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# Using Ecological Theory to Predict Invasion Dynamics in a Pacific Northwest Marine Fouling Community

## ENVIRONMENTAL ISSUE

Introduced species have been proven to alter ecosystem processes, act as vectors of human disease, cause millions of dollars in loss to commercial industries and are considered the second largest threat to diversity behind habitat loss and degradation (1).

Invasions are particularly rampant in marine systems, with 298 non-indigenous species identified in U.S. waters. Of these, 187 occur on the Pacific coast (2). Fouling communities associated with pilings and piers are especially prone to invasions because of close association with human activities.

Ecological theory predict invasions and their effects in fouling communities? Can we extend this to implement strategies to ensure communities will be resistant and/or robust to invasions?

### Indigenous Species in the Makah Marina Fouling Community



*Botrylloides violaceus*, a non-indigenous ascidian (“sea squirt”) common in PNW fouling communities

## SCIENTIFIC APPROACH

### HYPOTHESES

- Non-indigenous species are strong interactors in the fouling community that are able to pre-empt space and exclude other species.
- Diverse communities will be more resistant to invasion.
- If invaded, diverse communities will be more robust to invaders (meaning that fewer species will go locally extinct).

### METHODS

- Employ PULSE experiments and dynamic regression analysis to estimate per capita species interaction strengths.
- Simulate community dynamics under different scenarios using a food web model based on estimated interaction strengths.
- Reconstruct these scenarios in experimental communities on replicate 20cm X 20cm plots. Scenarios will included the reduction in the diversity of competitors (done manually) and reduction in predation pressure via cage enclosures.

<p>Space Competitors</p>  <p>Include feather duster worms, native ascidians, sea anemones, bivalves, &amp; others</p>	<p>Predators</p>  <p>Include the kelp crab, <i>Pugettia producta</i>, and the common tidepool sculpin, <i>Oligocottus maculosus</i></p>
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- Test the food web model predictions of non-indigenous species abundance with experimental results.

## RESEARCH SITE



### The Makah Marina

Located on the northwest tip of the Olympic Peninsula, WA



## IMPACT

- This study will test the utility of food web models based on ecological theory and empirically measured interaction strengths in predicting invasion resistance in communities.
- This study will also provided crucial baseline data on non-indigenous marine fouling organisms, especially the recently-introduced ascidians *Botrylloides violaceus* and *Styela clava*, in the Pacific northwest region.

## ACKNOWLEDGEMENTS

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1. International Union for Conservation of Nature and Natural Resources (IUCN). (1996). Compiled by Mick Clout, Sarah Lowe, and the UCN/SSC Invasive Species Specialist Group
2. Ruiz, G.M *et al.* (2000). Invasion of coastal marine communities in North America: apparent patterns, processes and biases. *Annual Review of Ecological Systematics*, 31:481-531