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

Shannon Bard  
Hemmera, Canada, sbard@hemmera.com

Aaron Eger  
Univ. of Victoria, Canada, aeger@uvic.ca

Julia Baum  
Univ. of Victoria, Canada, baum@uvictoria.ca

Follow this and additional works at: https://cedar.wwu.edu/ssec

Part of the Fresh Water Studies Commons, Marine Biology Commons, Natural Resources and Conservation Commons, and the Terrestrial and Aquatic Ecology Commons

Bard, Shannon; Eger, Aaron; and Baum, Julia, "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" (2018). Salish Sea Ecosystem Conference. 157.  
https://cedar.wwu.edu/ssec/2018ssec/allsessions/157

This Event is brought to you for free and open access by the Conferences and Events at Western CEDAR. It has been accepted for inclusion in Salish Sea Ecosystem Conference by an authorized administrator of Western CEDAR. For more information, please contact westerncedar@wwu.edu.
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

Dr. Shannon Mala Bard,
Practice Leader, Biological Risk Assessment & Science and Innovation
Hemmera, an Ausenco Company

Aaron Eger & Dr. Julia Baum,
Department of Biology, University of Victoria
CSI Coastal Scene Investigation
Sites selected along pollution gradient
Pulp and paper pollution

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

Woodfibre, Howe Sound

BOD
TSS
AOX

Port Mellon, Howe Sound

BOD
TSS
AOX

Powell River

BOD
TSS
AOX

Prince Rupert

BOD
TSS
AOX

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
Q1: Species recovery post regulations

![Graph showing species recovery over years from regulations.](image)
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

* P < 0.05
Q2: Trait assignment

<table>
<thead>
<tr>
<th>Size (cm)</th>
<th>Value</th>
<th>Mobility</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 21</td>
<td>5</td>
<td>Mobile</td>
<td>3</td>
</tr>
<tr>
<td>11 - 20</td>
<td>4</td>
<td>Semi-mobile</td>
<td>2</td>
</tr>
<tr>
<td>3 - 10</td>
<td>3</td>
<td>Fixed</td>
<td>1</td>
</tr>
<tr>
<td>1 - 2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Community average trait value
Q2: Which traits thrive?

\[ P < 0.001 \]

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

\[ P = 0.03 \]
\[ R^2_{\text{adj}} = 0.05 \]
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
Acknowledgements

- UVic, Aaron Eger, Julia Baum, Quinn Lowen, Tella Osler
- SFU, Katerina Vassilenko, Chris Kennedy, Vicki Marlatt, Fabiola Ukah, Jeremy Jackson
- Eric Chiang, DFO

Funding

- NSERC Engage & Discovery Grants
- Dalhousie University Fac of Science
- Howard Hughes Medical Institute
- Stanford University URO
- Haas Public Service Fellowship
- Morrison Institute for Population and Resource Studies
- Nova Scotia Dept of Economic Dev.
- YTV Environment Award
- NSERC Engage Grant
- MITACS
- DFO

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

Consultation and logistics

• Metlakatla Nation
• Gitxaala Nation
• Lax Kw’alaams Nation
• Kitsumkalum Nation
• Kitselas Nation
• Northwest Community College
• Prince Rupert Port Authority
Thank you – Questions?

Dr. Shannon Mala Bard
sbard@hemmera.com

604.669.0424
www.ecotoxicology.ca