reserve led by Amigos docents.
9:00 a.m. to 10:30 a.m.

Last Saturday of the Month Bird Walk

Free bird walk led by Amigos docents. 9:00 am.
Reservations are encouraged,
714-840-1575

Free monthly tours are on a first come, first served basis. Carpooling is encouraged as parking at the Bolsa Chica Ecological Reserve is limited. All tours begin at the south parking lot, PCH between Warner Ave. and Seapoint St.

Pickleweed Revisited

By Kim DiPasquale



Halophytes are salt-resistant or salt-tolerant plants that thrive in soils or waters containing high salt concentrations. Much has been written about the halophytic plants that grow in the Bolsa Chica Ecological Reserve, especially cordgrass and pickleweed, but many people aren't aware of the fact that there are actually three species of pickleweed in our wetlands. The differences can be subtle but learning a few unique characteristics will make identification much easier, and help one appreciate the complexity of the coastal saltwater wetlands. To begin, recall that salt marsh zonation patterns are commonly observed and occur because of variations in elevation, available water, soil chemistry, and nutrient availability. Of our three pickleweed species, one is an annual and two are perennial. Starting at the lowest elevation and continuing to the high marsh, the species are as follows:



Bigelow's Pickleweed, *Salicornia biglovii* (above), is a slender annual that grows straight up from the ground and is sparingly branched. It grows in the mud flats in the lower part of the marsh where it is inundated by high tides and exposed at low tides. It is often found intertwined with saltwort (*Batis maritima*). It grows 4-18 inches tall, is light green in color, and flowers from July to November.



Pacific Pickleweed, *Salicornia pacifica* (above), is a perennial shrub that has a semi-woody base, is multibranched, and can be upright or with a creeping growth habit. Branching is not as dense as Parish's Pickleweed (described below). It grows throughout most of the elevational range of cordgrass in the low marsh zone all the way up to the high marsh zone that is covered only by the highest of tides. It is 8-28 inches tall, blue-green in color, and flowers from August to November. The stem tips turn a drab reddish green in the fall. Its tiny yellow-white flowers sprout near the tips of the stems.



Parish's Pickleweed, *Anthrocnemum subterminale*, (left) is a dense perennial shrub that grows at higher elevations and in drier soils than the other two species. It grows 3-12 inches tall and has narrower branches and a darker green color as compared to *Salicornia pacifica*. This species of pickleweed also has tiny flowers but they are instead spread around the middle of each stem. It flowers from April to September.

Photos by Kim DiPasquale. References: Allen and Roberts. (2013), *Wildflowers of Orange County and the Santa Ana Mountains*. Baye P. (2007) *Selected Tidal Marsh Plant Species of the San Francisco Estuary*.

A Year at Bolsa Chica with Segerstrom High School Environmental Science Students

By Thomas Pfeifer

Segerstrom High School just finished its third year working alongside Amigos de Bolsa Chica to explore and study the Bolsa Chica wetlands. Segerstrom environmental science students started the 2017-18 school-year in September participating in the annual Coastal Cleanup Day. They started at the south parking lot of the Bolsa Chica Ecological Reserve, made their way down Pacific Coast Highway all the way to the Wintersburg channel, recovering loads of discarded trash and recovering multiple plastic bottles to recycle.

Winter was spent at the Bolsa Chica Ecological Reserve and the tidal inlet collecting plankton and doing water quality testing under the stewardship of Jerry Donohue. After participating in the FLOW program, Segerstrom Environmental Science students headed to the Bolsa Chica State Beach headquarters to remove invasive plants and take out any dead branches from the native plants.

In February 2018, Segerstrom students continued learning about the state of wetlands in Southern California by participating in the World Wetlands Symposium at the Newport Back Bay Science Center. Amigos de Bolsa Chica volunteers gave a demonstration of the FLOW program and the importance of plankton to wetlands in particular and to the world at large. The incredible speakers addressed the impact climate change is having on wetlands and the importance of protecting present wetland habitat throughout Southern California. The conference not only enriched the knowledge of the students about wetlands but addressed foundational scientific concepts that are covered on the Advanced Placement Environmental Science Exam at the end of the course each year.

In March students learned some native planting techniques at the Newport Back Bay Science Center and purchased native plants to bring back to Bolsa Chica State Beach headquarters. After learning some native plant propagation techniques in the Newport Back Bay Science Center nursery from Matt Yurkos, Segerstrom environmental science students set off with shovels and water to transplant Coastal Sage and California Buckwheat to the hills surrounding the Newport Back Bay Estuary.

April 14 saw the Earth Day celebration at the Bolsa Chica Ecological Reserve. It was followed two weeks later by the Huntington Beach Unified School District STEAM (Science, Technology, Engineering, Art and Math) Fair. Segerstrom environmental science students demonstrated plankton identification microscopy and bird adaptation demos at both Earth Day and the STEAM fair with

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Students started the school year at the annual Coast Cleanup in September. Photo by Thomas Pfeifer.



