

*3<sup>rd</sup> Annual*

# CITIZEN SCIENCE

*for Conservation in Southern California*

# SYMPOSIUM

*SYMPOSIUM PROCEEDINGS*



**Edited by**

**Jennifer A. Lentz, Ph.D.**

**Cassandra M. Davis, M.Sc.**

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*3<sup>rd</sup> Annual*  
**CITIZEN SCIENCE**  
*for Conservation in Southern California*  
**SYMPOSIUM**

# ACKNOWLEDGEMENTS

*This symposium was made possible by the  
individuals who served on the **Planning Committee**,  
our **Symposium Volunteers**,  
and the generous financial support of our **Event Sponsors***

Saturday, March 24, 2018 at the Aquarium of the Pacific in Long Beach, CA

# Planning Committee



**Jennifer Lentz, Ph.D.** – *Aquarium of the Pacific (AOP)*

**Cassandra Davis, M.Sc.** – *Aquarium of the Pacific (AOP)*

**Linda Chilton** – *USC Sea Grant*

**Richard Smart** – *Natural History Museum of Los Angeles County (NHMLA)*

**Citizen Science for conservation in Southern California Symposium**  
**Saturday, March 24, 2018 at the Aquarium of the Pacific in Long Beach, CA**

# Symposium Volunteers



**Sarah Kaleel** – *Aquarium of the Pacific*

**Montserrat Russell** – *Santa Ana College*

**Arely Cardoso** – *Santa Ana College*

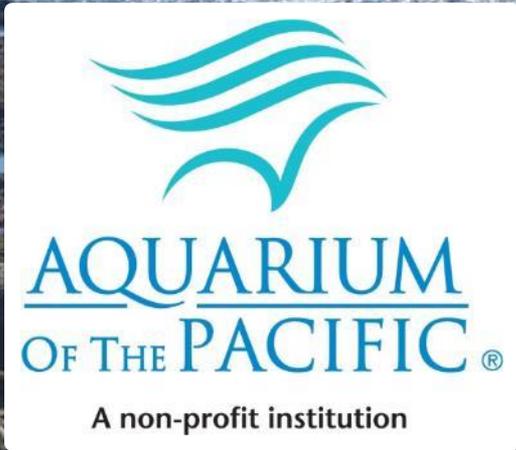
**Leticia Castro** – *California State University Fullerton*

**Ejike Anusiem** – *California State University Fullerton*

**Jacqueline Olvera** – *Aquarium of the Pacific*

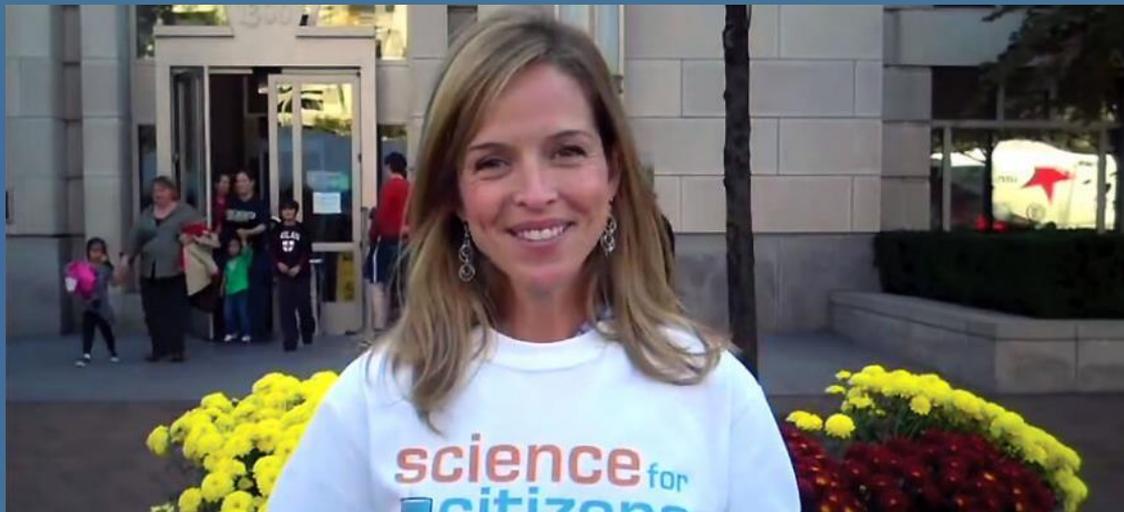
Citizen Science for conservation in Southern California Symposium  
Saturday, March 24, 2018 at the Aquarium of the Pacific in Long Beach, CA

# Event Sponsors



**KEYNOTE SPEAKER**

# Darlene Cavalier



Founder of **SciStarter** and **Science Cheerleader**, cofounder of **ECAST**, and a founding board member of the **Citizen Science Association**

Saturday, March 24, 2018 at the Aquarium of the Pacific in Long Beach, CA



Darlene Cavalier  
@SciStarter

Arizona State University

We connect  
regular people  
to real science  
they can do.



Millions of people  
enjoy  
science & nature.

Thousands of  
scientists need  
volunteers.

*But they can't find  
each other.*



We  
connect  
them



The logo for Citizen Science Day features a stylized orange molecular structure with three spheres and connecting lines above the text. The word "CITIZEN" is in dark blue, "SCIENCE" is in light blue, and "DAY" is in orange, preceded by a horizontal orange line.

# CITIZEN SCIENCE — DAY

This video is available online at:

[https://d32t5kbtvp82a7.cloudfront.net/generic/CS\\_Day\\_no\\_dates.mp4](https://d32t5kbtvp82a7.cloudfront.net/generic/CS_Day_no_dates.mp4)



CITIZEN SCIENTISTS ARE

USING SCIENCE TO ADDRESS  
LOCAL AND GLOBAL PROBLEMS

- 1) Find projects
- 2) Join projects
- 3) Record participation
- 4) Research ecosystem

- 1) Recruit
- 2) Train
- 3) Equip
- 4) Support participants



**CITIZEN SCIENTISTS ARE  
USING SCIENCE TO ADDRESS  
LOCAL AND GLOBAL PROBLEMS**



**FIND A PROJECT**

Find a location

enter a location



Select a topic

select a topic...

**find a project**



CITIZEN SCIENTISTS ARE

BUILDING TOOLS FOR  
THE FUTURE



FIND A PROJECT

Find a location

enter a location



Select a topic

select a topic...



find a project



CITIZEN SCIENTISTS ARE

DISCOVERING  
NEW WORLDS



FIND A PROJECT

Find a location



Select a topic

find a project



CITIZEN SCIENTISTS ARE

ADVANCING  
MEDICAL RESEARCH



FIND A PROJECT

Find a location

enter a location



Select a topic

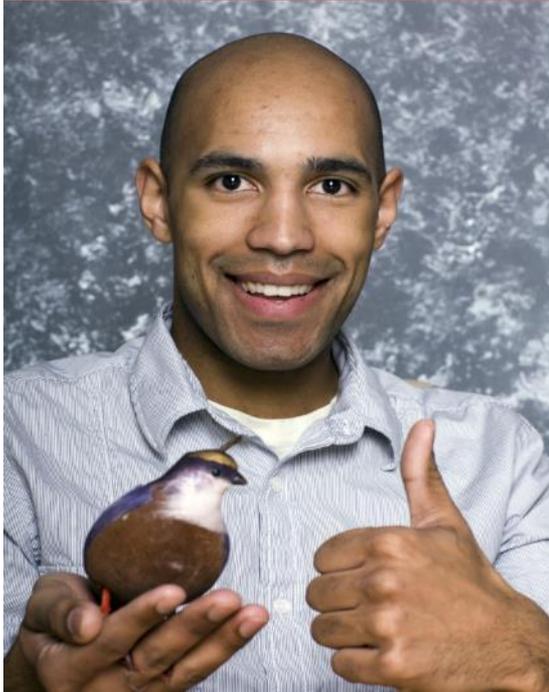
select a topic...

find a project

# Someone you know is a Citizen Scientist

*eBird*

1.5 million reports



*1.5 million  
water testers*



*SETI@home 5  
million volunteers*





INATURALIST.ORG

# Year In Review 2017

SHARE 



We're NOT talking home chemistry kits



# Citizen Science is Serious Science.

## Galaxy Zoo

Co authored  
*dozens of  
peer-reviewed  
papers*

<https://www.zooniverse.org/about/publications>

## Audubon

Showed that  
*birds migrate  
closer to  
poles* due to  
global warming

## Sound Citizen

Discovered  
*cocaine &  
hormones* in  
Puget Sound  
drinking water

# Because of Citizen Scientists, we now know:

Cooper, Caren et al. (2014)

Knudsen et al. (2011)

Cooper, C., Shirk, J.,  
Zuckerberg, B. (2013)

- Birds are breeding earlier
- 50+ types of bacteria live in your belly button
- Jupiter-sized planet discovered
- Invasive mosquito species has arrived in Germany
- Half of what we know about migratory birds and climate change came from citizen scientists! Yet not ONE of the publications reviewed (Knudsen et al.) cited the term “citizen science”.

# Because of Citizen Scientists, we now know:

Wiggins, A., Kosmala, M.,  
Swanson, A., Simmons, B.  
"Assessing data quality in  
citizen science." (2016)

## Data quality

"Quality and quantity with citizen science."

Caren Cooper. PLoS Blogs

**Expert review** – over three-quarters of projects in Wiggins et al sample included some form of expert review to validate observation.

**Photo submission** – 40% of projects in the Wiggins et al sample include photo vouchers for validating data.

**Training and testing** – over 20% reported having a training program related to quality assurance and quality control.

**Replication by multiple participants** – almost one-quarter of projects in Wiggins et al sample use redundancy to validate data

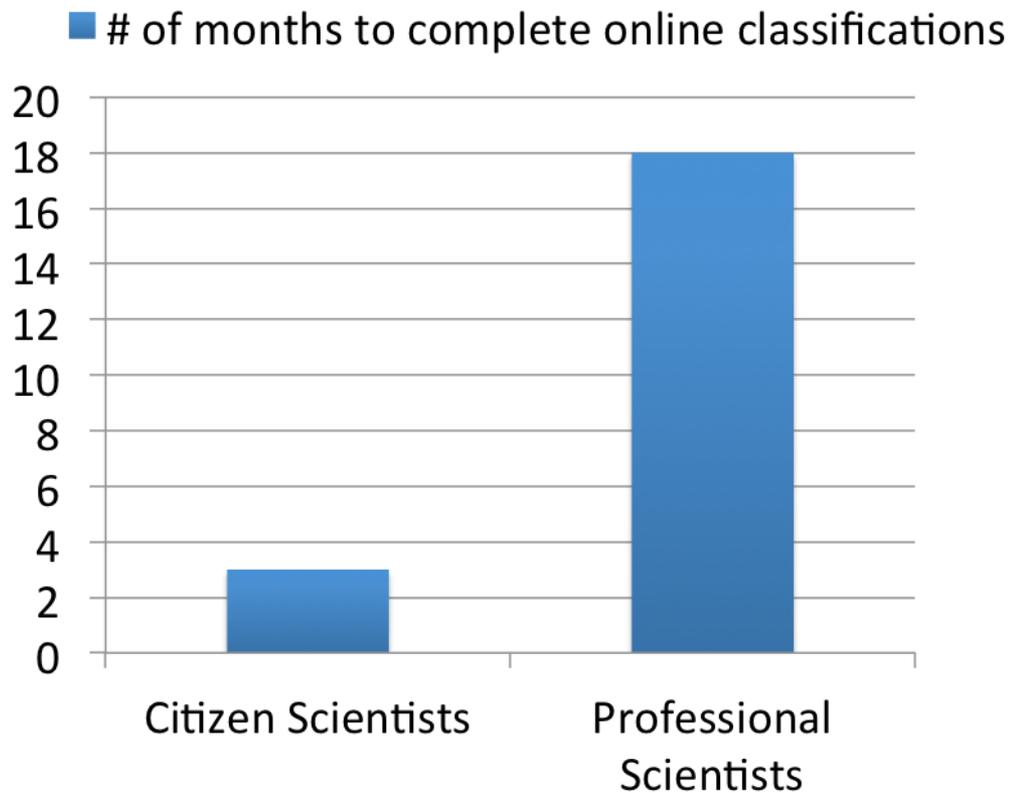
Because of  
Citizen  
Scientists:

In a study of **338** citizen science projects:

**1.3–2.3 million** citizen scientists had an economic value of **\$2.5 billion** per year.

*Parrish, Julia. University of Washington (2014)*

Because of  
Citizen  
Scientists:  
Cell Slider:  
Classify Online  
Images of Cancer



Because of  
Citizen  
Scientists:

“... increased understanding  
of scientific methodology,  
validity, and reasoning...”

*Source: Brossard, et, al,*

# Because of Citizen Scientists:

- Usable data
- Accelerated research
- Economic impact
- Increased understanding of the scientific method

Imagine if we  
had more  
Citizen  
Scientists:

We spend 3 billion hours/week  
playing videogames.

Imagine if we applied a fraction of  
that effort to citizen science.

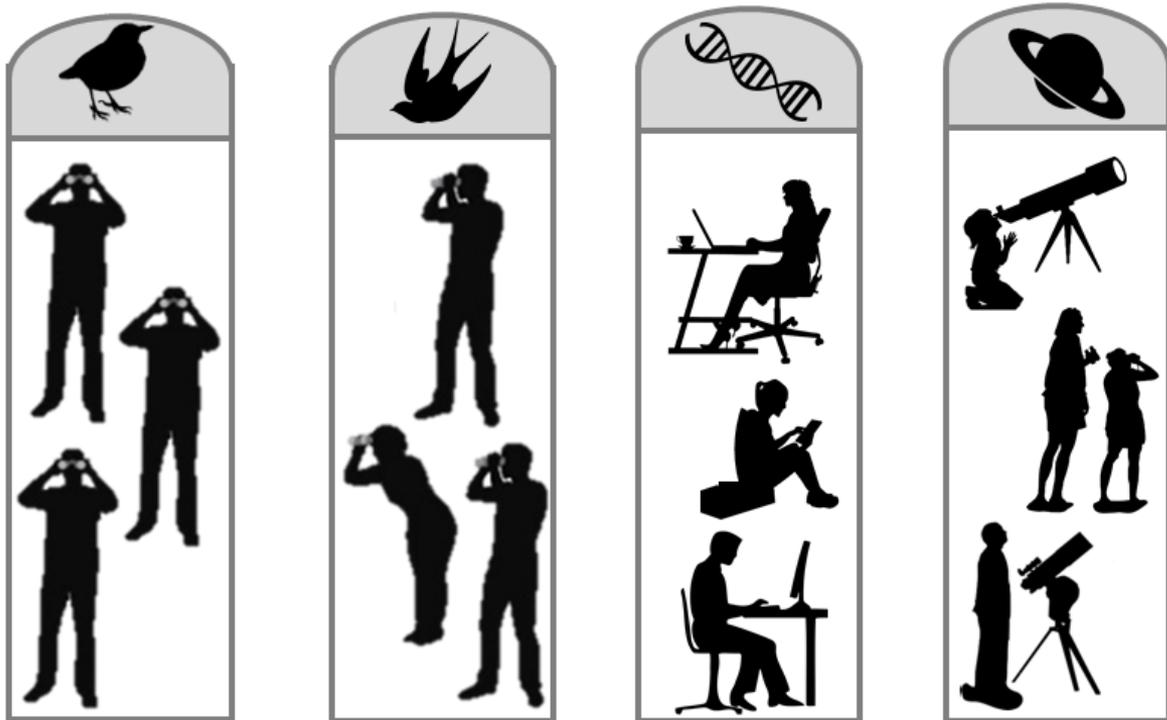
*Source: Jane McGonigal*

# multi-project participation

Result 1: All respondents do more than one bird project

Result 2: 36% also do non-bird projects

Result 3: Multi-topic participants have depth & breadth



## **MORE ENGAGED**

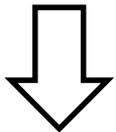
*Early adopters*

*Dedicate time to learning*

*Willing to invest time*



# **Spectrum of Citizen Science Volunteers Archetypes**



## **LESS ENGAGED**

*Require convenience*



### **Hyper Enthusiast “Jeff”**

*Hyper Enthusiast*

*Deeply engaged; quasi expert*



### **Facilitator “Kathy”**

*Committed Facilitators, Amplifiers,  
Doers, Evangelists and Early Adopters*



### **Multitasker “William”**

*Mainstreamer; Participates in ~5  
projects; Committed.*

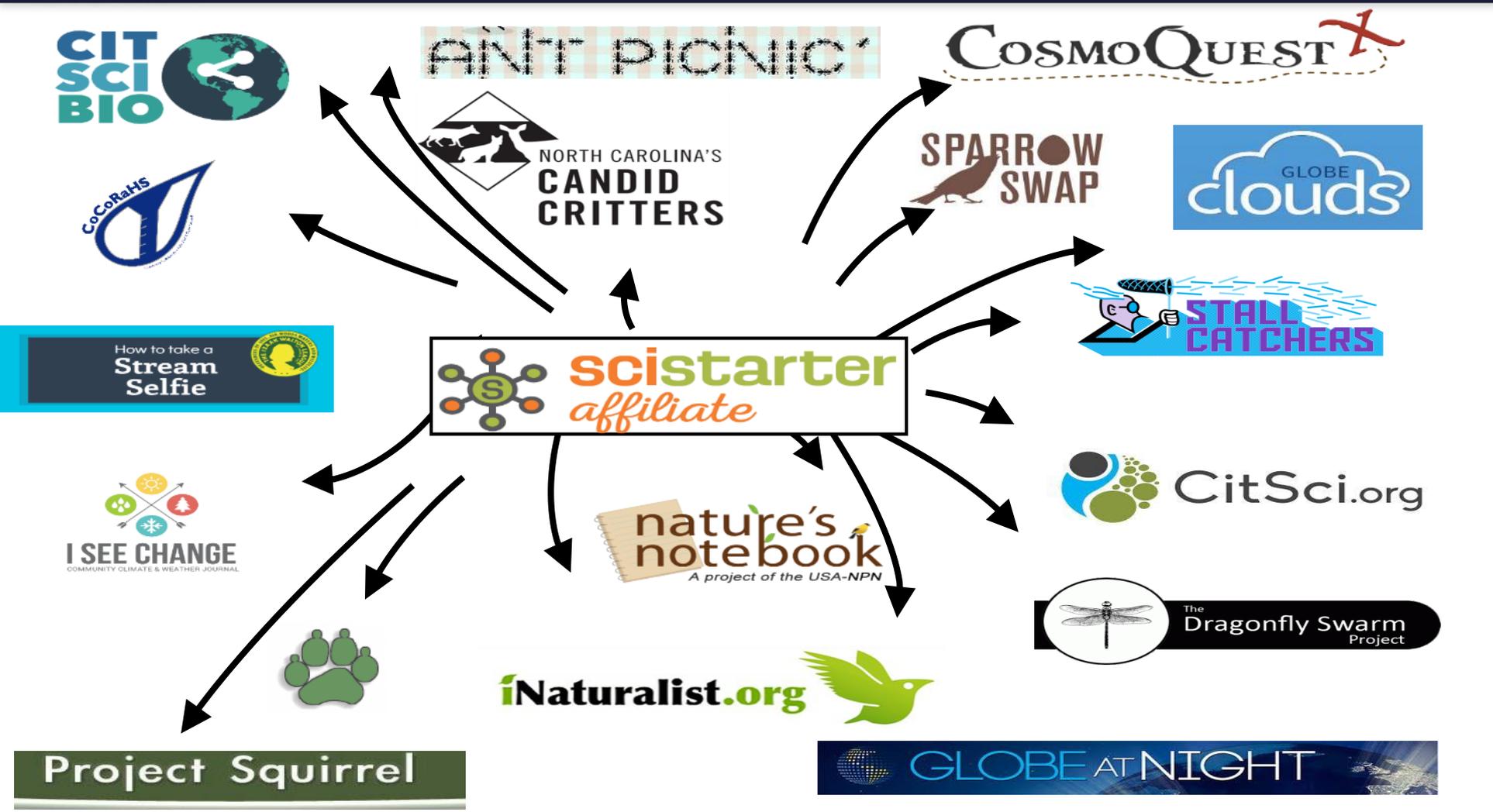


### **Toe-dipper “Taylor”**

*Toe-dipper; Share projects on social  
media, may never fully engage*

## Featured tools offered with SciStarter 2.0:

1. Easy to use, embeddable web snippet and API
2. SciStarter OAuth
3. One-click Registration System
4. Volunteer Support
5. Custom Link for “one and done” projects



## Participant Dashboards: Easily find, join, & track contributions to all types of projects.



[My Account](#) [Project Finder](#) [Event Finder](#) [Calendar](#)

My Account

Dashboard

My Projects, Bookmarks & Events

My Messages

My Profile

Account Settings

My Interests & Tools

My Places



### My Projects

Projects you participate in



### My Bookmarks

Save projects to review later



### My Events

Events you participate in



### NASA GLOBE Observer: Clouds

</project/16830-NASA-GLOBE-Observer%3A-Clouds>

Joined: 06/20/2017

#### YOUR PARTICIPATION HISTORY



LAST PARTICIPATION

06/20/2017

[participate now](#)

[more actions](#)

RELATED PROJECTS:

# Find Volunteers

Looking for more volunteers for your project?

1. Fill out as many of the fields in [Additional Info](#) as you can. That helps potential volunteers find your project based on their location and interests.
2. Help us build a new tool that will help Affiliate and Premium members target and recruit volunteers! Complete our short survey so we know what features will best help you do that: [goo.gl/forms/oFXNshH6DVoiEnjF3](https://goo.gl/forms/oFXNshH6DVoiEnjF3).

## Show Only



Recruit and Retain  
Acquire Data

# Project Leaders can add specific locations

If at a location or range

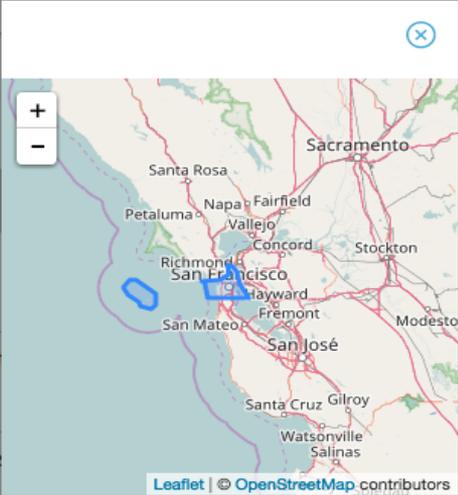
*SciStarter uses OpenStreetMaps as a tool for specifying geographic location(s). To use it, enter a location's name in the search field below and then select search for, and add additional locations. You can also pre*

Enter a location

San Francisco, CA

Lookup results

<input type="checkbox"/>	San Francisco, San Francisco City and County, States of America
<input type="checkbox"/>	San Francisco City and County, California, Uni America
<input type="checkbox"/>	San Francisco, 9405, Boulevard Leduc, Quartie Quebec, J4Y 0A5, Canada



Recruit and Retain  
Acquire Data

# Citizen scientists can add location

## My Places

Add locations where you would like to find projects. This will help Scistarter find the projects you want, and alert reseachers conducting studies in these areas.

Chicago, Cook County, Illinois, United States of America



Los Angeles County, California, United States of America



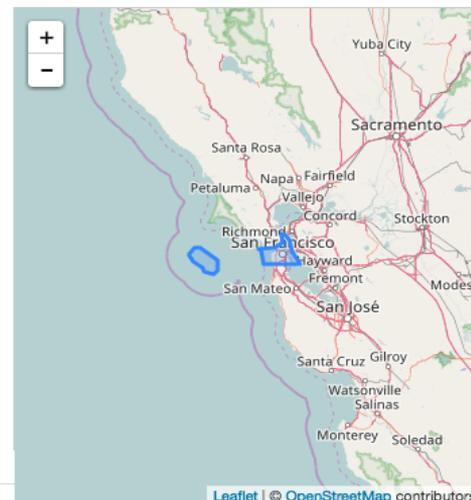
San Francisco City and County, California, United States of America



Tucson, Pima County, Arizona, United States of America



Save My Places



Local Relevance

# Find projects based on location

## Project Finder

List

Map

Enter a word or phrase 

San Fran 

-  San Francisco CA, United States
-  San Francisco County CA, United States
-  San Francisco Avenue Long Beach, CA, United States
-  San Francisquito Canyon Road Santa Clarita, CA, United States
-  San Francisco Avenue Pomona, CA, United States

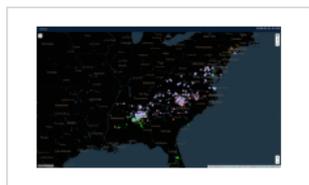
powered by 

- can be done online
- can be done indoors
- can be done outdoors
- can be done at home



Local Relevance

## Featured Projects



credit: University of Oklahoma

 Add Bookmark

### mPING

★★★★★ (3)

Goal: Collect global observations of weather conditions at the ground

Task: Use app on iOS or Android to submit weather conditions

Where: Anywhere



### Community air quality monitoring

Participants Say

Educators Say



Rate this project



 jred8987 12/15/2016

Great location for information



 carolyn.santangelo 12/15/2016

Easy to use and something that would be "on the spot"  
teaching

## Project Finder



# We can now ask and answer new research questions

- What drives participation in citizen science?
- What motivates people to stay or change projects?
- Do people who participate in multiple projects serve as better citizen scientists?
- Can we use embedded tracking and assessment in SciStarter to understand linkages between participation dynamics across projects and learning outcomes?
- What roles do different projects play in the landscape network of projects?



Limited Studies

## Leading source of referrals

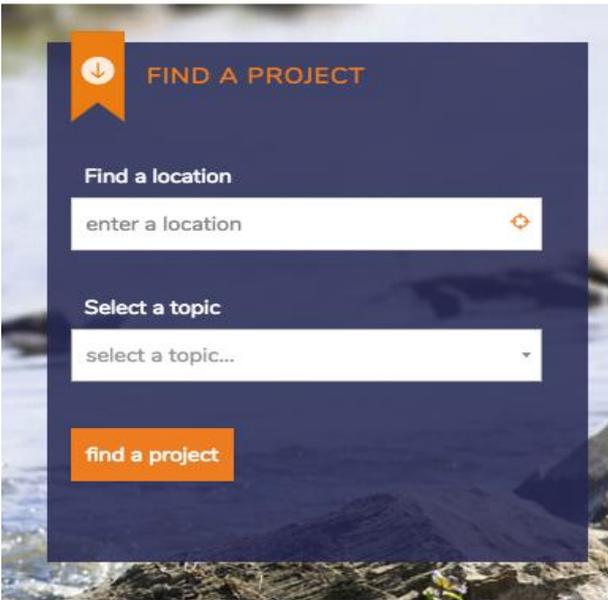
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“The majority of our approximately 1000 monthly referrals originate from SciStarter, an indispensable strategic partner project, ensuring that even when we aren't actively engaged in a recruitment campaign, that we have a steady influx of new users. SciStarter is excellent for citizen science.”

-Pietro Michelucci, Founder, EyesOnALZ

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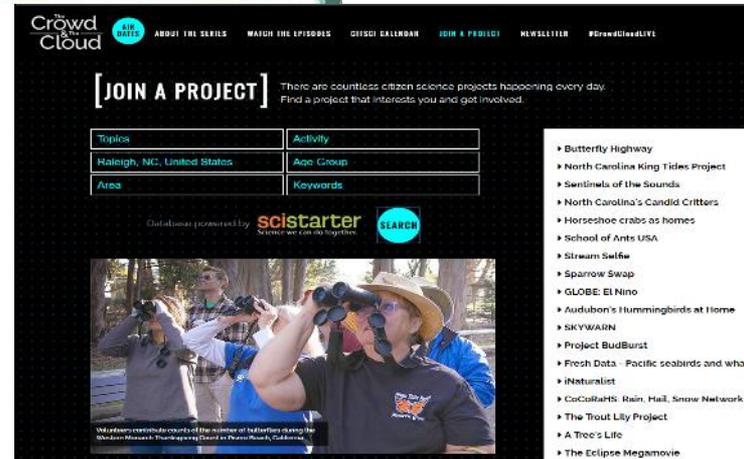
## Updated Project Finder: GIS implementation



PPSR-CORE



Free  
"Widgets"





“Girl Scouts is thrilled to collaborate with SciStarter on new citizen science programming, which will allow **girls around the country to substantively contribute to and impact research** that professional scientists are conducting,” said GSUSA CEO Sylvia Acevedo. “Connecting Girl Scouts with SciStarter’s enriching platform further enhances our engaging and comprehensive STEM programming. Girls who participate in the ‘Think Like a Citizen Scientist’ series will be **fully immersed in the scientific process—some for the first time**—as well as gain a broadened understanding that science is for everyone.”

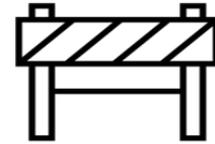
# Citizen Science Maker Summit



<https://makersummit.asu.edu/>

Follow on support from the National Science Foundation and the Wendy and Eric Schmidt Foundation to build a SciStarter Tools database to complement the Project and Events databases.

**Lower Barriers** to participate in projects that require tools



**Help**

citizen scientists AND scientists find and access the right tools

Partner with **libraries** and **museums** to curate, bundle projects, tools, instructions into kits so people can do >1 project



Review and validate tools so scientists & project owners can direct people to Consumer Reports-style, 3<sup>rd</sup> party resource **to recommend** tools



Develop designs and prototypes of tools needed for citizen science projects

Make Makers/manufacturers' low cost instruments **discoverable**.



# Future... <https://scistarter.com/people-finder>



Create/support local networks of participants.

# Future



More information-to-action

Integrate citizen science tools

Develop microcredits or badges



Link STEM <> Live Events <> Citizen Science <> Science Policy

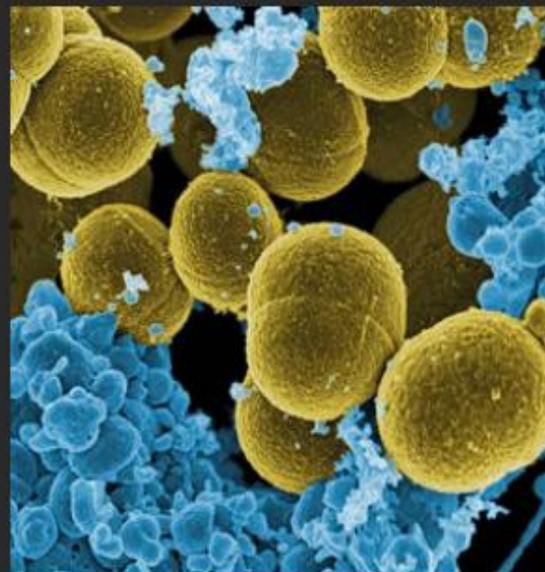
Connect tools and platforms to support seamless movement  
between multiple forms of engagement.

## Swabbing Stadiums & Space Meetups



How do bacteria differ across different types of surfaces in a building?

## Microbial Playoffs...in SPAAAAACE!



How will microbes from YOUR favorite team perform in the space playoffs?

## Space Station Microbiome



What kinds of bacteria lurk on the surfaces inside the International Space Station (ISS)?

# NEW AUDIENCES



## NSTA CONFERENCE NIGHT WITH THE SPURS

- Watch a 4-time NBA Championship team
- Sit close to the floor to watch pregame warm-ups
- Shoot a free throw on the court postgame
- Take a photo at center court postgame

Receive all of this for a discounted rate through the NSTA Conference. Tickets start at just \$25. Prices vary on location.



**CLICK HERE TO PURCHASE**  
**ENTER PROMO CODE: SPURS**



**NSTA**  
National  
Science  
Teachers  
Association



Do science at the game! Help collect microbes to send to space!



**CITIZEN**

**SCIENCE**

**— DAY**



CITIZEN SCIENCE  
ASSOCIATION

# April 14, 2018

Saturday



all-day

8 AM

9 AM

10 AM

11 AM

Noon

1 PM

2 PM

3 PM

4 PM

5 PM

6 PM



Celebrate the incredible contributions the public has made to #science on (or around) Citizen Science Day, April 14! Check out the calendar of events on @SciStarter or add your own event!

