Using Lessons from Chronic Pollution Disturbance to Develop New Marine Ecological Monitoring Tools to Allow Rapid Assessment under Emergency Spill Response

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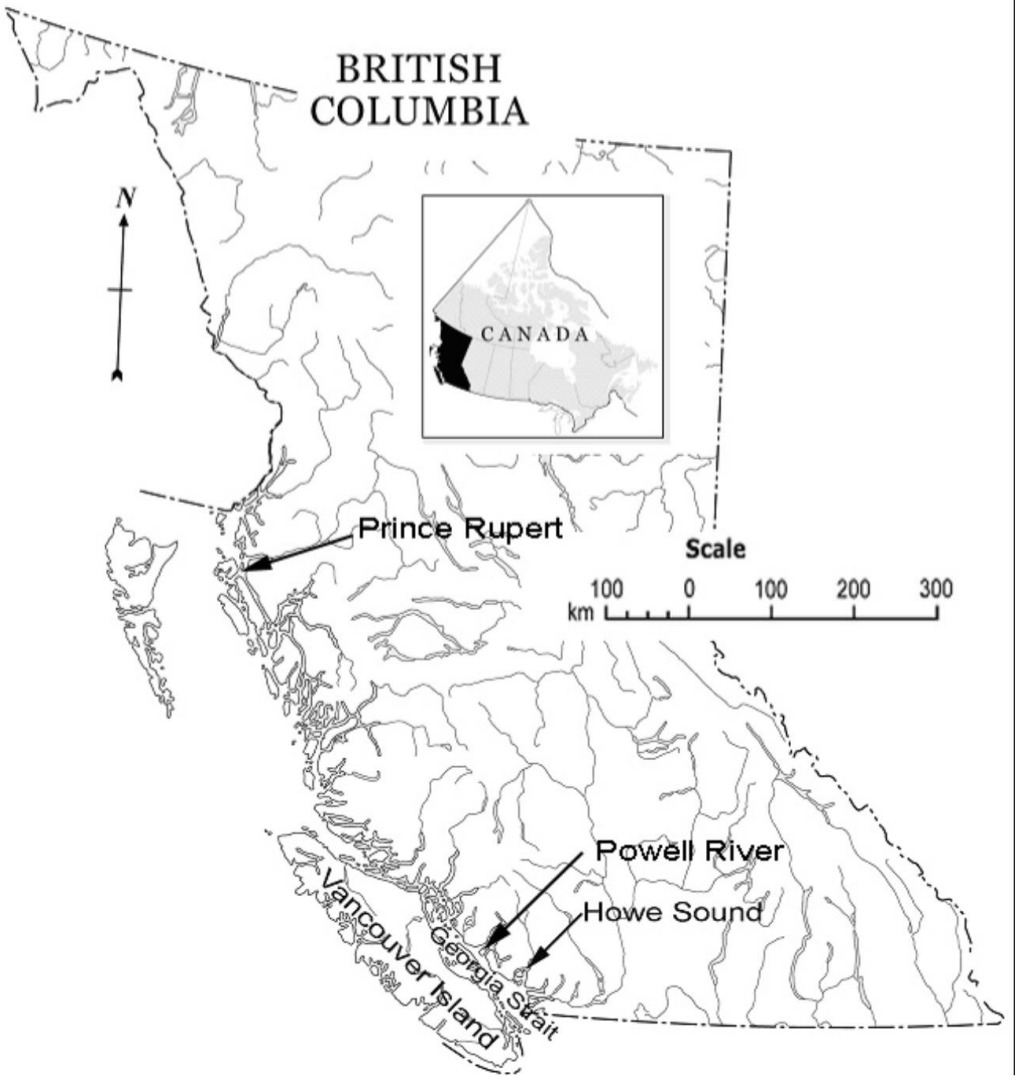
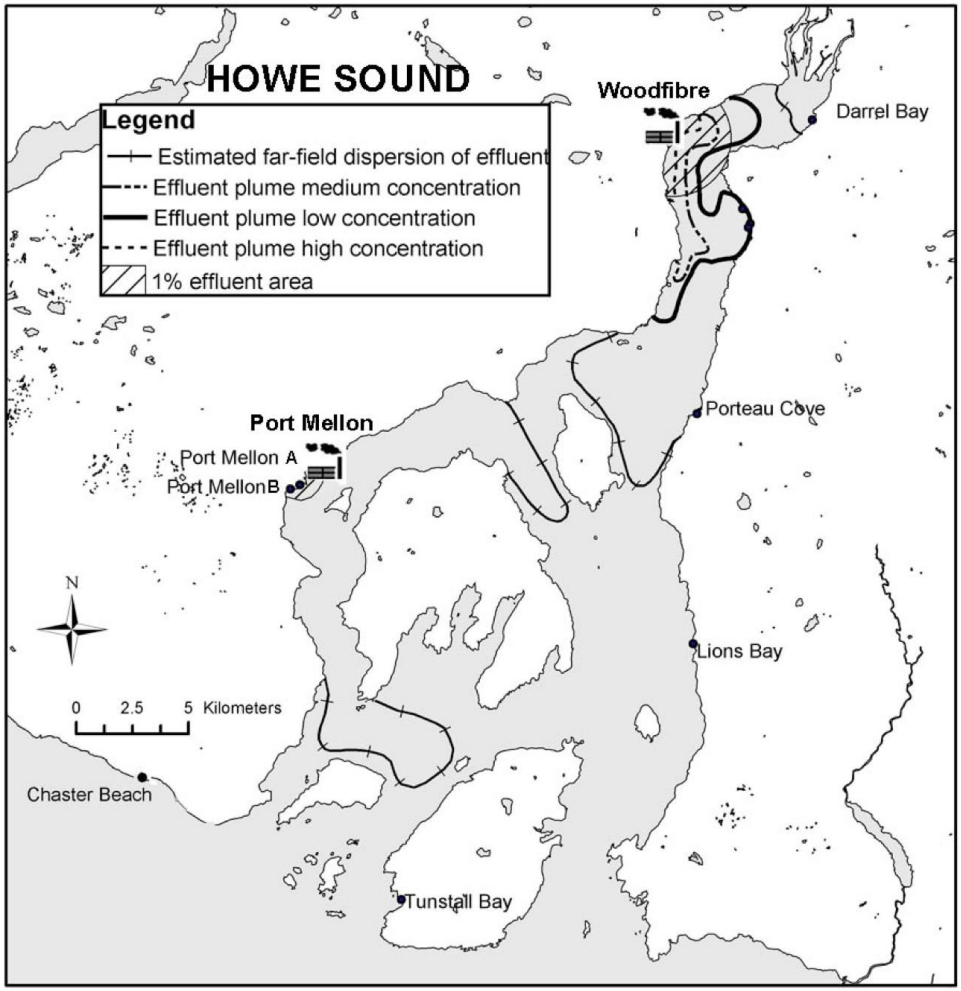
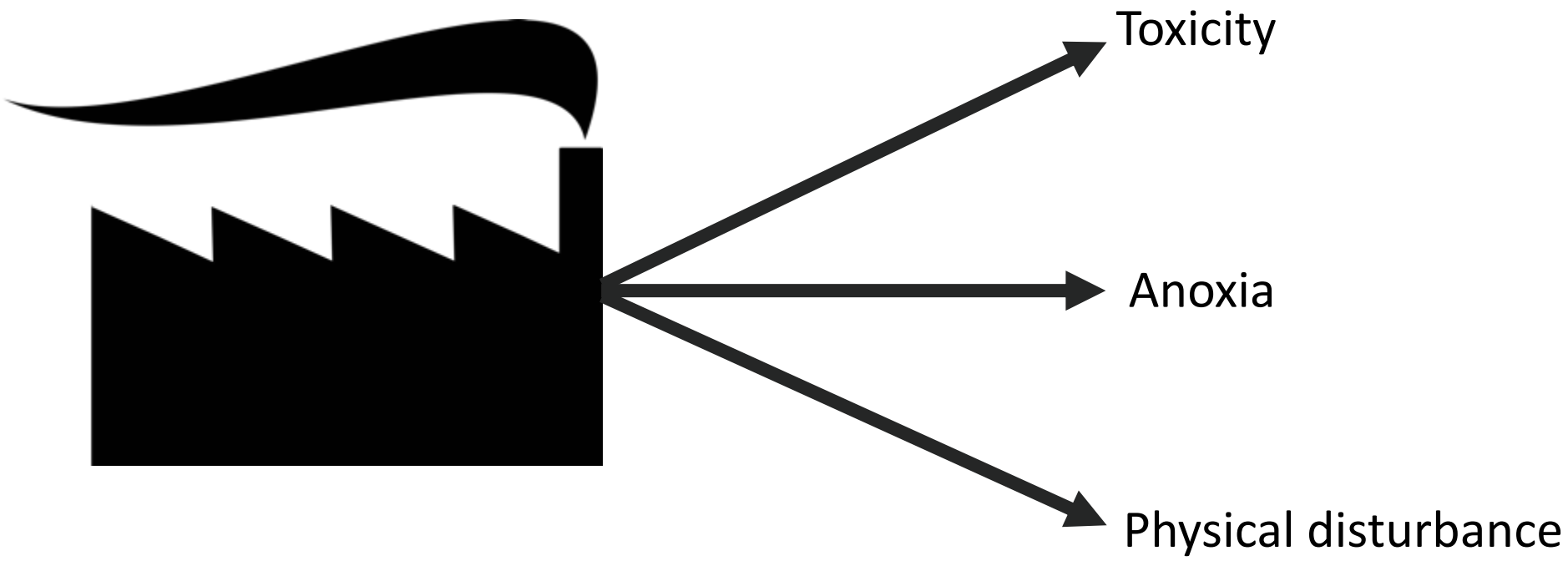
CSI Coastal Scene Investigation



