Temperature and pH effects on feeding and growth of Antarctic krill

Grace Saba1, Abigail Bockus2, Ryan Fantasia1, Caroline Shaw3, Monisha Sugla1, and Brad Seibel3

1Rutgers University  2University of Rhode Island  3University of South Florida

OVERVIEW

The West Antarctic Peninsula (WAP) has undergone profound warming in the past decades.

In addition to rapid warming, there are predictions that by the end of this century the Southern Ocean will be the first region to be affected by seawater chemistry changes (i.e., reduced pH) associated with enhanced CO2.

Antarctic krill, specifically Euphausia superba, are a key species in the food web at WAP. Thus, it is important to understand how these organisms will function in the future warmer, acidic ocean.

APPROACH

We conducted perturbation experiments to determine potential changes in feeding rates and growth of juvenile Euphausia superba (> 30 mm) due to decreased pH and elevated temperature. Target pH was reached in the experiments via CO2 bubbling of seawater flowing through gas equilibration columns.

FEEDING RATES

- Feeding rates of juvenile krill were affected by pH when acclimated to experimental treatments for only a short time (48 hours; Exp 1).
- After exposure to treatments for 21 days (Exp 2), feeding rates were generally lower, and significantly lower only in the low pH/high temperature treatment.

GROWTH INCREMENT

- Growth increment (GI) was lower with decreased pH at the first molt.

Second Growth Experiment

<table>
<thead>
<tr>
<th>Mean GI (%)</th>
<th>Treatment</th>
<th>First molt</th>
<th>Second molt</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°C, 8.0 pH</td>
<td>-1.2</td>
<td>-3.0</td>
<td></td>
</tr>
<tr>
<td>0°C, 7.5 pH</td>
<td>-0.8</td>
<td>-1.8</td>
<td></td>
</tr>
<tr>
<td>0°C, 7.1 pH</td>
<td>-0.4</td>
<td>-1.1</td>
<td></td>
</tr>
<tr>
<td>3°C, 8.0 pH</td>
<td>-1.7</td>
<td>-3.0</td>
<td></td>
</tr>
<tr>
<td>3°C, 7.5 pH</td>
<td>-1.2</td>
<td>-3.6</td>
<td></td>
</tr>
<tr>
<td>3°C, 7.1 pH</td>
<td>-0.8</td>
<td>-8.4</td>
<td></td>
</tr>
</tbody>
</table>

INTERMOLT PERIOD

- There was significantly less time between molts in the high temperature treatments (16.9 compared to 22.8 days).
- pH did not significantly impact intermolt period.

SUMMARY AND FUTURE RESEARCH NEEDS

Food supply likely plays a large role on how krill respond to environmental stressors (i.e., metabolic suppression vs. enhanced metabolism). Low food concentration is an added stressor, while high food availability may aid Antarctic krill in acclimating to changes in temperature and pH. We would benefit greatly from determining threshold food concentrations in future studies.

High variability in experiments and individual krill response leaves an open design to maximize sample size.

REFERENCES