Local Crabs in Hot Water:

Larval Crab Analysis Informing Efforts to Support Sustainable Dungeness Populations in the Pacific Northwest

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Dungeness Crab

- *Metacarcinus magister* (previously *Cancer magister*), decapod crustaceans
- Span the west coast of North America
- Life stages: eggs, larvae (5 zoeae, 1 megalopae), juveniles (including "instars"), adults
- Pelagic until juvenile settlement
- Larval population → adult yield (Shanks and Roegner 2007)

Motivation for Research

- Notable fluctuations in crab catch
- Lack of data on recruitment and early life stages
- Extreme heat event in June 2021 succeeded by a large pulse of megalopae and instars
- Marine heat waves doubling in frequency over the last century

Purpose

Investigate the relationship between climate change and early-stage Dungeness crab to help determine what effects, if any, more frequent extreme heat events may have on the health of Dungeness crab early life stages.

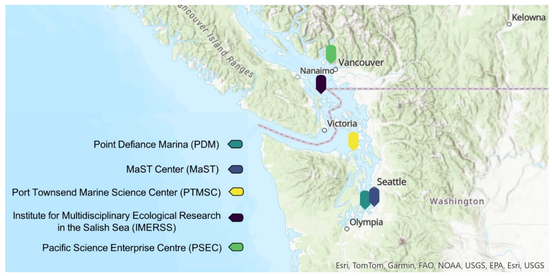

Figure 1. Map of the Salish Sea, each flag represents a study site. Sites north to south are PSEC in West Vancouver, BC, IMERSS in Galiano Island, BC, PTMSC in Port Townsend, WA, MaST in Des Moines, WA, and PDM in Tacoma, WA.

Sample Collection

- Light traps were deployed overnight to attract crab larvae using light activated by a timer set for sunset to sunrise
- Traps were monitored 4 mornings per week
- Temperature data was recorded by proximal loggers
- Megalopae (n=50) from five PCRG sites were preserved in the field with 100% ethanol

Size Analysis

- Each specimen was imaged under a microscope with an ocular scale bar using a phone camera. A ruler was placed on the stage to calibrate the ocular scale bar
- The calibrated scale bar was used to set size in mm for image processing
- Image-j was used to measure three parameters: carapace width (fig 2), carapace height (fig 3), total height (fig 4)

Carapace Width

Figure 2. Megalopa carapace width measured with Image-J line tool.

Carapace Height

Figure 3. Megalopa carapace height measured with Image-J line tool.

Total Height

Figure 4. Megalopa total height measured with Image-J line tool.

Results of This Study

- Significant relationship between total height and temperature
- Significant relationship between temperature and site
- No significant relationship when differences between site are accounted for

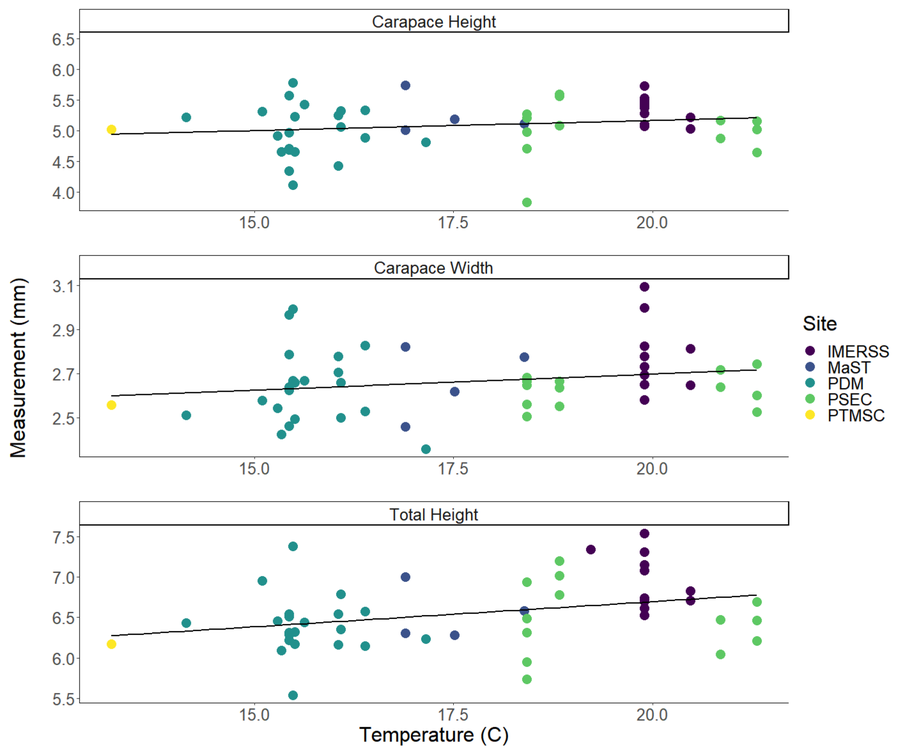

Figure 5. R-generated graphs display measurements for carapace height, width, and total height for megalopae related to maximum temperature logged the day prior. The black line demonstrates the linear regression for each model. Specimens were collected at five Salish Sea locations, marked on Fig. 1.

Measurement Type	Regression P-value	Adjusted R^2	Df	Mixed Effects P-value
Total Height	0.0226	0.08496	48	0.5327
Carapace Height	0.208	0.01268	48	0.658
Carapace Width	0.133	0.02652	48	0.443

Table 1. Linear regression analysis displays significant differences for total height of megalopae, however, ANOVA mixed effects modeling including site variation contradicts these results.

PCRG's Goals

- Support sustainable Dungeness populations
- Gather information on life history traits
- Determine population variation over time and across space
- Understand larval response to environmental changes

Conclusions & Considerations

- Larval total height differs significantly between locations
- Site-related differences coincide with variation in temperature, with greater total height where temperatures were higher
- Megalopae age, cumulative environmental history, and other possible mechanisms for site-related variation have not been ruled out

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