



Science by the Sea

Natural Resources and Science in the Mediterranean Coast Network
July, 2016

Investigating Ocean Acidification in the Rocky Intertidal



A rocky intertidal pool teeming with life at Santa Cruz Island, Channel Islands National Park. Ocean acidification makes it more difficult for many intertidal organisms to build shells and perform other functions essential for life. Photo by Jessica Weinberg McClosky / NPS.

The rocky intertidal zone, or the band of rocky coastline that is flooded by high tides and exposed during low tides, is home to a wealth of colorful seaweeds and uniquely adapted invertebrates. In Southern California, Cabrillo National Monument and Channel Islands National Park both protect rocky intertidal habitat to the delight of curious visitors young and old. Cabrillo NM's intertidal zone is one of the region's best-protected and most easily accessible rocky intertidal areas, and a popular San Diego tourist destination. Channel Islands NP intertidal areas are more remote, but harbor an unparalleled variety of marine life.

Although rocky intertidal life is adapted to harsh conditions such as crashing waves and scorching sun, it is nonetheless

vulnerable to human impacts like trampling, harvest, invasive species, and pollution. Rocky intertidal species are also vulnerable to climate change, and not only via rising sea levels, air temperatures, and ocean temperatures. The ocean also absorbs a significant portion of the excess carbon dioxide in the atmosphere, triggering changes in seawater chemistry that lead to a more acidic ocean (with more positive hydrogen ions and a lower pH value). This process, known as ocean acidification, makes it more difficult for intertidal organisms to build shells and perform other functions essential for life.

Cabrillo NM and Channel Islands NP are concerned about the impact that ocean acidification will have on their intertidal communities and the ability of their visitors to enjoy a seascape rich in marine life. They already monitor populations of several key rocky intertidal species to better understand and protect the ecosystem long term as part of the National Park Service's [Inventory and Monitoring Program](#). However, to understand the dynamics of ocean acidification in the rocky intertidal and how the monitored species are responding, a new type of monitoring has become necessary.

[Read more on the web...](#)

Exciting Times for California Red-legged Frog Reestablishment Project

In 2014, following years of careful planning, 849 California red-legged frog tadpoles were reintroduced to two streams in the Santa Monica Mountains. California red-legged frogs are the largest native frog in the west and were once commonplace throughout California's coastal ranges. However, habitat loss and degradation, and possibly introduced species and diseases, triggered their disappearance from 70% of their historic range. They vanished decades ago from the Santa Monica Mountains and have been listed as federally threatened since 1996.

The 2014 tadpole release was the first step in a multi-year reestablishment project aimed at supporting California red-legged frog recovery by increasing both the number of frogs and the number of places where they are found. It is a collaborative effort of the Santa Monica

Mountains National Recreation Area and several other federal, state, and local stakeholders. The process involves transferring partial egg masses from a thriving frog population in the nearby Simi Hills to tadpole rearing pens in suitable streams. The tadpoles are then released when they grow large enough to avoid predators. The hope is to have self-sustaining populations in each of the streams following roughly five years of tadpole releases.

Challenges to the project's success include the highly urbanized surrounding landscape and the continuing drought. The project has nonetheless reached some exciting milestones this year. First, it has [expanded to include two additional streams](#). More than 2,000 tadpoles were released this spring across what is now a total of four streams. In addition, adult frogs have been observed for the first time at the original tadpole reintroduction sites, indicating that some of the first tadpole cohort has survived two years to maturity! Formal surveys will take place over the summer to more precisely estimate the number of adult California red-legged frogs now calling the Santa Monica Mountains home.



A juvenile California red-legged frog in the hand of National Park Service Biologist Katy Delaney at a reintroduction site. Young frogs emerging from the water are highly vulnerable to predation, typically suffering 90-95% mortality. Those that make it to adulthood, though, can grow to be more than five inches long and may live up to 10 years. For more photo and video from the reestablishment effort, check out [this USFWS Flickr album](#). NPS photo.