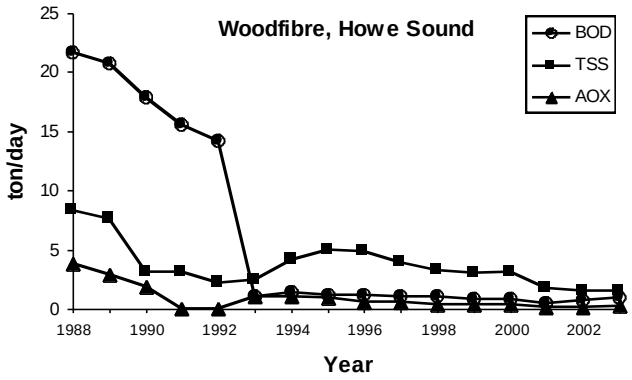
Sites selected along pollution gradient

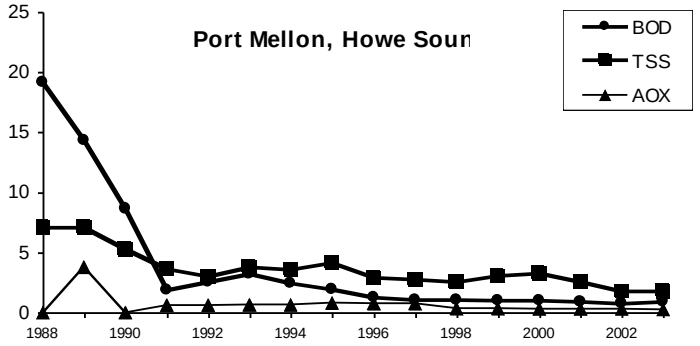


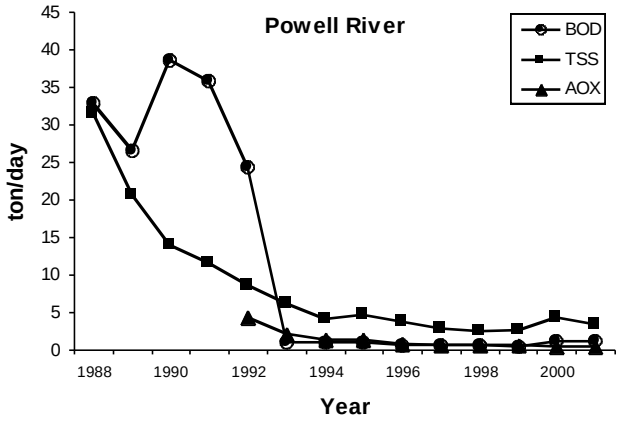
Pulp and paper pollution

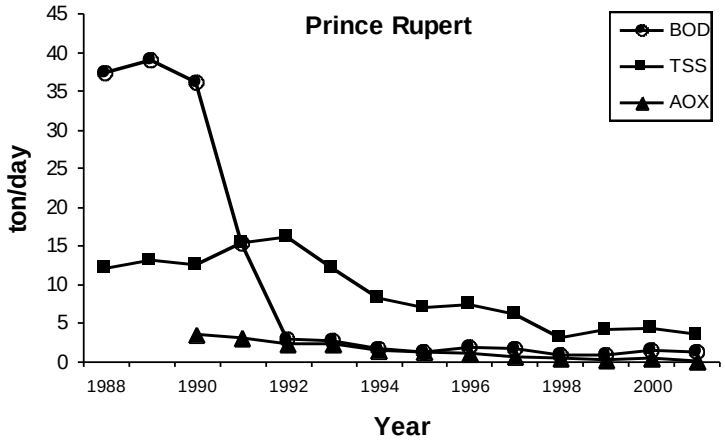


Improvements in Effluent Quality since EEM









Data kindly provided by Environment Canada and Hatfield Consultants, 2004

Economic shutdowns

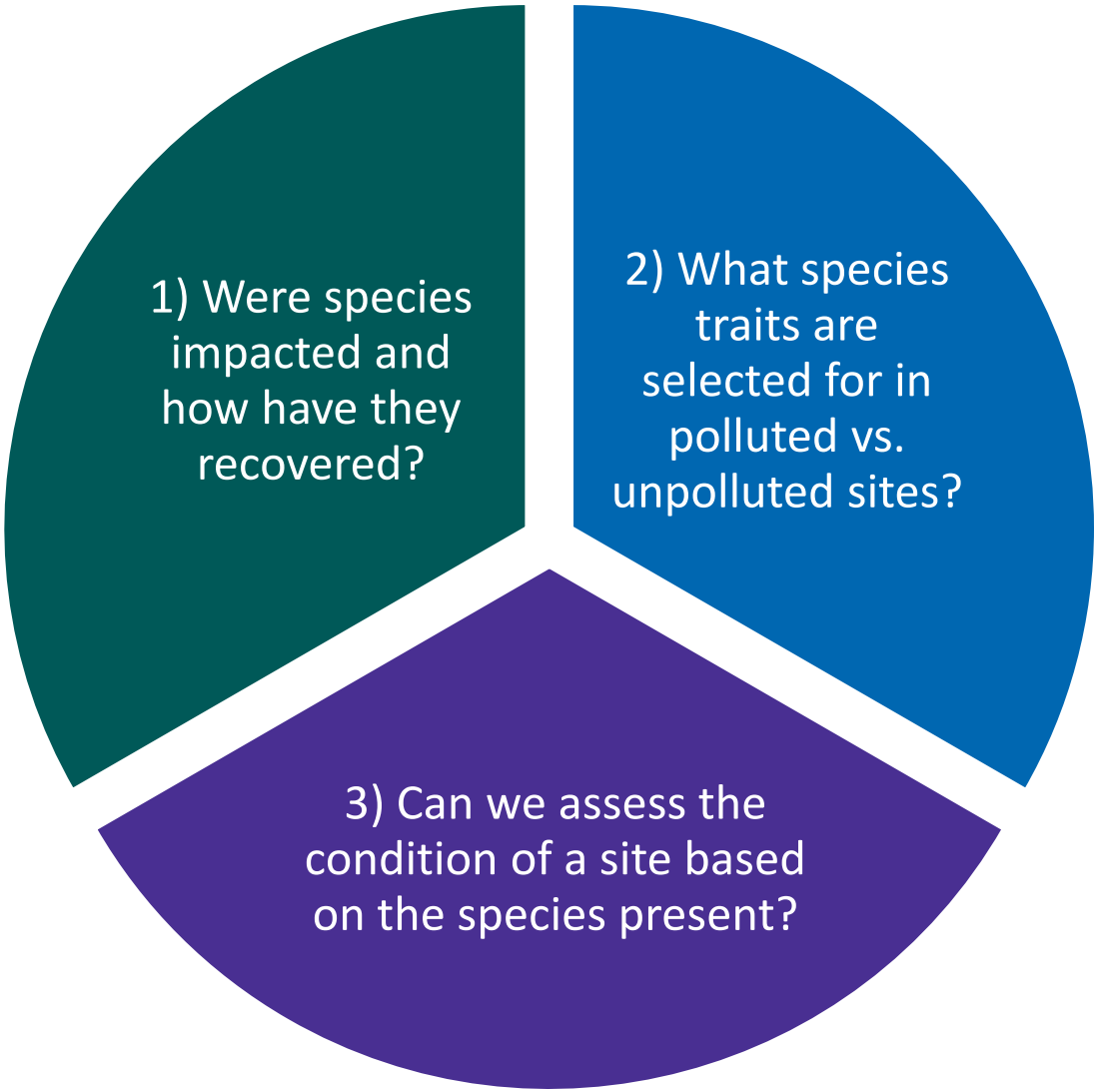
- **Prince Rupert mill closed 2001**
- **Woodfibre mill closed 2006**
- **Powell River, closure of 1 of 2 historic mills**

