

Update Report

Period: 2/1/2014 - 1/31/2015

Project: R/LME/N-3 - Alleviating Regulatory Impediments To Native Shellfish Aquaculture

STUDENTS SUPPORTED

Heare, Jake, jakeheare@gmail.com, University of Washington, SAFS, status: cont, *no field of study*, advisor: Roberts, degree type: MS, *no degree date*, degree completed this period: No
Student Project Title: *none*
Involvement with Sea Grant This Period:
research assistant
Post-Graduation Plans: *none*

Jackson, Katie, k.e.jackson.1992@gmail.com, University of Washington, SAFS, status: cont, *no field of study*, *no advisor*, degree type: BS, *no degree date*, degree completed this period: No
Student Project Title:
Genetic sample management and optimizing oyster relaxation
Involvement with Sea Grant This Period:
intern
Post-Graduation Plans: *none*

CONFERENCES / PRESENTATIONS

Jackson et al. A comparison of restoration breeding methods for the Olympia oyster, *Ostrea lurida*. 16th International Conference on Shellfish Restoration, Charleston, SC., public/profession presentation, 100 attendees, 2014-12-11

Heare et al. Identifying Local Oyster Stocks Useful for Restoration. 16th International Conference on Shellfish Restoration, Charleston, SC., public/profession presentation, 100 attendees, 2014-12-11

ADDITIONAL METRICS

P-12 Students Reached:	0	P-12 Educators Trained:	0
Participants in Informal Education Programs:	0	Volunteer Hours:	100
Acres of coastal habitat protected, enhanced or restored:	0	Helped process oysters	
		Resource Managers who use Ecosystem-Based Approaches to Management:	0
Annual Clean Marina Program - certifications:	0	HACCP - Number of people with new certifications:	0

ECONOMIC IMPACTS

No Economic Impacts Reported This Period

SEA GRANT PRODUCTS

Description	Developed?	Used?	ELWD?	Number of Managers	Names of Managers
Olympia oyster anesthesia method	No	Yes	No	0	

HAZARD RESILIENCE IN COASTAL COMMUNITIES

No Communities Reported This Period

ADDITIONAL MEASURES

Number of stakeholders modifying practices: 1

Sustainable Coastal Development

of coastal communities: 0

PSRF changed aquaculture practices (see Impacts)

PARTNERS

Partner Name: Clam Fresh, LLC

Partner Name: Fagergren Oyster Co.

Partner Name: Fidalgo Marina

Partner Name: NOAA Manchester lab

Partner Name: Puget Sound Restoration Fund

Partner Name: Rock Point Oyster Company

Partner Name: Swinomish Tribe

Partner Name: Washington Department of Fish and Wildlife

IMPACTS AND ACCOMPLISHMENTS

Title: **Washington Sea Grant research investigates local adaptation in native oysters to predict impacts of their culture on restoration and commercial production**

Type: accomplishment

Description:

Relevance: Restoring native Olympia oysters is a key goal of the Puget Sound recovery plan, but cultured native shellfish plantings can affect the genetic makeup of nearby wild populations. Information about local adaptation in Olympia oysters would allow managers and practitioners to predict the performance of seed from different

origins and address concerns about the interbreeding of wild and maladapted cultured stocks.

Response: With funding from a national strategic initiative, researchers evaluated fitness components and performance of seed from different origins in a reciprocal transplant experiment. They established grow-out sites at Dabob, Fidalgo, and Oyster bays to examine site-specific trait differences and characterize unique genetic and phenotypic markers. The transplant experiment examined differences in survival, maturation, and growth based on origin. Researchers also developed an anesthetic that induces oysters to open their shells so larval counts may be conducted without harming them.

Results: Researchers identified significant differences in life-history traits among Olympia oyster populations, reflecting adaptations that might be linked to environmental cues. Oysters from Dabob Bay—a relatively harsh, highly dynamic environment with low primary production—had greater survival rates when transplanted. Oysters from Oyster Bay—a lush site with lower habitat dynamics and high primary production—exhibited more reproductive activity when transplanted. Researchers are developing an instructional pamphlet and discussing the oyster anesthesia developed during the project with shellfish producers.

