USC Wrigley Institute for Environmental Studies

Year in Review 2017
NEW LEADERSHIP AND
A BOLD NEW VISION

2017 was a big year for the USC Wrigley Institute (WIES). Among our many achievements, we proudly welcomed our new Director, Dr. Ken Nealson. Since 2001, Ken has been the Wrigley Chair in Environmental Studies and a Professor of Earth Sciences and Biological Sciences at USC. Dr. John Heidelberg, Interim Wrigley Institute Director and USC Associate Professor of Biological Sciences since 2006, remains on as co-Associate Director of the Institute with Ann Close who has been with the Institute since 1997.

Since taking the helm, Dr. Nealson has begun to craft an ambitious new vision for the Institute. This vision reflects our outstanding potential to play a leading role in global environmental and sustainability programs in the USC Dornsife College of Letters, Arts and Sciences.

Issues of water, energy, food, and waste are never far from our minds, due to the remote setting of our Catalina Island environmental field station. The Wrigley Institute is leading by example with creative sustainability research and strategies at the Wrigley Marine Science Center (WMSC). With these efforts, our community can participate in and learn from today’s most innovative solutions.

But sustainability challenges are not restricted to islands; they are global in scale and touch every corner of our world. The Wrigley Institute also serves as a hub for sustainable programs on USC’s main campus. We introduced the inaugural USC Wrigley Sustainability Prize in 2017 which encourages environmental entrepreneurship within the USC community. Undergraduate internships continue to inspire students through research and training, and our graduate fellowships support excellence in sustainability and natural science themes.

In the coming years, the USC Wrigley Institute will continue to grow our sustainability emphasis to match our longstanding excellence in environmental science. Together, these programs will enable us to be a catalyst for science-led solutions and offer leading expertise in the laboratory, classroom and beyond. We look forward to sharing these ongoing accomplishments with you.
Wrigley-affiliated scientists are conducting transformative research in environmental science and sustainability. Their work helps support society and industry while sustaining the planet’s natural resources for future generations.

**Kelp as Biofuel**

Giant Kelp, *Macrocystis pyrifera*, is an incredibly fast growing coastal species and a potential source for biofuels. Working with Marine BioEnergy Inc., our researchers are testing methods to grow kelp away from shore in deep open-ocean environments. Unique ‘kelp elevators’ transport kelp up and down on a daily basis: kelp is raised to the surface during the day to gather sunlight for photosynthesis, and lowered at night to absorb nutrients not found in open-ocean surface waters. If kelp responds well to this process, it could pave the way for sustainable open-ocean kelp farms for the biofuel sector.

**Breeding a Better Bivalve**

Using selective breeding and advanced genetic techniques, graduate student Nathan Churches and Dr. Sergey Nuzhdin are looking to transform the aquaculture industry. They have been funded by NOAA’s Small Business Improvement Research program to study the genetics behind shellfish phenotypes, and ultimately commercialize improved varieties. Their work takes advantage of the Wrigley Institute’s aquaculture resources at Catalina, allowing scientists to raise shellfish like oysters and mussels in the natural environment and pursue this important research on sustainable seafood.
**USC Wrigley Sustainability Prize**

In 2017, the Institute launched a new cross-campus event: the USC Wrigley Sustainability Prize. Through this annual competition, we aim to highlight entrepreneurial start-up ideas from all disciplines and reward concepts that could result in “real life” solutions to environmental challenges. Judges include USC experts and startup investors, and winning teams receive funds to translate their ideas into action.

