



National Oceanic and Atmospheric Administration (NOAA) Offshore Aquaculture Investments Address Our Nation's Growing Demand for Seafood

NOAA and Department of Commerce (DOC) Aquaculture Policy

In 1997, NOAA and the Department of Commerce developed a NOAA/DOC aquaculture policy that was signed by the Secretary of Commerce in 1999. The vision for U.S. Aquaculture and the DOC Aquaculture Mission and policy can be viewed at:

<http://www.lib.noaa.gov/docaqua/docaquapolicy>



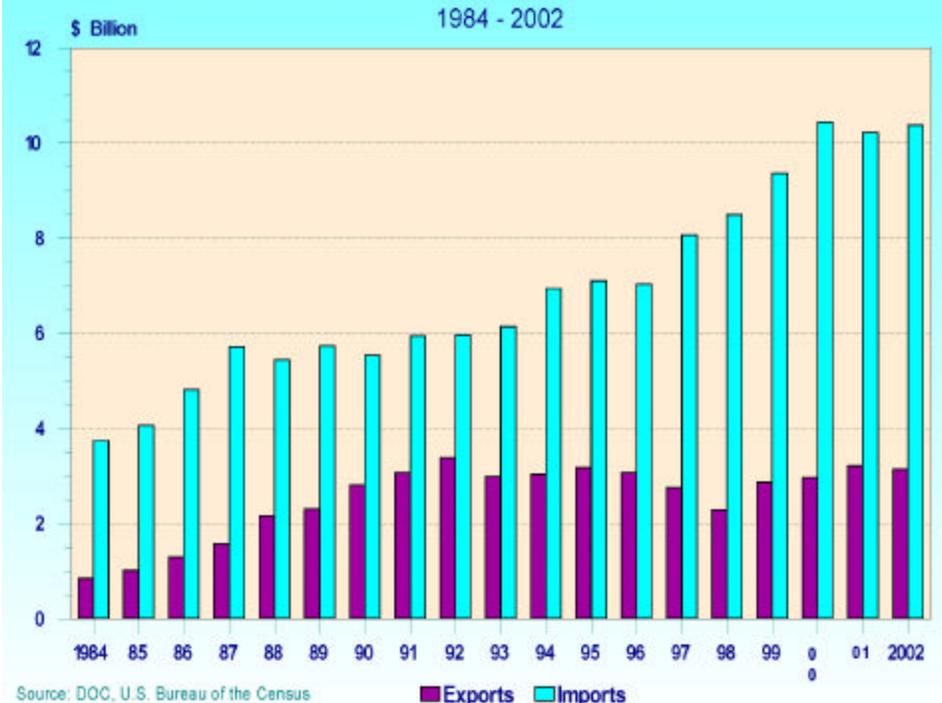
See highlights of marine offshore projects, inside.



Background

The NOAA Marine Aquaculture Initiative is a commitment by NOAA to meet its responsibilities for environmental stewardship and economic development of the nation's living marine resources in the 21st century. Through NOAA's investment in offshore aquaculture, we hope to establish an environmentally sustainable, profitable offshore aquaculture industry in the U.S. and the Caribbean that will alleviate stress on natural fish stocks, create thousands of jobs, provide healthy protein to Americans at a reasonable cost, improve food safety and security, and address our nation's trade deficit.

U.S. EXPORTS AND IMPORTS OF SEAFOOD



MOVING AQUACULTURE OFFSHORE

The Challenges

- The United States currently imports over 60% of its seafood.
- Seafood's \$7 billion trade deficit ranks second to oil among natural products being imported.
- Many valuable fish species are disappearing from the oceans through overharvest, loss of habitat, and pollution.
- Nearshore coastal areas are already heavily compromised by multiple users and activities contributing to poor water quality.
- The U.S. does not have a regulatory framework that allows aquaculture in EEZ waters.
- American consumers demand food products high in Omega-3 fish oils for a healthy diet.

Offshore Aquaculture Offers a Solution

Investing in marine aquaculture provides an assured source of high-quality seafood for the consumer, while offsetting fishing pressure on wild resources. Fish are raised in fully enclosed



cages stationed below the surface of the water in an open ocean area, far from the fragile coastal environment. Recent technological advances through NOAA-funded research are making this an increasingly safe, profitable, and environmentally sustainable production system. In addition, NOAA's offshore projects using indigenous species from unmodified genetic stock insures no introduction of non-native species and reduces genetic impacts on natural stocks.

What Makes Offshore Unique?

- **Submerged cages:** The offshore cage system is submerged 40 to 50 feet below the surface to avoid navigational conflicts and to preserve aesthetic aspects of the area.



- **Improved cage security:** Submerging the cage reduces vandalism, reduces cage damage by surface waves, provides a more benign environment for fish stock, eliminates bird predator issues, and greatly reduces chances of lost stock and equipment.
- **Reduced environmental impacts:** The water depth of the offshore sites (> 100 ft.) and steady currents (between 0.5-1.5 knots) disperse organic and inorganic material widely, resulting in little organic build-up beneath the cages. Nutrient increases are undetectable within 100 meters of cages.
- **High water quality:** NOAA's current commercial-scale studies have shown no observable disease. Therefore, antibiotics are not needed. Additionally, stronger currents offshore keep the fish in physical condition similar to wild stocks.
- **Higher economic return:** The potential scale of offshore aquaculture can result in better economic returns than many existing onshore aquaculture technologies.

Marine aquaculture is widely predicted to be a significant global industry for food production. NOAA hopes to be the leader in an administrative framework that recognizes and treats marine aquaculture as a legitimate activity equal in importance and governance to the nation's capture and recreational fisheries sectors.

