



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 FY2019



United States Department of Agriculture
National Institute of Food and Agriculture

REQUEST FOR WRAC REGIONAL RESEARCH AND OUTREACH PROJECT PRE-PROPOSALS

for FUNDING YEAR 2019 (FY2019)

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For more information, go to the WRAC website at <http://depts.washington.edu/wracuw/> and click on *Funding Opportunities*.

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Pre-Proposals are due by 5 PM, Friday, April 6, 2018.

Western Regional Aquaculture Center Request for Regional Research and Outreach Project Pre-Proposals for Funding Year 2019

Overview

Proposed Research Areas

Based on extensive input from aquaculture industry, extension and research representatives throughout the region, the Western Regional Aquaculture Center (WRAC) is seeking Pre-Proposals for ten research areas, listed here in no specific order or rank:

1. Reducing Impacts of Aquatic Nuisance Species on Shellfish Aquaculture
2. New and Emerging Species
3. Emerging and Re-emerging Diseases Affecting Aquaculture Production
4. Aquaculture Opportunities Through Genetics
5. Alternatives to Antibiotics and Chemicals for Disease Control and Prevention
6. Economic Value of Aquaculture in Western United States
7. Aquaculture: Applied Technology Solutions
8. Diet Nutrition/Innovation
9. Aquaculture Water Quality
10. Micro- and Macro-plastics in the Marine Environment Associated with Shellfish Aquaculture

Project Submission & Review Schedule

Pre-Proposals are due by	5 PM, Friday, April 6, 2018
Notification of Pre-Proposal review outcome	Late May
Full proposals due by 5:00p p.m.	Mid-July
External, IAC/TC, and Board reviews	July through November
Notification of funding decisions	Early December
Projects scheduled to begin 2019 (dependent on release of funds)	September 1

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.
- 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.

Specific Criteria for Regional Projects

(Section 3.3 from WRAC Manual of Operations)

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 activities within two states and the most effective use of resources within the western region. However, depending on the nature of the problem, if the research expertise to solve the problem resides in a single state, and the results will have significant positive impact on multi-state industries, an exception for funding can be made. Strong justification is required. Priority will be given to projects with multi-state research approaches.
- Is likely to attract additional support for research and/or outreach on the problem, 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 the solution to a problem of fundamental importance or fill an information-gap in knowledge from the standpoint of present and future aquaculture in the western region.
- Contain an outreach component with defined objectives and deliverables according to Appendix B, Attachment F - Outreach and Evaluation Plan (see B8).

Research on the Problem

- Requires more scientific labor, equipment, and facilities than are generally available at individual research institutions. (Priority will be given to projects with multi-state research approaches.)
- 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 Extension Outreach components are included in the Pre-Proposal, please see Appendix B (page B8).

Other Information

- Guidelines for development of Pre-Proposals and the Pre-Proposal format are enclosed for your information (see pages B1–B8). These guidelines are also posted on the WRAC website: <http://depts.washington.edu/wracuw/>
- Please note that while each of the priority statements indicate 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 *Guidelines section [attached]* for specific instructions)

Submission

1. Email submission is preferred. Send **both** PDF and WORD versions (and any Excel spreadsheets) to the WRAC Administrative Office at jkhahn@uw.edu
2. Mailing address, in case you are unable to email your document.

Mail one (1) signed, printed copy to:

Western Regional Aquaculture Center

c/o Julie Hahn

University of Washington

School of Aquatic and Fishery Sciences

Box 355020

Seattle, WA 98195-5020

For deliveries that require a street address, use:

Western Regional Aquaculture Center

c/o Julie Hahn

University of Washington

School of Aquatic and Fishery Sciences

1122 NE Boat Street

Seattle, WA 98105

Deadline for Submission of Pre-Proposals is 5 PM, Friday, April 6, 2018.

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 what requirements are not met. Thus, the authors will have time to adjust and re-submit their Pre-Proposals before the final deadline.
- WRAC strongly encourages investigators who are submitting a Pre-Proposal for the first time to consult with the relevant contact person listed for each problem statement. Executive Director Graham Young (grahamy@uw.edu) and Program Manager Julie Hahn (jkhahn@uw.edu) 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 PM on Friday, April 6, 2018.

Problem Statements for Pre-Proposals—FY2019

Based on extensive input from aquaculture industry, extension and research representatives throughout the western region, WRAC is seeking Pre-Proposals for ten research areas listed here by title, in no specific order or rank. The complete statements are linked to the title and by page number.

