



Third Industry Action Plan

2007/2010

Report

Prepared by:

**Inter-Provincial Partnership for
Sustainable Freshwater Aquaculture Development**

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TABLE OF CONTENTS

EXECUTIVE SUMMARY3

1. IPSFAD MISSION & OBJECTIVES4

2. THIRD INDUSTRY ACTION PLAN – 2007-20104

3. STATUS OF RESEARCH, DEVELOPMENT AND COMMERCIALISATION FOR FRESHWATER
AQUACULTURE IN CANADA6

THEME 1 – FISH HEALTH MANAGEMENT6

THEME 2 – NUTRITION10

THEME 3 – BROODSTOCK MANAGEMENT13

THEME 4 – ALTERNATIVE SPECIES & PRACTICES14

THEME 5 – EXPERIMENTAL FARM INITIATIVE (LAND-BASED)15

THEME 6 – CAGE CULTURE19

MISCELLANEOUS23

EXECUTIVE SUMMARY

Canada's freshwater aquaculture sector consists of more than 700 operations that produce more than 10,000 metric tonnes of output annually with a farm-gate value of approximately \$70 million. Located in every province of the country, the majority of these operations are land-based facilities where fish are reared in ponds, tanks and/or raceways. There are also approximately one dozen cage culture operations located in lakes and reservoirs; the latter account for more than 45% of total production. Trout and charr are the principal production species.

Globally, Canada ranks a distant 13th in total freshwater trout and char output; however, given our natural resource base and other strategic advantages, this level of output is not commensurate with the opportunity, or potential, that exists. Growth in the sector has been forestalled due largely to concerns regarding the environmental and social sustainability of aquaculture. *Therefore, any expansion in the Canadian freshwater aquaculture sector is dependent upon the development of knowledge, technologies and practices to address and resolve such challenges.*

In 2001, producers in different provinces with similar challenges launched the *Inter-Provincial Collaborative R&D Initiative for Sustainable Freshwater Aquaculture* (the Initiative) to promote coordinated efforts in applied research, development and commercialization (RDC) to advance the sector. The Initiative's first Industry Action Plan, in 2002, focused largely on nutrition. In 2004, priorities were re-evaluated and a second Industry Action Plan was developed with a renewed focus on nutrition but with the addition of waste management, farm management and environmental carrying (assimilative) capacity. In total, more than \$1.9 million in RDC projects were delivered through these first two Action Plans.

In 2006, the Initiative became a registered not-for-profit organization – the *Inter-Provincial Partnership for Sustainable Freshwater Aquaculture Development* (IPSFAD) - with headquarters in Quebec City, QC. In the winter of 2006/07, the IPSFAD coordinated five 1-day workshops across Canada with industry and government stakeholders to solicit input regarding RDC initiatives most pertinent to industry development. Consolidation of stakeholder input from these meetings is the foundation for the Third Industry Action Plan which served as a coordinating instrument for sustainable freshwater aquaculture development throughout Canada from 2007-2010. The Action Plan encompassed 16 RDC initiatives within six thematic groups: (1) Fish Health Management, (2) Nutrition, (3) Broodstock Management, (4) Alternative Species and Practices, (5) Experimental Farm Initiative (Land-Based) and (6) Cage Culture.

1. IPSFAD MISSION & OBJECTIVES

Mission:

To promote sustainable development of freshwater aquaculture in Canada.

Objectives:

- 1. Create consensus regarding applied research, development and commercialization (RDC) priorities identified by industry.*
- 2. Promote applied research, development and commercialization projects and assemble required research and/or technology transfer expertise for execution.*
- 3. Foster the establishment of necessary synergies among various players while avoiding duplication of work and making optimal use of resources.*
- 4. Organize and seek funding for projects that result directly from priorities identified by industry.*

2. THIRD INDUSTRY ACTION PLAN – 2007-2010

The Third Industry Action Plan of the Inter-Provincial Partnership for Sustainable Freshwater Aquaculture Development (IPSFAD) was intended to focus applied research, development and commercialization (RDC) efforts on those issues that can best enhance productivity and prosperity within the sector. Pure research is not within the scope of IPSFAD's activities.