Recap:

Recap: Washington Sea Grant-sponsored research suggests the existence of Olympia oyster population structure within Puget Sound and provides information on selection of broodstock for restoration purposes.

Comments:

Primary Focus Area: LME (SSSS)

Secondary Focus Area: LME (HCE)

Associated Goals: Support conservation and sustainable use of living marine resources through effective and responsible approaches, tools, models and information for harvesting wild and cultured stocks and preserving protected species. (SSSS Supply; HCE Science)

Partners:

Clam Fresh, LLC

Fagergren Oyster Co.

Fidalgo Marina

NOAA Manchester Lab

Puget Sound Restoration Fund

Rock Point Oyster Company

Swinomish Tribe

Washington Department of Fish and Wildlife

Related Partners: *none*

Title: **Washington Sea Grant-funded research leads to change in hatchery breeding practices**

Type: impact

Relevance, Response, Results:

Relevance: Hatchery breeding methods focus on efficient production of healthy seed that maintains fitness traits and is not maladapted. The assessment of breeding methods that are cost-effective and maintain genetic diversity helps shellfish

producers determine how best to breed oysters for both commercial and restoration purposes.

Response: With funding from a national strategic initiative, Washington researchers completed a genetic analysis of two Olympia oyster-breeding methods. The first is a commercial or traditional mass-spawning approach. The second is a restoration method that deploys numerous batch spawns and uses more resources than the commercial method.

Results: Analyses demonstrated that the mass-spawning method provided as much genetic diversity as the small-batch spawning method. In several analyses, the researchers spawned Olympia oysters with no loss of diversity using mass spawning and fewer resources than the batch spawns required. These results are already beginning to effect change in industry practices. Switching to the mass-spawning approach, the Puget Sound Restoration Fund can obtain needed seed for restoration purposes with a significant reduction in staff hours.

Recap:

Recap: Washington Sea Grant-funded research discovers that mass spawning of oyster seed reduces overall hatchery costs without limiting genetic diversity, a finding that can be immediately applied to achieve cost savings in the shellfish industry.

Comments:

Primary Focus Area: LME (SSSS)

Secondary Focus Area: LME (HCE)

Associated Goals: Support conservation and sustainable use of living marine resources through effective and responsible approaches, tools, models, and information for harvesting wild and cultured stocks and preserving protected species (SSSS Supply; HCE Science).

Partners:

Clam Fresh, LLC

Fagergren Oyster Co.

Fidalgo Marina

NOAA Manchester Lab

Puget Sound Restoration Fund

Rock Point Oyster Company

Swinomish Tribe

Washington Department of Fish and Wildlife

Related Partners: *none*

PUBLICATIONS

Title: **Evidence of *Ostrea lurida* (Carpenter 1864) population structure in Puget Sound, WA**

Type: Miscellaneous Reports (not peer-reviewed; see RR for peer-reviewed reprints)

Publication Year: 2014

Uploaded File: *none*

URL: <https://peerj.com/preprints/704/>

Abstract:

Where restoration efforts occur, such as with *Ostrea lurida* in Puget Sound, Washington, it is important to consider genetic population structure. Traits that hold adaptive advantage such as reproductive timing and stress resilience may differ at local scales. Using three established populations of *O. lurida* within Puget Sound Washington, we performed a reciprocal transplant experiment and monitored survival, growth, reproduction. We found that performance differed for each population at each of these three metrics. *O. lurida* from a relatively harsh home site environment with low primary production and high dynamic habitats exhibited generally greater survival at all sites, whereas those from a relatively lush home site environment with high primary production and lower habitat dynamics exhibited generally greater reproductive activity at all sites. Populations from sites with shorter growing seasons exhibited greater growth in sites with longer growing periods, suggesting a countergradient adaptation may have occurred in these populations.