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1. Reducing Impacts of Aquatic Nuisance Species on Shellfish Aquaculture

Problem

For the past century or more, west coast shellfish aquaculture has been carried out on extensive tidal flats. The rapidly changing environment can facilitate the introduction and propagation of aquatic nuisance species on shellfish culture. There exists an immediate need to mitigate the impact of these organisms. Example organisms of immediate concern include Japanese eelgrass (*Zostera japonica*) and ghost shrimp (*Neotrypaea californiensis*).

- **Japanese Eelgrass (*Zostera japonica*)**
Potential tradeoffs between the economic value of shellfish and potential costs and benefits of non-native eelgrass have caught the attention of regulators charged with managing marine waters, coastal habitats, and threatened species. However, in some places, non-native, invasive Japanese eelgrass (*Zostera japonica*) modifies existing native eelgrass (*Zostera marina*) beds. The uncertainty regarding the extent and overall effects of Japanese eelgrass on native eelgrass has created problems for both regulators and the shellfish industry. Japanese eelgrass has spread to many coastal estuaries, where it forms thick blankets at low tide, affecting water drainage, sediment temperature, shellfish operations, and nutrient composition. Regulatory response has varied among states, creating significant problems for growers in areas where it is protected. Regionally, the bivalve shellfish aquaculture industry faces new and existing regulations that restrict expansion into eelgrass, both native and non-native, which can curtail existing shellfish operations.
- **Burrowing Shrimp (*Neotrypaea californiensis*)**
Burrowing shrimp species cause major habitat modifications in benthic estuarine habitats on the west coast, but effective management strategies are currently limited. Additional work is needed to develop new tools to better manage burrowing shrimp in shellfish culture areas.
- **Emerging Aquatic Invasive Species**
Non-native and native species are capable of affecting production of shellfish in coastal estuaries. New and emerging issues may require information to inform decision-making, potential solutions, and management actions.

Solution

WRAC requests proposals that address solutions for the control and management of aquatic invasive species that directly impact shellfish production. Proposals must include industry partners and address a solution for a specific problem. Proposals must include a significant in-field component that has regional applicability and must address how the proposed research will inform regulatory responses and associated issues. Applied research objectives are favored although basic research questions will still be considered if addressing shellfish production needs.

Outreach

A funded participant responsible for outreach must be included as part of the project Work Group from the inception of the project. A minimum of one outreach publication is required for all WRAC-funded projects. Expected outreach products include presentations to industry, agencies, and the public. The content of the outreach should include the problem and potential solution that restores the habitat to a prior multi-use state.

Duration and Funding Level

Anticipated project duration is up to four years. Funding requests should not exceed \$120,000 per year. In-kind and leveraged funds from industry, academia, and other entities are strongly encouraged.

Contact

Jim Gibbons (jlgibbons@seattleshellfish.com) may be contacted for further information on this statement.

2. New and Emerging Species

Problem

Aquaculture is expanding rapidly worldwide to meet seafood demand. For the US aquaculture industry to remain competitive on the world stage and decrease reliance on imported seafood products into the US, culture of new or alternative marine and freshwater species of fish, shellfish, and aquatic plants is needed. Operations need to diversify production of species to meet market pressures from imports. Aquaculture opportunities may exist for polyculture or production of new species 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.

Solution

This priority area seeks proposals that address any needs related to development of alternative aquaculture species 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., seedstock production, disease concerns, nutrition, etc.). Projects should propose new or emerging species for existing aquaculture industries or systems and/or new or underutilized resources. Priority alternative species are those that can provide an economic benefit and/or encourage development in states with minimal aquaculture. An example would be mitigating an adverse environmental impact from another species in cultivation. Examples for consideration may include, but are not limited to:

- Production of a species of potential commercial value that is currently not being commercially produced in the western states. Examples include:
 - Freshwater or marine fish (could include tropical fish)
 - Freshwater or marine shellfish
 - Crustaceans and other invertebrates
 - Aquatic plants (macro algae)
 - Existing species in novel environments (brackish water)
- Polyculture of multiple species of commercial value, including multitrophic.
- Development of marine or freshwater hatchery, larval, nursery rearing, and grow out technologies for new or emerging species.

Outreach

A funded participant responsible for outreach must be included as part of the project Work Group from the inception of the project. A minimum of one outreach publication is required for all WRAC-funded projects. Outreach products should target the states and/or industries that the project addresses.

