WRAC Western Regional Aquaculture Center

Alaska • Arizona • California • Colorado • Idaho • Montana • Nevada • New Mexico • Oregon • Utah • Washington • Wyoming

REQUEST FOR

Regional Research and Outreach Project Pre-Proposals FY2027

Western Regional Aquaculture Center

United States Department of Agriculture
National Institute of Food and Agriculture

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Pre-Proposal information can also be found on the WRAC website at: http://wracuw.org and click on *Current Funding Opportunities*.

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Pre-Proposals are due by 5:00 pm PST, Friday, April 10, 2026.

Watch the WRAC RFP informational video:

"*How To Apply for Western Regional Aquaculture Center Funding*"

This instructional video was created for our previous RFP, but remains applicable today. To view the video, visit: **https://wracuw.org/current-funding-opportunities/**

This detailed walk-through video illuminates the steps needed to craft a successful pre-proposal, paving the way for impactful and strategic aquaculture research projects.

Follow our expert guidance to ensure your proposal embodies the collaboration, industry relevance, and scientific rigor expected by the Western Regional Aquaculture Center.

Cover photo: Purple sea urchins, ma-no at iStockphoto.com

Overview

Proposed Research Priority Areas

Based on extensive input from the aquaculture industry and extension and research representatives throughout the region, the Western Regional Aquaculture Center (WRAC) is seeking Pre-Proposals for ten research areas, listed below alphabetically. WRAC volunteers, who are available to answer your questions, are listed at the top of each priority area page.

1. Advancing Aquaculture Development through Actionable Data and Work Force Innovation
2. Aquaculture Opportunities Through Genetics
3. Ecosystem Services and Aquaculture
4. Feed and Nutrient Innovation
5. Improve Product Quality and Safety
6. Improvements in Hatchery Technology and Techniques
7. New and Emerging Species
8. Non-antibiotic Solutions to Control or Prevent Infectious or Non-infectious Diseases and Stressors Affecting Aquaculture Production
9. Reducing Impacts of Aquatic Nuisance Species
10. Transforming the Aquaculture Industry through Digital Innovations

Project Submission & Review Schedule

Pre-Proposals are due by (PST)	**5:00 pm PST, Friday, April 10, 2026**
Notification of Pre-Proposal review outcome	Late May
Full Proposal Submission & Review Schedule	
Full proposals due	Mid-July
External review of Full Proposals	July through September
Lead PI presents Full Proposal at WRAC Annual Meeting (IAC/TC)	October
WRAC review process	October through November
Notification of funding decisions	Early December
Projects scheduled to begin 2027 (dependent on release of funds)	September 1, 2027

Please note: Pre-Proposal submissions can be made directly to WRAC's Administrative Office. While there is no requirement for you to submit Pre-Proposals via your institution's sponsored project office or equivalent, each Work Group is responsible for following their specific institutions' procedures. WRAC does not require a signature from your Authorized Organization Representative (AOR) at the Pre-Proposal stage.

General Criteria for WRAC-funded Research & Outreach Projects

- The region includes Alaska, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.
- Priority will be given to projects that include participation by two or more states located within the western region (see specific criteria on the next page).
- Partnerships may be formed among all elements of federal, state, and local government; public institutions; and the private sector.
- Project partnerships should depend on the nature of the problem and the most effective use of resources.
- Any member of the proposed research team who has served as Work Group Chair on any WRAC project in the past five years must report on whether outreach objectives have been completed for that project. Please confirm the status of your outreach on the Checklist, page 18, of this document.

Specific Criteria for Regional Projects

The following criteria are used to prioritize cooperative regional research and outreach projects for receiving WRAC funding:

Proposed Project

- Involves at least two institutions and research activities in at least two states and the most effective use of resources within the western region.
- Is likely to attract additional support for research and/or outreach on the priority, which is not likely to occur through other programs and mechanisms.
- Can be made sufficiently specific to promise significant accomplishment within four or fewer years.
- Can be effectively organized and conducted on a regional level, ensuring coordinated and complementary contributions by all participants.
- Produces results that can provide a solution to a problem of fundamental importance or fills an information gap from the standpoint of present and future aquaculture knowledge in the western region.
- Contains an outreach component with defined objectives and deliverables according to Pre-Proposal Guidelines: Outreach and Evaluation Plan (page 23).

Research

- Requires more scientific labor, equipment, and facilities than are generally available at individual research institutions.
- Is adaptable and particularly suitable for inter-institutional cooperation, resulting in better use of limited resources and research funds.
- Complements and enhances ongoing research by participating research institutions.

Importance of the Outreach Component in Assessing WRAC Pre-Proposals and Full Proposals

A well-considered and appropriate outreach component is an essential part of any WRAC project. Increasing attention to the quality of outreach has been emphasized by USDA-NIFA and has received considerable emphasis from WRAC's Board of Directors. To ensure the necessary outreach components are included in the Pre-Proposal, please see page 23 of this document.

A Principal Investigator (PI) responsible for outreach must be included as a member of the project Work Group from the development of the Pre-Proposal through to the completion of the project. The PI responsible for developing outreach objectives should be involved in all major meetings and discussions throughout the project. This level of involvement gives this PI the in-depth knowledge of the research that is needed to identify and implement appropriate and effective outreach.

The maximum funding level for each project is $200,000 per year. WRAC's Board of Directors also wishes to ensure that adequate funding is available to support the integration of PIs responsible for outreach into research teams at the earliest stages. The funding request for outreach objectives will be an important element in the evaluation of Pre-Proposals and invited Full Proposals. Instructions for submitting this information are included on pages 24–25 of this document.

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Other Criteria for Regional Projects

- Guidelines for development of Pre-Proposals and the required format are enclosed for your information (pages 16–25). These guidelines are adapted from the WRAC Manual of Operations, Appendix B, Pre-Proposal Guidelines.
- Pre-Proposal submission must identify how it aligns to one or more Priority Statements included in the RFP.
- All investigators are encouraged to contact WRAC representatives for each individual priority statement. Contact information for the representatives are listed at the top of each statement.
- Please note that while each of the priority statements indicates that funding requests should not exceed the stated maximum dollar amount, the WRAC Pre-Proposal and Full Proposal review processes are highly competitive, and the proposed budget is an important criterion used in assessment of Pre-Proposals and Full Proposals.

