

RESEARCH/PD ANNUAL REPORT - PROGRESS REPORT

2015 annual report - progress

Bonnie Becker

[full] Recovery of the native Olympia oyster, *Ostrea lurida*, in Northern Puget Sound: measuring the larval import to and export from a restored subpopulation

R/HCE-8

Submitted On: 04/25/2016 02:54:04 AM

METRICS & MEASURES

Metric/Measure	Value	Note
Acres of coastal habitat	0	
Fishermen and seafood industry personnel	0	
Communities - economic and environmental development	0	
Stakeholders - sustainable approaches	0	
Informal education programs	80	Informal talks about this work given at: Pacific Science Center Science Cafe series (~40 people), SIAS Brown Bag Series (~15 people), and the UW Tacoma Environmental Seminar Series (~25 people) (both UW Tacoma series are open to the public). In year 2, talks have or will be given at the Washington State History Museum Scholarly Selections Series (~15 people) and the Museum of Glass. Also of note, a UW Tacoma web feature and short video were produced about this work and distributed on the university webpage.
Stakeholders who receive information	110	Informal talks about this work given at: Pacific Science Center Science Cafe series (~40 people), Washington State History Museum Scholarly Through parallel efforts, 30 people have been reached with a PSRF produced Olympia Oyster Field Guide. Next year, an additional 50 guides, printed with WSG support, will be distributed. On April 25 there will be a workshop at Northwest Indian College supported by Sea Grant and another will be given in the Tacoma region within the year. + presentations listed above
Volunteer hours	100	Volunteers doing field work through UW Tacoma.
P-12 students reached	1	A high school student working on this project in the Becker Lab. Competed in state science fair and won college scholarship.
P-12 educators	0	

REQUESTED INFORMATION

Publications

No **Publications** information reported

Students Supported

Megan Hintz (New Student)
hintzm@uw.edu
University of Washington, School of Aquatic and Fishery Sciences

Field of Study: Aquatic and Fishery Sciences
Advisor: Bonnie Becker/Steven Roberts
Degree Type: MS
Degree Year: 2017

Student Project Title: At the whim of the tides: population connectivity of Olympia oysters (*Ostrea lurida*) in Puget Sound

Involvement With Sea Grant This Period (capstone, fellow, intern, etc.): Technician, Graduate Student

Post-Graduation Plans (employer, grad school, etc.): Marine science

Was this thesis/dissertation supported by Sea Grant?: Yes

Thesis / Dissertation: TBD

New or Continuing?: New

Degree awarded this reporting period?: No

Financially supported?: Yes

Axton Bullock (New Student)
axtonb@uw.edu
University of Washington Tacoma, School of Interdisciplinary Arts and Sciences

Field of Study: Environmental Science
Advisor: Bonnie Becker
Degree Type: BS
Degree Year: 2017

Student Project Title: Olympia Oyster (*Ostrea lurida*) larval abundance from two bays in Puge Sound

Involvement With Sea Grant This Period (capstone, fellow, intern, etc.): Paid Undergraduate Research Assistant, Capstone Student

Post-Graduation Plans (employer, grad school, etc.): Marine science

Was this thesis/dissertation supported by Sea Grant?: No

Thesis / Dissertation:

New or Continuing?: New

Degree awarded this reporting period?: No

Financially supported?: Yes

Jennifer Gonzaga (New Student)

gonzjenn@uw.edu

University of Washington Tacoma, School of Interdisciplinary Arts and Sciences

Field of Study: Environmental Science

Advisor: Bonnie Becker

Degree Type: BS

Degree Year: 2017

Student Project Title: TBD

Involvement With Sea Grant This Period (capstone, fellow, intern, etc.): Capstone Student

Post-Graduation Plans (employer, grad school, etc.): Marine science

Was this thesis/dissertation supported by Sea Grant?: No

Thesis / Dissertation:

New or Continuing?: New

Degree awarded this reporting period?: No

Financially supported?: No

Luan Dang (New Student)

dangluan@gmail.com

University of Washington Tacoma, School of Interdisciplinary Arts and Sciences

Field of Study: Environmental Science

Advisor: Bonnie Becker

Degree Type: BS

Degree Year: 2016

Student Project Title: NA

Involvement With Sea Grant This Period (capstone, fellow, intern, etc.): Paid Undergraduate Research Assistant

Post-Graduation Plans (employer, grad school, etc.): Pharmacy School (accepted)

Was this thesis/dissertation supported by Sea Grant?: No

Thesis / Dissertation:

New or Continuing?: New

Degree awarded this reporting period?: No

Financially supported?: Yes

Brittany Eisel (New Student)

briteise@uw.edu

University of Washington Tacoma, School of Interdisciplinary Arts and Sciences

Field of Study: Environmental Science

Advisor: Bonnie Becker

Degree Type: BS

Degree Year: 2017

Student Project Title: Collection and measurement of Olympia oyster, *Ostrea lurida*, larvae

Involvement With Sea Grant This Period (capstone, fellow, intern, etc.): Paid Undergraduate Research Assistant; Undergraduate Research Experience Class

Post-Graduation Plans (employer, grad school, etc.): Marine Science; currently working part-time for private marine biology consulting firm.

Was this thesis/dissertation supported by Sea Grant?: No

Thesis / Dissertation:

New or Continuing?: New

Degree awarded this reporting period?: No

Financially supported?: Yes

Ly Dang (New Student)

lydang93@uw.edu

University of Washington Tacoma, School of Interdisciplinary Arts and Sciences

Field of Study: Environmental Science

Advisor: Bonnie Becker

Degree Type: BS

Degree Year: 2016

Student Project Title: Examining the Population Density and Height Frequency of *Ostrea lurida* in the Puget Sound

Involvement With Sea Grant This Period (capstone, fellow, intern, etc.): Undergraduate Research Experience Class

Post-Graduation Plans (employer, grad school, etc.): Pharmacy school (accepted)

Was this thesis/dissertation supported by Sea Grant?: No

Thesis / Dissertation:

New or Continuing?: New

Degree awarded this reporting period?: No

Financially supported?: No

Jared Moser (New Student)

jtmosier@uw.edu

University of Washington Tacoma, School of Interdisciplinary Arts and Sciences

Field of Study: Environmental Science

Advisor: Bonnie Becker

Degree Type: BS

Degree Year: 2016

Student Project Title: Collection and measurement of Olympia oyster, *Ostrea lurida*, larvae

Involvement With Sea Grant This Period (capstone, fellow, intern, etc.): Undergraduate Research Experience Class

Post-Graduation Plans (employer, grad school, etc.): Agency Water Quality Technician

Was this thesis/dissertation supported by Sea Grant?: No

Thesis / Dissertation:

New or Continuing?: New

Degree awarded this reporting period?: Yes

Financially supported?: No

Hannah Yang (New Student)

hannahya@uw.edu

University of Washington Tacoma, School of Interdisciplinary Arts and Sciences

Field of Study: Environmental Science

Advisor: Bonnie Becker

Degree Type: BS

Degree Year: 2016

Student Project Title: Measuring Efforts of *Ostrea lurida* Using Demographic Analysis

Involvement With Sea Grant This Period (capstone, fellow, intern, etc.): Undergraduate Research Experience Class

Post-Graduation Plans (employer, grad school, etc.): TBD

Was this thesis/dissertation supported by Sea Grant?: No

Thesis / Dissertation:

New or Continuing?: New

Degree awarded this reporting period?: No

Financially supported?: No

Jefferson Emm (New Student)

jemm@students.nwic.edu

Northwest Indian College, Native Environmental Science

Field of Study: Native Environmental Science

Advisor: Marco Hatch

Degree Type: BS

Degree Year: 2016

Student Project Title: Early Life History of a Restored Olympia Oyster (*Ostrea lurida*) Population

Involvement With Sea Grant This Period (capstone, fellow, intern, etc.): Paid Undergraduate Research Assistant

Post-Graduation Plans (employer, grad school, etc.): MS in Environmental Science at Western Washington University (accepted)

Was this thesis/dissertation supported by Sea Grant?: No

Thesis / Dissertation:

New or Continuing?: New

Degree awarded this reporting period?: No

Financially supported?: Yes

Narratives

Olympia Oyster Larval Tracking Progress Report: Year 1
Uploaded File: [Narrative_Yr1_BJBecker.pdf](#)

Partners This Period

University of Washington, Tacoma, Center for Urban Waters (UW)

Types: Academic Institution

Scale: STATE

Notes: Use metal-free clean lab, rent provided as match.

Taylor Shellfish Farms

Types: Industry/Business

Scale: Other

Notes: Access to farms given for sampling sites, larvae provided for standards and verification.

Samish Indian Nation

Types: Other

Scale: Tribal

Notes: Boat and driver provided as match for work in Fidalgo Bay.

Swinomish Tribe

Types: Other

Scale: Tribal

Notes: Collected brooder samples for us as match.

