

CITIZEN SCIENCE

FOR CONSERVATION IN SOUTHERN CALIFORNIA

SYMPOSIUM

FEBRUARY 20, 2016

*Aquarium of the Pacific*TM

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Marine Conservation Research Institute*

CITIZEN SCIENCE
for Conservation in Southern California
SYMPOSIUM REPORT

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Table of Contents

Summary	ii
Acknowledgments	ii
Symposium Planning Committee	iii
Introduction	4
What is Citizen Science?	4
Symposium Overview	5
Keynote Speaker	6
Lightning Round Presentations	7
Discussion Panels	12
Special Sessions	13
Poster Session	15
Summary and Conclusions	17
Appendix A – Symposium Attendees	18
Appendix B – Pre-Symposium Survey Results	19

Summary

This report summarizes the Symposium on Citizen Science for Conservation in Southern California hosted by the Aquarium of the Pacific and its Marine Conservation Research Institute (MCRI) on Saturday, February 20, 2016. More than 100 citizen science volunteers and practitioners, educators, students, and others gathered to learn more about conservation-oriented citizen science opportunities in Southern California. Some of the participating organizations included: the Ocean Science Trust, National Oceanic and Atmospheric Administration (NOAA) Fisheries, Heal the Bay, University of Southern California (USC) Sea Grant, the California Academy of Sciences, the California State Water Resources Control Board, and the Natural History Museum of Los Angeles. The Symposium format included lightning round presentations that were conducted by the citizen scientists and organizations that host these programs, as well as panel and special sessions presentations that looked at the broader potential and obstacles for the further development of citizen science programs in the region. It also included a meet-and-greet poster reception and a keynote presentation by Dr. Caren Cooper, assistant director of the Biodiversity Research Lab at the North Carolina Museum of Natural Sciences.

Acknowledgments

The Symposium was made possible by a generous contribution from the Aquarium of the Pacific's Marine Conservation Research Institute. The Symposium Planning Committee would like to thank Caren Cooper for an inspiring keynote address; Sanden Totten and Jenny Lentz for moderating, Linda Brown for providing administration support, Aliya Rubinstein for designing the Symposium's marketing and promotional materials, and Cassandra Davis and Claire Atkinson for editing and providing content for this report. We would also like to thank Robert Conrad for providing AV support, Isis Troy and the Aquarium's Guest Services staff for logistical support, Anitza Valles for providing web and social media support, and the Aquarium's Education staff for providing the interactive activities. And, of course, this event would not have been possible without our amazing volunteers: Jannett Bidwell, Linda Brown, Cambria Hanson, Caron Laird, Lynn Massey, Corinne Monroe, Peggy Morrison, Barbara Ramon, Cristina Robinson, and Aliya Rubinstein. Last but not least, thank you to all who presented and participated.

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Introduction

The Aquarium of the Pacific and its Marine Conservation Research Institute (MCRI) hosted the first Symposium on Citizen Science for Conservation in Southern California on Saturday, February 20, 2016. More than 100 attendees including citizen science volunteers and practitioners, educators, students, and others gathered to learn more about conservation-oriented citizen science opportunities in Southern California. The Symposium format included lightning round presentations that were conducted by the citizen scientists and organizations that host these programs, as well as panel and special sessions presentations that looked at the broader potential and obstacles for the further development of citizen science programs in the region.

What is Citizen Science?

Citizen science is the term used to describe scientific research conducted by individuals participating on a volunteer basis, outside of their own professional scope. Citizen science projects are generally structured by scientists, with public participation and engagement through any combination of data collection, analysis, discussion, or collaboration. Although the term “citizen science” was officially coined in 1995, the practice of amateur-led or self-funded scientific research has a rich and varied history, with most science before the late nineteenth century being conducted by citizens. Modern citizen science programs help scientists to overcome a variety of obstacles in gathering and processing data. Opportunities for crowd-sourced scientific participation are expanding with technology advances, especially the increased availability of internet connectivity and high-quality portable cameras. As technology continues to advance, so do opportunities to improve awareness and scientific literacy, setting the stage for a bright future for citizen science and public engagement. This term is further defined throughout the presentations included in this report.

Symposium Overview

The Aquarium of the Pacific and MCRI recognize the importance of citizen science and wanted to provide a venue where citizen scientists and practitioners representing diverse disciplines in environmental conservation with varying levels of experience could come together to share ideas with fellow citizen scientists from diverse programs throughout Southern California; interact with scientists and experts from California and the U.S.; discover new programs and opportunities for citizen science in Southern California; and learn more about citizen science in formal and informal settings. Thanks to a generous contribution provided by MCRI, we were able to produce the event. The final themes and Symposium format were informed by citizen scientists via surveys that were conducted in the beginning of the planning process (see **Appendix A**).

The event kicked off on an inspiring note as Dr. Caren Cooper, assistant director of the Biodiversity Research Lab at the North Carolina Museum of Natural Sciences, took us through the history of citizen science and what it means for science and conservation today in her keynote remarks. Dr. Cooper's enlightening talk was followed by the lightning round presentations in which citizen scientists and program managers shared information about a variety of citizen science program opportunities occurring in Southern California. At lunch time Symposium participants had the opportunity to learn more about the citizen science programming available at the Aquarium of the Pacific, including their San Gabriel River Sea Turtle Monitoring Program and Whale Photo ID Program, as well as programs from other organizations that the Aquarium takes part in, such as SeaGrant's HABwatch program and Earthwatch's Focal Trees program.