Pre-Proposals Submission and Deadline

(*See pages 16–25, for specific instructions*)

Submission

1. Submit the entire Pre-Proposal as a single PDF (Excel budget sheets may be sent separately) to the WRAC Administrative Office by email to Julie Hahn at jkhahn@uw.edu. Electronic signatures are allowed.
2. If you have any questions or need any further information, contact Julie Hahn at jkhahn@uw.edu.

Deadline for Submission of Pre-Proposals is 5:00 pm PST, Friday, April 10, 2026.

Notes

- WRAC encourages early submission of Pre-Proposals. If a Pre-Proposal is received at least two weeks prior to the final deadline, it allows time for the Administrative Office to review the Pre-Proposal (using the checklist) and to notify the authors if any requirements are not met. Thus, the authors will have time to adjust and re-submit their Pre-Proposals before the final deadline.
- All investigators, but especially those submitting a Pre-Proposal for the first time, are strongly encouraged to consult with the relevant contact person listed for each Priority Statement. Administrative staff are also available to answer questions regarding the Pre-Proposal submission process.
- Please plan accordingly to ensure inclusion of all necessary components and signatures by the deadline of 5:00 pm PST on Friday, April 10, 2026.

Research Priority Statements for Pre-Proposals FY2027

Based on extensive input from the aquaculture industry and extension and research representatives throughout the western region, WRAC is seeking Pre-Proposals for ten research priority areas listed here alphabetically. Each title below is linked to the research priority statement and listed by page number. Click on the title or the page number to go directly to the detailed statement.

Please note:
Your Pre-Proposal submission must include a statement that details how it aligns to one or more Priority Statements.

1. Advancing Aquaculture Development Through Actionable Data and Work Force Innovation

Research Priority Contacts

All interested investigators are highly encouraged to contact a WRAC representative:

- Jackie Zimmerman (jacqueline.zimmerman@merck.com)
- Doug Bush (doug@oceanrainforest.com)

Research Priority

We are seeking proposals focused on overcoming obstacles and increasing opportunities in aquaculture development and growth in the western U.S. With growth in the global population and increases in demand for seafood, the long-term outlook for the expansion of domestic aquaculture is quite favorable. Growth of the industry is limited by barriers, such as the current regulatory frameworks, access to novel or alternative markets, limited workforce recruitment and training and need for cost-savings solutions.

Solution

Project proposals focusing on issues and opportunities for small-scale farmers are encouraged. Examples for consideration may include, but are not limited to:

- Mapping and analyzing existing regulatory and permitting frameworks to identify redundancies and propose pathways for improved coordination among state and federal agencies.
- Evaluating opportunities to simplify or harmonize multi-agency permitting for aquaculture operations, particularly those involving water use, interstate distribution, effluent discharge, and new species approvals.
- Developing workforce training programs to support small-scale or emerging aquaculture sectors (e.g., hatchery management, water quality monitoring, compliance navigation).
- Conducting market and supply chain analyses to expand access for new or existing species, products, or value-added forms (e.g., stabilized seaweed products, freshwater shellfish, direct-to-consumer models).
- Technoeconomic assessment and alternative/by-product valorization; such as waste or processing side streams.
- Develop innovative approaches to streamline beneficial movement of aquaculture products to market. This may include improving food safety and product certification processes, or resolving regulatory barriers that limit market development and commercialization across finfish, shellfish, and seaweed sectors.

Outreach

A funded participant (PI) responsible for outreach must be included as a member of the Work Group from the inception of the project. The goal is that the outreach PI works together with all members of the Work Group from the pre-proposal stage to the conclusion of the project, so that they are able to create products that are informative and effective for all stakeholders. Outreach products should target the states and/or industries that the project addresses. Examples of outreach products include: publications, workshops for interested industry and regulatory members, presentations at scientific meetings, and any other products that provide information on project results. Products should also include information for consumers, such as FAQ sheets and infographics. It is important to note that a minimum of one outreach publication is required for all WRAC-funded projects.

Duration and Funding

Project duration can be up to 4 years, and the request from WRAC should not exceed $200,000/year. In-kind and leveraged funds from industry, academia, and other entities are strongly encouraged.

2. Aquaculture Opportunities Through Genetics

Research Priority Contacts

All interested investigators are highly encouraged to contact a WRAC representative:

- Finfish: Sean Nepper (sean.nepper@riverence.com)
- Shellfish: Sue Cudd (whiskeycreek1@mac.com)
- Seaweed: Chuck Toombs (chuck@oregonseaweed.com)

Research Priority

Various types of genetic improvement are used in the production of many aquatic species. Existing commercial applications include traditional selective/pedigreed breeding, hybridization, sex reversal, polyploidy, genomics and marker-assisted selection, and other emerging genetic tools. Traits that can be directly measured on a broodstock population include growth rate, survival, feed conversion ratio, disease resistance, and body conformation, nutritional attributes of seaweeds. Indirect traits include growth and survival under changing environmental conditions, processing yields, and product quality. Additional types of investigation may include production of monosex stocks without the use of chemicals, assessing the genetic basis for resistance to pathogens in shellfish, and genome-wide association studies for sex determination in sturgeon and other species. A variety of techniques can be used to address different production objectives, including improved growth performance or desired marketing characteristics.

Sterility is increasingly required in aquatic species to reduce impacts on native species. However, genetic techniques are still not developed for many species. For example, genetic improvement resulting in single-sex populations would seem to have great utility for sturgeon and shellfish, and possibly many other species. Additionally, current techniques for many species could benefit from further refinement. In some cases, genetic improvement techniques have been developed for certain species (e.g., shellfish, catfish hybrids, seaweeds), but not widely adopted by commercial growers due to uncertainty about their performance characteristics under production conditions. Although the time scale of the funding cycles does not support traditional or pedigreed selective breeding programs, commercial-scale testing of promising stocks could demonstrate their value to west coast aquaculture operations.

