



Principal Investigators - please use this form to submit your MPA Baseline Program project annual report, including an update on activities completed over the past year and those planned for the upcoming year. This information will be used by the MPA Baseline Program Management Team to track the progress of individual projects, and will be provided to all MPA Baseline Program PIs and co-PIs prior to the Annual PIs workshop to facilitate discussion of project integration. Please submit this form to California Sea Grant when complete (sgreport@ucsd.edu, Subject [Award Number, project number, PI, "Annual Report"].)

Project Information

Project Year: Sept 1, 2012 -Aug, 31, 2013 MLPA Region: South Coast

Project Title & Number: Sandy-Beach Ecosystems: Baseline Characterization and Evaluation of Monitoring Metrics along the South Coast, Project Number R/MPA-24B, Grant: 10-049

PI name: Jenifer E. Dugan Co-PI name: Henry M. Page

PI Contact Info Co- PI Contact Info (please list additional PIs and contact info in the "Project Personnel" section if necessary)

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Project Goals & Objectives

Sandy beaches and adjacent surf zones are important foraging areas for shore birds and fishes that feed on intertidal invertebrates. The amount of wrack and plankton cast onto beaches is dynamically linked to adjacent ecosystem features, ocean climate and the reproductive output of invertebrates. The condition of beach ecosystems is also linked to the reproductive success of beach-nesting fishes and birds. These links are the critical pathways through which direct and indirect effects of MPA implementation and variation in ocean climate will cascade, making sandy beaches an important target for long-term monitoring to assess ecosystem condition and functioning of the SC region. Sandy beaches are also used extensively for a variety of recreational activities, including shore-based fishing, clamming and bait collection, beachcombing, dog-walking, jogging, sunbathing, surfing, swimming, volleyball and other sports, birding, and picnicking. We will:

- 1) provide a comprehensive, baseline description of the biodiversity of sandy beaches of the SC region using both new and historical/existing data
- 2) develop informative ecosystem indicators and a plan for long-term monitoring of the network of MPAs involving citizen scientists, and
- 3) interpret the important ecological links among the components of this and other ecosystem features, including humans, for use in evaluating the effectiveness of the network of MPAs.

Summary of Project Activities Completed to Date

Overview of Project Year __ Activities, including progress towards meeting goals & objectives

Progress on our goals and objectives has been excellent in Year 2. We have followed the proposed timeline for monthly surveys and the semi-annual surveys of indicator/focal taxa at our study beaches. We conducted surveys designed to describe the ecological conditions, including draft indicator/focal species or taxa for key attributes and metrics of a range of beach types located inside and outside of MPAs in the South Coast Region. Between late August and early November 2011 we conducted intensive biodiversity surveys of intertidal invertebrate communities, wrack and beach characteristics at 12 beaches (6 inside MPA and spatially paired 6 Reference beaches located outside MPAs). We continued the monthly surveys of the birds, people, dogs, kelp plants, wrack, and beach characteristics on the 12 beaches that were surveyed for biodiversity initiated in December 2011. Standard monthly photos are also shot at each study site. These surveys will span two years and continue through November 2013. In Sept/Oct 2012 and May/June of 2013, draft indicator invertebrate taxa (Sand Crabs, *Emerita analoga* and Beachhoppers, *Meglaorchestia* spp.) were surveyed at all 12 beaches. Repeat surveys of these taxa at the 12 study beaches are planned for September/October 2013.

Laboratory processing and identification of preserved samples from the biodiversity surveys by the graduate student and technicians on the project are now completed. Processing of samples from indicator/focal taxa surveys are completed for 2012 and in progress for the 2013 surveys. Data entry is in progress for all these components of our study.