After lunch, participants returned to discuss the broader impacts of citizen science. There were two panel discussions, one looking at the nature of science and understanding citizen science's role in it and the other looking at effective communications and outreach strategies for recruitment and to amplify the conservation impacts resulting from the citizen science programs. A series of four "special sessions" concluded the broader impacts discussion and the formal programming.

The event concluded with a meet-and-greet poster reception that also included booths featuring information about citizen science programming available through Earthwatch; El Dorado Audubon, local chapter of The National Audubon Society; the National Wildlife Federation; and the Aquarium of the Pacific.

Full presentations are available at: <http://www.aquariumofpacific.org/mcristo/info/cscsc>

Keynote Speaker

Dr. Caren Cooper's keynote address, "Citizen Science: When Numbers Speak Truth to Power," began by explaining the importance of citizen science programs at both the individual and community level. Most citizen science programs are designed to address a scientific question and produce new knowledge while also fostering social capital between the individual and their surrounding environment and community, which in turn creates a more scientifically literate and environmentally focused public. In other words, "knowledge production + social capital = conservation & environmental justice."

Citizen science programs can also enable data collection on a scale that would have been nearly impossible through traditional scientific means. For example, the eBird program created by the Cornell Lab of Ornithology and National Audubon Society enables birders from all over the world to upload their sightings data and view bird observations, abundance, and distribution data in almost real time.

Dr. Cooper went on to explain that while citizen science programs have recently become a hot topic, the underlying principles of lay people crowdsourcing data is not at all new. Some of our earliest global data on whale migrations came from efforts spearheaded by Matthew Fontaine Maury in the mid-1800s. Cooper explained that Maury used whale sightings by both whalers and sailors to plot the seasonal migrations of different species. Later Maury went on to use sailors' log books to create the world's first ocean current chart, which earned him the nickname "Father of Oceanography." At its core citizen science is not about basic versus applied research, or even whether or not it fosters social capital, but rather *who* the science serves. This concept is illustrated in the following quote from a letter a mariner wrote to Maury: "Until I took up your work, I had been traversing the ocean blindfolded."

She went on to provide some examples of some present-day citizen science programs, including the Flint Water Study; Surfrider's "Blue Water Task Force," which collects water quality data around the world; Woods Hole Oceanographic Institution's Radioactive Ocean program, which uses citizen science to collect data on the spread of radiation from the Fukushima meltdown; Australia's nationwide Koala Count; and the California King Tides Project.

Dr. Cooper closed by explaining that the citizen science movement designs projects which create knowledge while also building social capital, enabling us to "remove our blindfolds" and "steer a better course in managing natural resources."

Lightning Round Presentations

The following speakers were allotted five minutes for their presentations, with questions saved for the break. Abstracts from each of the talks are provided below, along with a link to their presentation when possible.

Citizen Science for Natural Resource Management: Does Participation Foster Awareness and Stewardship?

by Sarah Chase and Dr. Arielle Levine, San Diego State University, Geography Department

While citizen science is frequently touted for the ability to foster environmental awareness and stewardship ethic among participants while collecting valuable data, there is little evidence to support this claim. My research seeks to better understand how, and to what extent, natural resource monitoring through citizen science influences volunteers' behavior and attitudes towards the resource being monitored. While other studies have sought to document statistically significant attitude and behavioral changes using a pre-post participation questionnaire, often with little success, this study examines participants' personal perceptions of attitude and behavioral change. Survey data were collected from seven citizen science programs monitoring a range of natural resources. Using a qualitative approach to explore participants' perceptions of their own attitude and behavioral changes offers unique insights where existing quantitative instruments have been inconclusive. These findings contribute to an improved understanding of program outcomes and may inform the development citizen science programs.

Using Citizen Science to Identify Sevengill Sharks

by Barbara Lloyd and Michael Bear, Ocean Sanctuaries

Ocean Sanctuaries, a San Diego NPO founded to support and create marine citizen science projects is using the pattern recognition algorithm in 'Wildbook,' a web-based application for wildlife data management, to identify Sevengill sharks in both California and South Africa.

Mission Bay Pollution Survey

by Laura Coleman

Mission Bay is a man-made bay that attracts hundreds of recreational boaters every year. In addition to its recreational qualities, Mission Bay is a valuable habitat for juvenile fish, marine invertebrates, birds, and aquatic plants. Sadly, Mission Bay has a reputation for being "gross" due to anthropogenic sources: run off and poor waste disposal. I am proposing a Citizen Science project called the Mission Bay Pollution Survey to monitor the pollution in Mission Bay and changes in underwater biodiversity. My long-term goal is to organize monthly cleanups at several locations in Mission Bay in order to monitor the type of pollution, the amount of pollution, the bottom type where the pollution occurs, and the underwater biodiversity. In addition to monthly cleanups, citizen scientists will be able to report their encounters with pollution in an online database.