Solution

This priority statement invites research that develops and/or quantifies the efficacy and feasibility of genetic improvement to achieve production objectives. Research may address improvements to existing practices and/or develop new techniques or novel species. Production benefits, such as growth, survival, feed conversion and disease resistance, and reduction of production costs, as well as economic performance of genetically improved vs. pure strains, should be considered. Research that uses tools for selection for improved traits, such as growth, improved feed efficiency, increased survival, increased disease resistance, final processing traits, and overall genetic improvement in shellfish production is also desired. Examples include, but are not limited to, genomics, marker-assisted selection, ploidy manipulation, challenge studies, growth assays, and varietals.

Outreach

A funded participant (PI) responsible for outreach must be included as a member of the Work Group from the inception of the project. The goal is that the outreach PI works together with all members of the Work Group from the pre-proposal stage to the conclusion of the project, so that they are able to create products that are informative and effective for all stakeholders. Outreach products should target the states and/or industries that the project addresses. Examples of outreach products include: publications, workshops for interested industry and regulatory members, presentations at scientific meetings, and any other products that provide information on project results. Products should also include information for consumers, such as FAQ sheets and infographics. It is important to note that a minimum of one outreach publication is required for all WRAC-funded projects.

Duration and Funding Level

Project duration can be up to 4 years, and request from WRAC should not exceed $200,000/year. In-kind and leveraged funds from industry, academia, and other entities are strongly encouraged.

3. Ecosystem Services and Aquaculture

Research Priority Contacts

All interested investigators are highly encouraged to contact a WRAC representative:

- David Beugli (wghoga@gmail.com)
- Doug Bush (doug@oceanrainforest.com)

Research Priority

Aquaculture is the world's fastest-growing food production sector, yet its relationship with ecosystem services remains poorly quantified and under-leveraged. Ecosystem services offer direct and indirect benefits beyond just the production of food. While aquaculture can provide essential ecosystem benefits such as nutrient recycling, carbon sequestration, habitat enhancement, and improved coastal resilience, these services are rarely measured, valued, or integrated into management frameworks.

There is an urgent need for innovative, interdisciplinary research and demonstration projects that quantify, enhance, and communicate the ecosystem services provided by aquaculture systems across freshwater, estuarine, and marine environments. Projects may focus on improvements in environmental quality (e.g., nutrient cycling, water filtration, carbon capture) or support (e.g., habitat creation, biodiversity enhancement). Understanding these benefits within a systems framework will allow producers, policymakers, and land managers to make informed policy decisions and help to improve aquaculture literacy and social license.

Solution

Proposals are sought that address, but are not limited to:

- Quantification and valuation of ecosystem services from aquaculture and integrated systems (e.g., constructed wetlands, oyster farms contributing to eelgrass recovery, IMTA).
- Field or modeling approaches that evaluate nutrient removal (other than/in addition to nutrients generated by the farm), habitat creation, or carbon dynamics (e.g., carbon sequestration).
- Development of frameworks or metrics for incorporating ecosystem services into permitting, certification, and incentive programs.
- Socioeconomic or policy analyses that link ecosystem service valuation to decision-making or market mechanisms (e.g. lifecycle analysis).
- Demonstration of aquaculture infrastructure, gear, and/or practices leading to ecosystem services (e.g. habitat provisioning, increased species diversity).

Outreach

A funded participant (PI) responsible for outreach must be included as a member of the Work Group from the inception of the project. The goal is that the outreach PI works together with all members of the Work Group from the pre-proposal stage to the conclusion of the project, so that they are able to create products that are informative and effective for all stakeholders. Outreach products should target the states and/or industries that the project addresses. Examples of outreach products include: publications, workshops for interested industry and regulatory members, presentations at scientific meetings, and any other products that provide information on project results. Products should also include information for consumers, such as FAQ sheets and infographics. It is important to note that a minimum of one outreach publication is required for all WRAC-funded projects.

Duration and Funding Level

Anticipated project duration is 1-4 years. Requests from WRAC should not exceed $200,000 per year. In-kind and leveraged funds from industry, academia, and other entities are strongly encouraged.

4. Feed and Nutrient Innovation

Research Priority Contacts

All interested investigators are highly encouraged to contact a WRAC representative:

- Carrington Gorman (carrington.gorman@rangen.com)
- Chuck Toombs (chuck@oregonseaweed.com)

Research Priority

Feeds represent a significant cost of aquaculture production. Growers of aquatic species are faced with a lack of access to proven alternative and supplemental ingredients, limited supplies of marine-derived ingredients, and reliance on live feeds. Out of necessity, growers in arid regions of the western U.S. are increasingly turning to recirculating aquaculture systems as a means to produce high value species. Because initial capital investment in such intensive recirculating systems can be relatively high, optimizing diets in these production systems is needed to increase the potential for economic growth. Additionally, there is an increasing consumer demand for locally sourced food and feed ingredients, which necessitates continued evaluation of nutrition solutions.

Solution

Innovative approaches are needed to reduce these challenges without compromising growth and feed efficiency, product quality, and marketability, in addition to the health of aquatic animals and their environment. Economic viability analysis should be included. Laboratory testing that culminates in on-farm trials is required. Examples include:

- Continued evaluation of nutritional products for finfish, shrimp, mollusks, echinoderms, and other aquatic species. Examples include, but are not limited to: camelina/cottonseed meal, spirulina, algae, single-cell organisms, insects.
- Development of artificial diets for rearing bivalves, larval finfish, and larval crustaceans.
- Phased/feeding and finishing feed approaches for alternative lipid strategies that include economic benefit analysis and product quality evaluations.
- Nutrient optimization for improving economic growth potential for less understood aquaculture species (e.g., algae), high value species, species' life stage (e.g., catfish feed for growing sturgeon).
- Characterization of life cycle assessments for various production systems (e.g., shrimp/tilapia grown in recirculating systems or aquaponics systems, salmonids with alternative ingredients in recirculating aquaculture systems [RAS]).
- Utilization of microbial methods/techniques to create nutritional products for aquatic species.
- Feed and ingredient processing technologies and feed management approaches that improve feed digestibility and reduce waste production.
- Examination of formulation and processing driven effects on feed stability, quality, and food safety. Examples include oxidation and microbial contamination.