During summer 2013 we initiated comparative surveys of sand crab populations in the Campus Point MPA using the citizen science protocol used by the Limpets sandy beach monitoring protocols and a modified Limpets protocol. These surveys were conducted in cooperation with staff of the Channel Islands National Marine Sanctuary, Santa Barbara Coastal LTER staff and K-12 teachers in the Research Experience for Teachers (RET) summer program. Coordinated sand crab surveys were conducted on four dates. All sand crabs collected were measured live and released. Analyses of these data are in progress and will be presented at a teacher education conference during Fall 2013. Results of these surveys will also be presented in the teacher workshop in 2013.

Highlights from project progress so far, such as successes achieved, new collaborations or partnerships, or interesting stories from the past year that may be suitable for a blog post or other media venue

Our results on the distribution of remaining populations of two upper beach isopod species were published in Estuarine Coastal and Shelf Science and received considerable media attention including internet news, blogs, newspaper and radio coverage.

Associate Investigator Hubbard contributed extensively to a draft website on sandy beach ecosystems that was developed by Sea Grant Advisor Monique Myers. The new site is currently under review.

Description of any unforeseen events and substantial challenges, and resulting effects on project activities and progress. Please indicate any issues that may affect other PI's or require coordination with other Baseline partners (e.g., ME, DFG, Sea Grant).

No additional challenges or events beyond the access issues and habitat suitability described in our Year One report affected our project activities and progress.

Data status (i.e., paper/raw format or digitized; if digitized, what format?)

All field data are in paper format and data entry is in progress. Data from samples that have been processed are in paper format and data entry is in progress.

Activities Planned for following Project Year __ (if applicable) – *Please describe remaining work and approximate timelines for completing that work, including any anticipated budget variances necessary to complete the project.*

We will continue monthly surveys through November 2013 to complete 2 full years of data collection at the 12 study beaches. We will conduct surveys for indicator taxa at the 12 study beaches during September 2013. We will continue and complete sample processing and species identifications in the laboratory. We will continue and complete data entry for the monthly surveys and for the biodiversity and the indicator taxa surveys. We will generate data summaries and conduct analyses for the datasets collected during the study.

In collaboration with the Rocky Intertidal SCMPA baseline study and CINMS we plan to conduct a teacher's workshop to share our refinements of citizen science protocols for potential monitoring application during Summer 2013.

Results from our study will be presented at two national scientific meetings in Fall 2013, the Binghamton Symposium in October and the Coastal and Estuarine Research Federation Meeting in November.

We anticipate requesting a no cost extension of up to 1 year on this project to allow us to complete the proposed research activities including the teacher workshop, the extensive data processing and analyses of our survey data, the production of datasets for posting, and the preparation of a final report and manuscripts.

Project Personnel – Please indicate additional project personnel involved in your MPA baseline project, including students and volunteers, or additional PI contact information if necessary, as well as the nature of their assistance in the project project.

| | <i>Students Supported</i> | <i>Student Volunteers</i> | <i>Nature of Assistance</i> |
|----------------------|---------------------------|---------------------------|-----------------------------|
| <i>K-12</i> | | | |
| <i>Undergraduate</i> | <i>3</i> | <i>14</i> | <i>Field and laboratory</i> |
| <i>Masters</i> | <i>1</i> | | <i>Field and laboratory</i> |
| <i>PhD</i> | | | |

Number of other Volunteers not counted above and the nature of their assistance in the project:

3 RET teachers – participated in citizen science protocol testing and analyses

Additional PI contact info not listed on first page:

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Cooperating Organizations and Individuals - Please list organizations or individuals (e.g., federal or state agencies, fishermen, etc.) that provided financial, technical or other assistance to your project since its inception, including a description of the nature of their assistance.

| Name of Organization or Individual | Sector (City, County, Fed, private, etc.) | Nature of cooperation (If financial, provide dollar amount.) |
|------------------------------------|---|--|
| California State Parks | State | Personnel and collaboration on K-12 outreach |
| SBC LTER | University- NSF funded | Personnel and collaboration, shared study sites |
| California Sea Grant Extension | State | Collaboration on educational website |
| | | |
| | | |
| | | |
| | | |