Los Cerritos Wetlands Bird Counts

by **Mary Parsell**, *El Dorado Audubon*, local chapter of *The National Audubon Society*

El Dorado Audubon citizen scientists have been leading monthly field trips on Los Cerritos Wetlands since 2009. Los Cerritos Wetlands is an Audubon California Important Bird Area (Orange Coast Wetlands). "At Audubon California, bird science is a participatory activity. People take to the outdoors to pursue their love of birds, and we take advantage of the cumulative value of these outings in a number of ways. We encourage people to take part in a variety of monitoring activities, bird surveys, even a local Christmas Bird Count -- and all of this feeds back into our usable knowledge base."* On our monthly field trips to Los Cerritos Wetlands citizen scientists record the bird species observed and count the number of each species. This data is then entered into eBird. "A real-time, online checklist program, eBird has revolutionized the way that the birding community reports and accesses information about birds. Launched in 2002 by the Cornell Lab of Ornithology and National Audubon Society, eBird provides rich data sources for basic information on bird abundance and distribution." **

*Audubon California/**eBird

Empowering and Supporting Naturalists in Biodiversity Documentation for Research, Conservation, and Community Building

by **Alison Young and Rebecca Johnson**, *California Academy of Sciences*

Technology informs and enhances our work. Buoys and weather stations provide real-time meteorological and physical data. Satellites help us map forests and algal blooms. What if technology could provide current species-level biodiversity information while building a community of stewards? Citizen Science at the California Academy of Sciences is fostering a small but growing network of people making high-quality biodiversity observations in California through the iNaturalist platform. These observations provide valuable biodiversity data, mapping populations of invasive species and helping to track events like sea star wasting disease. This talk will expand upon the research and management benefits of a mobilized public empowered to document biodiversity, as well as the advantages of connecting people to nature and each other. We will provide tips for engaging people in this type of work, from reaching out to the current network of observers to building new communities through events and other citizen science projects.

Happywhale: A Citizen Science Web Platform to Improve the Participatory Experience and Quality of Whale Photographic Identification Studies

by Ted Cheeseman, John Calambokidis, Ken Southerland, and Kiirsten Flynn, Happywhale.com

Citizens have long contributed to California marine mammal science through sharing images of photographically identifiable whales. But photo-ID work is manual and time intensive and garners little public feedback. This has left excellent potential data unutilized and misses public educational opportunities from storied whales. In 2015 a pilot effort—Happywhale.com—began in collaboration with Cascadia Research (manager of most West Coast large whale photo-ID catalogs) in the Monterey Bay region focused on humpback whales to both improve image management and make feedback accessible to contributors. Citizen scientists report that learning about the individuals in their photographs is engaging and rewarding, motivating them to contribute more and better photos, while automation is improving the quality, quantity, and efficiency of data accessible to science. We present results of our pilot effort, steps under way to make findings public, and the applicability of this effort to other areas and species.

Sand Crab Monitoring As a Way to Engage the Community About Ocean Health

by Taylor Spesak and Catherine Hoffman, Heal the Bay

Studying populations of sand crabs can provide a picture of a functioning, healthy ecosystem. At Heal the Bay, we are looking at sand crabs and their relation to ocean water quality and overall ocean health. In September we began collecting data on sand crab populations near the Santa Monica Pier using a method modified from the statewide LiMPETS program. We take into account several variables including variation in tides, days since the last rain, and water quality. In three months we have started to see trends in our data, but with the limited repetitions it is difficult to make definitive conclusions. As we collect more data, we hope to see trends more clearly. Moving forward we are looking to increase community engagement with this monitoring program by promoting our program to public visitors at the Santa Monica Pier Aquarium and as linked-learning for high schools.

Long Beach Fish Study

by William Preston Bowling, Resource Conservation District of the Santa Monica Mountains, Friends of the Los Angeles River (FoLAR)

In 2008 FoLAR completed their two-year study of fish in the Glendale Narrows that can be found at <http://folar.org/wp-content/uploads/studies/fish-study-2008.pdf> With over 2,000 fish collected, a dozen were taken to Dr. first name? Gossett at California State University, Long Beach, for sampling. Dr. Gossett found the fish are low in mercury and polychlorinated biphenyls (PCBs) in comparison to other river fish. This was a collaboration with citizen scientists and contracted biologists. In 2016 results of the two-year study of the Long Beach river fish will be compiled in a similar document. This study was a partnership between FoLAR and the Aquarium of the Pacific. Dr. Gossett has again been hired for the toxicity portion of this study. This was also a collaboration with citizen scientists, volunteer anglers, and contracted biologists—truly a group effort of experts and nature-lovers, from collection to the final document.

Urban Tides Community Science Initiative

by **Holly Rindge** and **Linda Chilton**, USC Sea Grant

You can help document the impacts of rising sea levels in your community! Urban Tides is a yearlong community-based science effort to photo-document tidal lines, coastal flooding, and erosion along our coast. Images provide critical information to help calibrate scientific models used to identify locations vulnerable to damage from future sea level rise. These tools and information enable community leaders and local governments to set priorities as they plan strategies that will help the region adapt. Working with scientists, we have designated a series of beach and wetland locations where photographs are needed the most. Urban Tides uses an innovative mobile app to ensure data accuracy. Public participation is critical to ensure quantity and geographic coverage of data. We have learned lessons about developing the program, building community engagement, working with scientists, and data collection methods and storage. Learn more at <http://bit.ly/1O0arhl>.

