Sanctuary Currents Symposium 2015

Saturday, April 25, 2015

California State University, Monterey Bay

University Center, Seaside, CA

U.S. Department of Commerce

Sanctuary Currents Symposium 2015

We Want You!
The Rise of Citizen Science

Saturday, April 25, 2015
California State University, Monterey Bay
University Center, Seaside, California

Planning Committee
James Lindholm, Ashley Knight, Michael Esgro, and Sarah Finstad
California State University, Monterey Bay

Andrew DeVogelaere and Erica Burton
NOAA's Monterey Bay National Marine Sanctuary

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Cover Graphics
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We Want You! The Rise of Citizen Science

Any management of the marine environment is only as good as the quality (and quantity) of the monitoring data that support it. Traditionally, monitoring of the marine environment was the unique purview of trained academic and government agency scientists. However, with the proliferation of environmental problems, increased awareness of the general public, and the simultaneous decrease in financial support for monitoring at both state and federal levels, the role of citizen scientists is on the rise. Come join us for a lively discussion on what it means to be a citizen scientist. Keynote presentations will focus on topics ranging from programs focused primarily on education to those modeled closely on formal monitoring efforts, from the rocky intertidal to the open ocean. A poster session follows the presentations and an exhibit hall will provide attendees with many opportunities to get involved.

The annual Sanctuary Currents Symposium provides an exciting opportunity to bring scientists, managers, students and members of the public together to address the most important issues of the day with respect to the Monterey Bay and beyond, and this year we are taking on citizen science. Discussions will occur around plenary sessions featuring internationally-recognized scientists, a research poster session, and exhibitry throughout the day.

Dr. James Lindholm

James W. Rote Distinguished Professor of Marine Science & Policy

Director of the Institute for Applied Marine Ecology

California State University, Monterey Bay

PROGRAM OF EVENTS

8:00 – 8:45 AM **REGISTRATION**
This is a FREE event, pre-registration is not necessary

9:00 – 9:15 AM **WELCOME**

Dr. Eduardo Ochoa
President
California State University, Monterey Bay

Paul Michel
Superintendent
Monterey Bay National Marine Sanctuary

Dr. James Lindholm
James W. Rote Distinguished Professor of Marine Science & Policy
Director of the Institute for Applied Marine Ecology
California State University, Monterey Bay
Chair, Sanctuary Research Activity Panel
Research Representative, Sanctuary Advisory Council

Dr. Andrew DeVogelaere
Research Coordinator and SIMoN Program Director
Monterey Bay National Marine Sanctuary

9:15 – 9:40 AM **SOURCING THE CROWD: THE UNIQUE SCIENCE BEHIND YOUR DAY AT THE BEACH**

Dr. Steve Haddock
Monterey Bay Aquarium Research Institute

9:40 – 10:05 AM **WHAT IS IT AND WHY SHOULD I CARE? EDUCATIONAL OUTCOMES IN CITIZEN SCIENCE**

Alison Young
California Academy of Sciences

10:05 – 10:30 AM **TAPPING INTO THE PUBLIC'S SKILLS—HOW CITIZEN SCIENTISTS BECOME EXPERTS**

Dr. Jan Freiwald
Reef Check California

10:30 – 11:00 AM **BREAK**

11:00 – 11:25 AM	**EYES ON THE WATER: ENGAGING THE GENERAL PUBLIC IN THE FIELD** Lauren Hanneman California State University, Monterey Bay
11:25 – 11:50 AM	**A SPECTRUM OF CITIZEN SCIENCE—COOPERATION, COLLABORATION, AND CROWDS** Dr. Jennifer Caselle Marine Science Institute, University of California, Santa Barbara
11:50 AM – 12:30 PM	**LUNCH**
12:30 – 2:30 PM	**RESEARCH POSTERS SESSION and EXHIBITS**
2:30 – 3:00 PM	**ED RICKETTS MEMORIAL AWARD and LECTURE** **INVESTIGATION OF SEA STAR WASTING: THE CRITICAL IMPORTANCE OF CITIZEN SCIENCE** Dr. Peter Raimondi University of California, Santa Cruz
3:00 – 3:30 PM	**RESEARCH POSTER AWARDS and CLOSING REMARKS**

INVITED SPEAKER ABSTRACTS

Ballroom 9:00 AM – 11:50 AM

Dr. Steve Haddock
Scientist
Monterey Bay Aquarium Research Institute

SOURCING THE CROWD: THE UNIQUE SCIENCE BEHIND YOUR DAY AT THE BEACH

Your eyes are some of the most important tools we have for monitoring ocean health! Scientists and engineers have developed sophisticated instruments for measuring all kinds of properties of the sea, but even these high-tech gadgets have serious limitations. They only measure in the few locations where they are deployed, and they are unable to sample the biology and diversity necessary to assess ocean health. Researchers around the world are increasingly reliant on armies of citizen scientists to gather data on fish, whales, birds, mammals, jellyfish, and even large ocean waves. The observations collected are incredibly unique and important: they provide coverage across times and regions that cannot be achieved by conventional means. This talk will describe some of the marine-related crowd-sourcing projects, their challenges and successes, and how *you* can get involved.

Alison Young
Citizen Science Engagement Coordinator
California Academy of Sciences

WHAT IS IT AND WHY SHOULD I CARE? EDUCATIONAL OUTCOMES IN CITIZEN SCIENCE

What do participants in marine citizen science project get out of participating, besides some time with the ocean and potentially some wet shoes? Well-designed citizen science projects not only generate important and useful data, but also educate those involved. Education via citizen science is not just limited to youth- and classroom-focused projects; adult volunteers, families, and even the scientists themselves all experience learning outcomes through participation in citizen science. Starting with the intertidal citizen science work we do at the California Academy of Sciences and expanding out to other marine projects – including projects that are entirely online – this talk will explore the many ways citizen science educates about the marine environment, increases science literacy, and connects people to the ocean and each other.

Dr. Jan Freiwald
California Director
Reef Check California

TAPPING INTO THE PUBLIC'S SKILLS—HOW CITIZEN SCIENTISTS BECOME EXPERTS

Citizen science has become widespread and contributes towards many scientific and educational goals. Programs focus on public engagement in resource management, education and life-long learning, and research and data collection. While many projects benefit from the involvement of large numbers of volunteers to cover vast geographic areas

other programs relay on highly trained groups of volunteers to implement monitoring or research projects. For example, citizen science projects in challenging environments, projects that require species identification at a moment's glimpse or estimate difficult biological parameters require specialized skills. Similarly, to collect quantitative data in situations in which data collection is expensive and opportunities are rare, programs need skilled and reliable volunteers. To participate in these projects, volunteers often need preexisting, particular skills and/or go through extensive training programs. This talk will explore how citizen scientists become experts and draw from marine and terrestrial examples of programs that require highly skilled volunteers to collect quantitative scientific data.

Lauren Hanneman
Lecturer
Science and Environmental Policy, California State University, Monterey Bay

EYES ON THE WATER: ENGAGING THE GENERAL PUBLIC IN THE FIELD

The Monterey Bay National Marine Sanctuary, the "Serengeti of the Sea" is the largest of the fourteen Sanctuaries. Visitors range from local to international, from tourist to fishermen, from bird enthusiast to prospective hunter, presenting exciting challenges in the communication of important information across such diverse audiences. How receptive is the tourist in learning that he/she has just flushed a raft of endangered otters, including moms and pups, for a picture? How does the out-of-town fisherman with his son who used to fish these waters with his father react to learning that the Slough is now a protected MPA? How do we, as citizen scientists, handle situations when somebody feels exempt from the laws protecting these species because they are "local?" This talk will describe what it really looks like to be on the ground level, interacting with both the scientists and the public. One size definitely does not fit all!

Dr. Jennifer Caselle
Research Biologist and Lecturer
Marine Science Institute, University of California, Santa Barbara

A SPECTRUM OF CITIZEN SCIENCE—COOPERATION, COLLABORATION, AND CROWDS

Citizen science has a long history, beginning with the great naturalists of the 18th century. Modern definitions of 'citizen science' vary widely and raise questions relating to: nature of the participants (paid vs. volunteer vs. student), level of training (professional vs. expert amateur vs. novice), level of participation, input into design, and purpose of the project. Citizen science can often be the most practical way to achieve the large-scale geographic extent required to address ecological questions relevant to species range shifts, migration patterns, disease spread, broad-scale population trends, and impacts of environmental processes like climate change. However, there may also be issues of data quality and management that must be dealt with. In this talk I will explore issues related to the very definition of citizen science and provide examples of programs focused on marine habitats and protected areas in California that span a continuum from 'contributory' to 'co-created'.

ED RICKETTS MEMORIAL AWARD and LECTURE

Ballroom 2:30 PM – 3:00 PM

Dr. Peter Raimondi
Professor
University of California, Santa Cruz

INVESTIGATION OF SEA STAR WASTING: THE CRITICAL IMPORTANCE OF CITIZEN SCIENCE

Sea stars along much of the North American Pacific coast are dying in great numbers from a mysterious wasting syndrome. Similar die-offs have occurred before in the 1970s, 80s, and the 90s, but never before at this magnitude and over such a wide geographic area. *Pisaster ochraceus* and many other species of sea stars have been affected by the current sea star wasting syndrome event. The paper by Hewson et al. "Densovirus associated with sea-star wasting disease and mass mortality" provides evidence for a link between a densovirus (SSaDV) and sea star wasting syndrome (SSWS). However, even assuming that the disease is related to a pathogen it is unclear what caused the outbreak to initiate, particularly because the virus identified has been present in the system for decades. This event is probably the most rigorously described disease event in a marine system. This is due to three major elements. First – there were existing monitoring efforts along the west coast including PISCO, NPS and BOEM efforts. Second, a website was developed rapidly that acted as a repository for observations and as a portal for depicting (using interactive graphics) the spread of wasting geographically, temporally and by species. Third, there was a massive infusion, enabled through upload capacity in the website, of citizen science observations. These were high quality, geographically and temporally explicit observations that provided a huge augmentation to traditional science observations. This event, the response to it and the formal incorporation of citizen science provides a model for future events where rapid data acquisition is essential.

