



NATIONAL
Aquaculture
ASSOCIATION

2024
**AQUACULTURE
RESEARCH
PRIORITIES**

ONE INDUSTRY, ONE VOICE

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ONE INDUSTRY, ONE VOICE

For over 33 years, the National Aquaculture Association (NAA) has been the unifying voice of the United States' aquaculture sector. NAA remains committed to the growth and success of all American aquaculture farms through collaborations with state and federal governments that foster a positive business climate and cost-effective regulations that ensure environmental stewardship. As a not-for-profit trade association, we fulfill our mission primarily through government advocacy, public outreach and farm promotion.

Sebastian Belle
President



FOREWORD

Applied research that develops practical, cost-effective solutions for existing problems is essential to the economic sustainability of U.S. aquaculture. Research programs designed to address priority research needs of U.S. aquaculture producers will contribute to its growth, economic impact, and contributions to food security. The National Aquaculture Association (NAA) conducted a survey of its members to identify priority research needs. This booklet provides details on the priorities identified.

Survey results revealed several over-arching needs of U.S. aquaculture. A very high priority expressed by NAA members was to increase Extension support for U.S. aquaculture. There is a great deal of concern over the loss of full-time Extension personnel dedicated to aquaculture. U.S. aquaculture producers recognize the essential Extension functions of communicating producer needs to researchers, framing appropriate research questions, and assisting researchers to develop effective experimental designs. Extension personnel further translate and disseminate research results to farmers and follow up with critical support to assist farmers to adapt research results to their specific farm.

A second over-arching research need identified by NAA members was the need for research trials to be conducted under conditions that effectively mirror commercial farming conditions. Ponds, tanks, and net pens do not necessarily have to be the same size as those on commercial farms, but the size of the unit must be sufficient to produce similar results to those on commercial farms.

FOREWORD

Aquaculture producers differ in preferences for the best communication methods to disseminate results. Nevertheless, one-on-one visits with farmers, on-farm trials, and research verification programs (that test research recommendations in a few production units with close monitoring and data collection) are among the most effective. Workshops, articles in trade journals and magazines, email notices of new publications, newsletter articles, and fact sheets are all reported to be useful to aquaculture producers.

Programs that fund aquaculture research are strongly recommended to use the research priorities identified in this booklet as priority objectives for future research funding competitions. Focusing research dollars on the most important priorities of aquaculture producers is critical for growth and development of U.S. aquaculture.

Dr. Carole Engle
*Chair of the National
Aquaculture Association's
Research and Technology
Committee*





PRIORITY RESEARCH TOPICS

EXTENSION SERVICES

Farms require aquaculture Extension specialists who possess in-depth familiarity with individual farms and have nurtured close working relationships with the farming community.

Aquaculture Extension specialists should:

- ➔ Collaboratively manage research yield verification trials on farms to verify that research results will hold up under commercial conditions.
- ➔ Actively engage with the aquaculture research community to ensure that the researchers focus their proposals and research programs on real, applied problems on farms.
- ➔ Assist farmers to understand regulations and anticipate regulatory changes.

USDA must strengthen aquaculture Extension services by conducting frank discussions with land-grant universities to increase base Extension support for aquaculture producers, especially in major aquaculture-producing states, with priority given to Extension programming, not grant writing.

PRODUCT AND CONSUMER MARKETING

Increase market value by informing: 1) new farm planning or existing operation expansion, 2) candidate species evaluation to appreciate pricing, product forms, and demand and 3) enhance consumer valuation and product value through consumer education, value-added processing, or attribute labeling.

- ➔ Consumer education.
- ➔ Market evaluation and reporting.
- ➔ Product development and promotion.
- ➔ Enhancing product value through processing efficiencies, value-added processing, and establishing Aquaculture Organic Standards.



PRIORITY RESEARCH TOPICS

ANIMAL BREEDING

Achieve the complex goals of improved growth, health (including disease resistance), and yield within different production systems using agricultural biotechnology (traditional selection, hybridization, or genetic modification) that may include sterility to reduce environmental risk or achieve desirable growth and yield characteristics.

- 🌸 Production-system based domestication that optimizes growth, health, and yield through:
 - Selection.
 - Hybridization.
 - Sterility.
 - Genetic modification.
- 🌸 Candidate species evaluation

ANIMAL HEALTH

Implement risk-based health assessment and management practices to protect and support the care and growth of farm-raised aquatic animals and to prevent pathogen introduction, spread, or release.