Catalina Conservancy Divers: Lessons Learned for Volunteer Based Monitoring

by **Dirk Burcham** and **Thomas W. Turney**, WIES-Catalina Conservation Divers

The Catalina Conservancy Divers (CCD) was formed in 1991 as a support group of the Catalina Island Conservancy, a non-profit organization dedicated to preserving Catalina Island. CCD was a volunteer-run organization with minimal institutional involvement. At its peak CCD conducted four ongoing monitoring programs at Catalina Island: Sea Temperature Recording, Key Species Monitoring, Kelp Census at USC Wrigley Marine Science Center, and Urchin Census at USC Wrigley Marine Science Center. CCD became a model for volunteer-based marine monitoring. Today the group is affiliated with USC and is known as WIES-CCD, or the Wrigley Institute for Environmental Studies – Catalina Conservation Divers. WIES-CCD research data spans from 1992 to the present. In this presentation we will draw from our experience and give practical advice on starting and running a citizen science monitoring program.

Reef Check California – How Scuba Divers Become Expert Citizen Scientists

by **Jan Freiwald** and **Colleen Wisniewski**, Reef Check California

Citizen science has become widespread and contributes to many scientific goals. Programs focus on public engagement in resource management, research, and data collection. While many projects benefit from the involvement of large numbers of volunteers to cover vast geographic areas, other programs rely on highly trained volunteers to implement monitoring or research projects. For example, citizen science projects in challenging environments and projects that require species identification at a moment's glimpse require specialized skills. Similarly, to collect quantitative data in situations in which data collection is expensive and opportunities are rare, programs need skilled and reliable volunteers. To participate in these projects, volunteers often need preexisting skills or go through extensive training programs. This presentation will explore how Reef Check California citizen scientists become highly skilled experts and collect quantitative data on subtidal rocky reef and kelp forest communities.

Visualizing Sea Turtle Surfacing Data

by *Heidi Ziegler, Los Cerritos Wetlands Sea Turtle Monitoring Project*

The green sea turtle (*Chelonia mydas*) is listed as Endangered on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species. These turtles are not typically found in a freshwater river but have been observed in the San Gabriel River in Southern California. The supposition is that the turtles are drawn to the warm-water outflows of the existing power plants. The power plants are slated for shutdown in the next ten years, indicating that time is short to gather data to better inform potential river habitat conservation policies. As part of the Los Cerritos Sea Turtle Monitoring project, volunteers meet monthly at pre-designated locations along the San Gabriel River for half an hour to observe surfacing sea turtles. The goal is to record parameters such as size, time, direction of travel, and location to ascertain how many turtles may be present in the river at any given time. We present the dataset through various methods to aid in its visualization. The Los Cerritos Sea Turtle Monitoring project is in its third year.

From Baseline Data Collection to On-Going Resource Management: 12 Years of Engaging Community in Citizen Science Along the San Diego River

by *Shannon Quigley-Raymond, San Diego River Park Foundation*

The San Diego River Park Foundation, a non-profit organization, engages over 400 volunteers annually in citizen science. In 2004, the first citizen science program, RiverWatch, was developed to collect baseline water quality data. This program has successfully progressed into a robust ambient water quality monitoring program with concrete evaluation metrics. Developed in 2008, RiverBlitz citizen scientists assess two key stressors of ecosystem health: trash and non-native plants along the San Diego River. These citizen science efforts have led to a key role for the organization in managing and advocating watershed health through reporting results, sharing data, and taking action. This presentation will highlight pathways to successes in engaging the community, effective use of results in land management, and data sharing. It will also touch on a new effort, expanding assessment and monitoring into the headwaters where there is a data void and terrain and logistics are challenges to engaging volunteers.

Community HABwatch Program

by *Holly Rindge and Linda Chilton, USC Sea Grant*

You can be an extra set of eyes on the ocean to detect harmful algal blooms! HABwatch is a network of scientists and volunteers from science centers, aquaria, marine sanctuaries, and schools in Southern California that monitors local coastal ecosystems for harmful algal blooms (HABs) and educates the public about toxic events. Volunteers collect and analyze plankton samples from beaches, estuaries, wetlands and harbors. Participants are trained in scientific methods of collection, observation, and identification of harmful algae. This effort increases the number of eyes on the ocean for early detection and sets into place a method for rapid response should harmful algae be detected. Working with partners, the program has developed data collection protocols, volunteer trainings, and a user-friendly database. HABwatch significantly increases the amount of information on the locations and timing of harmful algal species. Learn more at <http://bit.ly/1PGIgD6>.

Discussion Panels

The Discussion Panels were forty-five-minute moderated discussions. Each panelist was given three minutes to introduce themselves. The Moderator then asked the panel questions (provided below), and ended the panel by taking fifteen minutes of questions from the audience.

Panel 1: Understanding the Nature of Science and Citizen Science's Role

Moderator: **Jennifer Lentz**, *Education & Citizen Science Programs Coordinator, Aquarium of the Pacific*

Panelists: **Heidi Ballard**, *Associate Professor, Environmental Science Education & UC Davis
Chancellor's Fellow, UC Davis School of Education*

Dan Lawson, *Fisheries Biologist, NOAA, West Coast Region Protected Resources Division*

Katherine Pease, *Watershed Scientist, Heal the Bay*

Rebecca Johnson, *Citizen Science Research Coordinator, California Academy of Sciences*

Questions for the Panel:

What advantages (if any) do citizen science programs have over “traditional science” programs?

