

**Setting Priorities for British Columbia
Shellfish Aquaculture
Research and Development:
Process, Outcomes and Evaluation**

**Facilitated by the Centre for Shellfish Research, Malaspina
University-College**

Funded by: DFO – Aquaculture Collaborative Research and
Development Program - AquaNet

February 2006

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1 *Introduction*

Setting research priorities is a complex affair, requiring the integration of many issues and variables into a coherent strategy that can effectively be implemented and provide tangible benefits to industry. The reality of resource scarcity for research in general and aquaculture in particular means that choices must be made and they must be made based on the best available information and the highest anticipated return on investment.

Past experience has shown that over-simplifying the process of priority setting and boxing it into a restrictive time frame and process is likely to result in “research plans” that do not adequately reflect the needs of industry and do not adequately address the actual constraints and issues that affect industry. Furthermore, such hastily prepared strategies may result in misspent effort and resources. Therefore, a multi-stage process may be necessary in order to develop an adequate framework for research priority-setting and to identify the most promising and fruitful avenues of research effort.

With this in mind, the Centre for Shellfish Research is developing a novel approach to R&D priority-setting for the British Columbia shellfish industry. The CSR envisions two key principles to be the basis of this new approach, one based on **Process** and the second based on **Participation**:

Process: creating a multi-stage process that “fits” the BC shellfish industry.

Participation: enabling a higher level of participation and integrating a broader spectrum of stakeholders into the process with a more active role in the process and outcomes.

CSR’s novel approach to industry R&D priority-setting is based on a three-stage iterative structure that develops each stage on the outcomes of previous stages. At the end of the process, a more robust industry R&D strategy should emerge that has a strong level of ownership by industry, the research community and other stakeholders.

Discussion of the process will be in two parts, the first dealing with the activities and outcomes of the process and the second consisting of the rationale, structure and evaluation of the process.

2 The BC Shellfish Research and Development Priority-Setting Process – Overview

2.1 OBJECTIVES

The objectives of the 3-stage R&D priority-setting process are:

- To develop and test a workable, effective and repeatable workshop template for the establishment of R&D priorities for the BC shellfish aquaculture industry.
- To develop a prioritized list of research topics for use by R&D funding agencies in the funding approvals process.
- To create a forum within which BC shellfish aquaculture industry producers and shellfish research scientists can achieve consensus on the R&D priorities of the industry.
- To develop key research questions for scientific study that will best support the growth and development of the BC shellfish industry.
- To develop a strategic research plan for each shellfish species.
- To develop collaborative research partnerships among interested parties to support a specific area of investigation.

The 3-stage R&D priority-setting process is also expected to fulfill the following ancillary aims:

- To facilitate a better understanding by scientists of the problems facing the BC shellfish industry and a better understanding by industry of the process of scientific research and research funding.
- To continue to expand the industry research network.
- To facilitate the development of industry/researcher working relationships.

2.2 STRUCTURE OF THE PROCESS

The process consists of three iterative stages which were undertaken between April and November 2005.

Stage 1: Initial plenary workshop (April 2005) – This multi-stakeholder participatory workshop set the stage for subsequent stages and had two main goals. The first was to identify issues and constraints affecting the advancement and growth of the BC shellfish industry. The second was to assess the applicability of research and development to resolving the issues, addressing the constraints, and advancing the industry.

Stage 2: Species workshops (May 2005) – Because the BC shellfish industry is based upon the primary culture of oysters, clams and mussels plus several secondary and “emerging” species such as scallops, geoduck, urchins, sea cucumbers and abalone, a series of workshops were held to allow the participants to focus on issues and

constraints that pertained to particular species. Six workshops were held, one each on oysters, clams, mussels, scallops, echinoderms and geoduck.