<https://scistarter.com/citizen-science-day>  
#CitSciDay2018 #citizenscience #citsci



Citizen Science Day is April 14! Celebrate by observing #nature on @inaturalist, exploring #exoplanets on @the\_zooniverse, photographing #clouds for GLOBE Observer (@NASAGO), or checking @SciStarter for other projects & events you can join! #CitSciDay2018 #citizenscience #citsci

*3<sup>rd</sup> Annual*  
**CITIZEN SCIENCE**  
*for Conservation in Southern California*  
**SYMPOSIUM**

**LIGHTNING ROUND**  
**PRESENTATIONS**

**5 minute** presentations  
*given back to back, without Questions from the Audience*

Saturday, March 24, 2018 at the Aquarium of the Pacific in Long Beach, CA

# Lightning Round Presentations

## Data Analysis: Individual Citizen Science Monitoring Data

by Cassandra Davis, Barbara Ramon, Celeste Hassler, Jose Ortiz, and Zaida Ortez – *Aquarium of the Pacific*

## Citizen Science in the Classroom Using Photo Identification

by Saki Hashimoto – *TGR Foundation*

## Leveraging Citizen Science as an Outreach and Education Tool

by Erika Delemarre – *MAS-MBC Candidate, Scripps Institution of Oceanography, UCSD*

## eLearning Tools – “Hubs” Between Volunteers, Educators, Classrooms, & Events

by Barbara Lloyd – *Ocean Sanctuaries*

## Friends with Fins – Educating the Next Generation of Ocean Stewards

by Jaclyn Friedlander and Timothy Riese – *Friends with Fins*

## San Diego Zoo’s Wildlife Watch: Empowering Students to be Citizen Scientists

by Colleen Ferguson and Brooke Castro – *San Diego Zoo Global*

## Climate Change: Sea to Trees at Acadia National Park

by Aviva Intveld and Aaron Rovinsky – *Earthwatch Ignite*

## Evaluating Grunion Response to Ecosystem Changes Forced by Recent Environmental Conditions in California’s Oceans

by Lael Wakamatsu, Karen Martin, Sol Kim, and Ariana Nickmeyer – *NASA DEVELOP-JPL*

**MPA Watch: Community-Based Monitoring of Human Use in Marine Protected Areas**

by Angela Kemsley – *WILD Coast*

**Using Citizen Science to Estimate Frequency of Latrine Site Usage Along Tributaries of Humboldt Bay by North American River Otters**

by Korinna Domingo, Ximena Gil, and Dr. Jeffrey M. Black – *Humboldt State University*

**Human Dimensions & Citizen Science:  
Using Remote Sensing Cameras to Mitigate Wildlife Conflicts**

by Korinna Domingo and Ron Dean – *Mountain Lion Foundation*

**An Evaluation of Volunteer Effort in the Restoration of Terrestrial and Aquatic Resources in the Santa Monica Mountains**

by Angela De Palma-Dow, J. Curti, D. Sharpton, E. Sode, S. Rubin, J. Smith, R. Kosugi, A. Shy-Sobol, T. Hayduk, J. Health, and B. Youngerman – *Mountains Restoration Trust*

**Volunteer Research Programs Inform the Recovery of Rare Bird Species**

by Josh Weinik – *Palos Verdes Peninsula Land Conservancy*

**Beta Testing the Trident ROV for Citizen Science, Species ID and MPA Monitoring in the Golden Gate MPA Collaborative**

by David McGuire – *MPA Collaborative and Shark Stewards*

**So Cal Sea Slugs – Diversity and Distribution**

by Sarah Kaleel

# Celeste Hassler & Zaida Ortez



**Data Analysis:  
Exploring Individual  
Citizen Science  
Monitoring Data**

# **Data Analysis: Exploring Individual Citizen Science Monitoring Data**

by Barbara Ramon<sup>1</sup>, Celeste Hassler<sup>1</sup>, Zaida Ortez<sup>1</sup>, and Cassandra Davis, M.Sc.<sup>1,2</sup>;  
*Southern California Sea Turtle Monitoring Project<sup>1</sup> & the Aquarium of the Pacific<sup>2</sup>*

Citizen science observation is an increasingly important tool for wildlife monitoring and management. Analysis of observational data traditionally examines sightings, observations, and recordings from groups, locations, time periods, or stations. Data quality analysis may examine group performance, specific case studies, or training methods. Citizen science projects offer another unique data point: Individual contributions.

Examining individual observations, total observations, and relationships between observations, training, experience, and site location for the citizen scientists in the Southern California Sea Turtle Monitoring Project revealed unique insights into data quality and observation probability. It also revealed an ongoing opportunity to engage citizen scientist volunteers and communicate a personal connection to the data for individuals.

This study explores the findings of an in-depth analysis of individual contributions to monthly citizen science wildlife observations over the course of six years, and explores the potential for ongoing volunteer engagement through personalized data reports.

# Data Analysis: Exploring Individual Citizen Science Monitoring Data

Barbara Ramon, Celeste Hassler, Zaida Ortez,  
Cassandra Davis

Southern California Sea Turtle Monitoring Program

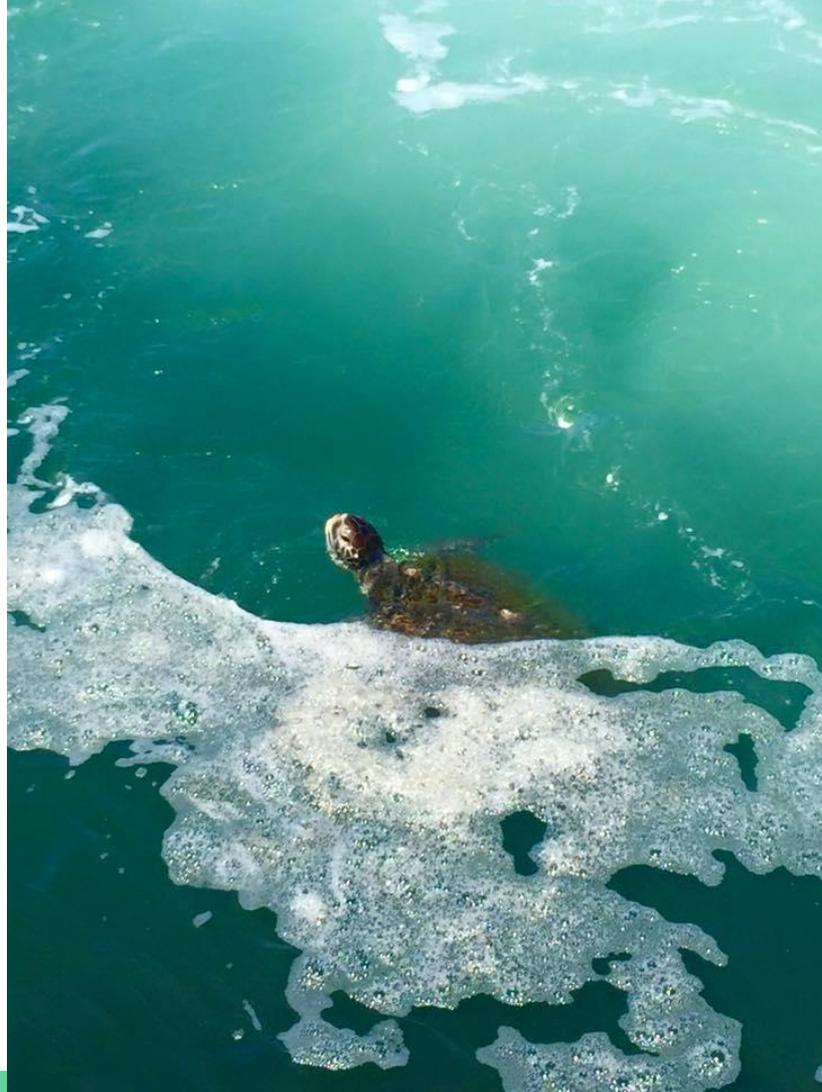


# Long Term Citizen Science Data Analysis

Observational data traditionally focuses on aggregate data: observations and recordings from groups, locations, time periods, or stations.

Data quality analysis may examine group performance, specific case studies, or training methods.

What can we learn from individual contribution statistics?



# Our Citizen Scientists



- 30 minute concurrent wildlife observation, once a month
- 86 currently active volunteers (volunteered in the last 6 months)
  - Over half completed 10 or more observation sessions
  - 10% completed almost 40 sessions
- Over 300 total trained citizen scientists
- Long term data about urban wildlife
- The majority are local residents
  - 25% commute less than 5 miles

# Individual Contributions

What is one person's likelihood to see a turtle over time?



# Value to Research



Increase data quality

Fine-tune population analysis

- Recording observation probability with the individual as a constant
- Probability of an individual seeing a turtle in a given time period
- Are there differences between individuals?

# Value to Volunteers

What is the value for volunteers?

- Interest level in the program
- Reflection of their work and investment in the program
- Improves communication of individual input and contributions
- Important tool for volunteer feedback



# Continued investigation: Next Steps

- Continuing long term data analysis from individual contributions
- Exploring patterns in observations over time as volunteers increase their experience
- Evaluating training and logistical needs according to the data





# Saki Hasimoto

Citizen Science  
in the Classroom  
Using Photo Identification

# Citizen Science in the Classroom Using Photo Identification

by Saki Hasimoto; *TGR Foundation*

The development of photo identification techniques as a valid means of studying some sea turtle species has accelerated in recent years. We have found this technique to be useful in the lower San Gabriel River in Long Beach, California, where we can observe and photograph surfacing green sea turtles in the area. Our next steps involve development of an organized photo collection program that can be incorporated into existing citizen science monitoring efforts, as well as participation from the public anytime photos can be collected. Additionally, increasing awareness and accessibility of citizen science programs are much needed in public school settings. Providing professional development opportunities about citizen science can allow teachers and educators to gain tools to easily incorporate programs into their curriculum.



# Citizen Science in the Classroom Using Photo Identification



Saki Hashimoto  
Learning Facilitator



**TGR FOUNDATION**  
A TIGER WOODS CHARITY





- Past research: turtles captured and brought on board.
  - Collect body measurements & DNA samples
  - Metal or PIT tags to identify for future recapture

(Su, Huang, & Cheng, 2015)

# Sea Turtle Photo ID Project

- Risks: tags deteriorating and being lost
  - Possible stress and injury to animals
- Photo Identification can be an alternative noninvasive research method

(Schofield, Katselidis, Dimopoulos, & Pantis, 2008;  
Reisser, Proietti, Kinas & Sazima, 2008)



# Sea Turtle Photo ID Project



- San Gabriel River in Long Beach, CA
- Next to Power Plants: warm water discharge

\* Research conducted with NOAA

# Method: Photography



- Photos taken from the walkway along the San Gabriel River (2008 - 2015)
- Photographs must be good quality to be able to run through the database



Blurry Photo



Clear Photo

\* Research conducted with NOAA

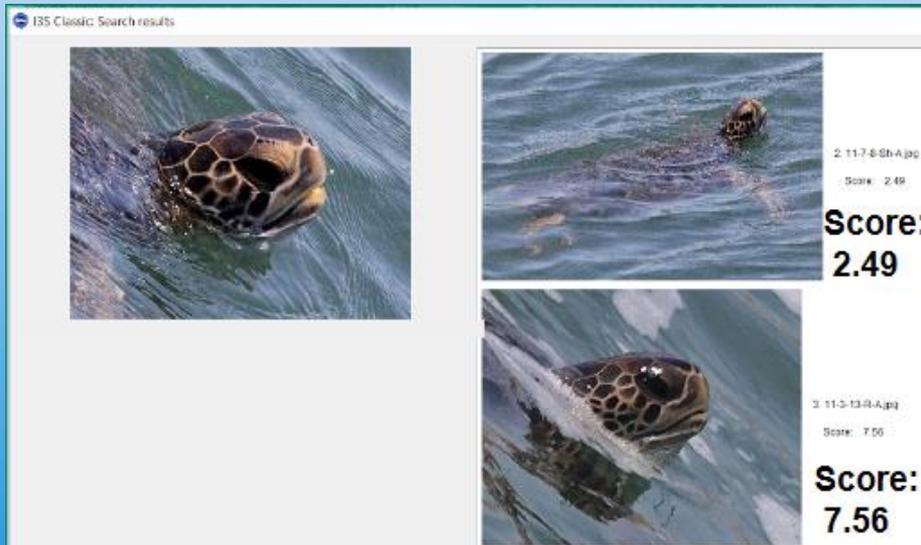
- Computer software, Interactive Individual Identification System (I<sup>3</sup>S)
- Manually enter into the database by plotting 3 main points of reference
  - Tip of the jaw, highest point above the eye, and lowest point of profile scales

(Dunbar, Ito, Bajhri, Dehom, & Salinas, 2014)



\* Research conducted with NOAA

# Method: Interactive Individual Identification System



- Run the photograph through database
- Provides list and can compare photographs that have similar spatial pattern and provide a numerical score
  - Lower score = higher match
- Matches verified by visual examination of photos

\* Research conducted with NOAA

Reprinted with permission by TGR Foundation



# Results



- 244 photos usable for database
  - August 2008 - October 2015
- 76 individuals in total
- 15 individual Left Profiles identified
- 61 Right Profiles (turtles primarily traveling upriver?)

\* Research conducted with NOAA

# What's Next?



- New Software
- Bridge gap between science and the public
- Data can be gathered by anyone with quality photo equipment and patience to collect photos

\* Research conducted with NOAA

# Citizen Science in the Classroom





## Why Citizen Science?

- ❖ Allows students and community members to connect with their natural world.
- ❖ If people are engaged and participate in a project, they are more likely to care about protecting their environment.
- ❖ For teachers, this is a great way to engage students with hands-on experiences and incorporating STEM-based projects! It can be a hour-long lesson or a year-long project.

## STEM Studio

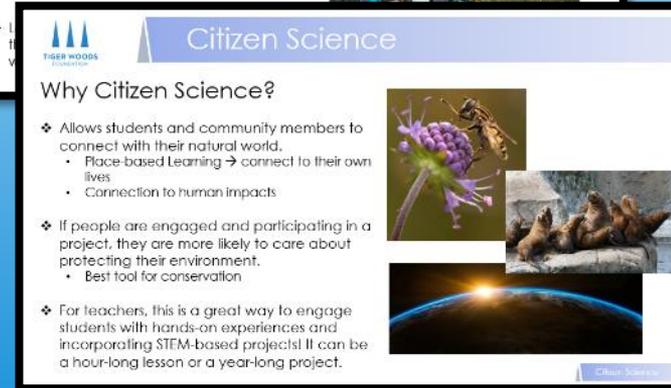
- ❖ Professional Development opportunities to provide workshops and resources for educators, administrators, etc. involved with the vital subject of STEM education and college access.
- ❖ November 2017: We piloted a new workshop involving Citizen Science.
  - 24 participants
  - 17 different schools
  - 11 different school districts



**Citizen Science**

What is Citizen Science?

- ❖ A study of our world by anyone with or without prior research experience to be a part of a scientific investigation led by experts in the field.
- ❖ Scientists may not be able to be in the field all of the time.

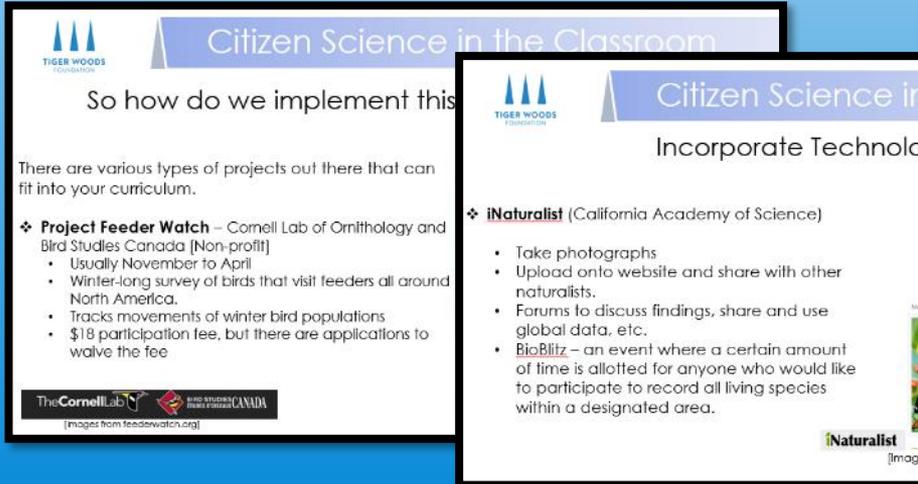


**Citizen Science**

Why Citizen Science?

- ❖ Allows students and community members to connect with their natural world.
  - Place-based Learning → connect to their own lives
  - Connection to human impacts
- ❖ If people are engaged and participating in a project, they are more likely to care about protecting their environment.
  - Best tool for conservation
- ❖ For teachers, this is a great way to engage students with hands-on experiences and incorporating STEM-based projects! It can be a hour-long lesson or a year-long project.

- ❖ Increase Awareness
- ❖ Easy Implementation
- ❖ Integrating with Curriculum



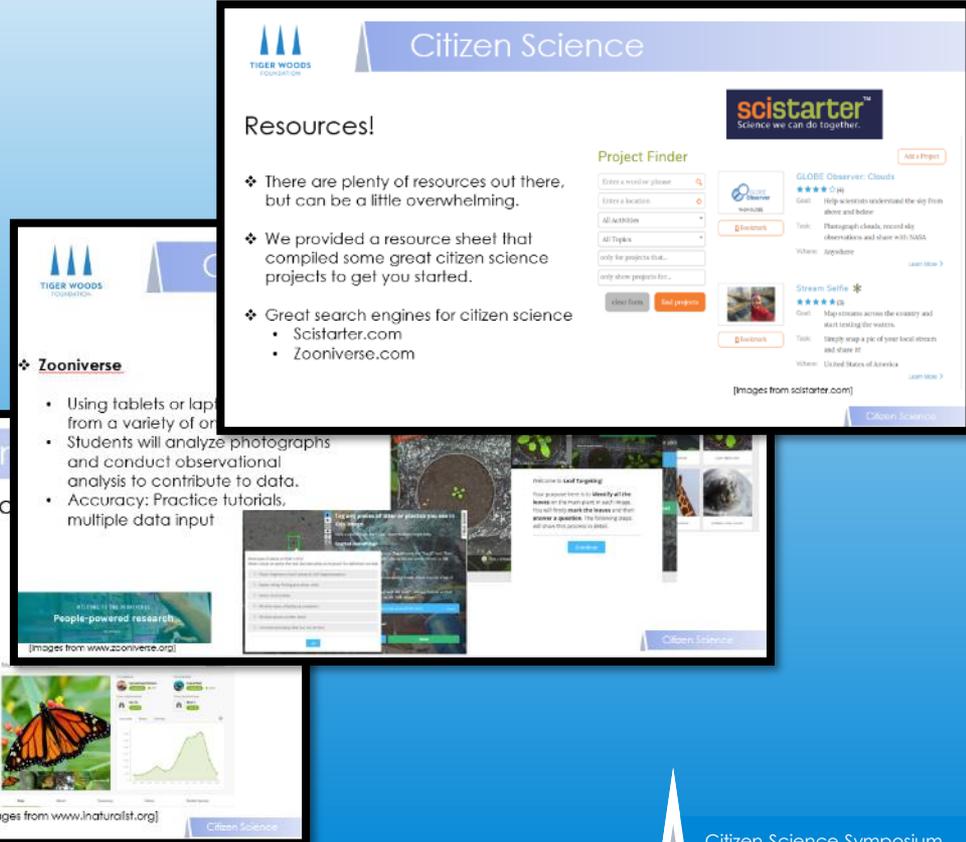
**Citizen Science in the Classroom**

So how do we implement this?

There are various types of projects out there that can fit into your curriculum.

- ❖ **Project Feeder Watch** – Cornell Lab of Ornithology and Bird Studies Canada (Non-profit)
  - Usually November to April
  - Winter-long survey of birds that visit feeders all around North America.
  - Tracks movements of winter bird populations
  - \$18 participation fee, but there are applications to waive the fee
- ❖ **iNaturalist** (California Academy of Science)
  - Take photographs
  - Upload onto website and share with other naturalists.
  - Forums to discuss findings, share and use global data, etc.
  - **BioBlitz** – an event where a certain amount of time is allotted for anyone who would like to participate to record all living species within a designated area.

*[Images from feederwatch.org]*



**Citizen Science**

**Resources!**

- ❖ There are plenty of resources out there, but can be a little overwhelming.
- ❖ We provided a resource sheet that compiled some great citizen science projects to get you started.
- ❖ Great search engines for citizen science
  - Scistarter.com
  - Zooniverse.com

**Zooniverse**

- Using tablets or laptops from a variety of on
- Students will analyze photographs and conduct observational analysis to contribute to data.
- Accuracy: Practice tutorials, multiple data input

*[Images from www.zooniverse.org]*

**iNaturalist**

*[Images from www.inaturalist.org]*

**Scistarter.com**

*[Images from scistarter.com]*

# Photo ID in the Classroom



- ❖ Using technology in the classroom
- ❖ Next Generation Science Standards (NGSS)
  - Life Science
  - Earth and Space Sciences
  - Engineering, Technology, and Applications of Science



**iNaturalist**



- ❖ Global data
- ❖ Resources!





Thank you for Listening!

Please come find me after the lightning talk if you have any questions!



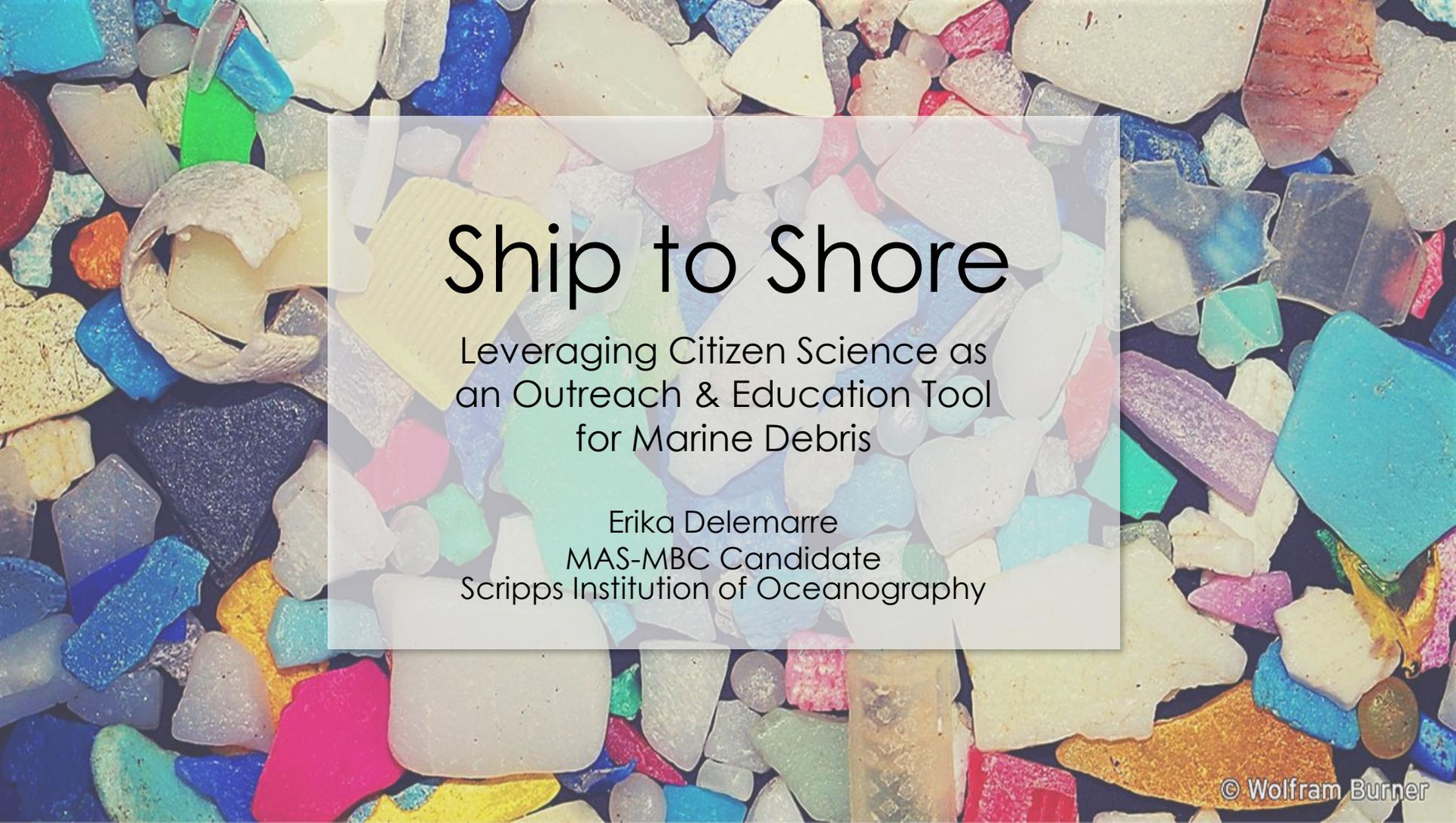
# Erika Delemarre

Leveraging Citizen Science  
as an Outreach and  
Education Tool

# Leveraging Citizen Science as an Outreach and Education Tool

by Erika Delemarre; *MAS-MBC Candidate, Scripps Institution of Oceanography, UCSD*

Marine plastic pollution has become a global problem which impacts the health of marine ecosystems worldwide. Plastics can entangle or be ingested by marine animals at all trophic levels, threatening their wellbeing and potentially impacting economically important fisheries and human health. Five Gyres is harnessing the power of citizen science to collect data on marine debris through their TrawlShare program. The data collected will contribute to the organization's research and efforts to educate the public and inform international policy change. I am currently designing an experiential education curriculum to enhance the learning experience of the TrawlShare program for students aboard sailing training vessels. The program will be designed to increase understanding of the issue while inspiring young people to initiate change within their communities.



# Ship to Shore

Leveraging Citizen Science as  
an Outreach & Education Tool  
for Marine Debris

Erika Delemarre  
MAS-MBC Candidate  
Scripps Institution of Oceanography

MORE  CEAN  
LESS PLASTIC  
THE 5 GYRES INSTITUTE

SCIENCE – ART – EDUCATION – ADVENTURE



**70% of the world's SURFACE  
50% of our OXYGEN**

**100% THREATENED BY PLASTIC**



# SINGLE-USE PLASTICS





8 MILLION TONS

1 GARBAGE  
TRUCK PER  
MINUTE



Source: World  
Economic  
Forum 2016



PLASTIC TEAM  
PLASTIC POLLUTION INSTITUTE









# SAIL HANDLING & **SEAMENSHIP**



# NAVIGATION





# LEADERSHIP





# WILDLIFE ENCOUNTERS

**280 ships.  
Thousands of young people.**

Many programs don't teach  
their students about  
marine plastic pollution.

# EDUCATION INSPIRES ACTIVISM





**THANK YOU.**

**Erika Delemarre | [edelemar@ucsd.edu](mailto:edelemar@ucsd.edu) | 928.607.9737**



# Barbara Lloyd

eLearning Tools –  
“Hubs” Between Volunteers,  
Educators, Classrooms,  
& Events

# **eLearning Tools —** **“Hubs” Between Volunteers, Educators, Classrooms, & Events** by Barbara Lloyd; *Ocean Sanctuaries*

One of the challenges of leading a citizen science effort is that volunteers bring with them a wide range of knowledge and experience. Volunteers may live in an area that lacks hands-on field opportunities or may simply be new to the practice of science. Training volunteers is important for the development, motivation, and retention of volunteers as well as ensuring the quality and consistency of data collection.

Ocean Sanctuaries wants to bridge the gap between the newly initiated, remote classrooms, hands-on training, and live citizen science events. Although we use social media regularly to generate interest and participation, we believe that an eLearning platform can provide a strong foundation in the What, Why and How of Citizen Science, for our current and future volunteers. To that end, we developed an eLearning tool to introduce people without a background in science how to participate in scientific investigation and, eventually, design and conduct their own investigations. The tool was designed as a foundation upon which both the burgeoning citizen scientist, as well as organizations, can develop, grow, and strengthen themselves and the movement.

In my 5 minute talk, I will suggest how eLearning tools can be used as a "hub" between new volunteers, continuing education, remote classrooms, and even live events including bioblitzes.

# eLearning Tools

“Hubs” between volunteers,  
educators, classrooms, and events



**OCEAN**  
**SANCTUARIES.**

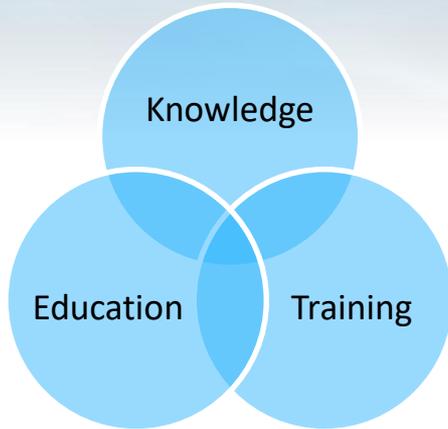
# What is eLearning?

## An Online Training Platform

- Self-paced vs. Group learning
- Automated quizzes or exam
- Independent vs. Instructor lead
- Supported on multiple devices
- Just-in-time vs Needs-based training
- Official certification with passing grade
- Reduced costs for student and organization



# Why is it useful?

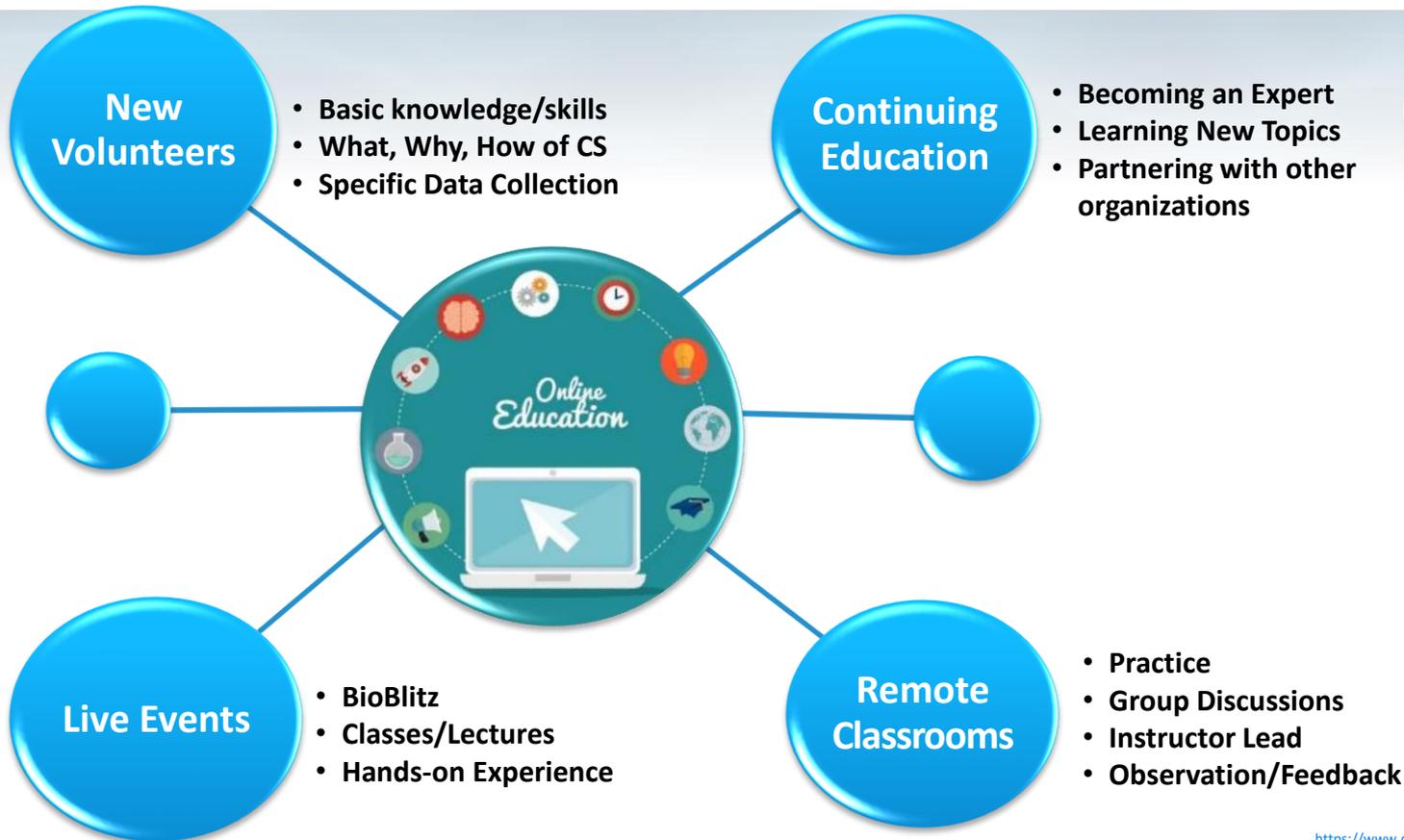


- Volunteers may not be local
- Unavailable during live events
- Recruited through social media
  
- Volunteers will have varying levels of knowledge and experience
- May need additional education
- May need practice and training



People without a background in science need to learn how to participate in scientific investigation and, eventually, design and conduct their own investigations.

