

Florida Aquaculture Plan



August 2017



Prioritized recommendations for applied research and economic development by the Aquaculture Review Council for the purposes of creating new technologies, improved farm productivity, increased farm income and employment, and other economic and environmental benefits to the state of Florida.

Dear Floridians:

On behalf of the Aquaculture Review Council, it is my distinct pleasure and honor to present a revised and updated *Florida Aquaculture Plan* as required by the Florida Aquaculture Policy Act. The *Plan* consists of aquacultural research and development recommendations as required by statute (597.003(1)(b) Florida Statutes) that are provided to guide public investment into answering these challenges.

Florida aquaculture is an extraordinarily diverse agribusiness. We culture approximately 1,500 species or varieties of fish, plants, mollusks, crustaceans, corals, and reptiles for food and non-food markets that include seafood (fish and shellfish), freshwater and marine aquarium hobbyists, high fashion leather, water gardening, bait, biological control, or as "seed" for national and international aquaculturists to culture.

Societal, political and economic trends have accelerated global trade, fuel and feed cost volatility, and information exchange and technology sharing. These factors require unceasing innovation by Florida farmers to remain competitive. Florida's aquaculturists are adapting to change by investigating new species to culture (e.g., marine ornamentals, mollusks, and food fish), new markets (e.g., biofuel), and new, sustainable production systems (e.g., alternative energy).

We are very appreciative of the state of Florida's history of investing public funds to support applied research, extension, and education to benefit the aquaculture farmers, product distributors, and equipment manufacturers and suppliers. Public investment has been and is critical to our continued success and ability to respond to unexpected technical and economic change.

To learn more about Florida aquaculture, visit the Florida Department of Agriculture and Consumer Services website, www.FreshFromFlorida.com, or contact the Division of Aquaculture at (850) 617-7600.

Thank you,

A handwritten signature in black ink, appearing to read "Allen Register". The signature is fluid and cursive, with the first name "Allen" being larger and more prominent than the last name "Register".

Allen Register, Chair
Aquaculture Review Council



Applied Aquaculture Research and Development Priorities

An annual Florida Aquaculture Plan is authorized by statute to communicate research and economic development needs by Florida aquaculturists to state government and the public. The goal for identifying these priorities is to support public funding to conduct practical research that will:

- Diversify production.
- Prove the practicality of new technologies.
- Improve farm productivity and sustainability.
- Reduce input costs.
- Increase farm-gate income.

This applied research answers biological or technical challenges that benefit aquafarmers raising aquatic plants, clams and oysters, crustaceans, alligators and turtles, and fish for food, aquariums, pond stocking, and bait.

Research Priorities

A. Species

1. Determine ornamental fish and invertebrate species reproduction and grow-out characteristics of priority species identified by the Florida Tropical Fish Farms Association.
2. Determine reproductive, production and/or marketing characteristics and potential for new and existing aquaculture species to diversify the bivalve molluscan shellfish industry.
3. Develop techniques for increasing the level of domestication of cultured bivalve molluscan shellfish species (e.g., polyploidy, hybridization, broodstock selection and/or crossbreeding).
4. Examine the commercial feasibility of producing and marketing emerging marine and freshwater food fish or crustacean species in outdoor ponds, raceways, tanks or indoor tank or raceway systems to include an economic analysis of production costs and potential market returns.
5. Examine the commercial feasibility of producing and marketing live marine and freshwater sportfish or bait species in outdoor ponds, raceways, tanks or indoor tank or raceways systems to include an economic analysis of production and marketing costs and potential returns.

6. Develop a breeding program for hard clams, especially native (*Mercenaria campechiensis*) species for high summer survival and the sustainability of clam aquaculture.
7. Develop public Florida oyster broodstock lines (diploids and polyploids) for the emergent oyster culture industry.
8. Explore and determine new areas of public waters for alligator egg collection.
9. Determine techniques for optimal growth and propagation of commercially important aquatic plant species (*Microsorium pteropus* (Java fern), etc.)

B. Production Cycle Improvements

1. Evaluate and recommend water conservation practices.
2. Investigate and compare costs of alternative energy sources (e.g., electric, propane, solar) to heat small and large scale grow-out systems.
3. Develop or compare methods to estimate shrimp or fish numbers or biomass in ponds.
4. Masculinize (improve color and/or finnage) ornamental fish through approved chemical or environmental treatments.
5. Achieve the labeling of a chemical pond treatment to eliminate predacious zooplankton.
6. Increase on-farm productivity and efficiencies by identifying and testing technology to reduce production costs.
7. Develop methods to evaluate bivalve molluscan shellfish production technologies relative to environmental effects, cost effectiveness and efficiency.
8. Develop cost effective remote technologies for bivalve molluscan shellfish growing area surveillance and security.
9. Compare various techniques/methods to prevent and control bio-fouling of bivalve molluscan shellfish farming gear and products including economic analysis of producer investment and return (product durability/longevity).
10. Evaluate nursery design (i.e., water flow rate and direction, screen types and sizes, and substrates), environmental (i.e., chemical and physical) and biological (i.e., phytoplankton species) characteristics to maximize nursery production of bivalve molluscan shellfish.
11. Scale-up for commercial application emerging technologies to mitigate off-flavor compounds in food fish recirculating production systems.
12. Investigate Integrated Aquaculture Systems (IAS) and Integrated Multi-Trophic Aquaculture (IMTA) to improve recirculating aquaculture system economics.
13. Develop water quality specific mineral supplement recommendations for low-salinity marine shrimp grow-out.