Outreach

A funded participant (PI) responsible for outreach must be included as a member of the Work Group from the inception of the project. The goal is that the outreach PI works together with all members of the Work Group from the pre-proposal stage to the conclusion of the project, so that they are able to create products that are informative and effective for all stakeholders. Outreach products should target the states and/or industries that the project addresses. Examples of outreach products include: publications, workshops for interested industry and regulatory members, presentations at scientific meetings, and any other products that provide information on project results. Products should also include information for consumers, such as FAQ sheets and infographics. It is important to note that a minimum of one outreach publication is required for all WRAC-funded projects.

Duration & Funding Level

Anticipated project duration is 1–4 years. Requests from WRAC should not exceed $200,000 per year. In-kind and leveraged funds from industry, academia, and other entities are strongly encouraged.

5. Improve Product Quality and Safety

Research Priority Contacts

All interested investigators are highly encouraged to contact a WRAC representative:

- Leo Ray (leoray@fishbreedersofidaho.com)
- Sean Nepper (sean.nepper@riverence.com)

Research Priority

Producing a quality aquaculture product does not occur by accident. It is the result of good management practices before, during, and after harvest. Management practices have been shown to affect flavor, quality, texture, shelf life, and consumer acceptability. Product quality can be negatively impacted by a lack of understanding of food science, logistics, technology, and workforce training. There is a need to develop new quality control measures and practices, especially for new products.

Solution

We are seeking proposals that identify and define methodologies that improve product quality to further differentiate and enhance US farm-raised products to compete in the global aquaculture marketplace. A series of science-based guidelines should be developed that address specific practices that affect product quality.

Examples for consideration may include, but are not limited to:

- Husbandry practices
- Off flavor mitigation
- Harvest practices (to include pre and post-harvest)
- Rapid cooling/processing
- Packaging
- Supply chain/distribution channels
- Product quality
- Increased shelf life
- Value-added products
- Food safety guidance
- Public health and shellfish safety
- Early detection, prediction and/or monitoring of HAB (harmful algae blooms) and human pathogens

Proposals may address food science principles and solutions at any stage—from farming operations to commercial processing, distribution, and retail market—to maintain optimum product quality. Projects could focus on awareness of factors that contribute to negative fish flavor and/or quality, with a mind-set towards prevention and maintaining optimum quality throughout the supply chain, from farmer to consumer, using a scientifically grounded management approach. Research may address improvements of existing practices and/or developing new finfish, shellfish, and algae processing technologies or methods. Deliverables should provide scientific data, analysis, and tools that could include measuring effects of water quality, feed, pond sanitation, harvest, temperature fluctuations, storage, and delivery throughout the supply chain. Projects could highlight the scientific linkages between operations practices and the quality experienced by the distributor, customer, and the end consumer. The goal is to focus on desired quality outcomes and develop recommendations for production and processing improvements to enhance the quality, perception and reputation of western region aquaculture products.

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5. Improve Product Quality and Safety (continued)

Examples of potential solutions include:

- Correlation of trout age or size with overall texture and flavor quality.
- Awareness of temperature fluctuations throughout manufacturing and distribution and their impacts on quality.
- Modern methodologies and approaches to increase caviar texture pre- and post-harvest.
- Impact of water quality on flavor freshness.
- Overall health of aquatic plants/algae and animals and impact on off-flavors and overall sensory quality.
- Post-harvest impacts on product quality.

Outreach

A funded participant (PI) responsible for outreach must be included as a member of the Work Group from the inception of the project. The goal is that the outreach PI works together with all members of the Work Group from the pre-proposal stage to the conclusion of the project, so that they are able to create products that are informative and effective for all stakeholders. Outreach products should target the states and/or industries that the project addresses. Examples of outreach products include: publications, workshops for interested industry and regulatory members, presentations at scientific meetings, and any other products that provide information on project results. Products should also include information for consumers, such as FAQ sheets and infographics. It is important to note that a minimum of one outreach publication is required for all WRAC-funded projects.

Duration and Funding Level

Anticipated project duration is 1–4 years with up to $200,000/year requested from WRAC. In-kind and leveraged funds from industry, academia, and other entities are encouraged. Smaller demonstration projects are also encouraged.

6. Improvements in Hatchery Technology and Techniques

Research Priority Contacts

All interested investigators are highly encouraged to contact a WRAC representative:

- Finfish: Sean Nepper (sean.nepper@riverence.com)
- Shellfish: Sue Cudd (whiskeycreek1@mac.com)
- Aquatic plants and algae: Dallas Weaver (deweaver@mac.com)

Research Priority

Modern hatcheries require controlled, specialized environments and techniques for breeding and culture of sensitive early life stages. We are seeking new or improved methodologies and approaches to hatchery management for aquatic animals and algae. In the case of aquatic animals, we invite proposals related to broodstock management and spawning, larval production and health, and improving hatchery techniques and systems. Special consideration will be given to projects related to batch spawning finfish. In the case of algae, research is needed in areas of spore and gametophyte production and health, seed format, and outplanting solutions.

Solution

This priority statement invites research for use in hatcheries that develops and/or quantifies performance as it relates to:

- Developing new or improved reproductive techniques, including manipulation for extended or out-of-season spawning for finfish and shellfish.
- Broodstock collection and selection, breeding, sporulation and gametophyte propagation for algae.
- Optimizing culture conditions and methods for aquatic species with an emphasis on increasing survival and quality of early life stages.
- Evaluation of new technologies including, but not limited to artificial intelligence, optical systems, automated controls, machine vision, and automated monitoring and control.
- Water conditioning/treatment for ideal culture conditions, including recirculation techniques.