**2017 Winners:**

- **1st Place** – Interphase: Jenny Liu and Noah Snyder  
  USC Marshall School of Business  
  *Heat retentive, non-toxic coating for industrial piping*

- **2nd Place** – ReFlo: Camille Connor, Kyle Borch and Willie Du  
  USC Marshall School of Business  
  *Real time shower water use monitor with gamification*

- **3rd Place** – Believe in Bambara: Holly Tassi  
  USC Marshall School of Business  
  *Creating an American market for food products made by women in Ghana*

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**Student Spotlight – Team Interphase**

**The Winning Pitch: By Team Interphase, 2017 Prize Winners**

The U.S. Department of Energy projects world energy consumption will increase 56% by 2040. This causes two major problems: rising utility cost and carbon emission from energy generation. At Interphase Materials, we invented a nano-coating that improves the heat transfer of cooling systems. Our materials improve the interaction between cooling water and tubing, resulting in an immediate 5-10% increase in efficiency of heat transfer.

This means we ultimately reduce the amount of utility cooling systems use, which not only saves money but also greatly reduces CO₂ emissions from energy generation.

In addition, the coating prevents bio-fouling and provides long-term protection against corrosion and scale buildup using all natural FDA-approved components.
Faculty research continues to offer new insights into California’s coastal biodiversity and complex human dynamics with our environments.

**Squid and Symbiosis**
Using the mutually beneficial association between the Hawaiian Bobtail squid and the bioluminescent bacteria *Vibrio fischeri*, USC researchers in Dr. Scott Fraser’s lab work to understand how animals and bacteria establish and maintain such positive relationships. At the Wrigley Marine Science Center, they are establishing a breeding colony of squid for use in their research. They hope to learn what animal genes are important for selecting and maintaining beneficial bacteria, and how the relationship may alter features of the squid anatomy such as the nervous system.

**New Understanding of Microbes**
Nitrification is an essential process in aquaponics systems where fish, plants, and microbes are raised together in closed ecosystems. Microbes take potentially toxic ammonium from the water and turn it into benign nitrate. This process is typically carried out in two steps by different microbes, but new research shows that some organisms can carry out the whole process by themselves. USC faculty, Drs. Eric Webb and Jill Sohm, and students are beginning to use molecular biology techniques to look for this newly identified microbe physiology in the Wrigley Institute’s aquaponics system.

**Diversity at the DISCO**
The Diversity Initiative for the Southern California Ocean (DISCO) is a research initiative of the Natural History Museum of Los Angeles County. Led by Associate Curator Dr. Regina Wetzer, its aim is to discover and document invertebrate biodiversity in California’s coastal environment using genetic techniques. As part of the study, researchers have collected fouling organisms from the floating dock at the Wrigley Marine Science Center for identification and genetic barcoding. The research will help managers better know what species are where, and how their distributions change along the California coastline over time.
Climate Impacts in the Ocean
Over the next century, surface ocean temperatures are expected to rise considerably because of climate change. USC faculty Dr. David Hutchins and graduate student Joshua Kling are studying the impacts on phytoplankton, microscopic organisms that remove carbon dioxide and create oxygen. By culturing phytoplankton at different temperature regimes, they hope to understand the consequences of human fossil fuel emissions for ocean biochemistry and predict feedbacks from these changing ocean processes on atmospheric CO2 and global climate.

Catalina’s Water Bears
Tardigrades, also known as ‘water bears’, are microscopic animals considered to be extremophiles because of their ability to survive conditions such as desiccation, UV and X-ray exposures, and very high or low temperatures. They are found around the world and serve as interesting model organisms for medical and aerospace research. Until recently, there were no records of tardigrades on Catalina Island. But by targeting known tardigrade habitat types on the island such as moss and barnacle beds, USC Environmental Studies Program Director Dr. Karla Heidelberg and students have confirmed that they do exist on Catalina. The group is now further characterizing the different populations they have found.

Monitoring the Night Light
Many marine species are sensitive to light sources at night. USC professor Dr. Travis Longcore studies the intensity of human light pollution on coastal areas to minimize our impact. He and his students monitor Southern California beaches using sensitive camera equipment and compare light pollution between developed beaches and more isolated ones like those at Catalina. Dr. Longcore also performed light pollution analyses at the Wrigley Marine Science Center, helping us to improve our facility’s visual footprint on the environment.
Faculty Science Highlights

Below are additional faculty and senior scientist research projects we hosted at the Wrigley Marine Science Center in 2017.

