Cooperative Research at the Experimental Lakes Area: Proceedings of a Workshop Between Environment Canada and Fisheries and Oceans Canada, 27–28 February 2007, Winnipeg, Manitoba

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COOPERATIVE RESEARCH AT THE EXPERIMENTAL LAKES AREA: PROCEEDINGS OF A WORKSHOP BETWEEN ENVIRONMENT CANADA AND FISHERIES AND OCEANS CANADA, 27–28 FEBRUARY 2007, WINNIPEG, MANITOBA

by

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EXECUTIVE SUMMARY

The objective of the workshop was to hold preliminary discussions on the new EC–DFO[1] partnership at ELA, as outlined in the interdepartmental MOU. Specifically, the workshop was intended to identify potential collaborative short- and long-term research projects at ELA and develop a structure and function for the ELA Science Management Committee identified in the MOU.

Seven short-term research programs were deemed priorities (mesocosm pilot studies, data sharing, modelling, archived tissue samples, METAALICUS, aquaculture, and acidification recovery) and contact persons who could act as "engines" for these projects were identified. Four long-term research programs were deemed priorities (nutrient management, chemical fates/effects, air quality, and climate change), and contact persons who could act as engines for these projects were identified. These contact persons were asked to better focus the four research projects using criteria suggested by workshop participants.

A provisional structure was developed for the ELA Science Management Committee (an upper-level manager and two scientists from each department), and DFO personnel were suggested for the positions. However, further consultation was needed within EC before EC appointments could be made. The actual functioning of the Committee was left until after the EC appointments were made and the first meeting of the Committee was held.

Workshop participants articulated six major recommendations for improving the EC–DFO collaboration at ELA: 1) the need for an umbrella agreement between the two departments to overcome administrative bottlenecks; 2) the appointment by EC of a counterpart to the ELA leader; 3) emplacement of this EC "scientific champion" at the

[1] Acronyms are listed in Appendix 1

Freshwater Institute in Winnipeg; 4) development of the rationale for priority, collaborative, long-term research projects; 5) finalization of the structure and function of the ELA Science Management Committee; and 6) improved communication between EC and DFO.

Progress in the EC–DFO partnership up to the end of December 2007 included the start of collaborative research at ELA and elaboration of the structure of the Science Management Committee (membership to be finalized by both departments early in 2008).

The EC–DFO collaboration at ELA is a rare example of a top-down-generated partnership between two government departments. Many of the workshop participants were committed to make the partnership work.

SOMMAIRE

L'atelier avait pour but de tenir des discussions préliminaires sur le nouveau partenariat EC-MPO[2] dans la région des lacs expérimentaux (RLE), tel qu'il est décrit dans le protocole d'entente (PE) interministériel. Plus particulièrement, l'atelier visait à cerner de possibles projets concertés de recherche à court et à long terme dans la RLE et à élaborer une structure et une fonction pour le Comité de gestion des sciences de la RLE indiqué dans le PE.

Sept programmes de recherche à court terme ont été considérés comme des priorités (études pilotes en mésocosme, partage de données, modélisation, échantillons de tissus archivés, METAALICUS, aquaculture et reprise de l'acidification) et les personnes-ressources qui pourraient servir de « moteurs » de ces projets ont été désignées. Quatre programmes de recherche à long terme ont été considérés comme des priorités (gestion des éléments nutritifs, le devenir/les effets chimiques, la qualité de l'air et le changement climatique), et les personnes-ressources qui pourraient servir de « moteurs » de ces projets ont été désignées. On a demandé à ces personnes-ressources de mieux concentrer les quatre projets de recherche à l'aide des critères proposés par les participants à l'atelier.

Une structure provisoire a été élaborée pour le Comité de gestion des sciences de la RLE (un gestionnaire supérieur et deux scientifiques de chaque ministère), et des membres du personnel du MPO ont été proposés pour occuper les postes. Cependant, une nouvelle consultation était nécessaire au sein d'EC avant que EC puisse procéder à des nominations. On a reporté le fonctionnement réel du Comité jusqu'à ce que les nominations aient été effectuées au sein d'EC et que la première réunion du Comité ait eu lieu.