Outreach

A funded participant (PI) responsible for outreach must be included as a member of the Work Group from the inception of the project. The goal is that the outreach PI works together with all members of the Work Group from the pre-proposal stage to the conclusion of the project, so that they are able to create products that are informative and effective for all stakeholders. Outreach products should target the states and/or industries that the project addresses. Examples of outreach products include: publications, workshops for interested industry and regulatory members, presentations at scientific meetings, and any other products that provide information on project results. Products should also include information for consumers, such as FAQ sheets and infographics. It is important to note that a minimum of one outreach publication is required for all WRAC-funded projects.

Duration and Funding Level

Project duration can be up to 4 years, and request from WRAC should not exceed $200,000/year. In-kind and leveraged funds from industry, academia, and other entities are strongly encouraged.

7. New and Emerging Species

Research Priority Contacts

All interested investigators are highly encouraged to contact a WRAC representative:

- Freshwater: Leo Ray (leoray@fishbreedersofidaho.com)
- Saltwater: Jeff Hetrick (jeff@crrc.alaska.org)

Research Priority

For the US aquaculture industry to remain competitive on the world stage and for the US to decrease reliance on imported seafood products, the culture of new and alternative marine and freshwater species, or strains of fish, shellfish, and aquatic plants, is needed. Aquaculture operations may need to diversify and increase the number the species under production to meet market pressure from imports. Opportunities may exist for polyculture or production of new species and strains that can be reared sustainably and compete at a commercial scale. Existing aquaculture operations must respond to changing economic circumstances and environmental regulations that require improved production efficiency. Alternative species used in isolation or combination with other species may provide economic opportunity and increase efficiencies, species, or products that address known sustainability issues.

Solution

This priority statement is aimed at proposals that address any needs related to development of alternative aquaculture species or strains that have market potential. Research may be specific and targeted to one or two specific objectives that would address any bottleneck preventing commercial development (i.e., seed-stock production, disease concerns, nutrition, etc.). Proposals should address new or emerging species for existing aquaculture industries or systems and/or new or underutilized resources. Priority alternative species would be those that can provide an economic benefit and/or encourage development in states with minimal aquaculture.

Examples for consideration may include, but are not limited to:

- Production of species or strains of potential economic value that currently are not being farmed commercially in the western states. Examples include:
  - Freshwater or marine fish (could include tropical fish)
  - Freshwater or marine shellfish
  - Crustaceans and other invertebrates
  - Aquatic plants/algae
  - Existing species in novel environments (e.g., brackish water)
- Polyculture of multiple species of commercial value, including multi-trophic systems.
- Enhancing capture fishery products utilizing aquaculture systems.

Outreach

A funded participant (PI) responsible for outreach must be included as a member of the Work Group from the inception of the project. The goal is that the outreach PI works together with all members of the Work Group from the pre-proposal stage to the conclusion of the project, so that they are able to create products that are informative and effective for all stakeholders. Outreach products should target the states and/or industries that the project addresses. Examples of outreach products include: publications, workshops for interested industry and regulatory members, presentations at scientific meetings, and any other products that provide information on project results. Products should also include information for consumers, such as FAQ sheets and infographics. It is important to note that a minimum of one outreach publication is required for all WRAC-funded projects.

Duration and Funding Level

Anticipated project duration is up to 4 years, and requests from WRAC should not exceed $200,000/year. In-kind and leveraged funds from industry, academia and other entities are strongly encouraged.

8. Non-antibiotic Solutions to Control or Prevent Infectious or Non-infectious Diseases and Stressors Affecting Aquaculture Production

Research Priority Contacts

All interested investigators are highly encouraged to contact a WRAC representative:

- Shellfish: Sue Cudd (whiskeycreek1@mac.com) or David Beugli (wghoga@gmail.com)
- Finfish: Sean Nepper (sean.nepper@riverence.com)

Research Priority

Infectious and non-infectious disease can significantly affect production in aquaculture due to direct mortality or reduced performance. In the western region, aquaculture is characterized by a large diversity of farmed species and production systems for both freshwater and marine species. Losses due to disease at fish and shellfish operations require further investigation. Examples of infectious diseases and pathogens that impact aquaculture include but are not limited to: Salmincola (copepods), *Flavobacteriosis*, IHNV, *Vibrio* sp., and *Aeromonas* sp. infections. Examples of mortality associated with non-infectious diseases or stressors include but are not limited to: shellfish mortality events (e.g., oyster summer mortality), chronic sturgeon mortality, harmful algal blooms, and ocean acidification.

Solution

There is a need to identify more sustainable and environmentally friendly solutions for fish and shellfish health and for farm management. Research should develop new and practical solutions (e.g., early detection methods, new proactive farm management approaches, new or improved vaccines, immunostimulants, probiotics/beneficial bacteria, and/or antimicrobial peptides, etc.) that address specific issues. Proposals should identify and address the research priority in the context of impacts to the industry. Therefore, it is recommended that Principal Investigators (PIs) establish close partnerships with industry at the pre-proposal stage. This will ensure that the research and solutions have strong industry support and practical recommendations to improve production will be developed.

Outreach

A funded participant (PI) responsible for outreach must be included as a member of the Work Group from the inception of the project. The goal is that the outreach PI works together with all members of the Work Group from the pre-proposal stage to the conclusion of the project, so that they are able to create products that are informative and effective for all stakeholders. Outreach products should target the states and/or industries that the project addresses. Examples of outreach products include: publications, workshops for interested industry and regulatory members, presentations at scientific meetings, and any other products that provide information on project results. Products should also include information for consumers, such as FAQ sheets and infographics. It is important to note that a minimum of one outreach publication is required for all WRAC-funded projects.

Duration and Funding Level

Project duration of up to 4 years and up to $200,000/year will be considered, but shorter projects are encouraged. In-kind and matching funds from industry, academia, and other entities are strongly encouraged.