ABOUT PETER RAIMONDI

Peter Raimondi is a professor in and chair of the Department of Ecology and Evolutionary Biology at UC Santa Cruz. He received his PhD from UC Santa Barbara in 1988 and prior to his appointment at UC Santa Cruz had post-doctoral fellowships at the University of Melbourne in Australia and at UC Santa Barbara. He is the author of 100+ peer reviewed papers and technical reports on a wide range of topics, such as coral recruitment, kelp forest and rocky shore ecosystems, demography, molecular genetics, marine protected areas, wave energy, ecotoxicology, once-through cooling at power plants and desalinization facilities, nearshore oceanography and particularly design of monitoring programs. He is a principal investigator with the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO), a multi-university consortium designed to conduct interdisciplinary research that informs coastal marine management and policy. He advises numerous panels, including the California Marine Life Protection ACT (MLPA), the California Coastal Commission Scientific Advisory Panel, the Statewide Ocean Desalinization Task Force, National Marine Sanctuary Program (NOAA) and the California State Water Board Advisory Panel. His current projects include: (1) Population and essential habitat assessment for the endangered species, black abalone (2) linking genetics to ocean circulation models to assess metapopulation

connectivity of Kelp populations, (3) Assessment of patterns of biodiversity along the west coast of North America, (4) Baseline assessment of coastal resources in newly established marine protected areas in California and, (5) Assessment of biological effects resulting from intakes from discharges into state of California coastal waters. Dr. Raimondi has more recently started a project assessing the patterns and effects of seastar wasting along the west coast of North America.

HISTORY OF ED RICKETTS MEMORIAL AWARD and LECTURE

Ed Ricketts was born in Chicago in 1897 and studied ecology at the University of Chicago. He moved to the Monterey Peninsula in 1923 and opened Pacific Biological Laboratories, providing specimens and slides to research institutions. Ricketts met John Steinbeck in 1930 and became a major influence on the author's writing and philosophy, serving as the inspiration for many notable Steinbeck characters. On their famous trip aboard the *Western Flyer*, Ricketts and Steinbeck explored the Gulf of California and collaborated on the book *The Sea of Cortez*. Ricketts also wrote *Between Pacific Tides*, an ecological handbook of intertidal marine life that is still used as a textbook at many universities. The scientific catalogue of organisms documented by Ricketts, both aboard the *Western Flyer* and during his other studies, has been invaluable to marine scientists. His work and unconventionally holistic approach to science has inspired generations of researchers.

The Ed Ricketts Memorial Lecture was created to honor lifetime achievement in the field of marine science. The first award was presented in March 1986. Recipients are selected by members of the Monterey Bay National Marine Sanctuary Research Activity Panel.

Previous Award Recipients

2014 Francisco Chavez
2013 Mark Carr
2012 Ken Johnson
2011 Michael Foster
2010 Rikk Kvitek
2009 Bruce Robison
2008 James P. Barry
2007 Gary B. Griggs
2006 Dave Epel
2005 Barbara A. Block
2004 John Pearse
2003 James Estes
2002 Jane Lubchenco
2001 Mary Silver
2000 Paul K. Dayton
1999 Joseph Connell
1998 George Somero
1997 Greg Cailliet
1996 Steve Webster
1995 Dick Parrish
1994 Wayne Sousa
1992 Jim Childress
1991 Walter Munk
1990 Gene Haderlie
1989 John Martin
1988 Sandy Lydon
1987 Dick Barber
1986 Joel Hedgepeth

EXHIBITORS

Lobby and Fireside Room – All Day

Please take time to visit the exhibitor tables featuring organizations addressing citizen science. Mingle and find out about their activities and volunteer opportunities. Find out how you can make a difference and get involved with one of these organizations.

Bay Net
http://montereybay.noaa.gov/getinvolved/volunteer/baynet.html

Beach COMBERS
http://montereybay.noaa.gov/getinvolved/volunteer/bchmon.html

California Academy of Sciences
www.calacademy.org

Camp SEA Lab
http://campsealab.org

Elkhorn Slough National Estuarine Research Reserve
www.elkhornslough.org

First Flush
http://montereybay.noaa.gov/getinvolved/volunteer/firstflush.html

Institute for Applied Marine Ecology at CSUMB
http://sep.csumb.edu/ifame/

Jellywatch
www.jellywatch.org

LiMPETS
http://limpetsmonitoring.org

Marine Science Institute
www.sfbaymsi.org

Monterey Bay National Marine Sanctuary
http://montereybay.noaa.gov

MPA Watch Program/Otter Project
www.otterproject.org/get-involved/volunteer/

Reef Check California
www.reefcheck.org

Save The Earth Foundation
www.savetheearth.org

Snapshot Day
http://montereybay.noaa.gov/getinvolved/volunteer/snapshotday.html

Surfrider Foundation, Santa Cruz Chapter
http://santacruz.surfrider.org

Team OCEAN
http://montereybay.noaa.gov/educate/to/welcome.html

Urban Watch
http://montereybay.noaa.gov/getinvolved/volunteer/urbanwatch.html

RESEARCH POSTER ABSTRACTS

Conference Room 12:30 PM – 2:30 PM

Researchers and students from around the region present the results of their research in scientific posters, with an emphasis on the communication of complex science to diverse audiences. Come view their latest findings in the central California area and talk to scientists conducting the research.

Aiken, Emily, Jannette Bodwell, Ali Fremont, Kyle Hascall, Mark Joachim, Veronica Larwood, David Norman, Josh Smith, Serena Thurston, Akemi Yamaguchi, and James Lindholm

California State University, Monterey Bay

LANDSCAPE ECOLOGY OF NEARSHORE BIOLOGICAL COMMUNITIES ALONG THE CALIFORNIA COAST: PRELIMINARY RESULTS FROM DIVER-OPERATED VIDEO AND VISUAL CENSUS SURVEYS.

The purpose of this study was to conduct diver-operated video and underwater visual census surveys as part of an on-going monitoring project aimed at characterizing the distribution patterns of biological communities along the coast of California. The objectives of year one were to 1) study patterns in the distribution of nearshore marine fishes, invertebrates and algae, 2) collect data inside and out of State Marine Protected Areas, and 3) establish a video archive of imagery for use in future analyses. We collected both structural and biological community data in the following rocky subtidal locations (from north to south): Gerstle Cove within the Salt Point State Park, Hopkins State Marine Reserve, Leo Carrillo State Beach, and La Jolla Cove. Each location was selected based on its general biogeographic regime, presence of existing monitoring data (e.g., California Reef Check), and presence of state marine reserves or conservation areas. On-going analyses of project data include fine-scale analyses of patterns in fish- and invertebrate-habitat interactions within and among sites as well as inside and out of State Marine Protected Areas, and spatial modeling resulting from the combination of observational data and the high-resolution topographic maps produced by the California State Mapping Project. All SCUBA dives were conducted by trained research divers from CSU Monterey Bay's Research Diving Program. Additional sampling sites and time periods are planned as the number of project partners is expanded in the coming years.

Alvarado, Ernesto, Miguel Chavez, Jose Diaz, and Moises Zuniga

Watsonville High School, Watsonville, CA
Watsonville Area Teens Conserving Habitats (WATCH) Program, Monterey Bay Aquarium

MEASURING CLAW FORCE IN A VARIETY OF CRABS SPECIES AT ELKHORN SLOUGH

In the Elkhorn Slough wetland there are many species of crabs that coexist. The primary source of defense for these crabs is their claws. The subject we studied was the strength of the crab's claws. We studied the crabs because we wanted to know the differences between species. Our testable question is how does the crab claw pressure vary by sex, carapace size, claw size and species. We used several methods to test the claw force including a scale system called the spring scale apparatus. We used this system to have the crabs pinch on the device and to tell how strong the claw was in newtons. We also decided to have the crabs pinch on clay (since not all the crabs were big enough to pinch our device) to measure pressure of the pinch. In the end we had more crabs with clay samples (N=65) and for some of the bigger ones we had with a force (newton) measurement. We found that the strongest crab overall was the Pacific Rock Crab, but that the Yellow Shore Crab was

strongest relative to its size. We found that claw strength varies among sizes and species of crabs in Elkhorn Slough, and think that this is important for understanding crab defense.

Amerzada, Arezo and Yusuf Nayib

James Logan High School, Union City, CA

DO TURBAN SNAIL POPULATIONS CHANGE WITH SEASON?

Our experiment was undertaken after we noticed a major increase in turban snail population with the change of seasons. We questioned if the turban snails population change with seasons and if there is a correlation between sea star disease and turban snail population. We approached our problem by performing citizen science and also looking at the Limpets data. We noticed that in the previous year, the turban snail population had increased by almost 33 times as much from winter to summer of 2014. Turban snails have not been around in the area for very long until June 2014. The dramatic increase in turban snail populations between seasons that we found in 2014 has seemed to continue in 2015. Then, the population decreased again in February of 2015. We concluded that this could be the new trend that correlates season to the growth of turban snail population.

Astorga, M., L. Boye, N. Brown, T. Burns, G. Oliveira Cruz, R. Silveira Moraes, J. Estrella, H. Facchini, B. Fitch, I. Foulks, D. Frick, A. Kochman, B. Lebbano, K. McDivitt, S. Ramirez, C. Wheeler, M. Wolf, and G. Zehner

California State University, Monterey Bay

ANALYSIS OF MAJOR GEOMORPHIC EVENTS IN THE MONTEREY CANYON WITH A 13 YEAR TIME SERIES

The Monterey Submarine Canyon is the most prominent of several canyons that bisect California's coast north of Point Conception. As a major vector for coastal upwelling, the canyon exerts great influence over the region's coastal ecology, and supports prominent California fisheries such as market squid and rockfish. Due to the proximity of deep waters to shore, it also provides a valuable asset for scientific research. Thirteen years of multibeam sonar bathymetric surveys note dynamic changes in the canyon's morphology. The research presented here will assess overall trends in the canyon head geomorphology, and test the general hypotheses of canyon expansion, infill or dynamic stasis. Our approach builds upon and extends the high-resolution bathymetric time series begun in 2002 by CSU Monterey Bay's Seafloor Mapping Lab.

Averbuj, Dan, Benjamin I. Ruttenberg, Lisa A. Needles, and Grant Waltz

California Polytechnic State University, San Luis Obispo

SURVEYING PISMO CLAMS: USING CITIZEN SCIENCE TO RESTORE AN ICONIC FISHERY SPECIES

Pismo clams (*Tivela stultorum*) once supported a thriving commercial and recreational fishery in Central California, but populations appear to have declined substantially in the past several decades. Commercial harvesting, recreational fishing, and the recovery of California Sea Otters are the main hypothesized reasons for their decline. Over the last few decades, there has been little work examining Pismo clam abundance, so we lack information on the status of populations across the state. The main purpose of this project is to initiate a citizen science research program to inform management and restoration efforts for Pismo clam across its range in California. Preliminary data collected by Cal Poly researchers have yielded surprising results; where there were once hundreds of clams, we now find only a few per sampling location. Due to their large species range (Monterey,

California to Baja California, Mexico), it is difficult to thoroughly sample all beaches to get an accurate estimation of Pismo clam abundance. Established methods sample sandy beaches at low tides; procedures to sample for these clams are therefore relatively simple and require minimal equipment and training, making this an excellent candidate for a successful citizen science project. To facilitate data collection, we have created a smartphone application to allow trained citizen scientists to easily go and sample for these clams. The collaboration between citizen scientists and Cal Poly researchers will help generate a clearer image of the abundance of Pismo clams along their known range, and ultimately assist in sustainable management into the future.