Stage 3: Priority-setting plenary workshop (November 2005) – The third stage workshop was scheduled to allow time for industry and other stakeholders to provide feedback on the outcomes of the first two stages and to consider how they might best be integrated into a coherent R&D strategy. At the workshop, theme and species issues were combined into a research activity ranking process which will form the basis of the overall strategic plan for shellfish R&D in British Columbia.

2.3 STAGE 1: INITIAL PLENARY WORKSHOP (APRIL 2005)

The initial workshop carved up the universe of shellfish aquaculture research and development into 5 major theme areas:

- **Theme 1: Animal Science (Health, Husbandry & Genetics)**
- **Theme 2: Environmental Interactions**
- **Theme 3: New Technology and Techniques**
- **Theme 4: Food Safety and Trade (e.g. Cadmium, CSSP, Biotoxins)**
- **Theme 5: Product Development and Markets**

In each of the 5 theme areas, participants

- identified a primary goal towards which outcomes for the theme area could be directed,
- listed issues and constraints affecting industry advancement within the theme,
- determined whether resolution should come through research, regulation, management or a combination,
- suggested possible types of research activity needed for each (e.g. intelligence gathering, technology transfer, pilot evaluation, basic research, etc.),
- identified who should be tasked to undertake the activity and where it should be done,
- estimated resources required, level of risk involved and return on investment.

The results were recorded and integrated into stage 2 and stage 3 workkshops.

2.4 STAGE 2: SPECIES WORKSHOPS (MAY 2005)

The initial plenary workshop was quickly followed by six species workshops held the following month. These were:

- Manila, Littleneck and Cockle Clam
- Oyster
- Mussel
- Scallop
- Geoduck
- Echinoderm (Urchins and Sea Cucumbers)

The species workshops were smaller in scale with discussion and input structured in two parts: discussion and identification of issues and constraints followed by the formulation of potential research questions and activities that might be undertaken.

Reports from these workshops were prepared and posted on the website for additional comment and input.

2.5 STAGE 3: PRIORITY-SETTING PLENARY WORKSHOP (NOVEMBER 2005)

Summaries of the initial plenary workshop and each of the species workshops were posted on the CSR website providing an opportunity for feedback from participants as well as those unable to attend the workshops.

In preparation for the final priority-setting plenary workshop, the results from the first two stages were carefully analyzed. The five theme areas were again adopted to provide consistency and allow for clear back-linkages through the process to be adequately traced. In order to facilitate a ranking process a set of goals within each theme was prepared based on the input during the first two stages.

A total of 18 goals were specified over the 5 theme areas. Under each of these goals a set of potential research activities was articulated resulting in 86 activities specified across the 18 goals.

During the final workshop and post-workshop on-line contributions, a total of 58 participants engaged in two separate ranking activities: the first to do an overall ranking of the goals across the 5 themes, and the second to rank the activities within each of the 5 theme areas. Participants were allocated a specific number of “votes” for goals. Participants were also allocated a specific number of “votes” which they could spend on activities within each theme (same number of votes for each of the 5 themes).

In order to accommodate the various stakeholder perspectives, the participants were identified as belonging to one of four groups:

- Industry (37 participants)
- Government (3 participants)
- Science (17 participants)
- Other (community, media, etc) (1 participant)

The combined results of the rankings of all four groups are presented in the following section.

3 The BC Shellfish Research and Development Priority-Setting Process – Outcomes

3.1 GOAL AND ACTIVITY RANKING

The outcomes of the process will be treated in terms of goals and activities ranked by participants in stage three in conjunction with background notes relating these back to the stage 1 and stage 2 workshops. The formulation of the goals and activities was directly derived from the outcomes of the stage 1 and stage 2 workshops and every attempt was made to remain “true to the material”.

The goals and the activities under them are put into one of **four categories** distinguishing each as a **very high, high, medium, or low** ranked goal or activity. In order to arrive at this 4-category ranking system, activities were ordered according to the number of “votes” received. These were normalized to account for the fact that each theme had a varied number of activities listed within it. When the results of the ranking of activities were tallied, it was apparent that there were a small number (5) of activities that garnered an exceptional number of votes. These have been provisionally identified as being “Very High Priority”. The “votes” on the remaining activities followed a relatively standard distribution. There are 19 high priority activities, 44 medium priority activities and 20 low priority activities. These included two activities which were added to the list by participants during the ranking exercise.

