Annual ACAIRDN Research Workshop

FINAL REPORT

January 26, 2007
Lord Nelson Hotel
Halifax, NS

Introduction

ACAIRDN (Atlantic Canada Aquaculture Industry Research and Development Network)

ACAIRDN is a unified voice for the Atlantic Canadian Aquaculture Industry in matters of R&D, providing leadership, coordination and communication for the direct benefit of the industry. The Network first began in 2002, with the placement of Research and Development Coordinators (RDC's) at each of the major aquaculture industry associations in Atlantic Canada. In addition, RDC's were placed in the two major aquaculture industry associations in British Columbia in 2006.

Goal of the ACAIRDN Research Workshop

The goal of ACAIRDN Research Workshops is to focus on industry R&D priorities and on ways of developing closer linkages and compatibility between funding programs to better assist industry. Attendees, including industry, funding agencies, academia, government and industry researchers, will discuss current aquaculture industry R&D initiatives and priorities to assist moving the industry forward. Sector planning from each province will be incorporated into an overall strategy to ensure input from all industry participants involved in R&D planning, and that outcomes reach the attention of funding agencies.

This Workshop will provide a focal point for industry leaders, funding agencies, government regulators and researchers to provide input into a regional R&D strategy, by sector. Following the workshop the RDC's working within provincial associations will produce the workshop proceedings, which will detail the priorities and issues facing the industry that require assistance. Following annual R&D workshops organized by the Network, this document will be updated on an annual basis. This process will aid in the facilitation of funding by providing a forum for industry to consult with funding agencies and government regulators in a more coordinated and cost effective manner.

This year the *Aquaculture Industry R&D Workshop* was held in conjunction with the Aquaculture Association of Nova Scotia's *Scotian Pride* annual conference, Lord Nelson Hotel, Halifax, Nova Scotia. The intention is to rotate the location of the meeting each year between participating associations.

Presentations

The following presentations illustrate the research priorities and activities that are continuing in the aquaculture industry in Atlantic Canada. In addition, Aaron Pannell presented the coordinated R&D efforts that are ongoing in the New Zealand Mussel industry. Copies of the presentations are included in Appendix 1.

- R&D Coordination in New Zealand – Aaron Pannell, Marlborough Mussel Company Ltd.
- Overview of R&D Network (ACAIRDN) – Peter Warris, Prince Edward Island Aquaculture Alliance (PEIAA), David McCallum, British Columbia Shellfish Growers Association (BCSGA)
- Reports of Provincial R&D Initiatives
  - NB Salmon Growers Association (NBSGA) – Caroline Graham
  - Newfoundland Aquaculture Industry Association (NAIA) – Darrell Green
  - Aquaculture Association of Nova Scotia (AANS) – Jason Mullen
  - Prince Edward Island Aquaculture Industry Alliance – Peter Warris
  - BC Salmon Farmers Association (BCSFA) – Norman Penton
  - BC Shellfish Growers Association – David McCallum

Facilitated Discussion on R&D Priorities, facilitated by Jason Mullen

ACAIRDN Funding Matrix

The ACAIRDN Funding Matrix was introduced at the Workshop, and is attached in Appendix 2. This document will serve as a central repository for Research and Development funding programs specific to the Aquaculture industry in Canada. This current version contains only programs from Atlantic and Western Canada, however, the goal for future revisions will be to include programs from across Canada.

Summaries are included for each funding program, as well as website links through which additional information can be obtained. Specific contact information for individuals responsible for these programs has also been included, where possible.

This document will be housed on the ACAIRDN website (unavailable as of January, 2007). In addition, each RDC will be the key point of contact for each region. This document will be reviewed and updated annually, and presented at the Annual Workshop for Funding Agencies.

ACAIRDN Quarterly Newsletter

The ACAIRDN Newsletter is an important means of communicating R&D activities that are occurring through each of the member Associations. The first newsletter was distributed to representatives of industry, researchers and government, and is attached in Appendix 3. The second newsletter is scheduled for distribution in February 2007. Participants are encouraged to contact their local RDC to be included in the distribution list.

General Discussion

The focus of the ACAIRDN presentations given at this Workshop was specific regional research priorities and activities. The next step will be to develop a matrix of priorities by region and by sector, which can be used to develop joint projects. This matrix, combined with the ACAIRDN Funding Matrix, will enable industry, researchers and regulators to maximize the benefits of funding programs to accomplish the research goals of the industry.

The participants acknowledged that research priority lists are useful tools for industry and researchers to demonstrate the importance of research projects to funding agencies. It was also acknowledged that it would be useful to identify whether each priority will require short or long term research. This would enable researchers, industry and funding agencies to better allocate resources and schedule projects accordingly.

The deficiency of scientific expertise in Atlantic Canadian universities was discussed, and it was suggested that ACAIRDN communicate the need for more expertise to University representatives. It was also recommended that ACAIRDN RDC's hold more frequent workshops with researchers and facility directors to facilitate communication between the research community and industry.

While the use of internet and email communication is important, there is a need for face-to-face contact between the RDC's, funding agencies, academia and researchers.

The ACAIRDN RDC's will incorporate the comments and suggestions from this Workshop into upcoming activities, and will schedule further meetings with participants to work together on addressing R&D priorities for the Aquaculture industry in Atlantic Canada.

Acknowledgements

The ACAIRDN RDC's wish to acknowledge the support of NRC-IRAP and ACRDP. In addition, ACAIRDN wishes to thank the organizing committee of Scotian Pride for incorporating this workshop into the Conference schedule.

ACAIRDN Research and Development Coordinators

For more information about ACAIRDN or the information presented at this workshop, please contact any of the following RDC's:

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Participant List

Name	Organisation
Sue Vatcher	NRC-IRAP
Neil Ross	NRC-IMB
Andrew Bagnall	NSFA
Amanda Swim	NSFA
Greg MacCullum	DFO
Peter Muise	Mussel Farmer
Robin Stuart	PEI Mussel Inc
Jon Grant	Dalhousie
Murray Mitchell	Agri-Food Canada
Michelle Theriault	Université Saint-Anne
Eugene Samson	NS Fisheries
Matthew Gillis	ACOA PEI
Scott Walker	ACOA NB
Tim Jackson	NRC-IRAP
Don Douglas	NRC-IRAP
Gary Rogers	G&D Rogers Mussel Farm
Carl Reynolds	PEI AA
Denise Methé	DFO-ACRDP
Russell Easy	NRC-IMB
Aaron Pannell	NZ Mussel Industry
Scott Bertram	Innovative Fisheries

APPENDIX 1 – Presentations
APPENDIX 2 – Funding Matrix
APPENDIX 3 – ACAIRDN Newsletter

United Innovation

Research co-ordination in the
New Zealand Aquaculture Industry

Research partners

- Individual companies
- Research providers
  - Cawthron Institute - trust
  - National Institute of Water and Atmosphere (NIWA)
  - Private contractors
- Universities
- Government organisations
  - Research
  - Funding bodies
  - Ministry of Fisheries (MFish)
  - Ministry of Bio security (BNZ)
- NZMIC / NZAQL
- Local Marine Farm Assn's

How research is initiated

- Most research is initiated by private companies
- Some generic research is initiated by NZMIC or local marine farming assn's
- Government often sets requirements for compliance based research
- Some research opportunities are suggested by research providers

Working relationships

- Science providers
  - Generally good one on one relationship with companies
  - Often end up as the “meat in the sandwich” between regulators and growers
  - Main income source is Govt funding or contracts with industry
- Universities
  - Used for small scale “specialist” research
  - Often not used to potential by industry
- Government organisations
  - Some departments have similar standing and relationship with industry as science providers
  - Others are “regulator” based, sometimes viewed as out of touch with industry.
  - Since 2005 most regulation in the industry has been transferred to local Govt.