# “hub” Essentials



# Who Benefits

- Volunteers:
  - Can help create a “community”
  - Can provide a sense of accomplishment (Certificates)
- Citizen Science Organizations:
  - Build a base of trained volunteers
  - Retention by providing continuing opportunities
- The Citizen Science Movement:
  - Provide better education and additional training



# Stay Connected

[OceanSanctuaries.Org](http://OceanSanctuaries.Org)

[eLearning.OceanSanctuaries.org](http://eLearning.OceanSanctuaries.org)

[fb: Ocean Sanctuaries](https://www.facebook.com/OceanSanctuaries)

[fb: Support Ocean Sanctuaries](https://www.facebook.com/SupportOceanSanctuaries)

[twitter @OSanctuaries](https://twitter.com/OSanctuaries)

[we.care@oceansanctuaries.org](mailto:we.care@oceansanctuaries.org)



# Jaclyn Friedlander

Friends with Fins –  
Educating the Next Generation  
of Ocean Stewards



# **Friends with Fins – Educating the Next Generation of Ocean Stewards**

by Jaclyn Friedlander and Timothy Riese (cinematographer); *Friends with Fins*

All it takes is a glimmer of inspiration or the seed of an idea to shape a child's future and create a citizen scientist. In a digital age where children spend hours in front of a screen, our goal is to bring ocean adventure to them and then encourage them to get out and participate!

*Presenter requested that only their abstract and contact info be included in the Proceedings*

# Friends with Fins Contact



**SUBSCRIBE:**

[youtube.com/jaclynfriedlander](https://youtube.com/jaclynfriedlander)

[www.Friendswithfins.org](http://www.Friendswithfins.org)

[Jaclyn@Friendswithfins.org](mailto:Jaclyn@Friendswithfins.org)

**310-909-7869**



# Colleen Ferguson

**San Diego Zoo's Wildlife Watch:  
Empowering Students to be  
Citizen Scientists**

# **San Diego Zoo's Wildlife Watch: Empowering Students to be Citizen Scientists**

by Colleen Ferguson and Brooke Castro; *San Diego Zoo Global*

The San Diego Zoo has been providing educational programming to students in Southern California since 1955. Through interactive assemblies, engaging classroom programs, and hands-on outdoor field trips, the San Diego Zoo Education Department reached over 65,000 students last year. In an effort to increase scientific literacy and inspire environmental stewardship, outreach programming has been updated to include citizen-science based skill building and conservation action. One initiative, "Citizen Science: Wildlife Watch," was developed in 2016 as a two-part outreach experience that involves a zoo educator-led classroom program and a field trip to a local nature park. Students are given the opportunity to utilize real-world citizen science platforms, including Zooniverse and iNaturalist. Through this innovative program development, the Zoo has incorporated citizen science into additional programming in partnership with organizations, e.g., the National Park Service and U.S. Fish & Wildlife Services. Through these programs alone, the Zoo was able to engage over 400 students in citizen science last year, and expects to engage over 2,000 students in citizen science by June 2018.

# SAN DIEGO ZOO'S WILDLIFE WATCH: EMPOWERING STUDENTS TO BE CITIZEN SCIENTISTS

Colleen Ferguson &  
Brooke Castro  
Educators  
San Diego Zoo Global

SAN DIEGO ZOO  
GLOBAL.

# OUTREACH PROGRAMMING THROUGHOUT SAN DIEGO COUNTY

- San Diego Zoo outreach programming reaches thousands of students each year
  - Assemblies and classroom visits
  - Field programs to local nature parks
  - On-site at the Zoo, Safari Park, and Institute for Conservation Research
- Funded through various grants
  - Reach primarily Title I Schools and underserved areas in San Diego County



# CITIZEN SCIENCE: WILDLIFE WATCH



- Combination classroom & field experience program in its second year
- 4<sup>th</sup>/5<sup>th</sup> grade & middle school
- Classroom curriculum:
  - Citizen science basics
  - Animal presentation
  - Zooniverse
    - WildWatch Kenya
    - AmazonCam Tambopata
- Field Experiences:
  - Elfin Forest Recreational Reserve
  - Mission Trails Regional Park
  - Cabrillo National Monument

# WILDLIFE RANGERS WITH US FISH & WILDLIFE

&

# GUARDIANS OF THE BAY WITH THE UNIFIED PORT OF SAN DIEGO



- Highlights:
  - Focus on native biodiversity & the role students can play in protecting native species
  - iNaturalist observation practice in the classroom
  - Citizen science success stories
  - iNaturalist in the field
  - Water quality testing in the field
- Field Experiences:
  - Sweetwater Salt Marsh
  - Outdoor Learning Lab at the Institute for Conservation Research

# BUILDING SKILLS FOR CONFIDENT CITIZEN SCIENTISTS

- Focus on skill-building for citizen science
  - Power of observation
  - Using citizen science platforms
  - In-field context
  - Excitement for science
- Project Participation
  - WildWatch Kenya
  - AmazonCam Tambopata
  - Southern California Squirrel Survey
  - Snapshot CalCoast Bioblitz
  - Various biodiversity projects on iNaturalist



THANK YOU!

# Aviva Intveld & Aaron Rovinsky



**Climate Change:  
Sea to Trees at Acadia  
National Park**

# Climate Change: Sea to Trees at Acadia National Park

by Aviva Intveld and Aaron Rovinsky; *Earthwatch Ignite*

Our team received a full merit scholarship through the Earthwatch Ignite program to stay at the Acadia National Park Schoodic Institute in Maine. Between talks from professionals at the institute on forestry and oceanography and interviews with local lobstermen to learn about the economic impact of climate change, we spent hours conducting field and lab research. In the field, this consisted primarily of sampling species in the intertidal zone to study the effects of ocean warming and acidification on biodiversity. We observed and documented the changing landscape of rock, seaweed, and various aquatic organisms using transects and quadrats. In the lab, we investigated the effect of invasive green crabs on the defensive behaviors of native periwinkles. In our free time, we assisted other research involving ascophyllum surveys and bird monitoring. This experience gave us a glimpse into the world of field research, an opportunity most students don't have until later in their lives, allowing us to do hands-on research in a professional setting. The emphasis on citizen science helped us realize how accessible research can be and how simple it is to make a tangible contribution to the scientific community.

# Climate Change: Sea to Trees at Acadia National Park

Aviva Intveld and Aaron Rovinsky



# Field Research: Monitoring Intertidal Biodiversity



- Quadrats/Transects
- Low/High Tide
- Use of field tools: GPS, drill, compass to find bearings, etc.
- Identifying various species of seaweed (ascophyllum “knotted wrack” and fucus “rockweed”)
- Identifying barnacles, smooth vs. rough periwinkles, etc.
- Entering data in spreadsheets

# Lab Work: Investigating the Effect of Invasive Crab Species on the Defensive Behaviors of Native Periwinkles

- Set up 4 habitats for invasive crabs and periwinkles (Control, Ocean Acidification, Warming, OAW)
- Learned to measure and adjust salinity (refractometer) and pH
- Created 'crab juice', water saturated with crab waste
- Noted time for periwinkles (from 4 environments) to respond to dangerous scent
- Inconclusive results --> tenacity in lab work



# Assisting Other Research at Schoodic Institute

- Talks from professionals (Professor of Forestry, National Park Rangers, Skype on board the Nautilus, etc.)
- Assisted research for ascophyllum monitoring
- Learned about political and economic impact on local fishermen
- Spoke with a lobsterman and learned about the family business





## Best Moments



Harbor seal after a long morning of field work!



Sunsets at Schoodic Point



# Takeaways & Californian Implications

- Professional science doesn't require degrees
- Science can be done *anywhere* (even ---and especially--- in places where there isn't visible biodiversity)
  - From Earthwatch, inspired to do own research in Southern California on soil remediation
- Common threat of global warming on coastal life
  - Ocean acidification and warming
- Important to understand how your research impacts the community





  
AQUARIUM  
OF THE PACIFIC

# Lael Wakamatsu

**Evaluating Grunion Response  
to Ecosystem Changes Forced  
by Recent Environmental  
Conditions in  
California's Oceans**

# **Evaluating Grunion Response to Ecosystem Changes Forced by Recent Environmental Conditions in California's Oceans**

by Lael Wakamatsu, Karen Martin, Sol Kim, Ariana Nickmeyer; *NASA DEVELOP-JPL*

The California grunion is an endemic fish species vital to the California coast, acting as a versatile food source for many species such as seabirds, large mammals, and other fish in the food web. This species, known primarily for the unique way in which they spawn, have two specialized regions. Historically, they only occur in Southern California and northern Baja California and are vulnerable to air and ocean temperature changes. In the last 16 years, scientists recorded grunion spawning further north to the San Francisco Bay area. In response to air and ocean temperature increases, the fish migrate to cooler waters they are more adapted to. This is an issue due to the fact that the grunion found here are much smaller in size, indicating the north coast may not be as suitable for the species. Increased beach activity, beach cleaning practices, and coastal erosion significantly contribute to the decrease in population and the significant shift of spawning areas. This project, in collaboration with the Grunion Greeters Project, used Aqua MODIS satellite data for sea surface temperature (SST) and chlorophyll-a concentration to create a time series of the California coast from 2003 to 2017. Analyzing this product will help predict grunion spawning areas and can be used to develop beneficial management practices as well as establish new protective areas to keep the species thriving and safe.



# Evaluating Grunion Response to Ecosystem Changes Forced by Recent Environmental Conditions in California's Oceans

Lael Wakamatsu, Karen Martin, Sol Kim, and Ariana Nickmeyer  
DEVLEOP - NASA Jet Propulsion Laboratory

# NASA DEVELOP at JPL

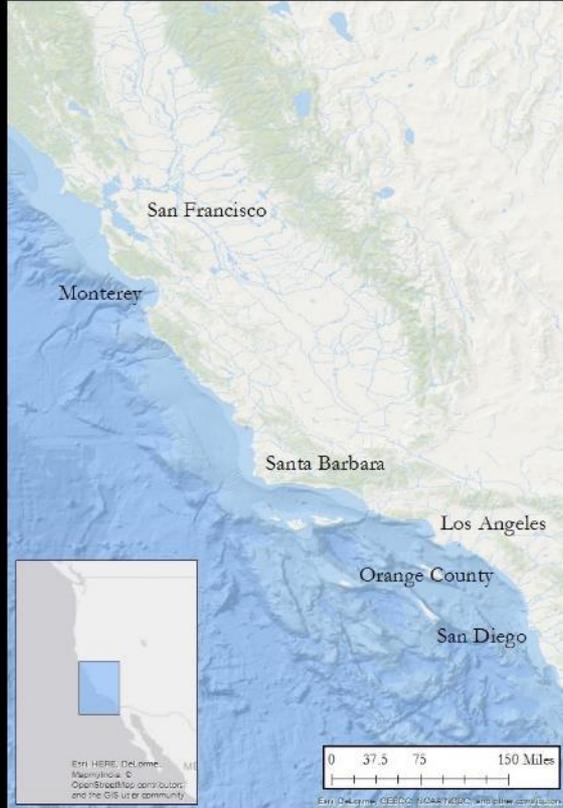
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- ▶ NASA's Applied Sciences Program
- ▶ Connects NASA Earth Science and society
- ▶ Collaborates with partners to create beneficial end products
- ▶ Capacity building opportunity for participants



# Grunion Greeters

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- ▶ Citizen scientists collect *in situ* grunion data along California coast
- ▶ Walker Scale: 0 to 5
- ▶ Collaborates with over 30 organizations

# Objectives

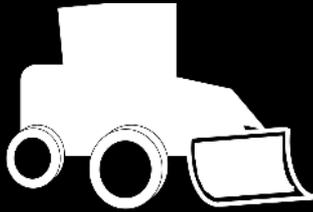
Temperature



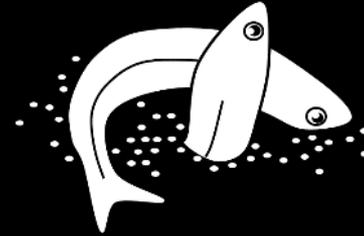
Chlorophyll-a



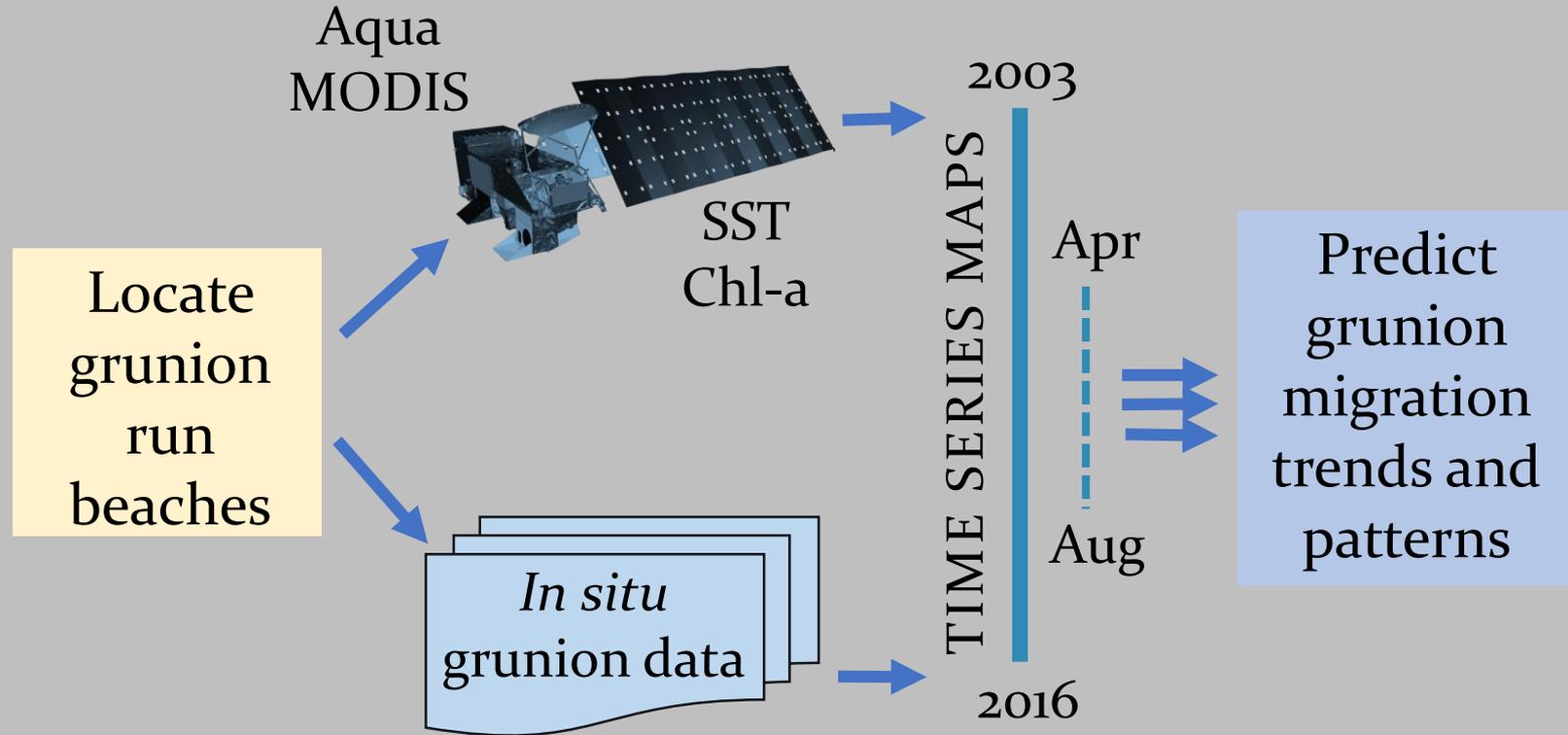
Anthropogenic  
Activities



Grunion Spawning  
Sites

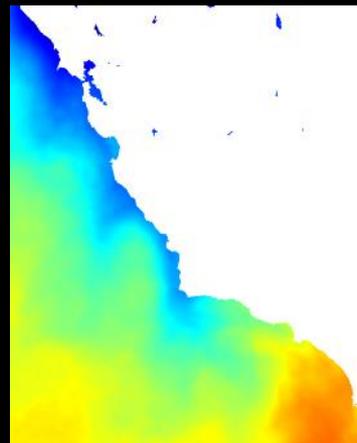
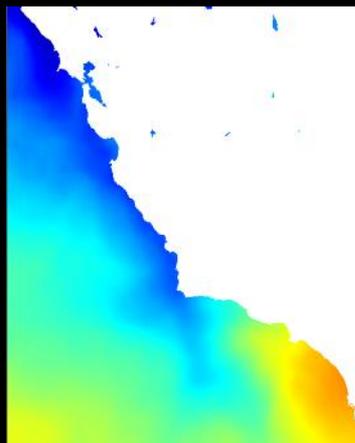
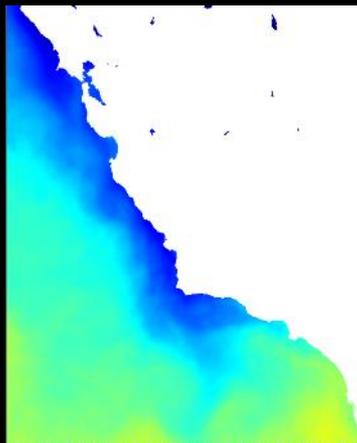


# Methodology

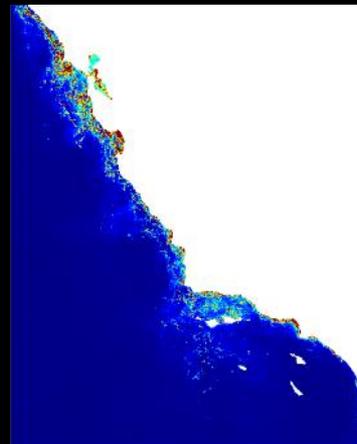
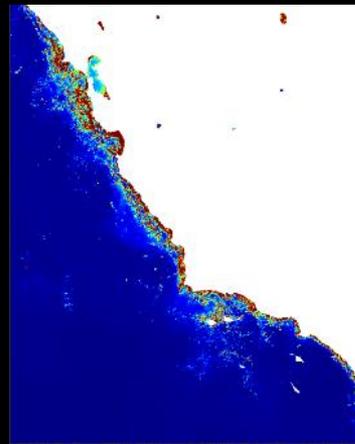
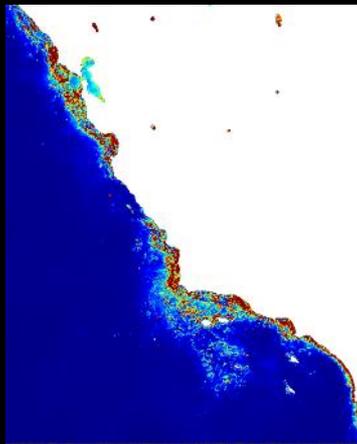


# April Sea Surface Temperature and Chlorophyll-a Means

Sea Surface  
Temperature  
(Degrees Celsius)

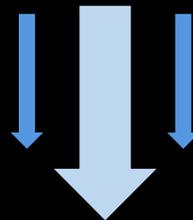
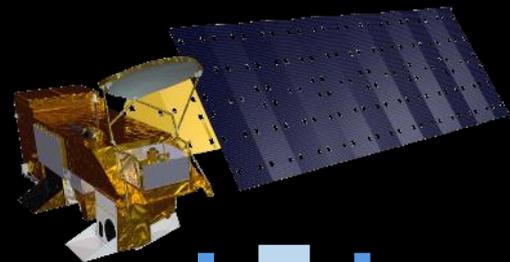


Chlorophyll-a  
Concentration  
(mg/m<sup>3</sup>)

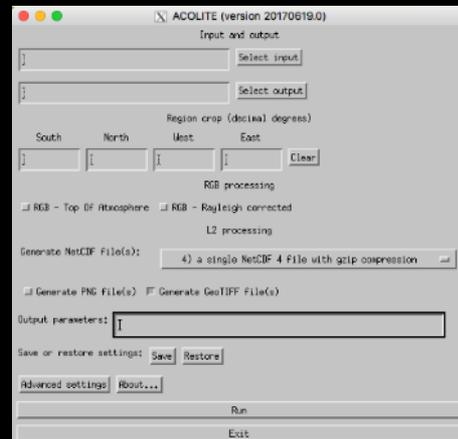


# Future Work

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- ▶ Continuation of project: Summer 2018
- ▶ Interactive application
- ▶ Continued remote sensing analysis
- ▶ Help improve Grunion Greeters' knowledge of factors influencing grunion migration and spawning patterns





# Angela Kemsley

**MPA Watch:  
Community-Based Monitoring  
of Human Use in  
Marine Protected Areas**

# **MPA Watch: Community-Based Monitoring of Human Use in Marine Protected Areas**

by Angela Kemsley; *WILDCOAST*

California's coastal and marine ecosystems produce some of the most important resources in the state; however, these ecosystems are some of the most exploited. Designed to protect the diversity and abundance of marine life while maintaining recreational access for people, marine protected areas (MPAs) protect over 16% of the California coast. Robust monitoring of the effectiveness of MPAs to conserve biodiversity is crucial to the continued success of the MPA network. Numerous efforts have been undertaken to monitor ecological change, but none have monitored human use of MPAs. MPA Watch was created as a citizen science initiative to collect data on coastal and marine resource use. Data are used to inform adaptive policy and management decisions as well as educate the public about marine stewardship. The MPA Watch network model is applicable across a range of locations and the data valuable to anywhere humans are using coastal or marine resources.

WILDCOAST  
COSTASALVAJE





1958



1980



1965



2007

# Marine Protected Areas (MPAs)





# Biological Data

WILDCOAST  
COSTASALVAJE



In 10 years fisheries biomass recovered **460%**

MPAs protect **ecosystems and wildlife** as well as enhancing **recreational value.**

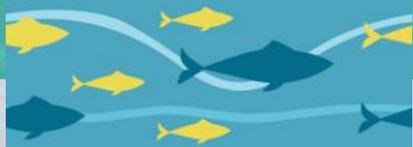


WILD COAST  
COSTASALVAJE

WILDCOAST

COSTASALVAJE

MPA  
WATCH



An underwater photograph of a seal pup swimming in clear blue water. The pup is dark brown with white spots and has prominent white whiskers. It is positioned in the center-left of the frame, looking towards the camera. To the left, there is a dense kelp forest with long, yellowish-brown blades. The background is a deep, clear blue.

WILDCOAST  
COSTASALVAJE

Collect **Inform** Educate

west  
marin  
environmental  
action  
committee

GREATER  
FARALLONES  
ASSOCIATION

CALIFORNIA  
ACADEMY OF  
SCIENCES

SAVE OUR  
SHORES

PACIFIC  
GROVE  
MUSEUM  
of NATURAL HISTORY

LOS ANGELES  
WATERKEEPER®

CAMP  
OCEAN  
PINES

Santa Barbara  
CHANNELKEEPER®

ORANGE COUNTY  
COASTKEEPER®

Heal the Bay

WILD  
COAST  
COSTASALVAJE

WILD  
COAST  
COSTASALVAJE

19,000 Surveys  
2,000 Volunteers

Adding partners along the **Central Coast**

Expanding to **North Coast**

WILDCOAST  
COSTASALVAJE

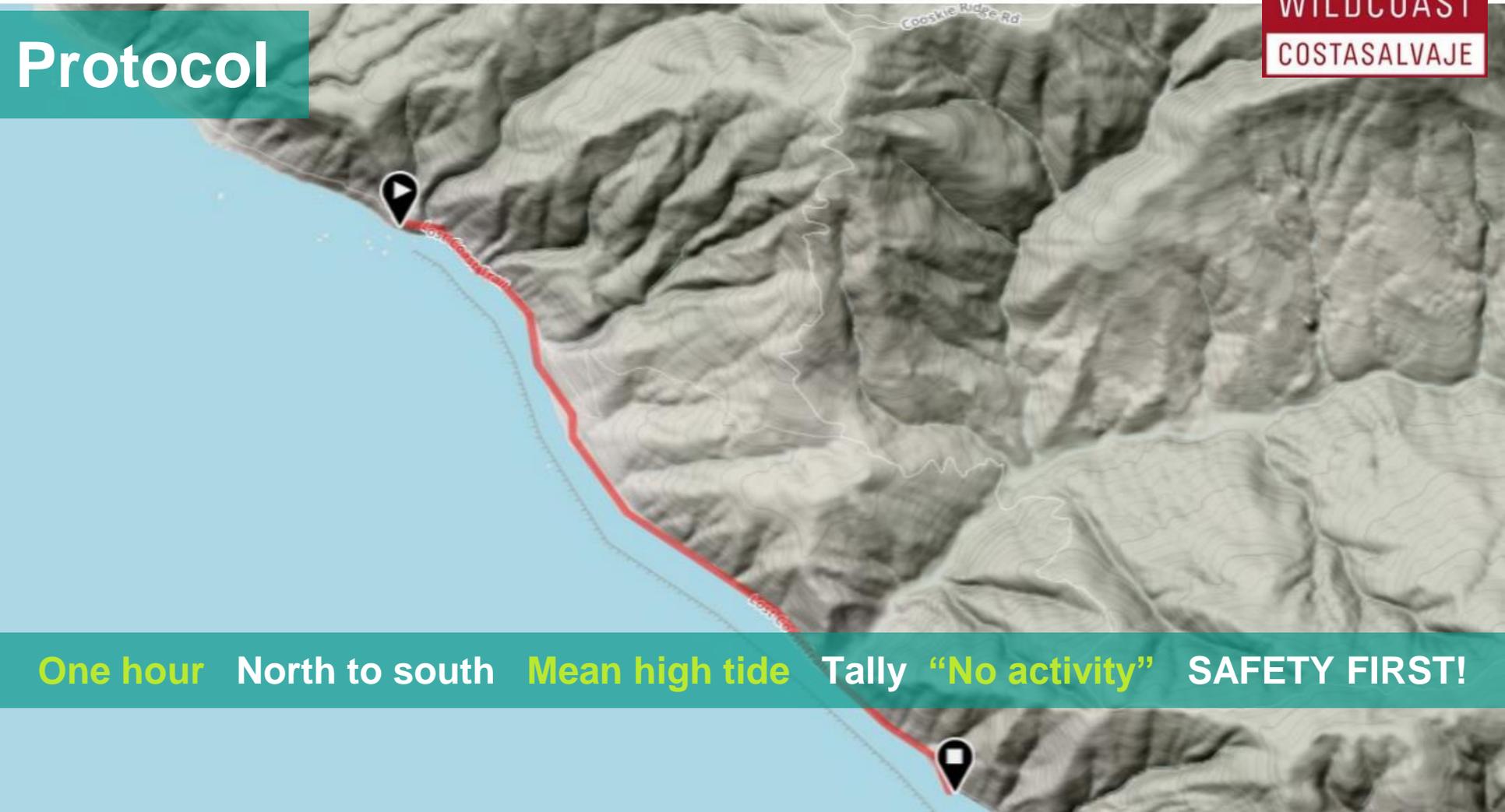
# Boat-Based Surveys





## Land-Based Surveys

# Protocol



One hour North to south Mean high tide Tally “No activity” SAFETY FIRST!



**WILDCOAST MPA Watch Data Sheet**

Name(s):		Date: / /	Transect ID:			
Start Time:	End Time:	Clouds: clear (0%)/ partly cloudy (1-50%)/ cloudy (50%+cover)	Precipitation: yes / no			
Air Temperature: cold / cool / mild / warm / hot		Wind: calm / breezy / windy	Tide Level: low / mid / high			
Visibility: perfect / limited / shore only		Beach Status: open / posted / closed / unknown				
<b>Onshore Activities</b>		Sandy	Rocky			
Beach Recreation (walking, hiking, running, resting, playing, sitting, camping, art, other, but NOT TIDEPOOLING)						
Wildlife Watching						
Domestic animals on-leash						
Domestic animals off-leash						
Driving on the Beach						
Tide-pooling (not collecting)						
Hand collection of biota						
Shore-based hook and line fishing						
Shore-based trap fishing						
Shore-based net fishing						
Shore-based spear fishing						
<b>Offshore Activities (Non-Boating)</b>						
Surfing/ Boogie Boarding						
Kite/Wind Surfing						
Stand up Paddle Boarding						
Offshore Recreation (Swimming/body surfing)						
Non-Consumptive SCUBA and snorkeling						
Spear Fishing (free diving or SCUBA)						
Other Consumptive Diving (e.g., nets, poles, traps)						
<b>Boating</b>	<b>Recreational</b>		<b>Commercial</b>		<b>Unknown</b>	
	Inactive	Active	Inactive	Active	Inactive	Active
Boat Fishing - Traps						
Boat Fishing - Line						
Boat Fishing - Nets						
Boat Fishing - Dive						
Boat Fishing - Spear						
Unknown Fishing Boat						
Boat Kelp Harvesting						
Commercial Passenger Fishing Vessel (5+ people)						
Kayak/Canoe/Dinghy						
Sailing						
Private Power Boat						
Dive Boat (stationary - flag up)						
Whale Watching Boat						
Work Boat (specify oil tender, DPW, research, coast guard)						
Other Boats (e.g., jet ski)						
<b>Comments:</b>						
Did you observe: <input type="checkbox"/> scientific research <input type="checkbox"/> education <input type="checkbox"/> beach closure <input type="checkbox"/> large gatherings <input type="checkbox"/> enforcement activity						
Describe below and provide counts of individuals involved where possible, and whether it took place on rocky or sandy or sandy substrate.						
Did you report a violation: <input type="checkbox"/> yes <input type="checkbox"/> no      If yes, how many violations did you report: _____						
Who did you report the violation to (mark all that apply): <input type="checkbox"/> DFW <input type="checkbox"/> State Parks <input type="checkbox"/> other entity (e.g., lifeguard, harbor patrol)						
Which method did you use to report your violation (mark all that apply): <input type="checkbox"/> phone call <input type="checkbox"/> text <input type="checkbox"/> mobile app <input type="checkbox"/> website <input type="checkbox"/> email <input type="checkbox"/> in person						

# Baseline Highlights from California's South Coast MPA Watch Program

## Monitoring Human Activities Along the California Coast



### About This Snapshot Report

This report highlights some of the core components of the California MPA Watch program, including key findings and information regarding regional programs.



Volunteers complete an MPA Watch survey in the dunes adjacent to Malibu's State Marine Reserve, which is one of 16 Southern California MPAs monitored by MPA Watch. Photo: Kneel/Russ/Wildcoast.

### Creating Human Use Profiles of California's Coastal Areas

MPA Watch is a statewide citizen science initiative designed to monitor human usage of coastal natural resources. By training and supporting volunteers as citizen scientists, MPA Watch facilitates the collection of relevant, scientifically rigorous and broadly accessible data.

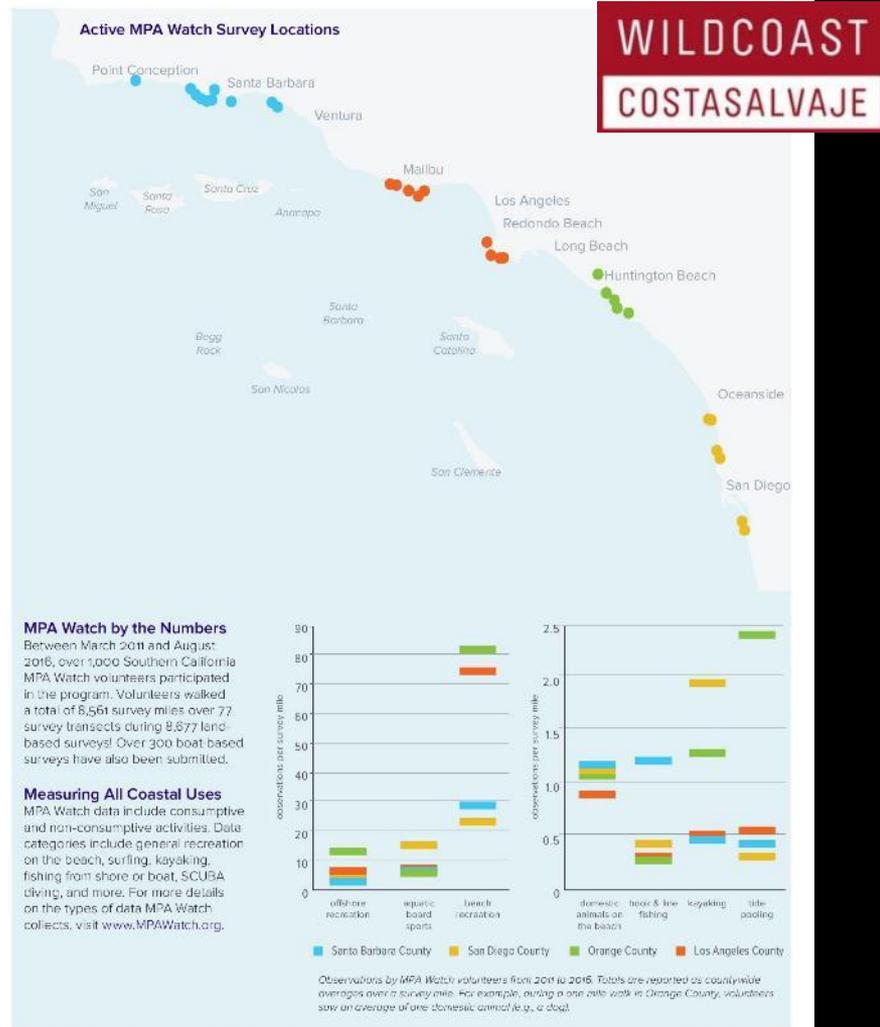
The data collected informs the science, management and enforcement of California's marine protected areas (MPAs) and coastal regions, documenting how coastal usage is changing as a result of MPA implementation. By involving local communities in this important work, MPA Watch programs inspire and empower stewardship while educating community members about California's ocean ecosystems.