↳ In the absence of formally trained scientists, how do you ensure data quality?

What do you see now or foresee in the future as the biggest or most interesting obstacles and challenges facing development of citizen science programs (that are not related to money) and use of citizen science data?

What have you, as a scientist, learned about your science, how you communicate, and your field in general by engaging in citizen science?

Panel 2: Engaging Local Communities

Moderator: **Sanden Totten**, *KPCC Science Reporter*

Panelists: **Beth Pratt**, *California Director, National Wildlife Federation*

Cassandra Davis, *San Gabriel River Sea Turtle Monitoring Program,
Education Volunteer Coordinator, Aquarium of the Pacific*

Susan von Thun, *Senior Research Technician and Social Media Associate, Monterey Bay Aquarium
Research Institute*

Dirk Burcham, *WIES-Catalina Conservation Divers*

Questions for the Panel:

How can engaging people in citizen science teach them about the natural world and science? Does it motivate people to care more about the natural world?

Now that practically everyone has a mobile device with them at all times, how has that increased the impacts of citizen science?

↳ How do you think social media is shaping citizen science? ...the way we value wildlife & conservation?

How can we establish communication between citizen science groups so we can share ideas and results and not duplicate efforts? Is there a need for that?

Special Sessions

The following speakers were allotted fifteen minutes for their presentation and to answer questions.

Citizen Science as a Tool for Engaging Communities in Science Education

by Lila Higgins, Citizen Science Program Manager, National History Museum

The Natural History Museum of Los Angeles County has been engaged in citizen science projects and programs since 1994, when the California Parrot Project launched. Today the museum engages communities in citizen science throughout the Southern California region. Museum staff train citizen scientists on project protocols—from school teachers and tweens, to families and young adults—for four focus projects including reptiles & amphibians, snails & slugs, squirrels, and flying insects. Currently the museum is working to partner with libraries to offer programs in underserved communities, where data gaps exist for focal taxa.

Ensuring a Legacy for your Citizen Science Environmental Monitoring Data

*by Erick Burrell, Citizen Monitoring Coordinator and Senior Environmental Scientist (Specialist),
Clean Water Team - State Water Resources Control Board*

Citizen science projects that produce environmental monitoring data have the ability to contribute much needed and valuable data contributing to environmental stewardship actions long past the life of their own monitoring project. By following seven simple steps as outlined by this SWRCB Clean Water Team presentation, citizen science project leaders can add value to their volunteer's time and contributions while ensuring a long legacy of their data's utility for their own and other's use: www.waterboards.ca.gov/water_issues/programs/swamp/docs/cwt/guidance/1148.pdf

Increasing Public Awareness and Engagement Through Citizen Science

*by Cassandra Davis, Sea Turtle Monitoring Program and Education Volunteer Coordinator,
Aquarium of the Pacific*

Museums, Zoos, and Aquariums have begun to leverage their roles as learning centers in participating in, developing, or supporting citizen science projects. This support manifests itself in both long-term and short-term projects, which are often spearheaded or championed by an individual or a department, but the effects of participating are often difficult to measure or define. By examining its citizen science project participation (a short-term, small commitment opportunity) in comparison with two connected long-term volunteering opportunities, the Aquarium of the Pacific discovered that citizen science involvement does seem to have a positive effect on inspiring volunteer involvement in related programs. A majority of volunteers started as Citizen Science volunteers and continued on to become new, long-term volunteers with either the Aquarium of the Pacific or Los Cerritos Wetlands restoration, providing evidence that participating in citizen science can foster further participation and engagement with related volunteer services at local institutions.

Citizen Science and MPA Monitoring In Support Of the State

by Marisa Villarreal, Project Scientist, Ocean Science Trust

California has the largest statewide network of marine protected areas (MPAs) in the nation. It has taken a partnership-based approach to monitoring MPAs to understand and evaluate their performance. The state has acknowledged that citizen science can play a valuable role in MPA monitoring and is working with the California Ocean Science Trust to understand what this role could look like and the existing citizen science capacity in the state. Organizations such as Reef Check, LiMPETS, and California Collaborative Fisheries offer examples of citizen science organizations already participating in MPA monitoring across the state. At Ocean Science Trust we're learning from these existing partnerships and actively exploring others to broaden and deepen citizen participation in California's MPA monitoring efforts.

Poster Session

The following abstracts are from the poster session during the afternoon social.

A Framework of Citizen Science: How the Nature of the Resource Influences Methods and Outcomes

by Sarah Chase and Dr. Arielle Levine, San Diego State University, Geography Department

Citizen science programs monitor a wide range of natural resources and employ diverse techniques to engage citizens in science and monitoring. Yet, to date, there has been no comprehensive review of citizen science programs to understand how the nature of the resource being studied influences the methods, outcomes, or appropriateness of participant engagement in citizen science. This poster presents a framework to explore how critical characteristics of the resource being monitored and the ultimate goals of the program (research, monitoring, and education) influence the methods and approaches for public engagement in citizen science. It may be instructive for those wishing to incorporate citizen science into research and monitoring programs, providing insight into approaches for citizen engagement, and the strengths and limitations of citizen science for monitoring a range of natural resources.

