Sea Star Belt Transect Densities

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Project
» Collaborative Research: Mechanisms of resistance and resilience to system-wide loss of a keystone predator in an iconic intertidal community (Keystone Species Loss)

Program
» Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO)

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Abstract
Density and biomass of sea stars in belt transects in the mid-low rocky intertidal from 2000-2021.

Table of Contents

[table of contents | back to top]

Parameters

Parameters for this dataset have not yet been identified

[table of contents | back to top]

Project Information

Collaborative Research: Mechanisms of resistance and resilience to system-wide loss of a keystone predator in an iconic intertidal community (Keystone Species Loss)

Website: http://pacificrockyintertidal.org

Coverage: Temperate west coast of North America

This project is affiliated with the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) and Multi-Agency Rocky Intertidal Network (MARINe).

NSF abstract:

Diseases that compromise the health of predators can lead to large, abrupt and sometimes unexpected

changes in the structure of ecosystems. This project will combine field surveys, manipulative experiments and mathematical models to both understand and predict the ecosystem-level effects of the unprecedented sea star wasting disease (SSWD) outbreak that devastated populations of Pisaster ochraceus, a critical predator, across the West Coast of the United States. Specifically, the project will determine (1) the ecological and environmental factors that promote vs. compromise the resilience of intertidal ecosystems to sea star wasting disease, (2) document the pace and extent of recovery from this major disturbance across the West Coast of the United States, and (3) identify hotspots of resilience to sea star wasting disease that may serve as important conservation targets to preserve these iconic ecosystems. The research will address important societal needs by cross-training undergraduate and graduate students in disease ecology, marine biology, mathematical modeling and biostatistics. Students from underrepresented groups will be recruited broadly from West Coast states. Each summer, four undergraduate students will be trained in rocky intertidal field research techniques. SSWD-focused modules will be developed and used in ecology courses at each institution to emphasize the importance of quantitative and interdisciplinary training for addressing important questions in biology. Graduate students will work with the Oregon Migrant Leadership Institute (OMLI) for migrant workers and their children to create workshops for students about SSWD. The PIs will continue interacting with the media and public groups, and will expand outreach activities through The Nature Conservancy and CoastWatch-sponsored workshops for high school teachers interested in involving students in sea star monitoring to ensure that the results of this project are disseminated beyond traditional academic circles. Finally, a series of model-based interactive web modules will be created as part of this project to illustrate the ecosystem-level effects of sea star wasting disease to the broader public. The studies on this model system will lead to a better understanding of how other ecosystems may resist or be vulnerable to human activities (e.g., fishing, hunting and habitat destruction) that asymmetrically influence top predators.

Diseases that threaten the health of predators can reduce their top-down influence and thus lead to significant changes in ecosystem structure. In 2013-15, sea star wasting disease (SSWD) devastated populations of Pisaster ochraceus, the original keystone predator, along the west coast of North America in one of the most extensive marine disease events ever recorded. This project will leverage this unprecedented outbreak to test and extend keystone predation theory by documenting and explaining the temporal pace, geographical extent, and spatiotemporal co-occurrence of ecosystem recovery from SSWD. The disease event also provides an opportunity to test the resistance and resilience of a well-studied ecosystem at an unprecedented scale. At each of 14 sites, the investigators will quantify processes that underlie potential resistance of the system to loss of sea stars (prey recruitment and colonization, mussel growth, predation intensity, facilitative interactions among sessile organisms, and the effect of alternative predators). In the latter experiments, the PIs will conduct caging exclusion experiments to test the effects of both larger (e.g., birds) and smaller (e.g., whelks) alternative predators on prey recolonization of cleared plots. The investigators will also conduct a novel set of experiments to manipulate factors affecting facilitation of mussels by barnacles and turf-forming algae. All these empirical studies will be used to parameterize modeling efforts that will explore the longer-term and larger-scale implications of these processes, both for this system and for other ecosystems. Specifically, the PIs will fit a novel spatially-explicit metacommunity model to the empirical data in order to determine the relative importance of intraspecific and interspecific resistance vs. resilience mechanisms for the recovery of intertidal ecosystems following a historical, coastal-scale SSWD disturbance.

[table of contents | back to top]

Program Information

Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO)

Website: http://www.piscoweb.org/

Coverage: West coast of North America from Mexico to Alaska

The Partnership for Interdisciplinary Studies of Coastal Oceans is a long-term ecosystem research and monitoring program established with the goals of:

- understanding dynamics of the coastal ocean ecosystem along the U.S. west coast
- sharing that knowledge so ocean managers and policy makers can make science based decisions regarding coastal and marine stewardship

- producing a new generation of scientists trained in interdisciplinary collaborative approaches

Over the last 10 years, PISCO has successfully built a unique research program that combines complementary disciplines to answer critical environmental questions and inform management and policy. Activities are conducted at the latitudinal scale of the California Current Large Marine Ecosystem along the west coast of North America, but anchored around the dynamics of coastal, hardbottom habitats and the oceanography of the nearshore ocean – among the most productive and diverse components of this ecosystem. The program integrates studies of changes in the ocean environment through ecological monitoring and experiments. Scientists examine the causes and consequences of ecosystem changes over spatial scales that are the most relevant to marine species and management, but largely unstudied elsewhere.

Findings are linked to solutions through a growing portfolio of tools for policy and management decisions. The time from scientific discovery to policy change is greatly reduced by coordinated, efficient links between scientists and key decision makers.

Core elements of PISCO are:

- Interdisciplinary ecosystem science
- Data archiving and sharing
- Outreach to public and decision-making user groups
- Interdisciplinary training
- Coordination of distributed research team

Established in 1999 with funding from The David and Lucile Packard Foundation, PISCO is led by scientists from core campuses Oregon State University (OSU); Stanford University's Hopkins Marine Station; University of California, Santa Cruz (UCSC); and University of California, Santa Barbara (UCSB). Collaborators from other institutions also contribute to leadership and development of PISCO programs. As of 2005, core PISCO activities are funded by collaborative grants from The David and Lucile Packard Foundation and the Gordon and Betty Moore Foundation. Core support, along with additional funding from diverse public and private sources, make this unique partnership possible.

[table of contents | back to top]

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[table of contents | back to top]