Formed into a cohesive statewide network in 2012 with the support of the Resources Legacy Fund, the California MPA Watch program has collected nearly 14,000 surveys as of

August 2016, and has engaged approximately 1100 citizen scientist volunteers. All volunteers utilize standardized data collection and reporting methods, and submit data for inclusion in a quality controlled centralized information management system.

#### MPA Watch's core goals are:

- To document human uses in MPAs and track trends over time.
- To provide contextual information on human use for interpretation of biological monitoring data.
- To inform MPA enforcement and engagement decisions regarding human activity inside MPAs.
- To train MPA Watch volunteers as stewards and effective public educators regarding MPAs.



WILDCOAST  
COSTASALVAJE

Refugio Oil Spill





**Human impact on local species**

An underwater scene featuring a diverse group of fish swimming through clear blue water. The fish include several large, reddish-brown fish, a bright orange fish, a dark blue fish, and a greenish-brown fish. The background is filled with green seaweed and red coral-like structures. In the top right corner, there is a red rectangular box with white text. In the bottom left corner, there is a dark teal rectangular box with white text.

WILDCOAST  
COSTASALVAJE

[mpawatch.org](http://mpawatch.org)

An underwater photograph showing a large fish, likely a rockfish, swimming in the center. The water is blue and filled with tall kelp stalks. Several smaller fish are visible in the background and foreground. In the top right corner, there is a red rectangular logo with white text.

WILDCOAST

COSTASALVAJE

**Angela Kemsley**  
**angela@wildcoast.net**  
**MPA Watch Program Coordinator**



# Ximena Gil

**Using Citizen Science to  
Estimate Frequency of  
Latrine Site Usage Along  
Tributaries of Humboldt Bay by  
North American River Otters**

# Using Citizen Science to Estimate Frequency of Latrine Site Usage Along Tributaries of Humboldt Bay by North American River Otters

by Korinna Domingo, Ximena Gil, and Dr. Jeffrey M. Black; *Humboldt State University*

Since 1999, citizen science volunteers have reported North American River Otters at 39 waterbodies in Humboldt, Del Norte, and adjacent counties in northern California. An average of 235 records per year have been reported (including scat, tracks and sightings), providing an index of use among sites ranging from high to low occurrence, depending on volunteers' participation (i.e. observer effort) or the otters themselves. Sightings of River Otters were reported at all times of the day. This study reports on the usefulness of a remote sensing camera (RSC) with night-time capabilities to better interpret the index of use provided by Citizen Science volunteers. The camera was positioned without bait and aimed at a rocky, shoreline latrine at an estuarine stream leading to Humboldt Bay. The latrine had been used by River Otters in use in all years of the study but to an unknown degree. The camera recorded a 20 sec video at each detection. River Otters triggered the camera 36 times (19 at night, 17 in the day) on 15 of the 53 camera-days. One ( $n = 22$ ), two ( $n = 9$ ) or three ( $n = 5$ ) otters were counted during the 20 sec videos. Based on size and sex characteristics, we determined that the latrine was visited by a minimum of five individuals.



8 63F ● 12/06/2017 01:47PM KORINNA 6

Video is available online at: <https://www.youtube.com/watch?v=xlwF1nc81Uw>



# Korinna Domingo

**Human Dimensions  
& Citizen Science:  
Using Remote Sensing Cameras  
to Mitigate Wildlife Conflicts**

# **Human Dimensions & Citizen Science: Using Remote Sensing Cameras to Mitigate Wildlife Conflicts**

by Korinna Domingo and Ron Dean; *Mountain Lion Foundation*

Footage obtained from remote sensing cameras can be powerful storytelling tools to encourage healthy coexistence with wildlife in local communities. Our focused three-month survey measured the frequency of mammalian occupation on a substantial privately owned property surrounded by both residential and natural areas in Arcata, California. Prior to our survey, citizen scientist Ron Dean spent three years documenting wildlife in his neighborhood after experiencing a mountain lion depredation. The objective of our study was to inform neighborhood residents about the variety of mammalian species present and how often they frequented this forested habitat. The following animals were observed: black bear, black tailed deer, bobcat, coyote, fisher, gray fox, mink, mountain lion, opossum, raccoon, and striped skunk. As representatives of the Mountain Lion Foundation's WildCameras program and our neighborhood, presentations have been made to the California Fish and Game Commission, demonstrating how citizen science and trail cameras can improve neighborhood wildlife conservation.



54°F 08/29/2017 10:30AM KORINNA 8

Video is available online at: <https://www.youtube.com/watch?v=xG2umkdQjv0>

# Angela De Palma-Dow

**An Evaluation of Volunteer  
Effort in the Restoration of  
Terrestrial and Aquatic  
Resources in the Santa  
Monica Mountains**



# **An Evaluation of Volunteer Effort in the Restoration of Terrestrial and Aquatic Resources in the Santa Monica Mountains**

by Angela De Palma-Dow, J. Curti, D. Sharpton, E. Sode, S. Rubin, J. Smith, R. Kosugi, A. Shy-Sobol, T. Hayduk, J. Health, and B. Youngerman; *Mountains Restoration Trust*

Mountains Restoration Trust (MRT), a local land trust organized as a 501(c)(3) public benefit corporation based in Calabasas, CA, has been working in the community for over 35 years conserving the natural and cultural resources of the Santa Monica Mountains. MRT hosts weekly events of between 3 – 6 hours, where volunteers directly contribute to the restoration and ecosystem enhancement of the unique and diverse ecosystems of the Santa Monica Mountains. Volunteers participate in hands-on restoration activities such as planting native trees and shrubs, removing invasive weeds, and conducting aquatic restoration by trapping and removing invasive red swamp crayfish. MRT has provided vegetation-based restoration opportunities for volunteers since 2010, where 14,000 MRT volunteers have planted 1,426 trees and 6,299 native plants. These efforts are valued over \$1,124,000 according to standard federal volunteer rates. For aquatic restoration, more than 3,400 volunteers have contributed their time and energy since 2015 and have removed 1,000 crayfish from streams. These efforts are valued at \$211,700. The effort of volunteers for restoration activities is essential for MRT to complete management goals and they serve as a method for the public to learn about and invest in their local natural resources. These programs encourage and enrich ideas of stewardship that will continue to percolate throughout the ecological and social community for generations to come.

# An evaluation of volunteer effort in the restoration of terrestrial and aquatic resources in the Santa Monica Mountains.



**Angela De Palma-Dow and  
J. Curti, D. Sharpton, E. Sode, S. Rubin, J. Smith,  
R. Kosugi, A. Shy-Sobol, T. Hayduk, J. Health, B. Youngerman**



# Thanks & Acknowledgments



California Department of  
**Fish and Wildlife**



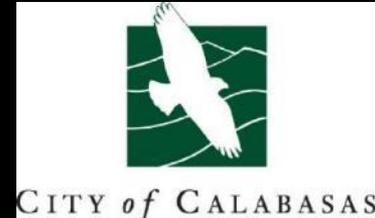
Integrated Regional Water  
Management Program  
Grant (prop 84)



**US Army Corps  
of Engineers**®



Mountains Recreation &  
Conservation Authority



CITY OF CALABASAS



THE METROPOLITAN WATER DISTRICT  
OF SOUTHERN CALIFORNIA



*Ucla*



ORVIS



**Las Virgenes**  
MUNICIPAL WATER DISTRICT



THE DORRANCE FAMILY FOUNDATION

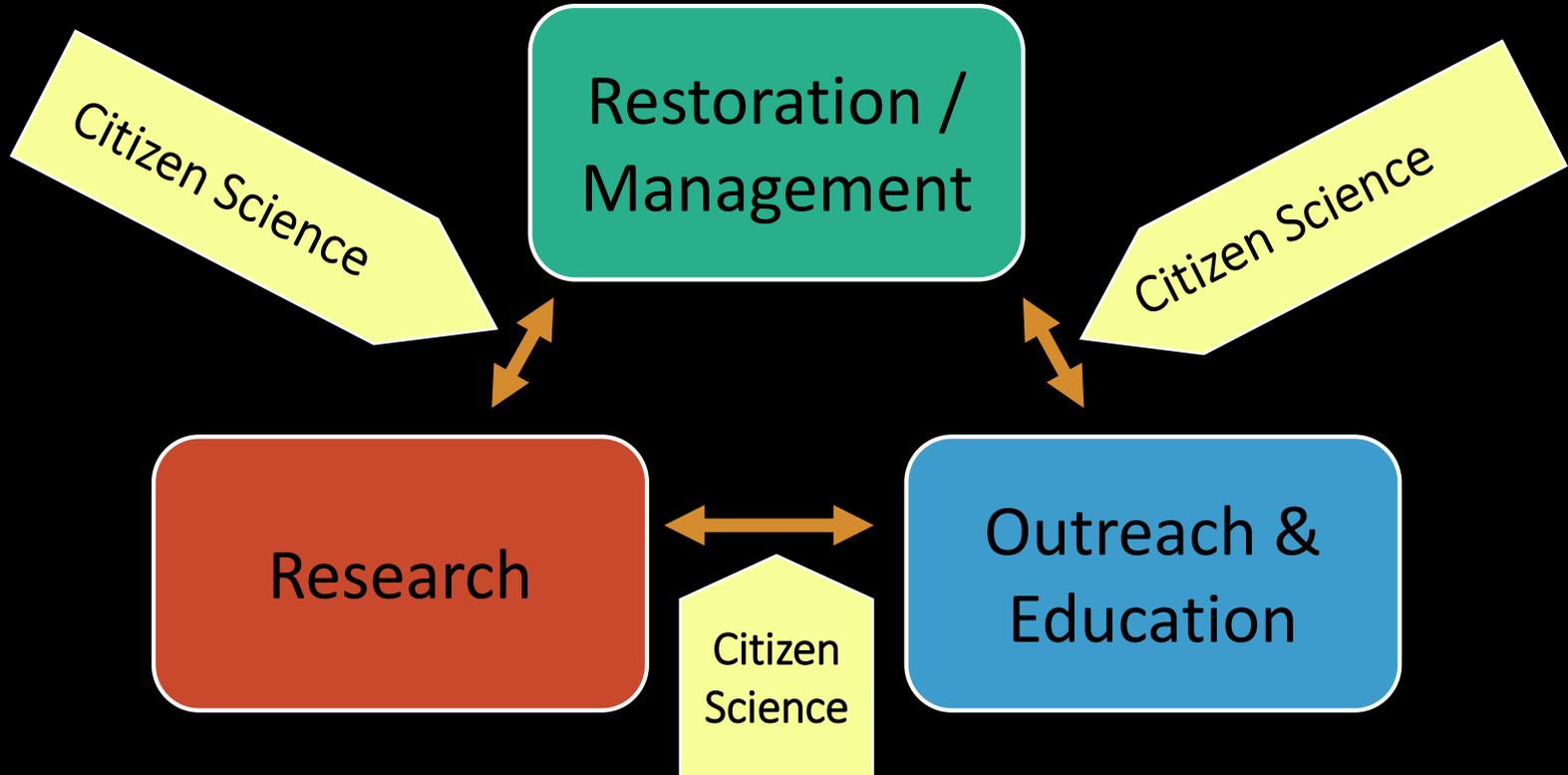
# MRT Background

- Land owned and managed
- Est. 1981
- Acquisition – 7000 acres preserved
- Restoration – 2000 acres restored
- 2010 Est. Crayfish program
- 2018 Initiating citizen science in aquatic programs
- Mission

*“MRT is committed to preserving wildlands and restoring degraded lands for future generations of wildlife, plants and people.”*



# The MRT strategy



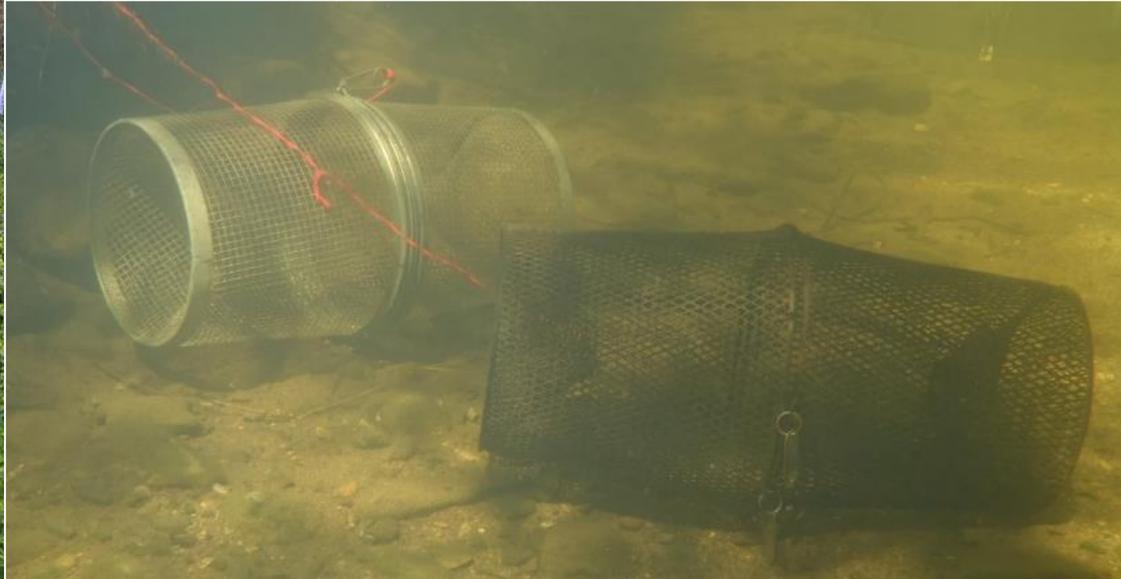
# Restoration

- Native Plant Communities
- Aquatic resources



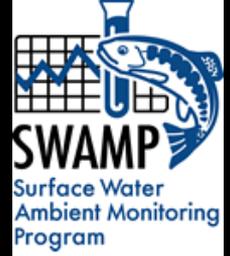
# Management

- Invasive terrestrial plants
- Aquatic species



# Research

- Water quality and biodiversity studies
- Big opportunity to utilize citizens



## Education / outreach

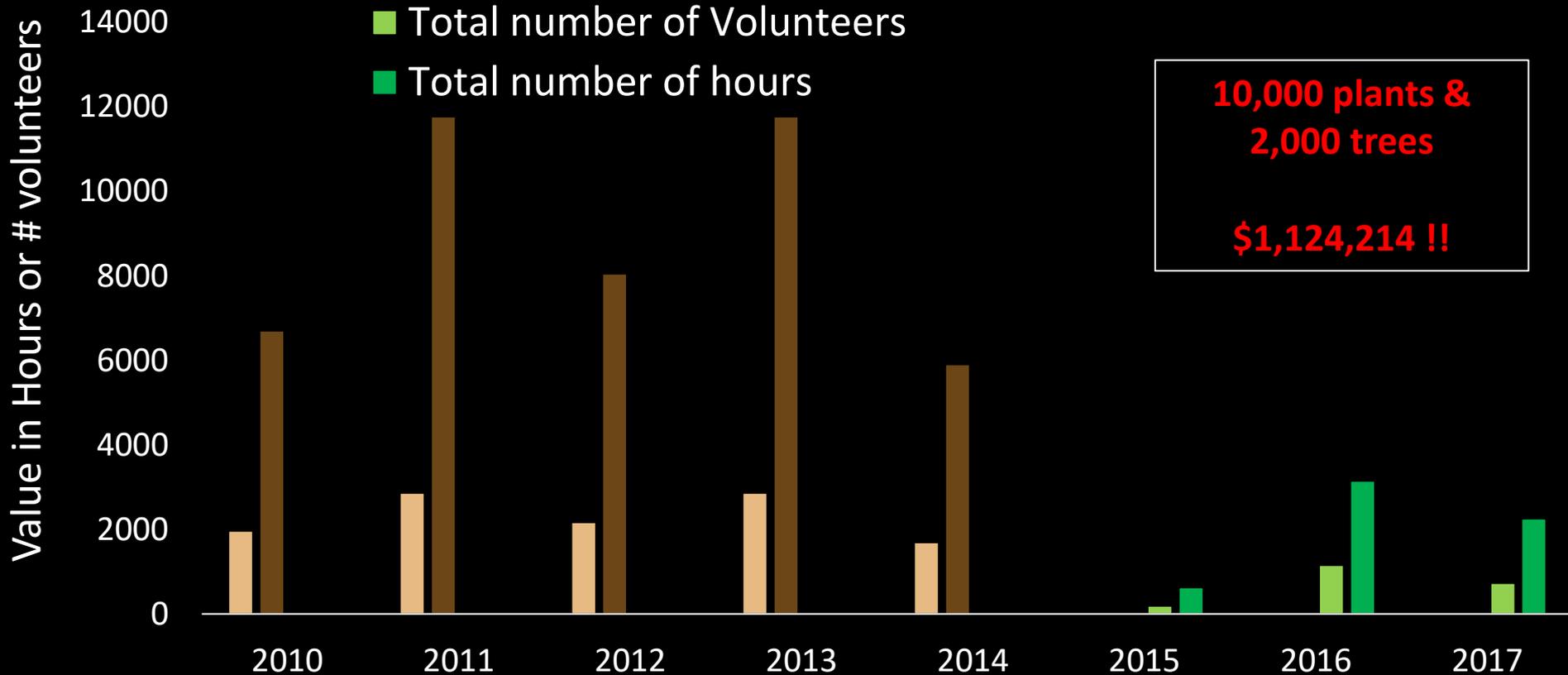
- Involve the community
- Develop partnerships
- Create sustainability



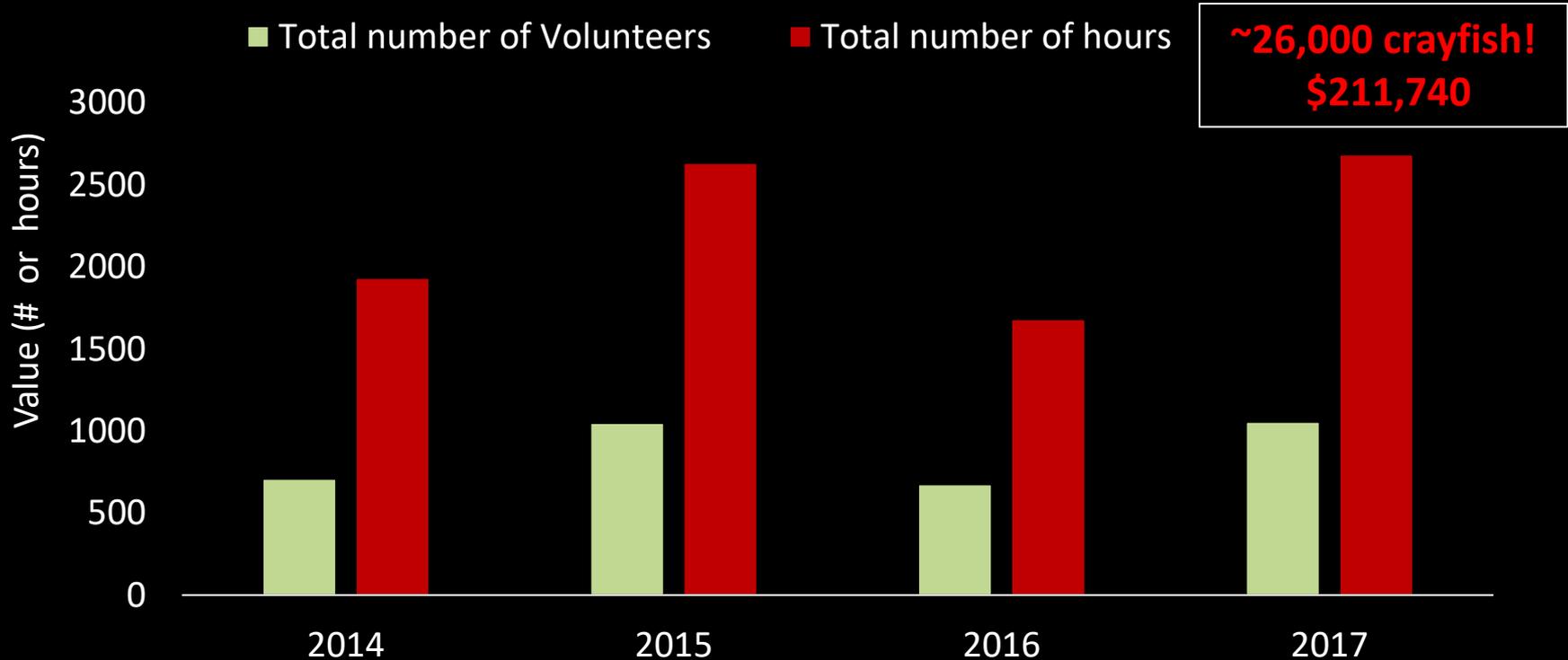
Instagram



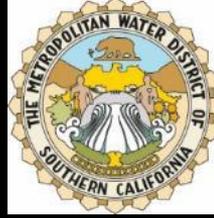
# Results – Volunteer Efforts – Restoration 2010- 2017



# Results – Volunteer Efforts - Crayfish 2014 -2017

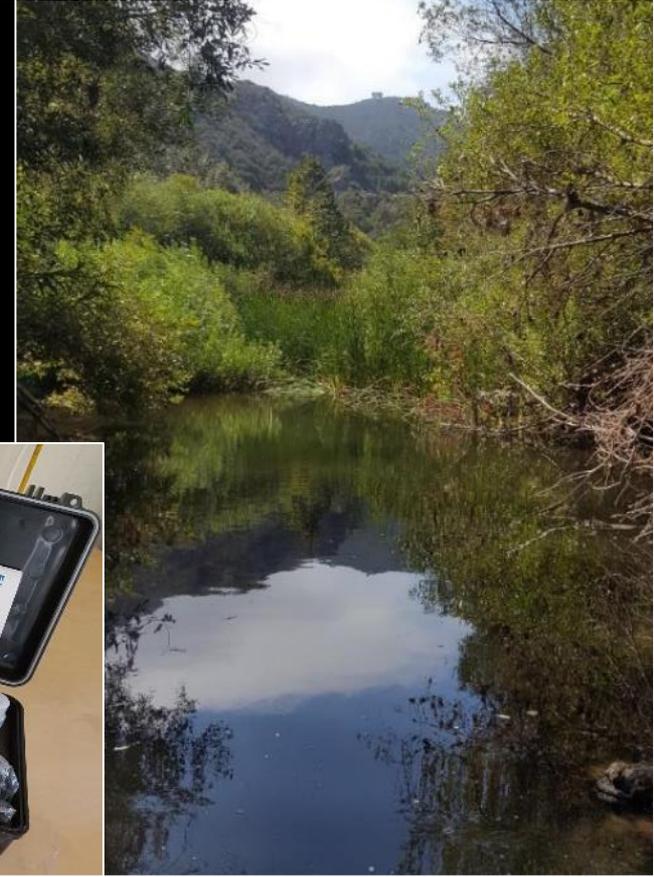


# WQ and Citizen Science



THE METROPOLITAN WATER DISTRICT  
OF SOUTHERN CALIFORNIA

- 2017 Developed WQ project and plan
- Monitoring 11 sites
- 2018 Received a grant for MWDSC Community Partnering Program\*
- Use student citizen scientists to test WQ
  - Nitrogen & Phosphorous\*
  - Turbidity\*
  - DO / pH / temp (YSI)



# Thank you!

Contact: [Adepalmadow@mountainstrust.org](mailto:Adepalmadow@mountainstrust.org)

We are hiring  
outreach &  
veg staff!





# Josh Weinik

**Volunteer Research Programs  
Inform the Recovery of  
Rare Bird Species**



# Volunteer Research Programs Inform the Recovery of Rare Bird Species

by Josh Weinik; *Palos Verdes Peninsula Land Conservancy*

Citizen science research programs comprise an important component of annual biological monitoring activities of the Palos Verdes Peninsula Land Conservancy (Conservancy). The Conservancy coordinates two citizen science research projects designed to inform the natural resource management strategy of the Palos Verdes Nature Preserve (Preserve) and support mandated monitoring requirements of the Rancho Palos Verdes Natural Community Conservation Plan (NCCP). The Citizen Science Cactus Wren Monitoring Program studies the level of coastal cactus wren (*Campylorhynchus brunneicapillus*) inhabitation across patches of habitat within the Preserve. The cactus wren is a protected species under the NCCP and annual monitoring by citizen scientists supplement the triennial monitoring requirements for the species in order to better understand cactus wren response to yearly environmental conditions and their behaviors. Another research program, the Citizen Science Wildlife Tracking Program, monitors wild canid presence and movement across the Preserve using track and scat analysis as well as motion-activated cameras. The inclusion of motion-activated cameras has facilitated the identification of individual wild canids and led to the only recent photographic documentation of the native gray fox (*Urocyon cinereoargenteus*) within the Preserve. Information regarding wild canid presence improves the understanding of predatory pressures on meso-predators, an important element of special status species recovery. Citizen scientists enable the Conservancy a broader and deeper look into species behaviors and utilization throughout the Peninsula's open space habitats and provide data to inform land management practices.

*Presenter requested that only their abstract be included in the Proceedings*



# David McGuire

**Beta Testing the Trident ROV  
for Citizen Science, Species ID  
and MPA Monitoring in the  
Golden Gate MPA Collaborative**

# Beta Testing the Trident ROV for Citizen Science, Species ID and MPA Monitoring in the Golden Gate MPA Collaborative

by David McGuire; *MPA Collaborative* and *Shark Stewards*

In 2017 and early 2018 the Golden Gate MPA Collaborative and NGO Shark Stewards partnered with the company Open Explorer, to perform preliminary survey work as a tool to record species and habitat within MPAs using a prototype Trident ROV. This small, camera equipped submersible proved useful in recording benthic observations at the Farallon Islands SMR and other locations, including areas of high surge, low visibility. This poster will highlight the findings from the videos and discuss the merits and challenges of using these underwater drones.

# SHARK STEWARDS

EDUCATION ◀ ADVOCACY ◀ CONSERVATION



Earth Island Institute

You are here.



David @  
SharkStewards.org



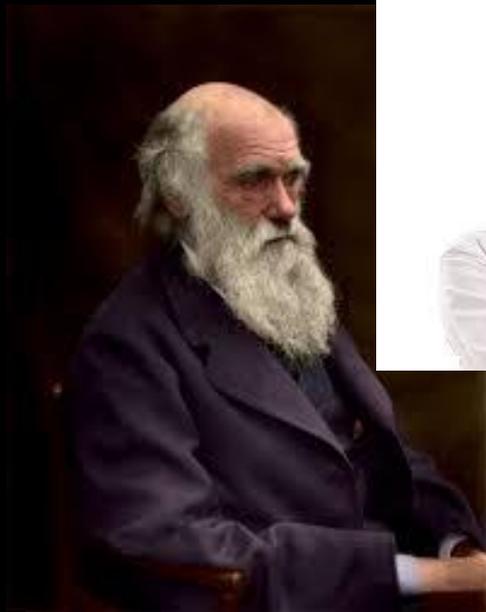
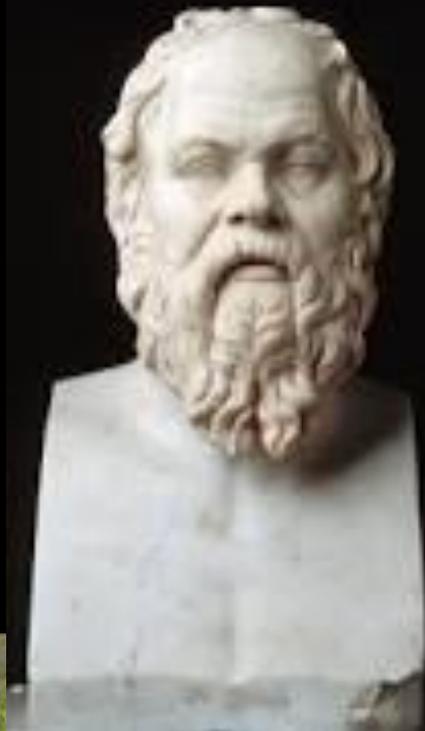
# Citizen Science

projects in which volunteers partner with scientists to answer real-world questions.

## OpenExplorer



"Those who educate children well are more to be honored than they who produce them; for these only gave them life, those the art of living well"





eBird

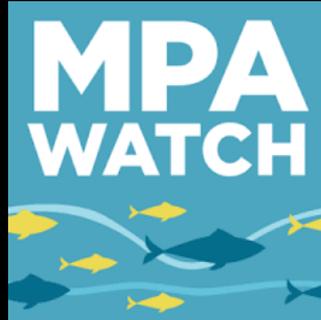
Submit

Explore

My eBird

Science

OpenExplorer



WELCOME TO CITIZENSCIENCE.ORG  
Home of the Citizen Science Association



Whale Alert

iNaturalist

Explore Learn Record



OCEAN  
SANCTUARIES

# Data Collection- Shoreline





# OpenExplorer





# CALIFORNIA MARINE PROTECTED AREAS

# OpenExplorer

## MPA Watch- Journey to the Devils Teeth 🇺🇸

Thirty miles off the San Francisco shoreline are the Farallon Islands, a Fish and Wildlife Refuge, nested inside our Greater Farallones National Marine Sanctuary. These enigmatic islands are critical habitat for 350,000 nesting seabirds, 6 species of seals and sea lions, amazing fish including great white sharks!

The Sanctuary is refuge to at least 16 species of dolphin and whales, including the endangered Blue Whale. Located so close to our coastline, the islands wildlife and habitat have been impacted from overfishing...

