May 2nd, 10:30 AM - 12:00 PM

Drill, baby, drill: Invasive oyster drills are the main driver of native oyster mortality at a restoration site

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Invasive oyster drills are the main driver of native oyster mortality at a restoration site

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&

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A New Landscape for Oyster Recovery

H. sapiens  S. alterniflora  C. gigas  O. inornata
Japanese Oyster Drills - *Mollusca Non Grata*

- No planktonic dispersal
- Associated with historic oyster culture sites

*Ocenebra inornata*

- Taylor Shellfish: $500k per year on control
- Consume up to 1/3 of outplanted Olys (Buhle et al. 2009)
A predator of my predator is my friend

Native Cancrids

? 

Ocenebra inornata

? 

Ostrea lurida

Ostrea lurida

Cancrids?
A predator of my predator is my friend…?

...or just another predator.
Restoration at Liberty Bay

Photo: Brian Allen
Field Manipulation of Predators

Drills Enclosed

Drills Excluded

Ostrea lurida x 10
Field Manipulation of Predators

Drills Enclosed

Crabs Excluded

Drills Excluded

Crabs Allowed

n = 5
April – Aug 2011
Field Manipulation of Predators

Drills Enclosed

Crabs Excluded

Drills Excluded

Crabs Allowed

No Cage Control

n = 5
April – Aug 2011
Field Manipulation of Predators
GLMMs of Predator Effects

- Crabs Allowed
- Number of Drills
- Month
- Cage (Random)

Generalized Linear Mixed-effects Model

• Oyster Survival
• Drilling Rate: How many oysters were killed by drills per day?

Model Averaging & Variable Weighting

Information Theory (AICc)
Which parameters appear in the best models?

Variable Weight: 0 - 1
Oyster survival varies by season

Variable Weight
Month: 1.0
Drills Reduce Oyster Survival

Variable Weight

Month: 1.0
Drills: 1.0

Month X Drills: 0.05
Crabs Increase Oyster Survival

Variable Weight

- Month: 1.0
- Drills: 1.0
- Crabs: 0.89

Crab X Month: 0.11
Month X Drills: 0.05
Predators interact additively

Variable Weight
Month: 1.0
Drills: 1.0
Crabs: 0.89
Crab X Drills: 0.19
Crab X Month: 0.11
Month X Drills: 0.05
Ambient predator effects vary
Drilling rates vary seasonally

Variable Weight

Month: 1.0
Drill Num.: 1.0

Crabs: 0.33
Crab X Drills: 0.09
Crab X Month: 0.04
Month X Drills: 0.09
Crabs only reduced drills in August

*only treatments where drills were included in cages*
Drill feeding rates mirror mortality

Per capita drilling rate (no. oysters drill$^{-1}$ d$^{-1}$)

Crabs Excluded

Crabs Allowed

# drills = Average of Initial and final number
Drills are major drivers of oyster success
Crabs are not bad news for oysters!
Recommendations

• Avoid drills at restoration sites
• Research density/size refuge for oysters
Many, many thanks are due to...

Puget Sound Restoration Fund

<3 Shore Access and Hospitality <3

Gitch and Yungkeit Families

Oyster Master
Joth Davis

Field and Lab Support

• Jennifer Ruesink
• Greg and Molly Jackson
• Avanthi Jayasuria
• Nima Yazdani
• Marie Clifford
• Matt Flora-Tostado

Thirsty for more?
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