Outreach products should include information for consumers such as FAQ sheets and infographics, where applicable. Expected products of the research include outreach publications, workshops for interested industry and regulatory members, presentations at scientific meetings and any other products that would provide information on project results. Applicants are required to develop proposals that would involve cooperating with extension personnel and/or aquaculture coordinators.

Duration and Funding Level

Anticipated project duration would be up to four years. Funding requests should not exceed \$120,000 per year. In-kind and leveraged funds from industry, academia, and other entities are strongly encouraged.

Contact

Leo Ray (leoray@fishbreedersofidaho.com) can be contacted for further information about this problem.

3. Emerging and Re-Emerging Diseases Affecting Aquaculture Production

Problem

Disease occurrence in aquaculture results in significant economic impact due to direct mortality or reduced performance. In the western region, aquaculture is characterized by a large diversity of farmed species and production systems. Emerging and re-emerging diseases and disorders may cause substantial losses to commercial fish and shellfish operations. For example, environmental/ bacterial gill disease in rainbow trout was traditionally considered a disease of small trout during early rearing, but over the past several years, has become a problem with larger fish. Fish losses are mostly chronic; however, given the size of the fish, the financial loss is much greater. In acute cases, the loss rate may exceed 20% in one day. In addition to direct losses, growth rate decreases and feed conversion ratios increase causing further financial loss. In the long run, production targets are not met, resulting in insufficient supply for customers. Another example is shellfish herpes virus: since 2008, massive mortality outbreaks have occurred on many *Crassostrea gigas* farms in France, Ireland, the United Kingdom, and Australia. Examples of other diseases and pathogens that impact aquaculture include, but are not limited to: strawberry disease, Flavobacteriosis, PKD, chronic sturgeon mortality, and *Tenacibaculum maritimum*.

Solution

Research should be specific and targeted to areas that increase our knowledge and understanding of emerging and re-emerging diseases and potentially lead to management solutions (i.e., control/prevention tools, further pathogen characterization, husbandry changes, nutrition). Proposals should identify and address the problem in the context of impacts to the industry. Therefore, it is recommended that PIs establish close partnerships with industry to ensure that the pathogen or disease is economically applicable.

Outreach

A funded participant responsible for outreach must be included as part of the project Work Group from the inception of the project. A minimum of one outreach publication is required for all WRAC-funded projects. Outreach products should target the states and/or industries that the project addresses and may include publications, workshops and presentations to stakeholders, and other products that would inform and educate target audiences on emerging problems.

Duration and Funding Level

Project duration of up to four years and up to \$120,000/year will be considered, but shorter projects are encouraged. In-kind and matching funds from industry, academia, and other entities are strongly encouraged.

Contact

Jeremy Liley (jeremy@lileyfisheries.com) can be contacted for further information about this problem statement.

4. Aquaculture Opportunities Through Genetics

Problem

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, genomic/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. 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 *Ostreid herpesvirus 1* (OsHV-1) and other 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 stocked fish to reduce impacts on native fish. 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 (bivalve shellfish, catfish hybrids), but not widely adopted by commercial growers due to uncertainty on 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 problem statement invites research that develops and/or quantifies the efficacy and feasibility of genetic improvement to achieve production objectives. Research may address improvements upon existing practices, and/or develop new techniques or novel species. Production benefits, such as growth, survival, feed conversion and disease resistance, reduction of production costs, as well as economic performance of genetically improved vs. pure strains, should be considered. Research that addresses tools for selection for improved traits such as growth, improved feed efficiency, increased survival, increased disease resistance and overall genetic improvement in bivalve shellfish production is also desired. Examples of research include:

- Genomics
- Marker-assisted selection
- Challenge studies
- Final yield processing traits
- Growth assays

Outreach

A funded participant responsible for outreach must be included as part of the project Work Group from the inception of the project. A minimum of one outreach publication is required for all WRAC-funded projects. The expected product or products, such as a manual and DVD, would describe guidelines for the implementation of species-specific techniques.

Duration and Funding Level

Duration can be up to four years. Funding requests should not exceed \$120,000 per year. In-kind and leveraged funds from industry, academia, and other entities are strongly encouraged.

Contact

Sean Nepper (Sean.nepper@evaquafarms.com) can be contacted for more information about this problem statement regarding finfish, and Sue Cudd (whiskeycreek1@mac.com) for more information on shellfish.

