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

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DRILL BABY DRILL!

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

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NOAA
A New Landscape for Oyster Recovery

Photos: PSRF & Shelly Solomon

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
A predator of my predator is my friend...?

...or just another predator.
Field Manipulation of Predators

Drills Enclosed

Drills Excluded

Ostrea lurida × 10
Field Manipulation of Predators

Drills Enclosed
Crabs Excluded

Drills Excluded
Crabs Allowed

n = 5
April – Aug 2011
Field Manipulation of Predators

- Drills Enclosed
- Drills Excluded

Crabs Excluded

Crabs Allowed

No Cage Control

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

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

Model Averaging & Variable Weighting

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

Variable Weight: 0 - 1

Oyster Survival
- Drilling Rate: How many oysters were killed by drills per day?
Oyster survival varies by season

![Graph showing oyster survival by month](image)

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

# 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
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<3 Shore Access and Hospitality <3
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• Matt Flora-Tostado

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