

Update Report

Period: 2/1/2012 - 1/31/2013

Project: R/OCEH-2 - *Impacts of Armoring on Puget Sound Beaches: Diverse Effects on Diverse Scales*

:: STUDENTS SUPPORTED

Dowell, Katie, ktmd23@gmail.com, University of Washington, School of Aquatic and Fisheries Sciences, status:cont, *no field of study*, advisor:Jeffrey Cordell, degree type:BS, degree date:2011-12-01, degree completed this period:No

Student Project Title: *none*

Involvement with Sea Grant This Period:
Paid laboratory assistant for processing samples.

Post-Graduation Plans: *none*

Hale, Rip, rhale@uw.edu, UW, Oceanography, status:new, field of study:Geomorphology, advisor:Andrea Ogston, degree type:PhD, *no degree date*, degree completed this period:No

Student Project Title: *none*

Involvement with Sea Grant This Period:
Graduate student involved in various aspects of field work; paid one quarter

Post-Graduation Plans: *none*

Heerhartz, Sarah, sarmarie@u.washington.edu, University of Washington, School of Aquatic and Fisheries Sciences, status:cont, *no field of study*, advisor:C.A. Simenstad and M.N. Dethier, degree type:PhD, degree date:2014-06-01, degree completed this period:No

Student Project Title:
QUANTIFYING THE IMPACTS OF SHORELINE ARMORING ON THE HABITAT VALUE OF NEARSHORE ECOSYSTEMS IN PUGET SOUND

Involvement with Sea Grant This Period:
Graduate student funded largely by WSG

Post-Graduation Plans: *none*

Richards, Marion, marionr2@uw.edu, UW, Environmental Studies, status:new, *no field of study*, advisor:Jeff Cordell and Jeff Adams, degree type:BA, degree date:2013-06-01, degree completed this period:No

Student Project Title:
Citizen Science Protocols for Effective Shoreline Restoration Monitoring with Washington Sea Grant

Involvement with Sea Grant This Period:
Capstone project, using our field methods in part

Post-Graduation Plans: *none*

Twomey, Niall, ntwomey@whidbey.com, UW, Oceanography, status:new, field of study:Coastal Geomorphology, advisor:Andrea Ogston, degree type:BA, degree date:2013-06-01, degree completed this period:No

Student Project Title:

Effects of shore armoring on profiles and average grain size in southern Puget Sound beaches

Involvement with Sea Grant This Period:

Capstone project, and volunteer for extensive field work.

Post-Graduation Plans: *none*

:: CONFERENCES / PRESENTATIONS

Presentation to science classes, Spring Street International School, Spoke to one high school and one middle school class about the armoring research, public/profession presentation, 28 attendees, 2012-09-18

People for Puget Sound “Sound Shoreline Science Forum- Kitsap,” Silverdale. Speaker Jeanette Dorner (Program Director: Salmon & Ecosystem Recovery, Puget Sound Partnership) used our data and some slides as part of talk on effects of armoring, public/profession presentation, 45 attendees, 2012-10-13

:: ADDITIONAL METRICS

K-12 Students Reached: 28	Acres of degraded ecosystems restored as a result of Sea Grant activities: 1
Presentation to science classes, Spring Street International School, Spoke to one high school and one middle school class about the armoring research.	Armor removal and shoreline restoration at Cornet Bay, WA
Curricula Developed: 0	Resource Managers who use Ecosystem-Based Approaches to Management: 0
Volunteer Hours: 100	HACCP - Number of people with new certifications: 0
Numerous UW students and other people have volunteered time to help with field work	
Cumulative Clean Marina Program - 0 certifications:	

:: PATENTS AND ECONOMIC BENEFITS

Description	Patents (\$)	Economic Benefit			
		Businesses Created	Businesses Retained	Jobs Created	Jobs Retained

