

Harnessing Environmental DNA to Assess the Environmental Sustainability of Commercial Shellfish Aquaculture in the Pacific Northwest United States

Authors : James Kralj

Abstract : Commercial shellfish aquaculture makes significant contributions to the economy and culture of the Pacific Northwest United States. The industry faces intense pressure to minimize environmental impacts as a result of Federal policies like the Magnuson-Stevens Fisheries Conservation and Management Act and the Endangered Species Act. These policies demand the protection of essential fish habitat and declare several salmon species as endangered. Consequently, numerous projects related to the protection and rehabilitation of eelgrass beds, a crucial ecosystem for countless fish species, have been proposed at both state and federal levels. Both eelgrass beds and commercial shellfish farms occupy the same physical space, and therefore understanding the effects of shellfish aquaculture on eelgrass ecosystems has become a top ecological and economic priority of both government and industry. This study evaluates the organismal communities that eelgrass and oyster aquaculture habitats support. Water samples were collected from Willapa Bay, Washington; Tillamook Bay, Oregon; Humboldt Bay, California; and Samsish Bay, Washington to compare species diversity in eelgrass beds, oyster aquaculture plots, and boundary edges between these two habitats. Diversity was assessed using a novel technique: environmental DNA (eDNA). All organisms constantly shed small pieces of DNA into their surrounding environment through the loss of skin, hair, tissues, and waste. In the marine environment, this DNA becomes suspended in the water column allowing it to be easily collected. Once extracted and sequenced, this eDNA can be used to paint a picture of all the organisms that live in a particular habitat making it a powerful technology for environmental monitoring. Industry professionals and government officials should consider these findings to better inform future policies regulating eelgrass beds and oyster aquaculture. Furthermore, the information collected in this study may be used to improve the environmental sustainability of commercial shellfish aquaculture while simultaneously enhancing its growth and profitability in the face of ever-changing political and ecological landscapes.

Keywords : aquaculture, environmental DNA, shellfish, sustainability

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