A Teaching Aid to Enable Better Turtle Observation Data Collection

by Heidi Ziegler and Dennis Ertzman, Los Cerritos Wetlands Sea Turtle Monitoring Project

Through monthly half-hour turtle observation along the San Gabriel River, volunteers are asked to record a set of parameters, e.g., time, size, direction of travel, and location, for each surfacing turtle. Volunteers receive training and are paired with more senior volunteers to increase the accuracy and completeness of recorded data. Yet, in reviewing just one month's worth of data, it is observed that 23% of the sightings recorded had some missing information. To remedy this, we propose a teaching aid that presents various observation scenarios along with example erroneous data collection sheets. A missing or an incorrectly recorded parameter in each example is highlighted. The goal is to deploy the teaching aid in 2016 and measure its effectiveness in decreasing missing data.

Aliso Creek Turtle Organization and Rescue

by Michael Skibsted, St. Mary's

For the past several months I've been working to create an organization that will locate and rehabilitate turtles that have been abandoned by their owners in the Aliso Creek area of Aliso Viejo. I will be presenting how this organization is going to be formed and what steps will be taken to get this organization up and running. With help this organization should be operational by September 2016.

Creating Pathways for Exploring & Monitoring Freshwater & Aquatic Environments

by **Erick Burre**, *SWRCB-Clean Water Team*

The Clean Water Team is California's citizen monitoring program. This poster highlights some tools used statewide by watershed groups and educators to create pathways for exploring and monitoring freshwater and aquatic environments. (1) Visual Habitat Assessment for Wadeable Freshwater Streams is based on an EPA methodology. We have created an enhanced spreadsheet and videos that supplement basic instruction. (2) Environmental Monitoring User Manual for The Creek Watch App (IOS). By leveraging this free, simple-to-use app, people can collect data that helps answer larger environmental questions. (3) The California Digital Reference Collection of Freshwater Benthic Macroinvertebrate Families. This interactive PDF brings aquatic invertebrate knowledge from the lab and library to the creekside. (4) Totally Trashed or Not: Conducting Rapid Trash Assessments. Nobody likes a trash-filled creek. Unfortunately clean-ups are only temporary solutions. By conducting rapid trash assessments you can learn more about trash accumulations and their harm.

Los Angeles Coastal California Naturalists

by **Holly Rindge** and **Linda Chilton**, *USC Sea Grant*

This naturalist training program brings together traditional and scientific knowledge about coastal regions in California. It is designed to provide interpreters in the field with a strong understanding of the natural history of coastal California and foster support for new and ongoing citizen science projects. Through presentations and field trips, participants learn to apply knowledge of Southern California ecosystems to understanding both local and global environmental issues. Naturalists are ready to take an active role in natural resource conservation, education, and restoration. Learn more: <http://bit.ly/1mBIKAA>.

Whale CITE: A Citizen Science Program for Whale Sightings Along the U.S. West Coast

by **Dan Lawson**, **Monica DeAngelis**, **Sarah Chase**, **Melissa Kent**, **Michelle Ferraro**, **Jacob Marziaz**, **Jen Jelincic**, **Arielle Levine**, and **Ellen Hines**, *NOAA NMFS West Coast Region*

Along the U.S. West Coast, there is great potential to enlist the public to help collect large whale sightings data; through programs or platforms that currently exist and through encouragement of new citizen scientists. Whale CITE is a multi-institutional program under development aimed at designing a standardized program to collect large whale sighting data along the U.S. West Coast and provide a central repository for this data in a format that can be widely beneficial. Whale CITE will explore the usefulness of citizen science data to augment existing research programs for large whales, helping to inform management actions or other activities. Development and implementation of Whale CITE to successfully yield both scientific and educational outcomes requires significant planning and effort necessitating a broad collaborative partnership between NOAA's National Marine Fisheries Service, California State University's COAST partner universities, and other academic or private institutions and organizations interested in large whales.

Summary and Conclusions

Citizen scientists can provide valuable data and data processing opportunities for scientific research that might otherwise not be available due to limitations, such as distance, timing, and staffing numbers or availability. Citizen science projects in California are expanding, progressing in their data quality measures, technical processes, and technology tools. Citizen science participants can also become advocates for the research in which they are participating, and help to amplify conservation messages within their communities related to the citizen science research. Within the greater Los Angeles area, citizen science participation is shedding light on both terrestrial and aquatic urban wildlife, ecosystems, and habitats.

Members of the scientific community have begun to work more closely with citizen science projects in order to address concerns about data quality, especially in collection processes and in training volunteers. Scientists from universities have led the way in engaging citizen science projects, especially through partnerships with Sea Grant programs and informal learning centers, although government institutions, including NOAA, are now increasing their involvement in citizen science efforts. The Symposium facilitated important dialogue about the role citizen science will play in future conservation research and outreach efforts in Southern California. The Aquarium of the Pacific and MCRI look forward to continuing this discussion by hosting future Symposiums for Citizen Science.