Project Outputs and Materials: Please provide any other project-relevant information, such as descriptions of

Examples of Media Coverage for Hubbard et al. article*

Los Angeles Times, <http://www.latimes.com/local/lanow/la-sci-sn-beach-roly-polies-extinction-california-20130719,0,4438992.story>,

KPCC Public Radio <http://www.scpr.org/news/2013/08/02/38494/ucsb-scientists-look-for-isopods-to-check-for-beac/>
<http://www.futurity.org/pretty-beaches-leave-tiny-critters-homeless/>

<http://www.sciencedaily.com/releases/2013/07/130718101341.htm>

<http://ktla.com/2013/07/19/beach-roly-polies-vanishing-in-southern-california-study-says/#axzz2gbi7eWgY>

Santa Barbara Newspress- attached pdf

Presentations:

- 2012 Dugan, J. E. D. M. Hubbard, H. M. Page, N.K. Schooler Beyond beach width - integrating ecological zones and function of sandy beach ecosystems. Poster. September 2012 LTER All Scientists Meeting, Estes Park, CO
- 2012 Beaches as ecosystems, Public Workshop on Beach Ecology, September 2012, City of Malibu, CA
- 2012 Dugan, J. E. Local Beaches and Climate Change. Workshop presentation. Santa Barbara Channel Ecosystems and Climate Change, Understanding local impacts and adaptation approaches, November 2012 Agency and public workshop jointly sponsored by California Sea Grant, Coastal Conservancy and CNAP.
- 2013 Hubbard, D. M., J.E. Dugan, N.K. Schooler, Local extirpations and regional declines: the case of endemic upper beach fauna in southern California, USA. Southern California Academy of Sciences Meeting, Fullerton, CA
- 2012 Viola, S., J. E. Dugan, D. M. Hubbard, N.K. Schooler Burrowing in beach fill, implications for recovery of sandy beach ecosystems. Southern California Academy of Sciences Meeting, Fullerton, CA

Publications:

- in press Schooler, N. K., J. E. Dugan, D.M. Hubbard. Comparing intertidal biodiversity over time: calibrating species richness estimates for sandy beaches. Est. Coastl Shelf Sci.
- 2013 Viola, S., J. E. Dugan, D. M. Hubbard, N.K. Schooler. Burrowing in beach fill, implications for recovery of sandy beach ecosystems. Est. Coastl Shelf Sci. DOI:
- 2013 *Hubbard, D.M., J. E. Dugan, N.K. Schooler, S. Viola. Local extirpations and regional declines: the case of endemic upper beach fauna in southern California. Est. Coastl Shelf Sci. <http://dx.doi.org/10.1016/j.ecss.2013.06.017>
- 2013 Dugan, J. E., D.M. Hubbard, B.J. Quigley Beyond beach width: steps toward identifying and integrating dynamic ecological envelopes with geomorphic features and datums for sandy beach ecosystems. Geomorphology 199: 95–105
- 2013 Lafferty, K. D., J. P. McLaughlin, J. E. Dugan. Novel foraging in the swash zone on sand crabs (*Emerita analoga*, Hippidae) by mallards. Wilson J. Ornithol. 125(2): 423-426
- 2012 Schooler, N.K., J. E. Dugan, H. M. Page. First host record for the parasitoid rove beetle, *Aleochara sulcicollis* Mannerheim, 1843 (Coleoptera: Staphylinidae) on the intertidal kelp fly *Fucellia rufitibia* Stein 1910 (Diptera: Anthomyiidae). Coleop. Bull 66(4): 1-4.

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Saving sand critters is no walk on the beach, UCSB scientists say

By GARRY WORMSER, NEWS-PRESS CORRESPONDENT

August 4, 2013 5:25 AM

In one of Roald Dahl's famous short stories, a man invents a machine that can hear grass scream when stepped upon.