Types of research commonly undertaken

- Existing species development
- New species growing systems
- New equipment design
- Environmental
- Bio security

Existing species development

Example 1 – Greenshell™ mussel selective breeding program

- Relationship – NZMIC with science providers (Cawthron institute) and Industry in-kind support
- Initiation – Science providers / industry
- Funding – 80% Government research grant, 10% NZMIC, 10% industry in kind

Greenshell™ mussel selective breeding program - aims

Transform the NZ mussel industry through the domestication of the Greenshell mussel

- Eliminate dependence on wild spat
- Improved yield, efficiency and product quality
- Designer breeds and niche products

Greenshell™ mussel selective breeding program - results

Superior, specialised brood stock for industry

- Breeding programme designed
- Several hundred families produced
- Genetic parameters measured
- Significant gains in shell length, meat weight

Existing species development

Example 2 – Greenshell™ mussel spat retention

- Relationship – Industry with science providers (Cawthron institute)
- Initiation – Industry – private company (Marlborough Mussel Co Ltd)
- Funding – 50% Government research grant, 50% private

Greenshell™ mussel spat retention - aims

To maximise survival of hatchery bred spat

- Reduce current losses
- Develop an economic system for the transfer of spat to the farms
- Maximise the potential economic gains of the Greenshell™ Mussel breeding program

Greenshell™ mussel spat retention - results

- Spat retention increased from 5% to 30%
- Systems developed for efficient spat settling and transfer
- Algae culture, larval rearing and hatchery systems all being refined at present.

New species growing systems

Example – Kingfish cultivation in sea cages

- Relationship – Industry with science providers (NIWA)
- Initiation – private company/science provider
- Funding – 80% private, 20% Government grant

Kingfish cultivation in sea cages- aims

To produce farm grown kingfish for the local and export market

- Develop economic growing systems
- Gain efficiencies by combining with existing shellfish growing infrastructure
- Achieve minimal impact on environment

Kingfish cultivation in sea cages - results

- Growing systems are being trialled to determine economic feasibility
- Finfish farming successfully integrated with shellfish
- Studies underway to establish environmental performance
- Out of this research, NIWA has established a commercial kingfish hatchery

New species growing systems

Example – Co-cultivation of seaweeds, kingfish, mussels and Kina (urchins)

- Relationship –science providers with Industry
- Initiation – science providers (NIWA)
- Funding – 100% government grant

Co-cultivation of seaweeds, kingfish, mussels and Kina - aims

To combine finfish, shellfish, seaweed and Kina culture to provide a symbiotic and efficient system

This project is in its infancy,

but has potential to:

- Improve production
- Reduce environmental impact
- Reduce market risk
- Reduce costs by combining infrastructure
- Maximise use of water space

New equipment

Example – technology for the removal of *Gymnodinium catenatum* cysts from mussel spat

- Relationship –NZMIC with science providers
- Initiation – Mussel Industry
- Funding – 50% government grant, 50% NZMIC

Removal of *Catenatum* cysts from mussel spat - aims

100% removal of catenatum cysts from Kaitaia mussel spat

- Must be totally effective to ensure no spread of *catenatum*
- Minimise negative effects on spat
- Economically viable
- Developed quickly to ensure continued spat supply

Removal of *Catenatum* cysts from mussel spat - results

- System developed that passed stringent environmental requirements
- Economically viable, simple to use
- System developed within time threshold
- Equipment successful but currently not used due to spat being clear of *Catenatum*

Environmental research

Example – Fisheries resource impact assessments (FRIA)

- Relationship –Industry with Government and science providers
- Initiation – Government
- Funding – 100% individual permit applicants

Fisheries resource impact assessments - aims

To gain an understanding of effects of new mussel farm applications on recreational, commercial or customary fisheries

- Required by Ministry of Fisheries for all new permit applications between 1998 and 2001
- Wide range of information requested
- Science providers contracted by applicants to complete research to the satisfaction of Ministry of Fisheries

Fisheries resource impact assessments - results

- Around NZ $3 million dollars spent in researching and reviewing effects of approx. 300ha of applications
- Long, complicated and at times frustrating exercise for applicants
- Majority of applications were found to have no significant effect on fisheries
- Numerous individual “FRIA’s” are now being collated into a useful research document

Bio security

Example – *Didemnum vexillum* control measures and research

- Relationship – NZMIC, NZ Marine Farming Assn, science providers (Cawthron) and Government (Bio security NZ)
- Initiation – mussel industry
- Funding – 50% Govt 50% industry

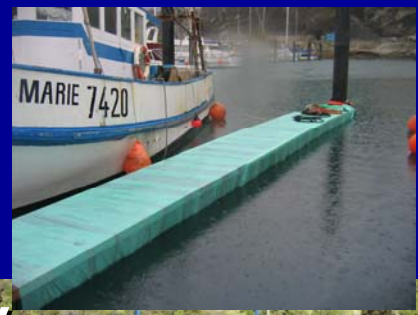
Didemnum vexillum research and control measures - aims

1. *The eradication or control of D. vexillum in the Marlborough Sounds*
2. *To further understand the biology of D. vexillum and its effects on aquaculture*

- Develop efficient, cost effective control measures
- Eradicate from areas where possible
- Monitor success of treatment for further outbreaks
- Implement trials to learn about biology and effects on aquaculture

Didemnum vexillum research and control measures - results

- Run and controlled by industry
- Eradication measures have generally been successful
- Control methods may be useful for other invasive species
- Follow up monitoring underway
- Information being gathered regarding effects on aquaculture



Other uses for *D.v.* controls - *3000 tonne frigate wrapped in 2 days to kill Styela Clava*

Other private research

Example – technology for separating blue mussels from Greenshell™ mussels

- Relationship – Private company (Marlborough Mussel Co), design and manufacturing company
- Initiation – Industry
- Funding – privately funded

Mussel grading technology - aims

To efficiently separate blue mussels from Greenshell™ mussels

- Transporting, sorting and dumping 1000 tonne blue mussel costs MMC NZ$250k/yr
- Hand sorting was slow, demoralising work
- Needed a system that removes the labour without sacrificing production speed

Mussel grading technology - results

- System developed that can handle 70 pieces per second (approx 12 tonne per hour)
- 99% accuracy
- Low labour input (one man operation)
- Costs recovered in less than one year

Mussel grading technology - results

Linking Industry Needs to Research & Development

Peter Warris
R&D Coordinator
PEI Aquaculture Alliance
A Member of

ACAIRDN

Atlantic Canada Aquaculture Industry Research & Development Network

Link

1. One of the rings or separate pieces of which a **chain** is composed.
2. Anything serving to **connect** one part or thing with another.
3. A unit in a **communications** system.

Problems

- **Communication**
  - Research work not always focused on the issues facing industry.
  - Solutions developed through Research not always reaching Industry.
- **Coordination**
  - Research projects not able to find industry partners.
  - Industry slow to take advantage of R&D Support Programs.

What is ACAIRDN

A Network consisting (so far) of the R&D Coordinators from the four Atlantic Provinces

- 2001 - Concept developed by Sue Vatcher (NRC-IRAP) and the four Associations.
- 2002 - Network created with the placement of R&D Coordinators in each association.
- 2006 – ACAIRDN funded directly via NRC-IRAP and ACOA.

Why form a Network?

"..a number of R&D support programs have emerged directed at enticing industry to participate in research and to coordinate efforts with other industry partners in the region."

Why form a Network?

"Industry, faced with a myriad of immediate operational challenges has been slow to take advantage of these programs."

Why form a Network?

"Coordination of R&D efforts to define industry needs and identify opportunities for regional cooperation in problem resolution remains critical."

What makes ACAIRDN different?

- Industry driven.
- A human element of interaction between Research and local Industry.

Objectives
Communication

- Link the industry to researchers, enabling focus on industry needs.
- Transfer R&D results back to industry.
- Connect Industry to Researchers as project partners.

Objectives
Communication

- Enable access to information.
- Increase public awareness of the value of aquaculture.
- Represent our Associations at various forums.

Objectives
Coordination

- Maximise efficiency.
- Minimise duplication.
- Collaborate with
  - Government Agencies.
  - Private Companies.
  - Academic Institutions.

Objectives
Coordination

- Develop Industry relevant research.
- Manage Aquaculture related Environmental Issues.
- Act as a Scientific Resource for our Associations.

Mechanisms

- Bi-monthly network meetings
- Annual meeting of Network with other Canadian aquaculture associations.
- R&D Funding Matrix
- Sector based R&D priority workshops.

Mechanisms

- AquaBase Canada
  - Website
  - Web based R&D Database
- Quarterly Network newsletter.