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[2] On trouvera la liste des acronymes à l'annexe 1

Les participants à l'atelier ont formulé six recommandations principales pour améliorer la collaboration EC–MPO dans la RLE : 1) le besoin d'un accord-cadre entre les deux ministères pour surmonter les goulots d'étranglement administratifs; 2) la nomination par EC d'un homologue du leader de la RLE; 3) la mise en place de ce « champion scientifique » d'EC à l'Institut des eaux douces de Winnipeg; 4) l'élaboration de la raison d'être des projets concertés et prioritaires de recherche à long terme; 5) la mise au point définitive de la structure et de la fonction du Comité de gestion des sciences de la RLE; 6) une communication améliorée entre EC et le MPO.

Les progrès accomplis dans le partenariat EC–MPO jusqu'à la fin de décembre 2007 ont compris le début de la recherche concertée dans la RLE et l'élaboration de la structure du Comité de gestion des sciences (la composition du Comité sera complétée par les deux ministères au début de 2008).

La collaboration EC–MPO dans la RLE est un rare exemple de partenariat descendant entre deux ministères gouvernementaux. De nombreux participants à l'atelier s'étaient engagés à veiller à ce qu'il fonctionne.

WORKSHOP OBJECTIVES

This workshop was the first meeting between Environment Canada (EC) and Fisheries and Oceans Canada (DFO) researchers and managers to discuss implementation of the recently signed Memorandum of Understanding (MOU) (see Appendix 2) for a partnership between the two departments at the Experimental Lakes Area (ELA) (see Appendix 3 for attendees).

ELA is located in a sparsely inhabited Boreal Shield region of northwestern Ontario. The area has been relatively unaffected by external human and industrial activities. Thus, over the past 38 years, ELA has served as a natural laboratory for the study of various human impacts (e.g., eutrophication, acidification, metals, endocrine disrupting chemicals [EDCs], mercury, greenhouse gases, aquaculture) through experimental whole-lake manipulations and mesocosms/limnocorrals installed in lakes. A suite of unmanipulated lakes has also been monitored over the long term to provide a reference envelope for experimental manipulations at ELA. Studies at ELA use an ecosystem-level spatial scale and a multi-year temporal scale.

The overall objective of the workshop was to develop a plan for and establish the next steps in implementing the EC–DFO MOU on ELA. Key sub-objectives were:

1. to identify common research priorities between EC and DFO, and to identify researchers and managers to take the lead on developing collaborative research on these priorities at ELA,
2. to elaborate the structure and function of the joint ELA Science Management Committee proposed in the MOU,
3. to identify common concerns and difficulties faced by EC and DFO researchers and managers in establishing and operating the ELA partnership,
4. to recommend possible solutions to the above difficulties and personnel to handle them, and

5. to establish timelines for various actions.

STRUCTURE OF THE WORKSHOP

DAY 1

The agenda for the first day (Appendix 4) included introductions of workshop participants, background material on ELA, descriptions of science priorities of each department as of spring 2007, and breakout groups to discuss opportunities and problems of interdepartmental collaboration in ELA research projects. The workshop began with background presentations by M. Paterson on the EC–DFO MOU, followed by a short history of ELA, past and present research there, and a look at the physical facility (Appendix 5). Most EC personnel at the workshop had never been to ELA. Science priorities in DFO were then outlined by S. Cosens (Appendix 6), followed by science priorities in EC (R. Bourbonniere, D. Muir, et al.). Science priorities in EC had not yet been crystallized in a formal document because of the recent reorganization of the department. Discussions on apparent research overlaps and opportunities for collaboration between EC and DFO continued throughout this background introduction.

Four breakout groups were formed (see Appendix 7 for group participants) to consider the following questions/challenges:

1. Where do needs and capacities of the departments overlap? What are the apparent synergies and potential problems? Describe each opportunity and difficulty.
2. For each opportunity, identify one or more experiment or monitoring exercise that could be undertaken at ELA.
3. For each identified difficulty, suggest how it could be overcome.
4. Which is the highest priority opportunity and why? Which is the highest priority difficulty and why?

Each breakout group was given a list of instructions (Appendix 8), and each group was assigned a recorder and a reporter (Appendix 7). Breakout group discussions were allowed to continue to the end of Day 1, contrary to the original agenda (Appendix 4), because of the time needed to review science priorities in DFO and EC.

DAY 2

Day 2 (see revised agenda in Appendix 9) included presentations from each breakout group, a consideration of the proposed ELA Science Management Committee, and a discussion of communication needs of the two departments.