It should be noted that these are relative rankings. The very fact that specific issues and actions were brought forward during the process indicates that they are of importance to the industry and sector as a whole and require attention.

Advancing industry through innovation is a complex and integrated process involving not only research but an array of complementary activities that need to be undertaken in conjunction with research (knowledge generation). These are complementary to an integrated approach. In certain cases, activities specified in the process may not be primarily a research and development activity at all, but rather an activity that enables research to be implemented in the industry, applies to community or consumer education, or focuses on business-oriented “research” (e.g. competitive analysis, market research, etc.). Each of the activities is followed by a preliminary identification of the kind of activities that may be needed in order to complete it. We have noted six aspects of activities as follows::

- Research & Development (Scientific, including natural, social and economic)
- Knowledge & Technology Transfer
- Regulation & Policy
- Best Management Practices
- Community & Communication
- Research for Business (e.g. competitive and market intelligence, etc.)

In many cases more than one aspect will apply to a particular activity.

The following analysis is based on the consideration of the combined results of goal and activity ranking in conjunction with stage 1 and stage 2 outcomes. The activity and goal rankings are grouped under each of the 5 themes.

3.2 THEME1. ANIMAL SCIENCE

Goal 1.1: Improve survival and growth of cultured stock

Goal Rank: High Priority.

Very High Priority Activities

- Investigate fouling reduction/mitigation and develop recommended management practices. **(Activity 1.1.4)** (Species - oysters, mussels, scallops) (Research & Development; Knowledge & Technology Transfer)

High Priority Activities

- Investigate more effective predator exclusion devices both with respect to protection from predation and reduced visual impact **(Activity 1.1.3)** (Species – clam, geoduck, mussels) (Research & Development; Knowledge & Technology Transfer)
- Assess optimal plant-out conditions/factors that minimize losses (e.g. including “shocking” of clam seed prior to out-planting [histology]). **(Activity 1.1.6)** (Species - geoduck, clams, scallops) (Research & Development)
- Investigate mortality events related to seasonality and develop mitigation/management strategies. **(Activity 1.1.7)** (Species - clams, oysters, mussels) (Research & Development)
- Investigate hatchery mortality and possible strategies to reduce mortality such as diet improvements. **(Activity 1.1.8)** (Species - clams, geoduck) (Research & Development)
- Assess nutritional requirements of juveniles in hatchery/nursery systems. **(Activity 1.1.5)** (Species - geoduck, clams, scallops) (Research & Development)

Medium Priority Activities

- Establish baseline survival information (monitor and assess on the farm) in relation to various species, farm practices, and environment. **(Activity 1.1.1)**
- Investigate predator biology, assess risk of predation to cultured animals and apply to production **(Activity 1.1.2)** (Research & Development; Knowledge & Technology Transfer)
- Develop stress indicator tools for assessment of shellfish husbandry practices **(Activity 1.1.10)** (Research & Development; Knowledge & Technology Transfer)

Low Priority Activities

- Investigate byssal attachment in order to reduce losses from sloughing. **(Activity 1.1.9)** (Species - mussels) (Research & Development; Knowledge & Technology Transfer)

Goal 1.2: Produce higher quality shellfish at farmgate

Goal Rank: Low Priority. However, specific activities did rank high and medium.