Appendix A – Symposium Attendees

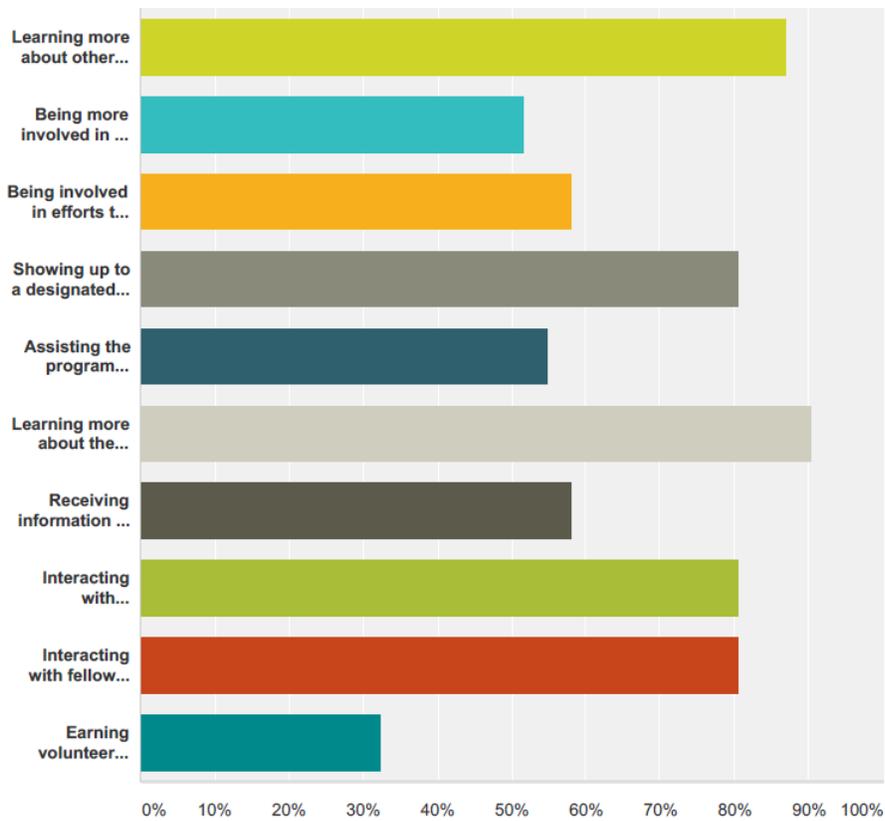
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Appendix B – Pre-Symposium Survey Results

Citizen Science Survey

**Q1 As a citizen scientist, I am interested in:
(mark all that apply)**

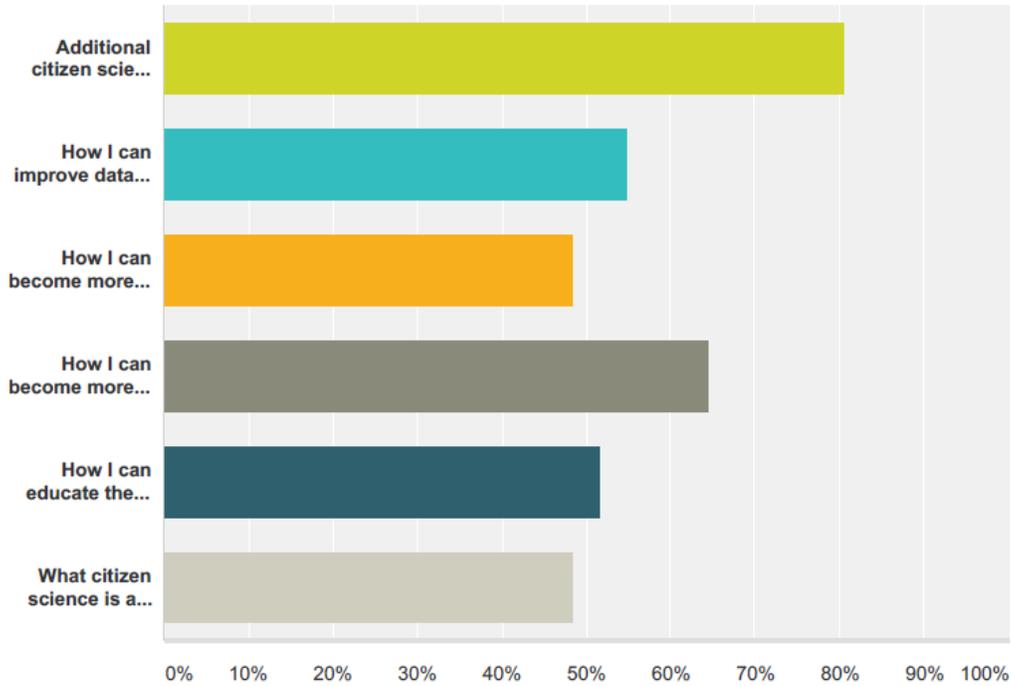
Answered: 31 Skipped: 0



Answer Choices	Responses
Learning more about other citizen science programs and opportunities.	87.10% 27
Being more involved in the program design and formulating the scientific questions.	51.61% 16
Being involved in efforts to improve data collection.	58.06% 18
Showing up to a designated spot and collecting data with the guidance of the program manager.	80.65% 25
Assisting the program managers with analyzing the data.	54.84% 17
Learning more about the progress of the research I'm participating in.	90.32% 28
Receiving information and tips on educating the community about the great work we are doing.	58.06% 18
Interacting with scientists.	80.65% 25
Interacting with fellow citizen scientists and enthusiasts.	80.65% 25
Earning volunteer credit hours.	32.26% 10
Total Respondents: 31	

Q2 I'm most interested in attending an event where I can learn more about:(mark all that apply)