Intertidal Quadrat Studies- faunal data

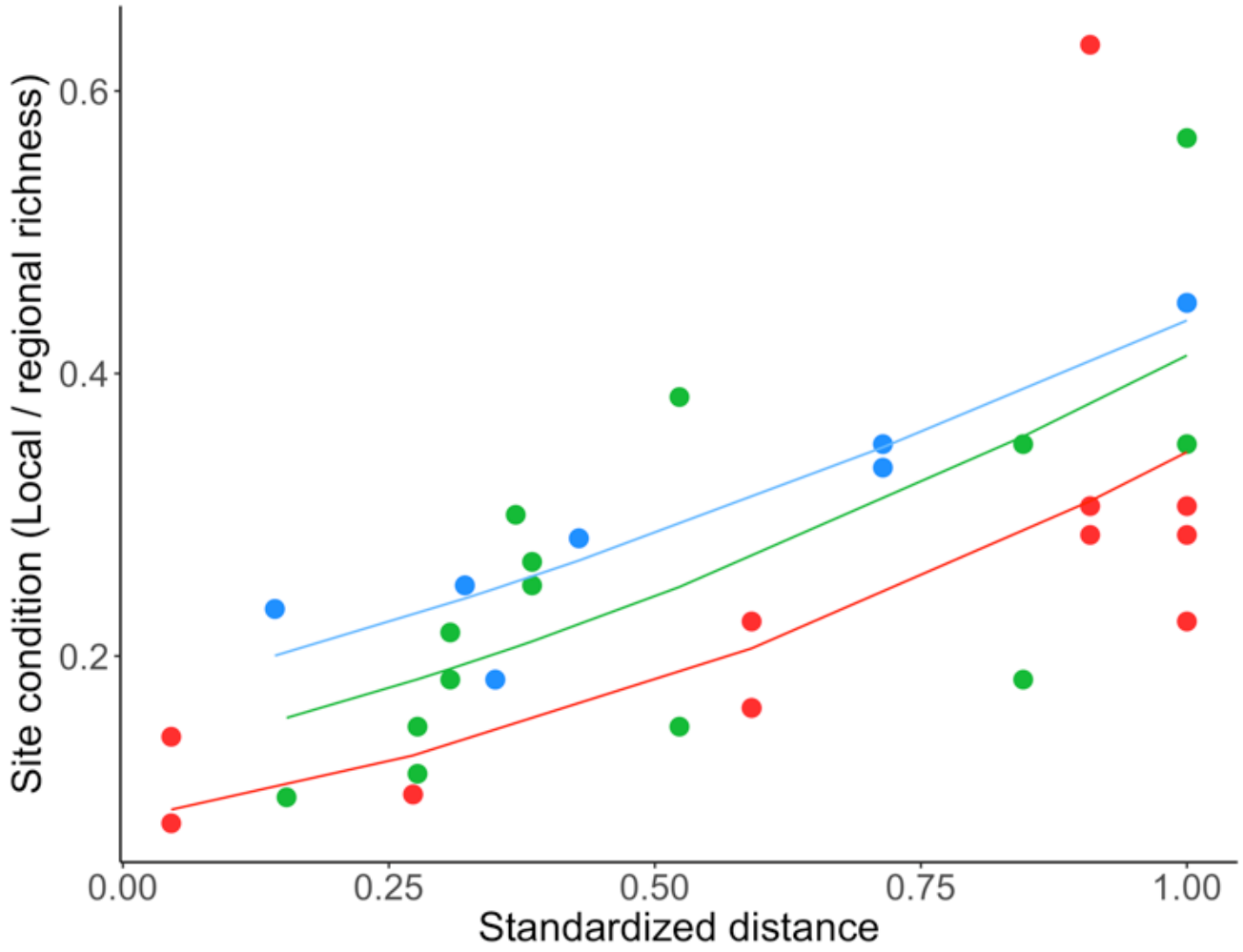
Percent (%) Cover

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



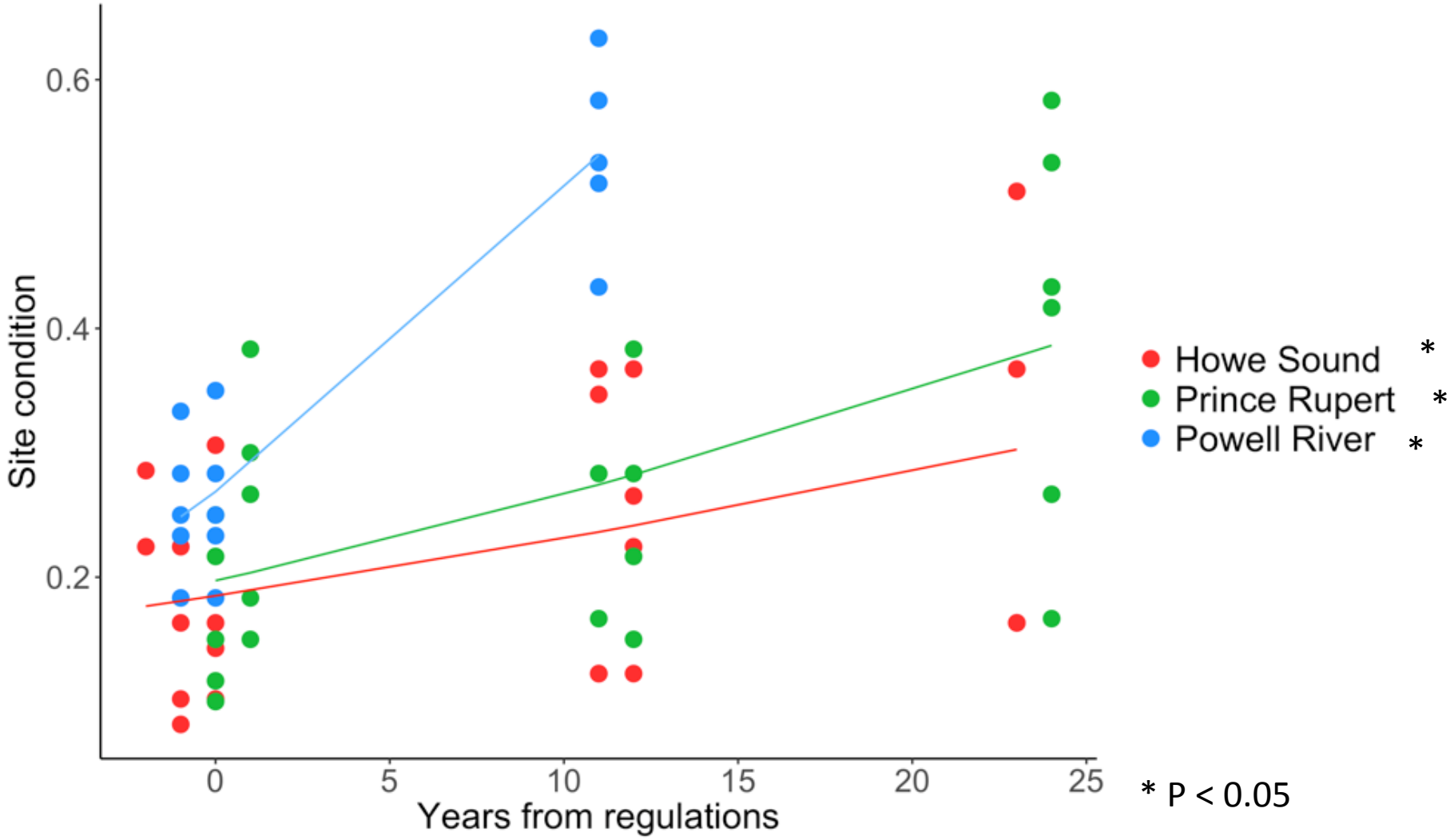
* P < 0.05

High Exposure: Port Mellon