In the autumn of 2006 and early winter of 2007, the IPSFAD coordinated five 1-day workshops with industry and government stakeholders to solicit input regarding those RDC initiatives deemed to be most pertinent to industry development and to once again update and prioritize sectoral challenges and opportunities. Meetings were held in Alberta¹, Québec, British Columbia and Ontario, and a pan-Atlantic meeting was held in New Brunswick. At each workshop, an identical process was followed, as outlined below:

- Status of aquaculture development in the province / region
- Overview of IPSFAD and results of past projects
- Identification of fundamental challenges and opportunities
- Overview of potential RDC projects
- Prioritization of potential RDC projects

¹ Stakeholders from Saskatchewan and Manitoba participated in the Alberta meeting.

The workshops successfully identified stakeholder perspectives on the fundamental RDC issues in each region, including identification of specific project objectives. Consolidation of stakeholder input from these meetings was the foundation for a renewed three-year Industry Action Plan that served as a coordinating instrument for sustainable freshwater aquaculture development throughout Canada from 2007-2010.

The total cost of the projects implemented under the Third Industry Action Plan was \$5.2 Million. Funding was provided by Fisheries & Oceans Canada's Aquaculture Cooperative Research & Development Program (ACRDP) and Aquaculture Innovation and Market Access Program (AIMAP). Additional funding was provided by the Ministère développement économique, l'innovation et l'exportation (MDDEP), the Société de recherche et de développement en aquaculture continentale (SORDAC) inc., the Industrial Research Assistance Program (NRC-IRAP), the Natural Sciences and Engineering Research Council of Canada (NSERC) and the Réseau Aquaculture Québec (RAQ).

3. STATUS OF RESEARCH, DEVELOPMENT AND COMMERCIALISATION FOR FRESHWATER AQUACULTURE IN CANADA

NOTE 1: Highlighted projects received support from IPSFAD

NOTE 2: More details on the project can be found by clicking on its title

Theme 1 – Fish Health Management

Project 1: Develop Best Management Practices (BMPs) for Fish Health that incorporate standard operating procedures (SOPs) and technologies for biosecurity and aquatic health for land-based and cage culture operations, based on CFIA and NAFTA requirements.

| Team | Title | Status |
|---|---|---------------|
| Table filière de l'aquaculture en eau douce du Québec | Standards for product quality & Best Management Practices | Draft 2011 |
| Northern Ontario Aquaculture Association (NOAA) | Best Management Practices for Sustainable Aquaculture in Ontario | 2006-on going |
| Northern Ontario Aquaculture Association (NOAA) | Standard Operating Procedures proposing minimum requirements for all fish farms | 2006-on going |

Status: Ontario trout growers have BMP & SOP protocols in place.
BC trout growers have a Farm Practice Reference guide published by the BC Ministry of Agriculture and Lands.
Quebec trout growers also have a guide in the making that will set standards for product quality & best management practices.

Outlook: The Canadian trout growers are continuing their investigation on various certification processes and IPSFAD is directly involved with the assessment of the WWF Trout Aquaculture Standards.

Project 2: Evaluate the pathogenicity of VHSV to commercial strains of rainbow trout, brook trout and arctic charr and develop effective management and treatment solutions, as required.

| Team | Title | Status |
|--|---|-----------|
| Canadian Food Inspection Agency | Surveillance for Viral Hemorrhagic Septicemia Virus in Wild Fish in Canada | On going |
| U. of Guelph, Ontario Veterinary College | Viral hemorrhagic septicemia virus (VHSV) type IVb experimental infection in rainbow trout... | 2009 |
| U. of Guelph, Ontario Veterinary College | Antimicrobial susceptibility of Ontario isolates of <i>Flavobacterium psychrophilum</i>. | 2009 |
| U. of Guelph, Ontario Veterinary College | Phenotypic and genotypic analysis of <i>Flavobacterium psychrophilum</i> isolates from Ontario salmonids with coldwater disease | 2008 |
| Fisheries & Oceans - PBS virology lab | Tracking & characterizing VHS in Canada | 2005-2008 |

Status: VHSV has been an important research effort in 2006-2008. Is the virus still an important threat in 2010-2011?