Western Washington University

Types: Academic Institution

Scale: STATE

Notes: Collaborating with Brian Rusk, Research Associate in the Department of Geology, on LA-ICP-MS method development.

Jones Family Farms

Types: Industry/Business

Scale: LOCAL

Notes: Access to farm for brooder sampling.

Acme Oysters

Types: Industry/Business

Scale: LOCAL

Notes: Access to farm for sampling brooders.

Skookum Point Oysters

Types: Industry/Business

Scale: LOCAL

Notes: Access to farm for sampling brooders.

Impacts and Accomplishments

(1)

Type	accomplishment
Title	Washington Sea Grant research offers improved Olympia oyster restoration efforts through effective tracking of larval native oysters
Relevance	The only indigenous West Coast oyster species, Olympia oysters, once ranged from Baja California to Alaska and were the first shellfish species farmed by Washington growers. Today, their restoration is a regional priority whose success relies on reestablishment of self-sustaining populations that can replenish surrounding beds, requiring effective measurement of larval oyster movement.
Response	Washington Sea Grant-funded researchers from three academic institutions partnered with state shellfish managers and growers and a local restoration group to develop a system for tracking movement of larval oysters. Working with undergraduates and colleagues from four oyster farms and two Native tribes, the team applied markers to the shells of larval oysters and tracked movement. More than 14,000 adult females were examined to identify the very small fraction (less than one percent) with shelled larvae that were needed to conduct the analysis.
Results	The team completed field collection and garnered enough samples to validate this approach to planning future sustainable restoration sites. A reference map showing the chemical signature distribution of the shells gathered from throughout Puget Sound will be used to determine the origin of juvenile oysters and measure the distance traveled by larvae. Educational benefits included the contribution of more than 1,000 hours by seven undergraduate students. The project has potential application worldwide.
Recap	Washington Sea Grant researchers developed a system for tracking native oyster larvae among Puget Sound populations, which will help identify sustainable restoration sites.
Comments	
Primary Focus Area	Healthy Coastal Ecosystems
Secondary Focus Areas	Sustainable Fisheries and Aquaculture
Goals	Ocean and coastal resources are managed using ecosystem-based approaches. Aquaculture operations and shellfish harvests are safe,

environmentally sustainable and support economically prosperous businesses.

Partners

Acme Oyster House Jones Family Farm Puget Sound Restoration Fund Samish Indian Nation Skookum Point Oysters Swinomish Tribe Taylor Shellfish Farms University of Washington Tacoma University of Washington, Tacoma, Center for Urban Waters (UW) Western Washington University

PI Draft

* Type accomplishment * Title Tracking larval native oysters for more effective restoration planning * Relevance Olympia oysters are the only native oyster on the west coast, and have been commercially extinct in Puget Sound since the 1940s. The success of oyster restoration efforts depend on determining whether restored populations are self-sustaining and replenishing nearby populations, but the transport of larval oysters is difficult to measure. * Response This project applies determination of natural markers in the shells of larval oysters to track their trajectories on short time scales. Shelled larvae that were brooded in adult females were collected throughout Puget Sound to create a map of chemical signatures imparted on the shells in various locations. Using this reference map, the site of origin of small juvenile oysters can be determined from samples collected at two sites important to restoration. The distance traveled by larvae will be determined, as well as whether restoration sites are able to sustain themselves with local reproduction. * Results The field collection is complete and results are pending. When completed, results will be used by restoration practitioners while planning sustainable networks of restoration sites. While the information is most useful for local species, it also applies to bivalve restoration in estuarine systems worldwide. This project also improves ocean literacy. Many students have participated in this project and significant public outreach has occurred, with more planned in the second year. * Recap Through this project, we will use a novel approach to track native oyster larvae among natural and restored population in Puget Sound, providing crucial ecological data to inform assessment of existing and locations of future restoration sites. Comments This work is a collaboration between academic, tribal, non-profit, and government institutions: University of Washington Tacoma, Northwest Indian College, Puget Sound Restoration Fund, Washington Department of Fish and Wildlife, and the UW School of Aquatic and Fishery Sciences. Primary Focus Area Healthy Coastal Ecosystems Secondary Focus Areas Ocean Literacy and Workforce Development Goals Ocean and coastal resources are managed using ecosystem-based approaches., Ocean and coastal habitats are protected, enhanced and restored., Fisheries are safe, responsibly managed

and economically and culturally vibrant.,The public is ocean literate.,The future workforce is skilled in disciplines critical to coastal and ocean economies and ecosystem health. Partners This work is a collaboration between academic, tribal, non-profit, and government institutions: University of Washington Tacoma, Northwest Indian College, Puget Sound Restoration Fund, Washington Department of Fish and Wildlife, and the UW School of Aquatic and Fishery Sciences.