Barber, Tiffany (1), Julie Keister (2), Anna McLaskey (2), Brady Olson (3), and Paul McElhany (4)

(1) California State University, Monterey Bay
(2) University of Washington
(3) Western Washington University
(4) National Oceanic and Atmospheric Administration

EFFECTS OF OCEAN ACIDIFICATION ON EARLY LIFE STAGES AND DEVELOPMENT OF KRILL, *EUPHAUSIA PACIFICA*

Increased CO_2 is changing the chemistry of the earth's oceans, threatening marine life. Decreases in seawater pH have been shown to affect growth and development of marine organisms. The early life stages of crustaceans may be particularly vulnerable to stressors because of the large morphological changes they must undergo during metamorphosis. We chose to study euphausiids (krill) because they are a primary prey resource for fish (including commercially important species such as herring, anchovy and salmon), whales and seabirds. We tracked egg hatching and subsequent development through four larval stages to the final feeding stage, calyptopis 2 (C2) to determine the effects of OA on these early life stages. We observed hatching success of krill was the lowest at the lower concentrations of CO_2. We observed that the strongest negative effect of CO_2 seems to be on development. The increase in CO_2 slows development of the krill. Our results contribute to a better understanding of future krill and food web dynamics with in the Puget Sound.

Becerra, Briana (1) and Natalie L. Cleavitt (2)

(1) California State University, Monterey Bay
(2) Cornell University

COMPARISON OF SEEDLING REGENERATION AND LIGHT AVAILABILITY IN A CLEAR CUT AND REFERENCE FOREST STAND IN HUBBARD BROOK EXPERIMENTAL FOREST, NH

Succession after a large scale whole tree harvest in Eastern hardwood forests remains little understood. The comparative influence of stand age, light, elevation, and leaf litter composition and depth on seedling regeneration was compared between an experimental clear cut (30-yr) and the reference forest (100-yr). The present day seedling layer was compared in different elevation ranges within the forest stands. Seedling densities were determined through seedling counts taken in 474 seedling plots. Light densitometer reading and leaf litter counts were used to assess canopy coverage and light availability above the seedling plots. Results showed stand age, elevation and leaf litter variables were the best predictors of seedling density. Higher seedling densities were more likely to occur in plots in the reference forest, at lower elevation, and with a thinner litter layer. Contrary to assumptions, the regenerating 30-yr forest was substantially darker than the 100-yr forest stand. Studying disturbance dynamics land managers make informed ecological decisions pertaining to forest management (Turner et. al. 2003).

Bedell, Loryn, Kirsten Boyer, Kelly Brundige, Tyler Burns, Emily Casillas, Danielle Fabian, ZoeJay Fletcher, Erica Godat, Breanne Hansen, Cristian Hernandez, Marissa Jacky, Terence Jarell, Mark Joachim, Nicole Kent, Caitlin Liedtke, Lauren Madden, Samantha Mendez, Tiago Pedrosa Hilario, Candace Reid, Nathalia Samper, Laila San Ahmadi, Serena Thurston, Cristina Villalobos, Emily Aiken, and James Lindholm

California State University, Monterey Bay

USING DEEP SEA VIDEO IMAGERY TO PREDICT DEMERSAL FISH ASSOCIATIONS AND HABITAT COMPLEXITY IN THE GULF OF THE FARALLONES NATIONAL MARINE SANCTUARY

The associations between demersal fishes and habitats on the seafloor are increasingly well established. However, in temperate systems it continues to be unclear precisely which attributes of the seafloor a given fish is associating with. This study sought to explore and expand on the connection between fishes and seafloor habitats by relating the density of fishes to the complexity of the adjacent habitat. Videographic imagery was collected in the vicinity of the Farallon Islands off northern California using a remotely operated vehicle (ROV). A total of 33 120 m transects were conducted in water depths ranging from 71 – 453 m. Data were extracted from ROV footage using visual analysis in a series of non-overlapping video quadrats. Data were collected on fish density and seafloor habitat classification. Following the habitat classification, a “complexity” score was assigned to each recorded quadrat based on substrate, relief, and the presence of structure forming invertebrates. Results of this study will increase our understanding of how habitat complexity can determine population dynamics. This information will provide new knowledge for management and policy makers regarding decisions in the marine environment.

Bell, Christy A., Maya K. George, Melissa A. Redfield and Peter T. Raimondi

Long Marine Lab, University of California, Santa Cruz

ASSESSMENT OF THE PATTERN OF INTERTIDAL COMMUNITY COMPOSITION AS A FUNCTION OF DISTANCE FROM THE ALDER CREEK LANDSLIDE

In the spring of 2011, a series of landslides occurred along Highway 1 south of Big Sur, California where Alder Creek meets the ocean. Surveys were conducted to characterize the intertidal community near the Alder Creek landslide in December 2012, December 2013 and again in January 2015. Because of the gradient of tidal exposure, intertidal areas have strong species zonation patterns. Our surveys were designed to sample the shoreline so that all three zones (high, mid and low) would be evaluated. This allowed us to determine how the pattern of community composition in each zone varied as a function of distance from the landslide. Survey methods included point contacts in photo plots to determine percent cover of sessile species and mobile invertebrate quadrat counts. As hypothesized, the area just downcoast of the slide was significantly different from the rest of the areas surveyed and there was a strong effect by intertidal zone ($p=0.001$). We found the pattern of community composition did not change over time ($p=0.176$). Many of the patterns observed were driven by the accumulation of sand just downcoast of the slide. Overall, 90 species of algae and invertebrates were observed in our surveys, with the lowest biodiversity seen in the area just downcoast of the slide. The patterns of intertidal community composition we observed were consistent with an impact to the community resulting from the landslide.

Bird, Wylie, Erin Larcher, Andrina Sanchez and Rafael Suarez

Aptos High School, Aptos, CA
Watsonville Area Teens Conserving Habitats (WATCH) Program, Monterey Bay Aquarium

ANIMAL ACTIVITY IN YOUNGER LAGOON RESERVE

Younger Lagoon is a very rare microenvironment and provides a habitat to animals who could not survive in the surrounding areas, due to human activity. It is an estuary with agriculture on one side, and housing on the other. The health of a habitat, or ecosystem, can be determined by analyzing the species abundance, diversity, and richness. Our research sheds light on animal activity, and provides the community with an urgency to protect the reserve—and the organisms that live within it. The question we asked was, "what time of day will animals be most active?" We hypothesized more animal activity during the nighttime, because we expect most of the animals to be nocturnal. To observe animal activity we situated one motion detecting camera at the entrance to the agricultural field, overlooking the lagoon, for four weeks. We retrieved the data weekly, by downloading the photographs with coded information—such as temperature, date, and time. We then analyzed the activity versus the time of day. Our data indicated that the animals in Younger Lagoon were more active during the nighttime. We photographed animals such as bobcats, deer, raccoons, coyotes, and skunks. We are able to conclude that most of these species tend to be nocturnal. This pattern helps to explain our findings.

Blakesley, Sam

University of California, Santa Cruz

THE BLUE WATER TASK FORCE

The Blue Water Task Force is an all-volunteer operated water quality monitoring and education program. As a program within the Surfrider Foundation Santa Cruz's chapter, the Blue Water Task Force has been in operation since 1994, but has never been more successful and relevant than it is today. In its weekly operation, Blue Water Task Force volunteers sample and test about 20 recreational beach and surf locations throughout Santa Cruz County for the fecal indicator bacteria enterococcus. Aside from informing countless ocean-going people on the quality of their water, the results of these tests hold special importance to many community members in general, whose very own Cowell's Beach currently holds the #1 position on Heal the Bay's Beach-Bummer report card (and Capitola 9th). Aiming to resolve this issue, Blue Water Task Force volunteers are well represented in the Cowell's Working Group, a collaboration of local nonprofit environmental organizations with experts from the city and county. The objectives of the Blue Water Task Force are to inspire and educate the future generation of citizen scientist and environmental activists as well and teaching and mentoring students of all ages on the bacterial and aquatic processes of earth, and the general importance of environmental stewardship, has arguably been the Blue Water Task Force's most fulfilling achievement.

Brown, Craig and William J. Goodger

Friends of the Elephant Seal

POPULATION SURVEY OF MALE NORTHERN ELEPHANT SEALS AT THE PIEDRAS BLANCAS ROOKERY DURING THE MOLTING SEASON

This study aimed to perform the first comprehensive survey of male northern elephant seals at the Piedras Blancas rookery and surrounding beaches during the molting season. The application of a non-invasive method for counting seals from the bluff was explored in order to minimize impact upon

the seals, and allow for surveys to be conducted in the presence of the public. While this study should be considered a preliminary investigation into types and numbers of male elephant seals in the population during the molt, the use of the non-invasive approach appears to be an effective means of accurately surveying all beaches in and around the rookery. The changes in age class demographics observed throughout the study correspond well with the known migratory patterns for male northern elephant seals at other rookeries, and shed some light on male beach preference during the molt. When compared with data from previous years, counts from this survey supported similar migratory patterns for subadult and adult males, but differed in the number of males returning to the beaches. Previous counts done at VP3 reported considerably lower numbers of adult males, with an average monthly count of 5.8 in 2008 as compared to 45.5 in 2014. It is possible that this difference may be a result of the increase in the population of seals in the rookery, but alternatively, it could stem from different parameters for categorizing subadult and adult males, but further seasons of study are required to verify this.

Camacho, Joshua, Josh Clark, Ghilda Fernandez, and Jessica Rocha Melgoza

Watsonville High School, Watsonville, CA
Watsonville Area Teens Conserving Habitats (WATCH) Program, Monterey Bay Aquarium

CULVERT EFFECTS ON FISH DIVERSITY AT WHISTLE STOP LAGOON

Many studies show that, when people disturb an ecosystem, its inhabitants may alter their behavior. To test this, our group surveyed fish abundance and diversity at Elkhorn Slough National Estuarine Research Reserve (ESNERR). We also tested the pH to see if it had any effect on fish diversity. A new culvert was recently implemented at Whistlestop Lagoon to keep water levels on both sides of the levee equal at all times and to create a safe walkway for visitors. Last year, another group surveyed fish diversity between areas with and without *Ulva*. Using their data, we sampled the same sites (when available) to compare the variance of fish diversity before and after the culvert was installed. For our experiment we had to capture the fish using a seine net. We measured the size of each fish, counted and recorded the species. Fish were then released back into the lagoon. Our results supported our hypothesis which states that the amount of fish and the number of species would decrease because of the increased flow of the culvert. Fish diversity decreased compared to last year's data. In conclusion, the instalment of the new culvert did have an impact on the fish biodiversity of Whistlestop Lagoon. Our results will help the people at ESNERR make better decisions for the slough and also the people that made and designed the culvert.

