USDA Northeast Climate Hub
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THE UNIVERSITY OF MAINE

GRADUATE STUDENT CLIMATE ADAPTATION PARTNERS (GRADCAP) WEBINAR SERIES

GREEN ALTERNATIVES TO WAVE ATTENUATION IN A CHANGING CLIMATE

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Suspended kelp aquaculture farms have the potential to be a resilient shoreline protection measure in a changing climate due to their capacity to dampen ocean wave energy in storms even with water level changes from tides, surge, and sea level rise.

The effects of climate change on ocean environment and ecosystems include increasing frequency of storms, sea level rise, ocean warming, ocean acidification and habitat loss. Kelp aquaculture farms have potential to mitigate and adapt to climate change by reducing CO_2 concentration, providing oxygen-rich habitats and damping wave energy. The objective of this work is to quantify the capacity of suspended kelp aquaculture farms to attenuate wave energy. A common kelp aquaculture farm is a longline system including longlines, culture lines, mooring lines, and anchors. The kelp grows from the culture lines, which are attached to the longlines. The mature kelp blades can reach up to 4 meters long (about 13 feet). A theoretical method based on energy conservation was used to calculate wave energy loss through model kelp aquaculture farms. The results showed that the modeled kelp aquaculture farms with 125 longlines in Saco Bay, Maine could have reduced 11% to 31% of wave energy during the Patriot's Day storm in 2007, which caused $264 million in damages (Colgan et al., 2016). This reduction in wave energy could be increased to 21% to 50% for larger kelp aquaculture farms with 250 longlines. As suspended structures, kelp aquaculture farms stay in the upper part of the water column, which is where the most wave energy concentrates. Thus, wave damping by suspended kelp aquaculture farms is less affected by water level changes such as tides, surge, and sea level rise. This analysis suggests that kelp farms may be a resilient shoreline protection measure in a changing climate.

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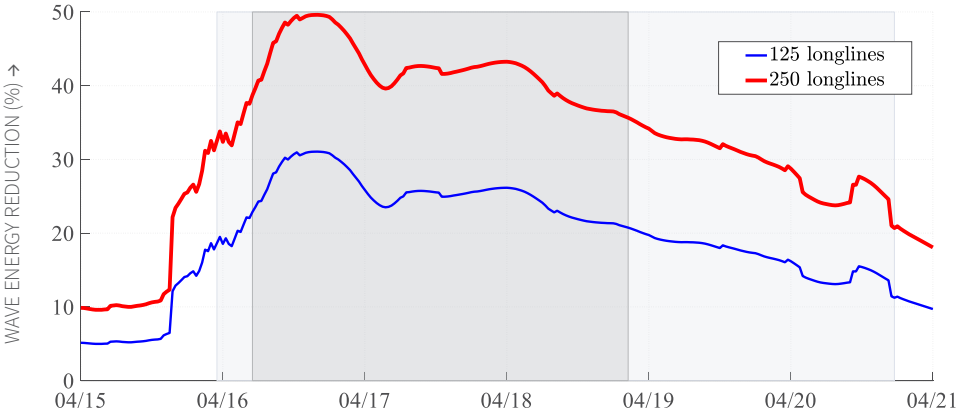

FIGURE 1.

Wave energy reduction by model kelp aquaculture farms at Saco Bay, Maine in the Patriot's Day storm of 2007. The light and dark shaded regions indicate the significant wave height greater than 1 m and 2 m, respectively.

Colgan, Charles S.; Kartez, Jack D.; and Sheils, Martha P., "Climate Adaptation and Resiliency Planning for New England Communities: First Steps and Next Steps" (2016). Climate Change. 7.
Photo: 2-3 meter swells on Maine coast from what remained of Hurricane Jose in 2017 by Paul VanDerWerf |