Mouth of the Columbia River Benthic Impact Study

Curtis Roegner

Stephanie Fields

MCR Science-policy Workshop
~
Ilwaco, WA
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**Scope:**
Investigate effects of sediment deposition events on benthic communities

Experimental approach using multiple techniques
**Experimental Design:**

**Before-Impact-After Design**
- Response variable x Treatment x Period
- Treatment = Impact vs Control // Period = Before, During, After disposal
- Acute effect: during deposition period; Cumulative effect: persist after deposition
- Null hypothesis: No difference in RV between treatment and period

A. H0: ACCEPTED
   No impact

B. H0: REJECTED
   Neg. Acute effect
   Neg. Cum. effect

C. H0: REJECTED
   Neg. acute effect
   No Cum. effect

D. H0: REJECTED
   Pos. impact

**Legend:**
- ▲ CONTROL
- □ IMPACT
1. **CamPod**
   Used to measure acute effects of disposal including sediment depth & impact on fauna

2. **Acoustic Tracking**
   Used to measure acute & cumulative impacts on crabs

3. **Benthic video sled**
   Used to compare invertebrate and fish abundances in different habitats
CamPod Arrays

CamPod daisy chain

30 m

0.5 m²

CamPod daisy chain
CamPod: Deposition event (16x)
CamPod: Results

Elapsed time (min)

Proportion of maximum (se)

Dungeness crab

Elapsed time (min)
CamPod: Results

Elapsed time (min)
0 10 20 30 40 50 60 70 80 90 100 110
Proportion of maximum (se)
0.0
0.2
0.4
0.6
0.8
1.0
Impact
Control
Pre-impact Impact Recovery
Dungeness crab

Roegner & Fields // 9 January 2015
CamPod: Results

- Deposition levels were minimal but velocities of the sediment plume were substantial.

- Observations indicate crabs flee from sediment plume but get enveloped.

- Crabs were displaced by the plume but returned within 30 min.
Experimental Design:

Results
- CamPod: Crab abundance: Negative acute effect, No cumulative effect
- Crab Pots:
- Acoustic Tags:

![Graph showing response density over time for different scenarios.](image-url)
Crab Pot: Results

**CRAB ABUNDANCE**

<table>
<thead>
<tr>
<th></th>
<th>PRE-IMPACT</th>
<th>EARLY IMPACT</th>
<th>LATE IMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Cancer magister</strong></td>
<td><a href="#">Data</a></td>
<td><a href="#">Data</a></td>
<td><a href="#">Data</a></td>
</tr>
</tbody>
</table>

**MEAN SIZE**

<table>
<thead>
<tr>
<th></th>
<th>CONTROL</th>
<th>IMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Male Cancer magister</strong></td>
<td><a href="#">Data</a></td>
<td><a href="#">Data</a></td>
</tr>
</tbody>
</table>

**SIZE-FREQUENCY**

**ESTUARY**

**MALE CRAB SIZE**

<table>
<thead>
<tr>
<th></th>
<th>CONTROL</th>
<th>IMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Male Cancer magister</strong></td>
<td><a href="#">Data</a></td>
<td><a href="#">Data</a></td>
</tr>
</tbody>
</table>

**TEST PERIOD**

**ESTUARY**

<table>
<thead>
<tr>
<th></th>
<th>PRE-IMPACT</th>
<th>EARLY IMPACT</th>
<th>LATE IMPACT</th>
</tr>
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<tbody>
<tr>
<td><strong>Percent observations</strong></td>
<td><a href="#">Data</a></td>
<td><a href="#">Data</a></td>
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Experimental Design:

Results
- CamPod: Crab abundance: Negative acute effect, No cumulative effect
- Crab Pots: Crab abundance & size: No impact effect
- Acoustic Tags:

![Diagram showing experimental design results]

A. H0: ACCEPTED
   No impact

B. H0: REJECTED
   Neg. Acute effect
   Neg. Cum. effect

C. H0: REJECTED
   Neg. Acute effect
   No Cum. effect

D. H0: REJECTED
   Pos. impact
Acoustic Node Array

![Tagged Crabs](image)

**TAGGED CRABS**

- **RECEIVER**
- **CamPod String**
- **300 m**

**RECEPTION RANGE**

**CONTROL**

**IMPACT**

- **TAGGED CRABS**
- **300 m**
- **CamPod String**
- **RECEPTION RANGE**

**IMPACT**

- **RECEIVER**
- **RECEPTION RANGE**
- **PLOT BOUNDARY**
Movement of tagged crabs
Movement results

![Bar charts showing Mean Distance and Mean Velocity for different treatments: TAG RELEASE IV, TAG RELEASE V, and TAG RELEASE VI. The charts display the mean values with standard errors (se).]
Crab survival
**Experimental Design:**

**Results**
- CamPod: Crab abundance: Negative acute effect, No cumulative effect
- Crab Pots: Crab abundance: No impact effect
- Acoustic Tags: Negative acute effect, No cumulative effect?

![Experimental Design Diagram](image-url)
Measurement metrics

- 0.01 m/s
- 0.1 m/s = 360 m/h = 8.6 km/d
- 0.14 m/s
- 623 m / 119 min = 0.06 m/s
<table>
<thead>
<tr>
<th>Crab</th>
<th>ADV</th>
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<tbody>
<tr>
<td>crab ID</td>
<td>Velocity</td>
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<tr>
<td>111</td>
<td>0.06</td>
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<tr>
<td>119a</td>
<td>0.07</td>
</tr>
<tr>
<td>119b</td>
<td>0.03</td>
</tr>
<tr>
<td>140</td>
<td>0.06</td>
</tr>
</tbody>
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Summary of CamPod, crab pot, and acoustic data:

- Conducted Control-impact experiments to investigate sediment deposition on crab.
- No differences in mean abundance or size from crab pot surveys.
- Both video and acoustic techniques show there are acute effects.
- CamPods: no burial, and crabs return within ~ 1/2 hour.
- Acoustic data reveal that crabs are highly motile and exhibit directed motions. Acute survival appears high and limited data indicates survival for weeks to months after tagging.
- Primary unknown is the cumulative effects of Deposition. Plan to test with a larger acoustic array.
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• CRCFA
• Oregon Dungeness Crab Commission
• LCSG

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Chris Jacoben
Drony Joe” Aga
Michael Wilkin & MERTS/CMO
More videos on YouTube at “fish00head”