NBSGA R&D Activities

Presented at ACAIRDN R&D Workshop,
Scotian Pride, Lord Nelson Hotel
January 26, 2007

Presented by: Caroline Graham, NBSGA RDC

NBSGA

New Brunswick Salmon Industry

- Located in Bay of Fundy
- 98 licensed marine salmon farms
- Potential Production
  - 40,000 MT
- Value
  - $260 million

2005 Aquafacts published by NB DAA

New Brunswick Salmon Growers Association (NBSGA)

- Established in 1987
- An industry funded association that works on behalf of salmon farmers in New Brunswick
- Represents over 90% of the NB salmon production and a broad spectrum of support companies.

NBSGA R&D Projects

- Economic Analysis
- Juvenile Lobster Project
- Efficacy Testing of Potential ISAV Disinfectants
- Processors Waste Water Treatment & Disposal
- Harvest Wharf Facility
- Identification of Virulence Specific PCR based Markers for Teleost Pathogens
- Salmon Holding Capacity in SWNB
- Standardizing Industry & Regulatory Genetic Screening Tests for detecting non-local strains in aquaculture and wild population of Atlantic salmon in the Bay of Fundy area.
- Genetic Characterization of ISA Isolates
- Evaluation of BMA Scenarios for SWNB salmon aquaculture
- Economic Profile
- Stock Containment

NBSGA

NBSGA R&D Projects

- PBS (Performance Based Standards)
- Codes of Practice
- Offshore Aquaculture Development
- SLICE Withdrawal Study
- Phytoplankton Early Warning Approaches for Salmon Farmers

NBSGA R&D Workshops

- Strategic Action Framework Planning Workshop
- Development of Open Ocean sites in the Bay of Fundy Technical Session
- AECC Environmental Monitoring Workshop
- ISA Workshops (3)
  - 2006: ISA Research and Control and Management Workshop

AGM Technical Sessions

- 2002 – ISA Management and Research
- 2003 – Criteria for Alternate Species Marine Aquaculture Site Development in Bay of Fundy
- 2004 – Development of Open Ocean Sites in Bay of Fundy
- 2005 - Research and Development to Support Implementation of the Atlantic Canada Salmon Farming Sustainability Plan in SWNB

Process of R&D Planning

- Develop NBSGA Research Priorities
  - NBSGA Science Committee and through consultation with industry experts
    - November 2003 NBSGA R&D Mandate V2.2
    - July 2005 Research Requirements to Support Implementation of the Sustainability Plan
    - December 2006 Research Priorities identified at ISA Research Workshop

Process of R&D Planning

- December 2006/January 2007 Review of NBSGA Research Priorities
  - 2007 – reconvene Science Committee to:
    - Update status of previous R&D priorities
    - Update list of R&D Priorities
  - Present to Funding Agencies, Government and Researchers at Annual Meeting
    - January 26, 2007 – Scotian Pride

NBSGA

NBSGA R&D Areas of Concern

- 2007 R&D List
  - Based on previously identified priorities
  - 2007 list not yet prioritized
  - Being reviewed by members
  - Will be vetted through Science Committee

NBSGA R&D Areas of Concern
Fish Health

- ISA
  - Strains
  - Epidemiology
  - Pathogen/host relationships
  - Vaccine development
  - Validation of biosecurity and husbandry practices
- Other disease concerns
  - Sea Lice
  - BKD
  - Emerging pathogens
- Effects of stress
  - Environmental parameters
  - Smoltification
  - Super Smolt process

NBSGA

NBSGA R&D Areas of Concern Environment

- Performance Based Standards
  - Best indicators
  - Application of new knowledge
  - Background conditions
  - Plume delineation
  - Spatial/temporal variability
- Farm fish/wild fish interactions
  - Genetic interactions
  - Habitat alteration
- Farm fish/environment interactions
- Carrying capacity issues
- Interactions with other stakeholders

NBSGA

NBSGA R&D Areas of Concern Production

- Bay management/site consolidation issues
  Access to New Sites
  - Development of offshore operations
    - Ocean/engineering
    - Mapping and conflict resolution
    - Environmental compatibility
    - Fish health and husbandry
    - Economic considerations
- Codes of practice
  - Auditing
  - Reporting
  - Consolidation between regions
- Land based facilities
  - Alternate/exotic species
  - Broodstock
- Improvements in production that can result in decreased costs or improved yield
- Feed (formulations, conversion, strategies)

NBSGA

NBSGA R&D Areas of Concern Future

- Collaboration and Communication
  - Between regions – ACAIRDN
    - Collaboration on joint projects
  - With regulators
    - DFO, CFIA, NB DENV, NB DAA…
  - With researchers

Thank You

NBSGA

R & D Update Newfoundland Aquaculture Industry Association

Darrell Green
Research and Development Coordinator

ACAIRDN

Atlantic Canada Aquaculture Industry Research and Development Network

Introduction

Introduction

- Determining R & D priorities
- Update – current and future projects
    - Shellfish
    - Finfish
- Partnerships

Introduction

Priorities

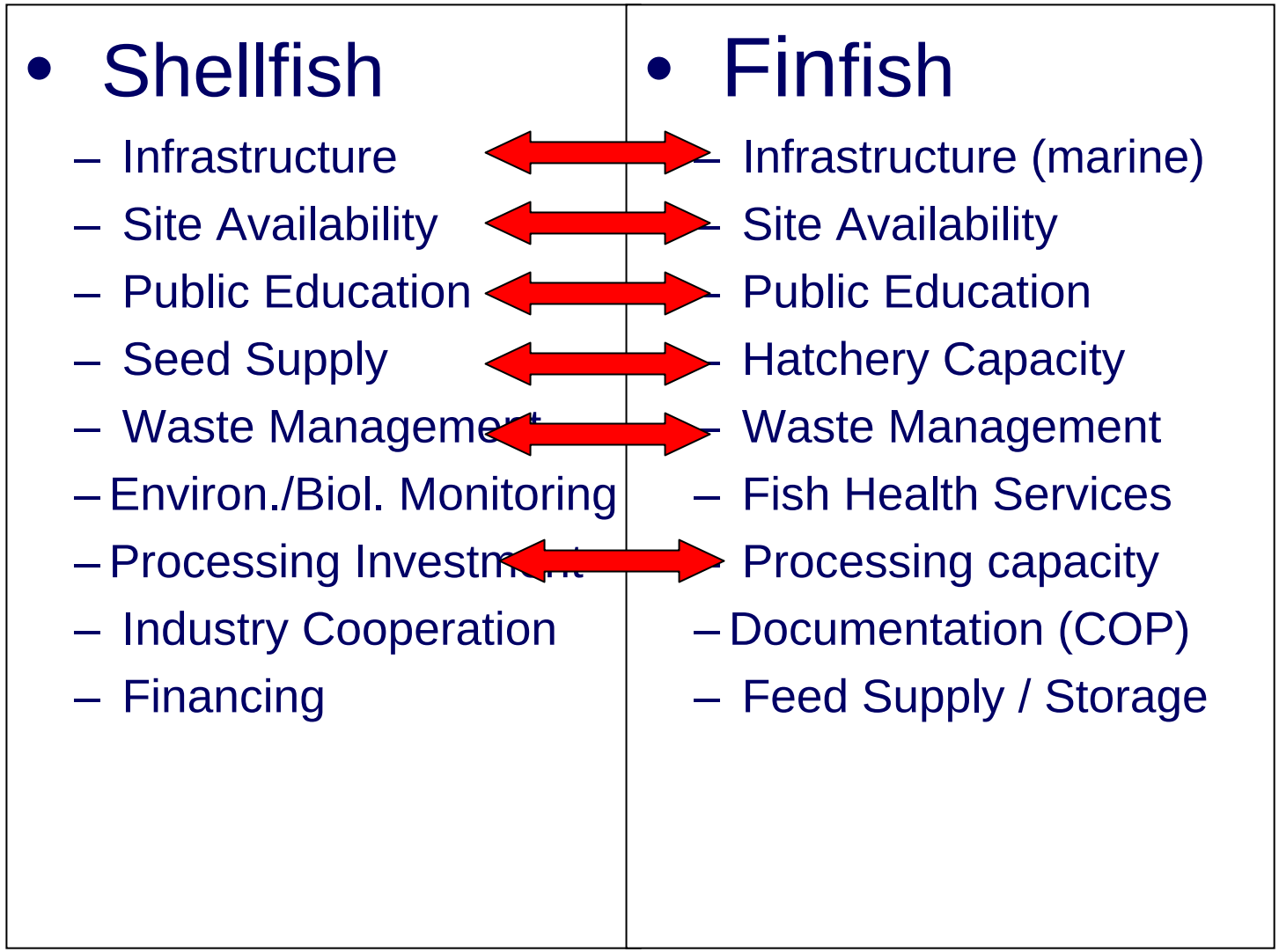
Determining R & D Priorities

- Sector based
  - Shellfish, salmonids, cod
- January – April
- Workshops, annual conference, surveys and one-on-one consultations.

