AQUACULTURE AND CLIMATE CHANGE:

Harmful Algal Blooms (HABs)

Gulf of Maine Research Institute

Overview

While algae is always present in the ocean environment, Harmful Algal Blooms (HABs) refer to the unrestrained growth of algal colonies, putting stress on wild and cultured marine species. A key climate-related driver to the increased risk for HABs is the increased occurrence of heavy rainfall events, causing nutrient run-off into coastal waters. Algae use nutrients, like phosphorus and nitrogen, to grow and reproduce. If the nutrients are present in excess amounts, they can cause an algal bloom. In addition, warmer waters exacerbate algal growth and create a habitable zone for non-native algae. While all aquaculture species can be impacted, HABs are particularly dangerous for juvenile fish and shellfish.

Common Impacts

- **Hypoxia:** HABs can reduce the available oxygen in the water, leading to poor growth and even death of other marine life.
- **Toxins:** HABs can produce toxins that can be lethal to aquacultured species and can cause sickness in humans. Warmer waters have been associated with higher production rates of these toxins. Juvenile shellfish are most susceptible to these toxins which can impact industries that rely on wild-capture practices to seed their farm.

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- **Product Quality:** EEven when not directly lethal, HABs can contribute to an environment of stress, leading to higher mortality, reduced growth rates, and harvesting closures, putting financial and operational pressure on aquaculture farms.
- **Environment and Economic Impact:** Due to warming waters, the season in which HABs are possible has grown by approximately 3 weeks over the past few decades. While each HAB is different, they can cause tens of millions of dollars in lost revenue and product losses.

Risk Mitigation Strategies

- **Monitoring:** Expand monitoring of harmful algae near farm sites. Companies have started to produce in-water sensors that can alert farmers of the early warning signs of HABs.
- **Process and Infrastructure:** Adopt strict harvest protocols to keep product cold from harvest to the end destination. This often involves having infrastructure in place, such as ice machines and refrigerated trucks.
- **Breeding programs:** Invest in developing species with improved resistance to pathogens, pests, and warmer waters. Decreasing the impacts of these stressors can lead shellfish that are more resistant to other environmental stressors.

Solutions in Progress

Companies, like **Marine Solar Technologies**, are leading the way in developing buoys that can monitor water conditions. Understanding water temperatures and indicators of nutrients and chemical markers in real-time can help provide an early warning system for aquaculture farmers. Other organizations, such as the **Downeast Institute**, are focusing on developing a market for local hatcheries to reduce the risk of operations that rely on capturing wild shellfish seed.

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.