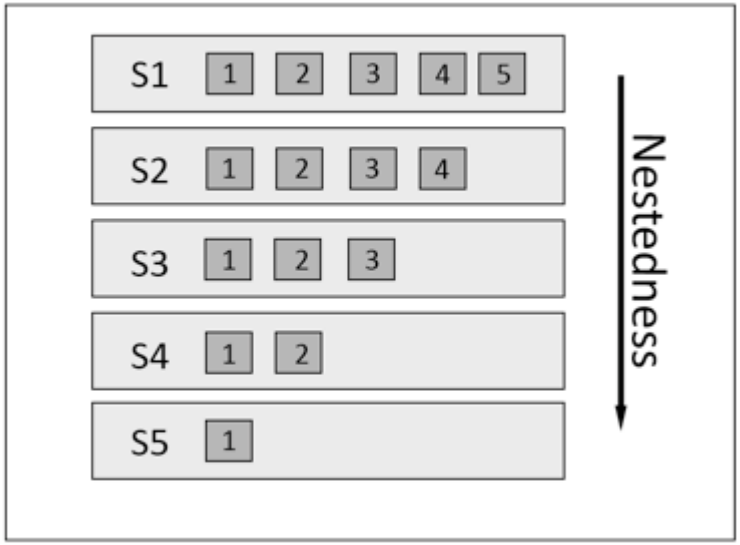
Moderately Exposed Bowen Is. 20

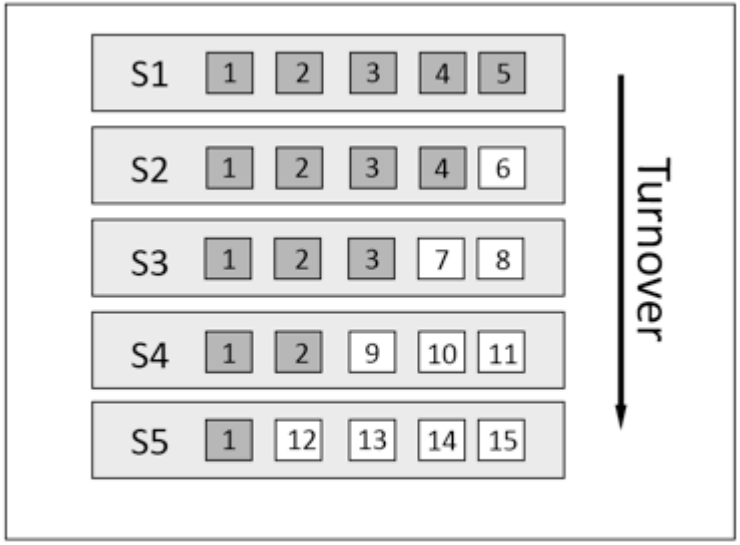
Reference Site

Q1: Species recovery post regulations



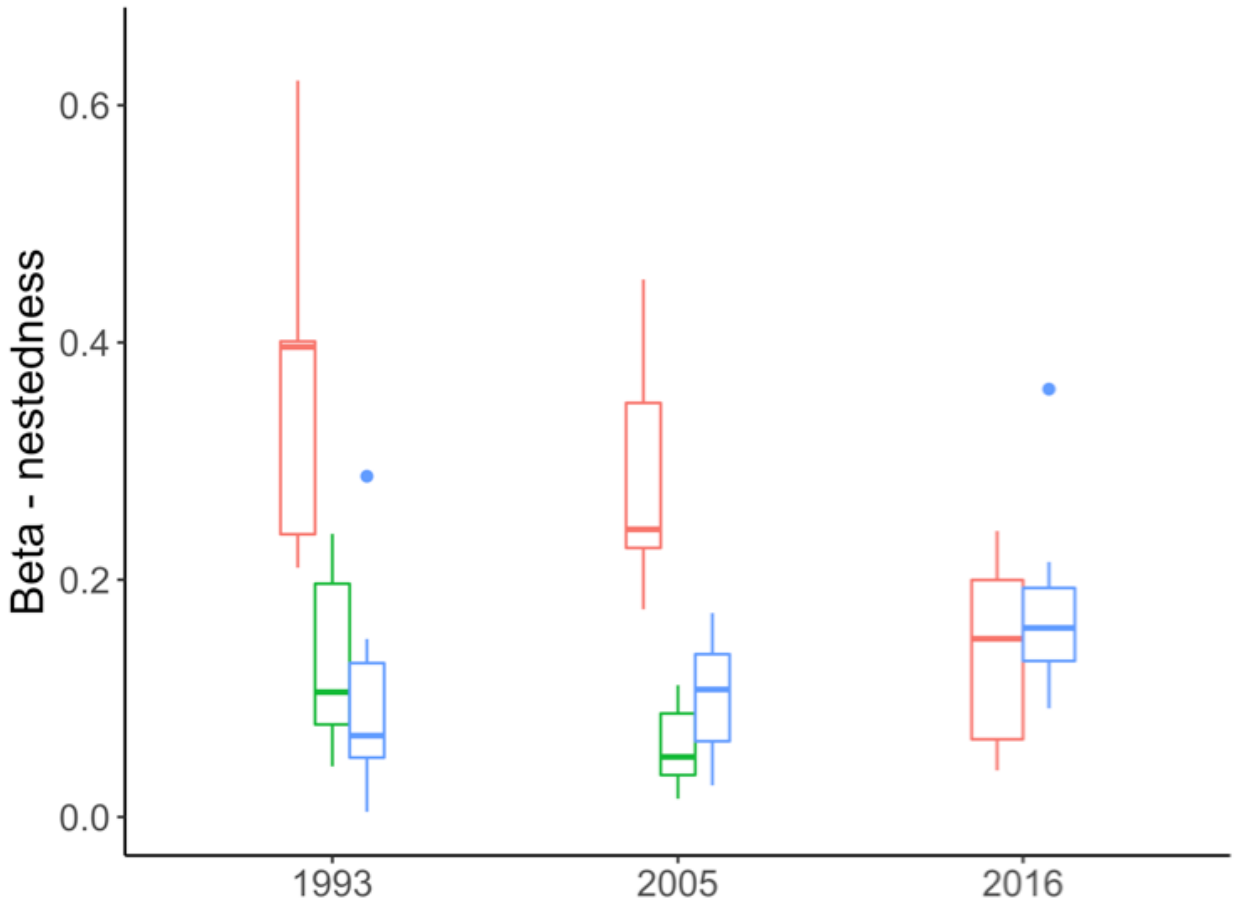
Q1: But how are they recovering?