Introduction

Priorities

R & D Priorities



Newfoundland R & D Update

- Shellfish
  - Mussel Seed Quality Project
    - Current seed supply not adequate
    - Evaluate new sites – production, genetic and physical parameters
    - Provides industry with a map of mussel seed quality in NL bays

Newfoundland R & D Update

- Shellfish
  - Aquatic Invasive Species
    - Potential impact of AIS in NL
    - Currently not a problem
    - Risk areas, monitoring and public awareness
    - Proactive approach provides industry security

Newfoundland R & D Update

- Shellfish (future)
  - Ice Slurry Technology
    - Providing product to mainland Canada and US
    - Purchase and evaluation of ice slurry machine
    - Enhanced product quality and processing efficiencies

Newfoundland R & D Update

- Finfish (future)
  - Aquaculture Waste Management
    - No overall industry strategy
    - Concerns – future growth
    - Will address biosecurity and environmental sustainability concerns

Introduction

Priorities

Update

- Shellfish
- Finfish

Newfoundland R & D Update

- Finfish
  - Cod Demonstration Project
    - Full scale cod farming not proven
    - Work out logistics
    - Moves industry towards commercialization

Newfoundland R & D Update

- Finfish
  - Cod Genome Project
    - Selective breeding - slow
    - Identify genetic markers relating to industry-relevant characteristics
    - Will provide a broodstock selection criteria based on genetics

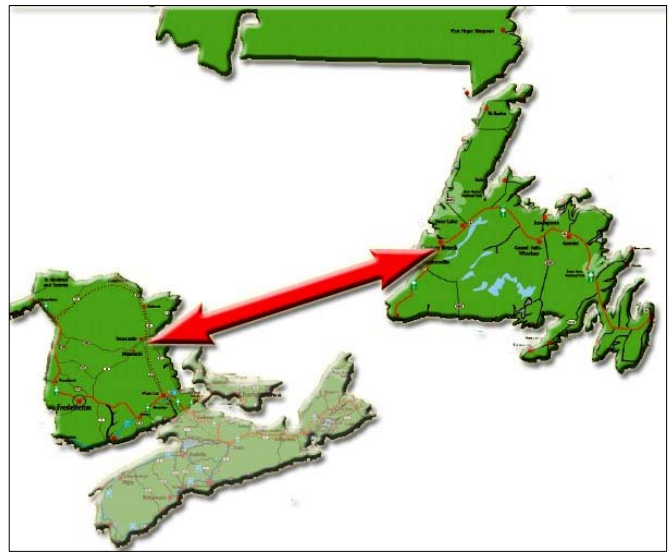
Newfoundland R & D Update

- Non-sector-based
  - AquaBase
    - No single database of aquaculture research
    - Database in 2/3 populated
    - Provides a database for planning aquaculture research initiatives

Partnerships

NL and NB

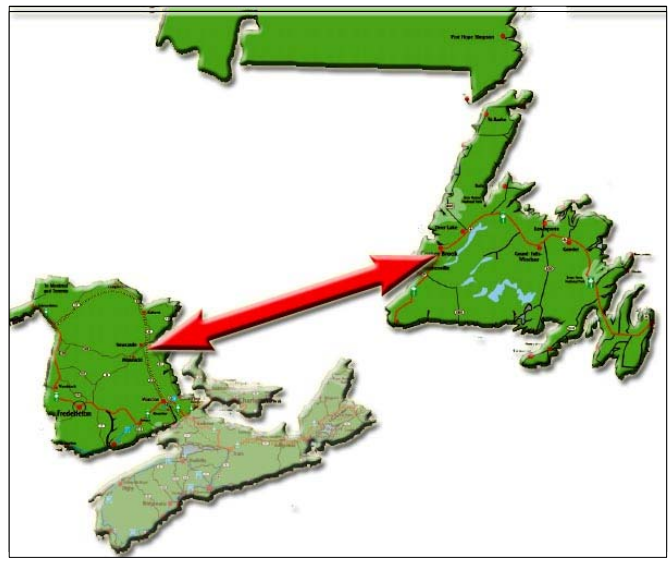
- Aquaculture Waste Management (future project)
  - Environmental sustainability



Partnerships

NL and NS

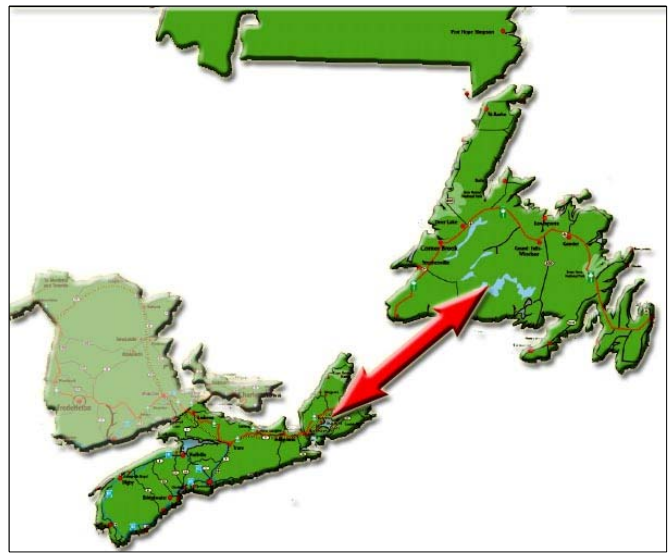
- Ice Mitigation (completed)
  - Ice / superchill management



Partnerships

NL and PEI

- Aquatic Invasive Species (ongoing)
  - Industry security
- Ice Slurry Technology (future project)
  - Improved quality and processing efficiencies



Partnerships

Atlantic Canada

Introduction

Priorities

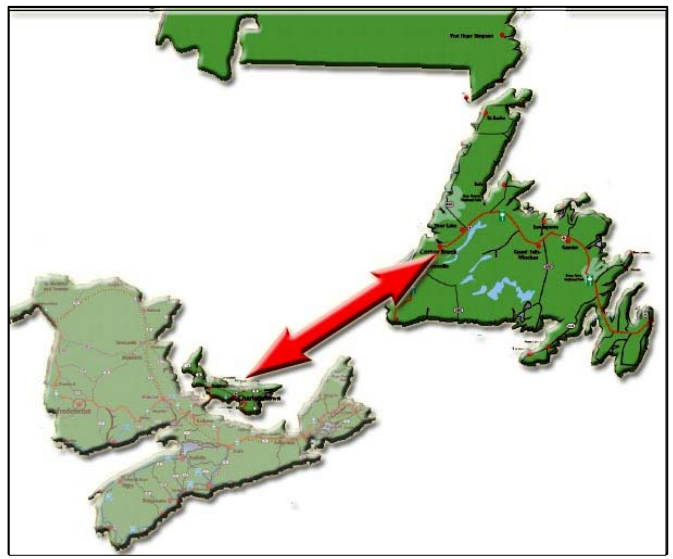
Update

- Shellfish
- Finfish
- Other

Partnerships

- ✓ NL - NB
- ✓ NL - NS
- ✓ NL - PEI

- AquaBase (ongoing)
  - Aquaculture Research Portal
  - Plans – include more info from NB,PEI, NS, BC



Introduction

Update
- Shellfish
- Finfish
- Other

Partnerships
- ✓ NL - NB
- ✓ NL - NS
- ✓ NL - PEI

Thank You !