The Unusual *Brodiaea*

It is the weird, beautiful, unexpected things in life that make one pause and take notice. They can be found almost anywhere. Take, for instance, the side of an island dirt road. The island is [Santa Rosa Island](#), one of eight southern California Channel Islands, and one of five within Channel Islands National Park. A large island of about 54,000 acres, it bears scars from over 100 years of intensive non-native animal grazing. Much of the island is dominated by non-native annual [grassland](#) but with the removal of the last non-native grazers, positive changes are afoot for the island's native plants.

One of the prettier native plants is a small *Brodiaea* (cluster lily), nominally called [Brodiaea jolonensis](#) or mesa brodiaea (there is some question as to whether it is actually *B. jolonensis*, or something different). This year, park botanist Dirk Rodriguez discovered a unique, off-kilter variety of mesa brodiaea along a roadside. Not only are the unusual plants mostly shorter than normal, but a closer look reveals that their flowers are also different. They have many more petals; in some cases three to four times the normal number. This is most likely because at least one parent plant had a genetic mutation causing extra petals in its offspring. Over the years these offspring have done much better than their normal brethren along the road.



Normal *B. jolonensis* (left) and unusual *B. jolonensis*. The newly discovered unusual form is doing well on a Santa Rosa Island roadside. It is shorter, has up to 3-4 times the usual number of petals, and lacks a floral structure (carpel) necessary for sexual reproduction. Photos by Dirk Rodriguez / NPS.

The intrigue doesn't end there. Floral development is controlled by three types of genes. Often a mutation in one gene type that increases the number of one flower structure can result in a corresponding decrease in number for a different structure. With that in mind, Dirk opened up one of the mutated flowers and found that there was no carpel (female reproductive flower structure). In other words, these brodiaeas cannot reproduce sexually. One could reasonably expect that such a mutation would spell the doom for any plants possessing it. Mesa brodiaea, however, can reproduce asexually by producing daughter cormlets from the main corm (water and energy storage structure) at the base of its stem.

So the next time you're walking about on a trail or road, stop and take a look around. See if you can find that strange gem hiding in the grass nearby.

L.A. Urban Coyote Project Enters Second Year



Two coyote pups run down a Westlake street, near downtown Los Angeles. Their mother is among the coyotes tracked as part of the L.A. Urban Coyote Project. View more photos of urban coyotes on the [Santa Monica Mountains National Recreation Area Flickr site](#). NPS photo.

It has now been just over a year since the Santa Monica Mountains National Recreation Area's L.A. Urban Coyote Project began in May 2015. The project involves fitting coyotes with GPS collars to track their movements and shed light on how they survive in one of the nation's most urban areas. A significant finding so far is that coyotes are more widespread in the city's dense core than previously thought. They also aren't just visiting or passing through. Instead, coyotes are living and raising pups in backyards or small open spaces in densely populated neighborhoods such as Westlake, right next to downtown.

A total of five coyotes were captured and tracked during the project's first year.

The coyote tracked in Westlake surprised biologists [early on in the study](#)

by crossing the 101 Freeway on many occasions. Another coyote [died in MacArthur Park due to drowning](#), but was also found to have several kinds of rat poison in her body. A sixth coyote was fitted with a GPS collar in June as the tracking effort enters its second year.

An additional component of the project, [collecting and analyzing coyote scat](#) with the help of citizen scientists, is getting underway this year as well. This will help answer questions about what coyotes eat in the city compared to what they eat in more suburban or natural areas.

Coyotes are naturally wary of humans, and though serious conflicts are rare, both people and wildlife can benefit from [keeping coyotes wild](#). Project researchers hope that what they learn about urban coyote ecology will prove useful as citydwellers strive to make informed decisions about [coexisting with coyotes](#) and other local wildlife.

Read more about the L.A. Urban Coyote Project and each of the coyotes that have been tracked so far in the [latest National Park Service press release](#).

