

RESEARCH ARTICLE

# A global spatial analysis reveals where marine aquaculture can benefit nature and people

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## Abstract

Aquaculture of bivalve shellfish and seaweed represents a global opportunity to simultaneously advance coastal ecosystem recovery and provide substantive benefits to humanity. To identify marine ecoregions with the greatest potential for development of shellfish and seaweed aquaculture to meet this opportunity, we conducted a global spatial analysis using key environmental (e.g., nutrient pollution status), socioeconomic (e.g., governance quality), and human health factors (e.g., wastewater treatment prevalence). We identify a substantial opportunity for strategic sector development, with the highest opportunity marine ecoregions for shellfish aquaculture centered on Oceania, North America, and portions of Asia, and the highest opportunity for seaweed aquaculture distributed throughout Europe, Asia, Oceania, and North and South America. This study provides insights into specific areas where governments, international development organizations, and investors should prioritize new efforts to drive changes in public policy, capacity-building, and business planning to realize the ecosystem and societal benefits of shellfish and seaweed aquaculture.

## OPEN ACCESS

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## Introduction

Globally, coastal ecosystems face numerous complex and interconnected anthropogenic threats, such as nutrient pollution, loss of habitats, and the compounding impacts of climate change [1]. These stressors can challenge or change the way in which ecosystems provide vital services, such as nutrient cycling or maintenance of fisheries, to coastal communities. As the global population grows, the demand for resources from coastal ecosystems, including seafood products, is increasing [2,3]. With growing consumption of seafood, plateauing wild fishery harvests, and apparent limits to land-based agriculture, aquaculture is one of the fastest growing forms of food production on the planet [2,4,5]. While aquaculture's rapid rise has in many cases coincided with negative localized impacts on surrounding ecosystems [6], evidence increasingly indicates that aquaculture production of certain species groups, such as bivalve