- Matthew Becker, CSULB – Mapping of springs, seeps, and baseflow in Cottonwood Canyon, Catalina
- Karen Crowe, SFSU – role of posterior Hox genes in evolution of novel body plan morphologies
- Lynn Dodd and SuJin Lee, USC – Spatial analysis of past and present freshwater sources on Catalina
- Jack Engle, UCSB – Pacific rocky intertidal monitoring with MARINe program
- Corey Garza, CSUMB – Drivers of MPA Performance in intertidal habitats related to spiny lobsters
- Scott Hamilton, Moss Landing – Nutrient cycling in kelp forests and the role of the fish community
- Karla Heidelberg, USC – Marine tardigrades found in dry moss on Catalina
- Jenny Hofmeister, UC Davis / CDFW – Site assessment for abalone restoration
- Adriane Jones, MSMU and Eric Webb, Jill Sohm, USC – Microbial diversity in an aquaponics system
- Diane Kim and Dave Ginsburg, USC – Exploring kelp as a potential source of biofuel
- Milton Love UCSB – Creating a photo-library of the giant sea bass of California
- Chris Lowe, CSULB – Aggregation patterns and site fidelity of giant sea bass at Catalina Island
- Donal Manahan, USC – Biochemical and physiological adaptations of developing marine animals
- Monica Martinez, UC Riverside – Hydrodynamics: flow-swimmer interactions in unsteady flows
- Dallas Masters, University of Colorado – CU / JPL NASA satellite altimetry sea level Cal-Val project
- Rita Mehta, UCSC – Feeding ecology of the California moray eel
- Sergey Nuzhdin, USC – Study and application of bivalve genomics
- Todd Oakley, UCSB, and Elizabeth Torres, CSULA – Collection of ostracods in Big Fisherman Cove
- John Orrock, University of Wisconsin – Determining prevalence of Sin Nombre virus in Channel Islands mice
- Ariadne Reynolds, Bay Foundation – Green abalone restoration project: deck spawning pilot study
- Ann Russell, UC Davis – Trace metal incorporation into non-spinose planktonic foraminifera
- Jayson Smith, Cal Polytechnic – Assessment of the endemic intertidal brown alga, *Pelvetiopsis californica*
- Brandon Southall, UCSC – Marine mammal behavior and reactions to sound
- Mark Steele, CSUN – Effects of predator risk cues on prey reproduction in a temperate reef fish
- Noah Synder, Interphase Materials Inc – Heat transfer study via surface treatment technology
- Josh Troll and Scott Fraser, USC – Genetic tools for Hawaiian bobtail squid in the squid/vibrio symbiosis
- Regina Wetzer, Natural History Museum of LA – Diversity initiative of the Southern California ocean
- Crow White, Cal Poly SLO – Kellet’s whelk surveying and sampling for assessing population connectivity
- Gail Woodward, JPL – Development of an adaptive AUV in-situ sensing system
International GeoBiology Course
The interdisciplinary field of geobiology provides new perspectives on the history of life on Earth and informs the search for life on other planets. Now in its 14th year, international students conducted fieldwork in the eastern Sierra and in the Ventura area. There, they explored hot springs and ancient sediments and collaborated on field projects. Students culminated the program with field and lab work at the Wrigley Marine Science Center, including exploration of Catalina’s unique geological resources.