Celebrating Biodiversity at San Diego's Urban Island

"You teach me, I forget. You show me, I remember. You involve me, I understand." These words, penned by the famous ecologist E.O. Wilson, exemplify the power of public involvement in nature exploration. In order to foster the next generation of environmental stewards, we must make ecosystems and the animals they encompass real and tangible entities. On May 21st, 2016 Cabrillo National Monument did just this. Along with over 119 park service units, Cabrillo proudly provided a platform for the San Diego community to get involved in citizen science through the 2016 [National Parks Centennial BioBlitz](#).



Collecting species observations by headlamp in the Cabrillo National Monument intertidal zone during the park's recent 24-hour Centennial BioBlitz. NPS photo.

Utilizing the biodiversity observation application *iNaturalist*, explorers of all ages made their way to the Monument to discover biodiversity in their National Park. Thanks to a truly outstanding community effort and an incredible team of over 157 scientists, exhibitors, and volunteers, [over 1706 observations](#) spanning 427 species were documented throughout the 24-hour BioBlitz period. Not only did this land Cabrillo in 3rd place for overall *iNaturalist* observations, but it was a tribute to the unique biodiversity hotspot that is San Diego, California.

In conjunction with the BioBlitz, Cabrillo hosted a Biodiversity Festival where over 19 exhibitors conducted hands-on science based activities for hundreds of park guests. From producing replica native Kumeyaay rock art, interacting with animal ambassadors, listening to current research updates from local scientists, and much more, park staff were excited to celebrate and introduce the public to science and biodiversity. Thanks to our strong partnerships with the Climate Science Alliance and California Geographic Alliance, over 300 students of all ages were provided transportation to the festival, including an international contingency from Mexico.

None of this would have been possible without the continued support from Cabrillo park partners and volunteers. The park will process all the data and observations to create unique graphics explaining biodiversity and why we should care about preserving it. Cabrillo will continue to bring students across the county to the park and will soon be implementing a permanent [BioBlitz curriculum](#). Our hope is that we can inspire the next generation of stewards by providing a platform for understanding of our natural world.

Events & Announcements

New on the Web: Videos from Cabrillo National Monument

Science in Action: Shaw's Agave

Scattered across the landscape here at Cabrillo National Monument, the conspicuous Shaw's Agave (*Agave shawii*) portrays a perfect example of the plight of global pollinators and the consequences of their decline to those that rely on them. Low replenishment of new individuals to the Agave population represents the threat of greatest concern, leading Cabrillo biologists to investigate this striking decline and its potential causes. This work supports a federal effort to understand and protect these native plant communities and those dependent on them. The National Park Service strives to foster resilient ecosystems, ensuring the well-being of current and future generations.

Climate Kids at Cabrillo

Cabrillo National Monument is a proud partner of the Climate Science Alliance. The Alliance is a collaboration of organizations and agencies focused on sharing ecosystem-based resiliency approaches to safeguard our communities and natural resources from climate change risk. Climate Kids, a program of the Alliance, facilitates student participation in hands-on science, art, and literacy activities regarding climate change. By facilitating these programs, Cabrillo National Monument is committed to supporting climate education and resilience in our community.

Upcoming "From Shore to Sea" Lectures

- **Searching for the Earliest Peoples of Santarosae**, Todd Braje - August 11, 7 pm
- **Breeding Birds of the Channel Islands**, Paul Collins - September 8, 7 pm
- **The Channel Islands Pygmy Mammoth**, Daniel Muhs - October 6, 7 pm

For further details about these free talks at the the Channel Islands National Park Robert J. Lagomarsino Visitor Center, visit <https://www.nps.gov/chis/planyourvisit/from-shore-to-sea.htm>.

Upcoming Santa Monica Mountains Events

- **Summer Star Festival** - July 30, 7:30 – 10:30 pm
- **Plant Promenade** - August 14, 10 – 11:30 am

Additional events and event details are available from the Santa Monica Mountains National Recreation Area [schedule of events](#).

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