Potential research collaborations were listed, and priority areas were discussed. Lead persons from both EC and DFO were identified for each research priority. Matters important to the success of the EC–DFO collaboration were identified throughout the discussion.

The structure and function of the ELA Science Management Committee, as proposed in the MOU (see Appendix 2), was then discussed, and attempts were made to name key EC and DFO members of the Committee.

The workshop ended with consideration of a common concern that was identified throughout the proceedings: communication and the best way to address gaps between the two departments.

RESULTS AND DISCUSSION

IMPORTANT POINTS FROM DAY 1

Presentation by M. Paterson (Appendix 5):

1. The key questions from this workshop are:

a) How can we develop the EC–DFO partnership at ELA to the best advantage of both departments?

b) What are the greatest opportunities for science collaboration between EC and DFO at ELA? How can we include academia?

c) What are the greatest potential difficulties, and how can they be overcome?

2. Advantages of working at ELA are: a) the ability to conduct controlled whole-ecosystem experiments, b) a 38+-year data set, c) a high-quality modern field facility, and d) the opportunity to collaborate with a multidisciplinary team of researchers dedicated to the ELA site.

3. The advantage of an EC–DFO partnership is a product that is greater than the sum of its parts, partly because whole-ecosystem research in fresh waters is best conducted under multiple government departments, and many important environmental problems span the mandate of both EC and DFO. Several issues of concern that could be addressed at ELA (e.g., contaminants) are under the mandate of EC and are no longer part of the DFO mandate. Hence, EC's mandate is often complementary to DFO research at ELA. For example, cooperation between EC and DFO could increase ecosystem coverage to include terrestrial parts of watersheds. Working with EC also allows for the extrapolation of DFO research to larger geographical regions. ELA researchers have been successful at finding agencies to fund projects. ELA has long-term databases and technical expertise, which are available to EC. For academia, ELA is a great facility for students and faculty, and offers a place to exchange ideas. Research funds are available, and field courses are possible (although ELA has not been used extensively for the latter purpose).

4. The EC–DFO partnership MOU (Appendix 2) was signed by Assistant Deputy Ministers (ADMs) for both departments, so it has a high level of approval. Under

terms of the MOU, EC and DFO are jointly responsible for all scientific operations at ELA. There is a proposed joint governance structure – the Science Management Committee. Researchers from each department are still beholden to their own department's mandates, and they are to seek areas of overlap for collaboration.

Questions

5. (L. Wassenaar) – Are there constraints on what can be done at ELA?

   (M. Paterson and J. Shearer) – Yes, we have a comprehensive agreement with the Ontario Government, and all lake-manipulation experiments have to be agreed to by the ELA Management Board. Almost any lake manipulation is possible, but a lot depends on political optics (e.g., we would probably have difficulty getting permission to add an invasive species to a lake).

6. (M. MacKay) – If I start an experiment, can I have assurances that the experimental lake will not be touched? Mistakes can be made if the partnership expands.

   (M. Paterson) – This has not been a problem, and we don't expect it to become one. The ELA Science Management Committee will be responsible for ensuring there is no overlap in lake use.

7. (D. Muir) – Does ELA have a fish tissue archive? How far back does it go and is it continuous?

   (K. Mills) – Yes, we have an archive. It goes back to the 1970s, and it is intermittent. The problem is storage space, and there is constant pressure for us to reduce the size of our present archive.

   (S. Page) – We have a 25-year collection of unprocessed water samples.

   (M. Stainton) – We also have a long-term collection of frozen seston samples on GFC filter papers.

8. (S. Page) – ELA also has a fully functional SCUBA facility, a radioisotope lab complete with licenses for various radiotracers, climate-controlled labs, and two communication towers with high-speed internet capabilities.
9. (L. Wassenaar) – Is terrestrial manipulation in the mandate?