- 🌸 Health management:
 - Farm management.
 - Veterinarian and fish health professional – education and training.
 - Therapeutant development and testing – vaccines and medicines.
 - Anti-microbial risk assessment.
 - Risk management:
 - Insurance.
 - Pathogen horizon scanning.
 - Zoonotic pathogens.
- 🌸 Animal Nutrition:
 - Live feeds – larval nutrient delivery system.
 - Nutrient retention.
 - Palatability.
 - Production system specific feeds.
 - Life stage specific feeds.
 - Plant-based feed optimization.



PRIORITY RESEARCH TOPICS

PRODUCTION AND TRANSPORT SYSTEMS

Hatchery, production, species, and transportation system economic feasibility evaluations, energy source selection, and workforce development focused on production efficiency and intensification through robotics and instrumentation while keeping innovation real and grounded through economic analysis.

🌿 Robotics

🌿 Production intensification

🌿 Instrumentation:

- Environmental parameter and biomass monitoring.
- Livestock inventory.
- Farm security surveillance.
- Harmful algal bloom detection/quantification.

🌿 Economics:

- Business planning.
- Production system evaluation.
- New species evaluation.
- Alternative energy source evaluation.

ENVIRONMENTAL MANAGEMENT

Environmental management, on- and off-farm, should integrate production system design, construction, management, and maintenance to provide optimum growing conditions, animal pathogen and pest protection, confinement, water conservation, eco-friendly materials and coatings, feed production, and minimal off-farm effects.

🌿 Production system design, management and maintenance:

- Effluent reduction and treatment.
- Water quality and conservation.
- Off-flavor mitigation.
- Alternative materials and coatings – biodegradable or anti-biofouling gear, containers, and packaging.

🌿 Crop pest management:

- Predator, pest, and parasite control.
- Nuisance plant and invasive species control.

🌿 Escape

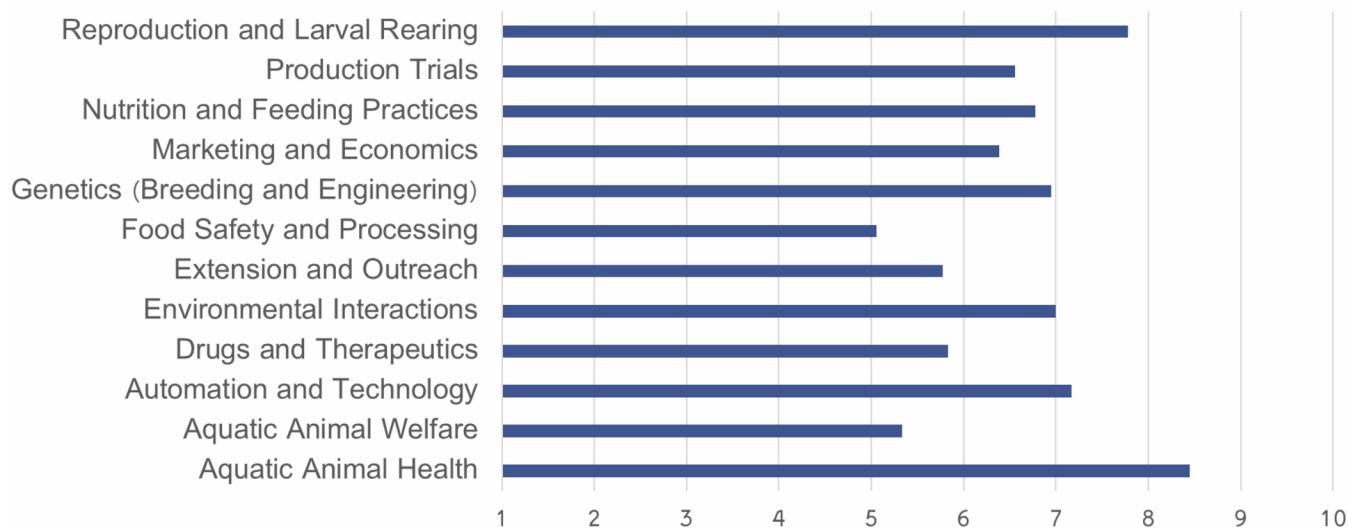
🌿 Feed production:

- Low environmental footprint U.S. grains.
- Pellet stability to minimize nutrient discharge.



RESEARCH TOPIC PRIORITIZATION

Table 1. Research categories most important to NAA members. Membership survey conducted April 2024.



OTHER PRIORITY TOPICS

Members provided the following additional high-level research needs.

➔ Workforce Development in High Schools and Community Colleges.

- ➔ Commercial Scale Research:
- Research on commercial farms and not exclusively at research labs.
 - Development of model indoor facilities.
 - Performance of various shellfish gear types.
 - Improved farm pond management techniques.
 - Marine finfish net pen research and demonstration.
 - Artificial intelligence.

