SHAPING MARICULTURE IN BRAZIL

Establishing and Mapping the Feasibility and Profitability of Offshore Mariculture

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BACKGROUND

Motivation

The world's population is expected to reach 10 billion people by 2050, therefore we need enough protein to meet global demands

Global wild fish stocks may not be able to keep pace with the growing demands for protein

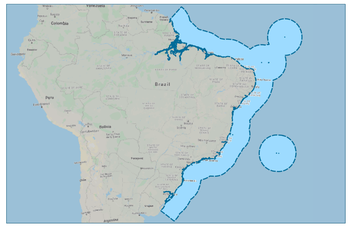
Land-based animal and fish farming are costly and have high environmental impacts

Our solution

After investigating the potential of offshore aquaculture, consider recommending it as a means for meeting global fish demand

Case Study

Assess potential for offshore mariculture in Brazil



Our objectives

Determine feasible sites for offshore mariculture in Brazil

Create a web-based tool for offshore aquaculture spatial planning

APPROACH

Site Suitability Analysis

We identified the location of suitable mariculture parcels. We considered spatial conflicts, infrastructure constraints, and biological constraints.

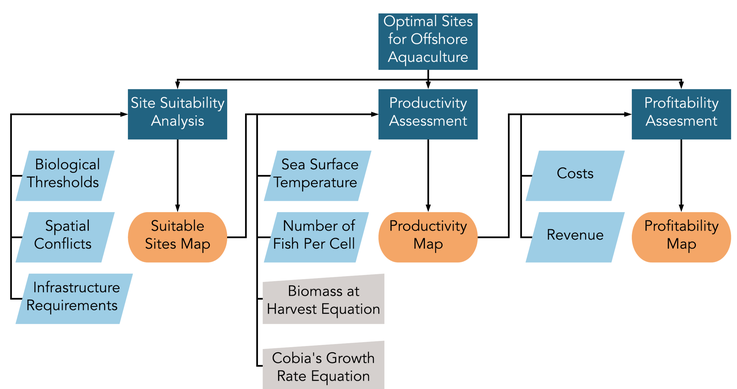
Productivity Analysis

We estimated Cobia's growth rate using a derived linear model. The growth rates for each parcel were then scaled relatively to the optimal growth weight at harvest to estimate biomass.

Economic Suitability Analysis

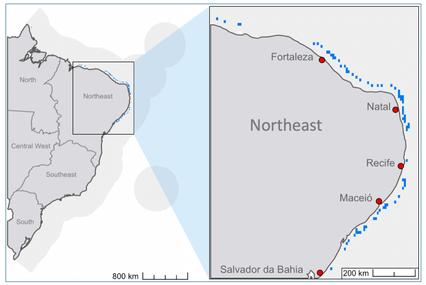
Finally, the Net Present Value (NPV) for each cell was calculated based on identified costs of production and potential revenues.

Cobia (***Rachycentron canadum***) was used as a model species to test our approach



IDENTIFIED FEASIBLE SITES

Majority of suitable sites were in the Northeast



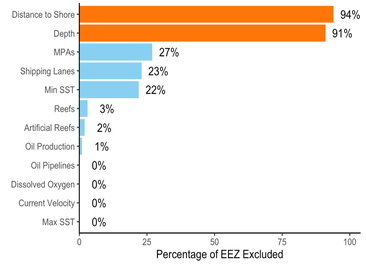
98% Suitable sites located in the Northeast region of Brazil

9,380 km²
Total Suitable Area
Determined by biological thresholds for **cobia:** 22-32 °C & 70.5 mol/m³ DO

Most limiting factors were constraints related to infrastructure

Distance from shore increases fuel usage and overall costs of farm operation

Depth limited placement and anchoring of aquaculture pens



InnovaSea ***Sea Station*** net pens were utilized to determine infrastructural limitations

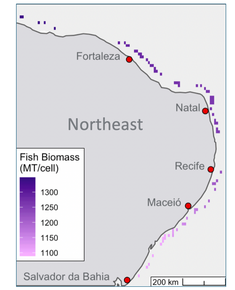

Photo: InnovaSea Systems, Inc

High annual productivity

The most productive cells were in the northern extent of the study area, where sea surface temperatures (SST) are closest to **cobia's optimal growth** temperature (**29°C**). It should be noted that all sites within Brazil's EEZ are within the temperature range of cobia.

94,000 MT
Annual Production
Determined through a temperature-dependent growth model

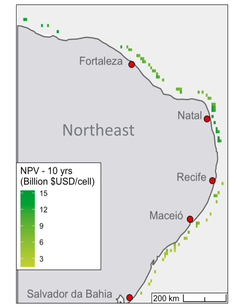
25% Brazil's annual seafood imports



Profitability is possible but variable

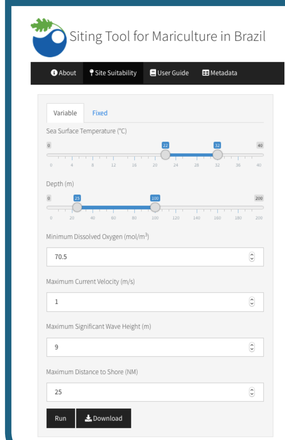
$16.93 Billion USD
Maximum NPV
Determined by charging **$8.60 USD** per kg of **fish** at a cost of **$2.00 USD** per kg of **feed**

Farms that are located closest to shore, within the same **SST** range, presented higher profitability. The further out in the EEZ, the more expensive the operation gets.



It is also important to note that profitability showed extreme sensitivity to **feed price** and cobia **market price**, which can vary greatly between regions.

ADAPTIVE MAPPING TOOL



We built an interactive web application that can guide planning efforts for aquaculture development. First, we defined preset values for the input parameters. Then, we integrated these parameters to our three suitability models (site suitability, productivity, and profitability).

Tool Outputs:
- Estimates the location of suitable sites, their productivity, and profitability.
- Creates downloadable maps
- Calculates total area of suitable cells

Developed with Shiny from R

Visit our project website at: https://maricultura.weebly.com/

Access the tool

IMPLICATIONS FOR MARICULTURE

Estimating the feasibility of aquaculture **decreases major challenges** for its development

- Abundance and location of sites can guide investors
- Estimated production can meet growing seafood demand
- Understanding potential profits minimizes investment risk
- Incentivizes development of local mariculture technology

Our mapping tool can assist with planning strategies to **shape the development** of aquaculture

- A single strategy does not fit all situations
- Can be used to explore the sensitivity of model inputs
- Starting point to build similar tools
- Adaptability for other locations across the world

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