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AANS and the Canadian Aquaculture Industry Research and Development Network

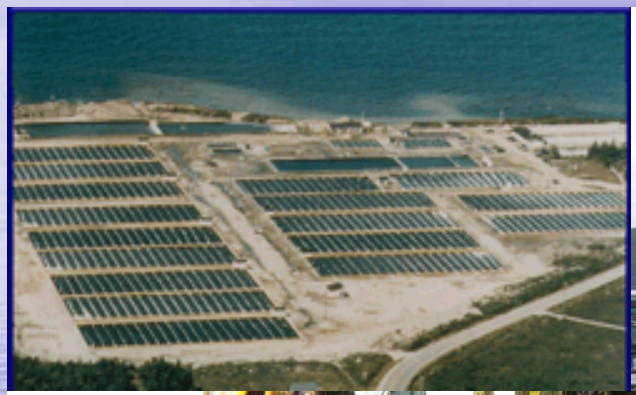
Jason Mullen

Research and Development Coordinator –

Aquaculture Association of Nova Scotia

AANS
AQUACULTURE ASSOCIATION OF NOVA SCOTIA

WE Grow a Diversity of Species



AANS
AQUACULTURE ASSOCIATION OF NOVA SCOTIA

Providing a Range of Products

Industry status

- *$41 million farm gate value (2003)*
- *Provide 1127 direct jobs in rural areas*
  - Higher levels of education
  - High proportion of youth & women
- *Industry consolidation*
- *Few new site approvals*
- *Disease and Biofouling Challenges*

R&D in Nova Scotia

Recent Focus

- Tunicate Mitigation
  - Analysis of reproduction and settlement patterns of Ciona intestinalis
  - Mitigation trials including NZ method
- Shellfish Disease Research
  - MSX management: AANS project & CBU project
- Ice/SuperChill Avoidance

R&D in Nova Scotia

- R&D Workshops
  - Invasive Species Workshop
  - Scallop Aquaculture Workshop
  - AC ’06
  - Annual Scotian Pride Conference
- CAIRDN Projects
  - CAIRDN R&D Newsletter
  - R&D Funding Matrix
  - AquaBase/AquaPort
  - R&D Priorities/Funding Workshop
  - R&D Coordination Workshop (AAC)
  - Ongoing Meetings/Networking of CAIRDN

Ongoing Projects Supported and Managed by the AANS

- Parasites Affecting Maritime Shellfish Aquaculture
- Analysis of Mass Mortalities Affecting the American Oyster
- MSX: Development of Management Strategies
- Guysborough County Sustainable Aquaculture Project
- Genetic Analysis of Farmed and Wild Salmon in the Bay of Fundy
- Offshore Mussel Aquaculture in the Northumberland Strait
- Abiotic Factors Affecting MSX transmission and survival
- Reproduction and Settlement Patterns of *Ciona intestinalis*
- Efficacy Testing of New Zealand Tunicate Mitigation Technology & Tunicate Monitoring
- Salmon Farming Manual Project
- Seed Source Development in Nova Scotia through Species and Genetic Analysis
- Development of GIS tools for Aquaculture Siting Process
- Development of Environmental Monitoring Program
- Construction of AANS R&D Database
- Ice/SuperChill Mitigation
- Duck/Mussel Farm Interaction Study

Future R&D Directions

- Tunicate/ Invasive Species Mitigation/Avoidance
- Duck/ Mussel Farm Interactions
- Shellfish/ Finfish Farm Biosecurity
- Integrated Multitrophic Aquaculture
- Offshore Aquaculture

Tunicates & Mussel Farming

Solitary Tunicates – *Styela clava* & *Ciona intestinalis*

Courtesy of PQ Gov't

Courtesy of PEIAFA, Peter Darnell & Andre Mallet

- Pull mussels from their lines
- Handling & Processing - $$
- Compete for food and space

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AQUACULTURE ASSOCIATION OF NOVA SCOTIA

Tunicates & Mussel Farming

Colonial Tunicates - *Botryllus schlosseri* & *Botrylloides violaceus*

Courtesy of PEIAFA

- Smother mussels & seed lines
- Handling & Processing - $$
- Compete for food and space

Status of Invasive Tunicates - Nova Scotia -

- *Ciona Intestinalis* currently the only problematic species
- Monitoring for new invasive tunicate species is ongoing

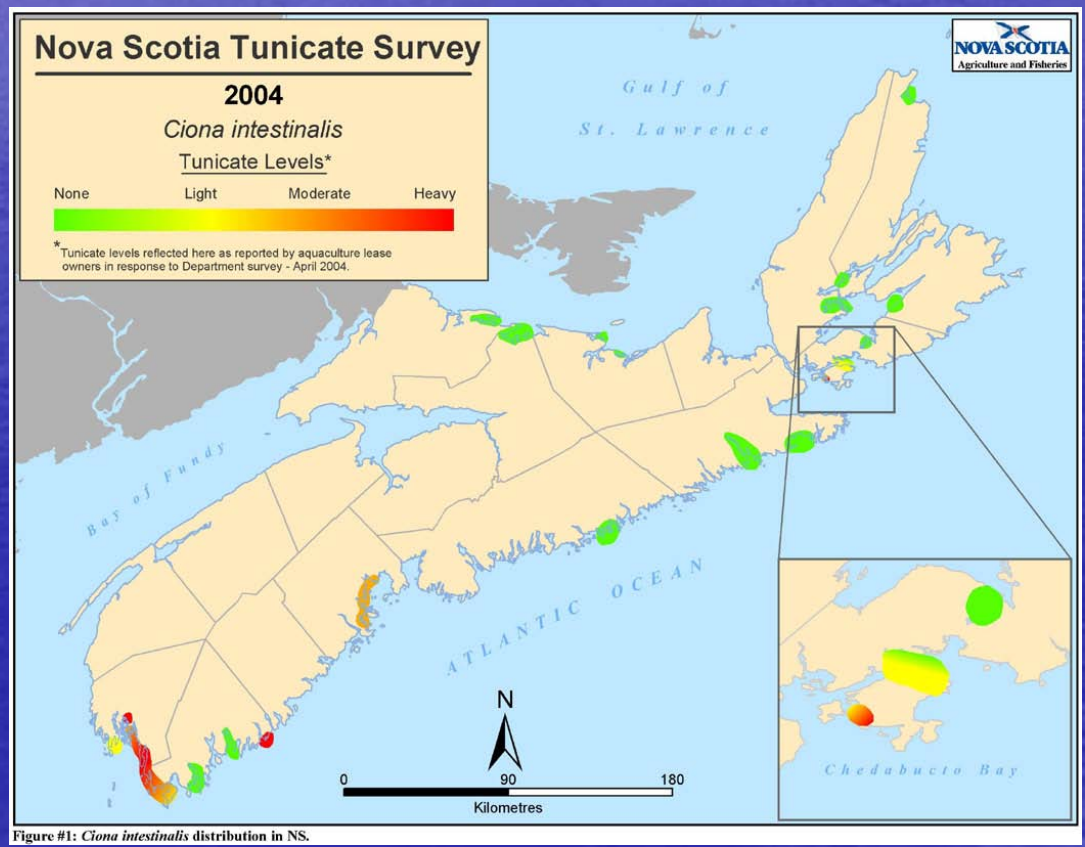

Figure #1: *Ciona intestinalis* distribution in NS.

Courtesy of Nova Scotia Aquaculture and Fisheries

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Invasion of the Blob...

Left: *Didemnum* covering the ocean floor, surrounding a sea anemone
Right: GROWING FROM THE BOTTOM UP—WHOI Scientist Mary Carman examines the invasive, filter-feeding sea squirt species of the genus *Didemnum* living in the tidepools at Sandwich Town Beach on Cape Cod. This species spreads up from the bottom of rocks as it grows, covering everything in its path, including vegetation and shellfish. "Anyone who likes to eat seafood should worry about this," Carman said. (Photos by Tom Kleindinst, WHOI Graphic Services)