- ➔ Improved Governance:
- Assess and provide suggestions to simplify permitting processes and reduce cost to farms.
 - Public education to improve social license.
 - Improve insurance and disaster assistance programs.

- ➔ Seafood Imports:
- Lack of U.S. equivalent regulatory standards for seafood imports.
 - Fish fraud, mislabeling of seafood.



COMMODITY RESEARCH PRIORITIES

FRESHWATER FISH AND CRUSTACEAN

- 🦞 Improve fish and crustacean survival during live truck transport and airfreighted styrofoam containers .
- 🦞 Farm pond management techniques to improve growth and survival and reduce costs.
- 🦞 U.S. farmed seafood marketing that increases demand and educates the public on safety and quality of products.
- 🦞 Chemical methods to eliminate "hitch hikers" - aquatic nuisance species - during harvest and transport.
- 🦞 Reduce fish losses due to bird depredation.
- 🦞 Increase Extension and outreach capacity to farmers.
- 🦞 Extension agent training on applied commercial skills and techniques that can be implemented by farmers.
- 🦞 Production automation that reduces the need for manual labor on farms utilizing ponds.
- 🦞 Develop feeding protocols to improve rearing methods for white suckers and creek chub.
- 🦞 Regulatory analysis that shows the cost and resources required to comply with individual permits and regulations across the U.S. baitfish industry and makes recommendations to streamline duplicative processes and reduce cost to farmers.
- 🦞 Assess ecosystem services and wildlife habitat value provided by U.S. aquaculture farms and investigate the potential for a subsidy program to compensate farmers.
- 🦞 Assess the economic benefits and needs for increased federal support programs for U.S. aquaculture, such as insurance, subsidies, and affordable workman's comp and health insurance.



COMMODITY RESEARCH PRIORITIES

MARINE FOODFISH

- ➔ Developing fish-meal free diets.
- ➔ Development of non-chemical pathogen prevention and treatment methods.
- ➔ Refine fish health management techniques for net pens.
- ➔ Investigate technologies to automate production and reduce labor.
- ➔ Refine larval rearing techniques for commercially produced marine fish.
- ➔ Develop selective breeding programs for increased growth and disease resistance.
- ➔ Assess the effect of farm selective breeding programs on commercial fisheries.
- ➔ Establish net pen demonstration and research facilities to refine production methods and improve social license for industry development.
- ➔ Research biofloc for marine finfish production.
- ➔ Develop breeding and larval rearing methods for eels and halibut.
- ➔ Conduct market analysis, provide marketing tools, and assess distribution economics.
- ➔ Improve fish health management techniques on farms.
- ➔ Assess the impact of global market conditions and consumer sentiment on U.S. marine aquaculture development and marketability.



COMMODITY RESEARCH PRIORITIES

SHELLFISH

- 🐚 Establish family-based breeding programs that increase shellfish growth, temperature, and salinity tolerance and disease resistance.
- 🐚 Development of non-chemical pathogen treatment methods.
- 🐚 Develop technologies that mechanize production methods and reduce the need for labor.
- 🐚 Develop new tools for gear and inventory management.
- 🐚 Establish breeding and larval rearing methods for scallops and razor clams.
- 🐚 Research interactions with harmful algae and develop mitigation strategies and new testing methods.
- 🐚 Improve social license for shellfish farms through community and public education campaigns.
- 🐚 Conduct stakeholder education and listening sessions to improve understanding of local and regional social interactions with existing and new farms.
- 🐚 Investigate environmental interactions with shellfish gear.

SEAWEED

- 🌿 Evaluate growth and survival of seaweed on farms and improve production methods.
- 🌿 Develop selective breeding programs that accelerate growth.
- 🌿 Examine the effects of ocean acidification on seaweed cultivation and identify mitigation strategies.
- 🌿 Improve social license for seaweed farms through community and public education campaigns.