High Priority Activities

- Investigate seed quality parameters and signs/symptoms of compromised quality and develop assessment tools. **(Activity 1.2.3)** (Species: all) (Research & Development; Knowledge & Technology Transfer)

Medium Priority Activities

- Investigate causes of shell deformities and prepare mitigation and management practices. **(Activity 1.2.2)** (Species: clam lip curling, scallop shell deformity, geoduck skin scabbing, oyster shell shape) (Research & Development; Knowledge & Technology Transfer)

Low Priority Activities

- Survey farms and document Best Husbandry Practices, including inventory systems. **(Activity 1.2.1)** (Species: all) (Best Management Practices; Knowledge & Technology Transfer)
- Investigate prepared diet composition in relationship to roe quality. **(Activity 1.2.4)** (Species: urchins) (Research & Development)
- Evaluate triploidy/tetraploidy in relation to specific production systems and consumer acceptance and marketability. **(Activity 1.2.5)** (Species - oysters, mussels, geoduck) (Research & Development; Knowledge & Technology Transfer)

Goal 1.3: Build a genetic improvement program for cultured shellfish

Goal Rank: Medium Priority

Medium Priority Activities

- Investigate development of a broodstock selection program (linked to genetically distinct natural populations, genetic variability, traceability by means of genetic markers, etc.). **(Activity 1.3.2)** (Species: geoduck, clams, mussels, oysters) (Research & Development)
- Identify important traits and investigate heritability as the basis of a genetic selection program (including cost/benefit). **(Activity 1.3.1)** (Species - mussels, oysters) (Research & Development)

Goal 1.4: Protect and improve shellfish health

Goal Rank: Medium Priority

High Priority Activities

- Develop a simple guide for disease identification in the field and an efficient mechanism for reporting disease occurrences. **(Activity 1.4.1)** (Species: all) (Research & Development; Knowledge & Technology Transfer)

- Develop an effective shellfish health management system which will ensure healthy stocks and will meet or exceed animal health standards. **(Activity 1.4.2)** (Species: all) (Best Management Practices; Knowledge & Technology Transfer)

Low Priority Activities

- Conduct cost benefit analysis of genetic research in relation to shellfish health / mortality. **(1.4.3. Activity)** (Species: all) (Research & Development; Knowledge & Technology Transfer)
- Asses conditions for pathogen/microbial build-up and transfer in trays and determine effect on stress, morbidity and mortality. **(Activity 1.4.4)** (Species: oyster) (Research & Development)

Goal 1.5: Develop feasible polyculture systems and culture systems for new species

Goal Rank: High Priority

Very High Priority Activities

- Investigate the integration/adaptation of polyculture into culture practices of floating systems (e.g. further investigation of urchin/sea cucumber and oyster polyculture) **(Activity 1.5.1)** (Species: oysters, mussels, scallops, echinoderms, seaweed) (Research & Development; Knowledge & Technology Transfer) (*nb*: This activity ranked highest overall.)

Medium Priority Activities

- Investigate potential of subtidal co-culture of geoduck with other species (e.g. cockles, manila clams) **(Activity 1.5.2)** (Species: Manila clam, littleneck clam, geoduck, cockles) (Research & Development)
- Investigate nursery and grow-out culture requirements for cockle culture including risk assessment with respect to various tidal zones within potential culture sites. **(Activity 1.5.3)** (Species: cockles) (Research & Development)
- Investigate potential of co-culture of kelp & other seaweeds with finfish & shellfish. **(Added Activity)** (Species:all) (Research & Development)

3.3 THEME 2: ENVIRONMENTAL INTERACTIONS

Goal 2.1: Improve knowledge of ecosystem variables that impact shellfish farming & develop adaptive strategies

Goal Rank: High Priority

High Priority Activities

- Develop environmental monitoring tools suitable for on-farm use by growers to enable site profiling (temperature, phytoplankton abundance and/or diversity, nitrates/nitrites, salinity, dissolved oxygen) and integrate with remote sensing data (satellite). **(Activity 2.1.2)** (Species: all) (Research & Development; Knowledge & Technology Transfer)

