Conserving Marine Life Along Catalina’s Coast

Principal Investigators: Dr. John Heidelberg, Dr. Jessica Dutton, Ann Close
Wrigley Institute for Environmental Studies
University of Southern California
2018

(Photo Credit: top left, Jude Kesl; top right and bottom, Rebecca Tiernan)
Dear Earthwatch Volunteers,

Thanks to your contributions in 2018, we had another outstanding year studying Catalina Island’s coastal environment. Our Expedition participants came from all parts of the country, and from a wide range of ages and walks of life. But despite those differences, you were united in your enthusiasm to understand and protect marine habitats and wildlife — energy that was invaluable to our project and inspiring to us. Thanks for the hard work and the excitement you brought to the experience.

As in 2017, each team monitored Catalina’s marine protected areas for harmful algae, observed the behaviors of local marine mammals, surveyed rocky intertidal biodiversity, and tracked human activity along the shore. They also explored the island, took day trips to nearby Avalon, viewed the island’s famous bison and foxes, kayaked through Blue Cavern, and night-snorkeled with glowing bioluminescent bacteria. Participants shared meals and lively discussions with university professors and students, and became part of our research community. As you saw, life at a marine lab is truly dynamic and special.

Now that 2019 is here, our staff are busily preparing for the next Earthwatch field season. Lorraine, Lynn, Meghan, Linda and the rest of the team are excited to continue our environmental monitoring, and also to add a few new research goals this year. In particular, we will start studying local anemones and their symbiotic algae across the intertidal to inform a newly-launched research project at USC. It should be another informative year in the field, building upon the important foundation of knowledge you have helped us establish.

Thank you again for supporting our work and our oceans. May 2019 bring fun adventures and new knowledge as we all continue to explore this awesome planet of ours.

Sincerely,

Dr. John Heidelberg
Associate Director
USC Wrigley Institute
SUMMARY

2018 represented Year 2 of the USC Wrigley Institute’s Earthwatch program, where we continued to build an essential catalog of baseline data about Catalina Island’s marine protected areas. By replicating Year 1’s data collection across a second year, we are beginning to better understand our observed trends about algal community seasonality, human activities, intertidal diversity, and mammal activities in this unique area. Our data contributed to one new publication and several popular and general purpose materials; it was also distributed to numerous researchers and decision-makers to inform larger state-wide programs related to California’s natural resource health and management.

GOALS, OBJECTIVES, AND RESULTS

The Catalina Earthwatch Expedition focuses on four coastal marine protected area (MPA) monitoring and research programs. Results for each program are described below:

1. HARMFUL ALGAL BLOOMS / HABWATCH PROGRAM

Volunteers in 2018 continued to collect data on microscopic algal communities in Catalina’s coastal waters to inform the HAB Watch program. HAB Watch is a study by USC faculty member Dr. Dave Caron on how harmful algal blooms (also known as HABs) occur along the coast, and how they relate to concurrent environmental factors and human coastal activities.

By understanding HAB events, Dr. Caron’s work may help to reduce their occurrences, create early warning systems, and minimize their harm to society and wildlife.

(Photo Credit: Rebecca Tiernan)
The 2018 algal diversity and abundance as measured by our Earthwatch teams is depicted below, in what is known as a heat map - the darker the color in a box, the more prevalent the algae was in the sample. Categories from lightest to darkest are binned as absent (0%, white), rare (<1%), present (1-9%), common (10-24%), abundant (25-49%) or dominant (>50%, black). Surface water temperatures are also listed, as recorded by volunteers during each sampling.

As in 2017, common dinoflagellates were the most abundant species in Catalina waters throughout the year, followed by common diatoms. Potentially toxic and noxious algal species were again also observed in low levels throughout the year, as they were in 2017, suggesting that this is a typical pattern in our local waters. As before, their presence was rare and not necessarily an indication of active toxicity, but demonstrate that the potential for harmful algal blooms is present if other environmental conditions facilitate their occurrence.

These data continue to comprise the most records ever sampled at Catalina Island for the HAB Watch program. They are providing valuable information about Catalina’s waters, and how they relate and compare to other mainland southern California sampling locations.
2. MPA WATCH PROGRAM

In 2018, Earthwatch teams helped observe human uses in our local Catalina protected areas - Blue Cavern MPA and Catalina Harbor MPA. This is part of a state-wide effort to monitor and conduct adaptive planning for California’s complex marine protected area network.