Outlook: Input required from NOAA, & U of Guelph, DFO and CFIA

Project 3: Identify and prioritize antibiotics, non-antibiotic therapeutic agents (e.g. for control of external pathogens) and/or anaesthetics required for effective management of cold water disease, columnaris, furunculosis, fungal disease and, if necessary, VHSV. Comparatively evaluate potential products based on their efficacy in fish farming and their likelihood for Canadian regulatory approval, and develop a business case to support product registration. Products available for use in aquaculture in other jurisdictions or that are approved for use in Canada in other sectors should be given priority.

| Team | Title | Status |
|--|--|-----------|
| AquaCage Fisheries Ltd., Lyndon Fish Hatcheries, U. of Guelph, DFO-ACRDP | Management of coldwater disease caused by <i>Flavobacterium psychrophilum</i> on Ontario trout farms | 2007-2009 |

Status: Very little R&D outcomes can be found for 2007-2009. There is always a need to study antibiotics and non-antibiotic therapeutic agents for an effective disease management.

Outlook: Continue Project 3 in conjunction with NASAPI initiatives

Project 4: There is an urgent need to identify a suitable replacement for malachite green, which was widely used as a disinfectant to treat external ectoparasites but which has been banned for use in food fish production.

| Team | Title | Status |
|--|--|-----------|
| Université Laval, U. de Montréal, UQAC, AgraQuest Inc., NSERC, RAQ, SORDAC | Bio-based approaches for the prevention and treatment of fungus (<i>Saprolegnia parasitica</i>) in fish | On going |
| Université Laval, ISMER, UQAR, Aquaculture Forestville, RAQ | Bases génétiques et physiologiques des performances aquacoles de croissance, de reproduction et de résistance aux infections opportunistes chez l'Omble de fontaine (<i>Salvelinus fontinalis</i>) | On going |
| Université Laval, IPSFAD, Pisciculture Jacques-Cartier, DFO-ACRDP, SORDAC | Utilisation du cinnamaldéhyde comme agent inhibiteur du champignon commun, <i>Saprolegnia parasitica</i>, infectant les oeufs et les alevins d'omble de fontaine et de truite arc-en-ciel | 2006-2009 |

Status: This R&D Project should be part of Project 3. Saprolegnosis remains a problem with egg incubation, early life stages (fry and fingerling) and broodstock.

Outlook: Is cinnamaldehyde effective? If not, continue with Project. If it is effective, is it approved for use? If not, work towards approval.

Project 5: Provide scientific support to advance regulatory approval of identified antibiotics, non-antibiotic therapeutic agents (e.g. for control of external pathogens) and/or anaesthetics for use with commercial aquaculture species.

| Team | Title | Status |
|------|--|----------|
| AAQ | Seeking approval of the chloramine-T for bacterial pathogen therapeutic purposes | On going |
| AAQ | Seeking approval of the formaldehyde for therapeutic purposes | On going |

Status: Projects for this R&D project can only occur at the end of a series of research and demonstration on the usage of a specific agent. IPSFAD should maintain an eye on new agent development. Efforts in Project 5 can also be regrouped within Project 3.

Outlook: Continue Project 5 in conjunction with NASAPI initiatives

Theme 2 – Nutrition

Project 6: IPSFAD will continue to support Canadian feed companies in their efforts to develop higher performing diets with reduced environmental impacts.