5. Alternatives to Antibiotics and Chemicals for Disease Control and Prevention

Problem

Currently, aquaculture stocks are managed to maximize production while maintaining stress at a point that reduces disease outbreaks. The limited availability of antibiotics and chemicals requires the development of new or improved tools and alternatives for disease control and prevention.

Solution

There is a need to identify more sustainable solutions for disease management. Research should develop new practical solutions that can enhance fish health and reduce disease impacts—for example, vaccines, immunostimulants, probiotics/beneficial bacteria, antimicrobial peptides, and other biological products. Practical recommendations to aquaculturists on how to better manage disease and/or apply new tools are expected from this project.

Outreach

A funded participant responsible for outreach must be included as part of the project Work Group from the inception of the project. A minimum of one outreach publication is required for all WRAC-funded projects. Outreach products should target the states and/or industries that the project addresses. Expected products could include outreach publications, workshop and/or presentations to stakeholders, and other products that would inform and educate target audiences on disease management practices that impact fish health and survival.

Duration and Funding Level

Anticipated project duration is up to four years, with a funding level up to \$120,000 per year. In-kind and matching funds from industry, academia, and other entities are strongly encouraged.

Contact

Sean Nepper (Sean.nepper@evaquafarms.com) can be contacted for further information about this problem statement.

6. Economic Value of Aquaculture in the Western United States

Problem

An economic impact analysis examines the effect of an event on the economy in a specified area, ranging from a single neighborhood to the entire globe. It measures changes in business revenue, business profits, personal wages, and/or jobs. The economic event analyzed can include implementation of a new policy or project, or may simply be the presence of a business, organization, or industry sector, in this case the aquaculture industry in the western region. To date, the only completed WRAC economic impact study was on the recreational-based aquaculture industry. Thus, we do not have a comprehensive understanding of aquaculture's contribution to local, state, and national gross domestic product; the number of jobs being generated; and tax revenue generated in the region. Moreover, the value and volume of individual aquaculture products and their flow through the economy has not been described. This information will provide a comprehensive and cohesive picture of the effect the aquaculture industry has on the region. The analysis, reports, and products of this work may be used to enhance awareness amongst stakeholders and the public and to improve communication with policy makers.

Solution

WRAC requests proposals that will measure the economic value/impact of the aquaculture industry across multiple states, species, and production methods. Proposals that are heavily weighted toward economic science, rigorous analysis, and evidence-based research are encouraged. Proposals that address the following are requested:

- Survey previous studies and existing information. This survey should evaluate relevant work in this field as well as ongoing data collection programs. Differences in methodology or emphasis of these studies should be highlighted. Synthesis of complementary or conflicting data or conclusions, and gaps in available information should be noted.
- Develop a comprehensive qualitative structural description of the current economics of the aquaculture industry. This description should include a thorough picture of end-user markets and distribution of products through the value-adding chain.
- Develop a quantitative analysis of the economic value and impact of all sectors of the aquaculture industry, from farm to the retail or end-user level. This analysis should include the operation of the farms themselves as well as the products they generate. It should detail the geography of the industry's economic impact and its effect on local, regional, and national economies, as well as the basis and rationale for any economic effect multipliers used in the analysis.
- Analyze the community impacts of the aquaculture industry throughout its study. This analysis should be expressed as quantitatively as possible.

Outreach

A funded participant responsible for outreach must be included as part of the project from the inception of the project. A minimum of one outreach publication is required for all WRAC funded projects. The lead researcher will be expected to work with the outreach coordinator to conduct public/policy makers/industry/stakeholder workshops to present findings.

Duration and Funding Level

Duration of the project is anticipated to be 2 years. Funding requests should not exceed \$80,000 per year. In-kind and leveraged funds from industry, academia, and other entities are strongly encouraged. Cost effectiveness of the proposal will be considered as part of the decision for award.

Contact

Ken Beer (beerfishery@yahoo.com) can be contacted for further information about this problem statement.

7. Aquaculture: Applied Technology Solutions

Problem

The aquaculture industry could greatly benefit from new, innovative technologies that increase efficiency, streamline production, or increase profitability. This project could test new technology or examine existing technology and include management tools and process control solutions for freshwater and marine fish or shellfish farms, including production management and recordkeeping. Examples include: biosecurity, traceability, husbandry, fish quality, efficient use of water (e.g., aquaponics, recirculation systems, water quality, and water treatment systems), disease control, production management harvest systems, and transportation systems.

