NRAC Problem Statements for 2012 Preproposal RFA

1. **Goal: To reduce human illness caused by exposure to pathogenic *Vibrios*, thereby allowing for continued growth in the shellfish aquaculture industry in the Northeast U.S.**

Statement of the Problem:
Vibrio bacteria are naturally occurring marine organisms that proliferate in warm waters. Molluscan shellfish can concentrate bacteria as they feed and thus consuming raw shellfish exposes humans to potentially pathogenic species such as *Vibrio vulnificus* and *Vibrio parahaemolyticus*. Shellfisheries resource managers need a tool to detect the presence of specifically pathogenic *Vibrios* so that they can adequately manage and ensure the safe harvest and marketing of shellfish product. Researchers have developed a simple and rapid fluorogenic procedures for the identification and enumeration of Vibrionaceae. However, while this procedure is useful in determining total Vibrionaceae levels, the predictive value has not yet been quantified. In addition, an important issue that has not been addressed by this method regarding Vibrionaceae abundance and distribution is the correlation between total Vibrionaceae and pathogenic species. To evaluate potential outbreaks, it will be essential to either identify pathogenic strains directly, or use total Vibrionaceae as an indicator of pathogenic species. This is analogous to current monitoring for total coliforms or fecal coliforms as indicators for the presence of enteric pathogens, e.g. *Salmonella* or *E. coli*. Resolution of this issue requires a critical comparison of the levels of total Vibrionaceae in seawater and shellfish, with levels of pathogenic strains of Vibrionaceae in the same seawater and shellfish samples. If there is a correlation between total Vibrionaceae and pathogenic Vibrio levels, then total Vibrionaceae may be used as an indicator of pathogenic species.

Unfortunately, detection and quantification of pathogenic species is not straightforward. Microbiological methods of detection are time consuming and are not statistically valid. Recently, molecular methods have been described using quantitative real-time PCR (qPCR) for sensitive and accurate detection and enumeration of pathogenic *Vibrio* spp. in water samples and shellfish tissue. Although these methods are less time consuming than microbiological methods, they require a greater level of training and expertise, and are costly.

Potential projects may include, but are not limited to:

- Investigate and validate the use of total Vibrionaceae as an indicator of pathogenic *Vibrio* spp.
- Development and/or demonstration of improved and cost-effective methods for the rapid detection of pathogenic strains of *Vibrio* bacteria.

2. Goal: Improved and cost-effective management of shellfish growout operations

Statement of the Problem:
The field growout portion of shellfish culture can be extremely labor intensive. Since shellfish growers do not typically use any herbicides or pesticides to reduce bio-fouling or repel predators, a thorough maintenance of gear in the marine environment requires the significant expenditure of time and money. Common processes for removing bio-fouling from hard clam predator control screens, oyster cages or mussel longlines have typically been a manual operation, possibly improved with a power washer. Others have employed a variety of dips with fresh water, very high salinity dips, hot water, and various other methods to keep fouling down and allow for good water flow to the cultured shellfish. This topic repeatedly comes up on the East Coast Shellfish Growers Association listserve as an area of great interest.

Successful growers have addressed biofouling but typically use the most expedient method whether or not it is totally satisfactory, mainly because of the aforementioned time and costs. There is certainly room to investigate alternative methods through research to take the cost and time impact out of the producers' hands and have a good scientific process address it. Collaboration is essential with industry.

Predation by numerous species has a large impact on overall crop survival. Cow Nosed Rays, various crab species and starfish pose problems for growers. The ray issue has grown significantly over the past 15 years, and if crops are left uncovered, can be devastating. Since these species will simply not go away, new innovative techniques are needed to reduce their populations near cultured shellfish.

Examples of specific issues – Lowering input cost in management and operation through:

- Reduction in biofouling problems.
- Control of shellfish predators such as cownosed rays and invertebrates including crabs and starfish.

3. **Goal: Improving aquaculture production by lowering input costs**

Statement of the problem:
High input costs (eg. energy, capital equipment, space) related to the production of aquatic organisms continues to hinder growth of the aquaculture industry in the Northeast region. For example, high energy costs related to the pumping, heating and cooling of water reduce competitiveness of the industry. Handling activities such as grading and counting aquatic crop species tends to be inefficient as practiced in the Northeast and need improved engineering to reduce labor and improve consistency of the end product. NRAC seeks proposals that will research and demonstrate innovative production technologies resulting in reduced input costs.

Examples of specific issues – Lowering input cost in management and operation through:

- Alternative energy sources
- More efficient, labor reducing systems engineering
- More effective spatial use – i.e., three-dimensional culture with plants, shellfish, finfish

4. **Goal: Increasing profitability and/or marketability through product diversification**

Statement of the problem:
Many existing aquaculture operations can improve profits through diversification of new products, thereby spreading out the capital costs. Unused waste stream products have potential to provide input for propagating a new species in existing operations. Proposals from existing or new producers should be outcome oriented. Additional species may be added to a producer's product line by utilizing the waste stream from existing operations for improved sustainability.

The Chesapeake region is threatened by many unwanted or invasive species. Research proposals focusing on the cultivation of native plants or animals that can be used for bioremediation, mitigation, or ecological restoration will qualify for this problem statement.

Examples of specific issues – increasing crop diversification by examining:

- New species potential
- Cultivating and propagating native plants for the ornamental aquatic plant industry that have bioremediation or ecological services potential

5. **Goal: Improving shellfish and finfish health maintenance and disease control**

Statement of the problem:
Animal health is a constant concern for aquatic animal production facilities and an issue that is commonly listed as a primary research need in aquaculture producer surveys. Shellfish and finfish diseases are continuously evolving and spreading, resulting in a high level of risk that requires careful management of cultured animals. In addition to disease, pests and environmental threats to animal health such as harmful algal blooms impact the grower's bottom line. Better information is required in the areas of disease etiology, prevention, and/or treatment to provide producers with the best management tools available for minimizing the impact of disease. Proposals are solicited that address further developing our knowledge-base of pathogenic and non-pathogenic health strategies leading to improved health management and improved production on the farm.

Specific issues for minimizing crop loss through effective control and/or prophylaxis might target:

- Non-chemical control of parasitic copepods in salt and freshwater
- Husbandry-management strategies for coping with Harmful Algal Blooms (HABs), especially newer species in the Northeast such as *Cochlodinium polykrikoides*

6. **Goal: Improving site selection and reducing user conflicts in marine aquaculture systems**

Statement of the problem:
Siting aquaculture operations in the marine environment, whether in estuaries or offshore can lead to both real or perceived conflicts with other stakeholders. As mapping (and potentially regulation) of ocean uses, including marine protected areas, develops as a component of marine spatial planning (MSP), a thorough analysis of relevant siting factors related to shellfish, finfish and macroalgal aquaculture is warranted. Geographic Information Systems (GIS) can be used to visually display and provide quantitative analysis of factors that influence siting of aquaculture operations. Development of appropriate siting factors (data layers including metadata) of value to the aquaculture industry will assist the marine spatial planning effort and ensure that the needs of aquaculture operators are fully considered.

Specific issues – Examining user conflict issues with regard to land-water and its interface by:

- Conducting an analysis of coastal spatial conflicts between user groups with recommended policy considerations
- Develop a rationale for the "layers" that need to be considered in a GIS format MSP exercise