Examining Zooplankton Population Variance in Response to Heat Waves in The Southern Salish Sea

Natasha Walker | Francesca Marvin | Bonnie Becker
Environmental Science | University of Washington Tacoma

Background

Figure 1. Shows the plankton light trap in the ocean attached to the Point Defiance marina dock.

As climate change is causing more frequent and intense heat waves in the Pacific Northwest and globally, the need for research on how it is affecting marine animals like zooplankton becomes increasingly important. Zooplankton are extremely crucial in the food chain because they provide energy by consuming primary production and serve as prey for a lot of marine life such as fish, brids, and mammals.

Introduction

Figure 2. Amphipod

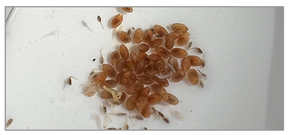

Figure 3. Ostacods and Cumacean

This study monitors the population of zooplankton, specifically amphipods, ostracods, and cumaceans in the Southern Salish Sea. This study is also a part of the PCRG that targets Dungeness crab larvae, but bycatch like zooplankton are recorded too.

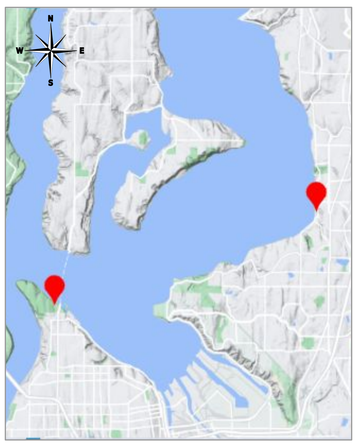

Figure 4. Geographic location of the two sites data was collected from in the southern Salish Sea. The pin to the South is the Point Defiance Marina larval light trap. The site to the North is Highline's Marine Science and Technology (MaST) larval light trap.

Methods

Figure 5. Diagram of the larval light trap made by UWT Becker Lab member Prasis Pandey.

- A trap is deployed that has a light timer which is set to turn on at sunset and turn off at sunrise. Marine organisms go into the trap via phototaxis (when an organism moves towards a light source)
- The traps are checked four days a week. Numbers of marine life caught in light traps are estimated and recorded on a data sheet.
- The organisms caught in traps are examined in a white bin with enough ocean water and a bubbler that supplies oxygen.
- After recording the data, the light trap is redeployed and attached to the dock.
- Sample data used and compared from the Pacific Northwest Crab Research Group (PCRG) light traps at Point Defiance and MaST Center.

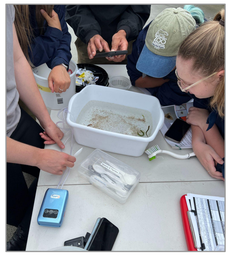

Figure 6. Volunteers looking at a sample.

Figure 7. A sample during a heat wave with heavy abundance of amphipods.

Figure 8. Volunteers assembling the trap.

Results

- Zooplankton population increasing during heat waves at both Pt. Defiance and MaST Center site.
- Figure 9 and 10 show lower numbers of zooplankton before a heat wave hits on 7/25/22.
- The Pt. Defiance site in figure 9 shows a large increase in amphipods at over 1000 during the 7/25/22 to 8/1/22 heat wave.
- The MaST Center site in figure 10 shows the highest number of amphipods at 1541.25 during the 7/25/22 to 8/1/22 heat wave.
- Figure 9 Pt. Defiance site shows more heat wave data on 8/8/22 with no increase of amphipods, instead over 1000 ostracods and cumaceans.
- Figure 10 shows at MaST Center site there are a couple random spikes of cumaceans on 6/11/22 with 400 and 7/6/22 with 429.8 for unknown reasons.
- Differences between figure 9 Pt. Defiance and figure 10 MaST Center site estimated numbers of zooplankton could be due to implications of the trap, such as the light not turning on or other organisms consuming the sample.

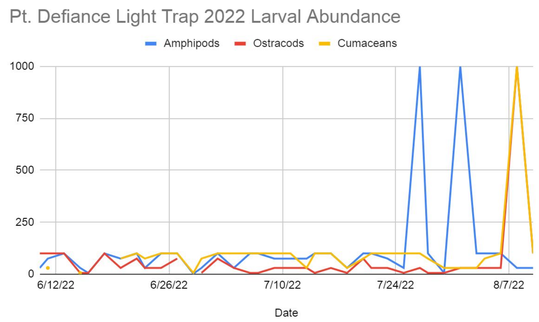

Figure 9. A increase of zooplankton during a heat wave from 7/25/22 to 8/1/22 and 8/6/22 to 8/10/22 at the Pt. Defiance site.

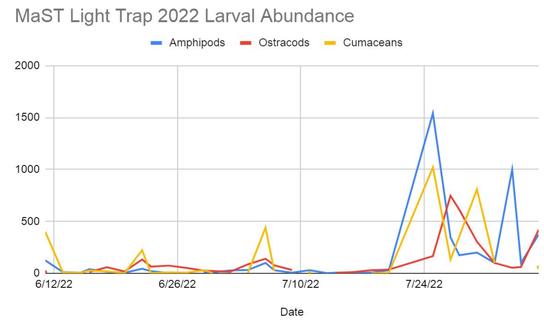

Figure 10. A increase of zooplankton during a heat wave from 7/25/22 to 8/1/22 at the MaST Center site.

Conclusion

These results show that zooplankton population increases when there is a heat wave. Global warming is what causes the more frequent heat waves. If the trend of zooplankton population increasing during heat waves is constantly occurring, then there could be some potentially damaging effects on primary producers which these zooplankton get their energy from. Zooplankton are primary consumers which means they eat phytoplankton which are primary producers. If there is too much zooplankton, then they will eat too much of the phytoplankton. This would cause a bottom-up trophic cascade, shifting the balance in the trophic level pyramid of biomass. A small organisms such as amphipods, ostracods, or cumaceans can cause so much destruction in the trophic pyramid if their populations increases out of control. Future research can be done to investigate further on how global warming is affecting our oceans primary consumers and if the increase of zooplankton during heat waves is causing a bottom-up trophic cascade.

Acknowledgements

A special thank you to our partners at PCRG, the Becker Lab, Science and Math Institute (SAMI), and the Point Defiance Zoo and Aquarium for helping and supporting us. Another thank you to Francesca Marvin for helping design this poster.

References

Suryan RM, Arimitsu ML, Coletti HA, Hopcroft RR, Lindeberg MR, Barbeaux SJ, Batten SD, Burt WJ, Bishop MA, Bodkin JL, et al. 2021. Ecosystem response persists after a prolonged marine heatwave. Scientific Reports. 11(1). doi:10.1038/s41598-021-83818-5.
Shanks AL, Roegner GC. 2007. Recruitment limitation in Dungeness crab populations is driven by variation in atmospheric forcing. Ecology. 88(7):1726-37. doi:10.1890/06-1003.1.