Solution

Applicants should propose a project to test systems on the farm comparing productivity, profitability, or overall utility. Transfer of existing technology to aquaculture would be appropriate. On-site trials are to be included within the scope of work to demonstrate targeted benefits or improvements through comparison with current systems including cost effectiveness. Applicants are expected to work with an industry partner. A demonstration project needs to be incorporated into the application that addresses a specific problem on site and for a particular industry segment. Regional cooperation is required and regional applicability mandatory. Metrics that show benefits must be included. Examples include:

- Gas super-saturation systems, oxygen systems, efficiency, cost, and safety
- Zero discharge systems and sludge management
- Imaging systems for fish (e.g., ultrasound)
- Applications of water reuse systems
- Technologies for improving stability of stable feed components
- Bioreactor to culture algae or microorganisms
- Hatchery management: water quality and water reuse
- Transfer of rapid testing methods for: gender selection, growth, disease, water contamination, etc.
- Software/management tools for modeling tracking and monitoring: tracking cohort/rearing unit and stock grow-out, stock management, survival and growth, water use, water quality, lot tracking, and supplier verification for seed, feed, etc.

Outreach

A funded participant responsible for outreach must be included as part of the Work Group from the inception of the project. A minimum of one outreach publication is required for all WRAC-funded projects. Development of appropriate technology for remote sites can also be included. Applicants are strongly encouraged to develop proposals that could involve cooperation with extension personnel and/or aquaculture coordinators.

Duration and Funding Level

Anticipated project duration is 1-3 years with a funding level up to \$120,000 per year. In-kind and matching funds from industry, academia, and other entities are strongly encouraged

Contact

Mark Francis (Markf@aquaneering.com) can be contacted for more information about this problem statement.

8. Diet Nutrition/Innovation

Problem

Feeds are reported to represent from 50% to upwards of 70% of the variable costs of aquaculture production. Growers are faced with the increasing challenges of decreasing water flows, increasing temperature and other climatic effects, a lack of awareness of novel alternative and supplemental ingredients, and limited supplies of marine-derived ingredients. 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 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 fish and environmental health. Proposals that examine novel ingredients that are not approved must include estimation of the process through which regulatory approval can be achieved. Metrics should include cost per unit/gain live production. Laboratory testing that culminates in on-farm trials is required. Examples include:

- Continued evaluation of alternative protein and lipid products for finfish and shrimp
 - Such as, but not limited to: camelina/cottonseed meal, spirulina, algae, microalgae, single-cell organisms
- Phased/feeding and finishing feed approaches for alternative lipid strategies that include economic benefit analysis and product quality evaluations
- Dietary optimization for improving economic growth potential for less understood aquaculture species, high value species, species' life stage (catfish feed for growing sturgeon) or production systems (shrimp grown in recirculating systems/aquaponics systems)
- Feed and ingredient processing technologies and feed management approaches that improve feed digestibility and reduce waste production
- Innovative methods to characterize nutrient utilization in aquatic animals

Outreach

A funded participant responsible for outreach must be included as part of the project Work Group from the inception of the project. A minimum of one outreach publication is required for all WRAC-funded projects. Researchers are expected to include participation with feed company representatives from inception of the project.

Duration & Funding Level

Anticipated project duration is up to four years. Funding requests should not exceed \$120,000 per year. In-kind and leveraged funds from industry, academia, and other entities are encouraged.

Contact

Jackie Zimmerman (Jackie.zimmerman@skretting.com) can be contacted for further information about this problem statement.

9. Aquaculture Water Quality

Problem

Growing awareness of environmental issues and the desire to be good environmental stewards, coupled with increasing regulatory restrictions have prompted the aquaculture industry to find new and innovative ways to decrease effluent nutrients, particularly phosphorus and ammonia, and improve effluent water quality. Furthermore, the aquaculture industry is continually trying to maximize production and produce more income from their allotted water resources. To accomplish that, growers must maintain or improve water quality of their influents and effluent to meet animal requirements on influents and regulatory standards on effluents. Research is needed so that growers can maximize the utilization of their water resource while maintaining quality of the effluent. If they can find economic ways to control their water quality, they can increase their production and still comply with regulatory effluent standards. Potential issues related to poor water quality include:

- Decreased quality of intake waters from wells, springs, and surface water.
- Aquatic chemistry changes resulting from climate change, changing aquifer utilization
- Indirect impacts created by effluents such as algae blooms and die-offs
- Indirect impacts on macrophytes
- Regulatory limits: nitrogen, phosphorus, total suspended solids