Cervantes, Martha and Erin Stanfield

California State University, Monterey Bay

IMPROVING MOLECULAR MODELS FOR IDENTIFICATION OF TOXIC CYANOBACTERIA

Toxic freshwater cyanobacteria represent a human and ecological health risk through exposure to toxins in the environment. The purpose of this study was to optimize cyanobacterial DNA extraction and apply the polymerase chain reaction method (PCR) to identify genes coding for the cyanotoxin microcystin. Based on previous research we hypothesized that *Microcystis* cultures containing a coding sequence for microcystin will not express the gene because there are also strains under the same genus that are non-toxin producers. In this study DNA from a *Microcystis aeruginosa* culture was extracted following four different treatments. We evaluated the resulting genomic DNA for extraction efficiency, DNA yield, and purity. Following extraction, established PCR primers targeting a cyanobacteria-specific 16S rRNA gene segment were used for the confirmation of taxonomy and to rule out PCR inhibition. We also used recognized primers for the *mcyB* gene to amplify part of the DNA sequence required by cyanobacteria for microcystin production. For DNA extraction, all methods resulted in high quality, pure genomic DNA; however ultrasonication of the cells using water as a

buffer resulted in the most efficient method of providing a large amount of high quality data. Amplification of the 16S rRNA was successful for all the samples. Identification of coding sequences for microcystin in cyanobacterial species using the PCR method is important to determine the toxicity of algal blooms in recreational waters and inform the public about the potential risks of exposure.

Chiu, Jennifer A. (1), Corina I. Marks (1), Richard M. Starr (1,2), Dean E. Wendt (3), Cheryl L. Barnes (1,2), Grant T. Waltz (3), and Andrea L. Launer (1)

(1) Moss Landing Marine Laboratories
(2) California Sea Grant
(3) California Polytechnic State University, San Luis Obispo

TAG RECAPTURES: HOW CITIZEN SCIENCE CAN PROVIDE INFORMATION ABOUT NEARSHORE FISHES

Since the 2007 inception of the California Collaborative Fisheries Research Program (CCFRP), we have worked toward bridging the gap between scientists and the community, and have worked collaboratively to better understand nearshore fish stocks. Our goal is to monitor and evaluate the effectiveness of four marine protected areas (MPAs) along the central California coast and provide information about economically important marine species for conservation and fisheries management. One part of the collaboration is our work with volunteer anglers to catch, tag, and release fishes in central California. CCFRP relies on tag recaptures from commercial and recreational fisheries, and SCUBA divers to provide valuable information about movements, growth rates, and times at liberty of nearshore fishes. This information improves our understanding of the life history of fishes and the potential for spillover from MPAs. The creation of the tag-recapture database would not be possible without the participation of the local fishing community. In this poster, we describe the proportion of tagged fishes that are recaptured, how far these fishes moved from where they were originally tagged, how many days they spent at liberty, and how the local community can get involved and contribute to this growing database.

Chow, Kaitlyn

California State University, Monterey Bay

A COMPARISON STUDY USING AERIAL PHOTOGRAPHY (PHOTOGRAMMETRY) AND TOTAL STATION SURVEYS FOR DIGITAL ELEVATION MODEL (DEMS) CREATION

To better monitor sediment, a major watershed pollutant, a comparative study looking at different technologies was conducted. This study used a total station, manually pre-rectified, aerial photos for photogrammetry, and auto rectified, fisheye photos for photogrammetry to create three digital elevation models of a sediment retention basin. A spot elevation test on the photogrammetric DEMs was conducted and compared using a total station survey (Manually Rectified average difference: 18 ± 16 mm, Auto Rectified average difference: 44 ± 5 mm). Volume was also compared (568 m^3 for total station, 565 m^3 for the manually rectified photos with 1% difference from the total station's DEM, and 550 m^3 for the auto rectified photo set with 4% difference from the total station's DEM). Manually rectified photos seem to produce a more accurate DEM; auto rectified photos seem to produce a more precise DEM. Compared to the total station, photogrammetry might have an application in monitoring landscape change and nonpoint sediment sources due to their relatively quick survey time, broad area capability, and low cost. On a broader scale, photogrammetry can be applied to a variety of landscapes such as coastal watersheds, beaches, benthic environments, or micro topographies for better monitoring long term monitoring data.

Daly, Alexandra, Michael Esgro, Ashley Knight, and James Lindholm

Institute for Applied Marine Ecology, California State University, Monterey Bay

ASSOCIATION OF ROCKFISHES WITH STRUCTURE-FORMING INVERTEBRATES AT FARNSWORTH BANK, CATALINA ISLAND

Seafloor-associated fishes are known to associate with microhabitat features on the seafloor, including biological features such as structure-forming invertebrates. These microhabitat features provide fishes with increased prey availability and a spatial refuge from predators. We used imagery collected by a remotely operated vehicle (ROV) to examine the relationship between rockfish density and the presence or absence of structure-forming invertebrates at Farnsworth Bank, Catalina Island. Imagery was collected in 2011 and 2012 as part of a larger-scale ecosystem characterization project in the Southern California Bight. All observations of structure-forming invertebrates larger than 10 cm were sampled in non-overlapping video "quadrats" centered on the invertebrate. We also randomly selected an equal number of video quadrats in which no structure-forming invertebrates were present. In each quadrat, we calculated rockfish density by dividing the total number of rockfish present by the area of the quadrat. We used model comparison with AIC to determine which of the following factors were significant predictors of rockfish density: presence or absence of structure-forming invertebrates, substrate type, vertical relief, and depth. Our results indicate that rockfish exhibit a positive association with large gorgonians and sponges. The association of ecologically and economically important fish species with structure-forming invertebrates has important implications for the management of human activities that directly alter the seafloor.

Dawson, Cyndi and Morgan Ivens-Duran

California Ocean Protection Council

THE OCEAN PROTECTION COUNCIL AND CITIZEN SCIENCE: A CASE STUDY ON THE BASELINE MONITORING OF MARINE PROTECTED AREA NETWORK

The Ocean Protection Council (OPC) was created by the California Ocean Protection Act in 2004. The OPC is charged with facilitating communication and collaboration among natural resource management agencies to meet the broad marine ecosystem health goals of the state. It accomplishes this by serving as the grantor and manager for designated state bond funds and by building partnerships, within and outside government, to increase the support and capacity of the state to meet its natural resource mandates. OPC has been actively engaged in supporting and advancing citizen science in California. This involvement highlights OPC's utility as an organization that works across issues and traditional institutional boundaries to improve governance related to ocean and coastal management. As of 2013 the state has the largest scientifically designed network of MPAs in the nation. The lead management agency for MPAs is the Department of Fish and Wildlife (DFW). DFW in close collaboration with their partners, the Oceans Science Trust and OPC, determined the need for a baseline condition assessment of the MPA network. These condition assessments are currently being implemented through regional baseline monitoring programs. Each of the regional baseline monitoring programs incorporates citizen science. This represents a continuation of an expanding paradigm of collaboration between state resource managers and citizen scientists. We summarize the lessons learned and set up future areas of focus for the OPC that identifies opportunities to advance the use of citizen science in informing natural resource management.

Dennis, Julia, Sarah Hughes, Patrick Hurley, and Emma Roberson

Aptos High School, Aptos, CA
Watsonville Area Teens Conserving Habitats (WATCH) Program, Monterey Bay Aquarium

CYANOBACTERIA COUNTS OF YOUNGER LAGOON

We explored how the estimated populations of cyanobacteria might differ in four sites across Younger Lagoon in relation to the changing conditions over the course of five weeks. Based on our initial observations, we predicted that the populations of cyanobacteria would be higher in areas with a higher salinity. The identified genus of the cyanobacteria is *Nodularia* sp. Using 50 micron plankton nets to collect two samples of cyanobacteria at each site over three sample days, we took a 15 foot tow at the surface level of the water and preserved them with 95% EtOH. On the first data collection day, at the highest point of the bloom, we estimated 23,995,940 c/L. On the last data collection day, it hit lowest at 225 c/L. On average, there was a 62% decrease in population of cyanobacteria. The nitrate and phosphate values decreased along with the size of the bloom, which could indicate the cyanobacteria was thriving off these nutrients. This is an important finding because it shows an interrelation between nutrients and the physical factors of the water, as well as the planktonic community. Low population counts can indicate there aren't enough nutrients in the water. We can conclude that the cyanobacteria blooms may affect the quality of the water which in turn affects the overall health of the lagoon.

Edwards, Tenaya, Josephine Palmer, Isabella Rose, and Maya Yokoyama

Aptos High School, Aptos, CA
Watsonville Area Teens Conserving Habitats (WATCH) Program, Monterey Bay Aquarium

EVOLUTION IN ACTION? HOW SALINITY CHANGES DURING AND AFTER DROUGHT AFFECT MACROFAUNAL COMMUNITIES

Small macroinvertebrates (0.4 - 2.2 mm) are essential to the food chain, and the stability of marine and freshwater ecosystems. We studied animals living in the mud at Younger Lagoon located in Santa Cruz. Our research question was: Does grainsize affect the diversity and abundance of macroinvertebrates living in the mud? We predicted that when grainsize was large (sand, which indicates more water movement and more disturbance) there would be fewer types of invertebrates, and smaller numbers of them, because there would be fewer nutrients and plant material there compared to in mud (small grainsize, low disturbance). To test our hypothesis, we collected mud samples from four different sites, then identified and counted all the macroinvertebrates in them. Animals were collected by taking five replicate core samples (35 ml) of mud at each site on multiple dates. One site was only sampled once because it had no animals and anoxic mud. The highest abundance of taxa was found at the site with intermediate disturbance and medium grainsize. The site with the largest grainsize (highest disturbance) had the highest diversity of taxa. After many months of drought, the number of copepods, bryozoans, ostracods, and oligochaetes increased substantially just after it rained when the salinity of the water decreased by almost half.

Fabian, Danielle M., Sarah Finstad, Ashley Knight, and James Lindholm

Institute for Applied Marine Ecology, California State University, Monterey Bay

BASELINE CHARACTERIZATION OF ROCKFISH SPECIES AT FARNSWORTH BANK, CATALINA ISLAND

A network of marine protected areas (MPAs) was implemented along the coast of Southern California in 2010. Rockfishes were included in the associated monitoring plan for the region due to their

ecological and economic importance. The purpose of this study was to characterize the distribution and habitat associations of rockfishes on Farnsworth Bank, located off the backside of Catalina Island, within the "mid-depth rock ecosystem" habitat. The ecological metrics concerning rockfish in mid-depth rock ecosystems include: density and size structure of the focal species Bocaccio (*Sebastes paucispinis*) and Vermilion Rockfish (*Sebastes miniatus*), size structure for all rockfish (*Sebastes spp.*), and total dwarf rockfish abundance (multiple species). This study was conducted using data collected as part of a larger-scale regional characterization in 2011 and 2012. We used a subset for the broader effort - two ROV transects conducted along the main axis of the rocky reef – to collect continuous videographic and still photographic imagery of fishes and the habitats in which they occurred. Data extracted from the imagery included size structure, density, and abundance of the rockfishes as well as the attributes of seafloor habitat immediately below and/or adjacent to them (such as substrate and any biogenic structure).