14. Develop alligator recirculating production system technologies to reduce water and energy consumption/costs.

C. Animal and Plant Health

1. Develop procedures or protocols for disinfecting live feeds.
2. Identify and develop diagnostic tools, potential treatment and prevention options, and biosecurity measures for emerging diseases of aquaculture species; or improve on diagnostic tools, treatment and prevention, and biosecurity for existing known diseases.
3. Investigate methods to control microbial communities in aquaculture hatcheries and larval rearing systems.
4. Identify the cause of and develop a hatchling alligator treatment or handling method to reduce or eliminate excessive umbilical scarring.
5. Develop a protocol to nest, incubate and hatch alligators to increase hatch rates and reduce umbilical scarring.
6. Develop a protocol for rearing alligators to increase growth rates and reduce scarring from bites (density levels, frequency of feeding, water level and optimum grow out house temperature).
7. Develop disease surveillance and health management strategies for cultured oysters.
8. Develop and establish an aquatic health and monitoring program for seed production of molluscan shellfish.
9. Investigate methods to control aquatic amphipods and snails (i.e. *Physella*, *Marisa*, etc) that feed on plants.

D. Nutrition

1. Develop or improve live feed species and production protocols for marine and freshwater aquaculture species.
2. Evaluate alternative feed ingredients and dietary formulations to reduce feed costs and increase growth and reproduction of Florida aquaculture species.

E. Environment

1. Conduct a science-based risk analysis (assessment and management) of non-native species that informs responsible cultivation.
2. Quantify disturbed and undisturbed habitat biotic and abiotic resistance to non-native species introduction.
3. Conduct a risk analysis of the tilapia species in Florida aquaculture to assist state agencies in decision-making regarding potential changes in tilapia management.
4. Improve the understanding of bivalve molluscan shellfish farm environmental interactions concerning carrying capacity, water quality, benthic soils and bathymetry.

5. Produce a how-to manual for the construction, maintenance and operation of an alligator anaerobic lagoon waste treatment system.
6. Compile existing Florida seawater quality data to establish a baseline for all identified and quantified essential components (temperature, salinity, water chemistry, food supply, and including positive/negative impacting bacteria and pathogens) necessary for efficient and effective hatchery/nursery production of shellfish in Atlantic and Gulf Florida Waters. Design testing procedures for regular ongoing monitoring of these components that would identify significant changes that may affect production on any level from spawn to 4mm size.

F. Food Safety

1. Develop and obtain FDA approval of an enzyme-linked immunosorbent assay (ELISA) and/or liquid chromatography-mass spectrometry (LC-MS) test for determination of brevetoxin concentrations in shellfish (oyster, clam or mussel) meats.
2. Assess /develop harvest management and/or monitoring tools in compliance with NSSP harvest/handling requirements to assure product quality of cultured oysters.
3. Develop and distribute an aquaculture food commodity producer's guide of Food Safety requirements.
4. Explore approved methods of freezing shellfish products (purging, freezing techniques, market demand, costs, product viability) as an alternative processing option for producers at peak harvest times.

G. Marketing

1. Create and distribute information (publication, social media/marketing campaign, etc) that describes Florida aquaculture: Culture methods, species grown, and potential environmental effects.
2. Determine whether the consumer is discriminating between wild-harvested or farm-raised and domestic or imported aquatic species.
3. Conduct a Florida aquaculture promotion/public education campaign for a segment of the population most likely to consume Florida grown products.
4. Test Florida aquaculture product branding using social media to quantify the value-added benefit.
5. Test Florida aquaculture product branding approaches (regional vs. generic vs. product quality characteristics).
6. Create and conduct an aquarium fish and plant promotional campaign to increase sales and product values.
7. Promote Florida tropical fish and aquatic plants through participation in aquarium or pet industry trade shows.

8. Complete a market analysis (value, volume, demand and product specifications) and/or financial characteristics for Florida cultured oysters.
9. Describe and define options and markets for the re-use or recycle of materials used in aquaculture farming, processing and shipping including compostable plastic.
10. Improve shellfish and/or foodfish processors and public understanding of food safety and quality issues across the entire processing system from production practices to consumption.
11. Develop an aquaculture-based model for agricultural tourism, and evaluate potential economic, educational, and/or marketing impacts.
12. Identify domestic markets for grade 2 and 3 green, salted alligator skins.
13. Identify designers/manufacturers in Florida and the US and educate them on marketing off grade hides.

H. Economic Analysis

1. Conduct a Florida aquaculture versus foreign competitor strengths, weaknesses, opportunities, and threats (SWOT) analysis that will yield actionable recommendations to improve national and global competitiveness.
2. Conduct a Florida aquaculture development analysis to: 1) define aquaculture resource needs: water, soils, temperature; 2) describe and map geopolitical regions of the state that welcome aquaculture activities, agriculture zoning, potential municipal partnerships that will accept effluents, and farming segments that will accept effluents for crop irrigation; and 3) combine and provide this information as a GIS tool to state and county economic development officials.

I. Education

1. Conduct a statewide aquaculture and business development and/or technology transfer workshop.
2. Develop and support school education programs leading to certification(s) of competency in aquaculture.
3. Create and launch an educational campaign to inform the public on the importance of responsible pet ownership, environmental stewardship and increase awareness of the consequences of releasing nonnative species and pets.
4. Develop an outreach campaign to promote the environmental benefits and ecosystem services provided by shellfish aquaculture to local community stakeholders and conservation organizations.

For additional information, please contact:

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Cover images, clockwise from top left: Larval blue tang, American alligators, water lilies and larval eastern oysters