NORTHWEST CLIMATE ADAPTATION SCIENCE CENTER

Mobilizing to Beat the Heat with the Shellfish Rapid Response Network

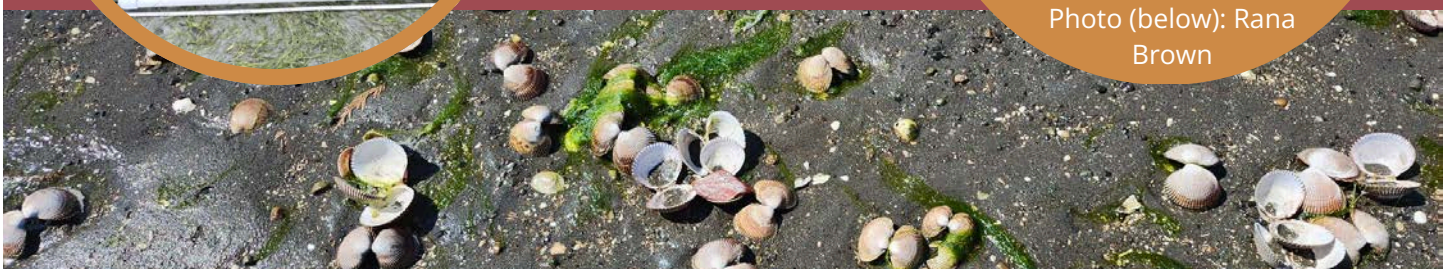
A case study from the 2025 Deep Dive on Managing the Ecological Impacts of Extreme Heat in the Northwest

As a heat wave shattered record temperatures across the Pacific Northwest during the summer of 2021, shellfish managers and researchers faced a dilemma. They needed to assess the impacts and protect the species they manage like clams, oysters and mussels, but they were not prepared to respond to these unprecedented conditions, especially when efforts to respond could threaten their own health and safety.

Returning to the field as the heat wave dissipated, they witnessed mass shellfish mortalities, but their trained eyes also picked up on patterns of survival. Some species that live deeper within the sediment were less impacted, but so were other species in shaded areas, areas with freshwater runoff or regions where low tides occurred during times of the day when the heat was less intense.

Vinnie Cayou, an on-call fisheries technician with the Swinomish Indian Tribal Community, surveys cockle mortality following the 2021 Northwest heat wave. Shellfish managers and researchers witnessed mass mortalities following this extreme heat event. Photo: Julie Barber

Extreme heat conditions can kill cockles, like this one, causing them to gape open. Many Northwest beaches were littered with dead clams following the 2021 heat wave (pictured below).
Photo (above): Julie Barber
Photo (below): Rana Brown



Members of the Washington shellfish management community realized they could greatly enhance their ability to understand the impacts of the 2021 PNW heat wave and respond to future events if they could consolidate their collective knowledge and use it to inform and drive coordinated action. Their efforts to do so provide an illustrative Northwest example of leveraging knowledge to better prepare for future climate risks like extreme heat events.

Forming a Network to Assess Impacts

In the wake of the event, Julie Barber, Senior Shellfish Biologist with the Swinomish Indian Tribal Community ("Swinomish"), began reaching out to colleagues to compare her observations with theirs. Realizing that there was a need to more systematically and quantitatively document impacts in shellfish communities throughout the region, she built a contact list with the help of existing networks throughout the Salish Sea. These initial conversations eventually became a collaboration with Dr. Wendel Raymond who subsequently led the effort that resulted in **two peer-reviewed papers documenting the observed impacts of the 2021 PNW heat wave on shellfish.**

The **first paper**, published in the journal *Ecology* (Raymond et al. 2022), offered a **broad spatial assessment of heat wave impacts** and their variability across the 108 locations and 203 observations collected through a survey. While informative as a general first step, these observations were self-reported impacts describing the current state of the species compared to normal on a 1–5 scale. There was a need to develop a more robust assessment to understand the impacts in greater detail.