9. Reducing Impacts of Aquatic Nuisance Species

Research Priority Contactws

All interested investigators are highly encouraged to contact a WRAC representative:

- Saltwater: Dave Beugli (wghoga@gmail.com)
- Freshwater: Jeremy Liley (jeremy@lileyfisheries.com)

Research Priority

Human and environmental factors can facilitate the introduction and propagation of aquatic nuisance species (ANS). Changing ocean conditions and the interstate movement of animals pose other challenges to ANS management. There is an immediate need to evaluate environmental factors that mitigate the impact of these organisms and subsequent need to develop tools and management strategies to directly influence ANS recruitment. Of primary concern is the study of new and emerging issues that have economic consequences to finfish, shellfish, and seaweed production to inform decision-making and potential solutions.

Aquatic nuisance species of economic concern to growers could potentially include: green crab, worms, moon snail, oyster drill, burrowing shrimp, non-native eelgrass, boring clams, tunicates, parasites, epiphytes, Dreissenid mussels, and other biofouling organisms.

Solution

WRAC requests proposals that address solutions for the control and management of ANS that directly impact finfish, shellfish and seaweed production. Although understanding how environmental conditions can help mitigate ANS is important in defining impacts, a successful proposal should also include hypothesis-driven research that works toward development of control mechanisms. Proposals must include industry partners and address a solution for a specific problem. Proposals must also include a significant in-field component that has regional applicability. Applied research objectives are favored although basic research questions will still be considered if addressing finfish, shellfish and seaweed production needs.

Outreach

A funded participant (PI) responsible for outreach must be included as a member of the Work Group from the inception of the project. The goal is that the outreach PI works together with all members of the Work Group from the pre-proposal stage to the conclusion of the project, so that they are able to create products that are informative and effective for all stakeholders. Outreach products should target the states and/or industries that the project addresses. Examples of outreach products include: publications, workshops for interested industry and regulatory members, presentations at scientific meetings, and any other products that provide information on project results. Products should also include information for consumers, such as FAQ sheets and infographics. It is important to note that a minimum of one outreach publication is required for all WRAC-funded projects.

Duration and Funding Level

Anticipated project duration is 1–4 years. Requests from WRAC should not exceed $200,000 per year. In- kind and leveraged funds from industry, academia, and other entities are strongly encouraged.

10. Transforming the Aquaculture Industry Through Digital Innovations

Research Priority Contact

All interested investigators are highly encouraged to contact a WRAC representative:

- Dallas Weaver (deweaver@mac.com)
- Jackie Zimmerman (jacqueline.zimmerman@merck.com)

Research Priority

The aquaculture industry could greatly benefit from integrating technology and engineering solutions that increase efficiency, streamline production, and increase profitability. This project could test new technology or examine existing technology that is not currently implemented in specific aquaculture sectors. Projects may include automation management tools and process control solutions related to production or processing of farmed aquatic species. Examples include: biosecurity, traceability, husbandry, fish quality, efficient use of water (e.g., aquaponics, recirculation systems, water quality, and water treatment systems), behavioral changes related to health status of aquatic organisms, production management, harvest, or transportation systems. Integrative projects that involve industry and academic partners with expertise in technology implementation (engineering, robotics, computer science, biotech, industry partners) are highly encouraged.

Solution

Applicants should propose a project to test systems or technology in an aquaculture application, comparing productivity, profitability, or overall utility. Transfer of existing technology to aquaculture would be appropriate. Commercially relevant trials are to be included within the scope of work to demonstrate targeted benefits or improvements through comparison with current systems, including cost effectiveness, regulatory compliance, and data management. Applicants are expected to work closely with an industry advisor/ partner throughout the duration of the project. Regional cooperation is required and regional applicability mandatory. Metrics that show benefits must be included.

Examples include but are not limited to:

- Designing and implementing technological solutions (i.e., artificial intelligence, machine learning, database management) tailored to the aquaculture environment.
- Developing data analytics tools, remote sensing, or computer vision to optimize feeding, water quality management, disease detection, and stock monitoring.
- Integrating remote sensing technologies, Internet of Things (IoT) devices, and automation to enhance production efficiency.
- Ensuring data security, privacy, and compliance with relevant regulations.
- Decrease labor and overhead costs to increase small farm profitability.

Outreach

A funded participant (PI) responsible for outreach must be included as a member of the Work Group from the inception of the project. The goal is that the outreach PI works together with all members of the Work Group from the pre-proposal stage to the conclusion of the project, so that they are able to create products that are informative and effective for all stakeholders. Outreach products should target the states and/or industries that the project addresses. Examples of outreach products include: publications, workshops for interested industry and regulatory members, presentations at scientific meetings, and any other products that provide information on project results. Products should also include information for consumers, such as FAQ sheets and infographics. It is important to note that a minimum of one outreach publication is required for all WRAC-funded projects.

Duration and Funding Level

Anticipated project duration is 1–3 years, with up to $200,000/year requested from WRAC. In-kind and leveraged funds from industry, academia, and other entities are encouraged.

Pre-Proposal Guidelines

(*adapted from the WRAC Manual of Operations, Appendix B*)

WRAC policy requires that each project include participation by two or more states located within the western region (Alaska, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming). Research partnerships may be formed among all elements of federal, state, and local government; public institutions; and private sectors as long as appropriate research activities are conducted in at least two of the above states.

Components

The Pre-Proposal must include:

Checklist (page 18)
- The lead PI must check each box and sign at the bottom of the Checklist to confirm the inclusion of each element.

Cover Page (page 19)

Table of Contents (page 20)

Summary Budget (page 21)

Biographies (page 22)

Outreach and Evaluation Plan (page 23)

Note: For a sample Pre-Proposal, contact the WRAC office at jkhahn@uw.edu.

Requirements

A Pre-Proposal must meet the following requirements or it will not be accepted:

- Received by the announced deadline. Electronic submission by the due date qualifies as meeting the deadline.
- Each element is addressed in the order presented on the Checklist.
- Include checked and signed Checklist (by the lead Principal Investigator [PI]).
- Cover page signed by the lead PI.