| Team | Title | Status |
|--|--|------------------------|
| CAWG | Various initiatives | On-going |
| Université Laval, U. of Guelph, Universiteit Gent, Université Paris 6, IFREMER, University of Idaho, Havforskninginstituttet, MDEIE, DFO-PCRDA, SORDAC, RAQ, | L'expression des gènes cibles dans le modelage osseux vertébral de la truite arc-en-ciel d'élevage : effets de différents apports en phosphore. | On-going |
| Université Laval, IPSFAD, DFO-ACRDP, SORDAC, AAQ, MAPAQ, MDDEP | Vers une meilleure caractérisation des rejets (azote, phosphore, solides) générés par la truite alimentée par des moulées commerciales actuellement produites au Canada | Continuing End 2012 |
| Université Laval, IPSFAD, Pisc. des Alléghanys, Marinard Aquaculture, Pisc. Val-des-Bois, Pisc. Mont-Tremblant, DFO-ACRDP, SORDAC | Étude des performances commerciales, environnementales et physiologiques des ombles de fontaine nourris avec de nouvelles moulées canadiennes à faible teneur en phosphore et à haute énergie. | 2005-2008 |
| U. of Guelph, Martin Mills Inc, OMAFRA | Feed company evaluates alternative fat sources in feed formulations for rainbow trout | 2007-2008 |
| U. of Guelph, Université Laval, Degussa Can., Martin Mills, Ont. Corn Prod., Radiant Technologies, SORDAC, NSERC | Nouveaux procédés et nouvelles stratégies de formulation pour améliorer la rentabilité et le caractère durable de l'aquaculture | 2005-2008 |
| U. of Guelph, DFO-Science, Env.Canada, OMAFRA | Newer feed formulations require updating of fish waste composition for Ontario regulations | 2006-2007 |
| U. of Windsor, Leadley Environmental Inc., DFO-Science, DFO-ACRDP. | Diet formulations and fat content under investigation for yellow perch | 2005-2007 |
| Université Laval, Polytechnique de Montréal, ETS, Biodôme, FQRNT | More stable fish feces in water: a plus for the environment | 2004-2007 |
| U. of Guelph, Laboratoire de Génétique des Poissons, INRA, Institute of Aquaculture Research, AquaNet. | Feeding trials aim to reduce fish farm waste at the source | 2003-2007 |

Outlook: This is the theme with the most R&D effort. There will always be a need for more work done on better performing feed with lower environmental footprint (fishmeal/fish oil replacement incl.).
Research on feed for emerging species is to be promoted also.
Continue Project 6 in conjunction with NASAPI and Canadian AquaFeed Working Group initiatives

Project 7: Prepare the necessary scientific documentation/rationale to support a formal request by fish farming and/or feed industries for a regulatory amendment that would enable lower phosphorus content in aquaculture diets.

| Team | Title | Status |
|-------------------|---|-----------|
| CAWG | Various initiatives | On-going |
| IPSFAD, DFO-ACRDP | Towards rational regulations for phosphorus content of Canadian salmonid diets. | 2006-2007 |

Status: The documentation was presented to the CFIA and the ANAC. The Canadian Aquafeed Working Group (CAWG) may continue the work towards regulatory amendments.

Outlook: IPSFAD should continue to collaborate with CAWG. Continue Project 7 in conjunction with NASAPI initiatives (AF3)

Project 8: Improvements in feeding strategy and feed delivery can also contribute significantly toward enhanced environmental sustainability in the sector. Reliance on standard feed charts to calculate rations remains a common practice, even though it has been proven to be inefficient. Improved methods to calculate feed rations are required and must reflect the high-energy diets used in the industry and the operational conditions at fish farms.

| Team | Title | Status |
|---|--|------------------------|
| Université Laval, IPSFAD, DFO-ACRDP, RAQ, SORDAC, Ferme Piscicole les Bobines | Mise à l'échelle d'un procédé en phase de la truite arc-en-ciel par contrôle du phosphore (P) alimentaire pour réduire les rejets en phosphore | Continuing End 2011 |

Status: This project may also be R&D that Canadian Aquafeed Working Group wants to address. Feed formulae change rapidly making it difficult for feed ration and feed chart to keep up with the pace.

Outlook: Continue Project 8 in conjunction with NASAPI initiatives

Theme 3 – Broodstock Management

Project 9: Develop a National broodstock program to develop enhanced performance in rainbow trout, specifically targeting improved fillet yield, enhanced growth rate and greater tolerance to warm-water conditions. Additional rainbow trout strains should be sought from local and/or imported stocks, taking into consideration the genetic characteristics (performance) of the target strains and their disease profile.