Favaloro, Jeanette and David Minovitz

California State University, Monterey Bay

AN EXAMINATION OF TIDAL SCOUR TRENDS IN ELKHORN SLOUGH USING BATHYMETRIC TIME SERIES FROM 2003-2014

Half of the world's wetlands were lost in the 20th century due to human activities. Tidal wetlands are critical areas for many plant and animal species and provide important ecosystem services. Elkhorn Slough, one of 28 National Estuarine Research Reserves, is the 2nd largest tidal salt marsh in California and supports over 785 species of birds, marine invertebrates and fish. The Elkhorn Slough Tidal Wetland Project constructed an underwater sill to specifically mitigate the loss of habitat due to tidal scour. Studies of Elkhorn Slough channel have revealed the presence of 'hotspots' within the slough that undergo extreme rates of erosion and sediment loss relative to other parts of the slough. The mouth of Parson's Slough is characterized as a hotspot due to its orientation and the high tidal energy that occurs at this narrow channel. Recent observations show a decreased erosion rate following the implementation the sill in 2011. We investigate whether the observed decline in hotspot erosion rates is a continuing trend or a process that fluctuates over time. Using multibeam sonar instrumentation, we collected a new bathymetric data set for Elkhorn Slough in 2015 and compare selected areas to previously collected datasets. Understanding depth and erosion changes over time will complement our knowledge of the dynamic processes that shape and alter estuary channels and sediments. Quantifying the effectiveness of the sill can inform future decision-making for controlling erosion and sediment loss in Elkhorn Slough and is useful in aiding estuarine conservation management efforts.

Fields, Ryan (1), Sabrina Beyer (2), Corina Marks (1), Rebecca Miller (2), Sue Sogard (2), John Field (2), Dan Howard (3), Dale Roberts (3), Deb Wilson-Vandenberg (4), and Rick Starr (1,5)

(1) Moss Landing Marine Laboratories
(2) National Marine Fisheries Service
(3) Cordell Bank National Marine Sanctuary
(4) California Department of Fish and Wildlife
(5) California Sea Grant Extension Program

ASSESSMENT OF THE RESPONSE OF ROCKFISH POPULATIONS TO ROCKFISH CONSERVATION AREA CLOSURES IN CENTRAL CALIFORNIA

Between 1987 and 1998, the California Department of Fish and Game (CDFG) sampled 2267 sport fishing trips on Commercial Passenger Fishing Vessels (CPFVs), and recorded data on species compositions, size and catch rates for nearly 300,000 fishes. In 2001, seven rockfish species (Bocaccio, Canary Rockfish, Cowcod, Darkblotched Rockfish, Pacific Ocean Perch, Widow Rockfish

and Yelloweye Rockfish) were declared overfished, leading to the creation in 2002 of fishery closures in the form of Rockfish Conservation Areas (RCAs). In an effort to assess how the RCAs (and other factors) have affected rockfish populations along central California in the 12 years since they were implemented, we conducted surveys of some of the same areas that were fished recreationally from 1987-1998. Our primary objective was to compare estimates of species composition, density, and mean lengths of fishes before and after the RCAs were established, with effort and emphasis concentrated in relatively shallow habitats (approximately 20-50 fathoms) that were the regions of greatest significance to recreational fisheries. With the help of local captains and over 100 volunteer anglers, 29 standardized hook-and-line fishing surveys were conducted from October 2012 to October 2014. More than 7500 fishes were caught from our three sample areas: Half Moon Bay, the Farallon Islands, and Cordell Bank. Here, we present findings on species composition, catch rates, and size frequency from sample sites inside and outside the closed areas. Also, we present comparisons of current fishing data with the historical data set collected by CDFG.

Freiwald, Jan and Dan Abbott

Reef Check Foundation

INVOLVING THE PUBLIC IN MARINE RESEARCH: CITIZEN SCIENTIST DIVERS MONITOR CALIFORNIA'S MARINE PROTECTED AREAS

Ecosystem-based management (EBM) has become an essential for marine resource management and conservation. This has greatly increased the need for long-term ecological monitoring data to implement management approaches, assess outcomes and adapt strategies accordingly. One pertinent example is the implementation of California's network of marine protected areas (MPAs). Management agencies are mandated to monitor the performance of these MPAs with respect to meeting their goals; for example, protecting diversity and restoring marine life populations. Citizen science can address these data needs while involving the public in scientific research and management. Reef Check California (RCCA) trains volunteer scuba divers as citizen scientists to conduct subtidal monitoring of an iconic habitat targeted for protection by MPAs: rocky reefs and kelp forests. Community members, in conjunction with staff scientists, then collect data that are used to inform MPA management and can also help understand ecosystem responses to impacts such as ocean warming and acidification. RCCA has conducted state mandated baseline monitoring since 2007 in all regions where MPAs have been implemented throughout California and continues to annually monitor about 15 sites in the Monterey Bay National Marine Sanctuary and around 75 sites statewide. Through this program, citizen scientists have established one of the geographically largest near-shore reef datasets in California. This level of citizen scientist involvement in subtidal monitoring is unprecedented in California and demonstrates how citizens can perform ecosystem monitoring in challenging environments. Additionally, the public's involvement in research informing marine management builds a science-based stewardship ethic in the ocean stakeholder community.

Fremont, Ali (1) and Christian Denney (2)

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RELATIONSHIP BETWEEN STANDARD FISH LENGTH AND OTOLITH LENGTH IN JUVENILE *SEBASTES MYSTINUS*

Otoliths are commonly used to identify fish species, as well as to determine the age and size of an individual when the whole fish is unavailable, such as in scat or gut contents. Information derived from otolith analysis is often useful for studies involving prey identification and population management. Numerous studies have been conducted in order to determine a relationship between fish length and otolith length of adults of many species. This study aims to determine a relationship between total fish

length and otolith length for juvenile *Sebastes mystinus*. Fish were collected from Stillwater Cove in Pebble Beach, CA using SCUBA and hand nets. Standard lengths (mm) were recorded for the each fish prior to the removal of the sagittal otoliths. The length of each dissected otolith, from the anterior tip to the posterior projection, was measured. The lengths for each otolith pair were averaged, and the relationship with fish length was found to be linear and significantly less than for adults.

Gaddam, Rani, M. Frenock, Maya George, Melissa Miner, Melissa Redfield, and Rachael Williams

University of California, Santa Cruz

CITIZEN SCIENCE ENHANCES THE ABILITY OF LONG-TERM MONITORING TO TRACK SEA STAR WASTING SYNDROME

Sea star wasting syndrome (SSWS) describes a set of symptoms observed in sea stars that often leads to death. The current wasting event extends from Alaska to Northern Baja California and has affected over twenty sea star species, including nine that occur within the Monterey Bay National Marine Sanctuary. Collaboration is key to maximizing monitoring coverage over this enormous expanse of coastline. Observations by the public allow for more comprehensive monitoring of SSWS by filling in spatial gaps between established long-term monitoring sites. Citizens become involved in helping track the syndrome in two ways: reporting casual observations (no training required) and collecting repeatable data (training required). Anyone can report observations of sea stars on seastarwasting.org and contribute to the sea star wasting tracking map; species identification is not necessary if photographs are submitted. Citizens interested in a more involved role are trained by researchers in repeatable methods to set up and survey long-term monitoring plots. With the syndrome affecting much of the coastline, citizen scientists are now also vital to efforts tracking the possible recovery of sea stars. A recent addition to the website allows citizens to report observations of juvenile sea stars. Interested citizen scientists can find resources, contribute observations, and view the tracking map at seastarwasting.org.

George, Maya, Karah Ammann, Nathaniel Fletcher, Christy Bell, and Rachael Williams

University of California, Santa Cruz

DOCUMENTING THE IMPACTS OF SEA STAR WASTING SYNDROME THROUGH LONG-TERM MONITORING IN THE MONTEREY BAY NATIONAL MARINE SANCTUARY

The Multi-Agency Rocky Intertidal Network (MARINe) has continued to monitor the progression of sea star wasting syndrome (SSWS) since it was first observed in 2013. This coordinated intertidal monitoring network was essential to early detection and documentation of the spread of SSWS. The temporal and spatial scale of monitoring allows for detection of abnormal occurrences, such as disease and subsequent changes in populations. MARINe protocols include three permanently marked plots established in areas of high ochre star (*Pisaster ochraceus*) density. For each individual found, researchers record size and disease category. As of January 2015, signs of SSWS have been observed at 98 of 137 long-term monitoring sites. Since the onset of SSWS all sea star monitoring plots within the Monterey Bay National Marine Sanctuary have shown significant declines. Data also show a marked increase in juveniles at many sites. However, this pattern is not ubiquitous. Microbiologists have isolated a densovirus as a potential pathogen but the ultimate cause of the syndrome is not fully understood. Although such events are often associated with warmer than typical water temperatures, one single factor is not sufficient to explain the broad scale pattern of the current outbreak. Continued intertidal monitoring will be crucial for understanding the population and community effects of SSWS and for documenting any recovery of impacted species.

Guzman, Melissa and Annie Chadha

James Logan High School, Union City, CA

IS THERE A CORRELATION BETWEEN THE ABUNDANCE OF GIANT GREEN SEA ANEMONES AND THE ABUNDANCE OF SEA MUSSELS AT PIGEON POINT?

This research was conducted to see if the population of Giant Green Anemones had a correlation with the abundance of Sea Mussels. In our study, we noticed that Giant Green Anemones had an impact on Sea Mussels because detached mussels were their food consumption. Although the Giant Green Anemone ate other small organisms as well, detached mussels was its primary food source. Our methods to conduct this study was to research about the Giant Green Anemones and what impact it has on the Sea Mussels' abundance. To conduct the research for our question, we used LIMPETS data and specifically focued on Pigeon Point. We compared the data tables from certain years, and saw numerous changes between the two organisms and their abundance in the habitat in general. For instance, during 2007 there was a 95% confidence interval that the average count of the Giant green Anemone was 0.06 and laying within the interval. Unlike the giant green anemone, the sea mussels were only counted as 1 during 2007. The major conclusion was drawn that the fewer the giant green anemones were, the more sea mussels were there, undetached. This eventually led back to the differential changes between the two, and made us realize that there is a correlation, regardless if giant green anemones are the predators. The more of one organism, the lesser of the other and vice versa.