Length

The body of the project narrative should be a maximum of five (5) pages—this limit does not apply to the reference, budget, or biography pages.

Submission

1. Submit the entire Pre-Proposal as a single PDF (Excel budget sheets may be sent separately) to the WRAC Administrative Office by email to Julie Hahn at jkhahn@uw.edu. Electronic signatures are allowed.
2. If you have any questions or need any further information, contact Julie Hahn at jkhahn@uw.edu.

Format/Content

Cover Page: Title of the project, participating institutions, research and outreach investigators, Industry Advisor, and suggested Project Monitor. The cover page must be signed and dated by the lead PI (page 19).

Table of Contents: Follow the format indicated (page 20).

Project Narrative:

Justification: Include a brief statement of the benefits to be gained by applying the anticipated results of the project.

Related, Current, and Previous Work: Assess the current state of knowledge concerning the priority or opportunity to be assessed and include a brief summary of previous applicable research.

Objectives: List the objectives to be achieved, including those of research and outreach.

Procedures: Provide a detailed description of the approach(es) to address the problem or solution, striking a balance between information and brevity in the description. If a multi-year project is proposed, indicate the activity that would take place each year.

Outreach and Evaluation Plan: (page 23)

Resource and Facility Commitment from each Institution: List the institutions involved in the project and the resources that are to be used from each.

Note: Pre-Proposals should show industry participation in the form of contributions of funds, matching funds, and in-kind services.

References: Include the references that are included in the Pre-Proposal text.

Budgets: Include preliminary budgets for each year proposed, according to the spreadsheet format indicated on (Summary Budget, page 21, Budget Spreadsheets, pages 24–25). Pre-Proposals **must contain** itemized budget breakdowns for each budget item for each PI.

Note: Per Section 1473 of Public Law 95-113, **indirect costs and tuition remission cost are NOT allowable on any portion of the sub-awards of the WRAC grant from USDA/NIFA.**

Industry and Academic Salary Support

- ***Industry:*** No industry PI salary is allowed. Industry technician funding is allowed with adequate justification; however, this may affect the competitiveness of the proposal.
- ***Academic:*** Payment of percentages of faculty salaries from WRAC funds is **strongly discouraged** by the Board of Directors, although it is recognized that in some cases it is essential for the success of the project. Up to one month's academic salary under certain circumstances with strong justification can be requested, but this may affect competitiveness of the proposal.

  Include specific breakdown of any salary funds required (i.e., who will receive the salary: Principal Investigators, Graduate Student/Research Assistant, etc.).

Biographies: Provide a one-page biography for each research and outreach investigator according to the format indicated (page 22).

Multi-state institution requirement met? See page 2 for details regarding regional requirements.

Completion of previous outreach objectives: If your checklist indicates lack of completion of outreach objectives for any WRAC-funded project in which a listed investigator has served as Work Group Chair within the last five years, provide a detailed justification/explanation (not included in the 5-page narrative page limit).

Pre-Proposal Guideline: Checklist

Note: The PI must check each box below to confirm inclusion of each element and then sign at the bottom.

Page # (if applicable)	***Does the Pre-Proposal include/identify the following?***
	Required Elements ❑ **Cover Page**: to include the following: • Title • Funding Levels • Submission Date • Duration of Project • Industry Advisor • Suggested Project Monitor • Principal Investigator responsible for Outreach • Principal Investigators and institutions • Statement matching Pre-Proposal to identified Research Priority Statement ❑ **Table of Contents** ❑ **Project Narrative**: to include the following: • Justification • Objectives • Outreach and Evaluation Plan (*page 23 for details*) • Resource/Facility Commitments • Related Current and Previous Work • Procedures ❑ **References** ❑ **Budgets** (s*ee Budget Section below*) ❑ **Biographies**
	❑ **Multi-state/institution requirement met? YES ___ NO ___** (With justification provided)
	❑ **Page limit is 5 pages for the Project Narrative portion.** (Page limit does NOT include the reference, budget, biography, single-state justification, or incomplete outreach project justification pages.)
	❑ **Has any listed investigator served as Work Group Chair for a WRAC-funded project in the last five years? YES ___ NO ___** If "YES," have all of the outreach objectives been complete for the project(s)? **YES ___ NO ___** If "NO," has a detailed justification/explanation of why these have not been completed been provided? **YES ___ NO ___**
	Outreach Components (*Follow the guidelines in Pre-Proposal Guidelines: Outreach and Evaluation Plan, page 23*)
	Are the following Outreach elements included and clearly identified? ❑ **Investigator responsible for Outreach** within the western region identified and consulted in the preparation of the Pre-Proposal? (You may contact WRAC Extension Subcommittee members listed on the WRAC website; there is no requirement for the PI responsible for Outreach to be a Subcommittee member.*)*
	For each Objective are the following identified: ❑ **Target Audiences**; Who will benefit from receiving project information? ❑ **Intended Learning Outcomes**; What will be learned? ❑ **Intended Management and/or Behavioral Outcomes** ❑ **Procedures to Achieve Intended Outcomes:** • Inputs: Who will do what and at what cost? • Outputs: What products will be developed and at what cost? • What publications, workshops, demonstrations, etc., will be developed? ❑ **Evaluation Plan**
	Budget
	❑ **Follow the format of the Summary Budget** (page 21). Sample Excel budget sheets are available on the website.
	❑ **For each year, follow the format of the Itemized Budget Spreadsheet** (pages 24–25)**. Specify who will receive salary** (e.g., principal investigator, graduate student/research assistant, etc.) Sample Excel budget sheets are available on the website. Include any Excel sheets into your final PDF submission.

If the WRAC Administrative Office cannot verify inclusion of any element, the Pre-Proposal will not be accepted.