The 2018 data begins to confirm trends we initially saw in 2017. Several patterns were surprisingly consistent between years - specifically the types of human activities occurring at each MPA, the months during which they are most popular, and the abundance of users observed in any given day.

Below is a 2-Year comparison of Earthwatch observations for human activity in the local MPAs:
We also found distinct consistency in the occurrence of MPA violations. For both 2017 and 2018, violations were observed (and reported to authorities) by Earthwatch observers in August, September, and October. All violations involved boats that were fishing or anchoring where such activities are banned, and all occurred in Blue Cavern MPA, none in adjacent Cat Harbor MPA. Should these patterns continue to hold, they will provide strong guidance for Catalina Island’s limited enforcement personnel about when, where, and how to allocate their efforts throughout the year.

3. MARINE MAMMAL SURVEYS

Throughout the year, Earthwatch teams observed many marine mammals across the San Pedro Channel. Teams consistently saw dolphins, California sea lions and harbor seals exhibiting a variety of behaviors throughout the channel.

The March team also recorded gray whales and a fin whale traveling through the area. Gray whales spend the winters in Baja, Mexico and begin to migrate north towards colder climates in the spring. The highest concentration of gray whales off Catalina is typically visible between mid-February and March at the peak of their migration period, making the Earthwatch observation a perfect fit for what we’d expect of gray whales in our area. Fin whales are found offshore locally year-round. Any sighting is an exciting occurrence since this species is endangered and their migratory patterns are not well understood, although scientists think that their population has been recently increasing in southern California.
4. INTERTIDAL BIODIVERSITY SURVEYS

Our expedition teams conducted intensive surveys of the rocky intertidal both inside a local MPA (Blue Cavern MPA, at a site called the Intake Pipes) and outside the MPA (in the neighboring town of Two Harbors). At each location they conducted three types of surveys. Together those help us understand the current biodiversity of our local species, as well as the potential recovery of species that have recently become largely absent from our coastline.

The teams conducted abundance surveys of three key species using standardized quadrats. These species - the owl limpet, the California spiny chiton, and the black turban snail - are all mobile grazers within the intertidal habitat. The compiled data across high, mid and low intertidal zones for 2018 are below:

Within the MPA, the teams found these species to be distributed differently at the two sites. Preference was observed among all grazers for the high intertidal at the Intake Pipes site, while we found more distributed populations across tidal height at the Two Harbors location. This is likely at least in part due to the high abundance of macroalgae dominating the low intertidal of the MPA site in 2018.
The teams also measured percent cover among sessile organisms - including stationary animals and rockweed - and in bare rock for the two sites. Percent cover is measured by observing 25 squares within a quadrat grid - the more squares that include a given substrate, the higher percent cover is calculated for that material. Similar to 2017, our 2018 teams found acorn barnacles to be the most abundant species in the mid-to-high habitats, a fairly distributed presence of rockweeds across all sites and tidal heights, and low levels of mussels and gooseneck barnacles.

Within the MPA at Intake Pipe, our 2018 observations indicate a slight decrease in mussels since last year (2017: average of 2.2-3.4 mussels per quadrat at all heights; 2018: average of 0-0.7 mussels per quadrat); causes for this decline are currently unknown. The mussel population outside the MPA remains equally low (less than 1 per quadrat) as in the previous year.

Finally, the teams conducted timed surveys for two groups of taxa that have been largely absent from Catalina’s coastline in recent years: abalone and seastars. Both groups have been hard-hit by diseases and other environmental changes, dropping their population numbers in our area. Only one juvenile variable star was observed during the 2018 expeditions, by the November 2018 team within the MPA intertidal. We continue to do these observations with the hope that numbers will increase, toward an eventual recovery and return of these taxa to the Catalina intertidal.
PROJECT IMPACTS

1. Increasing Scientific Knowledge

a) Total citizen science research hours

59 Earthwatch volunteers participated in 1-week expeditions with our 2018 research team. During their week at Catalina Island they dedicated approximately 7 hours per day to training, collecting, and processing data. All together, they contributed a total of 2,891 hours of citizen science research to our project last year.