Haapaniemi, Sam, Myong Hwan Kim, and Roberto Treviño

University of Washington

CITIZEN SCIENCE AND NOAA SPILL RESPONSE

Citizen science has the potential to be useful to NOAA's Office of Response and Restoration (OR&R). Having witnessed the surge of public interest to assist in environmental disasters, recent trends suggest that an opportunity exists to leverage citizen science to improve emergency response. Public engagement has been further facilitated through improvements in personal technology which allow the public to capture and transmit data virtually anywhere at any time. Collecting primary and secondary source data, we investigated the topic of citizen science in the context of oil spill response efforts. Our research suggests the integration of citizen science may improve NOAA's ability to fulfill its scientific support roles, and ensure emergency response is better informed by scientific knowledge. In our analysis, we explain and evaluate the liability, efficacy, and implementation tradeoffs of citizen science program decisions and models. Citizens may improve the scientific support to oil spill response efforts, but only so far as NOAA is prepared to receive and meaningfully incorporate the data and information. In this regard, we recommend opportunities and strategies for NOAA to integrate citizen science in future oil spills response efforts.

Kramp, Heather E. and Scott L. Hamilton

Moss Landing Marine Laboratories

DENSITY AND BIOMASS AS A PROXY FOR FISH PRODUCTION: A COMPARISON FOR THREE KELP FOREST FISHES ALONG THE CALIFORNIA COAST

Production is one of the most comprehensive measures for assessing ecosystem status because it incorporates a number of variables including density, size structure, growth, fecundity, and survivorship. However, the extensive data required to calculate production (i.e. life history characteristics) are often costly and challenging to attain. Previous studies have proposed using population density or biomass as a proxy

for production, yet, production is a functional measure incorporating a number of variables whereas density and biomass are structural response variables. Subtidal scuba monitoring surveys conducted by the Partnership for the Interdisciplinary Studies of Coastal Oceans (PISCO) along the California coast over the last decade provide data on densities and size structures of common kelp forest fishes. Published life history parameters allow for conversions of observed lengths to weights and ages, permitting estimation of the instantaneous rate of growth, or biomass production. IN this study, average density (no. m^{-2}), biomass (g m^{-2}), and production (g m^{-2} yr^{-1}) were compared for three species; Blue Rockfish (*Sebastes mystinus*), Kelp Rockfish (*S. atrovirens*), and Striped Surfperch (*Embiotoca lateralis*), on the north, north central, south central, and south California coast. Results show that density, biomass, and production vary latitudinally. Though these variables are similar for some species (i.e. Striped Surfperch), it is not true for all species. Blue Rockfish show high densities in northern California but relatively low production compared to more southern regions. As expected, density varies latitudinally for each species, however, biomass and production are generally higher in more southern regions.

Krone-Davis, P., Lisa Emanuelson, and Bridget Hoover

Water Quality Protection Program, Monterey Bay National Marine Sanctuary

SNAPSHOT DAY: 14 YEARS OF WATER QUALITY DATA COLLECTED BY CITIZEN

Since the first Snapshot Day in 2000, trained volunteers have donated more than 13,000 hours collecting water samples simultaneously in four counties and 10 watersheds along 279-miles of California's central coast. Each watershed flows to the Monterey Bay National Marine Sanctuary (MBNMS), the third-largest of 14 federally designated underwater areas protected by NOAA's Office of National Marine Sanctuaries. Snapshot Day (SSD) has endured for over 14 years as an annual event where citizen scientists are responsible for the collection of water quality samples at over 150 sites. An analysis of SSD data was conducted to determine: 1) the exceedance of analyte concentrations compared to water quality objectives (WQO); 2) assessment of trends over time for three water quality constituents; 3) representativeness of SSD data compared with the Central Coast Ambient Monitoring Program (CCAMP) at overlapping sites. Analysis of exceedances at sites monitored 5 or more years revealed that 6% of sites never exceeded any WQO while 65% of sites exceeded for nitrate, 47% for orthophosphate and 78% for *E. coli*. Trend analysis found 2 trends for nitrate, 11 for orthophosphate and 7 for *E. coli*. The rating comparison between the overlapping CCAMP and Snapshot Day sites for nitrate, orthophosphate and E. coli showed a good level of coincidence between the two programs despite differences in sampling regimes and years sampled.

Latham, B. (1), J. Haskins (2), and R. Jeppesen (2)

(1) Environmental Science Technology and Policy, California State University, Monterey Bay
(2) Elkhorn Slough National Estuarine Research Reserve

EFFECTS OF CIRCULATION STRUCTURES ON DISSOLVED OXYGEN LEVELS IN MANAGED WETLANDS

Anthropogenic structures located in wetland ecosystems can produce tidal restriction, decreasing water circulation and thereby decreasing biodiversity. At the Elkhorn Slough, CA low cost hydrologic circulation improvement structures were constructed to alter flow patterns and increase dissolved oxygen (DO) levels in a tidally restricted area with the intent of increasing estuarine biodiversity and lowering aquatic mortality. This study examines the effectiveness of these structures by comparing DO levels pre- and post-implementation. In this study DO levels were monitored at the site of interest, closest to tidal access and farthest from tidal access. DO levels of each year of the study were given a Water Quality Grade (0-100). Depth variation's influence on DO levels was examined and shown to be negligible. Short-term results showed a statistically significant difference in DO levels before and after the structural implementation, yet results from this study were inconclusive due to interannual

variation. Continuation of this study would come in the form of flow modeling, water stratification studies, and structural alterations.

Lindholm, Elizabeth (1) and James Lindholm (2)

(1) Carmel River Elementary School, Carmel, CA
(2) Institute for Applied Marine Ecology, California State University, Monterey Bay

SAMPLING CRABS IN THEIR CRABITATS

We were interested in learning how crab carapace width determines the habitat in which the crab lives. This information is important to marine ecologists because it helps them understand the relationship between crabs and their habitats better. It is also important for the management of the marine environment because the smaller crabs can be protected more easily if we understand the habitats in which they live. We used SCUBA to sample crabs and their habitats off the coast of central and northern California. We hypothesized that bigger crabs would be out in the open more than smaller crabs which we expected to be hiding under cover. We sampled crab habitats (or “crabitats”), from 3 – 10 meters water depth, including rocks, kelp, and sand. We then observed whether the crabs were under cover or in the open in each of those crabitats. For each crab we noted the species, the carapace width, water depth, and habitat, and we took a picture of each crab to confirm identifications later. We also sampled at the beginning and end of the day to see whether time of day was important. Come see our poster to see the exciting results!

Lippiatt, Sherry M. (1)(2) and Nancy E. Wallace (1)

(1) NOAA Marine Debris Program
(2) I.M. Systems Group

TACKLING TRASH: DEVELOPING A NATIONAL MARINE DEBRIS MONITORING PROGRAM

NOAA's Marine Debris Monitoring and Assessment Project (MD-MAP) has evolved from an effort to develop scientifically rigorous standardized protocols to a contributing network of nearly 50 different citizen science, volunteer-based organizations. Project partners conduct monthly shoreline assessments and enter survey data to an online database. One unanticipated focus of the MD-MAP is to investigate the impact of debris generated from the devastating March 2011 earthquake and tsunami in Japan. This presentation will provide an overview of efforts to date, challenges and lessons learned, and potential management and outreach outcomes of this citizen science initiative.

Luecke, Noah C. and John Silveus

California State University, Monterey Bay

CARNEROS WETLAND: PREDICTIVE MODEL MEASURING VEGETATION CHANGE RESULTING FROM SEDIMENTATION

Carneros creek is the main freshwater source into Elkhorn Slough. Carneros wetland is a constructed wetland connected to the creek. The purpose of Carneros wetland is to reduce sedimentation, to assist with biofiltration and to create habitat for some of California’s endangered species. While the nature of a constructed wetland is to collect sediment, after a certain amount of sedimentation the wetland no longer becomes functional. This study was done to create a predictive model to manage sedimentation. With surveying equipment, elevations were collected for the wetland and geographic modeling software was used to map these elevations. The vegetation of the area was also analyzed and a delineation between species was observed. The species separation was viewable from a topographical image which was then used to overlay the elevations to view potential correlation. Using

mean low water height of the wetland, the elevation of the species separation was calculated and plant species were separated into designations relative to their elevation above mean low water height. Then, a sedimentation simulation was created by adding two, five, seven, and ten centimeters to each elevation point. Any change in the percent area of each designation was looked a correlation between plant species and elevation above mean low water height was found. With the addition of two centimeters of elevation, total wetland area remained the same. With the addition of five, seven, and ten centimeters, total wetland area decreased. This model could be used to predict alteration of vegetation and assist in the prediction of maintenance requirements for similar wetland environments.

Makukhov, April D. (1), Lauren Tobosa (1), Giacomo Bernardi (2), Hamilton W. Fennie (3), Scott Hamilton (3), and Cheryl A. Logan (1)

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OCEAN ACIDIFICATION IMPACTS ON THE CELLULAR PHYSIOLOGY OF JUVENILE ROCKFISH (SEBASTES SPP.)

Despite teleosts' high capacity for acid-base regulation, recent ocean acidification (OA) studies on tropical marine fish have documented negative physiological effects on growth and reproduction. Impacts on temperate fish, however, remain understudied. Our previous work showed that temperate rockfish native to local Monterey Bay kelp forests, a naturally pH-variable environment due to upwelling, have reduced swimming performance when reared under chronic OA conditions**,** with juvenile blue rockfish *(Sebastes mystinus)* appearing more OA-tolerant than juvenile copper rockfish (*S. caurinus*)**.** To investigate potential underlying mechanisms leading to differences in OA susceptibility, we compared rockfish transcriptomes after chronic exposure to predicted end-of-century pH levels (7.3, 7.5, 7.8, 8.0). We extracted total RNA from white muscle tissue and prepared cDNA libraries for RNA-sequencing. We then assembled a copper rockfish *de novo* transcriptome from our sequences using Trinity, mapped sequences using RSEM, and examined differential gene expression (DE) using edgeR (FDR<0.05). We identified 358 and 147 significant DE genes among pH treatments in the blue and copper rockfish, respectively, with only 14 genes in common between them, suggesting differential acclimation responses to chronic OA exposure that may be species-specific. To further understand potential species-specific responses to OA, our future work will involve investigating gene expression in blue and copper rockfish gill tissue, where 90% of acid-base regulation occurs in marine teleosts. Our study is the first to use high-throughput sequencing to examine gene expression of OA-tolerant versus susceptible teleosts, providing important information about sublethal changes associated with OA resistance in marine fishes.