Adapted from Baselga 2009

Q1: Species nestedness



Howe Sound* ↓

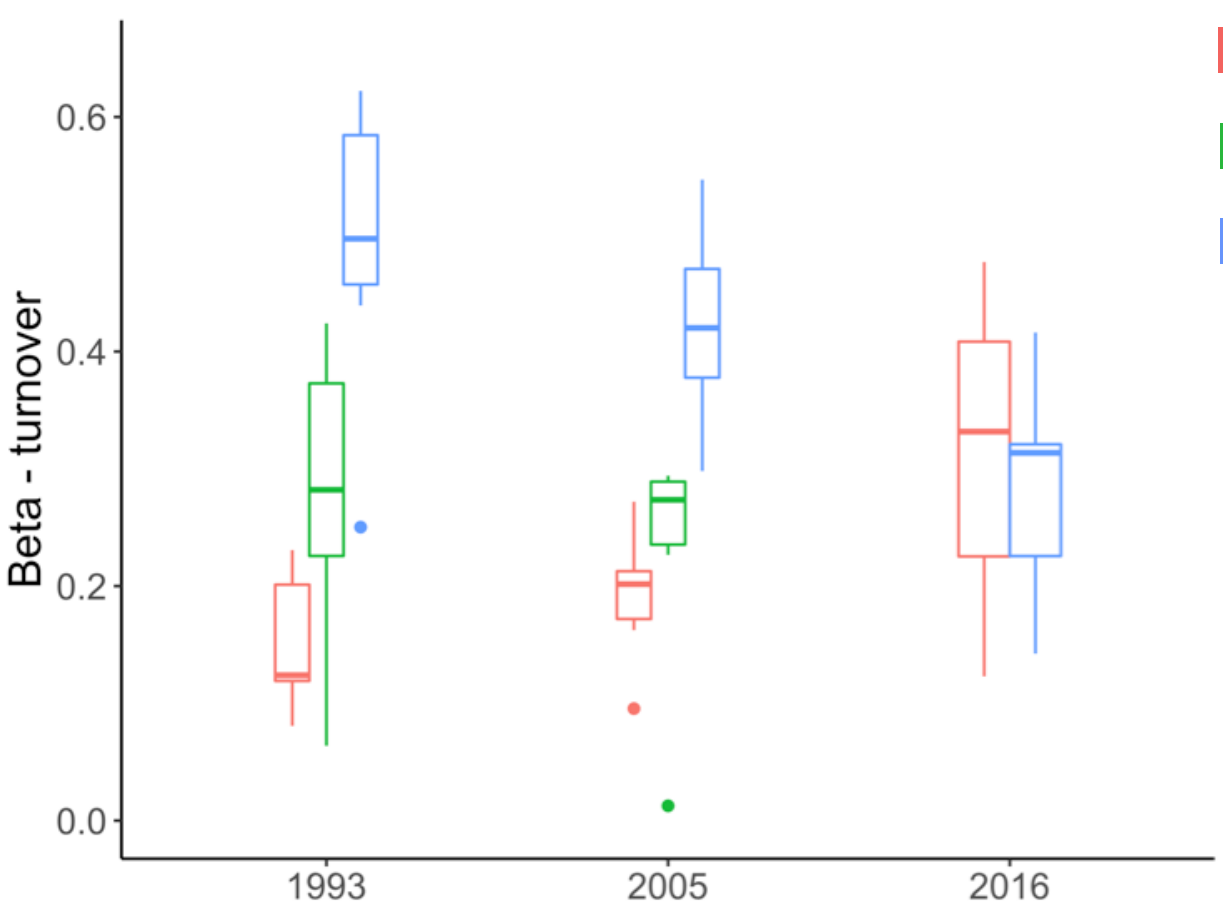
Powell River+ ↓

Prince Rupert

* P < 0.05

+ P < 0.1

Q1: Species turnover



Howe Sound* ↑