b) Peer-reviewed publications

NA

c) Non-peer reviewed publications:

Earthwatch volunteers and activities were regularly featured on the USC Wrigley Institute’s social media pages and summarized in the Wrigley Institute’s Annual Report.

d) Books and book chapters


e) Presentations:

NA

2. Mentoring

a) Graduate students

<table>
<thead>
<tr>
<th>Student Name</th>
<th>Graduate Degree</th>
<th>Project Title</th>
<th>Anticipated Year of Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>NA</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b) Community outreach

<table>
<thead>
<tr>
<th>Name of school, organization, or group</th>
<th>Education level</th>
<th>Participants local or non-local</th>
<th>Details on contributions/ activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girls in Science</td>
<td>High School</td>
<td>Non-local</td>
<td>Focused on teaching marine science principles to high school group</td>
</tr>
<tr>
<td>Jason’s Learning</td>
<td>High School</td>
<td>Non-local</td>
<td>Focused on teaching marine science principles to high school group</td>
</tr>
<tr>
<td>St. Andrews</td>
<td>High School</td>
<td>Non-local</td>
<td>Focused on teaching marine science principles to high school group</td>
</tr>
<tr>
<td>MEAD Teacher Expedition</td>
<td>Adult</td>
<td>Varied</td>
<td>Expedition to train and support science training and communication efforts for five K-12 teachers from across the country.</td>
</tr>
</tbody>
</table>
3. Partnerships

<table>
<thead>
<tr>
<th>Partner</th>
<th>Support Type(s)</th>
<th>Years of Association (e.g. 2006-present)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HAB Watch</td>
<td>Data collection, PI support and online exchange of information</td>
<td>Since inception of Earthwatch program (2017)</td>
</tr>
<tr>
<td>Whale mAPP</td>
<td>Data collection, PI support and online exchange of information</td>
<td>Since prior to Earthwatch inception</td>
</tr>
<tr>
<td>Heal the Bay (MPA Watch)</td>
<td>Data collection and online data submission</td>
<td>Since prior to Earthwatch inception (2015)</td>
</tr>
<tr>
<td>LiMPETS Program</td>
<td>Adaptive protocol sharing and data exchange</td>
<td>Since inception of Earthwatch program (2017)</td>
</tr>
<tr>
<td>Catalina MPA Collaborative</td>
<td>MPA Watch data is used to inform enforcement issues and education priorities</td>
<td>Since prior to Earthwatch inception (2015)</td>
</tr>
<tr>
<td>California Academy of Sciences</td>
<td>Biodiversity information for their statewide iNaturalist and Snapshot Coastal Cal programs</td>
<td>Since inception of Earthwatch program (2017)</td>
</tr>
</tbody>
</table>

1. Support type options: funding, data, logistics, permits, technical support, collaboration, academic support, cultural support, other (define)

4. Contributions to management plans or policies

<table>
<thead>
<tr>
<th>Plan/Policy Name</th>
<th>Type</th>
<th>Level of Impact</th>
<th>New or Existing?</th>
<th>Primary goal of plan/policy</th>
<th>Stage of plan/policy</th>
<th>Description of Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>California MPA Network</td>
<td>Management plan</td>
<td>Regional</td>
<td>Existing</td>
<td>Natural resource conservation</td>
<td>Ongoing</td>
<td>Data for adaptive management of California’s MPAs</td>
</tr>
</tbody>
</table>

2. Type options: agenda, convention, development plan, management plan, policy, or other (define)
3. Level of impact options: local, regional, national, international
4. Primary goal options: cultural conservation, land conservation, species conservation, natural resource conservation, other
5. Stage of plan/policy options: proposed, in progress, adopted, other (define)