Armor removal and shoreline restoration at Cornet Bay, Wash. Conducted as part of a WSG-funded research project. Restored acres are valued at \$10,000/acre. R/OCEH-4	Actual (2/1/2012 - 01/31/2013) :	10000	0	0	0	0
	Anticipated (2/1/2013 - 1/31/2014) :	10000	0	0	0	0

:: TOOLS, TECH, AND INFORMATION SERVICES

Description	Developed	Used	Names of Managers	Number of Managers
New methods for quantifying beach parameters (wrack and log accumulation, sediment types, beach profiles, juvenile clam abundance) that could be impacted by armoring. R/OCEH-2	Actual (2/1/2012 - 1/31/2013) :	1	"WDFW forage fish biologists; Skagit River System Cooperative biologists (shellfish, forage fish);"	3
	Anticipated (2/1/2013 - 1/31/2014) :	1		

:: HAZARD RESILIENCE IN COASTAL COMMUNITIES

No Communities Reported This Period

:: ADDITIONAL MEASURES

Safe and sustainable seafood

Number of stakeholders modifying practices

Actual (2/1/2012 - 1/31/2013) : 0

Anticipated (2/1/2013 - 1/31/2014) : 0

Number of fishers using new techniques

Actual (2/1/2012 - 1/31/2013) : 0

Anticipated (2/1/2013 - 1/31/2014) : 0

Sustainable Coastal Development

Actual (2/1/2012 - 1/31/2013) : 0

Anticipated (2/1/2013 - 1/31/2014) : 0

Coastal Ecosystems

Actual (2/1/2012 - 1/31/2013) : 1

Anticipated (2/1/2013 - 1/31/2014) : 1

Shoreline armor removal and restoration at Cornet Bay, Wash. Island County

:: PARTNERS

Partner Name: City of Burien

Partner Name: City of Seattle

Partner Name: Island County Marine Resources Committee, type: government, scale: regional

Partner Name: Nearshore Habitat Program, Washington State Department of Natural Resources

Partner Name: NOAA

Partner Name: Northwest Straits Foundation, type: NGO, scale: regional

Partner Name: Salmon Recovery Funding Board

Partner Name: University of Washington

Partner Name: US Geological Survey

Partner Name: Washington State Department of Ecology

Partner Name: Washington State Department of Fish and Wildlife

Partner Name: Washington State Parks, type: government, scale: state

Partner Name: WSU Beach Watchers, type: NGO, scale: local

:: IMPACTS AND ACCOMPLISHMENTS

Title: **Washington Sea Grant research documents the ecological effects of shoreline armoring, enabling more effective shoreline protection**

Type: accomplishment

Description:

Relevance: About 30 percent (800 miles) of Puget Sound's shorelines are armored, and climate-related erosion will likely spur demand for more armoring. The State of Washington considers armoring a significant threat to coastal habitats, and local agencies are weighing many actions to remove it. However, there is little empirical data on armoring's physical and biological effects on Puget Sound, in part because changes take decades to play out. Understanding these effects is essential to prudent shoreline protection and restoration.

Response: Washington Sea Grant-funded researchers surveyed paired beaches, one armored and one not, at 31 sites in Central and South Puget Sound. They measured topography, vegetation, and sediment grain sizes and gauged the abundance and types of logs, wrack, juvenile clams, and wrack-dwelling insects and crustaceans present. They are analyzing extensive data on wave reflection, sediment supply, and biological diversity and abundance and, in collaboration with Washington's Department of Fish and Wildlife, investigating armoring's effects on beach use by birds and foraging fishes.

Results: Investigators have already derived some important preliminary findings and found clear and striking differences between armored and unaltered shorelines. Armored beaches have significantly less riparian vegetation and beach wrack (which provides food and habitat for many invertebrates, which in turn support birds, juvenile salmon and other fishes). They also have fewer logs, which buffer storm effects.

Recap:

Washington Sea Grant research investigates the physical and biological effects of armoring on Puget Sound beaches, providing needed data to guide shoreline protection and restoration.