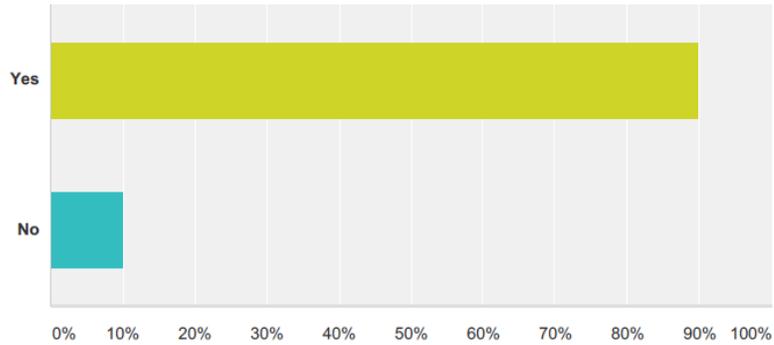
Answered: 31 Skipped: 0



Answer Choices	Responses
Additional citizen science programs and opportunities in my area and throughout Southern California.	80.65% 25
How I can improve data collection for my current program.	54.84% 17
How I can become more involved in the program design with program managers.	48.39% 15
How I can become more involved in analyzing the data with program managers.	64.52% 20
How I can educate the community about the great work we are doing.	51.61% 16
What citizen science is and how it is different from other volunteer programs.	48.39% 15
Total Respondents: 31	

Q3 I am interested in attending a one-day symposium with my peers to learn more about citizen science and how I can enhance my experience as a citizen scientist.

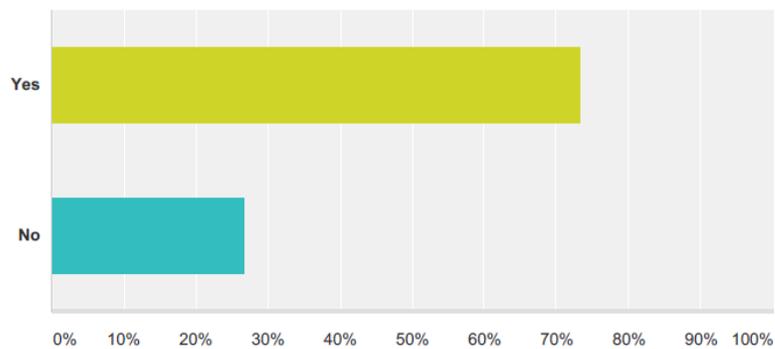
Answered: 30 Skipped: 1



Answer Choices	Responses	Count
Yes	90.00%	27
No	10.00%	3
Total		30

Q4 I am interested in sharing my experiences as a citizen scientist with my peers, scientists, and practitioners.

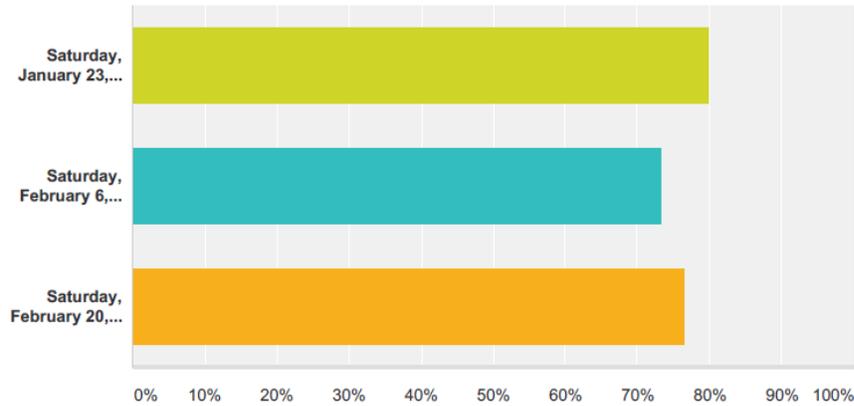
Answered: 30 Skipped: 1



Answer Choices	Responses	Count
Yes	73.33%	22
No	26.67%	8
Total		30

**Q5 I am available to attend the citizen science symposium on the following days:
(mark all that apply)**

Answered: 30 Skipped: 1



Answer Choices	Responses
Saturday, January 23, 2016	80.00% 24
Saturday, February 6, 2016	73.33% 22
Saturday, February 20, 2016	76.67% 23
Total Respondents: 30	

Q6 Please share any additional thoughts or comments you have that will help us design and create a successful citizen science symposium.

Answered: 6 Skipped: 25

#	Responses	Date
1	No comments at this time. I would be happy to provide comments after I participate in the next symposium.	8/11/2015 5:39 PM
2	Training on GIS software, Google Earth and Google maps would be great. Also reports on similar efforts that can serve as models in turtle conservation /creating/conserving / successes. Near term / long term goals for this effort.	8/7/2015 6:43 PM
3	I would need more information about #4 to really respond to that question It is too far out for me to know if I'm available on the proposed symposium dates	8/7/2015 5:27 PM
4	I am really looking forward to this event. Hands-on activities and free drinks/snacks would be the cherry on top for me. :)	7/29/2015 10:12 AM
5	I am interested in citizen science as part of a homeschooling curriculum / enrichment program.	7/29/2015 2:46 AM
6	i believe educating everyone on the bigger picture; how protecting our marine animals and protecting the environment also protects us and the research we do is just one piece of the puzzle.	7/28/2015 8:25 PM