- Rui Bao, Harvard University, USA
- Makayla Betts, Massachusetts Institute of Technology, USA
- Ines Eymard, University of Geneva, Switzerland
- Dawson Fairbanks, University of Arizona, USA
- Kate Fullerton, University of Tennessee Knoxville, USA
- Nir Galili, University in Rehovot Weizmann Institute of Science, Israel
- Benjamin Glasner, Pontifical Catholic University of Chile, Chile
- Miquela Ingalls, University Colorado Boulder, USA
- Stilianos Louca, University British Columbia, Canada
- Aaron Martinez, University of California Riverside, USA
- Jana Meixnerova, University Washington, USA
- Alexandra Phillips, California Institute of Technology, USA
- Jana Tischer, University of Basel, Switzerland
- Viola Warter, Royal Holloway, University of London, UK
- Michael Wells, Duquesne University, USA
- Sophie Westacott, Yale University, USA

“This course impacted my science interests, yes, but it also impacted my expectations for what a life as a researcher can be.”

- International GeoBiology Course Student
Wrigley Institute Summer Fellows

Thirteen graduate students were awarded fellowships in 2017 to conduct intensive summer field work on Catalina Island.

- Casey Barr, USC – Exploring Electrode Enrichments Yields in Marine Sediments
- Kenneth Bolster, USC – Anaerobic Iron Cycling Associated with Large Sinking Particles
- Nathan Churches, USC – Genetic Improvement of Bivalve Aquaculture
- Alyssa Clevenstine, California State University Long Beach – Study of Spawning Aggregations in Giant Sea Bass
- Melissa DellaTorre, USC – Influence of Food on Biology in Marine Larval Forms
- Alexis Estrada, California State University Northridge – Recovery of Green Abalone at Santa Catalina Island
- Elaina Graham, USC – Testing Catalina Waters for Aerobic Anoxygenic Phototrophs
- John Lee, Harvey Mudd – Autonomous Underwater Vehicles (AUVs) for Tracking Fish Aggregations
- Caitlin McGarigal, California State University Long Beach – Evaluation of Kelp Bass to Angling and Handling Stressors
- Emily Meese, California State University Long Beach – Acoustic Telemetry to Quantify Movements of Horn Sharks
- Erika Nava, California State University Northridge – The Effects of Marine Reserves on Fish Foraging Behavior
- Yubin Raut, USC (Victoria J. Bertics Fellow) – Study of Diazotrophic Microbiome Associated with Macroalgal Species
- Jason Wang, USC – Ocean Change on Feeding and Conversion Efficiencies in Marine Larvae

Wrigley Fellow Research: By Emily Meese, Master's Student, CSULB

My Master’s thesis aims to characterize horn shark movements and behavior to better understand their ecological role in the kelp forest ecosystem. The intriguing thing about why we care how much these sharks eat is that they are one of the few urchin predators in Southern California. This matters because urchins are kelp grazers. With no predators regulating them, the urchins will take over a kelp forest, creating a low-diversity urchin barren. However, horn sharks may help regulate those populations, allowing the kelp forest to grow and flourish.

To find out where and how horn sharks spend their time, I created a custom tag package. An acoustic transmitter pulses every two seconds, and allows me to follow a shark in a boat (what we call tracking). The second part of the tag is an accelerometer data logger, which records the shark’s 3D body movements as well as ambient water temperature and depth. Putting these two parts together, I can determine where sharks are, what they are doing in those locations (i.e., swimming, resting, eating), and also have an idea of the environment the sharks are in.

There’s no way my Master’s thesis would be possible without the Wrigley Fellowship. Having the convenience to live on Catalina Island for the summer, in the horn shark’s backyard, is extremely helpful to get a sense of how these sharks move among the different reefs in the area. It is rewarding to see the story of horn sharks come together and be able to answer questions about their role in the kelp forest.
Norma and Jerol Sonosky Sustainability Fellows

Four graduate students were supported on the USC main campus for summer research on sustainability themes. Their work helps pioneer solutions toward a more sustainable future for us all.

