If historic marine pollution ceases, will the natural intertidal community return? How exposure to and release from pollution disturbance shapes rocky intertidal communities in the Salish Sea

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If historic marine pollution ceases, will the natural intertidal community return? How exposure to and release from pollution disturbance shapes rocky intertidal communities in BC

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Sites selected along pollution gradient
Pulp and paper pollution

- Toxicity
- Anoxia
- Physical disturbance
Improvements in Effluent Quality since EEM

Data kindly provided by Environment Canada and Hatfield Consultants, 2004
Economic shutdowns

- Prince Rupert mill closed 2001
- Woodfibre mill closed 2006
- Powell River, closure of 1 of 2 historic mills
Intertidal Quadrat Studies- faunal data

Percent (%) Cover

Under-rock Species Diversity
Questions

1) Were species impacted and how have they recovered?

2) What species traits are selected for in polluted vs. unpolluted sites?

3) Can we assess the condition of a site based on the species present?
Q1: Initial impact - 1990s

![Graph showing the relationship between standardized distance and site condition (local/regional richness). The graph includes data points for three locations: Howe Sound, Prince Rupert, and Powell River, with significance noted at P < 0.05.]
Q1: Species recovery post regulations

![Graph showing site condition over years from regulations for different locations with statistical significance indicated by * P < 0.05.](image-url)
Q1: But how are they recovering?

Adapted from Baselga 2009
Q1: Species nestedness

![Box plot showing species nestedness over time for different locations.](image)

- **Howe Sound** *P* < 0.05
- **Powell River** + *P* < 0.1

*P* < 0.05
+ *P* < 0.1
Q1: Species turnover

* P < 0.05
Q2: Trait assignment

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Community average trait value
Q2: Which traits thrive?

\[ P < 0.001 \]
\[ R^2_{adj} = 0.52 \]
Q2: Which traits thrive?

\[ P = 0.03 \]
\[ R^2_{adj} = 0.05 \]
Q2: Trait implications

Predict & Assess
Q3: Indicator species

Presence-Absence of

Site Condition?
Q3: Determining indicator species

1) Split data into a) training set & b) test set
2) Build training models predicting condition with different combos of the 15 species as predictors
3) Assess predicted values against independent test data ($R^2$)
Q3: How many species?

Most common species coefficients

73 % “accuracy”
Take aways

1) Mill pollution reduced species richness

2) Recovery *can* occur naturally
   • Beta diversity provides additional insights

3) Pollution selects for smaller, mobile species

4) It is possible to assess the condition of a site based on a subset of species (with good accuracy)
Contaminated Sites Applications

- Use of community traits index more informative than presence/absence surveys - insight into community health
- Identify sites which are not recovering naturally, candidates for restoration efforts
- Shoreline Cleanup & Assessment Technique (SCAT)
  - Use indicator species survey technique for oil spill response baseline surveys - time restrictive, easily train volunteers
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