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VARIABLE SPINY LOBSTER FORAGING ACROSS AN INTERTIDAL LANDSCAPE

Managers include specific pieces of habitat within marine reserves to help restore ecosystems and to protect valuable species like the California Spiny Lobster (*Panulirus interruptus*). Both within and external to these protected areas previous studies suggest that rocky intertidal zones serve as an important nighttime high tide foraging habitat for lobsters, where they feed upon mussels, crabs, and limpets. On Catalina Island, variation in the prey lobsters target may reflect variation in prey availability independent of fishing pressure. We compared the summertime diet composition of protected and fished lobster populations from nearby shorelines by measuring their isotopic

signatures. We inferred the relative importance of each of three prey types that largely comprise spiny lobster diet during this season by applying stable isotope data to Bayesian mixing models. Mixing models indicate that mussels represent a greater proportion of the diet of lobsters from fished sites that have persistent mussel beds, a known foraging habitat for lobsters. The strategy of closing areas to fishing can impact local trophic dynamics but habitat quality, regardless of fishing pressure, remains an important factor in determining prey availability and community trophic dynamics. This study highlights how attention to fine scale differences in foraging habitat can help promote the desired trophic dynamics within protected reaches of marine reserves.

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DETERMINING THE EFFECT OF SEA SURFACE TEMPERATURE ON *PROFILICOLLIS SPP.* PREVALENCE IN *EMERITA ANALOGA*

Since 2002, the Careers in Science (CiS) Intern Program has monitored Ocean Beach in San Francisco, California for the population of Pacific mole crabs (*Emerita analoga*) as part of a partnership program with the Long-term Monitoring Program and Experiential Training for Students (LiMPETS) in the Bay Area. CiS contributes to LiMPETS by monitoring *E. analoga*, an indicator species of the sandy beach habitat in temperate regions along the Pacific Ocean (Siegel and Wenner 1984, Wenner 1988). Data recorded from beach collection and random sampling dissections includes size, sex, and *Profilicollis spp.* load. *E. analoga* is an intermediate host for the parasite *Profilicollis spp*, which when consumed can cause morbidity and mortality in shorebirds and sea otters (Mayer et al., 2003). Using CiS and LiMPETS long-term data, we investigated the possible effect of sea surface temperature on the prevalence of *Profilicollis spp.* in *E. analoga*. Our results indicate there is a slight yet significant negative correlation between SST and parasite prevalence in the Pacific mole crab at an eighteen day lag. We hypothesize the correlation may be attributed to nutrient-rich upwelling which could induce Pacific mole crabs to feed more, possibly leading to more parasite egg ingestion. Since SST is highly correlated with nutrient concentration in this region, future work should include analysis on possible effects of water nutrient concentration on *E. analoga*'s feeding habits, and survival rate of *Profilicollis spp.* eggs.

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WHAT COLOR IS YOUR WATER? MONITORING THE COASTAL OCEAN THROUGH COLOR

Ocean color as measured from satellite is a prominent tool in modern oceanography. However, people have been observing and recording the color of the ocean from the shore for centuries. There are two color systems commonly used worldwide for identifying the color of the water; one called the Forel-Ule system, and one based on the Munsell system. With the aid of color charts or instruments developed from these systems, people can observe and record the color of the water as it changes through time. Water reflects the blue of the sky, but if you look straight down into coastal waters, you are more likely to see green or brown. Green is due to the presence of phytoplankton, and brown is caused by suspended sediment (mud). Observing and recording the water color helps monitor how the phytoplankton community and the ocean environment change. The Kudela Lab at University of California, Santa Cruz, records the color of the water every week when we collect phytoplankton samples. Also, visitors to the Santa Cruz Wharf and San Francisco's Exploratorium museum can explore and observe the changing water color with exhibits of colored tiles suspended over the water. The 32 tile colors are specifically chosen to represent the color spectrum commonly seen in cold,

productive coastal waters. These real-time observations of oceanic variables, collected by both researchers and the public, can be used in the development of models to “forecast” changes in the ecosystem.

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CALIFORNIA MARINE SHELLFISH BIOTOXIN MONITORING: A CITIZEN-SCIENCE BASED APPROACH

Marine shellfish poisoning is a naturally occurring event often associated with harmful algal blooms (HABs), and known to cause serious or fatal consequences on human health. The California Department of Public Health (CDPH) has been monitoring outbreaks of shellfish disease from many intertidal locations (currently 116) along the coast of California since 1981. California State University, Monterey Bay students began assisting the state program in 2014 by sampling wild sea mussel (*Mytilus californianus*) populations from two locations in the Monterey Bay National Marine Sanctuary. *M. californianus* samples were tested by CDPH biologists for the presence of paralytic shellfish poisoning (PSP) and domoic acid (DA). In addition to seasonal and annual mussel quarantines, health advisories were issued on a regional basis where results indicated the presence of harmful levels of marine biotoxins. Statewide long-term monitoring trends suggest excessive levels of PSP and DA occur between the months of May and October, and coincide with the peak growth period of HABs. Results were published by the CDPH in monthly, quarterly, and annual reports to inform recreational and commercial harvesters of bivalve shellfish quarantine and warning events. Ongoing monitoring of marine biotoxins will be used to better inform the recreational and commercial fishing sectors of harmful shellfish toxins, and to predict future outbreaks of domoic acid and paralytic shellfish poisoning events.

Moore, Steven W., Lauren R. Boye, Samantha K. Whitney, and Joshua D. Ambrose

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LIFE IN THE “TWILIGHT ZONE” OF CARMEL SUBMARINE CANYON: A BASELINE SURVEY

Most marine ecological studies to date have focused on the intertidal zone or shallow subtidal depths easily accessible to scuba divers. Yet many species with ecological or commercial significance reside just below scuba depths in the ocean’s “twilight zone” (locally, about 20-150 m depth). This fascinating, but poorly understood realm is characterized by strong depth-dependent gradients in light intensity, water motion, temperature, oxygen saturation and other ecologically-important parameters. The head of Carmel Submarine Canyon near Carmel, California, provides near-shore access to these depths and features a variety of habitats that support diverse marine communities. To obtain baseline data on species abundance and distribution in the twilight zone of Carmel Canyon, we used a student-built ROV to conduct high-definition (1080p) video surveys of organisms and habitats between 20 and 140 m deep in the canyon head. In addition to assembling a preliminary list of macrofaunal species present in each habitat type (e.g., flat sand, sloping sand, rock walls), we found: distinct changes in species assemblages on each substrate type with depth, marked patchiness in both space and time for some species, large mounds of decomposing kelp at the base of some rock walls, and evidence of a possible depth refuge from sea star wasting disease for the sun star, *Pycnopodia helianthoides*. These observations will provide baseline data that can be used to detect and study potential changes due to climate change or other disturbances.

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MODELING INTERTIDAL BARNACLE COVER IN A LANDSCAPE ECOLOGY CONTEXT

Understanding the interplay of abiotic and biotic factors is a key step in predicting the impacts of climate change on intertidal communities. Principles of landscape ecology may allow us to gather knowledge of this interplay on small scales, such as one boulder field, and extrapolate it to scales as large as the California coast. We sought to model barnacle distribution and percent cover based on environmental data collected from an intertidal bolder field in Bodega Bay, California. We considered the presence and abundance of multiple predator and competitor species, abiotic variables including extreme temperature days, mean temperature, and water velocity, and landscape dynamics including tidal height, aspect, and slope as possible predictors of barnacle cover. We found that the presence of predators, specifically Pisaster sea stars, and the abundance of competitors, specifically California mussels, as well as the abiotic factors of water motion, velocity, and temperature were strong predictors of barnacle cover. This demonstrates how both biotic and abiotic processes influence where species will be found in intertidal systems. Combining this model with similar models for the distribution of other intertidal species will allow us to better understand the community dynamics of rocky intertidal zones. We hope to broaden these models to predict barnacle cover, and the cover of other species, across a larger landscape and in the context of a changing climate.

Orr, D.W. and Corey Garza

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PREDICTIVE MODELING OF WAVE VELOCITY AND ITS DISTRIBUTION OVER A ROCKY INTERTIDAL LANDSCAPE

Understanding the mechanisms that drive species diversity and patterns of species distributions is a fundamental goal in ecology. Large scale environmental forces, such as winds and waves, can interact with small scale heterogeneous landscapes. This interaction can affect species diversity and distribution by influencing or driving processes such as disturbance and recruitment. This is particularly important when considering the structure and distribution of foundation species within a community, such as corals in a reef or large trees in a forest. The California mussel, *Mytilus californianus,* is a sessile foundation species that forms massive aggregations along rocky shores in the North Eastern Pacific. In rocky intertidal communities waves are assumed to play an important role in disturbance and structuring the distribution of species. Here we measure wave velocity across a rocky intertidal using a swath of dynamometers. Coordinates and elevation were measured across each site. Bathymetric surveys were conducted offshore of survey sites. GIS modeling was used to characterize and quantify intertidal landscape and sea floor characteristics. These data were coupled with remotely sensed buoy data. Together these data were used to develop models to predict the mean maximum velocity experience at a site and the distribution of wave velocity across a heterogeneous intertidal landscape. Understanding and predicting how large scale environmental forces interact with small scale landscapes will help improve our understanding of the patterns and mechanisms that drive species distribution and diversity in both marine and terrestrial systems.

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VERTICAL STRATIFICATION OF DEMERSAL FISH COMMUNITIES ALONG THE WALLS OF THE LA JOLLA AND SCRIPPS SUBMARINE CANYONS

The geographic distribution of many coastal marine fish assemblages are strongly driven by habitat features, particularly among demersal fishes that live along the seafloor. Ecologists have long recognized the importance of characterizing fish habitat associations, especially for management and the design of marine protected areas. Despite this importance, little is known about fish distribution and habitat suitability in submarine canyons. The active continental margin of the California coast is cut by eight submarine canyons, many of which extend from the shore to the deep abyssal plain. We sampled the demersal fish communities in two of those canyons: (1) the Scripps submarine canyon in the San-Diego-Scripps State Marine Conservation Area (SMCA) and (2) the La Jolla canyon in the Matlahuayl State Marine Reserve (SMR). A remotely operated vehicle was used to sample 21 vertically oriented transects along the canyon walls in depths ranging from 20-300 m. Species composition was assessed in three depth-stratified bins (100m per bin) along, and to either side, of the canyon walls. Species richness, abundance, and habitat characteristics (slope and benthic terrain ruggedness) were quantified and mapped using ArcGIS. Three distinct communities were identified, which comprised 37 species of demersal fishes from 17 families. Among all factors analyzed in this study, depth had relatively the greatest influence on species richness, but did not significantly contribute to variation in abundance. These trends suggest that variation in canyon dynamics across depth strata may facilitate distinct community structures, but have little influence on overall abundance.

