AQUACULTURE AND CLIMATE CHANGE:

Salinity

Gulf of Maine Research Institute

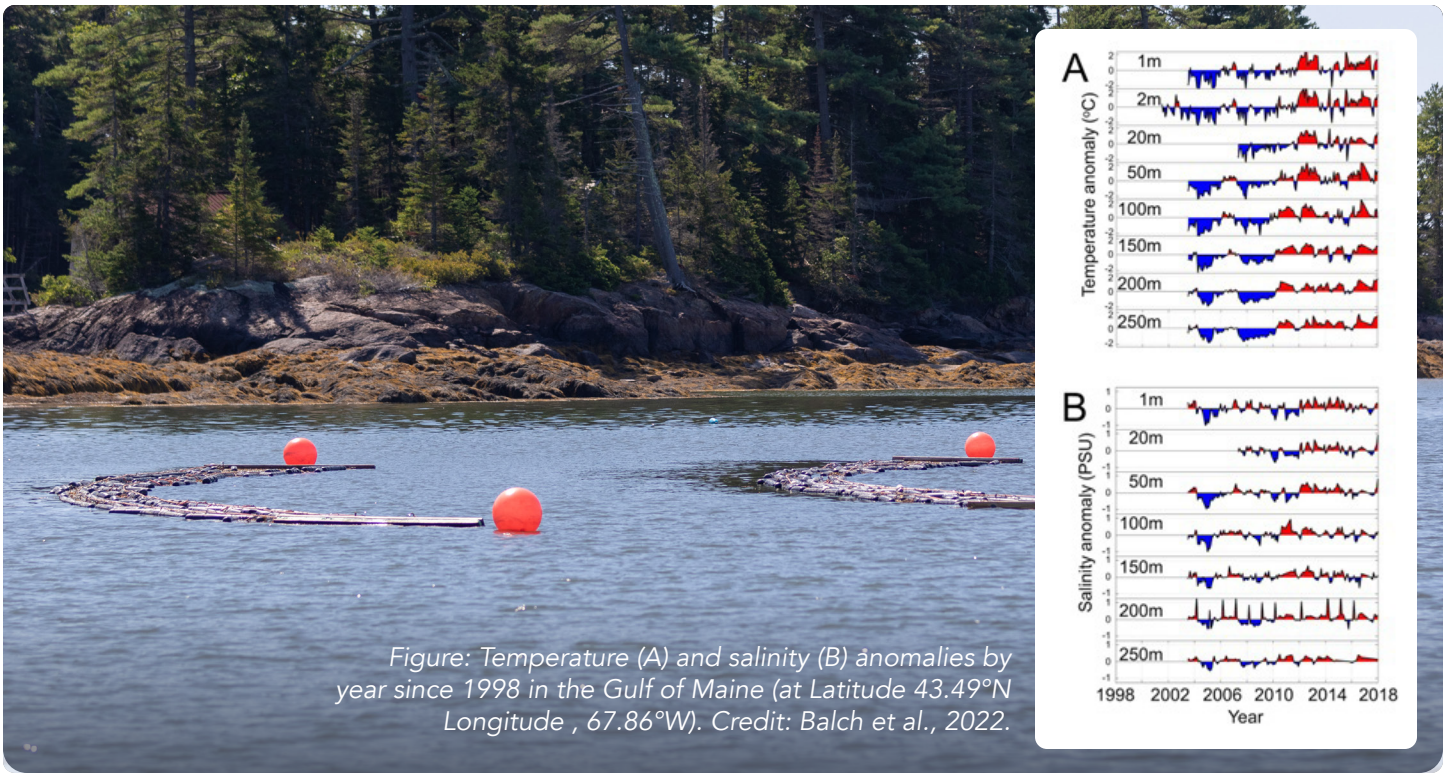

Figure: Temperature (A) and salinity (B) anomalies by year since 1998 in the Gulf of Maine (at Latitude 43.49°N Longitude , 67.86°W). Credit: Balch et al., 2022.

Overview

Salinity refers to the salt content of water and is affected by many factors, including runoff from freshwater sourc¬es, precipitation amounts, evaporation rates, and mixing of ocean and ground water sources. As climate change progresses, each of these factors is expected to change on a regional level, making the prediction of salinity in any given place difficult. In coastal regions, rising sea levels can impact fresh water supplies, increasing the salinity of potable water sources and putting stress on drinking water infrastructure due to the increased corrosiveness of saline water. Variations in the salinity of near shore waters can also contribute to an environment of stress for farmed species and can also impact the "merroir" – the specific flavor imparted from growing seafood in a particular location.

Common Impacts

- **Causes:** Increasing precipitation leads to influxes of fresh water into coastal ecosystems from run-off. This influx of fresh water creates variable swings in the salinity and chemical makeup of coastal waters.

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(Common impacts continued)

- **Health Impacts:** Variability in salinity levels can stress shellfish species as they are adapted to exist within a specific salinity range. While salinity levels outside of that range won't immediately kill shellfish, it can increase their energy expenditure, susceptibility to bacterial infections, and is linked to higher mortality rates.
- **Growth and Marketability:** Marine organisms regulate their internal salinity levels for optimal biological function. If external salinity is too variable, organisms need to expend energy to regulate their internal levels. This energy expenditure can affect their ability to grow and survive. While this is most impactful in juvenile shellfish, it can also impact growth rate and the merroir of marketable shellfish, potentially prolonging the time to market and quality of aquaculture products.

Risk Mitigation Strategies

- **Monitoring and modeling:** Buoy monitoring systems can help track freshwater inputs and salinity shifts in estuaries and nearshore farms, allowing farmers to manage to protect shellfish in vulnerable stages of their lifecycle.
- **Species selection:** Select and grow species or strains with broader salinity tolerance ranges, or shift farming operations to areas with more stable salinity profiles. Deeper waters tend to have more stable salinity fluctuations, but come with operational complexities.
- **Adaptive site planning:** If species are bred to tolerate wider salinity ranges, the impacts of sea level rise may open new areas for coastal farm sites that are less impactful to heritage fisheries.

Solutions in Progress

As with most climate impacts, juvenile shellfish are most susceptible, leading farmers to find it difficult to collect wild spat (juvenile shellfish). This has led some farmers, such as **Mook Sea Farm**, to start their own hatchery. This beneficial arrangement ensures their access to shellfish, decreases the pressure on wild shellfish populations, and provides a benefit to local farmers, who would otherwise have to buy seed shellfish from out of state.

These resource sheets were created in collaboration with the USDA Northeast Climate Hub to improve understanding of the likely impacts of climate change on the region's aquaculture industry. If you have questions, or would like to learn more, you can reach out to jwildwistle@gmri.org, cmaurin@gmri.org, or scan the QR Code to see a list of resources used in the creation of these materials.