Removing invasive plants at the Bolsa Chica State Beach Vistor Center. Photo by Thomas Pfeifer.



Students help out at the Amigos booth at the Huntington Beach Unified School District STEAM Fair. Photo by Thomas Pfeifer.

FLOW: Educating the Next Generation

By Jill Lemon

Take a breath; deeply inhale and appreciate the oxygen filling your lungs and spreading throughout your body. From a young age we were taught to thank the trees for the life-giving oxygen and their photosynthesis power. When I was a child the environmental battle cry was “Save the rainforest,” and we did book reports on its endangered species and pledged to “speak for the trees” like Dr. Suess’ *The Lorax*. But recent studies estimate 50 to 75 percent of the oxygen we breathe actually comes from the ocean, and the ocean and its inhabitants are in trouble.

Amigos de Bolsa Chica’s Follow and Learn about the Ocean and Wetlands (FLOW) program stands to educate and inspire members of the collective Southern California community with regards to the importance of the marine environment, specifically the phytoplankton. Phytoplankton are the basis for all life in the ocean and essential to the environment as a whole. Working just like plants, they capture the energy of the sun and turn carbon dioxide into sugars, releasing oxygen as a byproduct. The stored carbon becomes food and is removed from our atmosphere while the excess oxygen feeds into the atmosphere for us to breathe. Phytoplankton need a healthy ocean with the right temperature, salinity, and nutrients

to proliferate and stay in balance. Sometimes the conditions for phytoplankton become too good and large “blooms” occur. However, not all phytoplankton are heroes for humans and aquatic life. Certain species also produce neurotoxins that pose great risk to human health through the ingestion of tainted seafood. By monitoring the phytoplankton at both the tidal inlet and Inner Bolsa Bay, FLOW can assess the health of the ocean as well as inform the California Department



Students from Daryth Morrissey’s Marine Science class participate in the FLOW program. Photo by Jill Lemon.

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guidance from the Amigos de Bolsa Chica. Not only did students get to show off FLOW techniques they learned earlier in the year, they were also able to survey other demonstrations from the Surfrider Foundation, the Sea and Sage chapter of the Audubon Society, as well as the Pacific Marine Mammal Center and the American Cetacean Society.

At the Earth Day celebration, California Department of Fish and Wildlife biologist Kelly O’Reilly asked if Segerstrom students could scrub down the public information signs located around the Bolsa Chica Ecological Reserve. In May the students set off on a Bird Identification study at the Reserve and cleaned up all of the public information signs from the south parking lot to the mesa. Thanks to the keen eye of Jerry Donohue, the students were able to spot a Ridgway’s Rail on the way back, highlighting the importance

the Bolsa Chica Ecological Reserve plays in protecting threatened bird populations along the Pacific Flyway.

By mid-morning the students headed back to the Bolsa Chica State Beach Visitor Center and planted the Coastal sage and California Buckwheat they bought from the Newport Back Bay Science Center earlier in March. We finished off the day inside the Visitor Center celebrating the end of another successful school year by eating granola bars and Flaming Hot Cheetos!

On behalf of all the students at Segerstrom High School I just wanted to say “Thank You” to all the volunteers at Amigos de Bolsa Chica for another incredible year! Your hard work, dedication, and mentoring of my students at the Bolsa Chica Ecological Preserve is one the pillars of my Environmental Science program.

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of Public Health of potential harmful situations.

We all have personal actions that we engage when seeking change. Maybe you pick up that orphaned piece of trash in the parking lot, or read the latest article on climate change. These actions are noble and collectively

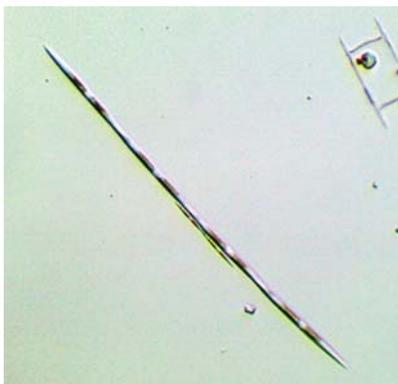


will influence the difference in the world you want to see.

Bigger still, you can combine personal actions with others and volunteer with an organization. As the Amigos

Students conducting microscopy during a FLOW Field Trip. Photo by Thomas Pfeifer.

know, many working together for a common cause allow a shoestring budget to advance greater change. Our Citizen Scientists with FLOW magnify their personal actions by not only volunteering with an organization, but by collecting and processing data that furthers the science and awareness of the health of the ocean and provides information to policy makers regarding human health and safety issues. Every Friday FLOW Citizen Scientists collect water samples from the tidal inlet and Inner Bolsa Bay. The samples are then analyzed under a microscope for harmful algal blooms of phytoplankton, chiefly *Pseudo-nitzschia*, which poses health risks to humans through the production of the neurotoxin domoic acid.