   (M. Paterson, J. Shearer, S. Kasian, and M. Stainton) – Yes. In fact, the Mercury Experiment to Assess Atmospheric Loading in Canada and the US (METAALICUS), the Flooded Uplands Dynamics Experiment (FLUDEX), and a bog-acidification study are examples of terrestrial work done at ELA. A proposal for terrestrial work just needs to be approved by the ELA Management Board.
10. (K. Mills) – I have fish mark–recapture data for a wide variety of lakes at ELA, some of which have eventually been chosen for manipulation (e.g., additions of cadmium and EDCs; a proposed polychlorinated biphenyl [PCB] addition). There is also a comprehensive survey of fish species presence/absence in >130 ELA lakes.
11. (K. Beaty and S. Page) – The camp facility can handle up to 50 people in summertime. However, people can use the camp all year round. The camp is virtually empty in winter and spring, so these are opportune times to work there. The road is cleared after major snowfalls, so the camp is accessible any time.
12. (S. Watson) – Is there a communal lab, and what equipment does an individual researcher have to bring?

    (M. Stainton and M. Paterson) – ELA has an accredited chemistry laboratory that has individual researchers as clients. Well-equipped laboratory space is available, some spare instruments are available, and others can be borrowed from individual research programs, upon negotiation. EC researchers can use instruments like spectrophotometers after proper instruction by ELA staff. It's best to start with the premise that you will bring your own equipment, but you can arrange with others, beforehand, to borrow their equipment.

(K. Mills) - There is a large communal laboratory in the new laboratory building that is not assigned space, and is used throughout the year by a variety of researchers. Other laboratories in this building are assigned to specific researchers on an annual basis, and can be re-assigned based on the needs of other researchers at ELA.

13. (M. Shepherd) – How does ELA decide on parameters for long-term monitoring?

(M. Paterson) – Long-term monitoring at ELA has been largely "accidental". ELA was originally established as a facility for ecosystem manipulation and variables were measured in support of manipulations. In many cases, monitoring of reference lakes has continued indefinitely. It's hard to decide what to monitor on a long-term basis, and ELA doesn't have a formal monitoring structure. I would encourage discussion on this topic because monitoring may be important to EC.

14. (S. Beauchamp) – Who monitors the weather station?

(K. Beaty) – The station was started by EC, and ELA staff now maintain the site. We use the data provided for individual experiments. We also provide daily site service for the Canadian Air and Precipitation Monitoring Network (CAPMON). The ELA camp manager is there in the winter to take care of the meteorological site. Lakes 239 and 240 are calibrated watersheds. Lake 239 is an index watershed for measuring variables such as terrestrial inflows, lake stage, dates of ice-on and ice-out, ice thickness, snow pack depth, etc. The reference watershed is never modified. The weather station is located in the Lake 239 watershed.

(T. Clair) – The METAALICUS program would be an opportunity for EC to establish long-term monitoring of mercury at ELA.

(N. Glozier) – Canadian Environmental Sustainability Indicators (CESI), a huge program on status and trends nationally, has gaps (e.g., lakes).

(M. Amrani) – EC currently has an initiative to find data useful for long-term monitoring.

Questions following presentation by S. Cosens on DFO's mandate (Appendix 6)

15. (D. Muir) – Are chemical stressors a part of the DFO mandate? DFO is already working on mercury. Is there common ground here? What about research on nutrients?

    (S. Cosens) – The term "chemical research" encompasses nutrients. DFO recently underwent a drastic downsizing in toxics. We remain involved in the METAALICUS program because it began before the downsizing. DFO understands it has a commitment to toxics but wants to change the emphasis from monitoring to impacts (e.g., how does exposure to toxics affect fish productivity?). This change in emphasis led to the establishment of the National Centre of Expertise in Pesticides, being headed by Vince Palace. Toxics are embedded in the ecosystem-management approach adopted by DFO. There is a link between EC and DFO because EC monitors toxics.

16. (M. Amrani) – Can you explain monitoring in DFO? DFO spends $30 million annually on "monitoring".

    (S. Cosens) – The $30 million is spent mainly on activities regarded by DFO as "monitoring", such as fish stock assessment, seal populations, etc. In the past, DFO has not had a monitoring component to many programs. It sees itself as having a monitoring responsibility, but it's not well-defined.

    (R. Fudge) – DFO is currently examining the money it spends on "monitoring".

17. (M. McMaster) – I'm still not sure why DFO set up a pesticide center. How do EC and DFO divide responsibility for pesticides?

    (R. Fudge) – It was a statutory requirement (Pesticide Management Regulatory Agency [PMRA]). Winnipeg was chosen as a result.

