

Environmental Models For Marine Aquaculture Site Selection and Spatial Planning

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BACKGROUND

Declines in ocean fisheries and growing demand for seafood have led to exponential growth in the aquaculture industry worldwide. NOAA is committed to expansion of the U.S. aquaculture industry to increase production of domestic seafood products. Growth of offshore aquaculture has been constrained by concerns about potential environmental effects in the ocean. NOAA is applying modeling and marine spatial planning in an integrated, ecosystem-based approach to sustainable development of marine aquaculture in U.S. coastal waters. This proactive process aims to balance the needs of multiple users of coastal resources with the conservation of critical ecosystem functions and services. Effective marine spatial planning can improve planning and regulatory efficiencies, enhance interagency and intergovernmental collaboration, decrease costs and delays in commercial development, and engage stakeholders in a transparent regulatory process.



APPROACH

- Evaluate and refine the existing aquaculture modeling tools used for siting marine fish farms
- Conduct modeling simulations based on pilot-scale and commercial-scale aquaculture operations in U.S. waters
- Identify thresholds for pollutant effects to avoid local and ecosystem level impacts
- Build strong partnerships between industry stakeholders, researchers, regulatory agencies, and conservation organizations

ENVIRONMENTAL FACTORS TO MODEL

PHYSICAL

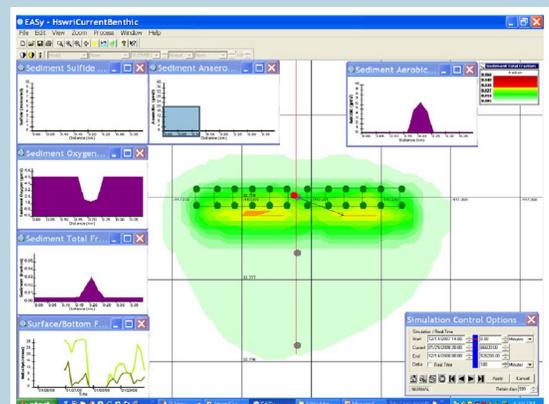
Coastal Topography
Bathymetry
Sediment Type
Hydrology
Weather & Winds
Temperature
Resuspension

CHEMICAL

Dissolved Oxygen
Turbidity
Carbon
Nitrogen
Phosphorus
Organic matter
Sedimentation

BIOLOGICAL

Chlorophyll
Harmful Algal Blooms
Fouling Organisms
Benthic Community
Predators
Pelagic Fish
Protected Species



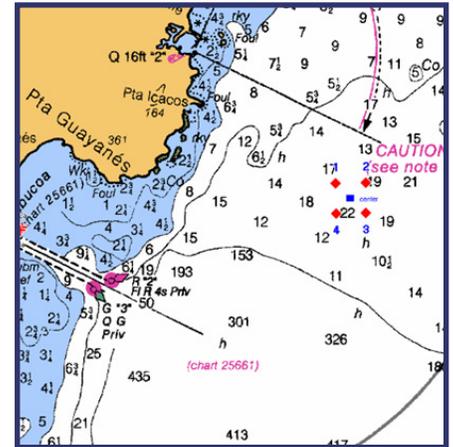
Example of output data from environmental model simulation



Together, the NOS National Centers for Coastal Ocean Science and the NMFS Office of Aquaculture are assessing environmental effects of marine cage culture and developing tools for ecologically sustainable growth of the U.S. marine aquaculture industry.

SITE SELECTION IN THE OPEN OCEAN

Moving fish farms offshore is a technological challenge, but a decade of research and numerous demonstration projects have shown there are environmental benefits of working in the open ocean. Careful selection of sites is the imperative first step to developing an environmentally sustainable offshore aquaculture industry. Detailed site assessments are used to identify biophysical parameters that directly or indirectly affect successful operation of aquaculture cages. Models that predict fish farm nutrient discharge and its environmental effects provide guidance for siting marine aquaculture operations. These models also help evaluate potential risks to our coasts from improperly sited farms.



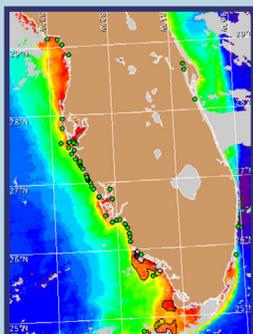
Why Model and Plan?

- Protect and maintain healthy coastal ecosystems while supporting a sustainable domestic aquaculture industry
- Provide science-based information for coastal communities managing demands for ocean resources
- Support commercial innovation, technology development, and job creation
- Create a framework for best management and siting of offshore aquaculture



Resources

- Nationally recognized leaders in aquaculture and development of environmentally sustainable and economically viable production technologies
- Aquaculture facilities include 8,000 ft² of hatcheries, nursery, and growout systems that incorporate recirculating technology to recycle water
- Research programs translate data into specialized decision support tools



Mapping Solutions

Geographical information systems (GIS) and remote sensing are powerful mapping tools to apply to spatial data for promoting effective environmental management. NOAA works with a diverse array of high resolution survey and mapping technologies to examine the interactions between environmental conditions with species and habitats. Models provide real-time, three-dimensional simulation of environmental processes.