Principal Investigator Signature _____ **Date** _____

Pre-Proposal Guidelines: Cover Page Format

Project Title:

Submission Date (mo/yr):

Duration of Project (number of years):

Funding Levels: First Year Request:
Second Year Request:
Third Year Request:
Fourth Year Request:
Total Request:

Statement aligning Pre-Proposal to identified Priority Statement(s)

Participating Investigators
(*List all Principal Investigators*)
Lead Principal Investigator (name and email address)
Institution (name and address)

Other Principal Investigators (names and email addresses)
Institution (names and addresses)

Principal Investigator responsible for Outreach (name and email address)
Institution (name and address)

Industry Advisor (name and email address)
Institution (name and address)

Suggested Project Monitor (name and email address)
Institution (name and address)
(*Subject to approval by Board of Directors*)

Signature of Lead Principal Investigator

Date Submitted

Pre-Proposal Guidelines: Table of Contents

Project Title:

TABLE OF CONTENTS

Page #

Pre-Proposal Guidelines: Summary Budget

PROPOSED SUMMARY BUDGET for YEAR _____
for All Participating Institutions
(additional budget pages should be prepared
for each year of proposed project)

Project Title:

	Institution (PI name)	Institution (PI name)	Institution (PI name)	Institution (PI name)	PROJECT TOTAL
Salaries					
Benefits					
Supplies					
Equipment					
Other					
TOTAL					

Notes:
Include specific breakdown of any **salary funds** required (i.e., who will receive the salary: Principal Investigators, Graduate Student/Research Assistant, etc.). ***Payment of percentages of faculty salaries from WRAC funds is strongly discouraged by the Board of Directors, although it is recognized that in some cases it is essential for the success of the project.***

In addition to the summary budget (example above), Pre-Proposals **must contain** itemized budget breakdowns for each budget item for each PI. The budget sheets **must be generated using the spreadsheet format** that is available on the WRAC website for download at: https://wracuw.org/current-funding-opportunities. (Samples of blank and filled-in itemized budget spreadsheets are included at the end of this document).

Pre-Proposal Guidelines: Biography

(One page per person)

Name:

Title:

Department:

Institution:

Address:

Telephone/FAX:

Email:

Education: (degree, name of institution, year; ***please list most recent first***)

Positions held: (title, name of institution, employment dates; ***please list most recent first***)

Professional memberships:

Selected publications: (***please list most recent first***)

Pre-Proposal Guidelines: Outreach and Evaluation Plan

Extension Outreach Criteria for WRAC Project Objectives

One of the principal goals of the Regional Aquaculture Center program is the application of project results for the benefit of industry; yet, without adequate and early attention to the outreach component of WRAC projects, research results and outcomes may be of limited value, or completely unknown to producers. The Board recognizes that a more detailed account of outreach plans at the proposal stage helps to identify project audiences, outcomes, and evaluation methods. This essential information ensures that results meet industry needs and that producers receive pertinent information that might be applied in their operations.

All Pre-Proposals must contain a comprehensive outreach plan containing the following information for ***each*** research objective:

Objective: [state research objective]

1. **Target Audience:** Who will receive the information generated?
2. **Intended Learning Outcomes:** What will be learned?
3. **Intended Management and/or Behavioral Outcomes:** What will be the management or behavioral outcomes?
4. **Procedures to Achieve Intended Outcomes**

   Inputs
   - Who will do what and at what cost?
   - How will target audience be contacted?

   Outputs (Outcomes?)
   - What products will be developed and at what cost?
   - What publications, workshops, demonstrations, etc. will be developed?
5. **Evaluation Plan:** What methods will be used to measure what learning or behavioral changes have occurred?

Outreach Publications

- The required outreach publication(s) portion of WRAC grants is funded through WRAC core funds and WRAC receives primary acknowledgment.
- The core funding for the WRAC outreach publication(s) may be supplemented by other funding sources, with acknowledgment of WRAC project funding.
- Ancillary funding may be applied in support of additional outreach activities.
- A minimum of one outreach publication must be produced for any multi-year grant award, and the publication must address the associated research component.
- The primary outreach publication should cover the project in depth (a flyer or fact sheet is not sufficient). The publication should clearly indicate the benefits to the targeted audience.

Sample of Blank Required Itemized Budget Spreadsheet

Excel sample: https://wracuw.org/current-funding-opportunities

INSTITUTION:	
PRINCIPAL INVESTIGATOR:	
SALARIES:	**$0**
BENEFITS:	**$0**
TRAVEL:	**$0**
SUPPLIES:	**$0**
EQUIPMENT:	**$0**
OTHER DIRECT COSTS:	**$0**
TOTAL:	**$0**

Sample of Filled-In Required Itemized Budget Spreadsheet

Excel sample: https://wracuw.org/current-funding-opportunities

INSTITUTION:	**University of Washington**	
PRINCIPAL INVESTIGATOR:	**Dr. John Smith**	
SALARIES:		**$5,000**
Research Technician (0.08 FTE)	**$3,000**	
Graduate Student (12 months @ 50%)	**$2,000**	
BENEFITS:		**$490**
Research Technician (@ 9%)	**$270**	
Graduate Student (@ 11%)	**$220**	
TRAVEL:		**$1,850**
WAS Meeting: room (3 days x $100)	**$300**	
Per Diem	**$350**	
Airfare	**$500**	
Work Group Meeting–Idaho (3 days x $100)	**$300**	
Per Diem (3 days)	**$150**	
Airfare	**$250**	
SUPPLIES:		**$1,600**
Chemicals	**$500**	
Fish Feeds	**$600**	
Reagents & vitamins for feeds	**$300**	
Glassware	**$200**	
EQUIPMENT:		**$0**
OTHER DIRECT COSTS:		**$800**
Publication – Page charges (4 pg @ $50/p)	**$200**	
Telephone	**$100**	
Photocopying & Printing	**$500**	
TOTAL:		**$9740**

The Western Regional Aquaculture Center (WRAC) is one of five centers in the United States. Developed to take advantage of the best aquaculture science, educational skills, and facilities within a twelve-state area, WRAC works to enhance viable and profitable commercial aquaculture production in the U.S. for the benefit of producers, consumers, and the American economy.

To learn more about WRAC, go to the website at: https://wracuw.org/

Contact WRAC at:
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University of Washington
Box 355020
Seattle, WA 98195-5020

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