    (D. Muir) – Vince Palace's work is a good example of integration of EC and DFO. He works closely with an EC group in southern Ontario. EC's part in a whole-lake

pesticide addition would be to look at chemical fate and effects, whereas DFO might look at toxic impacts on fish.

(M. Paterson) – Contaminants are a prime area for cooperation between EC and DFO: EC on cycling, DFO on population-level effects.

Questions and comments following presentations by D. Muir, R. Bourbonniere, et al. (**Note:** Several individuals from EC made presentations because a single EC science plan was not yet available.)

18. (R. Bourbonniere) – I am interested in climate change research possibilities at ELA, in particular materials flowing from the terrestrial watershed into the lake, and their effects on dissolved organic matter (DOM) and photochemical changes. At ELA, it may be possible to cover a lake, or part of a watershed, with a roof. A paired study could be done: ELA first, and then move elsewhere. Dean Jeffries is extremely interested in seeing the acidification-recovery work continue.
19. (N. Glozier) – Mohamed Amrani and I are part of the Water Quality Monitoring and Surveillance group. Databases, and taking a consistent approach to their management, are important. Here is a link to ELA. National reporting is expanding and there will be a network of networks; ELA is included. We have long-term monitoring sites in the Prairie and Northern Region of EC (e.g., effects of herbicides on wetlands; mountain lakes; Wood Buffalo National Park; biomonitoring of tributaries to the Red River; Lake Winnipeg). We are now assessing data gaps based on geography and ecosystems. For example, Saskatchewan does not have any monitoring, so a new Saskatchewan–Canada agreement is being negotiated.

(M. Amrani) – The EC national monitoring program divides the country into five regions. The mandate is to report on trends of water quality and report on emerging issues. Most of what EC does is linked to agreements with the provinces, and is done in conjunction with federal–provincial trans-boundary waters. Some marine

monitoring, using shellfish, is also part of the national program. There is a national report that uses "environmental quality indicators", but climate change is not included. EC does a lot of coring and takes a lot of physical/chemical measurements, and is trying to develop biomonitoring programs. We have an agreement with Parks Canada to develop a national biomonitoring program.

(D. Muir) – Monitoring of chemicals in fish was transferred from DFO to EC, and EC operates a national fish tissue bank. A program is developing on fish contamination status and trends.

(M. Amrani) – Fish are to be used as indicators of ecosystem health.

(N. Glozier) – Our emphasis is on reporting, but we are also monitoring to identify research needs.

(S. Kasian to M. Amrani) – What do you mean when you refer to "biomonitoring"? It sounds like overlap with DFO. What are you measuring?

(M. Amrani) – We emphasize reporting of physical/chemical data. Biomonitoring would measure impact on the environment of, for example, mercury. We measure biodiversity using the Canadian Aquatic Biomonitoring Network (CABIN) approach.

(D. Muir) – When EC refers to "impacts", it means deviation from established environmental quality guidelines.

20. (R. Fudge) – In developing the MOU, there was hope of embedding EC researchers at ELA. Is that still in the plan?

    (D. Muir) – It's no problem in theory, but EC is short of salary and operating money. However, it should be considered and could be a recommendation from this workshop.

21. (S. Beauchamp) – I am part of the Air Quality Service, which is primarily interested in atmospheric processes (e.g., transformations, scavenging, deposition, re-volatilization, source–receptor relationships) from the global scale and downward,

from point of emission to final sequestration. I deal with contaminants like O_3 (primarily) and persistent toxic substances (secondarily). I have worked on water/air exchange of persistent organic pollutants (POPs) on the Great Lakes, and mercury depletion events in the NWT. It is good that a CAPMON site is located at ELA, and I am interested in the METAALICUS experiment, especially the measurement of ambient air concentrations, speciation, aerosol size distributions, dry deposition, and watershed mass-balance work.

22. (M. Shepherd) – My group (Air Quality Measurements and Analysis Research) is concerned with monitoring of the chemistry of air and precipitation in support of domestic and international programs to mitigate health and ecosystem impacts. Two major drivers for this program currently are the Clean Air Regulatory Agenda and the Canada/US Air Quality Accord. We seek to improve monitoring in the North and West, and we are interested in variables such as NH_3 (currently monitoring prairie and mid-western US sources), NH_4NO_3, sulphur deposition, and cation deposition. We are currently planning to move our mercury work into the core program, but we have not yet interfaced with ELA. ELA is in an important geographical location because it occurs at the edge of maps of western Canada.
23. (M. MacKay) – My group (Climate Research) develops climate models, and my own research centres on atmosphere–land-surface exchange. I am interested in lakes because they are presently not included in our modelling systems, even though they can have significant impacts on the local and regional weather and climate. A requirement of land-surface models is to represent heterogeneous land surfaces; hence, a lake "tile" needs to be added to our modelling suite. ELA presents an excellent opportunity for research into small lake–atmosphere interaction, essential to the development of such a lake tile.