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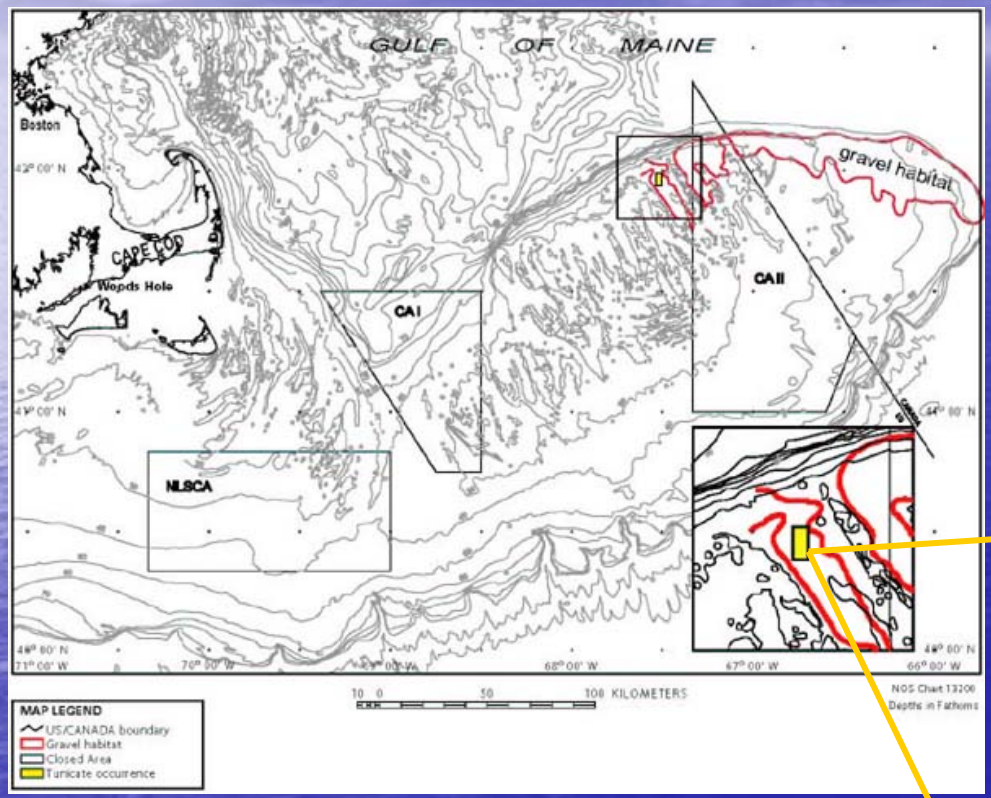
Didemnum spp.



- Over 200 square km now covered on the Grand Banks

Source: http://www.noaanews.noaa.gov/stories2003/s2125.htm

Status of Invasive Tunicates - Nova Scotia -

- Priorities for the industry:
  - Monitoring
  - Screening/Treatment of mussel seed
  - Seed sourcing
  - Mitigation

Courtesy of Peter Darnell, Indian Point Marine Farms

Contact Information:

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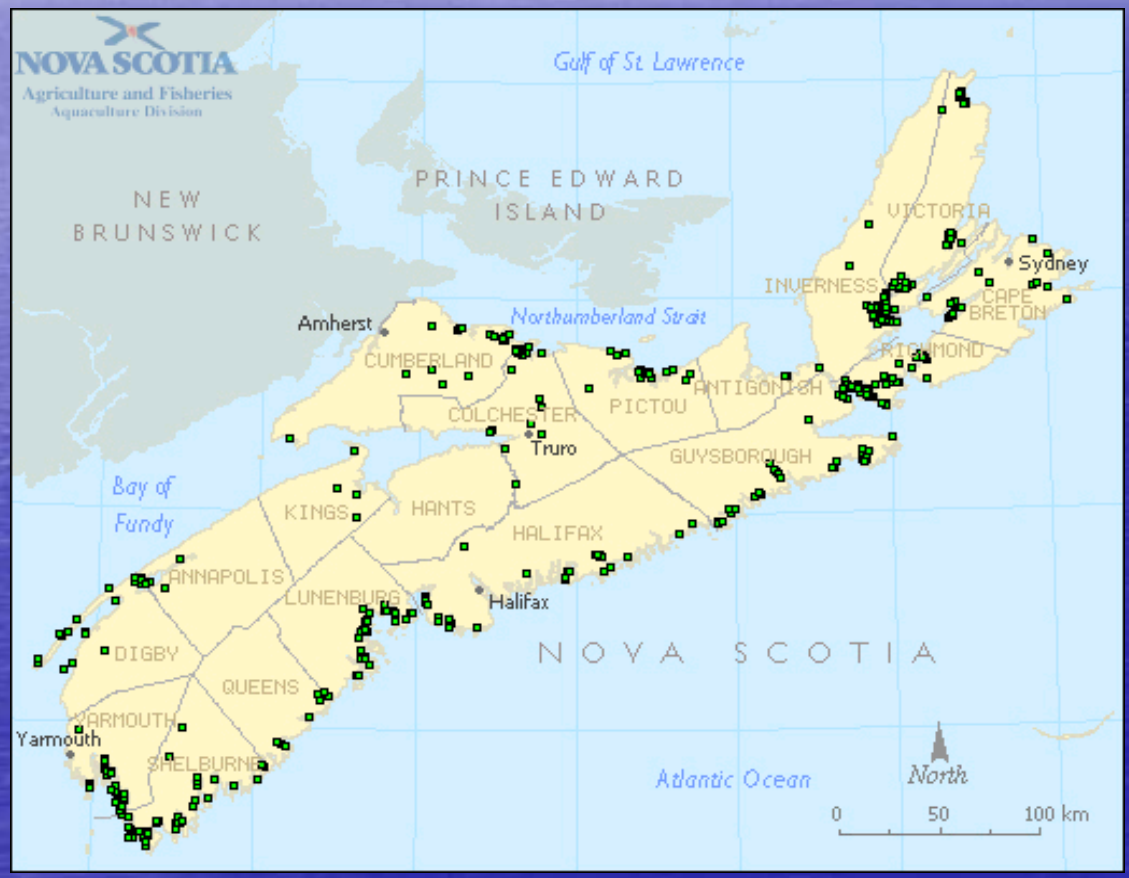
Aquaculture Sites In Nova Scotia



R&D Priorities for the PEI Aquaculture Industry

Peter Warris
R&D Coordinator
PEI Aquaculture Alliance

Prince Edward Island
AQUACULTURE
ALLIANCE

Introduction

- Overview of the Industry by sector
- Major issues facing the industry as a whole
- Sector based R&D Priorities

Major Issues

- Invasive Species
- Seed / Broodstock
- Nuisance Species / Predation

The PEI Aquaculture Industry

- Rapid expansion over the last 20 years
- Divided into three sectors
  - Mussels
  - Oysters
  - Finfish

Mussels

- Largest Mussel producer & exporter in Canada
- 2005 Production - 35.3 M lbs, $21.4 M
- Between 1,500 - 2,000 employees (farms & processing plants)

Oysters

- Largest Oyster producer in Eastern Canada
- 2005 Production - 6.2 M lbs, $5.5 M
- Approximately 1,000 employees

Finfish

- Specialized in the egg, fry & fingerling market (Rainbow trout and Salmon)
- Strong supporting R&D sector
- 2005 Production - $1.8 M
- 20-30 employees (at peak times)

Mussel Sector

- Represented by the ***PEI Cultured Mussel Growers Association***
- Main areas of interest are:
  - Seed
  - Nuisance Species / Predation
  - Invasive Species
  - Bio-security
  - Water Quality

Seed

- Quality
  - Improvements in the seed grading process
  - Improvements in the declumping process
  - General review of husbandry and collection techniques

Seed

- Quantity / Source
  - Survey to determine seed requirements
  - Interaction between seed set and presence of invasive species
  - Alternative sources of mussel seed
    - Broodstock operations / hatcheries

Nuisance Species / Predation

- Green Algae
  - Mechanisms to clean collectors
  - Basic biology, life cycle and fertility to help predict outbreaks and determine mitigative treatments

Nuisance Species / Predation

- Sea Ducks
  - Alternative deterrent systems
  - Alternative socking materials

Invasive Species

- Management
  - New or adapted farm management practices to reduce their impact
  - Industry based development projects, with a commercialization phase for those treatments deemed most practical

Invasive Species

- Control
  - Re-examination and confirmation of existing treatment options for control
  - Leading to standardized treatment options

Water Quality

- Effluent treatment for shellfish processing and socking operations
- Integration of management plans for the future of the industry.