Tools, Technologies, Information Services / Sea Grant Products

No **Tools, Technologies, Information Services / Sea Grant Products** information reported

Economic Impacts

No **Economic Impacts** information reported

Community Hazard Resilience

No **Community Hazard Resilience** information reported

Meetings, Workshops, Presentations

(1)

Type of Event	Public or professional presentation
Description	Becker, B.J. Are Native Oysters Making a Comeback? (SIAS Brown Bag Seminar Series, Tacoma WA)
Event Date	10-07-2015
Number of Attendees	15

(2)

Type of Event	Public or professional presentation
Description	Becker, B.J. Are Native Oysters Making a Comeback? (Pacific Science Center Science Café Series, Tacoma WA)
Event Date	10-13-2015
Number of Attendees	40

(3)

Type of Event	Public or professional presentation
Description	Becker, B.J. Dig-able Sound: Protecting and restoring shellfish populations through larval ecology (UW Tacoma Environmental Seminar Series,

	Tacoma WA)
Event Date	11-23-2015
Number of Attendees	25

Leveraged Funds

(1)

Purpose	Recovery of the native Olympia oyster, <i>Ostrea lurida</i> , in Northern Puget Sound: measuring the larval import to and export from a restored subpopulation
Source	Swinomish Tribe
Amount	778
Start Date	02-01-2015
End Date	01-31-2016

Recovery of the native Olympia oyster, *Ostrea lurida*, in Northern Puget Sound: measuring the larval import to and export from a restored subpopulation (R/HCE-8)

Washington Sea Grant

Year 1 Interim Progress Report

PI: Bonnie Becker (University of Washington Tacoma, UW Tacoma)

Co-PIs: Henry Carson (WA Department of Fish and Wildlife, WDFW); Marco Hatch (Northwest Indian College, NWIC); Brian Allen (Puget Sound Restoration Fund, PSRF); Brent Vadopalas (UW School of Aquatic and Fishery Sciences, SAFS); Betsy Peabody (PSRF)

This narrative describes the progress of the project from February 1, 2015 through January 31, 2016. Our biggest accomplishment in the first year was the completion of all field work, followed by the partial processing of samples and solid education and outreach efforts. We are on track to complete the analyses during the second year, and requested an extension of the funding through June 2017 in order to meet requirements for admission of Megan Hintz into SAFS. Further detail is given below, organized by goals outlined in our original proposal.

Research Goals

Goal A. Creating spatial reference signatures by conducting surveys of brooded larvae around the Puget Sound

During the summer of 2015, our research team conducted surveys of brooded larvae at 13 sites on 49 individual sampling trips. The number of brooding individuals was considerably lower than expected (possibly due to a warmer than usual winter and spring), so we increased our sampling in an effort to ensure enough brooded larvae were collected. In sum, we sampled over 14,000 oysters and collected shelled larvae from over 100 individuals. This is sufficient to successfully complete the study. The work was completed by UW Tacoma students and staff, NWIC students and staff, PSRF staff, and a small number of volunteers, as expected. In addition, staff from the Swinomish Indian Tribal Community collected samples for us at Similk Bay.

In the past, we have had to sacrifice adults in order to check for brooding. Due to the large numbers of oysters we needed to sample, we used a non-lethal sampling method, originally developed by students in Steven Robert's lab at SAFS but further refined by our team. We are currently writing a manuscript on this technique for submission for publication.

Over the fall and winter, we worked on developing methods to clean, mount, and analyze brooded larval samples using LA-ICP-MS, at the UW Tacoma Center for Urban Waters clean lab. We have completed a number of test runs at Western Washington University and have made some adjustments to our original protocols to minimize contamination of samples. In summer 2016, we will analyze our brooding larval samples to create spatial reference signatures. The work was completed by UW Tacoma students and WDFW staff, as expected. We added an additional team member, Brian Rusk from the Department of Geology at WWU, to contribute expertise in trace elemental sampling. He will serve as a co-author on relevant publications from this work.

Goal B: Characterizing provenance of planktonic larvae based on reference signatures.