- Ivan Demianets, USC Chemistry – Development of catalytical system for hydrogenation of carbon dioxide to methanol
- Eric Johnson, USC Chemistry – The design of new materials capable of converting oxygen gas (O₂) into water for the purpose of improving fuel cell efficiency
- Bonita Lam, USC Biology – Use of environmental bacteria as natural catalysts for converting toxic pollutants to less toxic forms
- Nicholas M. Orchanian, USC Chemistry – Developing a new solar-powered material to recycle carbon dioxide into useful fuels

Sonosky Fellow Research: By Nick Orchanian, USC Chemistry PhD Student

I’ve always been interested in the ways we generate energy to power our world and building new products and materials. My research as a PhD student in the USC Chemistry program now ties together these very different problems. Although fossil fuels have allowed us to achieve some amazing things as a society (building skyscrapers, powering hospitals, creating anything imaginable with the discovery of plastics, and many others), they can also trap us into depending on foreign powers for their oil or giving up our beautiful natural environments to dig up our own. To make an energy-independent America, we need new technologies to harness the greatest resource we already have here waiting for us: the sun!

My research focuses on using sunlight to power chemical reactions on a big scale. There are all kinds of reactions you could try to power with sunlight, but my main interest is “artificial photosynthesis.” Photosynthesis is a series of chemical reactions that plants use to turn sunlight into sugar, which they (and we!) use to live and grow. Plants are able to do this using special catalysts: chemicals that act like little factories to change one kind of molecule into another (such as carbon dioxide gas into sugar). What we’d like to do is make our own catalysts that can convert CO₂ into a huge range of important chemicals, including synthetic petroleum. By making this work, we could ultimately recycle the CO₂ waste that’s generated by burning fossil fuels back into usable fuel.
Through one of a kind programs at USC, across Los Angeles, and on our Catalina campus, the Wrigley Institute enriches the undergraduate education experience.

Writing the Solutions
Environmental Studies students in 2017 identified green improvements for both the University Park Campus and Wrigley Marine Science Center and worked with the Institute to turn these ideas into actions. From gardens to air quality monitors, solar generators to SCUBA surveys, students learned how to strategize and enact environmental goals through grant-writing.

Elizabeth Shakhnazaryan ‘20 wrote a proposal to acquire 25 new rain barrels for the Wrigley Marine Science Center. Her successful grant added 1,575 gallons of water storage at the island in time to be filled by spring rains. Elliot Patrick ‘18 received funding to reduce waste at USC football games. Through his grant, volunteers gave away 1,000 water bottles at the LA Coliseum, encouraging students to reuse rather than buy single-use plastic containers. Natalie Hayashibara ‘18 also got a kitchen herb garden built on Catalina, a boon for the staff and a highlight of our new Sustainability Park.

Sustainability Studies
Our Spring ‘490 Directed Research’ course focused on sustainable solutions. Taught by Wrigley Institute Undergraduate Programs Director, Dr. Diane Kim, students worked on sustainability issues on Catalina Island including waste, food and water conservation. Philine Qian ‘18 did her project on ‘Meatless Mondays’ – she worked with kitchen staff and online tools to understand the impact of meat-free meals one day a week. Eating meat-free one day a week saves water and costs us about 20% less than meat-inclusive meals. Best of all, she found that Meatless Mondays are supported by 92% of guests in the dining hall. They have now become a regular part of our Catalina menu.

A Green Spring Break
In March, twenty-two students spent spring break on Catalina with our ‘Introduction to Island Sustainability’ program. They toured the island and learned about Wrigley research including aquaculture, kelp biofuels, and food recycling. The program was followed by a sustainability seminar on the USC main campus with panel speakers from across campus.
Environmental Internships

USC students from all disciplines worked as interns in our research and education programs. They taught K-12 school kids through our aquaponics education program, conducted SCUBA surveys with our kelp biofuel research, and analyzed data from our ocean monitoring program the San Pedro Ocean Time-series (SPOT). Students from the USC Cinema School also learned to visualize and interpret science with our researchers.