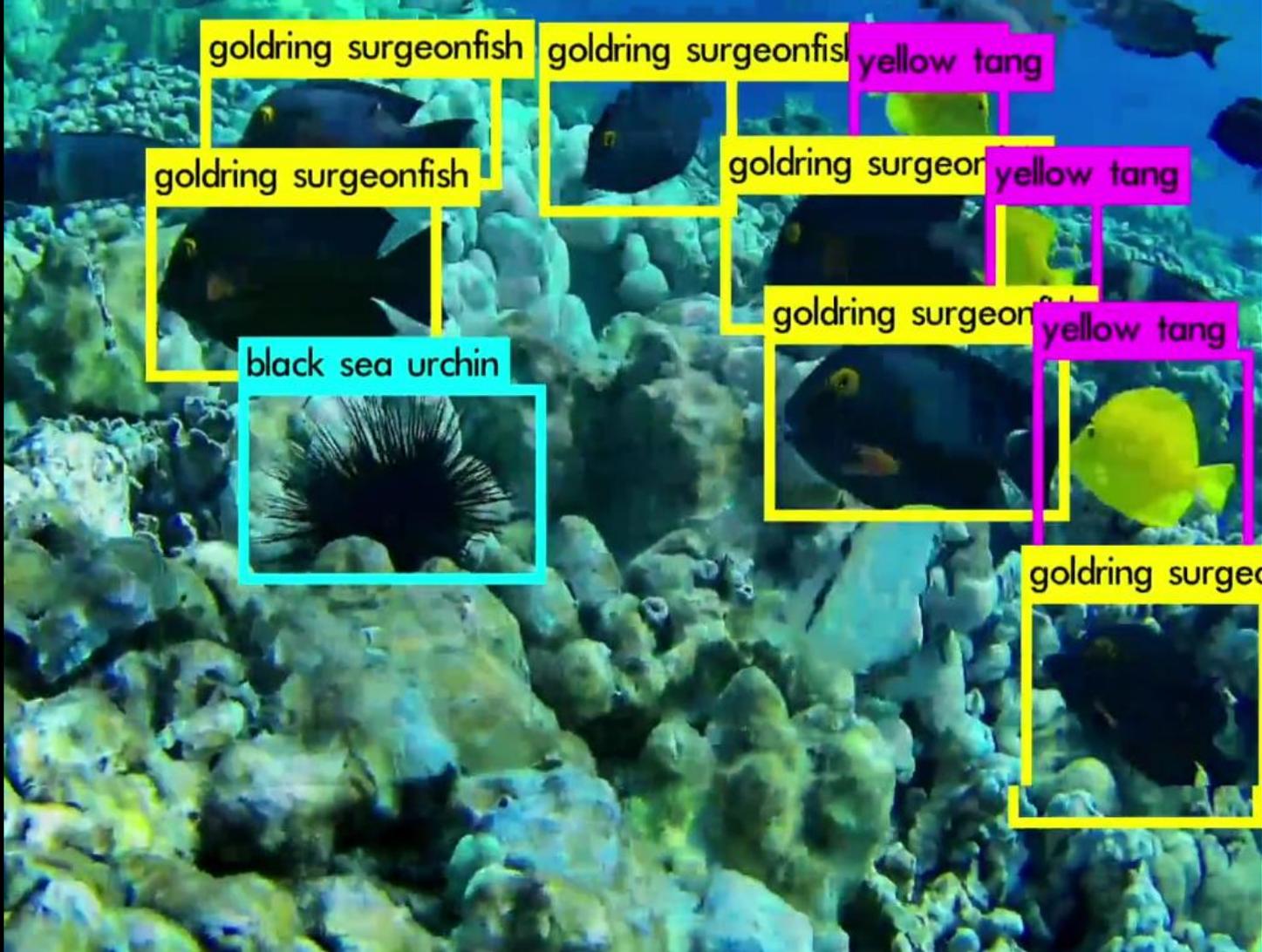
Sausalito, California, United States, Nov 3 to Dec 28 2017

Follow



COLLABORATIVE  
NETWORK





goldring surgeonfish

goldring surgeonfish

yellow tang

goldring surgeonfish

goldring surgeon

yellow tang

black sea urchin

goldring surgeonfish

yellow tang

goldring surgeon



## MPA Watch- Journey to the Devils Teeth

November 3 2017



Thirty miles off the San Francisco shoreline are the Farallon Islands, a Fish and Wildlife Refuge, nested inside our Greater Farallones National Marine Sanctuary. These enigmatic islands are critical habitat for 350,000 nesting seabirds, 6 species of seals and sea lions, amazing fish including great white sharks!

iNaturalist

Explore Learn Record



#SharkWatch



OCEAN  
SANCTUARIES



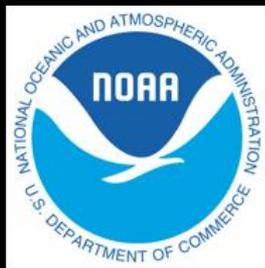
# Thank You



OpenExplorer

Earth Island Institute

You are here.





# Sarah Kaleel

## So Cal Sea Slugs — Diversity and Distribution

# So Cal Sea Slugs — Diversity and Distribution

by Sarah Kaleel

Southern California provides a fantastic opportunity to view various types of sea slugs without having to be dive certified. Various marine slugs - from sea hares (*Aplysia*) to nudibranchs - can be found in tidal pools throughout the coast line. This visually driven presentation reviews the location and variation in sea slugs found in tide pool locations from San Diego up to Malibu, using citizen science data provided via iNaturalist to support sighting frequencies. This presentation is to provoke interest in the citizen science community to capture sea slug data while tide pooling and identify additional information while documenting animal activity.

# SoCal Sea Slugs Diversity and Distribution

Presenter: Sarah Kaleel

3rd Annual CITIZEN SCIENCE for Conservation in Southern California Symposium

March 24, 2018

# WHAT IS A SoCal SEA SLUG?

- ▶ Sea slug is a common name for marine gastropod that has no shell or a shell so small it can not be seen or retracted into
- ▶ Nudibranchs are marine gastropods that have no shell at all



# California sea hare (*Aplysia californica*)

- ▶ Colors vary from pink-red to dark brown due to its diet on red algae
- ▶ Releases purple ink if disturbed (or stepped on!)
- ▶ Referred to as a sea hare because it's rhinophores look like bunny ears
- ▶ Very often in the tidal zones, found out of water during low tide
- ▶ It's "wing" flaps cover it's gills so it is OK while waiting for the tide
- ▶ Look in areas where there are rocks and sand





iNaturalist sighting map  
for  
California sea hares

Malibu

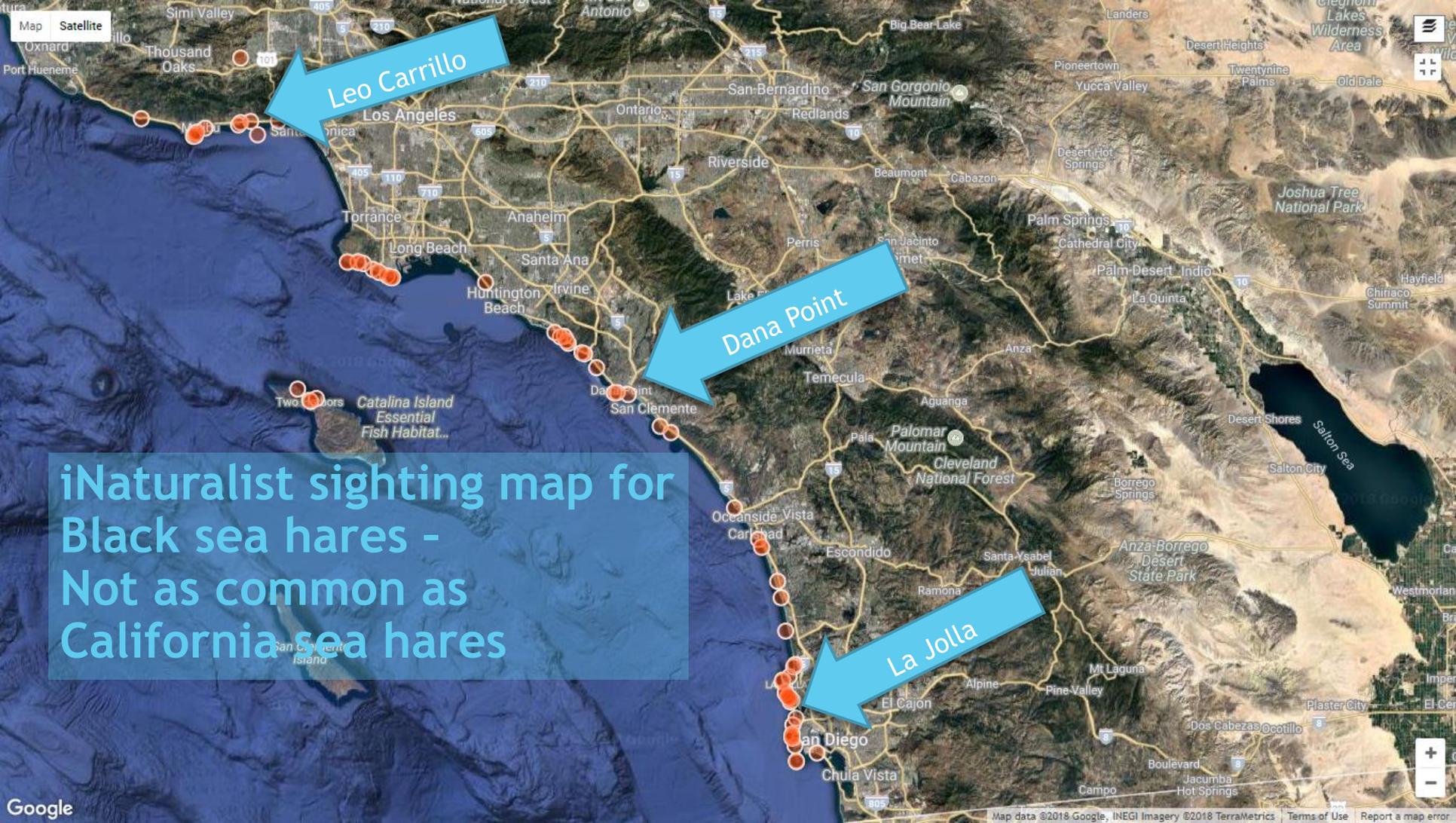
Palos Verdes

La Jolla

# Black sea hare (*Aplysia vaccaria*)

- ▶ Black Black Black!
- ▶ LARGEST of the sea slugs have been recorded over 3 feet long
- ▶ Does not release ink
- ▶ Sea slugs are hermaphrodites and can found linked up mating chains
- ▶ Their eggs are yellow-peach stringy masses and can contain 80 million eggs!
- ▶ Due to their giant neurons and structure of their nervous system, *Aplysia* has been paramount to numerous fields of research





Map Satellite

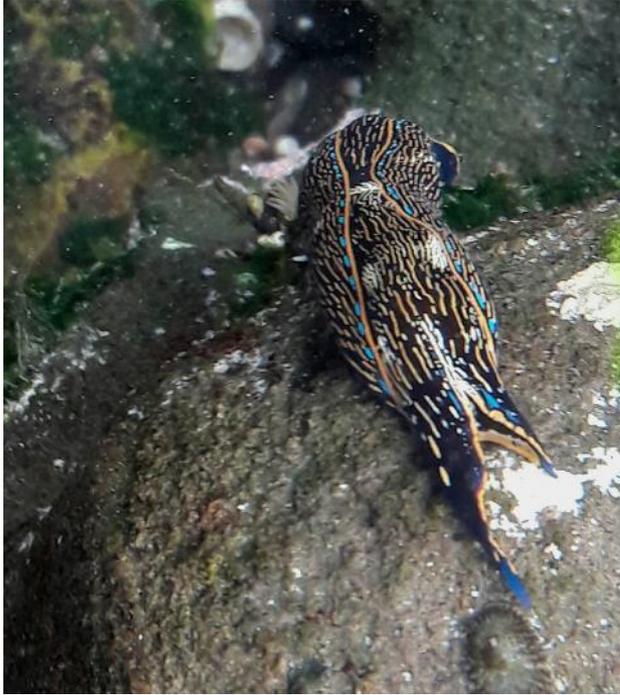
Leo Carrillo

Dana Point

La Jolla

iNaturalist sighting map for  
Black sea hares -  
Not as common as  
California sea hares

# California aglaja (*Navanax inermis*)

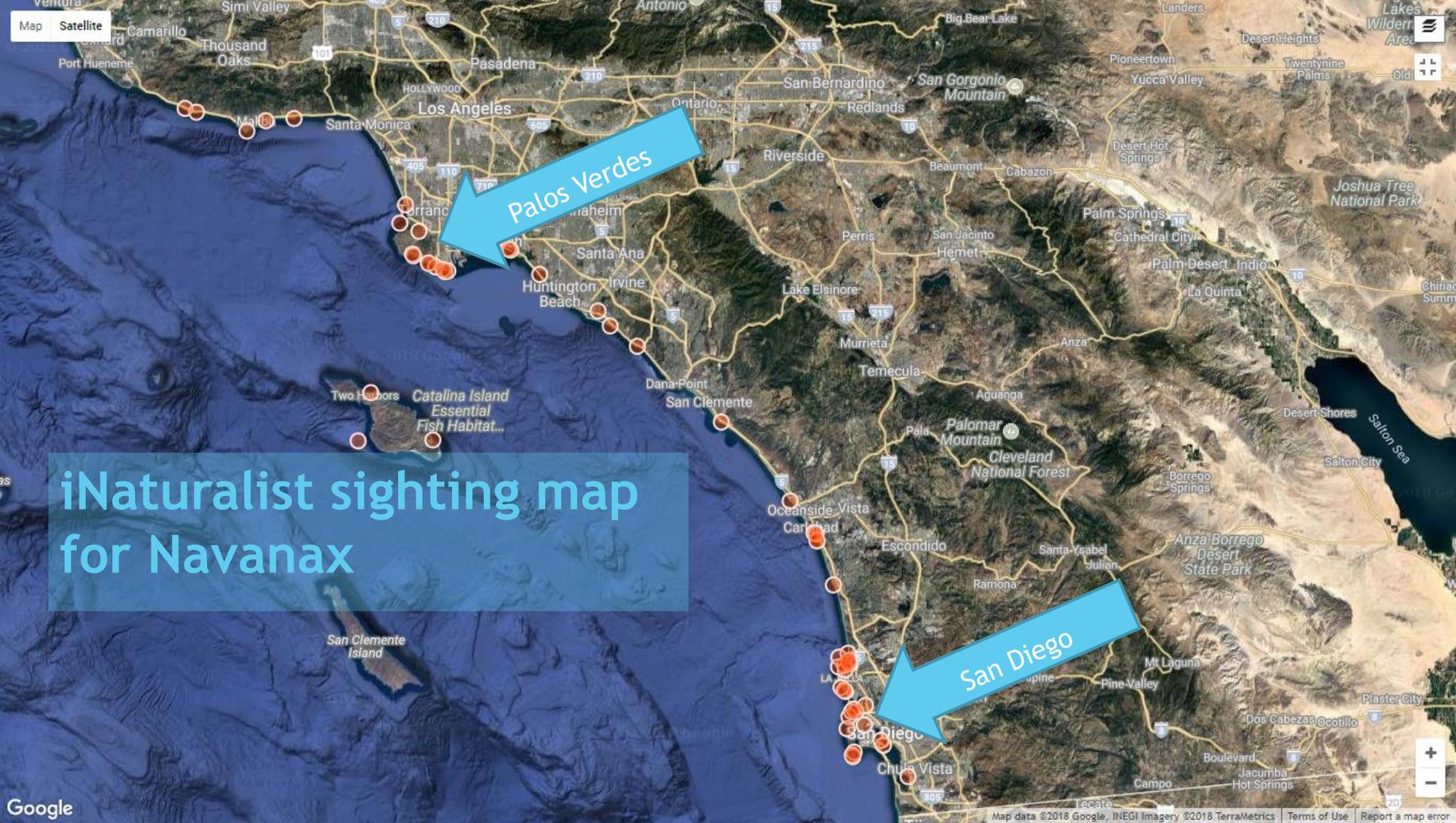


Tide  
Pooler  
Tip

Keep your eyes peeled  
for slugs in the  
seaweed

- ▶ Not a nudibranch but IS a sea slug
- ▶ Sea slug predator that feasts upon other slugs and snails
- ▶ It follows the slime trails left by their prey
- ▶ This beauty can grow up to 8 inches long





Map Satellite

Palos Verdes

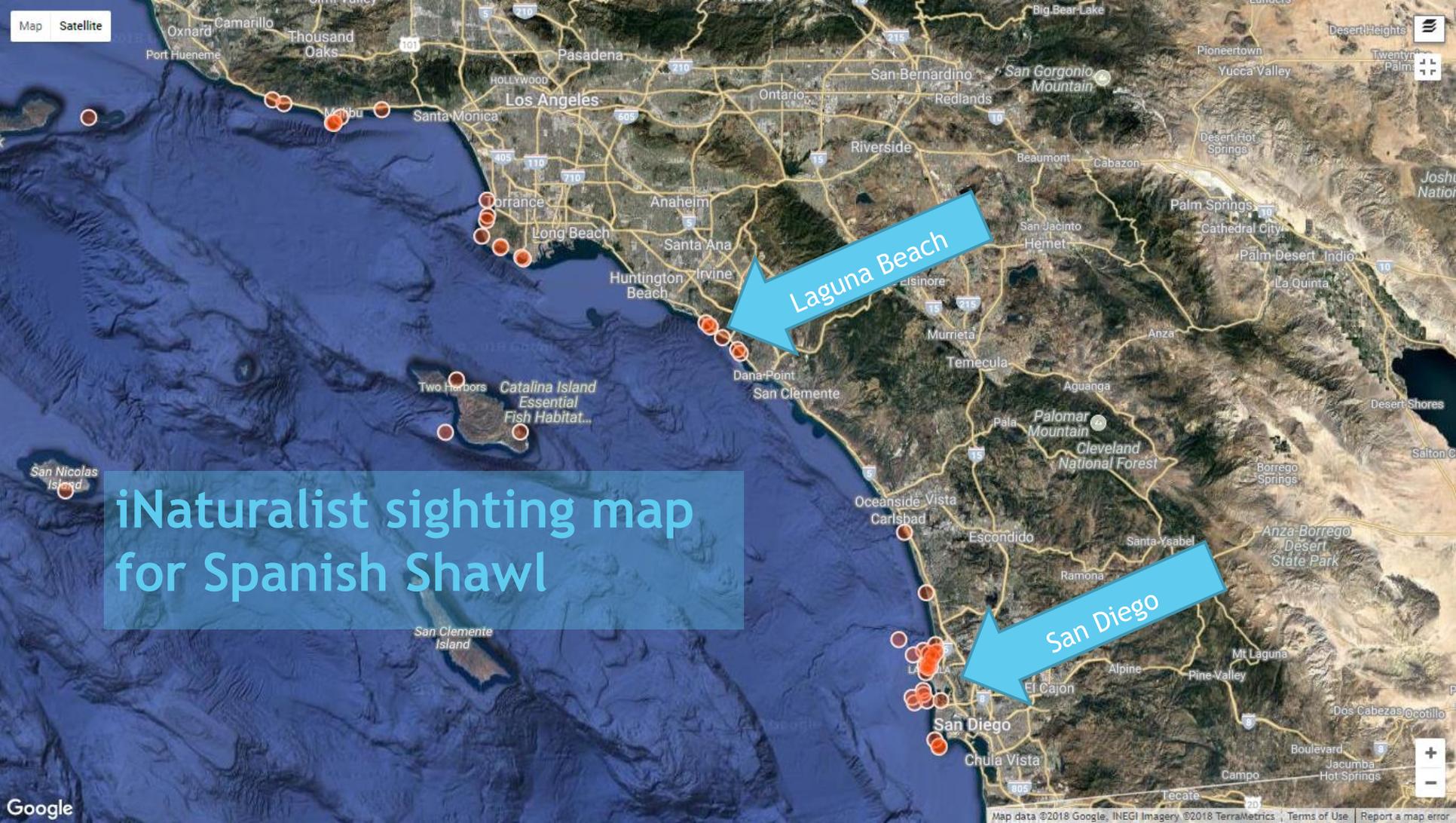
San Diego

iNaturalist sighting map for Navanax

# Spanish Shawl (*Flabellina iodinea*)

- ▶ Not often found in tide pools but in shallow waters off the coast
- ▶ Purple body and bright orange cerata make it an easy animal to spot when searching for them while diving or tide pooling
- ▶ They chomp on orange polyps, so their cerata help them blend in with their prey





**iNaturalist sighting map  
for Spanish Shawl**

Laguna Beach

San Diego

White-spotted Dorid (*Doriopsilla fulva*)  
Two-spotted Dorid (*Thordisa bimaculata*)

- ▶ Sea slugs can look very similar to each other; try to get several pictures from different angles to help ID the animal
- ▶ Dorids can be identified by their butt-frills, which are their gills





Bonus  
Slug

Both  
Dorids  
found  
in La  
Jolla

The lovely Hopkin's  
Rose nudi can be  
found at La Jolla as  
well

# iNaturalist sighting map for Two Spotted Dorid



## Resources:

- ▶ iNaturalist “[California Sea Slugs - Nudibranchs and opisthobranchs found in California](#)” Group for the local sea slug information
- ▶ [Tidal Times](#) - the closer to 0 ft (or in the negatives) is the optimal  
Arrive 90 minutes before low tide
- ▶ Sturdy water shoes, hat and a camera

## Black Land Hare



## Black Sea Hare

## Dana Point



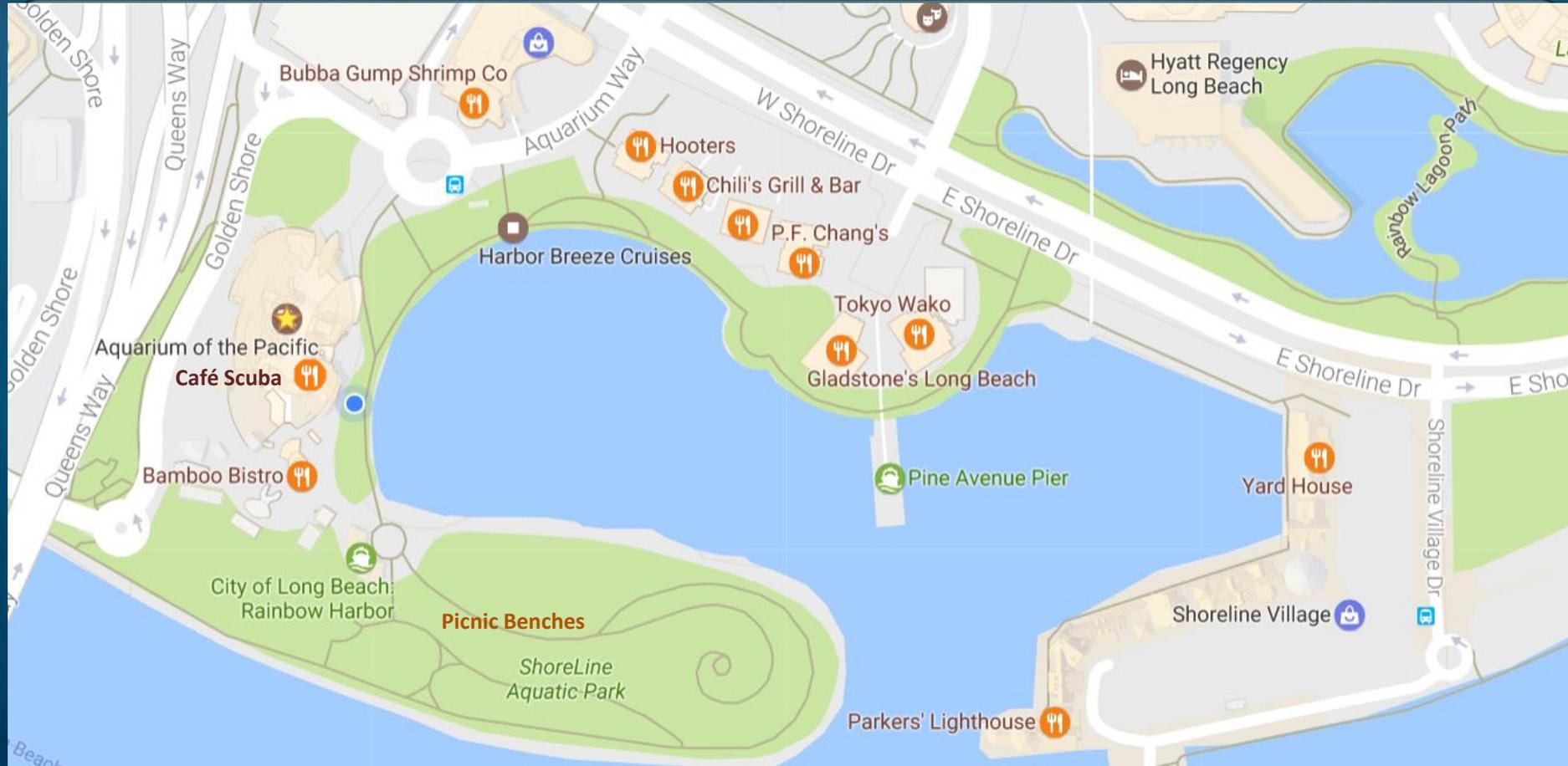
*3<sup>rd</sup> Annual*  
**CITIZEN SCIENCE**  
*for Conservation in Southern California*  
**SYMPOSIUM**

**LUNCH**  
**&**  
**OPTIONAL BIOBLITZ**

12:00 p.m. – 2:00 p.m.

Saturday, March 24, 2018 at the Aquarium of the Pacific in Long Beach, CA

# Onsite & Nearby Food Options



# Lunchtime Bioblitz (1-1:45 pm)

Aquarium of the Pacific

Aquarium  
of the  
Pacific

Shoreline  
Aquatic Park  
Bioblitz



# #AOPcitsci



## Shoreline Aquatic Park Bioblitz (CSCSCS 2018)

March 24, 2018, 8:00 AM - 6:00 PM PDT

This bioblitz is part of an annual effort in which the citizen science community helps to develop a census of the diversity and abundance of life at the Shoreline Aquatic Park. The bioblitz is held in

conjunction with the Aquarium of the Pacific's annual Citizen Science for Conservation in Southern California Symposium (CSCSCS).

[Register](#)

Register for this event at [www.aquariumofpacific.org](http://www.aquariumofpacific.org)

# Results from the Shoreline Aquatic Park BioBlitz

« Projects Terms & Rules | Edit project

#AOPcitsci

ADD OBSERVATIONS

AQUARIUM OF THE PACIFIC  
A non-profit institution

Shoreline Aquatic Park Bioblitz (CSCSCS 2018)  
March 24, 2018, 12:00 PM - 2:10 PM PDT

## Event Stats

### Totals

**310**  
Observations »

**99**  
Species »

**23**  
People »

### Most Observations



### Most Species



### Most Observed Species



The World 310 OBSERVATIONS + 99 SPECIES + 53 IDENTIFIERS + 23 OBSERVERS +

18 observations <span style="color: green;">CC</span>	14 observations <span style="color: green;">CC</span>	12 observations <span style="color: green;">CC</span>	12 observations <span style="color: green;">CC</span>	9 observations <span style="color: green;">CC</span>
8 observations <span style="color: green;">CC</span>	7 observations <span style="color: green;">CC</span>	6 observations <span style="color: green;">CC</span>	5 observations <span style="color: green;">CC</span>	4 observations <span style="color: green;">CC</span>
4 observations <span style="color: green;">CC</span>	4 observations <span style="color: green;">CC</span>	4 observations <span style="color: green;">CC</span>	3 observations <span style="color: green;">CC</span>	3 observations <span style="color: green;">CC</span>
3 observations <span style="color: green;">CC</span>	3 observations <span style="color: green;">CC</span>	3 observations <span style="color: green;">CC</span>	2 observations <span style="color: green;">CC</span>	2 observations <span style="color: green;">CC</span>

<https://www.inaturalist.org/projects/shoreline-aquatic-park-bioblitz-cscscs-2018>

*3<sup>rd</sup> Annual*  
**CITIZEN SCIENCE**  
*for Conservation in Southern California*  
**SYMPOSIUM**

**MODERATED PANEL  
DISCUSSION**

**2:00 p.m. – 3:00 p.m.**

**Saturday, March 24, 2018 at the Aquarium of the Pacific in Long Beach, CA**

Moderated Panel Discussion

# THE ROLE OF TECHNOLOGY IN CITIZEN SCIENCE

*Moderated by* Lila Higgins



Photo Courtesy of USC Sea Grant

Citizen Science for Conservation in Southern California Symposium  
Saturday, March 24, 2018 at the Aquarium of the Pacific in Long Beach, CA

Moderated Panel Discussion

# THE ROLE OF TECHNOLOGY IN CITIZEN SCIENCE

*Moderated by Lila Higgins*



Photo Courtesy of USC Sea Grant

Citizen Science for Conservation in Southern California Symposium  
March 24, 2018 at the Aquarium of the Pacific



# **The Role of Technology in Citizen Science**

**A moderated discussion with a well-rounded overview  
of the role of technology in citizen science.**

**Our panelists discussed some of the ways technology  
has facilitated data collection and improved the data  
QA/QC of the observations, some of the drawbacks, as  
well as, unexpected benefits they have experienced  
with the shift towards technology-based  
citizen science programs.**

**Moderated by Lila Higgins** – *Natural History Museum of LA County (NHMLA)*

## **Panelists**

**Brooke D. Simmons, Ph.D.** – *Einstein Fellow, Astrophysicist & Citizen Science Expert, UCSD*

**Kimball L. Garrett** – *Ornithology Collections Manager, NHMLA*

**Rachel Meyer, Ph.D.** – *Executive Director, CALeDNA citizen science program, UCLA*

**Shannon Waters** – *Smartfin Project Manager, Surfrider Foundation*



# Panel Highlights

## **How do you ensure your volunteers not only understand your study's methods but also have a meaningful experience participating?**

We're trying to figure that out right now. One way we are trying to connect is by looking at bioblitzes and iNaturalist observations, and then sending someone from our team to lead a group of volunteers to also collect eDNA samples when there is a high frequency of observations. We're really interested in seeing how eDNA aligns with citizen science observations, like through iNaturalist, and are continuing to brainstorm.