Medium Priority Activities

- Investigate health impacts on shellfish with respect to specific factors present in environment (e.g. pathogens, stressors, etc). **(Activity 2.1.4)** (Species: all) (Research & Development)
- Investigate parameters that can be used to assess culture capability at sites (in relation to new techniques, other species not previously done, e.g. mussels). **(Activity 2.1.3)** (Species: all) (Research & Development; Knowledge & Technology Transfer)
- Set up phytoplankton identification and monitoring program (baseline data). **(Activity 2.1.1)** (Species: all) (Research & Development; Knowledge & Technology Transfer)

Low Priority Activities

- Investigate effect of natural seed recruitment methods (ecological effect and production-related). **(Activity 2.1.5)** (Species - clams) (Research & Development)
- Oyster seed: monitor and protect Pendrell Sound. **(Added Activity)** (Knowledge and Technology Transfer)

Goal 2.2: Reduce or mitigate potential negative environmental impacts of shellfish aquaculture and demonstrate positive impacts

Goal Rank: Very High. This was ranked highest goal overall. However, no specific activities under this goal ranked very high or high.

Medium Priority Activities

- Establish performance measures of environmental interaction with respect to specific factors (biodiversity, benthic fauna community structure, habitat complexity, carrying capacity, bio-physical impacts, water column/benthic variables) **(Activity 2.2.1)** (Species: all) (Research & Development; Best Management Practices)
- Investigate polyculture systems in relation to reduction of “waste” inputs and other potential environmental impact(s). **(Activity 2.2.3)** (Species: all) (Research & Development; Knowledge & Technology Transfer; Best Management Practices) (Related to Activities under Goal 1.5: Develop feasible polyculture systems and culture systems for new species)
- Assess potential impacts of benthic culture in relation to activities of culture stages, e.g. out-planting, site preparation, harvesting. **(Activity 2.2.2)** (Species: geoduck)

Goal 2.3: Improve understanding of ecosystem species/populations and variations, including recruitment, “aliens”, “invasives”, etc.

Goal Rank: Medium Priority

Medium Priority Activities

- Investigate occurrence of natural sets and recruitment of species being cultured and relate to potential for natural seed collection practices. **(Activity 2.3.3)**

- (Species: clams, cockles) (Related to Activity 2.1.5) (Research & Development; Knowledge & Technology Transfer)
- Investigate risk of specific “invasive” species. **(Activity 2.3.2)** (Species - clams [Varnish], mussels, oysters [tunicates] clams [green crab], etc.) (Research & Development)

Low Priority Activities

- Determine presence and range of cultured and closely related species present in BC coastal waters (genetic identity). (Species: blue mussels - edulis vs. trosollus vs, gallos). **(Activity 2.3.1)**. (Research & Development)

Goal 2.4: Integrate community into environmental health and management

Goal Rank: High Priority

High Priority Activities

- Investigate upland influence on nutrient (e.g. nitrates, nitrites, N-isotopes) and contaminant (e.g. metals) input into shellfish growing waters and involve community in monitoring and mitigation strategy development. **(Activity 2.4.3)** (Species: all) (Research and Development; Community and Communication)
- Investigate significant public perception issues of shellfish culture and develop strategies for farm and/or community management. **(Activity 2.4.4)** (Species: all) (Research and Development; Community and Communication)

Medium Priority Activities

- Create strategies for community involvement in ecological management/monitoring activities. **(Activity 2.4.1)** (Species: all) (Community and Communication; Knowledge & Technology Transfer)
- Develop educational materials and resources to educate communities on environment and shellfish aquaculture. **(Activity 2.4.2)** (Species: all) (Community and Communication; Knowledge & Technology Transfer)

3.4 THEME 3: TECHNIQUES

Goal 3.1: Create an effective technology transfer system

Goal Rank: Low Priority. However, specific activities did rank very high and high.