**Spring 2017:**
- Paige Haines, USC Environmental Studies – Aquaponics / Kelp Biofuel Intern
- Ignatious Hoh, USC Environmental Studies – SPOT Intern
- Tiana Huling, USC Environmental Studies – Aquaponics Intern
- Sage Tyler, USC Environmental Studies – Aquaponics Intern
- Devin Manion, USC Environmental Studies – Aquaponics Intern

**Summer 2017:**
- Emilia Tripodi, USC Environmental Studies – SPOT Intern
- James Sturges, USC Environmental Studies – Kelp Biofuel Intern
- Sang Ki (Lui) Shin, USC Environmental Studies – Aquaponics Intern
- Hannah Roh, USC Environmental Studies – Aquaponics Intern
- Emily Nixon, USC Biological Sciences – Research Intern
- Ann Lee, USC Cinema Division of Animation and Digital Arts – Animation Intern
- Maryyann Landlord, USC Cinema Division of Animation & Digital Arts – Animation Intern
- Jacqueline Hernandez, USC Environmental Studies – Kelp Biofuel Intern
- Isaac Gilles, USC Philosophy, Politics and Law – Communications Intern
- Victoria Dudas, USC Environmental Studies / International Relations – Aquaponics Lead Intern
- Shelby Barnes, USC Environmental Science and Health – SPOT Intern

**Fall 2017:**
- Jodi Aiau, USC Environmental Studies – Aquaponics Intern
- Zannatul Zannat, USC Environmental Studies – Aquaponics / Sustainability Intern
- Margaux Wilson, USC Environmental Engineering – Kelp Biofuel Intern
- Kelly O’Rourke, USC Geology / Environmental Studies – SPOT Intern
- Natalie Hayashibara, USC Environmental Studies – Aquaponics / Sustainability Intern
- Lyndsey Franklin, USC Environmental Studies / Political Economy – Aquaponics Intern
- Hanna Fahsholtz, USC Narrative Studies – Kelp Biofuel Intern
- Sachi Elias, USC Environmental Science and Health – Kelp Biofuel Intern
- Tim Buchanan, USC Environmental Studies – Kelp Biofuel Intern
- Olivia Carmack, USC Environmental Studies – Kelp Biofuel Intern
Summer ‘Research Experiences for Undergraduates’ (REU) Program
In summer 2017, we again welcomed students to Catalina for our ten-week intensive REU program, funded by the National Science Foundation. Students came from across the country to participate in environmental research and oceanographic cruises with USC mentors.

- Lauren Averilla, College of William and Mary – Biogeography of marine microbes
- Isabelle Basden, Florida State University – Fish / Invertebrate ecology
- Anthony Caballero, California State University Dominguez Hills – Microbial ecology in aquaponics
- Taylor Dillon, University of Miami – Nitrogen fixation associated with macroalgae
- Katelyn Doyle, Indiana University-Bloomington – Microbial responses to ocean acidification
- Megan Fogle, Florida Southern College – Shellfish genetics for improved aquaculture
- Lauren Healey, California State University Long Beach – Reconstructing Catalina’s hydrology to identify archaeological sites
- Ivan Langefeld, Pomona College – Squid-Vibrio host responses to interactions with beneficial bacteria
- Rafael de la Zerda, University of Miami – Trace metal biogeochemistry of decaying macroalgae

“In one summer I have learned more lab and field techniques than I have throughout my whole undergraduate career.”

- REU Undergraduate Student
Field Courses at the WMSC

For students who wanted to spend an entire semester on Catalina, 2017 offered numerous courses to choose from.