One way of ensuring a meaningful experience is having a field experience in which people are interacting with the naturalist and learning through it. We really want to make sure that people feel that they're a part of this community. We have volunteers talking to a scientist and we're asking them what would be interesting about a place where we can collect, and we'll give them feedback as we analyze the sample. We are also building a web interface to communicate the results back to the community. This will help volunteers engage with the data and the results and actually help inspire us as to how we should use it to help shape policy, etc. – *Rachel Meyer, Ph.D.*

## **What has been the most unexpected benefit of using technology, specifically for citizen science?**

I think that question needs a little dissecting, because you have to separate the expected from the unexpected. We can expect that technology is going to help citizen science branch out into communities that would be harder to branch out into. Technology is also predictably making citizen science more portable and more diverse and reach into a lot of different disciplines. And you can expect serendipitous discoveries. Having all of those eyes on your data makes it more likely that you'll come across something unexpected and be able to recognize that its interesting. – *Brooke Simmons, Ph.D.*

## Panel Highlights (continued...)

### What has been the most unexpected benefit of using technology...? (continued)

Perhaps the most unexpected benefit was increasing accessibility. We get feedback all the time that projects on the Zooniverse enable people to take part in communities that they wouldn't otherwise have been able to. One volunteer has a host of medical problems and can't leave her house, but she's extremely involved. Basically she has time and she's willing to give it to us and she's actually become a really very good scientist in her own right. We also got feedback once that said I'm terminally ill and this makes me feel like I'm able to do something meaningful in the time I have left. – *Brooke Simmons, Ph.D.*

Maybe this is a self-selecting group that wants to use a data collecting fin while surfing, but we are seeing a great amount of investment from the surfers. We have surfers going out to surf even when the surf is bad because they know that they are going to be collecting data. They'll go when its bad, when it's small, when they should be on a short board but will go on their long board because that's what the study needs. – *Shannon Waters*

One of the benefits I got from eBird is in my conversations with people about their observations, I get an awful lot of “thank you for educating me about that” or “I didn't think of this or that.” – *Kimball Garrett*

One of the partners we worked with on the Great Sunflower Project, Gretchen LeBuhn, shared this story of this woman who was in an old people's home and was wheelchair bound and she would go out and participate in the Great Sunflower Project in the garden they had and she managed to meet Gretchen one day and she said “Gretchen thank you so much, I didn't think I had anything else to give to the world and this is making me feel like I have more to give back to the world.” So there are these amazing unintended benefits from citizen science. – *Lila Higgins*

## Panel Highlights (continued...)

### **How have technological innovations changed data quality standards for your projects?**

Before eBird, we had one source for aggregated bird observation data, the Christmas Bird Count, which was a snapshot for a specific spot at a specific time of year. eBird was a phenomenal step forward. It is worth emphasizing that the internet is one of the most important pieces of technology underlying everything that we are doing. The project started 15-20 years ago, and the biggest benefit for data quality was the addition of photographs. Photographs help both in documenting unusual occurrences but also in proving whether or not the submitting observer actually know how to identify birds. Because if the photo is misidentified, it can tell us about the accuracy of the recorded observations that were not photographed. So it helps us deal with variations in observers quality. One downside I see is the speed. Birders out in the field are able to enter data instantaneously, and I think you could enter it more thoroughly, more carefully, and provide more documentation if you hold off a bit. I think we need to take a step back, just because technology enables us to do something instantaneously, maybe there are advantages to being more thorough. – *Kimball Garrett*

### **Thoughts on the instant gratification piece of the citizen science with technology or apps**

That gets at the gamification discussion around citizen science, to what extent do we want to make the science bit of it secondary to the game that drives people to participate. I'm an anti-fan of things like leader boards and ranking lists because whatever you're ranking if you don't get it exactly right or it isn't aligned with the goals of your science you're driving to the wrong thing. For example when we started with Zooniverse we got it absolutely wrong, we used to rank people based on the number of scientific identifications they'd done, which motivated people to classify more organisms as quickly as possible which decreased the accuracy of the identifications. Which makes sense because users were being rewarded for the quantity and not the quality of their classifications. – *Brooke Simmons, Ph.D.*

## Panel Highlights (continued...)

**Question from the audience: Where does citizen science draw the line to prevent people from using data for nefarious purposes** (such as targeting endangered species)

Anybody dealing with species occurrence databases has to grapple with the issue of masking data. eBird masks occurrence data for certain threatened or highly sensitive species, and a lot of similar databases do that. Even scientific collections will not put data out for certain species. So that is always something you always want to consider, what are the unintended uses of the data? – *Kimball Garrett*

Before we publish any of our eDNA data we run it through an IUCN filter and scientists will decide if there are any observations that need to be withheld or masked from the public view. – *Rachel Meyer, Ph.D.*

On iNaturalist there are tools in place to obscure observations, and some things get automatically obscured, so that only the curators and the observer can see where something was located, but everyone else sees a huge circle with no indication of where within that circle the observation was made. – *Lila Higgins*

**How does the experience for citizen scientists change when technology is integrated?**

This is something I was really hoping to learn from being here. In our project, one benefit is that the technology is in the fin. The QA/QC is handled by the engineers and researchers working on the project, which means there's less human error that can go into collecting the data. It's not fool proof – you could turn this fin on right now and collect data on the environmental conditions of this room, as opposed to water temperature which is what we're looking for. – *Shannon Waters*

## Panel Highlights (continued...)

### **How does the experience for citizen scientists change when technology is integrated?**

On the other hand, there's a push and pull between streamlining data collection and at keeping in touch with the citizens and community members that you're trying to reach. So as an example right now, to upload data, a surfer has to use an app on their phone to upload the data from their fin to the cloud. There are a lot of issues with that because it transfers over Bluetooth low energy. So we're looking to change that to cellular transfer so the surfer wouldn't have to do anything to upload the data, but then that loses the touchpoint because when they're going through the process of uploading their data then they can look at their information and start get an idea their surf zone. Which is what led me to pose this question to the panel, how can we transition to improved technologies and still capture these teachable moments in our programs? – *Shannon Waters*

Don't hide the science. You get much better, deeper science, when you engage the community in your science.  
– *Brooke Simmons, Ph.D.*

**Another question that came up was this kind of tension between going out and exploring and discovering and studying nature, and being tied to a device. As Kimball put it, is exploring nature with your device another manifestation of “Nature Deficit Disorder”?**

Coming back to eBird, they are building in more ways to actually record natural history observations, other than just recording that this species was here at this time on this day. So for example, now you can enter through a pull-down menu the breeding behavior confirmation codes (feeding young in a nest or building a nest, etc.). – *Kimball Garrett*

## Panel Highlights (continued...)

### **Is exploring nature with your device another manifestation of “Nature Deficit Disorder”? (continued)**

eBird is starting to rebuild the kinds of natural history information that used to be observational where you'd go out with a notebook and record lots of information about what birds were doing, but initially was not recorded in eBird. So now you can actually use it as a platform to enter boundless amounts of natural history information and that takes careful observation. But the question is how many people actually take the time to enter this information into the app? I'd hate to lose that fascination with going out and observing and absorbing. – *Kimball Garrett*

We had lofty ambitions when we first started, but since then we've really scaled back the amount of information we ask people for to just the bare essentials, namely date, time, and GPS. – *Rachel Meyer, Ph.D.*

### **How can technology aid in making community/citizen science more inclusive or more diversified?**

That's a really complex question. I think we still have to do all the hard work of really reaching out and being on the ground. We can't just be like “if you build it they will come”. At the planetarium we found that we still needed to go out to schools and show the kids that never thought of themselves as scientist how they can contribute to science. I just want to sound the note of caution that we still have to do the work on a routine basis. – *Brooke Simmons, Ph.D.*

I think about this a lot because if you look for example at the bird sighting contributions in the greater LA area you see a big gaps in the urban core areas. Are those gaps real because urbanization has excluded birds, or is it artificial because that's not where most bird watchers live? Maybe we could use technology like *Merlin*, which allows you to enter in some information about a bird to get an identification. There are some pitfalls, but it ties to eBird data. I think if we could get this app into school yards, that would be a great way to infill data through urban areas that may be under-served. – *Kimball Garrett*

## Panel Highlights (continued...)

### How can technology aid in making community/citizen science more inclusive...? (continued)

Coastal access has for a long time been one of the key pillars of our focus areas. We've traditionally thought of that in terms of making sure there aren't any gates, developments, or barriers blocking access to the beach or coastal area. But now we've started re-framing that to how can we bring communities that normally wouldn't access the beach to the beach and give them the opportunities to really enjoy these spaces that we're working to protect and conserve. – *Shannon Waters*

### Question from the Audience: What can do about the subtlety of the difference between using the term “citizen science” when it sounds like what you're doing is “community science education”?

Well eBird is a little bit different in that it is a gigantic database that can then be mined to answer specific scientific questions. The citizens come in because the database wouldn't be gigantic enough to answer lots of questions without their input, so it's not like we developed eBird because we want to know the answer to this question, but rather there's enough of it that there's science in there somewhere and there have been a lot of publications using it. – *Kimball Garrett*

This is actually one of my biggest pet peeves, not because there are projects that don't really ever intend to publish scientific results about something, but because we call them all kind of the same thing, that's confusing. So it gets back to the terminology. It is a fairly new field so we're still working out how we should categorize things. – *Brooke Simmons, Ph.D.*

I fell like perhaps I misrepresented the project by not really talking enough about what data is for. But we absolutely do have scientific goals, we are collecting this data specifically so that researchers can use it in their studies. For example we have a researcher in the UK that uses satellite data to measure changes in sea surface temperature, but he finds that there's actually a 1-2°C difference between the satellite and in-situ measurements, so he's using this data to calibrate his satellite data.

– *Shannon Waters*

## Panel Closing Thoughts by Panel Moderator

Just to wrap it up I think its really fascinating that every single one of you in all of your projects really focused on the importance of community, and how even though this is a panel on technology, we cannot discount that community and the importance of the human to human interactions, whether that's through an interface of an app or through an online platform or bringing people together specifically to have people on the beach with their smart phones. So I think that's something that makes me feel really proud of the work that we're all doing in this room, because even through technology we're bringing people together and helping to answer these really wicked big problems with these really big datasets so lets give a round of applause to our panel. – *Lila Higgins*

*3<sup>rd</sup> Annual*  
**CITIZEN SCIENCE**  
*for Conservation in Southern California*  
**SYMPOSIUM**

**SPECIAL SESSION**  
**PRESENTATIONS**

**3:00 – 3:45 p.m.**

*10-12 min talks with time for Questions from the Audience*

**Saturday, March 24, 2018 at the Aquarium of the Pacific in Long Beach, CA**

# Special Session Presentations

## Our Urban Watershed: Fostering Connections Through Exploration & Citizen Science

by Alexandria M. Warneke, M.S. – *Cabrillo National Monument, NPS*

## Global FinPrint: A Collaboration with the Aquarium of the Pacific

by Erin McCombs, M.S. – *Aquarium of the Pacific*

## Snapshot Cal Coast: 21 Century Natural History Along the California Coast

by Alison Young & Rebecca Johnson – *California Academy of Sciences*



# Alexandria Warneke

**Our Urban Watershed:  
Fostering Connections  
Through Exploration  
& Citizen Science**

# **Our Urban Watershed: Fostering Connections Through Exploration & Citizen Science**

by Alexandria M. Warneke, M.S.; *Cabrillo National Monument, NPS*

In collaboration, Cabrillo National Monument and Ocean Discovery Institute developed a dynamic, hands-on science education program for students in the City Heights community. City Heights is a highly urbanized, densely populated, and ethnically diverse neighborhood in central San Diego. *Our Urban Watershed: Fostering Connections Through Exploration and Citizen Science* provides a unique opportunity to engage students in nature and scientific inquiry in meaningful ways across their local watershed both in their neighborhood and in their National Park. Utilizing a four-part guided and inquiry-based program with a classroom activities and field components, students explore watershed biodiversity and the challenges of living in the urban landscape. Using technological platforms provided by ESRI and the same techniques as park biologists, students participate in citizen science, long-term monitoring, and data analysis. The program is concluded with guided reflection and critical thinking regarding resource management and tools for action. The ultimate goal is that the *Our Urban Watershed* program sparks passion and excitement for science in the next generation of environmental leaders. Through this continuum of impacting experiences, we commit to the positive development of a healthy and enriched community – inspiring lifelong connections between students and their unique outdoor spaces.

# OUR URBAN WATERSHED

FOSTERING CONNECTIONS  
THROUGH EXPLORATION  
AND CITIZEN SCIENCE

ALEX WARNEKE, M.Sc. – CABRILLO NM



Photo Credit: Patricia Simpson

# CABRILLO NATIONAL MONUMENT





CITIZEN SCIENCE 2.0



BIO  
DIVERSE  
CITY





# GOALS

#1 Exploration of watershed biodiversity and the challenges of living in the urban landscape.

#2 Participation in citizen science, long-term monitoring, and data analysis techniques.

#3 Reflection and critical thinking regarding resource management and tools for action.





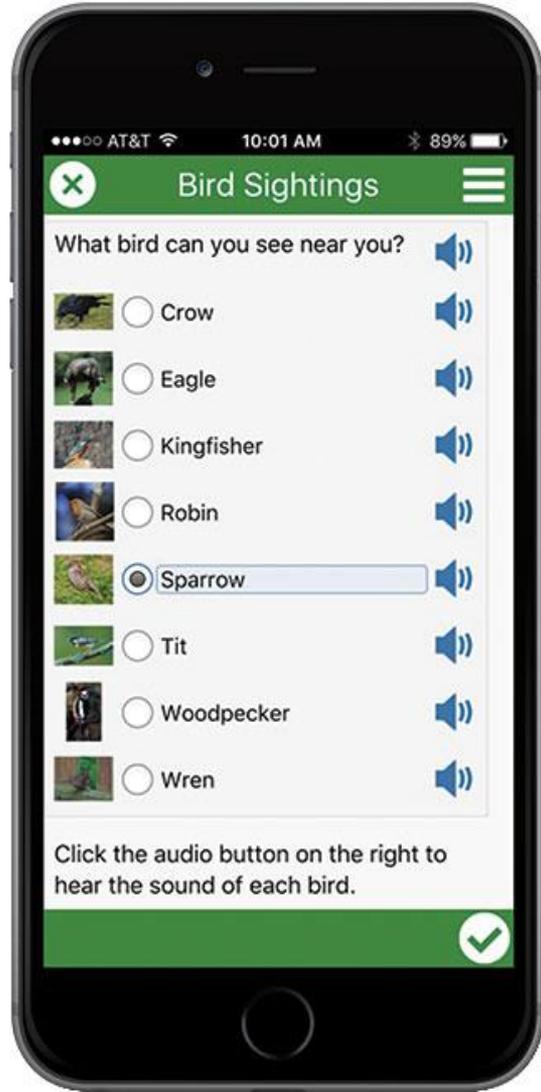
DATA COLLECTION METHODS



# Survey123 for ArcGIS

ESRI REPRESENTATIVE:  
MATTHEW BRINKMANN

(p) 800-447-9778 EXT. 6610  
(e) [mbrinkmann@esri.com](mailto:mbrinkmann@esri.com)



Andrew

[+ Create a New Survey](#)

All surveys ▾



Record(s): 38

CAHA Locations Survey



Record(s): 4

OUW Transect Data



Record(s): 0

Displaced Vessel Assessment Form 10.2...



Record(s): 5

OUW Site Overview



Record(s): 19

IRMA - Practice Condition Assessment F...



Record(s): 0

OUW Site Overview - Copy\_1



OUW Transect Data - Copy\_1



Record(s): 0

Urban Watershed





Add



Edit



Appearance



Settings

7

### General Plant Height \*

Observing the transect, what is the average height of the 5-meter section of study.

-Please Select-



8

### General Plant Density \*

Observing the transect, are the plants spread out with a lot of soil visible (Low), a mix of plants and some soil visible (Mid), not a lot of soil visible and a lot of plant matter present (High).

-Please Select-



9

### Transect Exposure \*

With a team member's toes at the edge of the sidewalk near the transect tape, what general direction are they facing?

Select One.

-Please Select-



10

### Environmental Data

Using the Kestrel, input the current atmospheric data at the transect's location

Jump to questions 11-20



Singleline Text



Multiline Text



Single Choice



Multiple Choice



Dropdown



Rating



Likert



Number



Date



Time



GeoPoint



Image



Email



Website



Note

Saved



Preview

Publish

Filtered Count: 4 (Total: 4)

9/14/17 - 9/15/17

View Settings



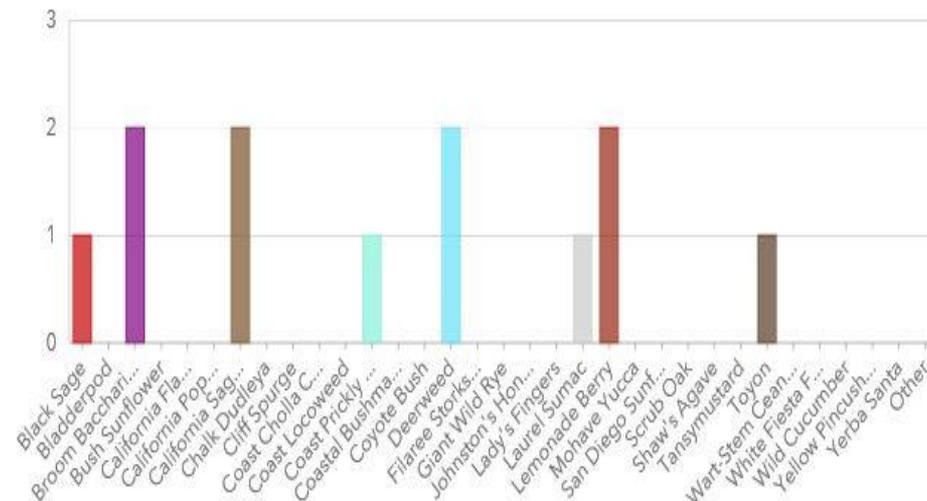
Set Visibility



Print Current View

Plant Diversity

Column Bar



[Hide Table](#)



Other Response

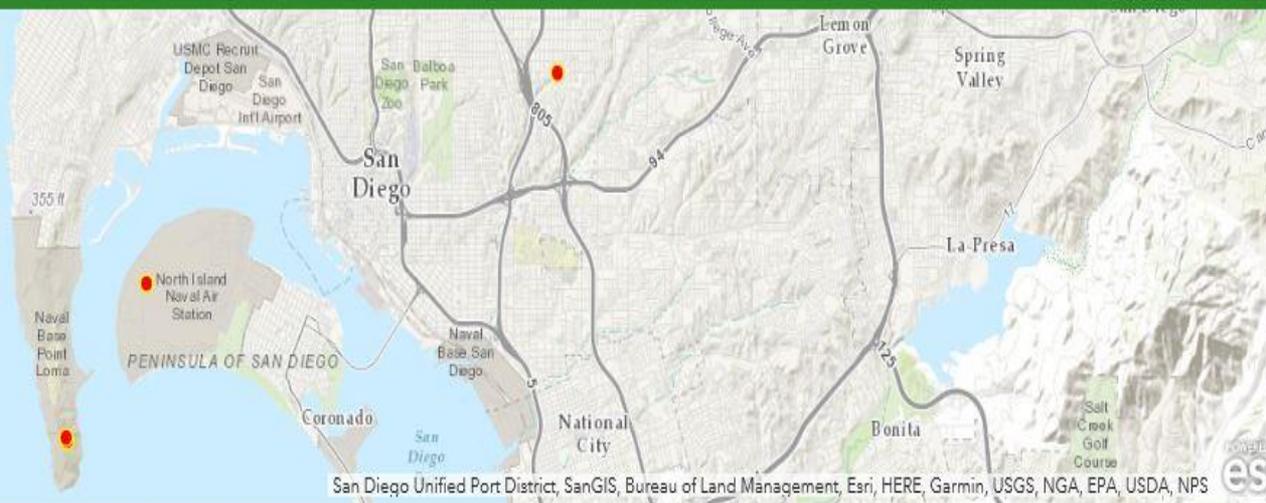


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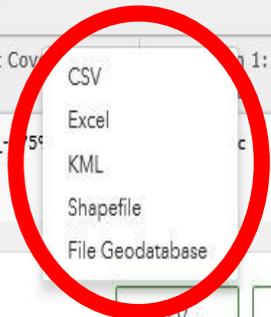
Sort

Answers	Count	Percentage
Black Sage	1	25.00%



SurveyPoint (Features: 4, Selected: 0)

Today's Location	Today's Date	Current Time	Transect Number	Meter Section of Study (Group Work)	Select Individual Meter.	Plant Diversity	Other - Plant Diversity	Plant Coverage	Other - Obs
ing Lab_ Manzanita nyon	Sep 14, 2017	14:37	Transect 3	6m - 10m	Meter 6	Black_Sage,Laurel_Su mac,Coast_Prickly_Pea r		51%_5%	1: Species



Show Individual Response





# Year on iNat 2017



543,015

People Signed Up

[SIGN UP](#) →

[MEET](#) →



# Learnings & **NEXT STEPS**



# QUESTIONS

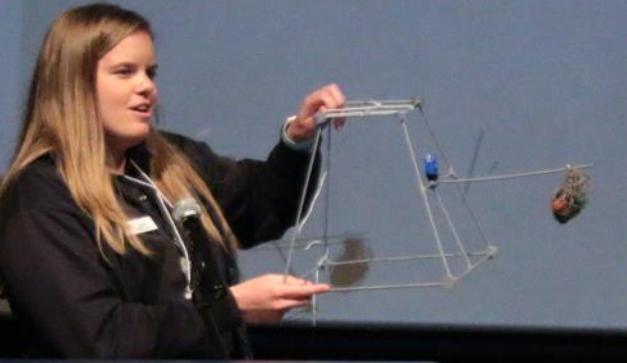




**Rochelle Mothokakobo**  
rmothokakobo@oceandi.org



**Alex Warneke**  
alexandria\_warneke@nps.gov



# Erin McCombs

**Global FinPrint:  
A Collaboration with the  
Aquarium of the Pacific**

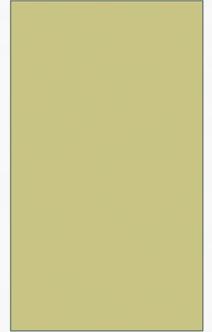
# **Global FinPrint: A Collaboration with the Aquarium of the Pacific**

by Erin McCombs, M.S.; *Aquarium of the Pacific*

Worldwide, 25% of shark species are threatened with extinction. To better understand this problem, Global FinPrint uses Baited Remote Underwater Videos or “BRUVs” to study shark distribution and population at 400 reefs around the world. A team of Citizen Scientists at the Aquarium of the Pacific is getting involved by viewing BRUVs in the Pacific Ocean and marking the appearance of sharks and rays before sending the information to scientists for further analysis. The information gained in this study will help inform policy decisions to protect reefs and shark populations, and identify shark hotspots that need protection.

# GLOBAL FINPRINT

A COLLABORATION WITH THE AQUARIUM OF THE PACIFIC



Erin McCombs, M.S.  
Aquarium of the Pacific

# WHY DO WE CARE ABOUT SHARKS?

- Maintain balance of food web
- Important for ecotourism
- Still a lot to learn
  
- Threats:
  - Unsustainable fishing practices (overfishing of prey items, shark finning, bycatch)
  - Habitat degradation

# GLOBAL FINPRINT: A WORLDWIDE SHARK SURVEY



Surveying  
400 reefs  
around  
the world

# HOW ARE THEY STUDYING SHARKS?

BRUVS = Baited Remote Underwater Videos



# WHAT ARE THEY LOOKING TO FIND?



Bright Spots



Refuges



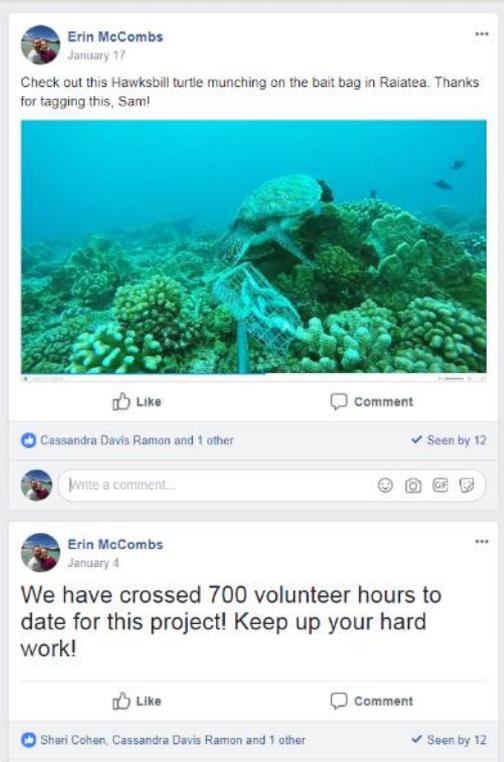
Hot Spots

# WHAT IS HAPPENING AT THE AQUARIUM?

Citizen scientists work remotely to view BRUVs, annotating the appearance of sharks, rays, eels and turtles



# ENGAGING REMOTE CITIZEN SCIENTISTS



- Facebook group
- Frequent Updates
- Sharing in person
- Firm schedule

# WHAT OUR CITIZEN SCIENTISTS SAY

- They like...
  - Being a part of a project
  - Seeing results and knowing they contributed
  - Seeing different parts of the world (underwater)
  - Observing fish behavior
  - Learning new things
  - Working on something as a family



# THE CHALLENGES



- Technology
- Maximum capacity
- The Ending
- Dependency on partner institutions

ANY QUESTIONS?



# Alison Young

**Snapshot Cal Coast:  
21 Century Natural History  
Along the California Coast**

# Snapshot Cal Coast: 21 Century Natural History Along the California Coast

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

Snapshot Cal Coast mobilizes and focuses community-based coastal stewards to address the need for open and accessible coast-wide biodiversity data. This citizen science program scales local, place-based species documentation efforts to occur simultaneously along the entire California Coast. We utilize the data collection platform iNaturalist and scaffold it with in-person bioblitz events, through close partnership the California Marine Protected Area Collaborative Network and other organizations who are dedicated to advancing marine education, research, and protection. Using this technology not only allows us to create a dataset that is instantly available to scientists and marine managers, but also democratizes this type of marine science, making it accessible for anyone to participate without the barrier of needing to be trained to identify species. 2018 will be the third year of Snapshot Cal Coast, building upon the more than 20,000 observations of 1634 species collected over the first two years.

# Snapshot Cal Coast: 21st century natural history along the California coast



SNAPSHOT

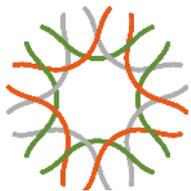


CAL COAST



CALIFORNIA  
ACADEMY OF  
SCIENCES

Rebecca Johnson & **Alison Young**  
Citizen Science Manager  
California Academy of Sciences  
@alisonkestrel



CALIFORNIA  
ACADEMY OF  
SCIENCES



iNaturalist

Details

1st

Unknown  
View Suggestions

Notes

Feb 28, 2018 Time

San Mateo County, CA, USA  
Lat: 37.49521944... Lon: -122.499833...

Location is Open

It is captive or cultivated

Projects 2

Observation

kestrel Feb 28



Monterey Dorid  
*Monterey Dorid*



My Observations

9,116 OBSERVATIONS | 1,903 SPECIES | 10,771 IDENTIFICATIONS

Starburst Anemone 1w  
San Mateo County, CA, USA 2

Hooked Slippersnail 1w  
San Mateo, California, United States 2

Bat Star 1w  
San Mateo County, CA, USA 2

Gumboot Chiton 1w  
San Mateo County, CA, USA 2

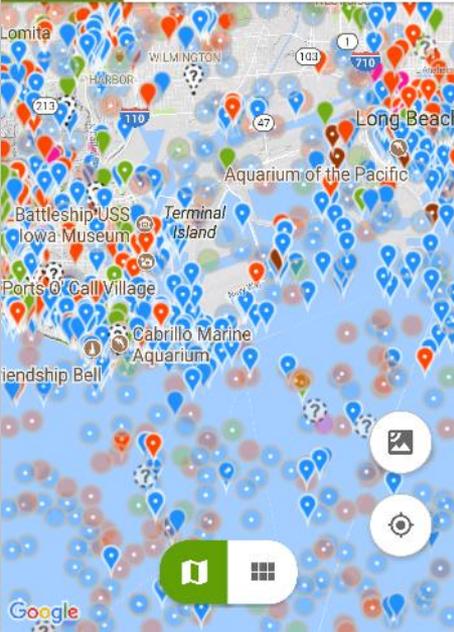
White-spotted Sea Goddess 1w  
San Mateo, California, United States 2

San Diego Dorid 1w  
San Mateo County, CA, USA 2

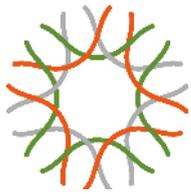
Pacific Purple Sea Urchin 2

Exploring All Map Area

9,296 OBSERVATIONS | 1,210 SPECIES | 623 OBSERVERS | 809 IDENTIFIED







CALIFORNIA  
ACADEMY OF  
SCIENCES



Details

    
 1st

 **Unknown**  
View Suggestions

 Notes

 Feb 28, 2018 Time

 **San Mateo County, CA, USA**  
Lat: 37.49521944... Lon: -122.499833...

 Location is Open

 It is captive or cultivated

 Projects 2

Species Search

We're pretty sure it's in this genus:

 **Doris**  
Genus *Doris* ✓

Here's our top 10 species suggestions:

 **Monterey Dorid**  
*Doris montereyensis* ↕ ✓  
[Visually Similar / Seen Nearby](#)

 **Sea Lemon**  
*Peltochordis nobilis* ↕ ✓  
[Visually Similar / Seen Nearby](#)

 **Heath's Dorid**  
*Geitodoris heathi* ↕ ✓

Observation

 kestrel Feb 28



 **Monterey Dorid**  
*Monterey Dorid* →

  
Pillar Point Air Force Station  
Maverick's Beach



# Monterey Dorid (*Doris montereyensis*) Research Grade

Edit



kestrel

9,124 observations

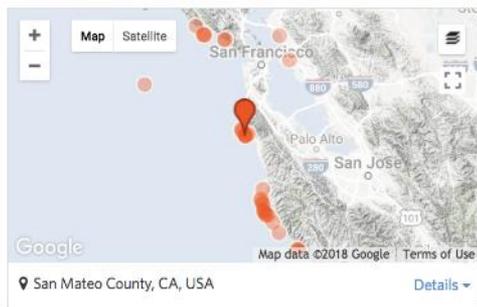


Observed:

Feb 28, 2018

Submitted:

Mar 1, 2018 · 2:17 AM -03



☆ jeffgoddard faved this observation

## Activity



kestrel suggested an ID

Improving 23d



Monterey Dorid  
*Doris montereyensis*

Compare



mcduck suggested an ID

22d



Monterey Dorid  
*Doris montereyensis*

## Community ID

[What's this?](#)

Monterey Dorid (*Doris montereyensis*)

Cumulative IDs: 2 of 2



0 2/3rds 2

Agree

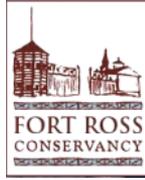
Compare

About

Annotations



Calla Allison



COLLABORATIVE NETWORK





ADD  
OBSERVATIONS



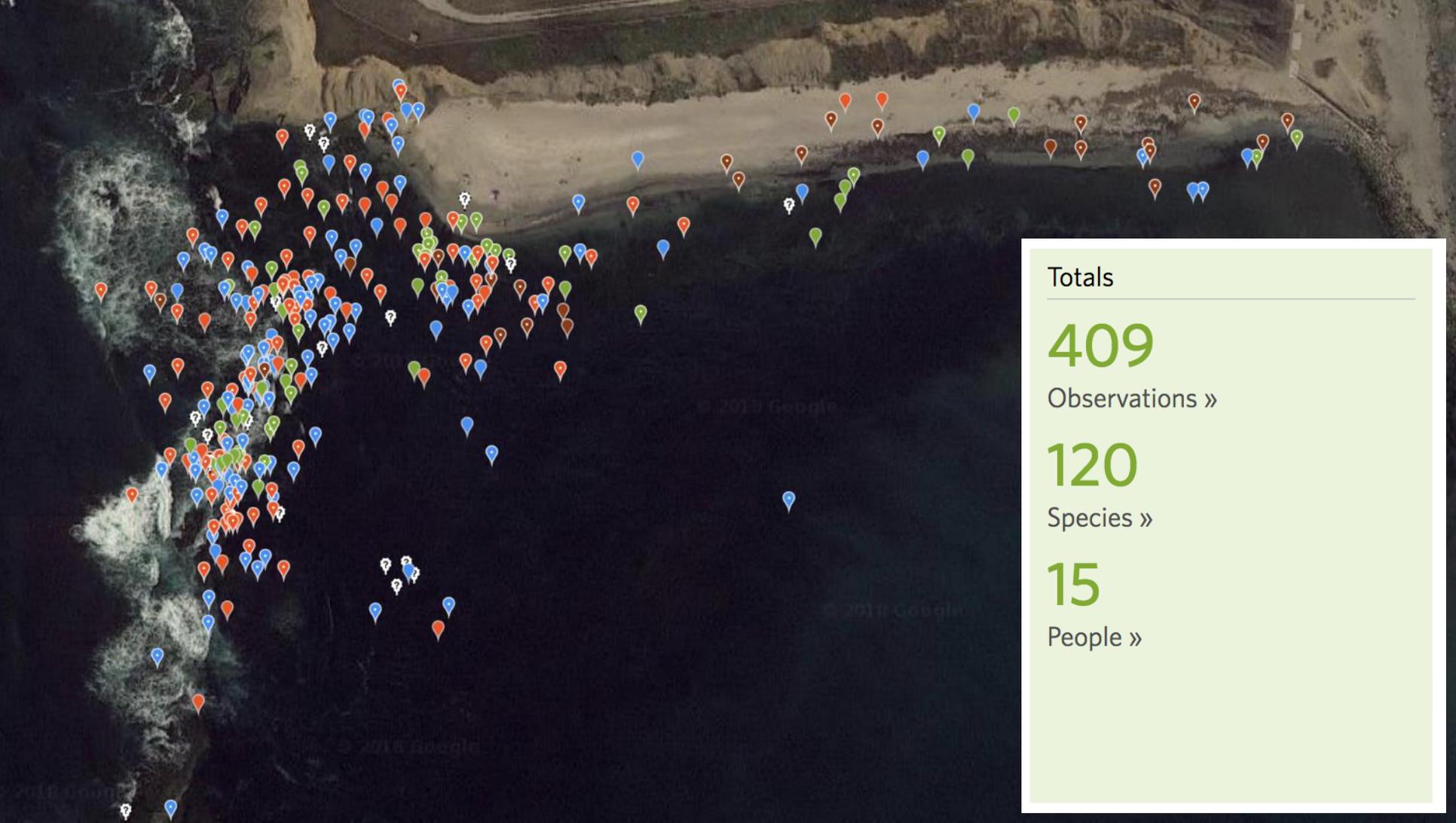
# Snapshot Cal Coast 2017: Pillar Point Reef bioblitz