Citation:

Heare JE, Blake B, Davis JP, Vadopalas B, Roberts SB. (2015) Evidence of *Ostrea lurida* (Carpenter 1864) population structure in Puget Sound, WA. PeerJ PrePrints 3: e1106 <https://dx.doi.org/10.7287/peerj.preprints.704v2>

Copyright Restrictions + Other Notes:

Journal Title: PeerJ PrePrints

OTHER DOCUMENTS

No Documents Reported This Period

LEVERAGED FUNDS

No Leveraged Funds Reported This Period

UPDATE NARRATIVE

Uploaded File: [Roberts_6976_update_na....8.pdf](#), 1076 kb

R/LME/N-3 - Alleviating Regulatory Impediments To Native Shellfish
Aquaculture

Progress Report: January 2014 – January 2015

A significant impediment to sustainable aquaculture is the lack of proper information to predict the impacts of culturing native shellfish species for restoration and commercial production. As a result, expansion and growth of domestic aquaculture is constrained and may be halted by management directives that restrict distribution of hatchery derived native shellfish until the potential interactions are better understood. The overall goals of this project are to increase our knowledge of local adaptation in Olympia oysters to address concerns that interbreeding between potentially maladapted cultured and wild stocks could negatively impact wild populations. Over the current reporting period we successfully completed research objective 1, to evaluate fitness components and performance of seed from different origins in a reciprocal transplant experiment. This research effort culminated in the preprint published in December 2014 [Heare JE, Blake B, Davis JP, Vadopalas B, Roberts SB. (2015) Evidence of *Ostrea lurida* (Carpenter 1864) population structure in Puget Sound, WA. PeerJ PrePrints 3:e1106 <https://dx.doi.org/10.7287/peerj.preprints.704>]. The paper is currently out for peer-review.

In summary, *Ostrea lurida* from Dabob Bay had higher survival at all sites but lower reproductive activity and growth (Figure 1 and 2). Oysters from

Oyster Bay demonstrated greater reproductive activity at all sites with moderate growth and survival (Figure 1). Together these data suggest the existence of *O. lurida* population structure within Puget Sound and provide information on how broodstock should be selected for restoration purposes.