Spring 2017
• USC Environmental Studies 490 – Independent Research
• Mount St. Mary’s University Spring Break Program – Microbiology
• USC Alternative Spring Break – Sustainability

Summer 2017:
• USC Environmental Studies 320a – Water and Soil Sustainability Course
• USC / CalTech International Geobiology Graduate Course
• USC Global Environmental Microbiology Summer Course
• USC Spatial Sciences SSCI 587 – Spatial Data Acquisition Course
• USC Scientific Diving Program
• USC Maymester Classes: 4-week short courses at Catalina on various topics:
  – Biological Sciences 431L – Aquatic Microbiology
  – Biological Sciences 457L – Methods in Marine Biology and Biological Oceanography
  – Environmental Studies 499 – Tropical Coastal Zone Sustainability
  – Religion 303g – Exploring Ancient Ways of Living

Fall 2017:
• Cal State University Marine Biology Semester
In 2017, our scientists and staff worked with thousands of people, translating science to the public and fostering a widespread appreciation for the natural world.

**Earthwatch**

The Wrigley Institute began hosting groups from the internationally known Earthwatch Program in 2017. A citizen-science adventure organization, Earthwatch sends interested, passionate individuals to remote locations to assist scientists in their research. On Catalina, Earthwatch groups can now help our researchers monitor the coastal environment. The expedition is called ‘Conserving Marine Life Along Catalina’s Coast’ and focuses on the activities and changes happening in Catalina’s special Marine Protected Areas.

**Food for Thought Program**

Now in its second year, this aquaponics education program brings resources and Wrigley Institute expertise into South LA schools. Growing food and fish together in a closed system, aquaponics teaches students about food webs, water chemistry, engineering and more through hands-on discovery. The program also engages USC undergraduates as mentors at the schools to deliver lessons plans with the systems.

**Catalina Educators Symposium**

In Fall 2017, we met with educators from Catalina’s many camps and the Catalina Island Conservancy to unify island education. Educators from each group shared information on current practices, and we all discussed ways to connect our efforts. Together, our groups host thousands of students each year with a common goal: using Catalina to inspire children to become tomorrow’s environmental champions.
As the Institute’s commitment to sustainability grows, our Catalina facility reflects these ideals through both research investments and campus improvements.

**Sustainability Park**
Neighboring our touch tank area, a new ‘Sustainability Park’ features the Institute’s best new sustainable initiatives, technologies, and student projects. This evolving installation will highlight USC research and efforts to improve our campus sustainability. It will also model conservation strategies for our visitors to consider incorporating into their daily lives.

**Catalina Harbor Longlines**
New aquaculture research longlines in nearby Catalina Harbor now enable our researchers to grow oysters and mussels outside of the laboratory. A series of cages hangs off the lines, below the surface where the shellfish feed naturally on ocean plankton. This allows them to grow to adulthood, well beyond sizes that can be sustained in the lab. As multiple generations are bred here, USC researchers can study their genetics and explore potential stock improvements for the shellfish industry.

**Water Conservation**
We began 2017 in a severe drought. At that time, Catalina Island was under Stage 3 water rationing, requiring all residents and guests to cut their water use by 50%. Although the spring rains alleviated this water shortage, it served as a sobering reminder that water conservation is a vital, ongoing part of California living. We continue to study new water reclamation and production methods, add rain barrels to catch what we can, and encourage water-wise choices by our guests.
Visitors to the Catalina Campus

Our marine laboratory welcomed thousands of visitors in 2017 including researchers, graduate and undergraduate students, school groups and the public.

Faculty and Researchers:
203 USC Faculty and Research Associates
188 Non-USC Faculty and Research Associates

Graduate Students and Postdocs:
68 USC Postdoctoral Scholars
181 USC Graduate Students
29 Non-USC Postdoctoral Scholars
113 Non-USC Graduate Students

Undergraduates:
581 USC Undergraduate Students
418 Non-USC Undergraduate Students

Others:
59 Citizen Scientists
296 Scientific Divers
752 K–12 School Program Visitors
401 George and MaryLou Boone Center for Science and Environmental Leadership
2221 Public Visitors (Includes 649 Saturday at the Lab Visitors)
George and MaryLou Boone Center for Science and Environmental Leadership

Our conference center hosted a number of influential science groups this year. These teams come to Catalina to study environmental challenges, connect the scientific community and promote solutions.