June 23, 2017, 5:00 AM - 9:00 AM PDT





Calla Allison



Totals

---

**409**

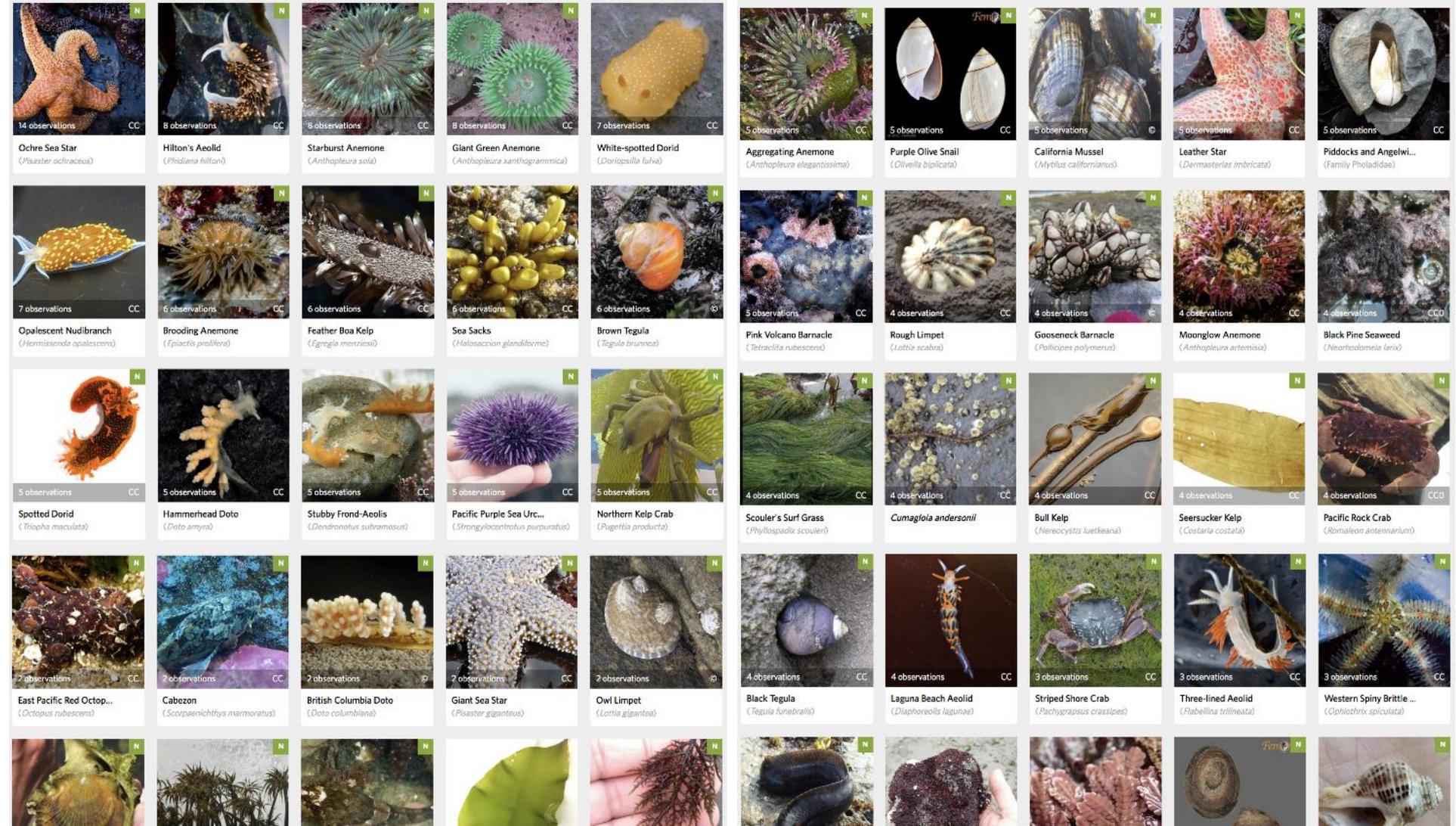
Observations »

**120**

Species »

**15**

People »





# Point Lobos Bioblitz - Monterey County



Charlotte Kelley

# Pelican Cove Bioblitz - Los Angeles County



# Davenport Landing Bioblitz - Santa Cruz County



# Muir Beach Bioblitz - Marin County



# Seaside Day Camp Bioblitz - San Diego County



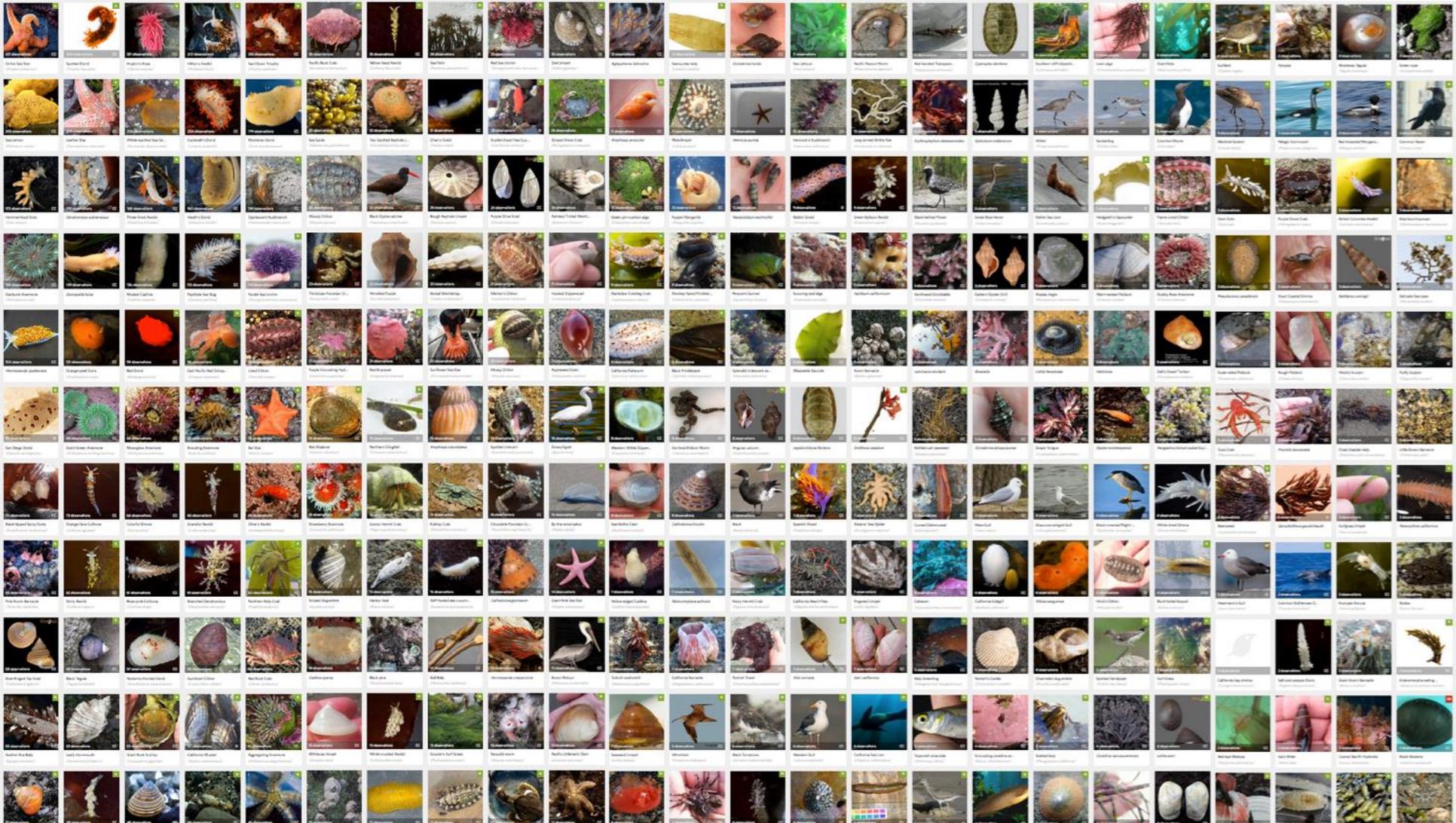
SNAPSHOT



CAL COAST

2017







# Snapshot Cal Coast 2016

June 1, 2016 to June 12, 2016



## Totals

7327

Observations »

990

Species »

413

People »



CALIFORNIA  
ACADEMY OF  
SCIENCES



# Snapshot Cal Coast 2017

June 23, 2017 to July 2, 2017

## Totals

---

**13880**

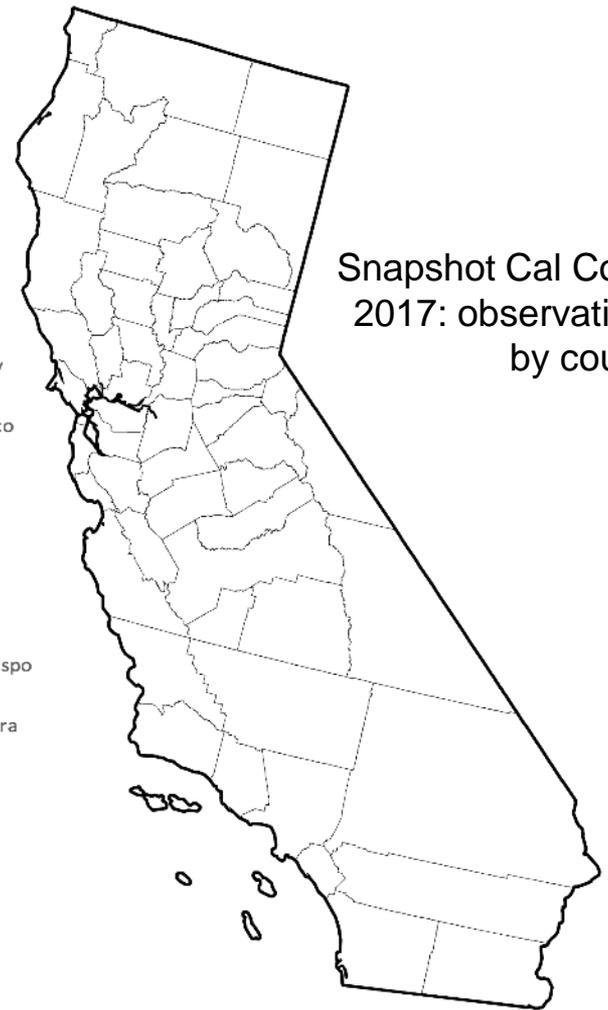
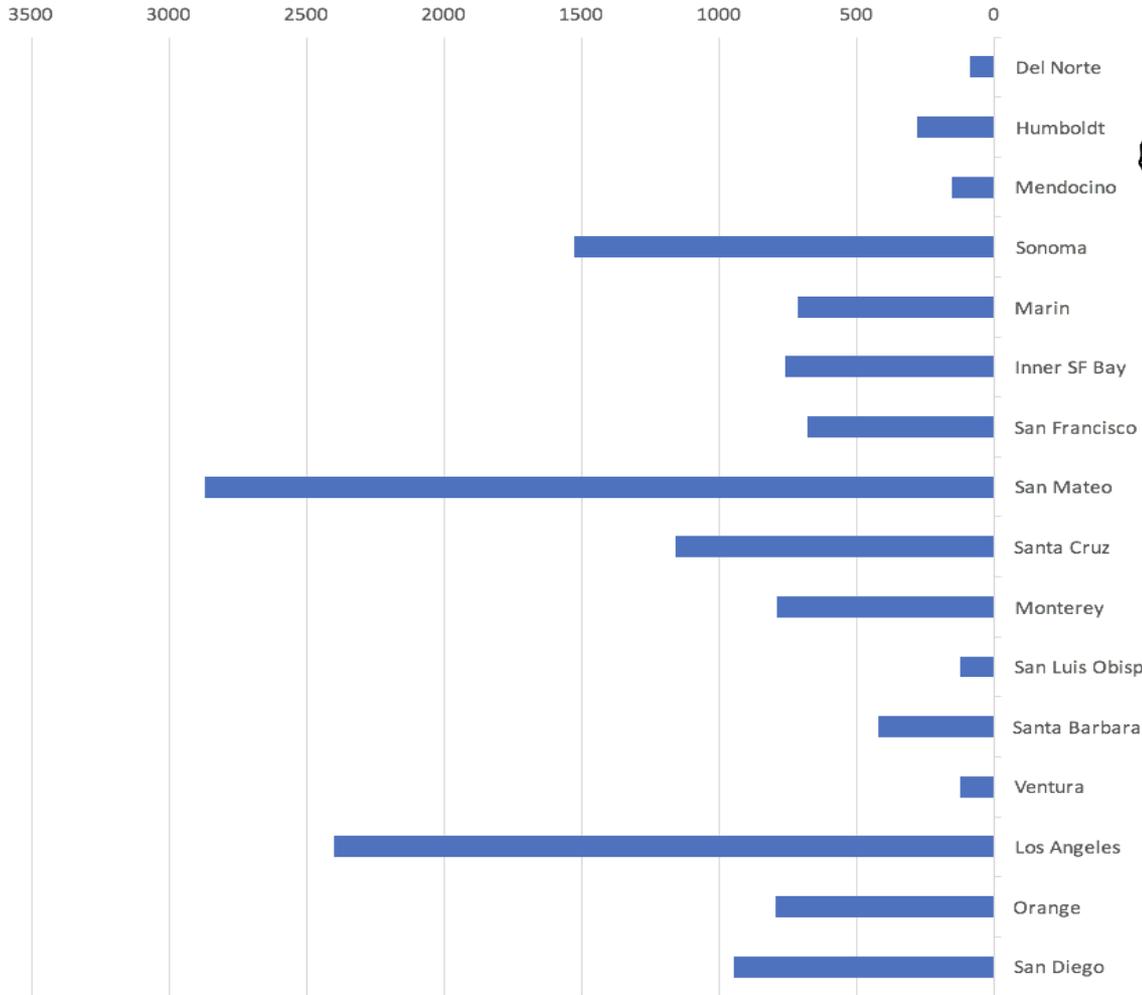
Observations »

**1359**

Species »

**683**

People »



Snapshot Cal Coast  
2017: observations  
by county

*Laminaria ephemera* (brown algae)



Brenna Green



Robin Agarwal

*Synidotea laticauda* (marine isopod)



Richard Smart

*Chondrocanthus spinosus*  
(red algae)



Alison Young

*Odontosyllis phosphorea* (polychaete worm)

*Parazoanthus lucificum* (zooanthid)



Phil Garner

*Betaeus macginitieae* (snapping shrimp)



Phil Garner



Phil Garner

Fragile tube worm  
(*Salmacina tribranchiata*)



Phil Garner

*Solemya reidi* (bivalve)



© Tiffany Poon

Tiffany Poon

Yellowfin Fringehead (*Neoclinus stephensae*)

Island Fox (*Urocyon littoralis*)

\*Near threatened



ariggle

Black abalone (*Haliotis cracherodii*)

\*Endangered



Robin Agarwal



Tiffany Poon

California Sheephead  
(*Semicossyphus pulcher*)

\*Vulnerable



Colin Harris

American Glehnia (*Glehnia littoralis*  
spp. *leiocarpa*) \*Vulnerable



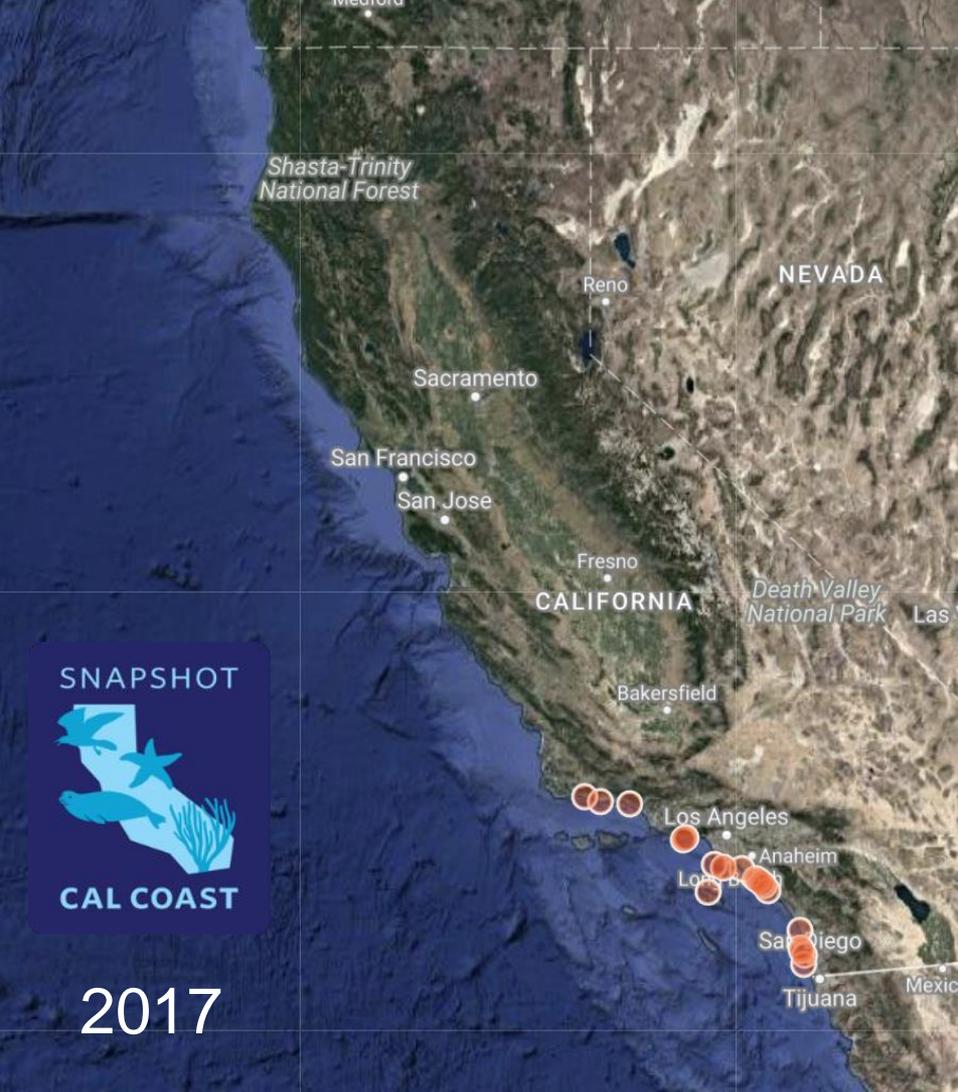
Jennifer Rycenga

Powdery sea-fog lichen (*Niebla*  
*cephalota*) \*Vulnerable

Western Beach Tiger Beetle  
(*Cicindella latesignata*)  
\*Critically imperilled



u\_phantasticus



SNAPSHOT



CAL COAST

2017



Sea Hares (*Aplysia* spp.)

# Hilton's Aeolid (*Phidiana hiltoni*)



SNAPSHOT



CAL COAST

[#SnapshotCalCoast](https://www.instagram.com/SnapshotCalCoast)

# SNAPSHOT CAL COAST

JUNE 13-20, 2018

*Join the statewide movement to discover, record & share observations of plants & animals found along the California Coast. Your observations will help us better understand & protect marine life in California.*

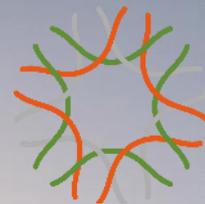
## ***How to record observations along the California Coast:***

1. Download the iNaturalist app & make an account.
2. Get to the beach or tidepools!
3. Take photos & make observations of plants & animals.
4. Learn as you upload observations & share with the iNaturalist community.



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To learn more and find events near you, visit: <https://www.calacademy.org/citizen-science/snapshot-cal-coast>



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ACADEMY OF  
SCIENCES

**THANK YOU!**

**Thank you to everyone who organized events,  
shared their finds, and identified observations.**

MPA Collaboratives & Calla Allison  
Resources Legacy Fund Foundation

Alison Young  
ayoung@calacademy.org  
@alisonkestrel  
calacademy.org/calcoast

*3<sup>rd</sup> Annual*  
**CITIZEN SCIENCE**  
*for Conservation in Southern California*  
**SYMPOSIUM**

**POSTER SESSION**  
and  
**RECEPTION**

4:00 – 6:00 p.m.

Saturday, March 24, 2018 at the Aquarium of the Pacific in Long Beach, CA

# Poster Presentations

## Using iNaturalist for Artificial Reef Monitoring

by **Michael Bear** – *Ocean Sanctuaries*

## Onshore Sea Turtle Observation and Monitoring

by **Cassandra Davis**<sup>1-2</sup>, **Barbara Ramon**<sup>2</sup>, **Kelly Burkhead**<sup>2</sup> and **Jennifer Lentz**<sup>1-2</sup>  
– *Aquarium of the Pacific*<sup>1</sup> & the *Southern California Sea Turtle Monitoring Project*<sup>2</sup>

## Short, Cheap...But Sweet! Informing Local Governments Regarding Wildlife Activity in a Recreational Area Through Inexpensive and Noninvasive Trail Camera Monitoring

by **Korinna Domingo** – *Mountain Lion Foundation* and *Humboldt State University*

## Catalina Marine Society Citizen Science Projects

by **Karen Norris** and **Craig Gelpi** – *Catalina Marine Society*

## Harmful Algal Blooms: Phytoplankton Monitoring Comparison of Two Locations in the Southern California Bight

by **Gavin Peters** and **Jenny Peters** – *Aquarium of the Pacific, HABwatch, CDPH Marine Biotoxin Monitoring*

## An Overview of the Findings of the North American Freshwater Turtle Research Group's Citizen Science Program

by **Michael Skibsted** – *Bio Time, Inc.*

# Using iNaturalist for Artificial Reef Monitoring

by Michael Bear; *Ocean Sanctuaries*

In 2000, the City of San Diego in collaboration with the San Diego Oceans Foundation (SDOF), purchased, cleaned and sank a 366 foot-long Canadian warship called the HMCS Yukon to create an artificial reef, a task at which has been spectacularly successful. Sitting at the bottom of the San Diego coast, the Yukon attracts dozens of local marine life species and is becoming a revenue-generating attraction for tourist divers from around the world.

When this project started, both the SDOF and the local scientific community were curious to understand the effects of an artificial reef on local fish populations and surrounding marine life. A joint study was undertaken by SDOF and Dr. Ed Parnell of Scripps Institution of Oceanography and released in 2004.<sup>1</sup> Crucial to the study was data gathered by local citizen science divers to generate a baseline of marine life species on the ship.

Ocean Sanctuaries, San Diego's first citizen science oriented, ocean non-profit is conducting a follow up study to the pioneering work of Dr. Parnell and colleagues using iNaturalist to log and identify marine species which have made the Yukon their home since 2004.

In 2017 Ocean Sanctuaries launched the *Yukon Marine Life Survey* project on *iNaturalist*, a biodiversity research platform.

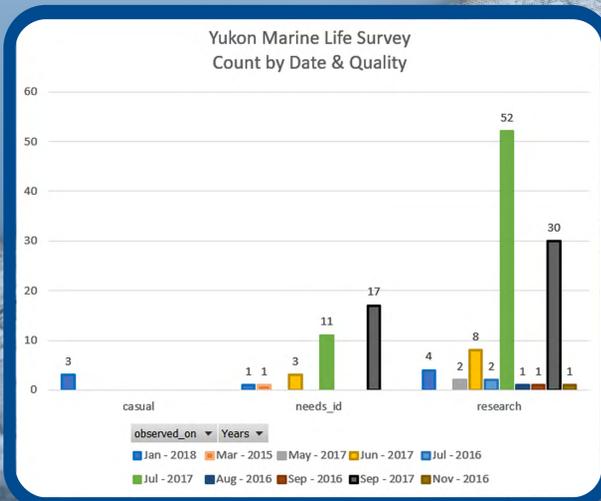
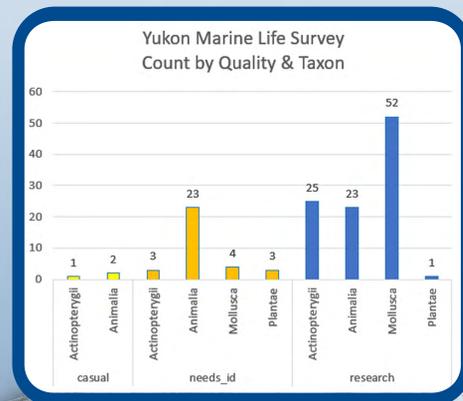
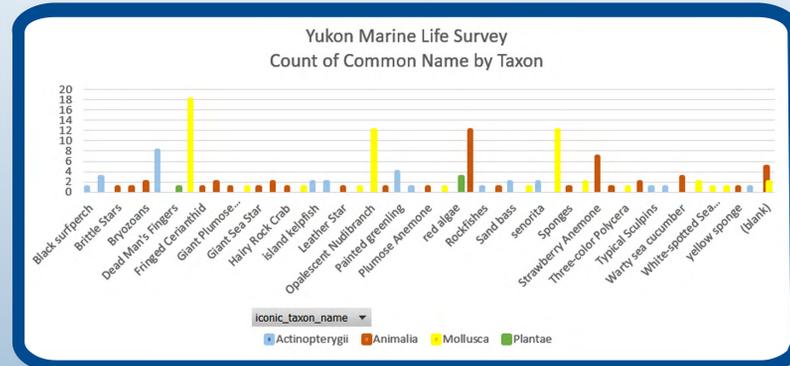
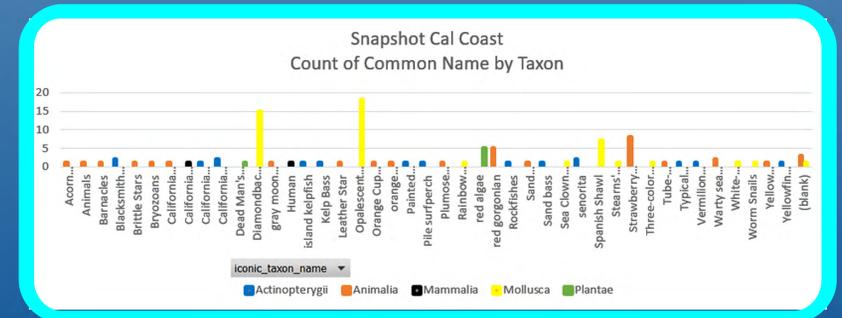
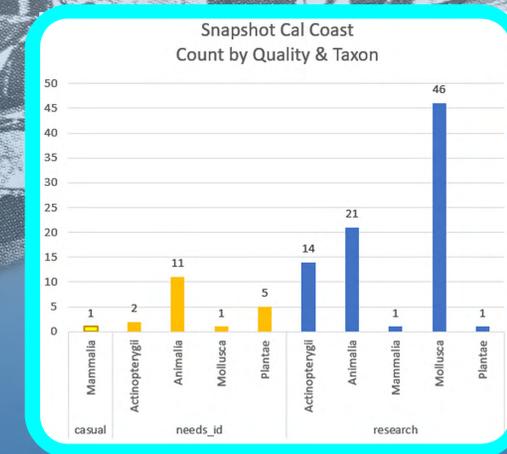


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www.OceanSanctuaries.org  
facebook.com/oceansanctuaries  
501c3 Nonprofit EIN 46-5209246

In June & July of 2017  
Ocean Sanctuaries participated in the  
*Snapshot Cal Coast* with our *Yukon Nudibranch Bioblitz*

# Onshore Sea Turtle Observation and Monitoring

by Cassandra Davis, M.Sc.<sup>1,2</sup>, Barbara Ramon<sup>2</sup>, Kelly Burkhead<sup>2</sup>, & Jennifer Lentz, Ph.D.<sup>1,2</sup>  
*Aquarium of the Pacific*<sup>1</sup> & the *Southern California Sea Turtle Monitoring Project*<sup>2</sup>

Increased populations and urban development around coastal areas has led to increased opportunities for individuals to interact with sea turtles in and around major cities, developments, and recreational areas. It is increasingly important for local and regulatory agencies to understand populations and movement habits of these highly migratory species. Monitoring and identifying resident populations can inform habitat and land usage decisions, better inform recreational users of coastal areas (including divers, paddle boarders, boaters and fishermen), and provide population insights for regulatory agencies.

The discovery of a resident population of Eastern Pacific green sea turtles (*Chelonia mydas*) in Long Beach led to an exploration of shore-based population monitoring using citizen scientists, and the formation of the Southern California Sea Turtle Monitoring Program. The year over year citizen science observations of sea turtles in the San Gabriel River contribute to a greater understanding of the local population of *Chelonia mydas*, and provide insight into successful onshore monitoring of sea turtle populations.

This study provides a conceptual overview of the materials and methods for recording onshore sea turtle observations with citizen scientists, which have been tested and proven successful through the Southern California Sea Turtle Monitoring Project, and examines the potential for observation projects at additional locations.

Cassandra Davis, MSc<sup>1,2</sup>, Barbara Ramon<sup>2</sup>, Kelly Burkhead<sup>2</sup>, Jennifer Lentz, PhD<sup>1,2</sup>  
 Aquarium of the Pacific<sup>1</sup>, Southern California Sea Turtle Monitoring Project<sup>2</sup>

## Abstract

Increased populations and urban development around coastal areas has led to increased opportunities for individuals to interact with sea turtles in and around major cities, developments, and recreational areas. It is increasingly important for local and regulatory agencies to understand population dynamics and movement habits of these highly migratory species. Identifying and monitoring resident populations of protected species like sea turtles can inform habitat and land usage decisions, better inform recreational users of coastal areas (including divers, paddle boarders, boaters and fishermen), and provide population insights for regulatory agencies.

This poster provides an overview of the materials and methods for recording onshore sea turtle observations with citizen scientists which have been tested and proven successful through the Southern California Sea Turtle Monitoring Project on the San Gabriel River.



Fig 1: Citizen science volunteers observe and record sea turtle surfacings from the shoreline of the San Gabriel River in Southern California. Photo: C. Davis

## Onshore Observation

- Onshore observation of sea turtle populations offers distinct advantages for citizen science projects.
  - It is more accessible than watercraft or underwater observation
  - Over time, observations can provide movement and abundance patterns for researchers and regulatory agencies.
  - Establish residency, support population studies, and identify locations or times of preferred habitat for the sea turtles.
  - Observations can be recorded with little or no technology.
  - Does not disturb the habitat or behavior of the species.
  - Educational opportunities for participants and passer-by to learn about the local ecosystem and habitat for resident nearshore turtles.
- Possibility for high observation frequency (monthly or weekly) to provide insight on population changes over time.
- Surrounding communities may already have observations or interactions with the turtles, providing both local history and conservation opportunities.
- Photo identification projects may be possible from onshore observation locations.

## Methods

- Observers are stationed at periodic locations near known or hypothesized sea turtle habitats.
- Locations with high probability of activity (warmer waters, seagrass beds, etc.) interspersed with locations that are not known to be favored sea turtle habitats.
  - Initially done to provide baseline data
  - Discovered turtle movement in unexpected locations
- Observations recorded on an observation sheet
  - Approximate size of turtle
  - Number of observed sea turtles
  - Time of surfacing
  - Additional notes, as appropriate (notable wildlife or human activity)

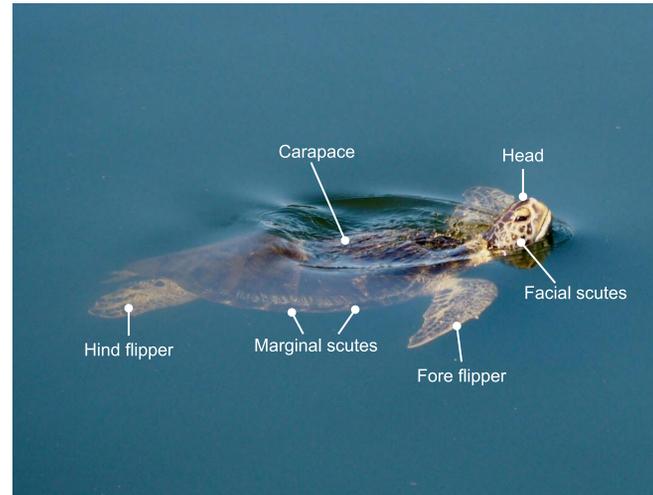


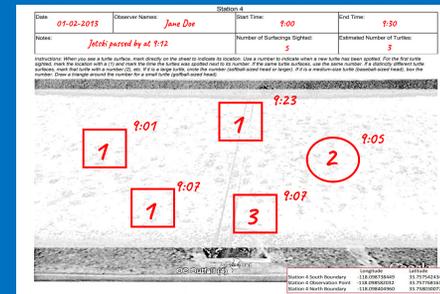
Fig 2: Eastern Pacific Green Sea Turtle surfacing in the San Gabriel River, March 4, 2018. Photo by S. Owechko

## Estimating the number of observed sea turtles

The same turtle may surface more than once during an observation session. The estimated number of turtles present captures the experience of the observer team at that time and station. Sea turtles are numbered as they are identified.

Estimating the number of observed sea turtles conservatively, is based on:

- Seeing multiple turtles surface at once
- Distinctly different head size
- Identifiable marking(s) or coloration
  - Visible shell barnacles
  - Distinctive facial scutes



## Best Practices

- Identify and mark static observation points and observation boundaries.
- Ideal observation point ("stations") are at least 2 meters and no more than 8 meters above the water.
- Record data with at least two observers present (three is preferable).
- Concurrent observation periods at stations with consistent radio contact.
- Observation periods of no greater than 30 minutes at a single station.
  - Records turtle activity
  - Reduces the identification of the same turtle as different individuals when estimating the number of sea turtles sighted in both high and low activity sites.
  - Avoids observer fatigue
- Briefly review observation protocol before each observation session.