HIGHLIGHTS OF CURRENT OFFSHORE RESEARCH PROJECTS

Florida/Puerto Rico Project

Partners: University of Miami, University of Puerto Rico, Aquaculture Center of the Florida Keys, Snapperfarm

Species: Cobia and mutton snapper



- First time that captive mutton snapper and cobia have spawned naturally.
- Extraordinary growth rates for cobia of 8-10 kg (16-20 lb) in one year.
- Snapper reach market size in 8 months.
- Survival rates of both species nearly 100%.
- Market response has been highly positive.
- No discernable nutrient build-up beneath and near cages.
- Juvenile spiny lobster landing and growing on the outside of the cages has resulted in additional DOC SBIR research project (see paragraph below).
- GIS studies for proper siting of offshore aquaculture have been completed.
- Saltonstall-Kennedy funding (NMFS) has been awarded for sociological and marketing analysis.
- *Miami Herald* food critic after cobia taste test said "Extraordinary, the future of food."
- Legal Seafood has completed taste tests of cobia and considers it a premium quality product.



- Cobia juveniles have been sent to other research partners.

Next Steps: Environmental monitoring and analysis will continue. Another interesting prospect is the culture of lobster, *Panulirus argus*,

in the area surrounding the offshore cages. A large number of juvenile lobster are settling on the nets of the cages, providing an opportunity for culture trials. These lobster provide an example of polyculture by using the nutrient from the fish culture for their nutrition. NOAA's Small Business Innovative Research Program (SBIR) has approved a grant for Snapperfarm, Inc. to conduct experimental trials with fish/lobster polyculture underneath the cages in Culebra, Puerto Rico.

If successful, this project will have great impact and bring enormous social and economical benefits to the local community.

Additional Information:

<http://www.rsmas.miami.edu/groups/aquaculture>

<http://www.snapperfarm.com>

<http://www.aquaculturecenter.com>

Hawaii Project

Partners: University of Hawaii, Oceanic Institute, Cates International

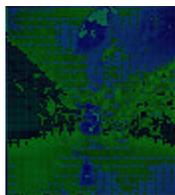
Species: *Moi (Polydactylus sexfilis)*

- First underwater cage system has been deployed in the United States.
- Production trials have resulted in 50 tons of product at market size of one pound in 8 months and production is now at the level of 6 thousand pounds a week.
- Three production cages are now in operation.
 - State of Hawaii passed new legislation to allow offshore leasing.
 - Four to five new commercial applications are pending for offshore leases as the result of this success.
 - New feeding technology using underwater pipe feeder with pump has been developed.
- New harvesting technology using "crowder" net and suction pump has been developed.
- The current level of fish production is having few measurable changes on ambient nutrient levels in the ocean around the cage.
- GIS studies have been completed for Hawaii to locate optimum sites for new farms.
- Two new commercial hatcheries have been started to supply juvenile moi.
- Improved diets have led to better food conversion rates and reduction of nutrient discharges.
- DOC SBIR grants have been awarded to improve automated feeding technologies.
- DOC Advanced Technology Program has funded



HIGHLIGHTS OF CURRENT OFFSHORE RESEARCH PROJECTS

additional studies for hatchery technology improvements and development of other species.



Next Steps: The State of Hawaii, Oceanic Institute and Cates International will conduct a research trial for amberjack, which has great potential for the sashimi market. Automatic feeding technology will be tested. Environmental monitoring and analysis will continue.

Additional Information: For more information http://www.soest.hawaii.edu/SEAGRANT/special_projects.html
<http://www.oceanicinstitute.org/techtransfer/seacage.html>

New Hampshire/New England Project

Partners: University of New Hampshire, Great Bay Aquaculture, Massachusetts Institute of Technology, Woods Hole Oceanographic Institution, Heritage Salmon Ltd., NET Systems Inc., Environmental Technologies, Inc (ETI), E-Paint, Buoy Tech, Cards Aquaculture and more.

Species: Halibut, Cod, Flounder, Haddock, Mussels, Scallops



- First United States cage production of Atlantic halibut, cod, and haddock in an offshore environment.
- First United States commercial hatchery production of flounder, cod, and haddock.
- Testing and establishment of mooring technologies for offshore net pens.
- Establishment of long-line technologies for mussels and scallops.
- Production and market tests of mussels have led to three new industry lease applications.
- Mussels grown in offshore location are a higher quality product with better meat to shell ratio.
- Halibut reach market size of 4 to 5 pounds in two years.
- New hatchery technologies for cod have been developed to assure virus free juveniles.

- Economic and market analyses have shown feasibility for mussel commercial operations.
- Economic and market analyses have shown feasibility for cod and haddock commercial operations.
- DOC SBIR funds have been awarded for related projects on environmentally acceptable net antifouling treatments and large-scale automatic feeders.
- Saltenstall-Kennedy funds have been awarded to test additional cod and haddock culture.



Next Steps: Full commercial scale cod production will be tested. Researchers and extension personnel will work with new lease applicants for mussel culture technology transfer. Hatchery improvements to increase survival of cod and haddock will be studied.

Automatic feeders will be tested. Environmental monitoring and analysis will continue.

Additional Information: For more information please go to:
<http://ooa.unh.edu/>

Net Systems Incorporated/Ocean Spar: Net Pens

Offshore aquaculture depends upon new designs and engineering for offshore conditions. Net Systems, Inc. was selected through a competitive process to work with all of the above projects in deploying submersible nets, developing feeding devices, and developing harvesting equipment. This partnership has resulted in synergistic interactions among all of the above research teams and several student internships. Because of this interactive approach, the company has made innovative changes in engineering designs for offshore net systems.

Additional information on NOAA funded aquaculture research can be found at:
<http://www.lib.noaa.gov/docaqu/frontpage.htm>