24. (T. Clair) – My group (Cumulative Impacts on Aquatic Biodiversity, headed by Keith Puckett) is interested, in a holistic way, in what atmospheric stressors (e.g., acid, UV-B, etc.) are doing to aquatic ecosystems. We currently have a new Treasury Board (TB) submission seeking to firm up acid rain program funding, and to get better information on mercury contamination. I am currently putting together an EC program for looking at mercury in aquatic ecosystems, so METAALICUS is important.

    (D. Muir) – I am involved with the Outcome Project Sub-Component (OPSC) whose main priority is links between mercury and acid rain. The program examines latitudinal and longitudinal trends of mercury deposition through cores (none taken at ELA). The CWS people are interested in effects of mercury on wildlife (birds), from atmospheric deposition to accumulation in top predators.

    (T. Clair) – How do you model mercury through the ecosystem? Does a reduction in loading mean anything? METAALICUS would be very useful in this regard.

25. (C. Spence) – My group (led by Phil Marsh) is predominantly hydrological (physical/chemical features are also included). We are interested in how processes change with scale, geographic region, and perturbation. How do you parameterize these processes for modelling? ELA is representative of a headwater system, and this scale is under-represented in our hydrological database. Working with ELA could enable us to scale up.

    (S. Beauchamp) – Models are being built into other models (e.g., coupling of ocean and atmosphere, mercury models built in), and there is progressively more refinement.

    (C. Spence) – ELA could shine as a centre for the development of models and as a test bed for environmental prediction and testing of models.

26. (L. Wassenaar) – My group (Cumulative Impacts on Aquatic Biodiversity) is a very diverse group spread across the country. It looks at the effects of multiple stressors on aquatic ecosystems. My research focuses on nutrient productivity in aquatic systems.
27. (M. McMaster) – My group (Ecosystem Health Assessment) works on fish health. It has identified Canadian areas of concern for fish health. Derek Muir does contaminants work, Scott Brown (now deceased) used to study effects on thyroid function, and I work on reproductive effects. My group developed the Environmental Effects Monitoring (EEM) program for pulp and paper mills and mining. Municipal wastes are next. My group is interested in the effects of complex mixtures of pulp and paper and sewage effluents on receivers. Potential interactions at ELA include the EDC experiment and any other contaminant or alteration of lakes that affects fish.
28. (S. Watson) – I am part of the Lake Management Research group, which has a limnological and ecosystem-based focus, and deals with eutrophication and management including monitoring (e.g., in the Great Lakes). The group is very interactive with stakeholders in pursuing remediation; research components are applied to management and to user groups. The group contains hydrodynamic modellers who study how physical processes interact to change biological processes. Watershed-based models are developed for amalgamation with other models (e.g., linked with climate models and remote sensing to understand algal blooms). My interest is in understanding algal bloom development and predator/prey relationships, and I am presently involved in the Lake Winnipeg study. The group also is involved in bioremediation of mine tailings (nutrient amendments), human impacts in alpine systems (fecal indicators), and reservoir studies in southern Alberta.

29. (D. Muir) – I am a member of the Atmospheric Contaminant Impacts group. I am interested in the long-range transport of POPs and mercury globally, and I focus on the Canadian Arctic and open parts of the Great Lakes. I study temporal trends of POPs in the Arctic, and work with monitoring programs there (e.g., PCBs in fish). I am particularly interested in fluorinated organic compounds in fish and sediment archives of temporal trends in contaminants. I am linked to other EC atmospheric research programs (e.g., POPs, chlorinated organics). My potential involvement at ELA would include new priority chemicals that need to be researched, following the same rationale as for the EDC experiment.

    (P. Blanchfield) – What are the emerging contaminant issues?

    (D. Muir) – Flame retardants and their bioavailability. There are now more flame retardants than PCBs in the Great Lake sediments!