| Team | Title | Status |
|---|--|-----------|
| University of Guelph, Lyndon Hatchery | The application of genomic approaches to rainbow trout aquaculture Genomic approaches to improve rainbow trout growth: fillet yield characteristics | On-going |
| IPSFAD, Huntsman Marine Science Center, NOAA, University of Guelph, Université Laval, DFO-ACRDP | Workshop on a Selection and Breeding Program for Rainbow Trout Aquaculture in Canada - Phase II | 2009-2010 |
| IPSFAD, NOAA, University of Guelph, Université Laval, OMAFRA, Canadian Aquaculture Systems, NSERC, NRC-IRAP, DFO-ACRDP, DFO-AIMAP | Workshop on a Selection and Breeding Program for Rainbow Trout Aquaculture in Canada - Phase I | 2008-2009 |

Outlook: Phase III: Creation of the Steering Committee for the National Selection and Breeding Program for Rainbow Trout is undergoing.
 Continue Project 9 in conjunction with NASAPI initiatives (ET1)

Theme 4 – Alternative Species & Practices

Project 10: Identify and prioritize those species (domestic and exotic) that offer the best opportunities for industry diversification based on market and production capacities in keeping with regional interests. For identified target species, develop core technologies and practices to establish commercial culture operations (e.g. systems technologies, water quality requirements, nutritional requirements, broodstock development, etc.) Following this prioritization exercise, IPSFAD will continue to support developmental efforts to advance the identified species.

| Team | Title | Status |
|---|---|-----------|
| Target Marine Hatcheries, AIMAP | Adopting Innovative Technology to Develop Canada's White Sturgeon Aquaculture Industry | On-going |
| Biodôme de Montréal, Université Laval, IPSFAD, Target Marine Products, Supreme Sturgeon & Caviar Ltd, Québec Caviar, NSERC, DFO-ACRDP | Workshop "From Culture to Conservation: A Workshop to Develop Advance Reproductive Technologies for Sturgeon" . | 2009-2010 |
| DFO-AMD, DFO-Science, Various Canadian aquaculture stakeholders | <i>Alternative Species for Freshwater Aquaculture Development.</i> A supporting initiative to the National Aquaculture Strategic Action Planning Initiative | 2010 |
| Coastal Zones Research Institute Inc., U. of Guelph, Merlin Fish Farm, CJL Pisciculture, Aquaculture Nord'est, ACOA-AIF, NBIF, NB Department of Agriculture and Aquaculture-Total Development Fund, NSERC | New Brunswick Institute conducts genetics program to improve Arctic char | 2004-2010 |
| U. of New Brunswick, NRC - Institute for Marine Biosciences, UPEI Atlantic Veterinary College, Mount Allison U, Saint Mary's First Nation, AquaNet. | Shortnose Sturgeon culture begins with growth and diet investigations | 2004- |

Status: White Sturgeon Farming Diversification - Target Marine Hatcheries Ltd. in Sechelt, B.C., has received AIMAP funding to advance Canada's sturgeon freshwater aquaculture industry.

Outlook: The NASAPI process identified a prioritized list of species for diversification of freshwater aquaculture.
Continue Project 10 in conjunction with NASAPI initiatives

Theme 5 – Experimental Farm Initiative (Land-Based)

Project 11: Coordinate an ‘experimental farm’ design workshop at which leading authorities on the design, operation, management and regulation of land-based aquaculture systems in Canada and elsewhere would meet to develop the principles and design concept for a ‘Canadian Experimental Farm.’ Workshop delegates would provide collective expertise to review and discuss all aspects of the ‘experimental farm’, including: rearing unit design, hydraulics, solid waste management, biofiltration, gas exchange, fish health management, production planning, systems management and control, waste disposal, environmental controls, etc.

| Team | Title | Status |
|---|---|-----------|
| IPSFAD, Canadian Aquaculture Systems, DFO-ACRDP | Canadian Model Aqua-Farm Technical Report | 2007-2008 |
| IPSFAD, Canadian Aquaculture Systems, DFO-ACRDP | Canadian Model Aqua-Farm Workshop | 2006-2007 |

Status: The Canadian Model Aqua Farm has been a priority for IPSFAD for the last four year. The workshops are over and the review of possible design, operation, & management are done.

Outlook: This Project is closed.