## Observable Size

- Estimating size informs population statistics
- Body size is best estimated by head size when recording surfacing data, as other parts of the turtle are not consistently observed.
- Size is recorded by drawing a symbol around the number that represents the individual turtle.
- Large Pacific green sea turtle:**
  - Head is the size of a grapefruit or a softball or larger
  - Possibly adult, of reproductive age
  - Identified with a circle on observation sheets
- Medium Pacific green sea turtle:**
  - Head is about the size of a baseball or an orange
  - Juvenile, probably not yet of reproductive age
  - Identified with a square on observation sheets
  - Most common size seen
- Small Pacific green sea turtle:**
  - Head is about the size of a golf ball or small lime
  - Small juvenile, not yet of reproductive age
  - Identified with a triangle on observation sheets

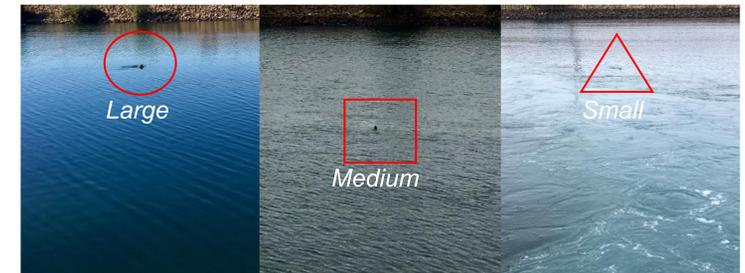


Fig 3: Observation sizes for sea turtles surfacing in the San Gabriel River. Photos: C. Davis

## Recommendations

- Where onshore observations are not possible due to geography, personal paddleboats or paddleboards may allow similar surface observations for nearshore sea turtle research.
- Photo ID: Photo observations are recommended in conjunction with recorded population observations. The ability to record data through photography is limited by equipment, especially shutter speed and optical zoom.
  - Cell phone recordings are possible, but unlikely to regularly yield usable identification data with current technology.
  - A zoom of at least 150x is recommended for onshore photo observation.
- When determining new observation locations, morning and evening times should be tested to measure local turtle activity.
- Observation times may need to be variable in order to provide enough light for observation (+/- 1 to 2 hours from sunrise or sunset).



Fig 4: Individual watercraft may be used where shoreline viewing is not possible. Photo: C. Davis

## **Short, Cheap...But Sweet!**

# **Informing Local Governments Regarding Wildlife Activity in a Recreational Area Through Inexpensive and Noninvasive Trail Camera Methodology**

by Korinna Domingo; *Mountain Lion Foundation* and *Humboldt State University*

Local governments value information about wildlife presence in order to reassure and inform residents about how best to coexist in recreation areas and along the urban edge, to inform land-use planning, and to conserve ecosystems. But most cities cannot afford peer-reviewed studies to document wildlife. This survey identified species of mammals that live in the Verdugo Mountains in Burbank, California using inexpensive, noninvasive techniques in collaboration with citizen scientists.

Little was known about the activity of mammals likely to interact with recreating humans relative to time of day along the primary trail system. Remote sensing cameras were deployed to compare results on fire roads, hiking trails, game trails and in areas without apparent trails.

A total of 162 photos were captured using motion-activated infrared cameras between January and June 2017. Of these, 33% were coyote, 17% bobcat, 14% gray fox, 12% striped skunk, 10% mule deer, 8% opossum, 5% mountain lion, and 1% other.



# Short, cheap... but sweet!

## Informing local government regarding wildlife activity in a recreational area through inexpensive and noninvasive trail camera methodology

Korinna Domingo, Outreach Coordinator, Mountain Lion Foundation, Wildlife Management & Conservation, Humboldt State University

### Introduction

Local governments value information about wildlife presence in order to reassure and inform residents about how best to coexist in recreation areas and along the urban edge, to inform land-use planning, and to conserve ecosystems. But most cities cannot afford elaborate peer-reviewed studies to document wildlife. Little was known about the activity of mammals likely to interact with recreating humans relative to time of day, temperature, moon phase, or habitat type along the primary trail systems in the Verdugo Mountains of Burbank and Glendale, California.



### Objectives

To use inexpensive, noninvasive techniques to inform recreation managers of wildlife presence along popular hiking trails so they may appropriately advise the community on how to limit negative interactions with urban wildlife. To use videos and pictures from the study for wildlife education and to foster a culture of peaceful coexistence on the urban-wildlife interface.



Male mountain lion P-41 walks on a fire road in Stough Canyon Nature Area at 7:58 PM. Twelve minutes later, at 8:10 PM a group of hikers walked down the same path. Establishing when and where large carnivores persist in recreation areas using remote cameras can help to inform management decisions and improve community safety. Signs can be posted at popular trail heads to advise the public that they should hike during daylight hours. During night hikes, walk in groups, use flashlights, speak when walking, and leave small dogs at home. Lions will go out of their way to avoid humans.



A female mountain lion (*Puma concolor*) makes her way down a canyon, traveling on a dried river bed that is off-trail and far from established roads and hiking areas. Mountain lions exhibit crepuscular behavior, which means they are active at twilight, and are also nocturnal. When human activity on roads and trails is high, this lion avoids interacting with people by taking the paths off-trail. The city of Glendale has signage posted at trail heads to inform people in recreational areas and close to residential housing of mountain lion activity, however more signage is needed throughout the Verdugo Mountain range.

### Methods

Remote sensing cameras were deployed to compare results on fire roads, hiking trails, game trails and in areas without apparent trails.



Mule deer (*Odocoileus hemionus*) walking on an established game trail.



Playful coyote (*Canis latrans*) doing zoomies on a popular hiking trail.



Female cougar (*Puma concolor*) & bobcat (*Lynx rufus*) off-trail.



Mule deer (*Odocoileus hemionus*) on the same hiking trail as above. The Old Youth Campground is a popular destination and is frequented by hikers during the daytime and nighttime hours.



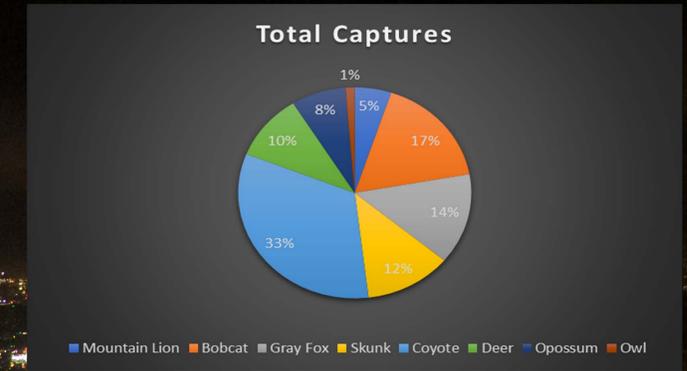
Gray fox (*Urocyon cinereoargenteus*) on a fire road. This was the first species observed in the survey and Burbank Nature Center's first confirmed sighting.



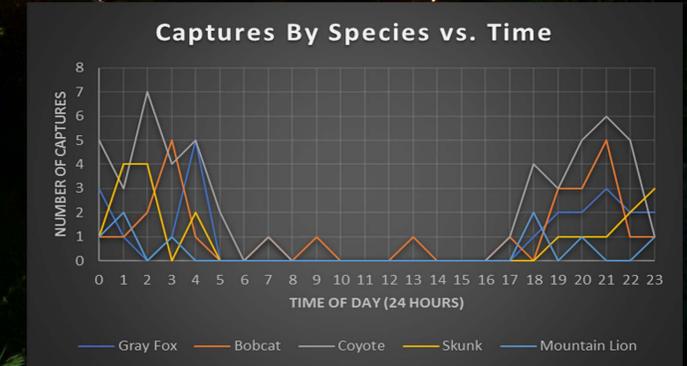
### Results

A total of 162 mammal photos were captured using motion-activated infrared cameras between January and June 2017. Of these, 33% were coyote (*Canis latrans*), 17% bobcat (*Lynx rufus*), 14% gray fox (*Urocyon cinereoargenteus*), 12% striped skunk (*Mephitis mephitis*), 10% mule deer (*Odocoileus hemionus*), 8% opossum (*Didelphimorphia*), 5% mountain lion (*Puma concolor*), and 1% other.

The majority of the photos were captured from sunset to sunrise, demonstrating that these urban animals are primarily crepuscular or nocturnal. This trend was inversely proportional to human activity. Wildlife was active during night hours in order to avoid people and frequently used fire roads to navigate through easier terrain.



Total number of captures by species divided by the total number of captures.



The number of times an animal was detected on the camera is on the y-axis. The time of day the animal was observed is shown on the x-axis. The x-axis begins at 0000 hours (midnight) and ends at 2300 hours on the right. Regardless of species type, wildlife activity was more prevalent from sunset to sunrise.

### Acknowledgements

Mountain Lion Foundation. Dr. Mary Bober, Santa Monica College (SMC), SMC Associated Students, Adrine Ovasapyan & Brian Pucio, Burbank Nature Center. City of Burbank. All the donors who contributed to crowdfunding efforts for the initial camera purchases and supplies.

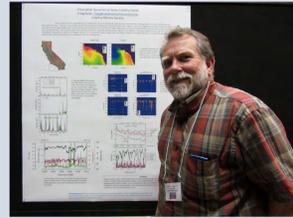


# Catalina Marine Society Citizen Science Projects

by Karren Norris and Craig Gelpi; *Catalina Marine Society*

The Catalina Marine Society is chartered to advance scientific knowledge of the local ocean. We design projects for which SCUBA divers and boaters can use their expertise to deploy sensors that automatically record important ocean data. Other volunteers organize and analyze the measurements. The Society has made considerable contributions to the understanding of the Southern California Bight using ocean temperature measurements gathered by citizen scientists coupled with data obtained from universities and government laboratories. Projects include determining a relationship between El Nino and urchin populations, measuring the vertical eddy diffusion coefficient, and chlorophyll dynamics in the Southern California Bight.

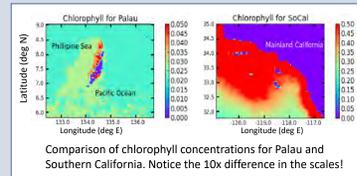
# Outreach Conferences



## OceanBights Magazine



Semi-annual magazine featuring articles by local researchers and contributors



## Natural History Lectures and Classes

**Catalina Marine Society presents**

**Kevin Lee and a Natural History of Opisthobranchs**

Kevin Lee is an adventurous, keen on the outdoors, the hardest SCUBA diver just 10 years ago and quickly found a passion and skill for underwater photography.

He's shared the waters of all 7 continents, seeking his favorite subject: opisthobranchs.

See Kevin's both images and learn about sea slug's behavioral aspects such as defense tactics, feeding, locomotion, and reproduction. Attention will be given to local opisthobranchs, helping you understand and perhaps to locate our local sea slug.

Light refreshments will be served following the presentation.

Saturday, August 24, 2 - 3:30 p.m.  
Catalina Marine Aquarium  
3700 Stephen M. White Dr  
Los Angeles, CA 90072  
www.catalinamarinesociety.org

## Trade Shows and Clubs



Long Beach Scuba Show



Aquarium of the Pacific Divers' Day

The Catalina Marine Society is proud to partner with the Aquarium of the Pacific, the California Science Center, the Antelope Valley Divers, UCLA, USC, the Dana Point Ocean Institute, the California Conservation Divers, and the Catalina Conservancy.

# Catalina Marine Society

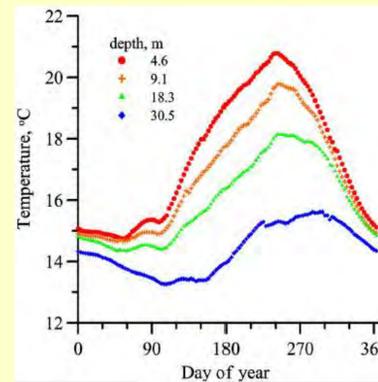
Understanding our Local Ocean

www.catalinamarinesociety.org

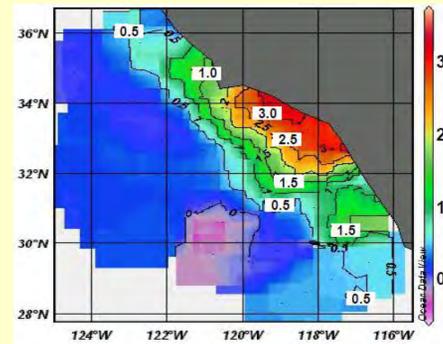


## Data Analysis

Does deep water heat at the same time as surface water?



Ten years of temperature data collected by divers at Catalina were used to determine the annual cycle at the island. Water at depth is warmer later in the year than surface water.

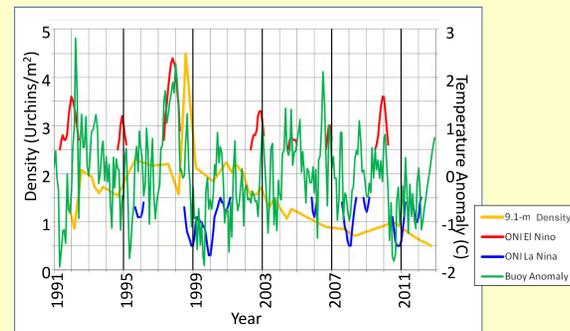


What is the rate of vertical mixing?

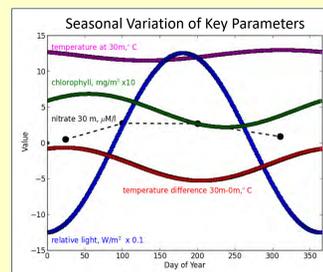
Water in the inner Southern California Bight is trapped. Surface water is heated through solar insolation and vertical eddy diffusion mixes the water. So heat is transported downward at a rate up to 0.3 meter/day.

## Are Urchins and El Niños linked?

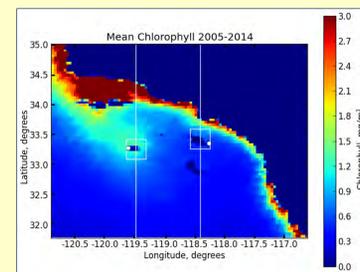
- Buoy temperature anomalies align somewhat with the El Niño index
- 9.1-m urchin density (Crowned, Red, Purple) show some correspondence to the temperature anomaly
- 9.1-m urchin density shows no correspondence to the El Niño index except an extreme increase in density 10 months after the 1997-1998 El Niño



## What are the Chlorophyll dynamics in SoCal?



Chlorophyll is in phase with stratification, implying it is controlled by vertical eddy diffusion.



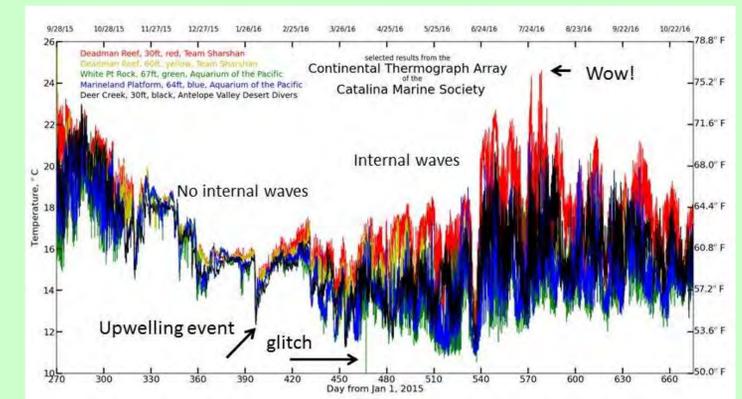
# Data Collection

## Depth Profiling Project



A sonde is deployed from a kayak, paddleboard, or boat and lowered to multiple depths to measure temperature, oxygen, chlorophyll, pH, and salinity. The instrument is periodically calibrated and the data are downloaded and analyzed by volunteers.

## David Tsao Continental Thermograph Array



Simple devices are deployed by volunteer divers from boat or shore. These stay in the field for 6 – 12 months to measure and record temperature every hour. They are collected and replaced, and the data are downloaded and used for CMS projects.



# Harmful Algal Blooms: Phytoplankton Monitoring Comparison of Two Locations in the Southern California Bight

by Gavin Peters and Jenny Peters; *AOP, HABwatch, CDPH Marine Biotoxin Monitoring*

This project was designed to discover the quantitative contributions of nutrient loading on marine phytoplankton. Through weekly water analysis from two locations, Redondo Beach's King Harbor and Long Beach's Rainbow Harbor near the fresh water outlet of the Los Angeles River, the main purpose of the experiment was to assign relative abundance percentages to observed phytoplankton cells. The hypothesis was that nutrients from the fresh water outlet of the LA River would create a greater prevalence of phytoplankton compared to a similar harbor without the input of these nutrients.

The California Department of Public Health (CDPH) Marine Biotoxin Monitoring Program supplies volunteers with a 20 $\mu$ m mesh phytoplankton net, 200 mL cod end for collection, identification field guides, data spread sheet, and microscope observation protocols. Using a OMAX digital compound LED microscope, three microscope slide plankton samples were averaged to obtain an accurate representation of relative abundance for each organism observed. The tallied data and water sample were sent to Richmond, California for verification by CDPH Environmental Management Branch experts. The samples were compared once a week from November to January and relative abundances were compared between locations.

Results were achieved by combining relative abundance percentages of Long Beach and comparing those to the combined percentages of Redondo Beach. The data showed phytoplankton accumulation.

The hypothesis that nutrient loading along fresh water outlets increases phytoplankton abundance was strongly supported by the results.

# Harmful Algal Blooms: Phytoplankton Monitoring Comparison of Two Locations in the Southern California Bight

By Gavin Peters and Jenny Peters, Aquarium of the Pacific, HABwatch, CDPH Marine Biotoxin Monitoring

## Statement of Problem

The goal was to test if the relative abundance of phytoplankton sampled from Long Beach Harbor, near the fresh water outlet of the Los Angeles River, would be greatly increased from the nutrient rich input compared to samples from Redondo Beach Harbor.

## Introduction

Some species of phytoplankton produce toxins that have extremely devastating effects on the environment, humans, and other animals. These Harmful Algal Blooms, or HABs, are caused by a rapid proliferation of algae due to natural and anthropogenic factors.

*Pseudo-nitzschia*, *Alexandrium*, and *Dinophysis* are the three most harmful biotoxin producing organisms along the California coast. They are responsible for Amnesic Shellfish Poisoning (ASP), Paralytic Shellfish Poisoning (PSP), and Diarrhetic Shellfish Poisoning (DSP), respectively. ASP and PSP are serious ongoing public health threats that require year-round attention.

Phytoplankton blooms occur in waters all over the globe, and have been called red tides, brown tides, or yellow tides. Since these descriptors tend to vary it is more accurate to call these natural phenomena harmful algal blooms or HABs. This experiment was designed to quantify the prevalence of phytoplankton in a nutrient rich environment.

## Materials

- 20 µm mesh plankton net fitted with a 200mL cod end
- 50-foot rope
- digital thermometer
- 16 ounce water tight collection jar
- refractometer
- pipette
- compound light microscope (100x-200x)
- glass slides and cover slips
- data collections spreadsheet
- many identification guides

## Methods

Two comparable inner harbor locations, Rainbow Harbor in Long Beach and King Harbor in Redondo Beach, were selected and sampled each week on a rotating basis for a total of six samples.

Water samples were taken using a vertical tow protocol obtaining a total depth of 50 feet. Next, the cod end was removed from the net and placed on the dock to settle before pouring the measured 200mL sample into a collection jar. The sample was immediately placed on ice in an insulated container.

A thermometer was placed in a five-gallon bucket with sea water and calibrated for 3 minutes before the temperature was recorded. A pipette was used to place a few drops of bucket water onto the refractometer prism. The salinity percentage was recorded by looking through the monocular eyepiece. The citizen science EyeOnWater app was used to calculate the Forel-Ule water color index.

A compound light microscope was used to identify all organisms and calculate the relative abundance of each cell present. Particular importance was paid to identifying cells responsible for PSP, ASP, and DSP- *Alexandrium*, *Pseudo-nitzschia*, and *Dinophysis*.

The most accurate relative abundance was assigned by averaging tallies from all slides taken. Relative abundances were assigned as a percentage for each species identified.

## Results



Figure 1: Photograph of sample taken in Long Beach from week 3. This sample showed a 94% phytoplankton prevalence.

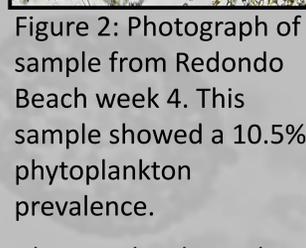


Figure 2: Photograph of sample from Redondo Beach week 4. This sample showed a 10.5% phytoplankton prevalence.

Photos taken by author

## Results cont.

Relative Abundance Percentages Observed

Phytoplankton	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
Acanthes			0		1	
Akashiwo			0			
Alexandrium			0		1	
Asterionella	8		15		0	
Bacteriastrium			0	0	1	
Ceratium	2	3	1	3	1	45
Ceratulina	3					0
Chaetoceros	8	1	15	0	0	0
Climacosphenia		1		1		0
Cocholeodinium	2			0		
Coscinodiscus	2	1	5		0	0
Cylindrotheca		1			0	2
Dactyliosolen			1	1		0
Dictyocha				0	2	0
Dinophysis						2
Ditylum			5	0	1	0
Eucampia	2					
Gonyaulax				1		0
Guinardia	2					0
Hemiaulus	2		1			
Lauderia	1					
Leptocylindrus	1		4			
Licmophora		1		1		2
Lingulodinium					2	0
Lithodesmium	2	1	3			
Melosira					0	
Navicula		1		1	1	1
Nitzschia		1		0		
Odontella	1					
Pleurosigma		2	2	1	1	1
Prorocentrum		2				
Protoperidinium		2	2	2	1	2
Pseudo-nitzschia	40	1	10			
Rhizosolenia	1					
Scrippsiella		1		1		
Skeletonema	10		15		0	
Stephanopyxis	2		2		0	
Thalassionema	1					
Thalassiosira			10			
Thalassiothrix	1					
Other	8	6	7	1	6	4
Detrius	1	75	2	85	87	35

Table 1: This table shows quantitative abundance estimates for each week, 1-6, color coded as blue for Long Beach and green for Redondo Beach.

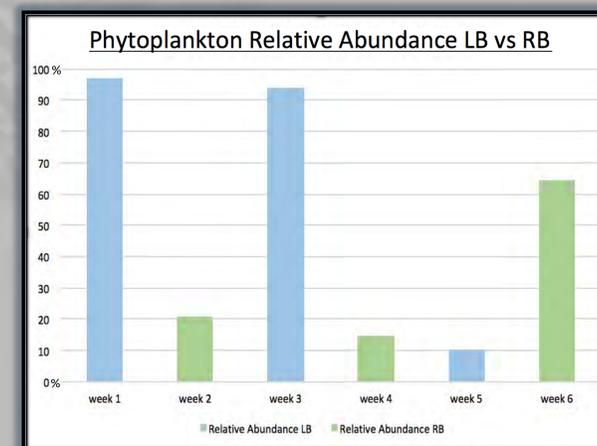


Figure 3: This graph summarizes the total relative abundance percentages each week while contrasting both locations.

## Discussion

By subtracting the “detrius” and “other” from each sample, highlighting only phytoplankton cells, Long Beach samples showed more than a 200% increase of phytoplankton in comparison to Redondo Beach.

These results strongly suggest that Southern California freshwater inputs greatly increase marine nutrients utilized by phytoplankton.

Week 5 abundance percentages seemed not to fit the data trends expected in Long Beach. Observational notes taken during sampling suggested that time of day, UV radiation exposure, and extremely low tide may have contributed to the anomaly.

Freshwater input sites should be carefully monitored as their nutrient enrichments can directly stimulate HAB events.

A BioBlitz event was held to create awareness in the general public of the anthropogenic contributions to HAB events.

Figure 4: This photograph was taken during the BioBlitz event on January 6, 2018.



Photo taken by Mr. Peters

## Future Implications

While scientists have yet to understand exactly how the marine phytoplankton make the biotoxins or what triggers their production, continuing to collect regular biotoxin monitoring data could uncover patterns of occurrence facilitating predictions of HAB events.

HAB monitoring is evolving from manual sampling to robotically sensing networks. Effective observations cannot be done with one technique alone. Until this new technology is cost effective and publically available, consistent monitoring will continue to be necessary for understanding and managing HABs.

# **An Overview of the Findings of the North American Freshwater Turtle Research Group's Citizen Science Program**

by Michael Skibsted; *Bio Time, Inc.*

For the past year I have been working with the North American Freshwater Turtle Research Group, a citizen science based program, in New Braunfels Texas. The project is a mark and recapture study that is ongoing. Volunteers (citizen scientists) participate in snorkeling for turtles and then process them, which includes PIT tagging and shell notching the turtles. The overall objective of the study is to learn as much as we can about the turtles inhabiting Comal Springs, the local spring system. Periodically, university students will attend samplings to focus on a specific aspect of the study that they will use for one of their projects. There are four samplings in each year in New Braunfels, each having somewhere around 30 volunteers attending. This poster provides statistics and data specifically focused on the turtles.

# AN OVERVIEW OF THE FINDINGS OF THE NORTH AMERICAN FRESHWATER TURTLE RESEARCH GROUP CITIZEN SCIENCE PROGRAM IN COMAL SPRINGS, TEXAS

Michael Skibsted @turtleified on Instagram / officialturtleinsta@gmail.com



## Introduction

The North American Freshwater Turtle Research Group (NAFTRG) is a citizen scientist-based study that actively operates in Texas, Florida, and Pennsylvania. All the studies conducted are long-term mark and recapture based.

## The Texas Site

One of the locations that the NAFTRG samples four times a year is Comal Springs, the largest fresh water spring in Texas. This site is home to four different species of freshwater turtles representing two different families. It is also an important source of water, for both drinking and recreation, for the surrounding communities.



## Citizen Scientist Activities

*How do citizen scientists contribute?*

Each field day lasts from dawn to dusk. The day begins with snorkeling in the spring for three hours and catching turtles. Generally each day we get over 100 turtles. At around noon, we head back to a table and house used to process the turtles.

Processing turtles includes PIT tagging, measuring, recording data from the last recapture, and finally release. All processing is done by citizen scientists. The most turtles that have been caught in the study's five year period was 496 in three days.



## Results To Date

With around 10-15 volunteers attending every sampling, and over 150 since the beginning, a lot has been done. The study has nearly 4,320 turtles in its database. Citizen science is helping to bridge the gap between the general public and the scientific community by allowing the two to work together in monitoring, managing, maintaining, and understanding the ecological issues around us.



Nearly 1,000 cooters have been marked...



300 sliders...

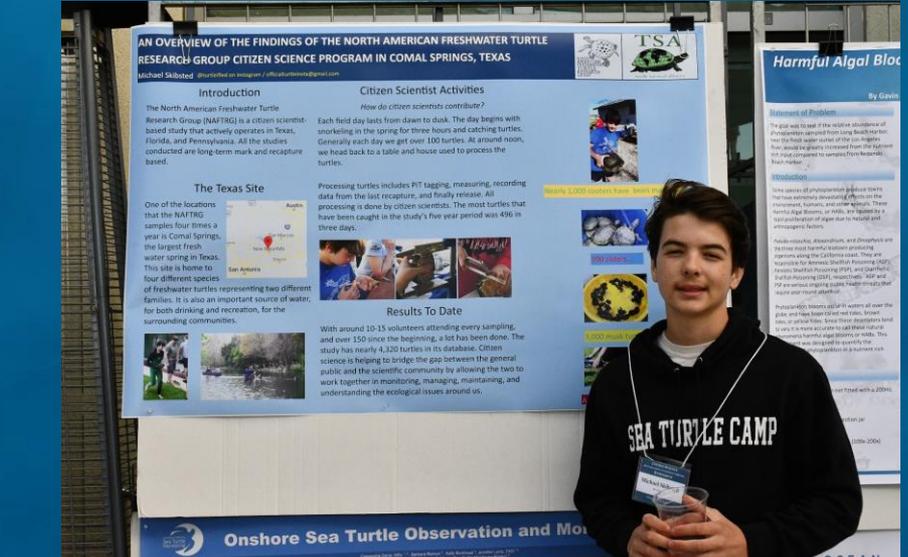
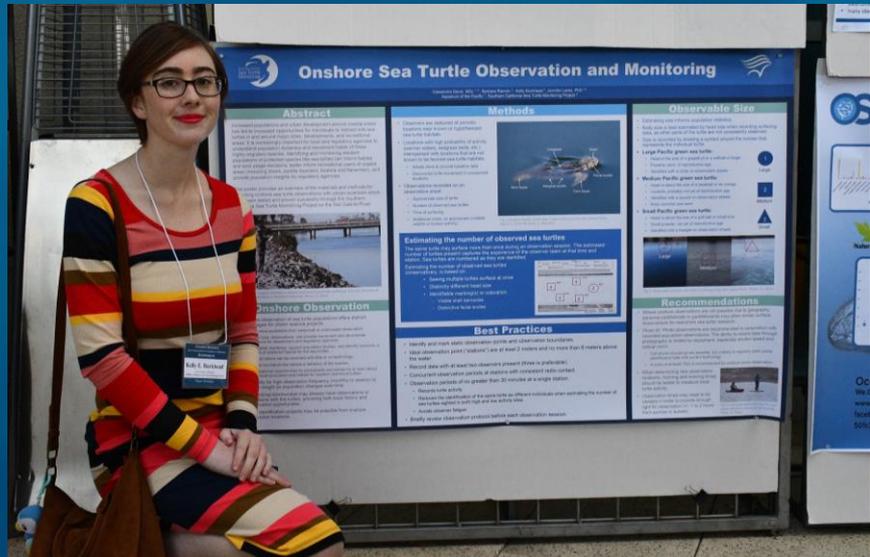


3,000 musk turtles...



And 20 snapping turtles!



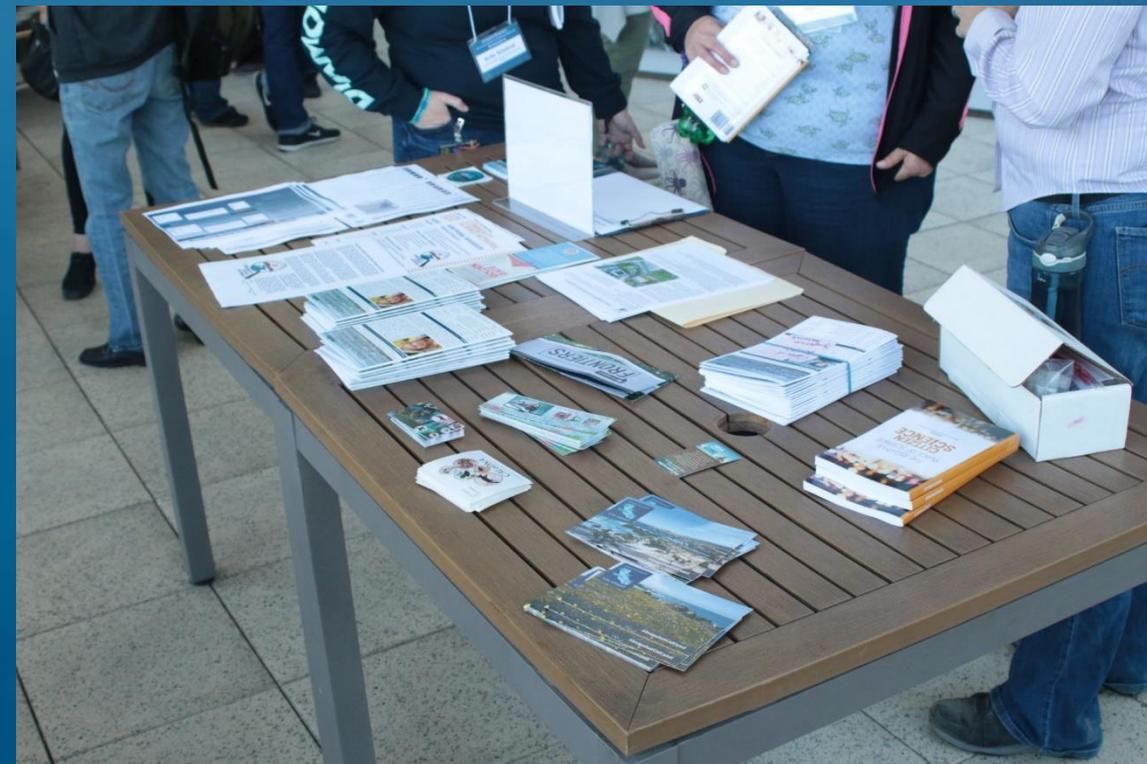














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**This document, along with information from our past & upcoming citizen science symposiums can be found online at:**  
**[http://www.aquariumofpacific.org/conservation/citsci\\_symposiums](http://www.aquariumofpacific.org/conservation/citsci_symposiums)**