If that machine could amplify the screams of sand-dwelling creatures being tormented when beaches are raked and groomed, California's sunbathers might get the message and try to save what's left of the beach ecosystem.

"By grooming and raking beaches with new sand to make them appealing to sunbathers, we are systematically exterminating creatures essential to marine biodiversity," say UCSB marine biologists Jenifer Dugan and David Hubbard.

They are co-authors of a recent paper on the subject in the journal Estuarine Coastal and Shelf Science.

Where the average sunbather may see only beauty — wide, flat swaths of soft sand — the scientists see peril for plant and animal life alike.

Beach filling and grooming to make a beach towel-friendly, so to speak, can be disastrous not only to upper beach animals that carry their young like kangaroos, but to species like grunion that lay their eggs in the sand.

From Point Conception in Santa Barbara County to Baja California, some animals have vanished from some 60 percent of beaches where they were recorded 100 years ago.

Barring the quick implementation of effective conservation strategies for sandy beaches, the researchers say, isopods and several other diminutive creatures — all-important prey for shorebirds — may be wiped out altogether.

Beach maintenance can be more intensive than agriculture. Both are big business operations.

"But while farmers may plow their fields several times a year, some Southern California beaches have the sand flattened and are raked clean of trash and seaweed twice a day to keep the area pristine for the tourist trade. Intensely managed beaches like this are viewed as a Southern California trademark, but

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the ecological costs are very high," said Dr. Dugan, an associate research biologist at UCSB's Marine Science Institute.

The nocturnal creatures that live on the upper sections of beaches are caught in an ecological Catch-22.

"The beaches where they are currently thriving — mostly on ungroomed, undeveloped shores — are also where the remaining populations of these animals face the greatest threat from sea level rise," Dr. Dugan said.

Such natural beaches are often bluff-backed, leaving the slow, vulnerable critters with no place to go as the sea level rises, said Mr. Hubbard, a member of the Marine Science Institute's research staff.

Of all the zones on a beach, the upper intertidal zones of beaches are the most likely to have a house or a parking lot on it, to be groomed, or to be covered with a sea wall, the two scientists say in their research paper.

In an earlier technical paper, Dr. Dugan noted that restrictive walls or seawalls could eventually drown sandy beaches. These structures include many types of barriers constructed to protect beachfront properties along the California coast.

"When someone builds a seawall, not only is beach habitat covered up with the wall itself, but, over time, sand is lost in front of the wall until the beach eventually drowns. The semi-dry and damp sand zones of the upper and mid intertidal areas are lost first, leaving only the wet lower beach zones," Dr. Dugan explained.

"As a result, the beach loses diversity and ecological function. With climate change squeezing beaches further, it's a very serious issue to consider," the scientist said.

Dr. Dugan is among a select group of UCSB researchers funded by the California Ocean Protection Council to study the baseline ecological and socioeconomic effects of the Marine Life Protection Act on the South Coast.

The act serves to protect the coastal ecosystems as a valuable part of California's natural resources and heritage.

"The fact that beaches were chosen for that study is a very positive sign," Dr. Dugan said said.

email: news@newspress.com



Graduate student Nicholas Schooler, left, and marine researcher David Hubbard take samples of crustaceans at Scripps Coastal Reserve in San Diego. Keeping beaches pristine is slowly destroying isopods and other sand dwellers.

NICHOLAS SCHOOLER PHOTO

Clearing upper beaches of kelp to make them appear cleaner and more attractive destroys the natural food of sand critters that feed on the kelp overnight.

UCSB PHOTO

This tiny alloniscus is a beach version of the roly-poly that rolls itself into a ball whenever threatened. The sand-dwelling critter has disappeared from 64 percent of beaches where it was first recorded 100 years ago.

During daylight hours, nocturnal isopods hide as much as 1 meter deep in the sand. Their burrows were once a familiar site to beachgoers until sand grooming began to systematically exterminate them.

DAVID HUBBARD PHOTOS





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