Project 12: Construct an ‘experimental’ farm for aquaculture development to ‘demonstrate’ industry potential. Evaluate all inputs and outputs, including: Fish, Feed, Other direct inputs (e.g. labour, electricity, etc.), Costs, Environmental Management (water and nutrients), Regulatory Components

| Team | Title | Status |
|---|---|-----------|
| École Polytechnique de Montréal, U. de Montréal, Arcelor Mittal, MAPAQ, MDDEP, AAQ, Pisciculture Gilbert, Matériaux Excell, Jacques Whitford Stantec Ltd, Ecole des mines de Nantes, IFREMER, Epur Nature, INRA, NSERC, RAQ, SORDAC, IPSFAD | Traitement de boues piscicoles sur lit à macrophyte et filtres réactifs - BOUES-LiMi | On-going |
| INRS-IAF, École Polytechnique de Montreal, University of Waterloo, Université Laval, Canadian Aquaculture Systems, NSERC, RAQ, SORDAC, IPSFAD, | Strategies to prevent off-flavours in fish grown in closed-circuit aquaculture system. | On-going |
| IPSFAD, Canadian Aquaculture Systems, Bill Robertson, MAFRI, Rudy and Leslie Reimer, Riddell's Roasters Inc, DFO-AIMAP, DFO-ACRDP | Construction of the first beta site of the Canadian Model Aqua-Farm in Manitoba to ‘demonstrate’ industry potential. | On-going |
| IPSFAD, Canadian Aquaculture Systems, Bill Robertson, MAFRI, Rudy and Leslie Reimer, Riddell's Roasters Inc, DFO-ACRDP | Canadian Model Aqua-Farm Initiative - Monitoring and Data Collection to Support a Performance Management & Benchmarking Program. | On-going |
| U. of New Brunswick, Atlantech, Cooke Aquaculture Ltd., NB Department of Agriculture and Aquaculture, Canada Center for Fisheries Innovation | Atlantic project develops models for drum filters and large diameter tanks | 2008- |
| Fleming College, Trent University, Wilfrid Laurier University, DFO-ACRDP, Haliburton Hatchery, Fisheries and Aquaculture Enhancement Association | Assessing the Efficacy of Subsurface Flow Constructed Wetland Cells for the Treatment of Land-based Fish Farm Discharge | 2007-2010 |
| U. of Guelph, Meeker's Aquaculture Canada Inc, DFO-ACRDP, Environment Canada | Conversion of Aquaculture Waste to Saleable Compost | 2006-2008 |
| U. of Guelph, Environment Canada, OMAFRA | Monitoring flow of water on land-based fish farms enables better management of Ontario water resources | 2006-2008 |
| Université Laval, École Polytechnique de Montréal, Biodôme de Montréal, Agricultural Research Service-USDA, Freshwater Institute, FQRNT. | Better tasting table fish produced in recirculated water | 2005-2007 |

Status: The Canadian Model Aqua Farm has been a priority for IPSFAD for the last four year. In 2010, fish were put in an operational model farm in Manitoba. This Project requires to remain active as are still needing to evaluate all inputs and outputs and “demonstrate” the potential of the CMAF.

Outlook: Continue to implement the Performance Monitoring and Management Program at the Manitoba-Canadian Model Farm Project.
Continue to support development of a second model farm using circular tanks to provide a comparison with the current raceway model farm project as agreed at the model farm design workshop.
Continue Project 12 in conjunction with NASAPI initiatives

Project 13: BMPs (Codes of Practice) effectively combine science, technology, economics, management and common sense to reduce or prevent adverse environmental effects of a defined activity. Comprehensive BMPs also serve to enhance operational effectiveness, environmental performance and the social licence of aquaculture ventures. As part of the process to establish standard procedures through the experimental farm initiative, comprehensive BMPs should be developed to provide overall management direction that will ensure responsible development.

| Team | Title | Status |
|------|-------|--------|
| - | - | - |

Status: Many sub-sectors of the freshwater aquaculture sector have established BMPs and SOPs. Other sub-sectors have yet to do so. Continue Project 13 in conjunction with NASAPI initiatives to get all sub-sectors to implement BMPs and SOPs.