Solution

Research is needed to evaluate different methods to enhance the water quality of aquaculture influent and effluent. It should be noted that proposed solutions for one operation (e.g., recirculating) may not work for another (e.g., flow through). Multiple technological solutions will need to be developed. WRAC encourages innovative solutions that currently may not be economically feasible for all sectors of the industry or regions. However, over time these innovative technologies will be refined to work in larger segments of the industry or become scalable. These solutions could include strategies addressing nutrient and other inputs to the system. Examples include:

- Modified fish feeds and/or fish-feeding regimens
- Input water treatment systems
- Different fish-rearing management systems
- Alternative solutions could encompass strategies mitigating outputs from the system. Examples include:
 - Chemical processes (precipitation reactions, sequestering agents, zeolites, etc.)
 - Biological organisms (e.g., plants, animals, and microbes) that can utilize, metabolize, or reduce effluent nutrients. This could include:
 - Filter-feeders such as mollusks
 - Other fish species
 - Specialty crops or other plants (e.g., chives, mint)

WRAC encourages cooperative research at existing aquaculture operations for pilot studies. Multi- and inter-disciplinary collaborative approaches are strongly encouraged. A well thought-out and designed economic component (cost-benefit analysis) is required.

Outreach

A funded participant responsible for outreach must be included as part of the project Work Group from the inception of the project. A minimum of one outreach publication is required for all WRAC-funded projects.

Duration and Funding

Anticipated project duration is 2-4 years. Funding requests should not exceed \$120,000 per year. In-kind and leveraged funds from industry, academia, and other entities are strongly encouraged. Shorter time more exploratory projects with lower levels of funding will be considered.

Contact

Dallas Weaver (deweaver@mac.com) can be contacted for more information about this problem statement.

10. Micro- and Macro-Plastics in the Marine Environment Associated with Shellfish Aquaculture

Problem

Micro- and macro-plastics in the marine environment have become a significant issue. Although this is a globally important problem, Pacific Coast shellfish growers are highly visible and are often being held partially responsible due to their intensive use of plastics in farming. Additionally, the industry is shifting to more and more intensive aquaculture methods using plastic, including increased use of nylon ropes and nets, polyethylene growbags, and polyvinyl chloride (PVC) predator pipes in geoduck farming. Environmental and consumer organizations have expressed growing concerns regarding the effects of micro plastics on the marine environment, including marine mammals and birds. But is the use of plastics by the shellfish industry really a significant contributor to the problem of micro- and macro-plastics in the marine environment?

In addition, there is evidence that micro-plastics could accumulate in shellfish and be passed on to humans. Understanding the nuances of this accumulation as a function of shellfish species and method of production will be important in mitigating concerns and minimizing a potential problem.

There are complex social and ecological problems that are only now being discussed and articulated. The problems go beyond the scope of industry to resolve. It will require partnership with the industry, a multi-state research team, and an effective extension outreach team to maximize results.

Solution

The most important contribution of the team will be developing a research proposal that clearly adds to the discussion. There is a need to quantify the extent of micro and macro plastics in the marine environment. Comparative studies or analysis showing actual risks will be looked upon favorably. Risk assessments that effectively communicate the extent and magnitude of the problem would be beneficial. Comparative analysis of different plastics used in shellfish farming might also be informative. Identifying the types of plastics found in shellfish, if any, would be useful.

This could be either a 2–4 year research project with an outreach component or a 1–2 year outreach project that associates gear use to the real or perceived risk. The inclusion of a toxicologist and chemist as a part of the outreach component would be useful.

Outreach

A funded participant responsible for outreach must be included as part of the project from the inception of the project. A minimum of one outreach publication is required for all WRAC-funded projects. The lead researcher will be expected to work with the outreach coordinator to conduct industry/stakeholder workshops to present project findings.

Duration and Funding Level

The duration of the project is anticipated to be 2–4 years for research or 1–2 years for outreach. Funding requests from WRAC should not exceed \$80,000 per year. In-kind and leveraged funds from industry, academia, and other entities are strongly encouraged.

Contact

Jim Gibbons (jlgibbons@seattleshellfish.com) can be contacted for more information on this problem statement.

Timeline for FY2019 Research & Outreach Projects*

Development of Problem Statements to Selection of Full Proposals

2017

Summer

- Solicit from all stakeholders identifiable Research Priority Areas.
- Industry Advisory Council (IAC) meets to compile priority suggestions into a short list.