Very High Priority Activities

- Search globally for technology that may be applied to BC shellfish industry and transfer knowledge to industry. **(Activity 3.1.1)** (Species: all) (Knowledge & Technology Transfer)

High Priority Activities

- Improve industry access to and collaboration with technical expertise for technology development. **(Activity 3.1.2)** (Species: all) (Knowledge & Technology Transfer)

- Conduct economic analysis of potential new technologies. **(Activity 3.1.3)** (Species: all) (Research & Development)

Goal 3.2: Advance the technology of current production systems

Goal Rank: High Priority

High Priority Activities

- Develop improved intertidal/subtidal planting and harvesting technology. **(Activity 3.2.1)** (Species - geoduck and clam) (Research & Development; Knowledge & Technology Transfer)

Medium Priority Activities

- Develop technology to better incorporate polyculture into production systems (e.g. modified trays). **(Activity 3.2.3)** (Species: all) (Research & Development; Knowledge & Technology Transfer) (Related to Activities under Goal 1.5: Develop feasible polyculture systems and culture systems for new species)
- Develop new technology for culturing manila clams “beyond the beach” (e.g. artificial substrate for suspended culture). **(Activity 3.2.4)** (species: clams) (Research & Development; Knowledge & Technology Transfer)
- Assess/develop new technology to track inventory (geoduck *in situ*, e.g. acoustic technology) **(Activity 3.2.6)** (Species: geoduck) (Research & Development; Knowledge & Technology Transfer)
- Evaluate and test performance of grow-out and harvesting technology (Species - mussels) **(Activity 3.2.7)** (Knowledge & Technology Transfer)
- Develop technology for cockle grow-out (e.g. modified trays or modification of BOB – “bags-on-bottom” system) **(Activity 3.2.5)** (Species: cockles) (Research & Development; Knowledge & Technology Transfer)
- Investigate, develop, and test mechanical clam harvester technology. **(Activity 3.2.2)** (species: clams) (Research & Development; Knowledge & Technology Transfer)

Low Priority Activities

- Advance FLUPSY technology for nursery of other species. **(Activity 3.2.8)** (Species - geoduck) (Research & Development; Knowledge & Technology Transfer)

Goal 3.3: Improve economics and business management of shellfish production

Goal Rank: Low Priority. However, specific activities did rank very high, high and medium.

Very High Priority Activities

- Improve regulations and incentives to encourage new technology development and its application in shellfish production. **(Activity 3.3.5)** (Species: all) (Knowledge & Technology Transfer; Regulation & Policy)

High Priority Activities

- Reduce cost of hatchery seed production. **(Activity 3.3.3)** (Species - geoduck) (Research & Development; Knowledge & Technology Transfer)

Medium Priority Activities

- Document best management practices for hatchery seed production. **(Activity 3.3.2)** (Species: all) (Knowledge & Technology Transfer; Best Management Practices)
- Implement Best Husbandry Practices system, including inventory systems. **(Activity 3.3.1)** (Species:all) (Knowledge & Technology Transfer; Best Management Practices) (Related to activity 1.2.1: Survey farms and document Best Husbandry Practices, including inventory systems)
- Develop a framework to fairly assess social factors relating to new technology and issues around “social license”. **(Activity 3.3.4)** (Species: all) (Research & Development; Regulation & Policy)

Goal 3.4: Develop and/or apply new technology in shellfish processing

Goal Rank: Low Priority. (Note that the processing sector did not have very high representation during the process and that the focus of the process was largely farm production)

Medium Priority Activities

- Investigate value-added and packaging technologies for application to BC products. **(Activity 3.4.3)** (Research & Development; Knowledge & Technology Transfer)

Low Priority Activities

- Investigate improvements to frozen product and assess CO₂ methods. **(Activity 3.4.2)** (Research & Development; Knowledge & Technology Transfer)
- Investigate shucking technology. **(Activity 3.4.1)** (Research & Development; Knowledge & Technology Transfer)

3.5 THEME 4: FOOD SAFETY

Goal 4.1: Develop effective monitoring programs for public health and food safety

Goal Rank: Medium Priority. Activities under this goal will apply to all shellfish species unless otherwise noted.