Bio-security

- A clear, concise bio-security policy
- Emergency contingency plans
- On a farm to farm basis and from government

Oyster Sector

- Represented by the ***Island Oyster Growers Group***
- Main areas of interest are:
  - Nuisance Species
  - Invasive Species
  - Seed

Nuisance Species

- Boring sponge (Cliona sp.)
- Algae such as Sea lettuce (Ulva sp.) and Green Hair (Enteromorpha sp., Cladophora sp.)
  - Environmental conditions
  - Equipment to remove
- Starfish

Invasive Species

- Tunicates
- Oyster thief (*Codium fragile*)
- Green crab (*Carcinus maenas*)
- Atlantic Oyster Drill (*Urosalpinx cinera*)
  - This species has become a lot more serious in recent years.
  - Is trapping an effective control?
  - Trap design & location

Winter Mortalities

- Affect of:
  - Stocking densities
  - Oyster physical condition
  - Food availability

Seed

- 80% of oyster seed collected on PEI comes from one area
  - Diversification and enhancement in form of broodstock relay to new underdeveloped areas
  - Alternative sources of seed - broodstock operations / hatcheries
  - Seed sites need protection from exposure to invasive species
- Broodstock enhancement through selective breeding

Environmental Concerns

- Increase in pesticide/fertiliser run off due to changing weather conditions
  - Changes in farm practices needed (ploughing at different times, less spraying in certain weather conditions) to address climate change and so reduce run-off
  - Buffer Zones (size by waterways, gradient requirements etc)
- Floating docks
  - Constructed in waterways, sometimes over leases
  - Concern regarding construction materials

Finfish Sector

- Represented by the *Island Finfish Association*
- Main areas of interest are:
  - Broodstock Development
  - Water Quality and Quantity
  - Bio-security

Broodstock Development

- Broodstock requirements
  - Nutrition
  - Genetics
  - Reproduction
- New species

Water Quality and Quantity

- New technology
  - Water re-use
  - Recirculation.
- Research required into the possible uses for systems specifically geared to individual stages of fish development

Bio-security

- A clear, concise bio-security policy
- Emergency contingency plans
- On a farm to farm basis and from government

BC Salmon Farmers Association

British Columbia Salmon Farmers Association: R&D Priorities

Norman Penton, RDC

BC Salmon Farmers Association

Outline

- Industry Brief
- How R&D priorities list developed
- Fish Health Priorities
- Fish Husbandry Priorities
- Environmental Priorities
- Marketing/Food safety Priorities

BC Industry

- Currently there are 6 producing companies operating in British Columbia

Creative Salmon

Grieg Seafood BC Ltd.

Mainstream Canada

Target Marine Ltd

Marine Harvest

West Coast Fish Culture Ltd

BC Salmon Farmers Association

- Broughton
- Inner Islands
- West Coast
- Sunshine Coast

BC industry cont.

- ~ 120 sites
- 60- 80 operating
- The largest agricultural export out of BC.
- $331.1 million (stats can)

Building R&D Priorities List

- A R&D priorities list completed every couple of years
- Surveyed industry
- Surveyed researchers
- Categorized List

BC Salmon Farmers Association

Fish Health: Sea Lice

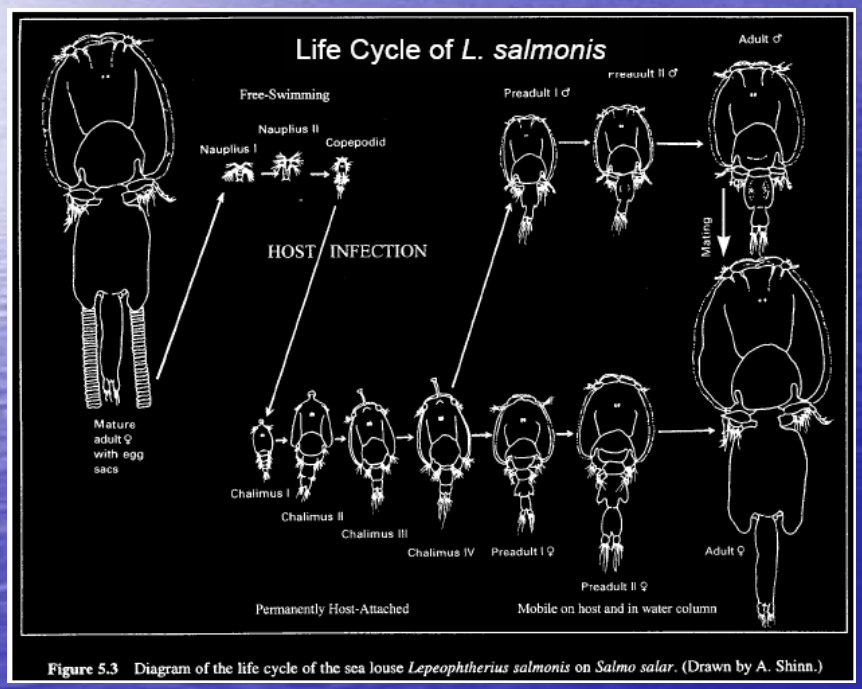


Figure 5.3 Diagram of the life cycle of the sea louse *Lepeophtherius salmonis* on *Salmo salar*. (Drawn by A. Shinn.)

- Id and licensing of bath treatment
- Alternate treatment options
- Sea lice vaccine

BC Salmon Farmers Association

Fish Health: Other areas

- IHN vaccine efficacy
- Non-Lethal indicator of stress
- Alternate species potential disease issues
- Loma salmonae vaccine
- Mortality utilization/disposal

Fish Husbandry/ Improved Production Priorities

- Broodstock development:
  - Selective breeding programs
  - Genetic improvement
  - Alternate species
- Feed replacement

BC Salmon Farmers Association

Environmental Priorities

- Processing plant effluent
- Ocean current modeling
- Solid waste reduction/removal
- Benthic remediation
- Integrated Multi-trophic aquaculture
- Hard bottom monitoring technique groundtruthing

Marketing/ Food Safety Priorities

- Customer Driven
- 3rd party audit programs

BC Salmon Farmers Association

Thank you

BC Shellfish Growers Association

BC Shellfish Aquaculture Research & Development Priorities and Issues

Aquaculture Industry R&D Workshop
Friday January 26th, 2007

David E. McCallum
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BC Shellfish Growers Association

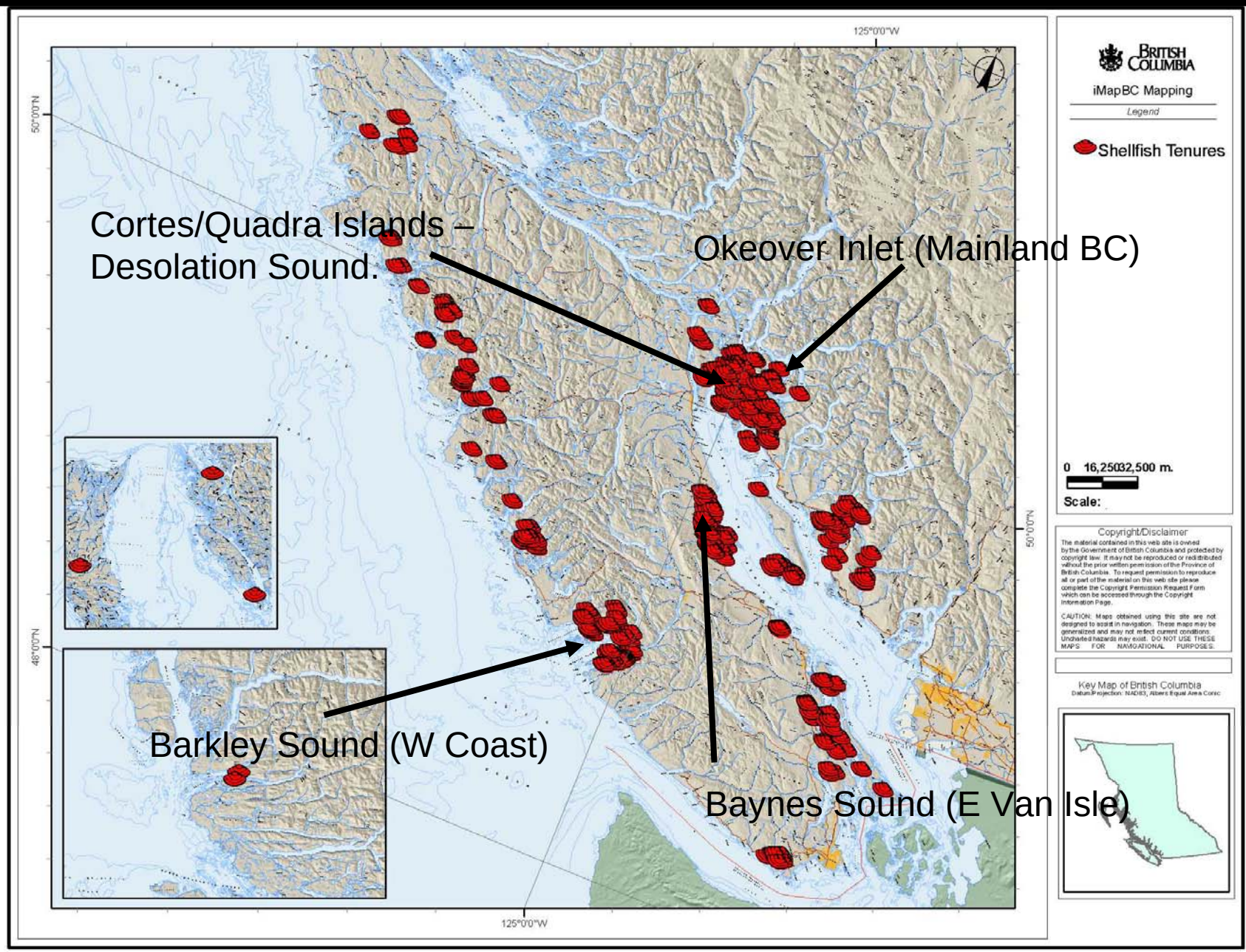
Voice of the shellfish industry in BC for over 55 years.