Fall

- IAC/Technical Committee (TC) meets to review priority listing and develop Problem Statements for submission to WRAC Board of Directors (Board).
- Board meets to review and approve Problem Statements.

2018

Winter

- Administrative Office (AO) produces and distributes Request for Pre-Proposals.

Early Spring

- Pre-Proposals are due by 5 PM on Friday, April 6, 2018.
- Executive Committee (EC) reviews Pre-Proposals and recommends to Board.

Spring

- Board meets—reviews and acts on recommendations from EC regarding Pre-Proposals.
- AO notifies Pre-Proposal authors of Board's decisions and instructs PIs regarding preparation of Full Proposals with due date (generally in July).

Summer

- Full Proposals are due. AO distributes new project proposals for external peer review.

Fall

- AO forwards new Full Proposals with compilation of peer reviews to the IAC/TC for review.
- IAC/TC meets to review Full Proposals and make recommendations to the Board regarding program funding.
- Board meets to act on IAC/TC recommendations for new and ongoing program funding.
- Notification to Lead PIs of Full Proposal status.

2019

Details regarding funding will follow final selection of projects with an anticipated start date of September 1, 2019. However, funding has been delayed in recent years. Be aware that funding could be received anytime from September 2019 to January 2020.

* This timeline has been adjusted for FY2019

Appendix B Pre-Proposal Guidelines

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:

Pre-Proposal Attachment A – Pre-Proposal Checklist (page B3)

The Checklist is intended as a guide.

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

Pre-Proposal Attachment B – Cover Page (page B4)

Pre-Proposal Attachment C – Table of Contents (page B5)

Pre-Proposal Attachment D – Summary Budget (page B6)

Pre-Proposal Attachment E – Biography (page B7)

Pre-Proposal Attachment F – Outreach and Evaluation Plan (page B8)

Note: please contact the WRAC office at 206-685-2479 for a sample Pre-Proposal if needed.

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—the printed copy must be received within a day of 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. Email submission is preferred. Send **both** PDF and WORD versions (and any Excel spreadsheets) to the WRAC Administrative Office at jkhahn@uw.edu
2. Mailing address, in case you are unable to email your document.

Mail one (1) signed, printed copy to:

Western Regional Aquaculture Center

c/o Julie Hahn

University of Washington

School of Aquatic and Fishery Sciences

Box 355020

Seattle, WA 98195-5020

Street address: 1122 NE Boat Street, Seattle, WA 98105.

Questions: Please contact the WRAC Office at 206-685-2479

Format/Content

Cover Page: Title of the project, participating institutions, PIs, Outreach Representative, Industry Advisor, and suggested Project Monitor. The cover page must be signed and dated by the lead PI. (Pre-Proposal Guidelines, Attachment B, page B4)

Table of Contents: Follow the format indicated (Pre-Proposal Guidelines, Attachment C, page B5).

Project Narrative:

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

Related, Current, and Previous Work: Assess the current state of knowledge concerning the problem 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: (Pre-Proposal Guidelines, Appendix B, Attachment F, page B8)

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 Pre-Proposal Guidelines, Appendix B, Attachment D, page B6). 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 investigator and outreach personnel according to the format indicated (Pre-Proposal Guidelines, Appendix B, Attachment E, page B7)

Appendix B Pre-Proposal Guidelines

Attachment A Checklist

See *Pre-Proposal Guidelines (pages B1–B8)* and *Sample (on WRAC website)* for more information.