Very High Priority Activities

- Develop monitoring tools for growers (science-based technology development) and faster/cheaper water quality tests. **(Activity 4.1.2)** (Research & Development; Knowledge & Technology Transfer)

High Priority Activities

- Investigate decontamination techniques for eliminating/reducing risk of human health impacts from shellfish (e.g. micro-bubbler technique). **(Activity 4.1.8)** (Research & Development; Knowledge & Technology Transfer)

Medium Priority Activities

- Develop an effective product traceability system (enabling domestic and export trade and protecting public health). **(Activity 4.1.5)** (Knowledge & Technology Transfer; Best Management Practices; Policy & Regulation)
- Standardize the surveillance and testing of shellfish stock & growing waters (e.g. vibrio). **(Activity 4.1.3)** (Research & Development; Knowledge & Technology Transfer; Policy & Regulation)
- Integrate On Farm Food Safety (OFFS) with Canadian Shellfish Sanitation Program (CSSP) Reform. **(Activity 4.1.6)** (Knowledge & Technology Transfer; Best Management Practices; Policy & Regulation)
- Research the history and ecology of biotoxin (PSP, etc.) closures and identify possible trends. **(Activity 4.1.1)** (Research & Development; Knowledge & Technology Transfer)

Low Priority Activities

- Improve knowledge transfer and training in monitoring, record keeping, certification etc. **(Activity 4.1.4)** (Knowledge & Technology Transfer)
- Evaluate factors affecting prevalence and abundance of Vp in the environment. **(Activity 4.1.7)** (Research & Development)

Goal 4.2: Improve reliability and accuracy of water quality indicators

Goal Rank: Low Priority. However, specific activities did rank high and medium.

High Priority Activities

- Improve fecal coliform sampling/testing protocols and develop recommendations for CSSP reform (e.g. 'time to lab'). **(Activity 4.2.1)** (Research & Development; Knowledge & Technology Transfer; Policy & Regulation)

Medium Priority Activities

- Research reliability of food safety indicators (e.g. surface waters versus shellstock). **(Activity 4.2.3)** (Research & Development; Knowledge & Technology Transfer)
- Investigate cause of fecal coliform "false positives" (e.g. bacteriological validation studies). **(Activity 4.2.2)** (Research & Development)

Goal 4.3: Develop a strategy for shellfish production and export in relation to cadmium

Goal Rank: Medium Priority. (Activities in this area are primarily of concern to oysters, scallops.)

Medium Priority Activities

- Investigate further mitigation strategies that can be utilized by producers to reduce cadmium levels in shellfish stocks. **(Activity: 4.3.3)** (Research & Development; Knowledge & Technology Transfer)
- Investigate further the risk to human health of consumption of shellfish with cadmium present. **(Activity 4.3.2)** (Research & Development)

Low Priority Activities

- Develop a coordinated approach to cadmium issues and ability to advocate and inform. **(Activity 4.3.1)**. (Knowledge & Technology Transfer; Policy & Regulation)
- Investigate genetic correlation to cadmium retention and follow up on Pacific Shellfish Institute work on potential of selective breeding. **(Activity 4.3.4)** (Research & Development)
- Investigate geochemical processes (sediments, benthic, suspended) of cadmium (e.g. in connection with J. Cullen at University of Victoria). **(Activity 4.3.5)** (Research & Development)

3.6 THEME 5: MARKETS

Goal 5.1: Improve market information and intelligence

Goal Rank: High Priority. Activities under this goal will apply to all shellfish species unless otherwise noted.