Comments:

Primary Focus Area – OCEH (HCE)

Secondary Focus Area – COCC (SCD)

Associated Goals: Protect and restore marine, coastal and estuarine habitats (HCE Restore).

Assist coastal communities and marine-dependent businesses in planning and making decisions that provide local and regional economic benefits, increase resilience and foster stewardship of social, economic and natural resources (SCD Efficiency).

Related Partners: American Fisheries Society (AFS)

City of Burien, WA

City of Seattle, WA

Island County Natural Resources Committee

Nearshore Habitat Program, Washington State Department of Natural Resources

Northwest Straits Foundation

Salmon Recovery Funding Board

University of Washington, Department of Biology, College of Arts and Sciences (UW)

US Geological Survey (US DOI, USGS)

Washington NASA Space Grant Consortium, Department of Earth and Space Sciences, College of the Environment (UW)

Washington State University Extension

Washington State Department of Ecology

Washington State Department of Fish and Wildlife

Washington State Department of Natural Resources, Nearshore Habitat Program

Washington State Parks

:: PUBLICATIONS

Title: **Science on the Edge: Birds on Beaches and the Quest for a Better Seawall**

Type: Reprint from a Newsletter, Magazine, or Other Periodical (not peer reviewed; see RR for peer-reviewed reprints) Publication Year: 2012

Uploaded File: AudubonNewsletter.pdf, 4851 kb

URL: *none*

Abstract:

[no formal abstract; article written by one graduate student at UW about the research of WSG-supported graduate student Sarah Heerhartz, and one aspect of her research]

Citation:

Kuehne, L. Science on the Edge: Birds on Beaches and the Quest for a Better Seawall. Earthcare Northwest, Summer 2012.

Copyright Restrictions + Other Notes:

Journal Title: *none*

Title: **Shoreline Armoring Website**

Type: Internet Resources, Topical Websites Publication Year: 2012

Uploaded File: *none*

URL: <https://sites.google.com/a/uw.edu/shoreline-armoring/>

Abstract:

This website provides an overview of our research activities in language for the general public.

Citation:

Shoreline Armoring in Puget Sound. University of Washington. 2012.

<https://sites.google.com/a/uw.edu/shoreline-armoring/>.

Copyright Restrictions + Other Notes:

This link is still live but has not been updated recently.

Journal Title: *none*

:: OTHER DOCUMENTS

No Documents Reported This Period

:: LEVERAGED FUNDS

Type: influenced Period: 2012-07-01::2014-12-31 Amount: \$82886

Purpose:

To expand WSG work into northern Puget trough using WSG methods and some personnel (funding to Skagit River System Cooperative, with subcontract to UW); plus extensive match from Tribes

Source: WDWF (EPA funding)

Type: influenced Period: 2012-01-01::2012-12-31 Amount: \$27253

Purpose:

Broad monitoring study of the shorelines of Puget Sound, which has many ties to this WSG project

Source: Washington Dept of Natural Resources:

PROGRESS REPORT NARRATIVE

for the period 2/1/2012 – 1/31/2013

PROJECT PROGRESS

We have now completed three full years of field work seeking to quantify physical and biological impacts of shoreline armoring on Puget Sound's beaches. Because of continued delays in plans for the Army Corps of Engineers to remove the seawall at Seahurst Park (due to lack of federal funding), we have focused our efforts on increasing the level of replication of our paired-beach sampling and on some of our experimental work. Participants in the work continue to be scientists from 3 departments at UW (Dethier from Biology/Friday Harbor Labs, Ogston from Oceanography, and Heerhartz, Toft, Cordell, and student assistants from SAFS) and from the Washington Dept. of Natural Resources (Berry and assistants). Volunteers on the project were: Niall Twomey (UW undergrad, current), and 5 current Oceanography graduate students: Rip Hale, Aaron Fricke, Emily Eidam, Katie Boldt, and Dan Nowacki.