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

Page # (if applicable)	<i>Does the Pre-Proposal include/identify the following?</i>
	<p>Required Elements</p> <ul style="list-style-type: none"> <input type="checkbox"/> Cover Page: to include the following: <ul style="list-style-type: none"> • Title • Funding Levels • Submission Date • Duration of Project • Statement matching Pre-Proposal to identified Problem Statement <ul style="list-style-type: none"> • Industry Advisor • Suggested Project Monitor • Outreach Coordinator • Principal investigators and institutions <input type="checkbox"/> Table of Contents <input type="checkbox"/> Project Narrative: to include the following: <ul style="list-style-type: none"> • Justification • Objectives • Outreach and Evaluation Plan (<i>see Outreach & Evaluation Plan [page B8] for details</i>) • Resource/Facility Commitments <ul style="list-style-type: none"> • Related Current and Previous Work • Procedures <input type="checkbox"/> References <input type="checkbox"/> Budgets (<i>see Budget Section below</i>) <input type="checkbox"/> Biographies
	<input type="checkbox"/> Multi-state/institution requirement met? YES ___ NO ___ (With Justification provided)
	<input type="checkbox"/> Page limit is 5 pages for the Project Narrative portion: (The page limit does NOT include the reference, budget, single-state justification, or biography pages.)
<p>Outreach Components (Follow the guidelines in <i>Pre-Proposal Guidelines, Appendix B, Attachment F, page B8</i>)</p>	
	Are the following Outreach elements included and clearly identified?
	<input type="checkbox"/> Outreach Representative within the western region identified and consulted in the preparation of the Pre-Proposal? (<i>see list of WRAC Extension Subcommittee members on website</i>)
	<p>For each Objective are the following identified:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Target Audiences; Who will benefit from receiving project information? <input type="checkbox"/> Intended Learning Outcomes; What will be learned? <input type="checkbox"/> Intended Management and/or Behavioral Outcomes <input type="checkbox"/> Procedures to Achieve Intended Outcomes: <ul style="list-style-type: none"> • 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? <input type="checkbox"/> Evaluation Plan
<p>Budget</p>	
	<input type="checkbox"/> Have you received WRAC funding in the Past? YES ___ NO ___ If “YES,” are all of the outreach objectives completed for this WRAC-funded project? YES ___ NO ___
	<input type="checkbox"/> Follow the format of the Summary Budget (Pre-Proposal Guidelines, page B6)
	<input type="checkbox"/> For each year, follow the format of the Itemized Budget Spreadsheet. Specify who will receive salary (e.g., principal investigator, graduate student/research assistant, etc.)

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

Principal Investigator Signature

Date

Appendix B Pre-Proposal Guidelines

Attachment B Cover Page

SUBMISSION

1. **Email submission is preferred.** Send both PDF and WORD (and any Excel spreadsheets) versions to: jkhahn@uw.edu.
2. **Mail address**, in case you are unable to email your document.

Mail one (1) printed copy to:

Western Regional Aquaculture Center
School of Aquatic and Fishery Sciences
Box 355020
University of Washington
Seattle, WA 98195-5020

For deliveries that require a street address, use:

Western Regional Aquaculture Center
School of Aquatic and Fishery Sciences
1122 NE Boat Street
University of Washington
Seattle, WA 98105

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:

Participating Institutions

Principal Investigator
Institution (name and address)

Principal Investigator
Institution (name and address)

Principal Investigator
Institution (name and address)

Principal Investigator responsible for Outreach
Institution (name and address)

Industry Advisor

Institution (name and address)

Suggested Project Monitor (Subject to approval by Board of Directors)

Institution (name and address)

Signature of Lead Principal Investigator

Date Submitted

Appendix B Pre-Proposal Guidelines

Attachment C Table of Contents

PROJECT TITLE:

TABLE OF CONTENTS

	Page #
Project Narrative	
Justification	
Related Current and Previous Work	
Objectives (Research and Outreach)	
Procedures	
Outreach and Evaluation Plan	
Resource and Facility Commitments from Each Institution	
References	
Budgets	
Budget Summary for All Participating Institutions:	
Year 1	
Year 2	
Year 3	
Year 4	
Biographies	

Appendix B Pre-Proposal Guidelines

Attachment D 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:

<http://depts.washington.edu/wracuw/funding/funding.html>. (Samples of blank and filled-in itemized budget spreadsheets are included at the end of this document).

Appendix B Pre-Proposal Guidelines

Attachment E 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*)

Appendix B Pre-Proposal Guidelines

Attachment F 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, but WRAC should be acknowledged.
- 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

INSTITUTION:	
PRINCIPAL INVESTIGAT	
SALARIES:	\$0
BENEFITS:	\$0
TRAVEL:	\$0
SUPPLIES:	\$0
EQUIPMENT:	\$0
OTHER DIRECT COSTS:	\$0
TOTAL:	\$0

Sample of Filled-In Required Itemized Budget Spreadsheet

INSTITUTION:	University of Washington	
PRINCIPAL INVESTIGATOR:	Dr. John Smith	
SALARIES:		\$5,000
Research Technician (0.08 FTE)	\$3,000	
Graduate Student (12 mths @ 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
Publications - Page charges (4pg @ \$50/p)	\$200	
Telephone	\$100	
Photocopying & Printing	\$500	
TOTAL:		\$9,740