High Priority Activities

- Educate value chain (wholesalers, retailers, restaurants, consumers) on quality and safety of BC shellfish. **(Activity 5.1.5)** (Community & Communication)

Medium Priority Activities

- Conduct in-market research for specific products and specific defined markets (include value added processing). **(Activity 5.1.1)** (Research for Business)
- Research BC production trends, and provide industry production forecasts. **(Activity 5.1.4)** (Research & Development; Research for Business)
- Transfer knowledge on effective marketing strategies **(Activity 5.1.2)** (Knowledge & Technology Transfer)

Low Priority Activities

- Conduct risk analysis and develop risk management strategies for production/markets. **(Activity 5.1.6)** (Research & Development; Research for Business)
- Acquire market-related information from other (government and non-government) agencies. **(Activity 5.1.3)** (Research for Business)

Goal 5.2: Foster value adding and product differentiation of BC shellfish

Goal Rank: Medium Priority. Activities under this goal will apply to all shellfish species unless otherwise noted.

High Priority Activities

- Develop quality standards for BC shellfish to help differentiate BC products in world markets. **(Activity 5.2.4)** (Research & Development; Knowledge & Technology Transfer; Best Management Practices)

Medium Priority Activities

- Develop new frozen/fresh packaged shellfish products. (Collaborations with UBC Food Science, Dalhousie University [Canadian Institute of Fisheries Technology], etc) **(Activity 5.2.2)** (Research & Development; Knowledge & Technology Transfer)
- Develop enhanced value strategies for BC shellfish through validated “organic”, “natural”, “fresh” labeling, eco-labeling. **(Activity 5.2.3)** (Research & Development; Research for Business)
- Improve local market penetration of BC shellfish products by investigating feasibility and requirements (regulatory, food safety, etc) for direct sales. **(Activity 5.2.5)** (Research & Development; Policy & Regulation)
- Investigate improved harvest to market transportation/distribution/holding systems. **(Activity 5.2.6)** (Research & Development; Knowledge & Technology Transfer)

Low Priority Activities

- Investigate consumer perceptions and market acceptance of BC shellfish (e.g. wild versus cultured product in geoduck) **(Activity 5.2.1)**

4 The BC Shellfish Research and Development Priority-Setting Process – Evaluation

Further Details to follow soon.

4.1 PROCESS OBJECTIVES

Primary Objectives

- To develop and test a workable, effective and repeatable workshop template for the establishment of R&D priorities for the BC shellfish aquaculture industry
- To develop a prioritized list of research topics for use by R&D funding agencies in the funding approvals process
- To create a forum within which BC shellfish aquaculture industry producers and shellfish research scientists can achieve consensus on the R&D priorities of the industry.
- To develop key research questions for scientific study that will best support the growth and development of the BC shellfish industry.
- To develop a strategic research plan for each shellfish species.
- To develop collaborative research partnerships among interested parties to support a specific area of investigation

Ancillary Aims

- To facilitate a better understanding by scientists of the problems facing the BC shellfish industry and a better understanding by industry of the process of scientific research and research funding.
- To continue to expand the industry research network.
- To facilitate the development of industry/researcher working relationships.

4.2 STAGE 1 - WORKSHOP FOR IDENTIFICATION OF INDUSTRY-WIDE ISSUES AND CONSTRAINTS

Led by an industry expert, each group began by determining what the overall objective was for their particular subject matter area. After the objective was determined, a full list of constraints was compiled. These lists have been included as a separate document under each topic area. The groups were then asked to choose the key constraints and expand on them by developing a research rationale and/or plan for each constraint. These were documented in a chart. In developing the charts, the group leaders asked the participants the following questions:

- Determine how the constraint can be resolved. Is it through management, regulation or research?
- What kind of research should be done to resolve the constraint? How should it be approached? (intelligence gathering, tech transfer, pilot evaluation etc.)
- Who should do it? Is this something the CSR should be researching? Are there collaborations that are obvious?
- Where should the research be done?
- What resources would be needed?
- Consider how the research project could be evaluated. Evaluate both the RISK and the RETURN. Is it high, medium or low?

4.3 STAGE 2 - SPECIES WORKSHOPS

4.4 STAGE 3 – FINAL GOAL AND ACTIVITY RANKING WORKSHOP