- Coral Reef Workshop – Meeting on biogeographic contrast of coral reef community resilience and response to Ocean Acidification in Mo’orea, French Polynesia, and the Galapagos, Panama (Researchers: P. Edmunds of CSUN, P. Fong of UCLA).
- International GeoBiology Course – Intense multidisciplinary summer science course exploring the co-evolution of the Earth and its biosphere for graduate students from around the world (USC / CalTech).
- Research Retreat – USC Faculty and researchers (Researcher: S. Nudzhin) prepared a proposal to the Department of Energy’s ARPA-E MARINER (‘Macrolaegae Research Inspiring Novel Energy Resources’) program which challenges scientists to accelerate the nascent U.S. macroalgae industry.
- Collaboration Meeting – Faculty (Researcher: W. Wood) from the USC Department of Psychology, USC Rossier / Brain and Creativity Institute met to discuss collaboration.
- USC Keck Parents Association – Hosted by Drs. John and Karla Heidelberg, the USC Keck Parents Association visited the Wrigley Marine Science Center and discussed WIES sustainability initiatives.
- USC Hearing & Communication Neuroscience Program – Provides graduate and post-graduate training in audition and vocal communication across USC Linguistics, Psychology, and Neuroscience programs.
- UCLA Bioinformatics Retreat – Gathering of the Bioinformatics Interdepartmental PhD Program, one of ten Home Areas within the UCLA Graduate Programs in Bioscience.
- California Department of Fish and Wildlife (CDWF), Scientific Diving Training – Trained CDFW divers in diving physics, physiology, decompression, night diving, dive planning, and research techniques.
• LA County + USC Medical Center, Emergency Medicine Doctors Course — 3rd Year Residents learn about hyperbaric medicine using the USC Catalina Hyperbaric Chamber. Residents become the physicians who oversee treatment of the diving accidents brought to the Chamber.

• USC QI Program — Professional Leadership Development Program that prepares USC employees to be leaders in their department and better serve the 21st century student and academic institution.

• High-throughput Amplicon Sequencing Workshop — USC Participants gained experience with new techniques for profiling community diversity via DNA sequencing.

• Genome-wide SNP genotyping Workshop — Instruction for USC science researchers on new techniques for genome-wide SNP genotyping with 2bRAD.

• USC Psychology Conference — ‘Advancement in the Science of Habits’, a 3-day conference on economic and psychological processes relevant to consumer habits; proceedings to be published in the Journal of the Association for Consumer Research.

• International Research Group on Ostracoda — Post-symposium field trip for the 18th International Symposium on Ostracoda with participants from around the world.

• USC Polymathic Student Retreat — A student cohort with invited faculty to discuss futurism from multiple, polymathic modes and perspectives.

• USC Mork Scholars — Sophomore Mork Scholars joined Trustee John Mork and his wife Julie, and President C.L. Max Nikias and his wife for a leadership retreat.

• USC Marine and Environmental Biology Retreat — Annual graduate student and faculty retreat to network and facilitate links to other USC units including Earth Sciences, Viterbi School of Engineering, the USC Wrigley Institute, and Natural History Museum of Los Angeles.

• UCI Writing workshop — Writing retreat for faculty of the University of California Irvine, School of Biological Sciences.

• Inspire Energy Development Retreat — A venture-backed start-up founded by alumni of some of the biggest energy companies, Inspire is the fastest growing 100% clean power retailer in the U.S.

• Scientific Boating Safety Association & Dive Officer of California Meetings — Annual concurrent meetings to review safe diving and boating practices in California.

• Seed Consulting Development Retreat — An environmental and leadership development organization, providing nearly $1.5M in pro-bono consulting to environmental nonprofits including Sierra Club, Natural Resources Defense Council, Surfrider Foundation, and the LA Mayor’s Office of Sustainability.
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