Powell River

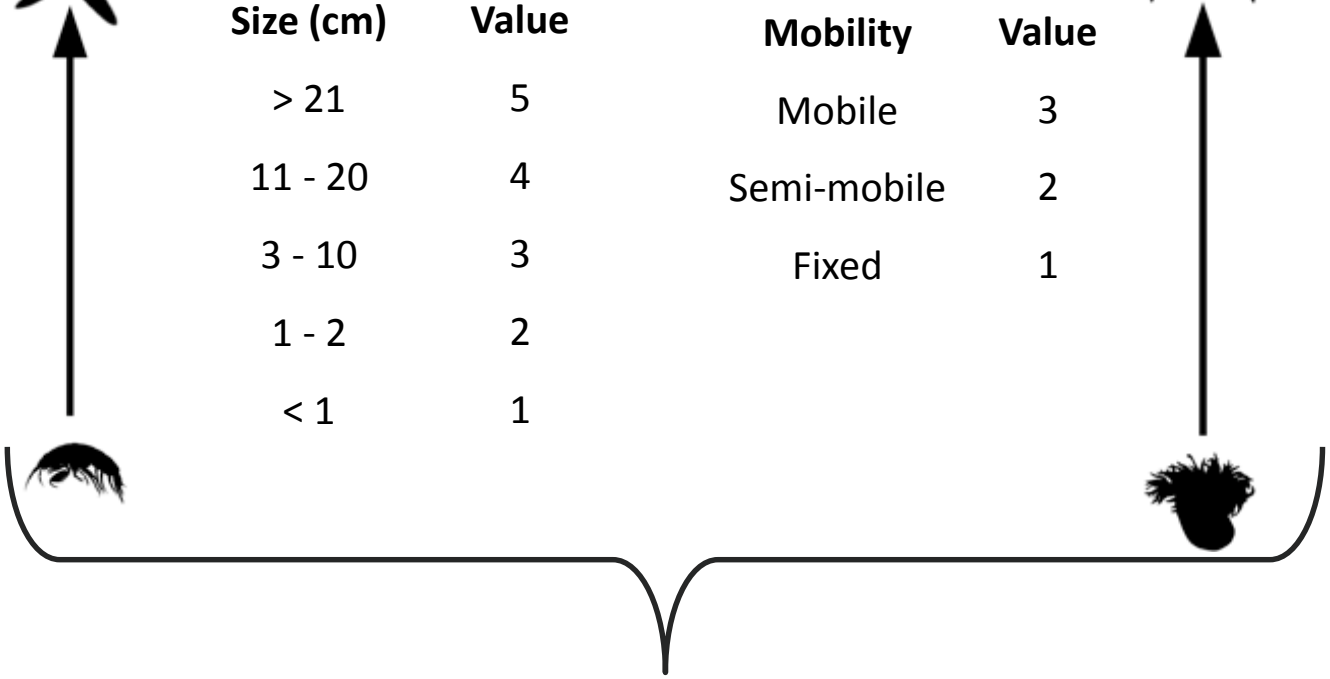
Prince Rupert* ↓

* P < 0.05

Q2: Trait assignment

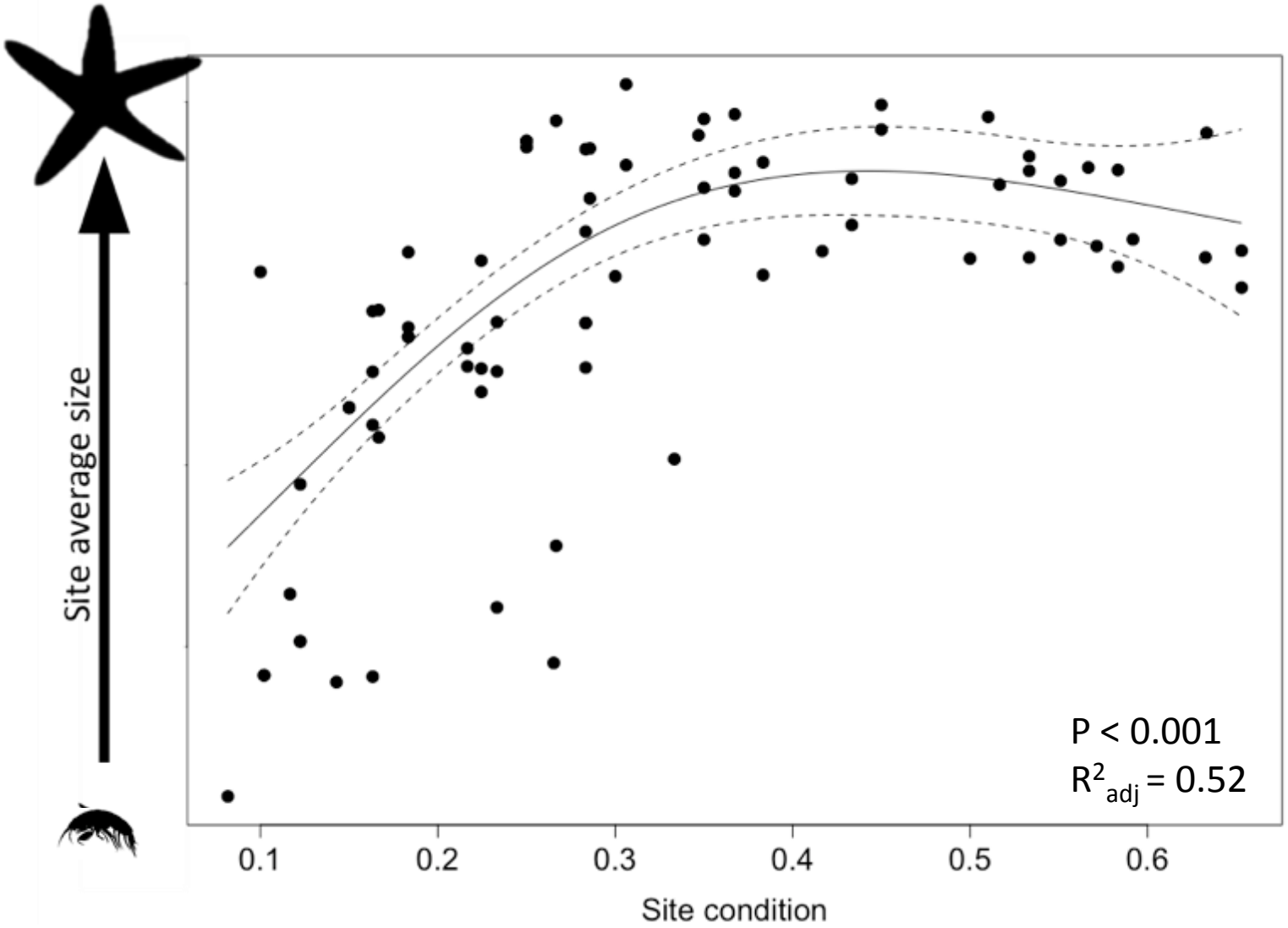
Size (cm)	Value
> 21	5
11 - 20	4
3 - 10	3
1 - 2	2
< 1	1