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KELP FLY PREFERENCES OF PHAEOPHYTE WRACK ON A CENTRAL CALIFORNIA BEACH

Along the Monterey Bay coast in California, kelp flies (Order Diptera) are commonly associated with various species of Phaeophytes. Kelp flies generally feed on stranded kelp and can have ecological importance in the degradation of organic matter on the coast. A previous study by Kompfner (1974) found that wrack of distances from the shoreline supports different species of kelp flies, indicating their different niches. Wrack's nutritional value changes throughout its decomposition, and since wrack that is farther away from the water line is more dried it has different characteristics compared to wrack closer to the shoreline that is more hydrated. Beach wrack was surveyed to determine the species composition of kelp flies as well as if the flies had a preference for species of wrack, and its level of decomposition. Kelp flies of the genus *Coelopa* and *Fucellia* were quantified by counting the number of flies on each kelp species. The kelp species observed included *Macrocystis pyrifera, Nereocystis luetkeana, Stephanocystis osmundaceae,* and *Egregia menzesii*. Multiple T-tests found a significant difference between the number of flies on the species tests *M. pyrifera* and *N. luetkeana*. The majority of flies found on the wrack within the quadrat was *Fucellia rufitibia*. Understanding the fly's preference for wrack may help to understand the population dynamics of various consumers in coastal ecosystems. This work can also lead to studies focusing on the life history of kelp flies as well as specifications on their individual consuming habits.

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RHODOLITHS AND TANAIDACEANS: IS THERE A CORRELATION?

Catalina Island is home to seven rhodolith beds. Rhodoliths are free-living coralline red algae that form beds on the seafloor and little is known of their associated fauna. Tanaidaceans are crustaceans that are commonly found in sandy sediments of deep marine environments. The purpose of this study was to identify if there was a relationship between Tanaidacean abundance and live rhodolith beds. Samples were collected from three sediment types (sand, >90% dead rhodolith cover, and >90% live rhodolith cover) from three sites (Isthmus Cove, Cherry Cove, and Avalon Harbor) at Catalina Island, CA. The samples were sieved and invertebrates were removed. Five genus of Tanaidaceans were found between the three sites and sediment types. Four of the five genus were found to have at least two times the abundance in samples of live rhodolith than in the other sediment types for each site. Cherry Cove was three times more abundant in Tanaidaceans than Avalon Harbor, and was two times more abundant than Isthmus. Higher species richness and diversity of Tanaidaceans were observed in live rhodolith beds than in other sediments at all three sites. This suggests rhodolith beds offer benefits to the Tanaidaceans such as shelter or access to food sources. The primary habitat of Tanaidaceans is thought to be tubes or burrows in sandy sediment. These findings are contrary to that and further study is needed to assess the benefits of rhodolith habitat and if there is a need to protect them.

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SEASTAR WASTING SYNDROME: IMPACTS ON THE INTERTIDAL ZONE

The Ochre sea star, *Pisaster ochraceus*, has experienced a substantial population decline, caused by a newly-identified virus that causes Sea Star Wasting Syndrome. Our goal for this project is to focus on the effects of sea star mortality on the neighboring species inhabiting the tide pool ecosystem. We predict that the sea mussel population will increase slightly as a result of the sea star decline. Sea stars are keystone species in the tide pools and through their predation control populations of other species, particularly mussels. We monitor twice a month at Davenport Landing, following the LiMPETS procedures for the rocky intertidal vertical transect. Our analysis so far reveals that sea mussels populations have in fact increased slightly over time as the Ochre sea star population declined. We plan to collect additional data to clarify the statistical significance of this relationship. We would like to thank our mentor John Pearse for his time and expertise on our project.

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California Ocean Science Trust

CITIZEN SCIENCE AND MPA MONITORING: WHAT'S THE OPPORTUNITY?

The Ocean Science Trust supports California's implementation of an adaptively managed statewide network of marine protected areas (MPAs) by designing and implementing scientific monitoring through a partnerships approach. In this context, we are actively exploring how different kinds of knowledge and different approaches to science can inform the management of the state's MPAs. Building on several successful partnerships with citizen science groups in the Central Coast, we set out to expand and deepen our engagement with citizen science throughout California by asking several related questions: What is the citizen science capacity in the Central Coast? What would

motivate citizen science groups to participate in MPA monitoring? What barriers to their participation exist, and how could those be overcome? This poster summarizes our main findings, and offers guidance for developing productive partnerships between citizen science groups and natural resource management. An important finding is that citizen science represents a range of potentially valuable approaches to MPA monitoring, in terms of cost-effectiveness and sustainability, but also for expanding the range of partners and participants in the monitoring program. We look across citizen science groups to identify shared traits amongst the strategies they use to connect to management. We also examine important contextual and institutional factors that present challenges and opportunities for making citizen science matter. Ultimately, we hope this effort will help shape a role for citizen science in informing marine resource management across the state and beyond.

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THE "SPOT A BASKING SHARK" PROJECT: HOW CITIZEN SCIENTISTS CAN HELP SAVE AN ENIGMATIC SHARK

The distribution and trans-equatorial migrations of the basking shark (*Cetorhinus maximus*) have been well documented in the Northern Atlantic, yet seasonal patterns of distribution have not to been fully elucidated in the eastern North Pacific**.** Filling in vital knowledge gaps will help inform the best recovery plan to rebuild the basking shark population in this region, which has been designated a 'Species of Concern' by NOAA's National Marine Fisheries Service and 'Endangered' by the International Union for the Conservation of Nature (IUCN). The 'Spot a Basking Shark' Project is a collaborative effort to investigate the abundance, distribution, and population status of basking sharks in the eastern North Pacific. The project employs a web-based reporting system for the public to record sightings, utilizes satellite tags to improve understanding of essential habitat and geographic range, and obtains additional information on life history and patterns of occurrence by data–mining existing records. Have you seen a basking shark? Report your sighting on our website: http://psrc.mlml.calstate.edu/current-research/basking-shark/

Yee, Laura and John Bello

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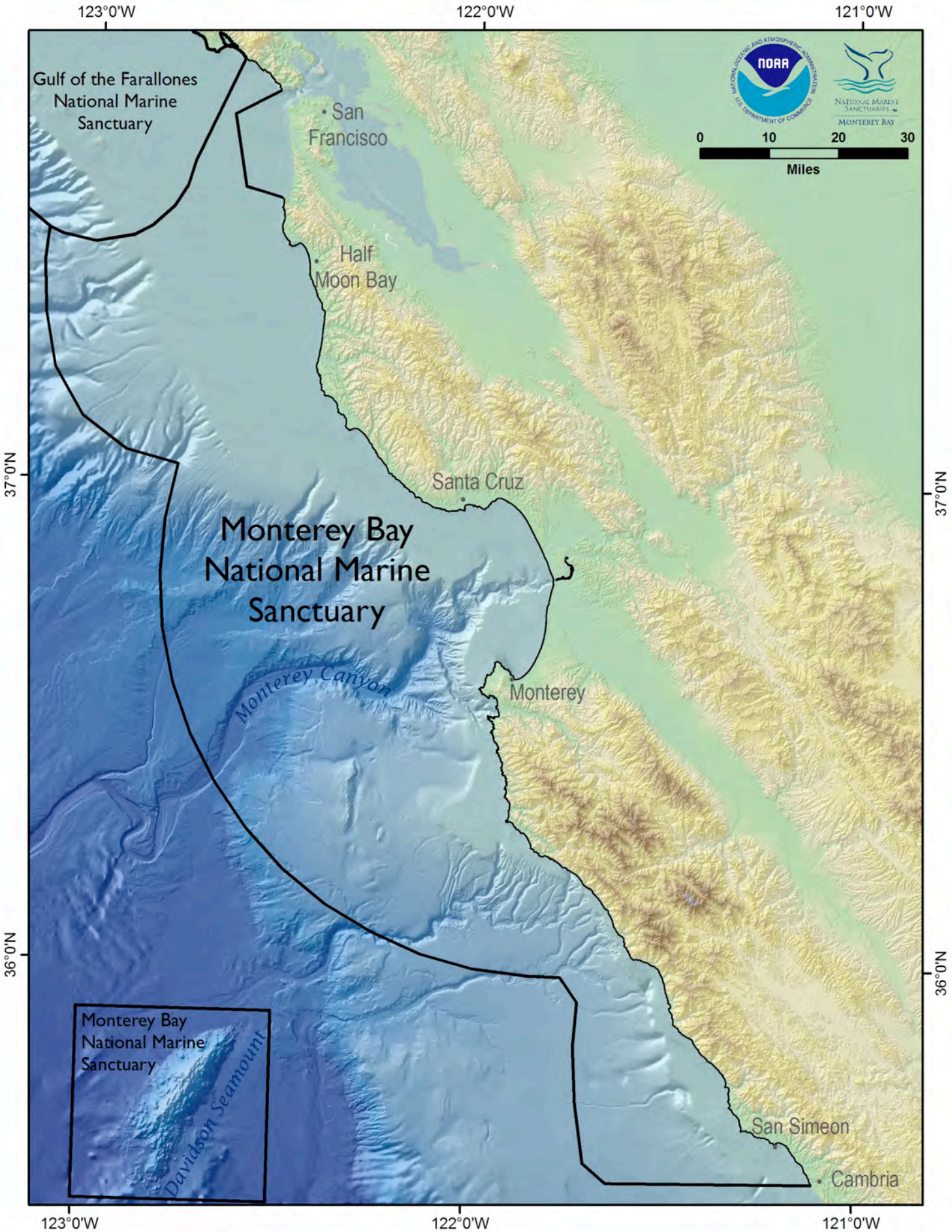
IS THERE A CORRELATION BETWEEN HOW FREQUENTED BY HUMANS A MONITORING SITE IS, AND THE RATIO OF STUNTED TURKISH TOWEL TO TAR SPOT ALGAE?

This study was undertaken to determine if there was a correlation between the frequency a site is visited and the ratio of Stunted Turkish Towel to Tar Spot Algae. We used data collected between the years 2005 and 2015 from the LiMPETS website. This data was collected through the use of vertical transects, which required counting the number of organisms within a $0.25m^2$ quadrat along a transect running from the high intertidal zone to the low intertidal zone. The ratio of Stunted Turkish Towel to Tar Spot Algae at Pigeon Point was compared to the ratio of the two algae at the Fitzgerald Marine Reserve, and it was apparent that the Tar Spot Algae was more abundant than the Stunted Turkish Towel at both sites. Although the ratio in the two sites was similar, the algae at the Fitzgerald Marine Reserve was located in the mid intertidal zone while the algae at Pigeon Point was located in the high intertidal zone. This similarity in ratios could be attributed to the fact that both sites are located in San Mateo, however, the difference in intertidal zones could be attributed to differences in factors other than the frequency of visits at each location, such as terrain or the abundance of other organisms.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