Based on interactions with the network, eight organizations stepped forward to contribute data that could provide a comparative picture of pre- and post-event population numbers covering 20 sites and 10 species. However, the **second paper**, published in *Frontiers in Marine Science* (Raymond et al. 2024), found that there were **limits to opportunistically using data collected before the heat wave**. Methods used to track the health of populations over time weren't well-suited to identify the heat wave's variable impacts.

Photo: Julie Barber

The network needed to develop and implement new population survey protocols before it could understand and respond to stressors like the 2021 PNW heat wave. In December 2022, Liz Tobin and Annie Raymond with the Jamestown S'Klallam Tribe, Wendel Raymond (then a postdoc at the University of Washington) and Julie Barber from Swinomish, hosted a workshop to discuss the draft results of their analysis with the shellfish community and steps forward. Those in the community recognized the need for more substantial coordination, leading to the formation of the Shellfish Rapid Response Network.

Managing the Network to Better Understand and Respond

For the past two years, the Shellfish Rapid Response Network has grown more organized and formal in its efforts to promote coordinated action to better understand and respond to events like the 2021 PNW heat wave. It is currently headed by Julieta Martinelli, Olympia Oyster Program Lead with Washington Department of Fish and Wildlife (WDFW); Rana Brown, Shellfish Biologist with Squaxin Island Tribe, and Ashleigh Epps, Aquaculture Specialist with Washington Sea Grant. This structure has provided the network with dedicated leadership committed to listening to and meeting the networks' needs, such as creating a standardized monitoring protocol for resource managers to use throughout Washington state. They also manage a Slack channel and email list to support communications and activities about shellfish mortalities related to climate-induced impacts.

The three network leads also meet once or twice a month to coordinate their efforts and develop plans for survey protocols and strategies to address data needs and support information sharing throughout the network. They regularly solicit feedback on drafts from those throughout the network. The leads also continually share information with the shellfish industry at two annual shellfish conferences, where they present updates and receive input from community members throughout the region.

The Shellfish Rapid Response Network promotes **coordinated action** to better understand and respond to extreme heat events.

Thus far, these efforts have produced a WA Sea Grant Rapid Response hosted **webpage and reporting tool**, a WDFW **shellfish mortality reporting tool** and soon-to-be presented Rapid Response Guidance document.

Insights for Building Similar Networks

LEVERAGE EXISTING NETWORKS.

The Shellfish Rapid Response Network has built on substantial existing relationships around the Puget Sound. So far, their efforts have focused on this region due to the importance of these networks.

IDENTIFY NEW OPPORTUNITIES FOR BUY-IN.

The effects of the 2021 PNW heat wave spurred the shellfish community to recognize the importance of collecting standardized data and further collective efforts.

FIND OPPORTUNITIES FOR IN-PERSON INTERACTION.

Consistently engaging with people at existing conferences has helped maintain motivation and sustained interest.

DEMONSTRATE RESPONSIVENESS TO INPUT.

Consistent meetings means the leads can demonstrate that the activities of the network are iteratively responding to feedback.

ENCOURAGE COLLECTIVE INTERESTS WHILE RESPECTING PRIVATE ONES.

Everyone is allowed to use data made available to the network as a public resource, which supports the perception of the network as a collective good. However, there is no expectation that many participants, such as Tribes or private businesses, share sensitive data.

EMBRACE CHALLENGES AND OPPORTUNITIES.

When the network realized previous population survey protocols were insufficient, they mobilized to meet the need. Participants have since raised other climate risks like freeze events, and the network leads are exploring ways of leveraging the network to address those concerns as well.

BE IN IT FOR THE LONG HAUL.

Consistent support and the commitment of resources from Tribes, Washington Department of Fish and Wildlife and Washington Sea Grant have encouraged participants to believe that their efforts today will pay off long-term.

NW CASC would like to thank Julie Barber, Rana Brown, Ashleigh Epps and Julieta Martinelli for reviewing working drafts of this case study and providing insight and resources during its development.

NORTHWEST Climate Adaptation Science Center

CLIMATE IMPACTS GROUP

References

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