Theme 6 – Cage Culture

Project 14: Augment knowledge regarding sediment and benthic science and monitoring requirements, including:

- Development of effective models to characterize sediments beneath freshwater cage aquaculture operations;
- development of practical surrogates to project complex physical, chemical and biological interactions;
- identification of fundamental decision criteria and thresholds to support effective risk management and a practical decision-making framework;
- further evaluation of site fallowing as a site management strategy; and
- development of appropriate site decommissioning protocols.

| Team | Title | Status |
|---|---|-----------|
| Wild West Steelhead, Open Ocean Systems, IPSFAD, DFO-AIMAP | Sustainable Expansion of Freshwater Fish Farming In Lake Diefenbaker | On-going |
| IPSFAD, NOAA, Canadian Aquaculture Systems, DFO-ACRDP, DFO-AMD | Workshop on Freshwater Cage Aquaculture Demonstration Farm | 2009 |
| DFO-Sciences, NOAA, OMAFRA, U. of Guelph, FEDNOR, DFO-ACRDP | Cage Culture Environmental Forum II | 2009 |
| DFO-Sciences, Meeker's Aquaculture Canada Inc., North Wind Fisheries Ltd, Laurentian University, OMNR, U of Manitoba, Trent University, DFO-ACRDP | Distribution and survival of farmed rainbow trout escaped from aquaculture operations in Lake Huron | 2008-2011 |
| U. of Guelph, Environment Canada | Studies seek methods to track aquaculture wastes in the environment | 2007-2010 |
| DFO-Sciences, Aqua-cage Fisheries Ltd, DFO-ACRDP | Nutrient fluxes across the sediment-water interface and Nutrient release rates from freshwater sediments in a lake with cage fish farming | 2006-2007 |
| | The Effects of Sediment Phosphorus Types and Water Temperature on the Release of Phosphorus and Nitrogen from Freshwater Sediments in a Lake with Cage Fish Farming | 2007-2008 |
| U. of Guelph, Environment Canada | Vertical temperature profiles aim to improve farm management at lake sites | 2007-2008 |

Status: Continuous research is required in this field. Currently, several projects within the ELA projects are winding down as the research teams are moving to a larger scale sediment and benthic science and monitoring requirements.

Outlook: Continue Project 14 in conjunction with NASAPI initiatives

Project 15: Refine practical and effective water quality modelling, monitoring and reporting requirements.

| Team | Title | Status |
|--|---|-----------|
| DFO-Science, U. of Guelph, Saskatchewan Environment, U. of Saskatchewan, Wild West Steelhead, DFO-ACRDP | Development of predictive modeling tools to assist with freshwater aquaculture site licensing decisions | 2008-2012 |
| U. of Guelph, OMNR, OMOE, DFO-Science, Environment Canada, OMAFRA, U. of New Brunswick, Canada Ontario Agreement Respecting the Great Lakes Basin Ecosystem, AquaNet | Computer tool supports regulator decision-making for site applications in Ontario | 2005-2009 |
| U. of Guelph, OMNR, OMOE, DFO-Science, Environment Canada, OMAFRA, Canada Ontario Agreement Respecting the Great Lakes Basin Ecosystem | Ontario advances coordinated process for cage aquaculture sites | 2004-2009 |

Status: Continuous research is required in this field. Currently, several projects within the ELA projects are whining down as the research teams are moving to a larger scale sediment and benthic science and monitoring requirements.

Outlook: Merge this initiative with Projects 14 and 16 and refine a work plan for the coming three years.

Project 16: Develop effective models to project the assimilative capacity of freshwater bodies to support cage aquaculture.

| Team | Title | Status |
|-------------------------------------|--|---------------|
| U. of Guelph, Environment Canada | Researchers begin developing predictive models and nutrient trigger limits for cage culture in lakes | 2008- 2009 |

Status: The Project integrates all the larger scale information associated with water quality monitoring, sediment and benthic science and monitoring requirements. It is important that the RD Project remain active.

Outlook: Merge this initiative with Projects 14 and 15 and refine a work plan for the coming three years.

Miscellaneous

Project 17: Towards a National Strategy for Certification Standard for Rainbow Trout in Canada

| Team | Title | Status |
|-------------------------|--|-----------|
| IPSFAD, NOAA, DFO-AIMAP | Participation and Evaluation of World Wildlife Foundation's Trout Dialogue | 2010-2011 |

Outlook: IPSFAD should lead the Development of Certification Standards for Aquaculture in Canada