5. Conserving natural and sociocultural capital

a) Conservation of new taxa

<table>
<thead>
<tr>
<th>Species</th>
<th>Common name</th>
<th>IUCN Red List category</th>
<th>Local/regional conservation status</th>
<th>Local/regional conservation status source</th>
<th>Description of contribution</th>
<th>Resulting effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seastars, intertidal (various)</td>
<td></td>
<td>Not evaluated</td>
<td>Largely absent from Catalina intertidal since 2014 due to wasting disease</td>
<td>Personal observations</td>
<td>Regular surveys to check for evidence of a potential recovery in local habitats</td>
<td>Detected a few juveniles that suggest a possible return in the future</td>
</tr>
<tr>
<td>Abalone, intertidal (various)</td>
<td></td>
<td>Critically Endangered (black)</td>
<td><code>Endangered</code> and <code>Species of Concern</code> - Largely absent from Catalina intertidal due to</td>
<td>NOAA Fisheries, Personal observations</td>
<td>Regular surveys to check for evidence of a potential</td>
<td>None seen to date</td>
</tr>
</tbody>
</table>

i. In the past year, has your project helped conserve or restore populations of species of conservation significance? If so, please describe below.
abalone) withering syndrome beginning in 1985 and poaching recovery in local habitats

6 Resulting effect options: decreased competition, improved habitat for species, range increased, population increase, improved population structure, increased breeding success, maintained/enhanced genetic diversity, other

b) Conservation of ecosystems

<table>
<thead>
<tr>
<th>Habitat type</th>
<th>Habitat significance</th>
<th>Description of contribution</th>
<th>Resulting effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coastal marine</td>
<td>CA Marine Protected Area</td>
<td>Biodiversity, water quality and compliance monitoring</td>
<td>Communication of activity violations to enforcement agencies; baseline information for monitoring ongoing health of MPA.</td>
</tr>
</tbody>
</table>

7 Habitat options: nursery, breeding ground, feeding site, corridor, migration path, refuge, winter range, summer range, spring range, fall range or other (define)

8 Resulting effect options: extent maintained, condition achieved, restored, expanded, improved connectivity or resilience

c) Ecosystem services

☒ Food and water
☐ Flood and disease control
☒ Spiritual, recreational, and cultural benefits
☐ Nutrient cycling

Details:

USC’s Catalina MPA Earthwatch program studies several aspects of the local coastline that provide numerous ecosystem services: rocky intertidal, subtidal and open water marine species, coastal water quality, and human uses of the environment. The habitats we study support individual and commercial sources of seafood, as well as many different forms of recreational and cultural benefits to society.

d) Conservation of cultural heritage

<table>
<thead>
<tr>
<th>Cultural heritage component</th>
<th>Description of contribution</th>
<th>Resulting effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>NA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9 Cultural heritage component options: traditional agriculture, artifacts, building(s), hunting ground or kill site, traditional ecological knowledge and practices, monument(s), oral traditions and history, spiritual site, traditional subsistence living

RESEARCH PLAN UPDATES

1) Have you added a new research site or has your research site location changed? ☐ Yes ☒ No
2) Has the protected area status of your research site changed? ☐ Yes ☒ No
3) Has the conservation status of a species you study changed? ☐ Yes ☒ No
4) Have there been any changes in project scientists or field crew? ☒ Yes ☐ No

Details:

This year, we welcomed Meghan MacGregor as the newest member of our USC Catalina field team. As a full-time Catalina Island resident and dive master, she enjoys sharing her knowledge of the local marine environment and spreading awareness about sustainable living. With a background in marine biology and wildlife conservation, Meghan worked as a marine mammal research assistant and continued on to work with wildlife in Belize, Costa Rica, and Indonesia. She recently completed her Master’s degree in Conservation Medicine and hopes to facilitate...
an interdisciplinary approach to help conserve Catalina’s marine life.

5) Provide details on any changes to your objectives, volunteer tasks, or methods, include reason for the change.
   NA

ACKNOWLEDGEMENTS

Once again, we extend a heartfelt thank-you to the volunteers who joined our team with focus, patience, eagerness and skill to acquire the highest quality data we can about Catalina’s coastline. We thank our amazing staff at the USC Wrigley Marine Science Center who keep our research running smoothly, our laboratories and boats functioning, our fieldwork safe, not to mention our bellies fed and our dorms feeling like home. Thank you to the many researchers and graduate students who gave lectures and shared meals with Earthwatch teams this year, inviting them into our special community of scientists. And as always, none of this would be possible without our wonderful Wrigley Institute field naturalists and education staff: Meghan MacGregor, Linda Chilton, Lorraine Sadler and field leader Lynn Whitley.