Mobility	Value
Mobile	3
Semi-mobile	2
Fixed	1

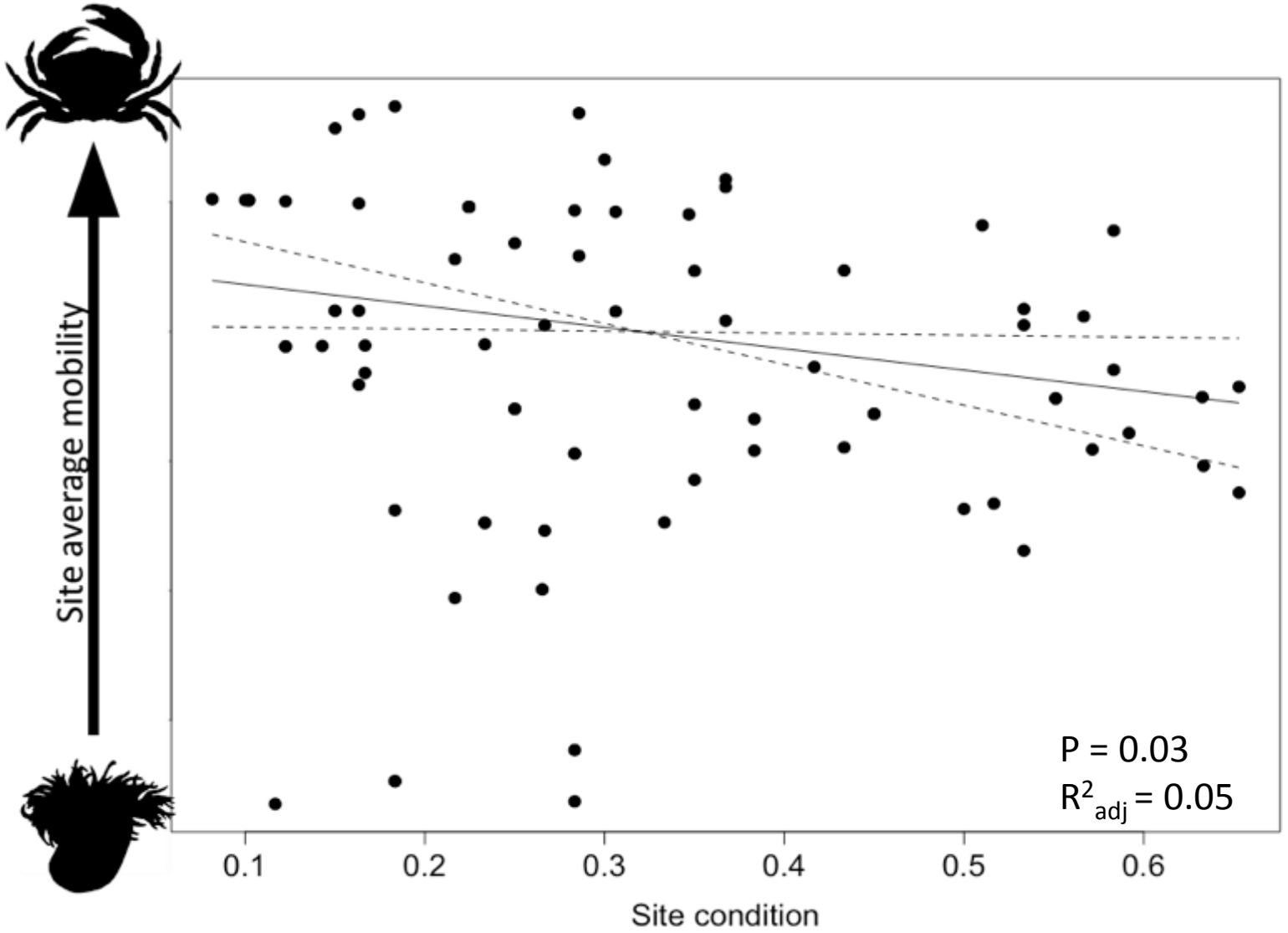


Community average trait value

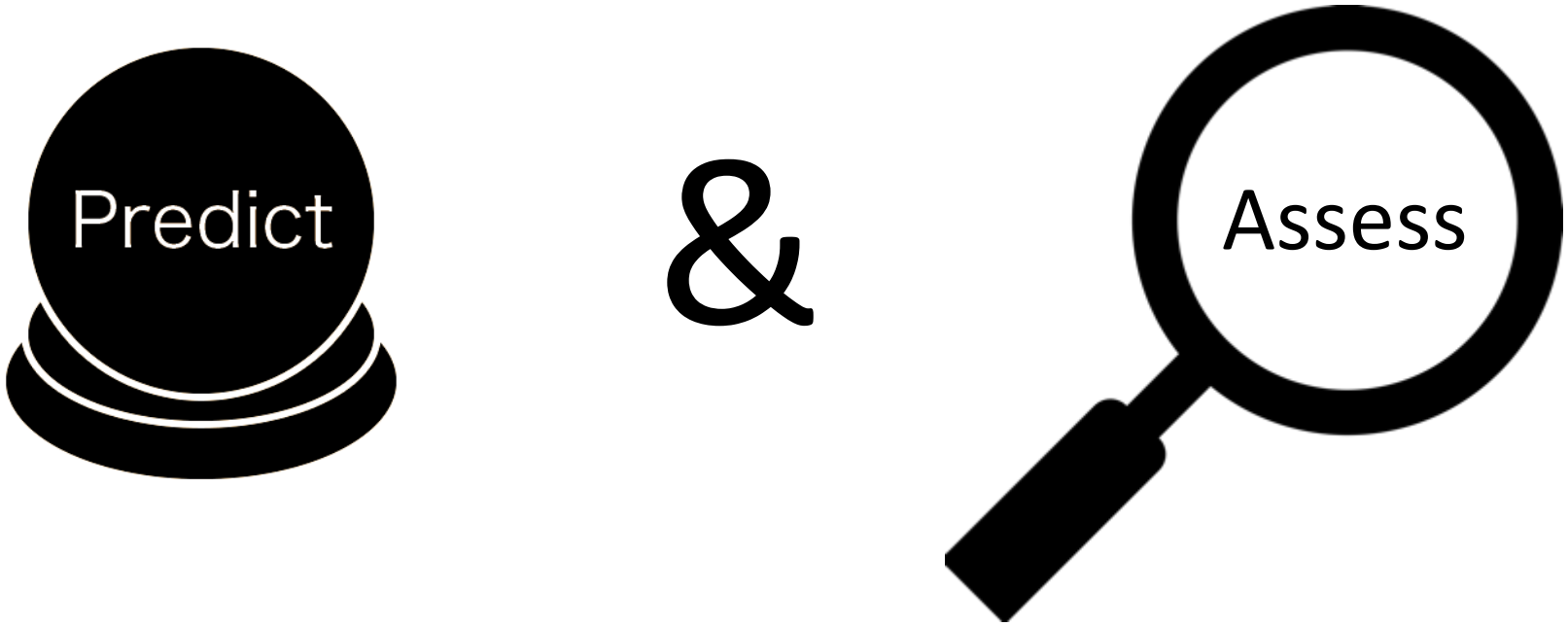
Q2: Which traits thrive?



Q2: Which traits thrive?



Q2: Trait implications



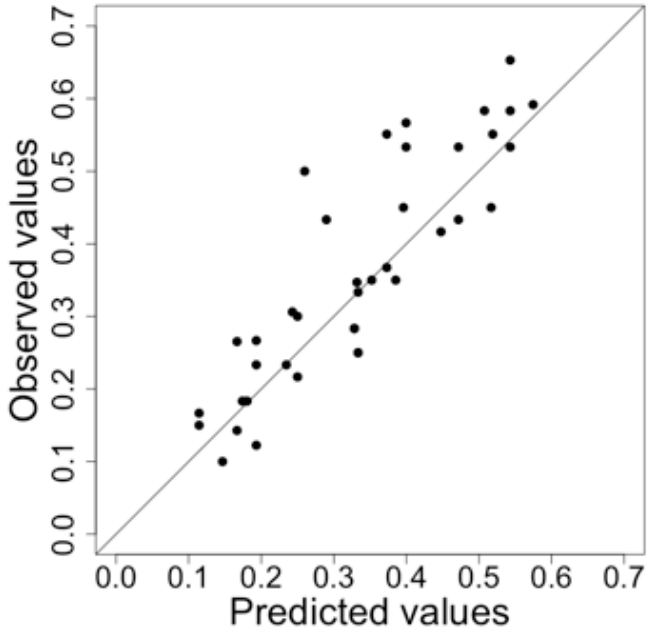
Q3: Indicator species

Presence-Absence of

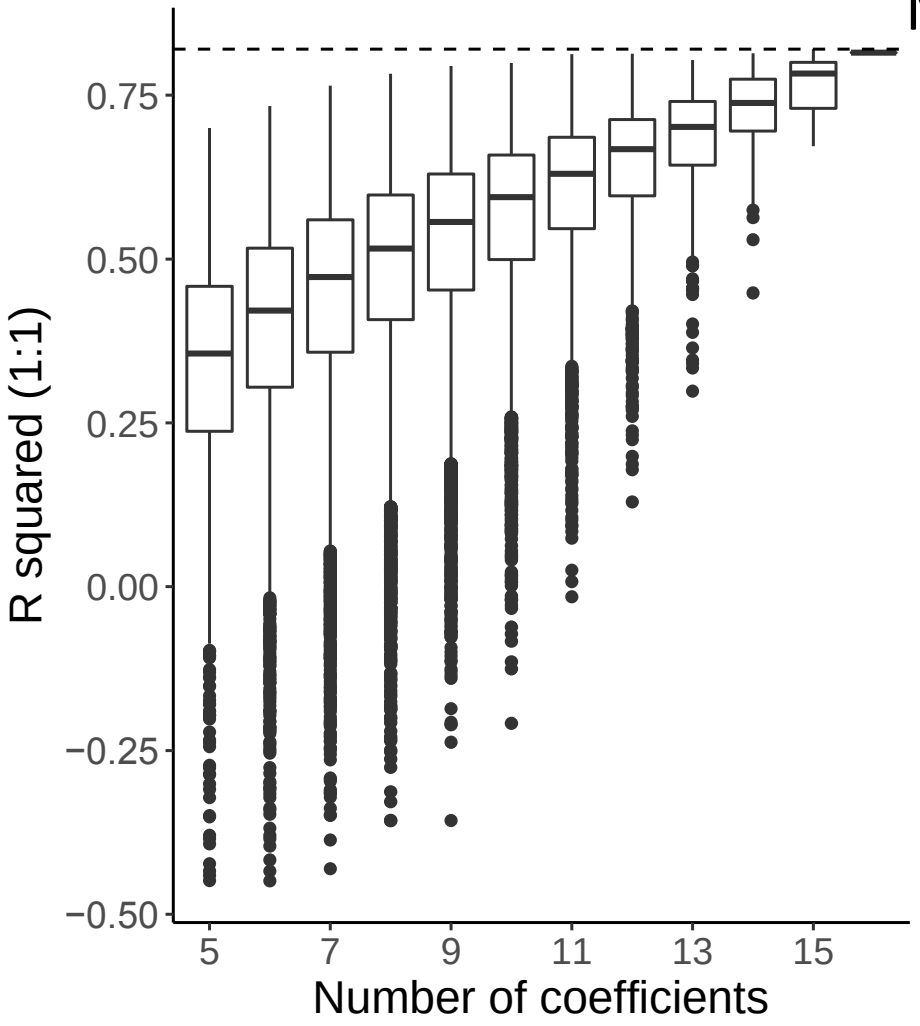
Site Condition ?

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

Acknowledgements

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- MITACS
- DFO

All Coastal Scene Investigators
1985 – present

For more CSI info, go to www.ecotoxicology.ca

Acknowledgements

Consultation and logistics

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- Kitselas Nation
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Thank you – Questions?

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