We have about 150 members – BCSGA represents the majority of growers & industry service providers.

<u>Vision</u>:

- The BC shellfish industry will be an innovative, competitive economic sector that is a world leader in sustainable shellfish culture.

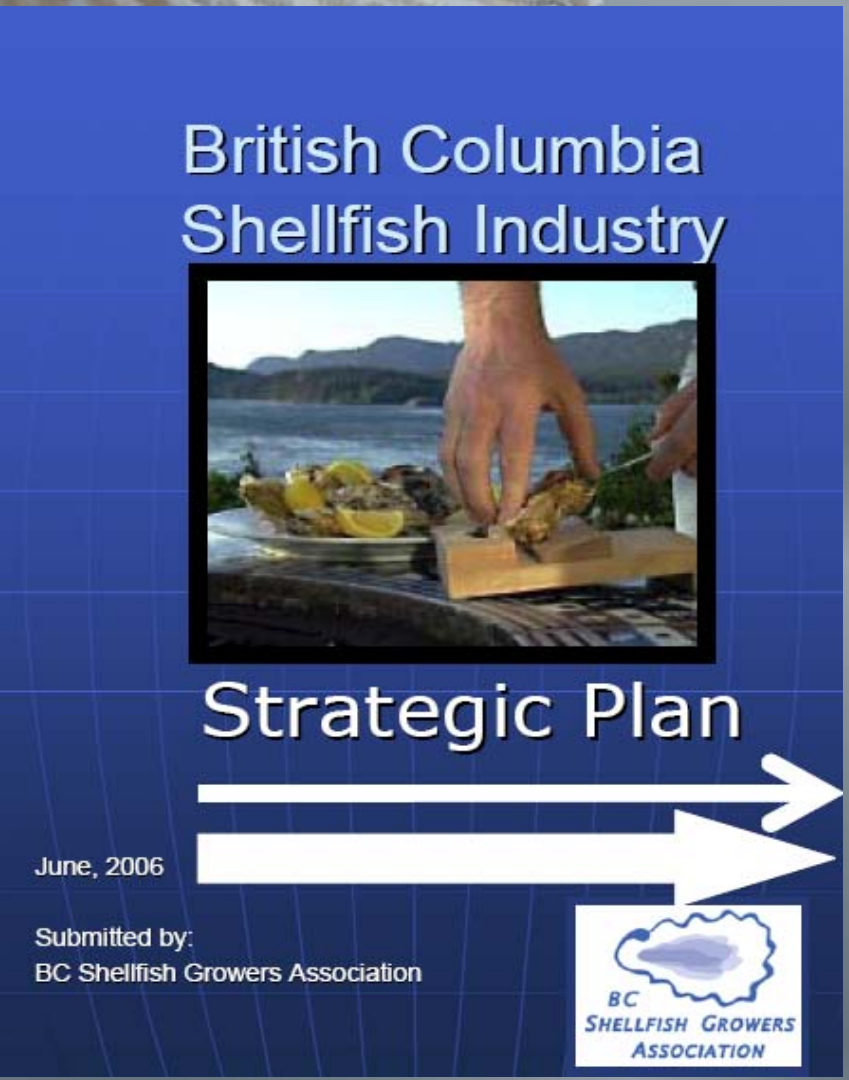
Geography of Shellfish Farms in BC



Recent Key R&D Milestones

- Research & Development Coordinator (May, 2006)
- BC Shellfish Aquatic Animal Health Program (2007)
  - Fall Pilot surveillance sampling recently complete:
    - (293 Manila clams, 130 Pacific Oysters – all negative!)
  - Currently developing high priority industry components.
- Industry *Strategic Plan* (2006)

R&D Background – Strategic Plan



- Main Components of Industry *Strategic Plan* (2006):
  - Industry Promotion
  - Consistent Product Quality
  - Industry Structure & Governance
  - Training & Education
  - Research & Development

Key Research Resources & Capacities

- DFO Pacific Biological Station (PBS)
- Centre for Aquatic Health Sciences (CAHS)
- Centre for Shellfish Research (CSR)
  - Canada Research Chair in Sustainable Shellfish Aquaculture
  - Lab & Recirculation Facility / Deep Bay Field Site
- Pacific SEA Lab

Photo Credits:
Brian Kingzett, Dr Steve Cross, DFO, CAHS

BCSGA Past & Ongoing R&D Projects

- Pathways of Cadmium in Cultured Pacific Oysters and the Effects of Environmental Parameters (Cassis *et al*., 2006)
- Stress Indicators and the Effect of Environmental Stressors in Pacific Oysters (ACRDP – in progress)
- Development and Optimizing Commercial Hatchery Production Techniques for the Indigenous Cockle (CSR)
- Shellfish Culture and Particulate Matter Production and Cycling (CSR – recently completed)
- Preparing the BC Shellfish Culture Industry for Monitoring of Marine Invasive Species (IASPP – commencing soon)
- Controlled Wet-Storage for Shellfish – Effects of Micro-Bubbling Contaminants of Oysters (ACRDP – in progress)

R&D Priority Setting To Date

- In recent year, BCSGA visioning has improved (RDC in place)
- Pacific Shellfish Institute / PCSGA
  - *West Coast Shellfish Research and Education 2015 Goals & Priorities*
- Centre for Shellfish Research
  - *Setting Priorities for BC Aquaculture R&D: Process, Outcomes, and Evaluation*
- April 21st, 2007 – BCSGA General Meeting – R&D Visioning

Stage 1 – Initial Plenary workshop (April 2005)

Stage 2 – Species Specific Workshops (May 2005)

Stage 3 – Priority Setting Workshop (November 2005)

CSR's Research Priority Outcome Categories:

- **Animal Science**
  - Improve survival and growth; higher quality product; genetic improvements; feasible IMTA systems
- **Environmental Interactions**
  - Ecosystem variables; negative / positive effects; integration of industry into regional development
- **Grow-out techniques**
  - Technology transfer; economics and business mgmt
- **Food safety**
  - Monitoring programs; reliability of water quality indicators; Cadmium strategy
- **Market development**
  - Improve market intelligence; value-added differentiation
- ***Social Science***
  - *Public perceptions & acceptance*

R&D Brainstorm & Wish-List

- Social Case Study: Analysis of anti-salmon aquaculture campaigns and how to avoid for the shellfish industry?
- Wild Salmon / Farmed Shellfish interactions (FRIA?);
- Harmful algae monitoring program (cooperative with BCSFA?);
- Farm design, construction and rigging innovations;
- Communications and Knowledge exchange to industry members (AquaPort?);
- Others…?

Summary Shellfish R&D in BC

- Work still to be done at BCSGA in terms of visioning and prioritizing R&D.
- There appears to be sufficient $ available for ***research***, but not necessarily for industry ***development***.
- CAIRD Network important (crucial) for equitable knowledge exchange across all of Canada.

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