Field work accomplished is as follows:

1. We have completed surveys (in some cases on multiple dates to get seasonal information) at 25 pairs of armored and unarmored beaches in central Puget Sound, and 6 pairs of sites in south Sound (Figure 1). At all sites we have data on physical setting (character of the backshore, overhanging vegetation, location in the drift cell, etc.), beach topography (surveyed) and grain sizes, abundance and types of logs and wrack, abundance and types of insects and crustaceans in the wrack line, and abundance and types of juvenile clams at Mean Low Water. For a subset of these sites we also have juvenile clam data from Mean Lower Low Water. All project personnel have participated in this intensive field work.
2. At a subset of these 31 pairs of sites we have deployed traps for amphipods (left out for 1 hour) and for insects (left out for 24 hours).
3. At 5 pairs of sites we have deployed "wrack tubes" to measure rates of decomposition of beach wrack in the presence and absence of amphipods, and in front of armoring versus on unarmored beaches. When these tubes were collected after a month, all the organisms that had colonized each were collected.
4. To get at the food web implications of the large differences in abundances of logs, wrack, arthropods, and overhanging vegetation that we see at armored vs. unarmored beaches, our graduate student, Sarah Heerhartz, spent many days in Spring-Summer 2012 snorkeling at armored and unarmored sites in central sound counting abundances and quantifying behavior of juvenile salmon. In addition, she conducted pilot studies to work out methodologies for quantifying beach use by terrestrial birds (from land). Gathering additional bird data will be the main focus of Heerhartz's 2013 field work.
5. Wave gauges were deployed in a paired fashion (i.e. at armored and unarmored beaches at the same time) twice for short periods during the fall 2011, twice in January/February 2012, and for a lengthy period in fall 2012. We will be analyzing these data during winter 2013 to increase our understanding of the impact of seawall armoring on waves and on sedimentary processes.

Laboratory work accomplished is as follows:

1. We have almost completed processing of almost 2000 samples from the extensive surveys and the experimental work to identify, count, and/or weigh wrack, amphipods,

insects, and other organisms found in the wrack line samples (725 samples), pitfall traps (500 samples), fallout traps for insects (80 samples), and the wrack tubes (264 samples). This has been very labor-intensive work. Some has been done by the graduate student, and she has trained 2 undergraduates or recent UW graduates to help with this sorting and taxonomic work on an hourly basis.

2. We have completed processing of 840 small sediment samples to extract, identify, and measure juvenile clams from the field surveys. This work has been done by Dethier.
3. We have almost completed processing of beach sediment samples for grain size analyses. This work has been done by Oceanography undergraduates, largely volunteers.

Analytical work accomplished is as follows:

1. Juvenile clam data have been worked up and we are seeking physical correlates to the large beach-to-beach variation in clam abundance and species richness. Dethier continues to work with Kristin Byrd, a statistician from the U.S. Geological Survey, Menlo Park, to run complex multiple regression models using the physical data collected at these sites by us and by other scientists. We are also seeking larger-scale differences in beach physical characteristics in front of armored and unarmored shorelines. Preliminary analyses of beach slope and sediment grain size have been undertaken (Ogston Sediment Dynamics group), and we find a steeper slope of the shoreface near armoring. Grain size differences between the armored/unarmored beaches are more complex and the focus of further investigation. This analytical work is continuing.
2. Preliminary analyses of abundances of logs, wrack, and insects and amphipods in the wrack line have been completed, and Heerhartz is running statistical tests. There are clear and striking differences in all these parameters between armored and unarmored shorelines; some of these have been suggested by other researchers, but the large spatial scale and level of replication of our work removes any uncertainty in these effects on central sound beaches. In winter 2013 Heerhartz will be writing up the first manuscript from these data, focusing on the log and wrack data.
3. Analysis of the data from the deployment of traps and wrack tubes is in progress.
4. Analysis of the juvenile salmon data is in progress, and will form the basis for a second manuscript, to be completed in Summer 2013.