DAY 2

Breakout Group Reports

Summaries of replies of breakout groups to questions on the template appear in Appendix 10. The following material is a record of the oral presentations of the breakout groups and ensuing discussion.

1. (S. Cosens) – Breakout group 4 presentation

    Our group felt there were many opportunities for and interest in collaboration, and that EC and DFO shared similar interests. Opportunities include:

    a) using data from ELA to validate EC models,

    b) sharing long-term monitoring data, and

    c) monitoring acidification recovery. ELA has had an acidification recovery project for many years, the information is valuable to both departments, and EC apparently has a proposal on this topic in the works.

There are a number of emerging issues for which EC and DFO could submit joint proposals:

a) climate change impacts (e.g., effects on water levels, water temperature),

b) impacts of management strategies on eutrophication – Do nutrient controls work? What effect does management have on systems? This research topic has implications to Lake Winnipeg, and would interest DFO's Habitat Management people (second priority),

c) terrestrial systems,

d) calcium levels – There seems to be a decline in calcium levels in boreal lakes (and nationally). Is this a response to acidification?,

e) flame retardants, and

f) oil dispersants.

The difficulties of working together are common to both departments:

a) capacity issues and impending retirements,

b) administrative barriers to collaboration. In EC, these include purchasing and hiring. In DFO, these include limits on full-time equivalents (FTEs), security checks, and hiring,

c) long-term funding for monitoring, and

d) lack of secure year-to-year funding.

The solution is for departments to pull down systemic barriers to collaboration. This message has to be sent up the line continuously.

(D. Muir) – The comment on barriers is a good one. I have had the personal experience of interminable delays in trying to send a small amount of money to a DFO colleague. Maybe EC and DFO need an umbrella agreement to cover the corporate end of things?

(V. Williams) – The MOU should ease passage of items through Corporate Services because they will realize that there is high-level agreement in place.

2. (T. Clair) – Breakout group 3 presentation

There is always overlap in synergies between the departments. Ensuring that ELA's data get incorporated into EC's database would provide security for ELA. The ELA meteorological site, CAPMON, and hydrology data should be incorporated into Hydrological Services. It may be worthwhile for ELA to strengthen its Environmental Monitoring and Assessment Network (EMAN) node.

(J. Shearer) – EMAN has limited resources.

(T. Clair) – EC needs ELA to help set guidelines for the EEM program, and to provide links between the physical and biological sides of things.

Our group recommended the following possible cooperative projects:

a) stable isotope studies testing models of fractionation and transfer,
b) METAALICUS – EC has had very little involvement in this study but has a lot of interest in it and would like to be included in any future planning (a priority),
c) flame retardants, stain repellents, etc. – Doing paleolimnological work at ELA would be an idea,
d) EDCs (a priority),
e) POPs,
f) climate change – aspects could include thermocline deepening and dissolved organic carbon (DOC) changes,
g) testing hypotheses generated for Lake Winnipeg at ELA,
h) acidification recovery, and
i) nitrogen addition – Where does N go in acidification?

The difficulties in collaboration include:

a) present workloads,

b) resources and attracting funding,

c) linking ELA to things that matter to EC – there is a need to sell ELA to EC researchers. They have lots to do, so a shift in thinking is needed, and

d) the need to reprise the concept of whole-ecosystem studies every few years for people who are unfamiliar with it.

(D. Muir) – Articles on the MOU and this workshop should be put into EC and DFO newsletters.

3. (R. Hesslein) – Breakout group 2 presentation

This group followed very closely their outline in Appendix 10. The following notes embellish the points made in their outline.

Regarding questions asked in "capacity overlap?" (p. 2 of Group 2's outline), does DFO need a chemistry laboratory when EC has so many? Could impending DFO retirements of chemistry laboratory personnel be replaced by EC people? DFO's chemistry laboratory traditionally developed methods but maybe this function could be assumed by the new University of Manitoba (U of M) chemistry laboratory (M. Abrahams's idea)?

Regarding "apparent synergies?" (p. 3 of Group 2's outline):

a) collaboration could unlock substantial money,

b) EC has many locations, which could assist ELA in regional collections and extrapolation outside ELA, and

c) there is no good way to move money from government to universities, which makes it difficult to lever money from the National Science and Engineering Research Council (NSERC). This problem may be solved by getting a person from EC or DFO into an NSERC Industrial Chair.

