Advances in Sustainable Marine Aquaculture Technology: Candidiate Species Research

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BACKGROUND

The U.S. marine aquaculture industry is poised for significant growth to satisfy demand and improve market competitiveness for domestic, high-quality seafood products. Recent advances in hatchery and growout technology are strengthening this emerging aquaculture industry. Significant progress has been made in ensuring the environmental sustainability of marine aquaculture. Fish can be grown in a variety of production systems including offshore cages or land-based farms utilizing sophisticated filtration systems to recycle water. Best management practices and standardized production methods ensure the safety, quality, and traceability of seafood from egg to market. Growth of a domestic aquaculture industry contributes to the infrastructure of local coastal communities through creation of jobs and support industries for shoreside seafood processing. Scientists with NOAA's Beaufort Laboratory have studied methods for artificial propagation of marine fish to accelerate recovery of depleted stocks and increase production of valuable fishery products. Biologists continue to investigate new candidate species for aquaculture and stock enhancement. Current studies are focused on environmentally sustainable culture of red porgy and vermilion snapper, which, like many snappers and groupers of the Southeast U.S. and Gulf of Mexico, are overfished.

Red porgy
Pagrus pagrus

- Highly prized for its delicate flavor
- Supports recreational and commercial fisheries
- Cultured throughout the Mediterranean
- Caught along reefs and rocky outcrops in 60 – 400 feet of water
- Spawns from January – February

Vermilion snapper
Rhomboplites aurorubens

- Similar to red snapper and other valuable reef fish
- Most frequently caught snapper along the southeastern U.S.
- Limited aquaculture research
- Spawns from April – August
- Matures at 1 – 2 years

ACCOMPLISHMENTS

Refined broodstock collection procedures for reef fish

Established captive vermilion snapper broodstock

Extended spawning season for domesticated red porgy

Determined salinity, ammonia, nitrite tolerances for red porgy

Standardized hatchery methods for larval marine fish

Developed plan to transfer culture technology to industry

WHAT'S NEXT

NOAA scientists have been working to establish year-round spawning methods and advance hatchery techniques for red porgy. Significant progress has been made in development of reliable spawning methods for the mass production of high quality gametes, larvae, and fingerlings. These efforts have resulted in the successful production of domesticated red porgy broodstock. Laboratory studies with larvae and juveniles have focused on growth and feeding efficiencies under varying environmental conditions. Findings suggest that red porgy can be cultured at high densities (30 kg/m^3) and fed commercially available diets. Pilot-scale studies will examine growth, nutrition, ecologically sustainable culture and economic viabilityusing state-of-the-art recirculating aquaculture systems.

Vermilion snapper is currently being evaluated as a new candidate species for aquaculture. Wild-caught broodstock are being conditioned to spawn in the laboratory. Fecundity, gamete quality, fertilization, and hatching success will be monitored. Larval rearing experiments will be used with digital microscopy and image analysis to document the early life history of this snapper species. Larvae will be cultured through metamorphosis using protocols developed for red porgy and other marine fish species cultured at the Beaufort Laboratory.

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.

NOS

National Centers For Coastal Ocean Science

NATIONAL OCEAN SERVICE

NOAA scientists at the Beaufort Laboratory will produce red porgy and vermilion snapper from egg to market-size using biotechnology developed through a collaborative partnership between **NOS National Centers for Coastal Ocean Science** and the **NMFS Office of Aquaculture.** Together, we aim to advance scientific knowledge and support a sustainable aquaculture industry that provides domestic jobs, products, and services while also ensuring healthy, productive, and resilient marine ecosystems.

Benefits

- Technologies that maximize environmental and production efficiencies, optimize product quality and safety, minimize waste, and create jobs
- Domestic strains of broodstock to supply eggs and for genetic improvement
- Year-round supply of quality seedstock for inland and offshore aquaculture
- Market competitiveness for domestic producers

Resources

- Nationally recognized leaders in aquaculture and development of environmentally sustainable and economically viable production technology for a variety of marine fish
- Production-scale research facilities include 8,000 sq. ft. of hatcheries, nursery, and growout systems incorporating recirculating technology to recycle water.
- Aquaculture systems ranging in size from 250 gallons to 10,000 gallons

Fisheries Science

Managing snapper and grouper fisheries is challenging due to the large number of species in the management unit and a lack of basic data on many of the species. Most species grow slowly, do not mature until late in life, and live a long time. These species often take years to fully recover from overfishing.