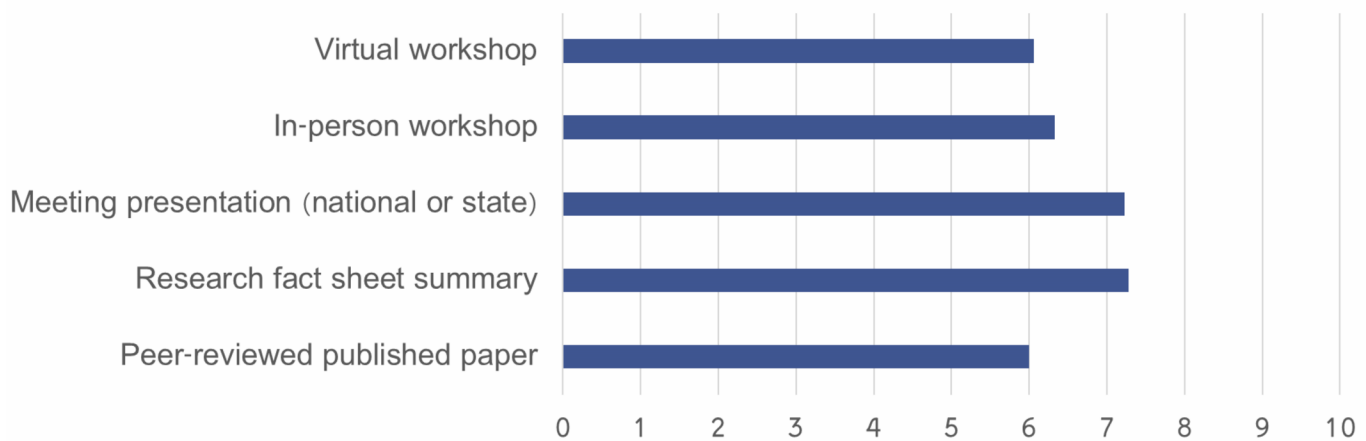
GAMEFISH

- 🐟 Research indoor larval rearing techniques for common species.
- 🐟 Develop live feeding protocols for common gamefish species.
- 🐟 Conduct feed research to determine nutritional requirements and optimize feeding strategies.
- 🐟 Conduct public education and marketing campaigns.
- 🐟 Refine production methods in ponds and tank systems.



COMMUNICATING RESULTS TO INDUSTRY

Table 2. Importance of research communication methods to farmers on a scale of 1-10. Membership survey conducted April 2024.



OTHER PRIORITY COMMUNICATION NEEDS

Members provided the following additional suggestions for communicating results to industry.

- ➔ Articles in trade journals and magazines, such as Fish Farming News, Aquaculture North America, etc.
- ➔ Distribute summary articles by email through state and national aquaculture association's listservs, such as NAA's *Friday at the Lab* email news.
- ➔ Researchers must communicate results with Extension agents and farmers, especially those that participated in specific research projects. Often farmers participate but are never notified when the project is completed and results are published.
- ➔ Publish research in open-source journals that are free to access.
- ➔ Prepare and provide access to all project data by request. Peer-reviewed papers do not provide source data and that can be very helpful for farmers that want to interpret and implement the research in a commercial setting.



LIST OF CURRENT RESEARCH PRIORITIES DOCUMENTS

Several U.S. aquaculture associations or industry advisory groups produce research priorities documents on routine basis. These documents provide much more specific guidance on priorities for a specific commodity group or state or region of the country.

- 🌸 [East Coast Shellfish Growers Association Research Priorities](#)
- 🌸 [Florida Aquaculture Plan 2023](#)
- 🌸 [Maine Aquaculture Research, Development and Education Priorities](#)
- 🌸 [Pacific Coast Shellfish Growers Association Research Priorities](#)
- 🌸 [Recirculating Atlantic Salmon Network's Summary of Land Based Salmon Stakeholder Priorities](#)

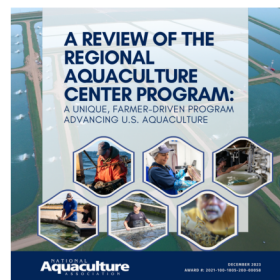
U.S. DEPARTMENT OF AGRICULTURE REGIONAL AQUACULTURE CENTERS

Each of the U.S. Department of Agriculture's five Regional Aquaculture Centers (RAC) has an active Industry Advisory Committee that oversees research prioritization and projects. Broadly speaking, U.S. aquaculture farmers strongly support the work of the RACs as funding results in applied research and Extension efforts that directly benefit farmers.

Researchers should contact the Director of a RAC to learn more about specific industry priorities and reach out to the industry Advisory Committee for feedback and collaboration.

- ➡ [Center for Tropical and Subtropical Aquaculture](#)
- ➡ [North Central Regional Aquaculture Center](#)
- ➡ [Northeastern Regional Aquaculture Center](#)
- ➡ [Southern Regional Aquaculture Center](#)
- ➡ [Western Regional Aquaculture Center](#)

LEARN MORE ABOUT THE RAC PROGRAM



A person wearing a wetsuit and a cap is standing on a boat, handling a large net filled with oysters. The boat has a metal frame and a canopy. In the background, there are orange crates and a body of water under a clear sky.

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