Planktonic larval samples were collected by pump at the two focus sites (Fidalgo Bay and Dyes Inlet) every other week throughout the summer of 2015. This field work was completed by UW Tacoma students and staff, NWIC students and staff, PSRF staff, and Samish Indian Nation staff in Fidalgo Bay.

Larval samples for trace elemental fingerprinting have been hand sorted using visual identification methods by UW Tacoma students. The samples will be further analyzed using quantitative PCR for species validation purposes in spring 2016. The planktonic larval samples will be processed using similar methods as developed for brooding larvae for analysis at WWU in summer 2016. The qPCR will be completed by UW Tacoma students with technical assistance from SAFS staff. Additional larval samples were collected in Fidalgo Bay by NWIC staff and students and visually identified.

Goal C: Assigning settlers to reference signatures to assign them to a place of origin.

Settler samples were collected from the two focus sites every other week throughout the summer of 2015. Five additional sampling stations were established near each focus site and settlers were collected in time-integrated samples throughout the summer. This work was completed by UW Tacoma students and staff. NWIC collected additional settler samples in Fidalgo Bay at higher spatial resolution that were analyzed separately.

Settlers were quantified by visual identification methods by NWIC staff and students. Cleaning and analysis methods for trace metal analysis are being developed along with methods for larval samples. These samples should be analyzed this summer with the other field samples.

In sum, we are on track to complete our research goals by the end of year 2, with additional time for analysis and writing of publications.

Education and Outreach Goals

Goal D: Training American Indian and non-traditional students in scientific methods to prepare them for careers in applied marine ecology.

This work involves students at multiple levels and institutions. Megan Hintz is working towards her MS degree from SAFS with this study as her thesis project. Ms. Hintz was a first-generation college student who graduated with a BS in Environmental Science from UW Tacoma in 2014. She originally worked as a technician on this project (funded through matching funds) until beginning at SAFS in fall 2015. She has already presented some of her work at the Salish Sea Ecosystem Conference in year 2. In our original proposal, we anticipated that a new MS degree at UW Tacoma would start at this time, but it was postponed due to budget constraints. Instead, Ms. Hintz is attending SAFS with Drs. Becker and Roberts as co-chairs. Since SAFS requires six quarters of funding, we requested an extension of our funding to cover her tuition and stipend through spring 2017.

At UW Tacoma, four undergraduate students worked on this project through a credit-bearing research course, three were paid research assistants (through matching funds provided by UW Tacoma), and two are continuing with the work for capstone projects. Two students participated in multiple groups, bringing the total undergraduates to seven. Five of these students are first generation college students. They come from a diversity of backgrounds, including a Pacific Islander, students of Chinese- and Filipino-American descent, and two first generation immigrants from Vietnam. They have presented their work in local venues, and one presented a poster at the Salish Sea Ecosystem Conference in Vancouver BC in April 2016 (funded by UW Tacoma), year 2 of this work. Many of these students are still in school, although one now has a part-time job with a marine ecology private company and two have been accepted into pharmacy school. The one who has graduated is employed in an agency job doing environmental science work. In addition, one high school student participated in this work, and

presented a resulting poster at a regional and state science fair; she placed first in her category and was awarded a college scholarship as a result.

An American Indian student from NWIC has participated in this project from the beginning. He completed his capstone looking at oyster settlement and has presented his work in a number of venues including the Salish Sea Ecosystem Conference in year 2. He is graduating this year with a BS in Native Environmental Science and will be participating in an REU program at Shannon Point Marine Station this summer. In fall, he will start an MS program in Environmental Science at Western Washington University.

Goal E: Educating coastal landowners and the general public on the importance of native oyster restoration and stewardship of nearshore habitats, and about the importance of connectivity in preserving and restoring Puget Sound.

We reached out to the public in a number of ways this year, although many of our outreach efforts will be concentrated in the second year. A PSRF-created field guide to Olympia oysters and production was partially funded with this grant. PSRF has distributed 20 guides and reached 30 people directly using PSRF funding. On April 25, PSRF and NWIC are giving a workshop on finding and preserving Olympia oysters. A similar workshop will be held at UW Tacoma later in the year. An additional 50 guides, printed through WSG funding, will be distributed between the events.

UW Tacoma staff gave a number of public talks about this work, including through a Pacific Science Center Science Café and a number of open talks at UW Tacoma. In Year 2, a Washington History Museum Scholarly Selections talk was given, and additional talks are planned through an upcoming collaboration with the Museum of Glass. In addition, a webpage that includes posts about this work has received almost 4000 hits and a corresponding YouTube channel has over 1300 views during this reporting period.