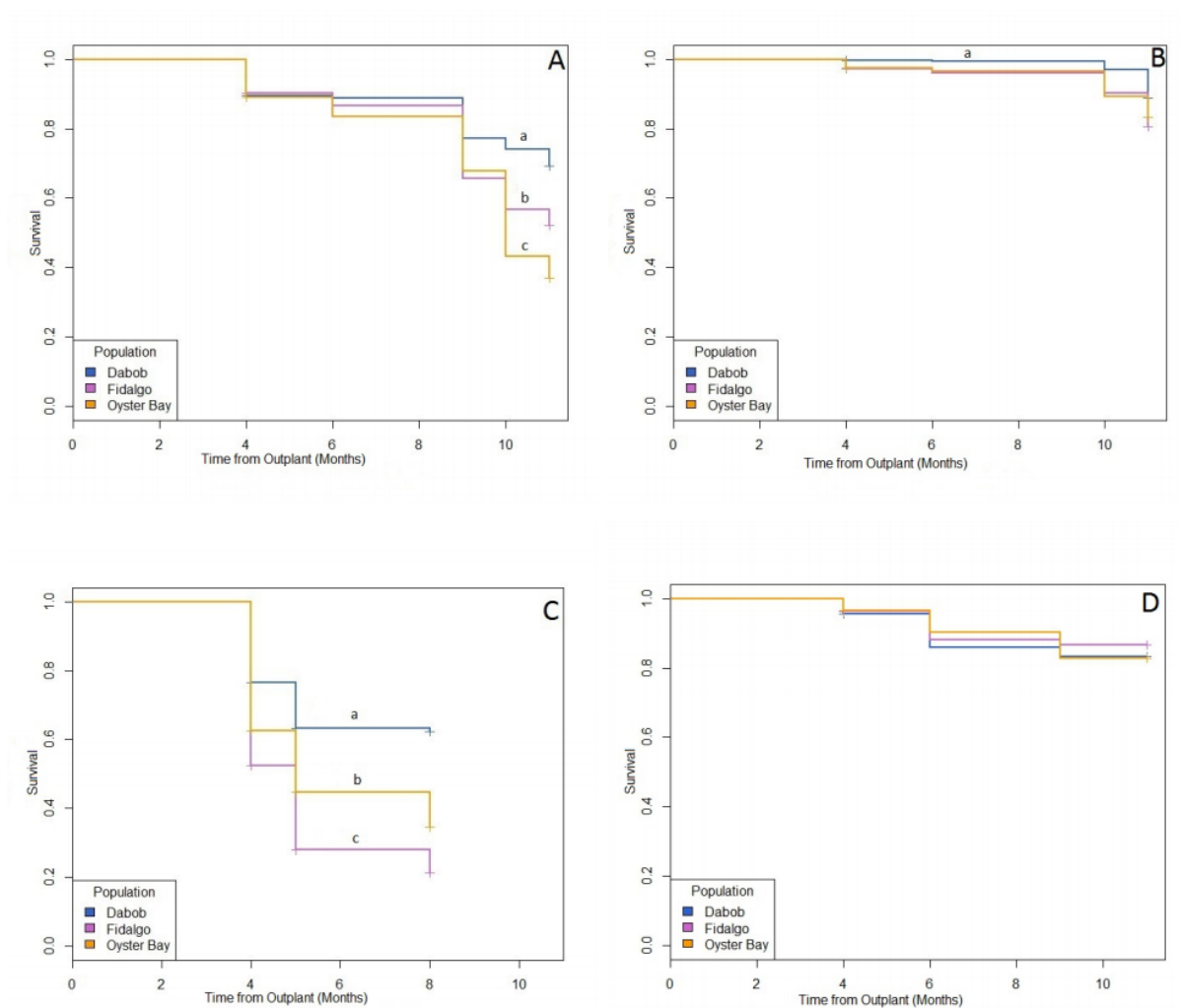