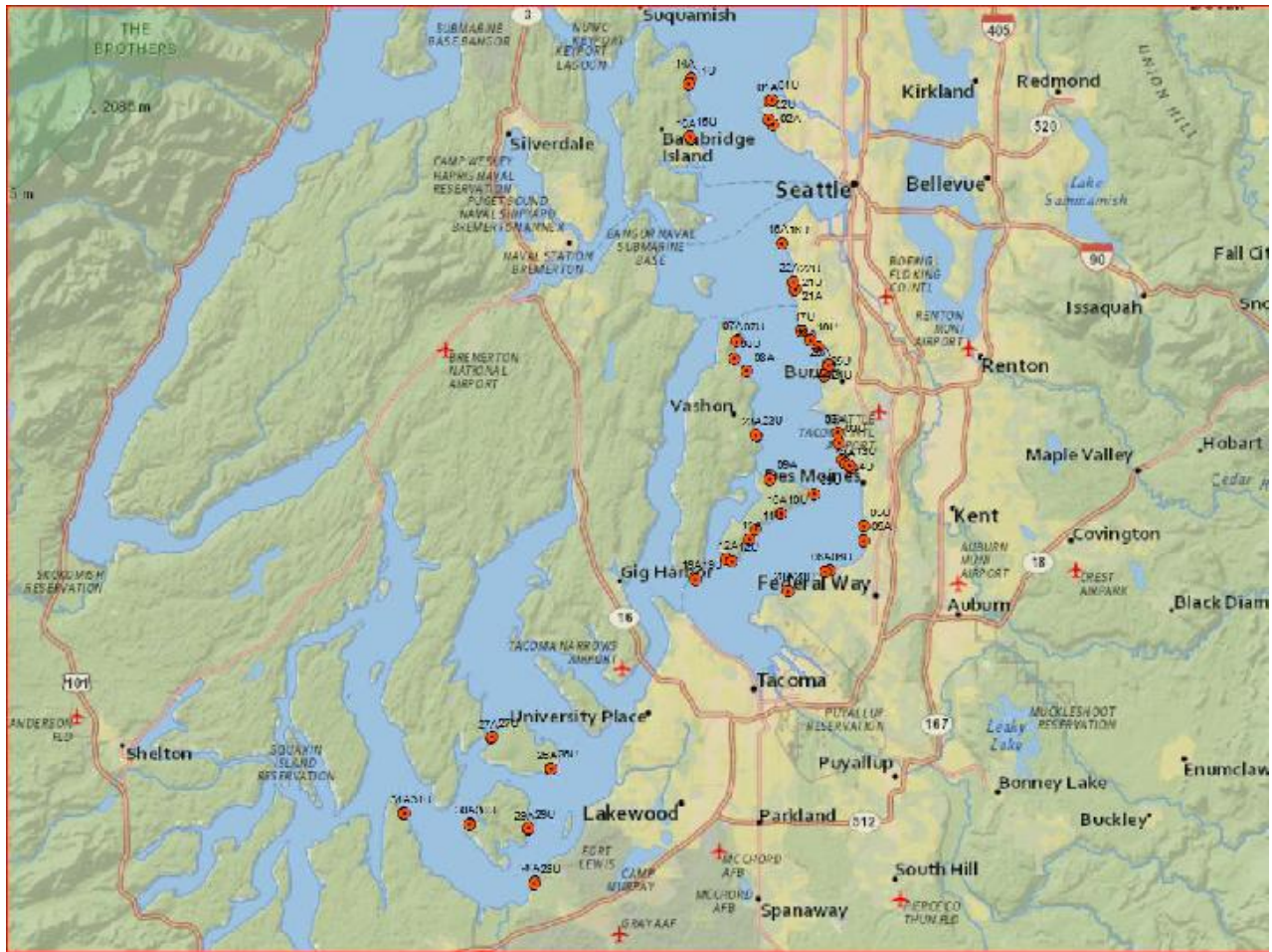


Figure 1. Study site locations.