A chain of *Pseudo-nitzschia*

The volunteers and Citizen Scientists of FLOW also work continually throughout the year to educate students with regards to their scientific efforts and the marine environment. This school year FLOW volunteers welcomed hundreds of students from across Southern California

to Bolsa Chica State Beach and Ecological Reserve for science-centered field trips. Each field trip rotates through stations that touch on key points of ocean and wetland ecosystems and scientific protocol in efforts to expose the next generation to the precious resources that need protection.

Students participating in FLOW learn, through water quality testing, that the amount and variety of phytoplankton observed provides a snapshot of the ocean-wetland ecosystem's health. During a short tour of the Bolsa Chica Ecological Reserve, students learn about the wetland ecosystem and how to collect water samples alongside our Citizen Scientists. On the other side of the Coast Highway at the Bolsa Chica State Beach Visitor Center, students are introduced to chemical analysis of the water samples and how to examine phytoplankton under a microscope. This requires great attention to detail and a critical eye. A critical part of FLOW is helping students understand their role in the health of the ocean.

The Greek root of the word plankton is “drifter.” Plankton is unable to move against the current and has to “go with the flow.” But the direction of flow of global actions towards the health of the ocean is not sustainable and needs a course correction. The members of this organization hope more people Follow and Learn about the Ocean and Wetlands and see how the actions of each individual affects the health of the ocean. The marine environment needs champions and an educated next generation to ensure its health, and that is the mission of the FLOW volunteers.



Student collecting a phytoplankton sample during a FLOW field trip. Photo by Jill Lemon.

Surprise Thank You Brunch for Jerry Donohue

By Jennifer Robins



Twenty-two Amigos de Bolsa Chica members surprised Jerry Donohue at a Brunch to thank him for serving as the President of Amigos de Bolsa Chica for four years. We met at the Omelette Inn Café on Edwards in Huntington Beach on May 20. Having been told a few of us were meeting there for some Amigos Education committee business, he was definitely surprised to see the crowd.

Following a lovely breakfast buffet, both long-time and newer members spoke about Jerry's effect on their lives. Jennifer Robins read a letter from Margaret Carlberg reminding everyone that Jerry became a member of the Amigos 37 years ago, and upon retirement became a model volunteer. Jennifer then talked about how Jerry encouraged her to go beyond what she thought would work for FLOW classes and the constraints of taking our programs to schools. Things always seem to work out and no one has ever been aware of the re-engineering behind the scenes.

Shirley Dettloff spoke of Jerry's commitment to Amigos goals and integrity of our organization. Shirley and Jerry met with Huntington Beach city council members, State officials, people knowledgeable about the challenges for the Bolsa Chica Wetlands and members of other environmental organizations to keep the success of the Bolsa Chica restoration as focus of our dedication.

Daryth Morrissey talked about the years she and Jerry taught science at Vista View Middle School. After he retired, she realized that many adults who once attended Vista View still remember the impact Jerry had on them when they were his students. This honor inspired Daryth to take the Amigos docent training class and become an involved member of the Board of Directors.

Joana Tavares came to Amigos de Bolsa Chica as a Curriculum Developer six years ago. She spoke about how she learned from Jerry how to be a better teacher as her career goals evolved from oceanographer to instructor at several community colleges to a PhD candidate at the University of California at Irvine. They worked together to create the FLOW program

which helps the local community learn about the connection between the ocean and the wetlands and open our minds to the importance of phytoplankton to the ocean and the world.

Shirley and Jennifer presented Jerry with a framed print of a Black-crowned Night Heron by Thomas Anderson, a Thank You card signed by everyone, and a gift card to be used at a restaurant favorite of his and his wife, Lori. The event was a total success with everyone thanking Jerry and talking about the future of Amigos with Wetland Tours, FLOW Program, Speaker Series and wonderful times at the wetlands.



The group assembled at Omlette Inn to thank Jerry Donohue for his four years as Amigos' President. Photo by Jim Robins.



Thomas Pfeifer, left, chats with Jerry and Lori Donohue. Photo by Jim Robins.



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AMIGOS DE BOLSA CHICA MEMBERSHIP APPLICATION

I support the specific and primary purpose of Amigos de Bolsa Chica, which is to advocate the preservation, restoration and maintenance of the Bolsa Chica, to encourage the public acquisition of all the wetlands and sufficient surrounding open space to create a viable ecosystem, and to provide education about the importance of wetlands.

ANNUAL DUES

\$ 10 Student

\$ 25 Individual

\$ 40 Family

\$100 Sustaining

\$1000 Life Member

Name: _____

Address: _____

City: _____ State: ____ Zip: _____

Email: _____

Phone: _____

Additional Contribution:

\$ _____ Fund operational expenses \$ _____ Fund education projects \$ _____ Total enclosed

Please check if you are interested in volunteering for:

FLOW Citizen Science __ Docent training/wetland tours __ Wetlands cleanups __ Fundraising __ Grantwriting __

All contributions to Amigos de Bolsa Chica are tax-deductible as allowed by law under IRS Code Section 501(c)3.

No goods or services were provided in consideration of this gift.

Return application to: Amigos de Bolsa Chica, P.O. Box 1563, Huntington Beach, CA 92647