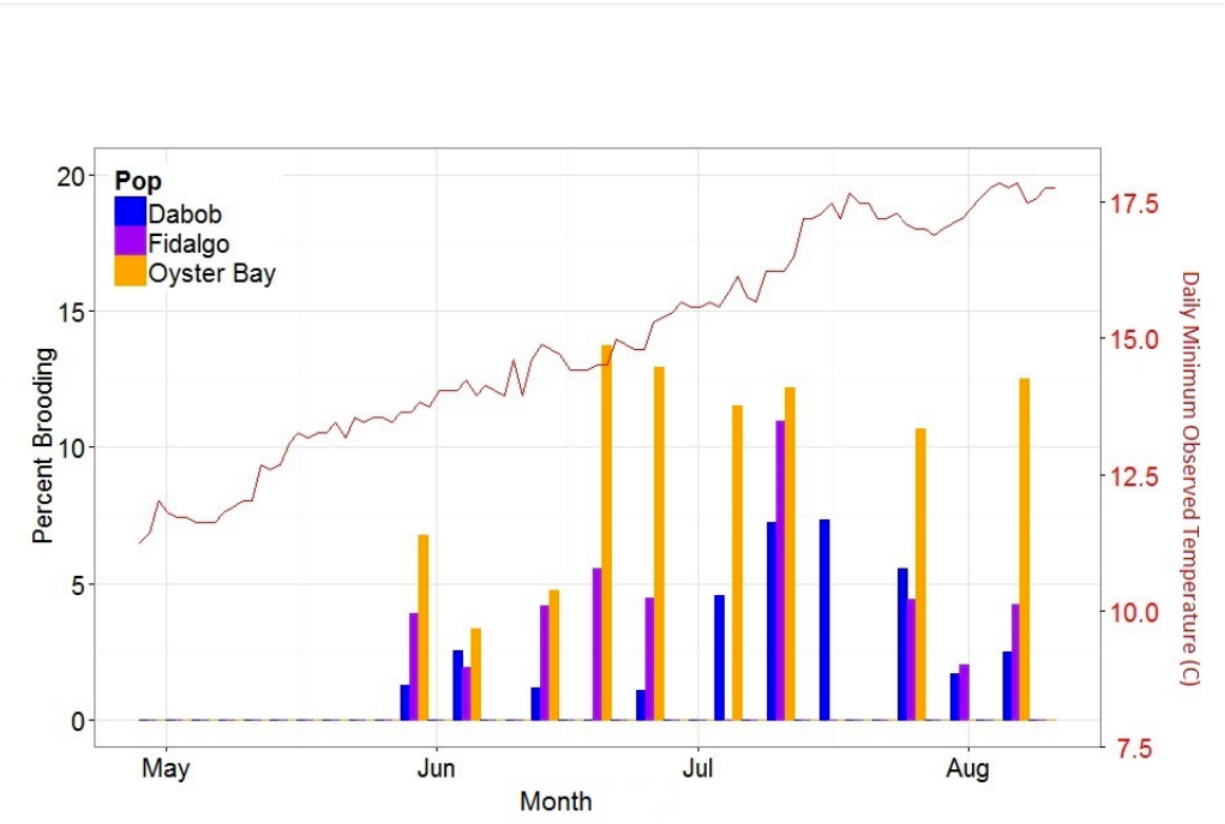


Figure 1 Proportion Survival for Three Oyster Populations. (Dabob = Blue, Fidalgo = purple, Oyster Bay = orange) at four locations; Oyster Bay (A), Manchester (B) Dabob (C), and Fidalgo (D). Lowercase letters (a,b,c) are

significant differences.



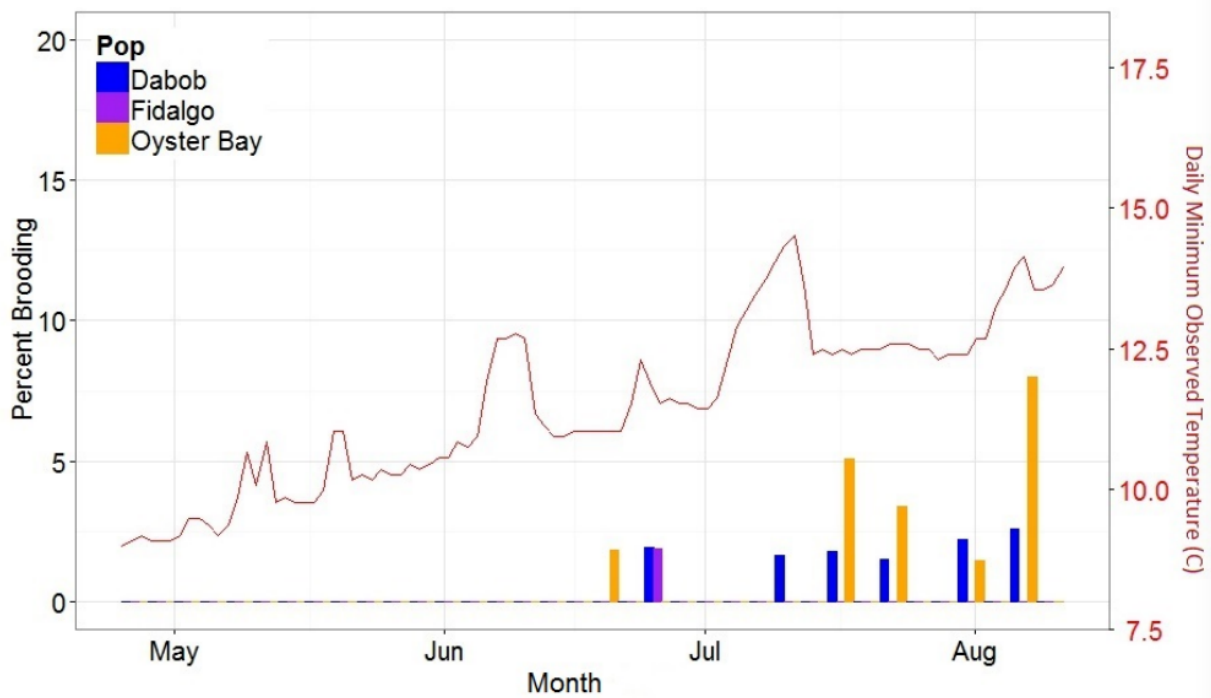
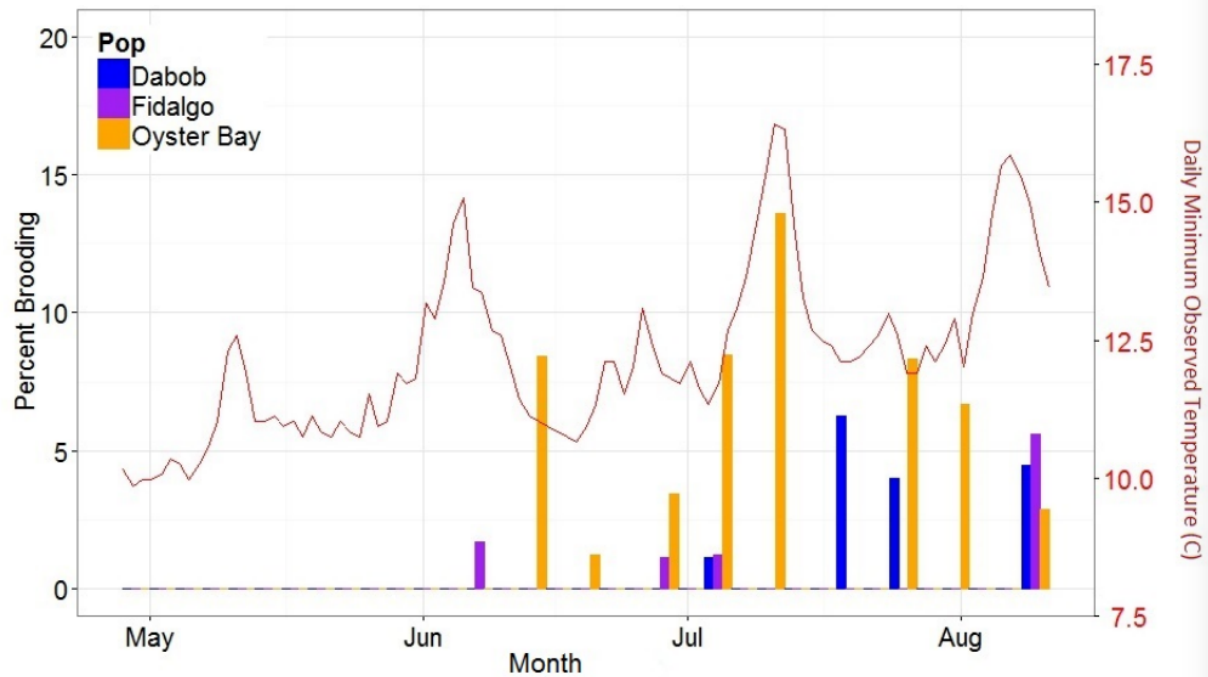


Figure 2 Percent Brooding Females from Each Population at Each Sample Date at Oyster Bay (top), Fidalgo (middle), and Manchester (bottom).

Percent determined by number of brooding females (Br) divided by number of open oysters (T) or $\% = (Br/T) * 100$. Blue = Dabob, Purple = Fidalgo, Orange = Oyster Bay.

In conclusion, significant differences in life history traits among *Ostrea lurida* populations within Puget Sound Washington demonstrate adaptations possibly linked with environmental cues such as high survival of the Dabob population may be due to extreme environmental variation at home site, greater proportion of brooding females in the Oyster Bay likely related to temperature trends at home site, and high growth in Fidalgo probably related to shorter growing seasons at home site. Over the next reporting period we will be focusing our efforts on testing some of these hypotheses as well as characterizing genetic and epigenetic structure of oysters in Puget Sound.