Group 2 categorized possible collaborative experiments or monitoring activities (pp. 4–7 in Group 2's outline) into long-term endeavours (chemical fate/flame retardants,

oil spills, fish stock recovery, nutrients, climate change effects, and a bactericide addition) and "quick and easy" approaches (use of existing ELA databases to work with EC modellers, formalize tissue and archive samples, and revisit ELA monitoring components to ensure suitability for EC). The details of these proposals can be found in Appendix 10.

Group 2's perceived difficulties included:

a) the need for EC researchers to be physically on site at ELA to allow effective interaction between EC and DFO personnel,

b) the need to start with easy-to-accomplish tasks because everyone is already so busy,

c) the need for office space at the Freshwater Institute (FWI) for EC personnel involved with ELA, and

d) the need for DFO to decide what staff to hire in the future (ELA is facing a large number of retirements) and how the new staff will be mentored.

Group 2 presented its highest priority opportunities:

a) DFO should interact with EC modelling teams to decide what is needed to calibrate EC models. Can existing data be used?, and

b) ELA archives should be documented and secured, especially before holders of data sets retire.

Group 2 ended its presentation by identifying its highest-priority difficulties:

a) the need for an EC scientist champion, one who can also spend dedicated time at ELA, and

b) the need to decide on cooperative efforts to pursue.

4. (P. Blanchfield) – Breakout group 1 presentation (also followed closely the outline in Appendix 10)

The overlap between EC and DFO lies in both trying to understand processes.

However, their focuses are different: e.g., EC is interested in land/water interactions and pathways to fish, whereas for DFO the endpoint is fish. ELA has an n = 1, whereas EC has an n = many. ELA has a need to transfer its results to a larger region.

Group 1 outlined the following possible collaborative opportunities:

a) climate change,

b) wetland manipulation,

c) integration of ELA into EC's long-term monitoring program,

d) nutrient manipulation, and

e) chemical manipulation – oil, mercury, pharmaceuticals, flame retardants.

(See Appendix 10 for further details.)

Group 1 identified the following problems and possible solutions:

a) capacity and funding – Given enough lead time (2–3 y), people can get involved and funding can be secured,

b) succession planning – universities can be brought in to fill holes in expertise,

c) communication between EC and DFO – needs to be improved by, among other suggestions (see Group 1's outline in Appendix 10), having an annual meeting, which could be tied into an already existing conference such as the Canadian Conference for Fisheries Research (CCFFR), and using a list serve or email,

d) the location of ELA is difficult for EC to access – ELA is set up and ready to go. High-tech communication is possible, personnel can be shared, and space should be made available at the FWI (see Group 1's outline for additional suggestions), and

e) EC's lack of familiarity with ELA's database (and vice versa) – can be improved by better communication through Susan Kasian (the ELA database manager), websites, and newsletters.

Group 1 also divided its priorities into short-term and long-term. It recognized that short-term projects such as using the ELA database and cooperative monitoring activities were essential. It chose climate-related work as its priority long-term project. Group 1 chose communication as its priority difficulty.

Priority Research to Pursue

The next part of the workshop was devoted to compiling a list of collaborative research suggested by each breakout group, and identifying the top three or four priorities among them, along with names of people who could act as "engines". The process engendered lively discussion, the essence of which is reported below.

1. (M. Paterson) – He suggested five big categories: a) climate, b) contaminants, c) eutrophication, d) acidification, and e) modelling/monitoring. The list could also be divided into short-term and long-term experiments.

   (M. Stainton) – Add sharing data.

   (P. Blanchfield) – The early part of a long-term experiment could also be short-term, i.e., pilot studies using mesocosms.

   (S. McLeod) – If there is general agreement to a division between short- and long-term experiments, then let's start with the short-term ones. Here is a provisional list:

   a) data sharing,

   b) model calibration, and

   c) archiving tissue samples.

   (M. McMaster) – Add existing projects to this list:

   d) METAALICUS,

   e) acidification recovery,

   f) aquaculture and nutrient management, and also

   g) pilot studies (see above).

2. (S. McLeod) – He pointed out that each of these short-term programs requires an engine, one from each department. The choices are summarized in Table 1. The following material recounts the discussion around each of the *short-term projects*.

   a) Mesocosm pilot studies

   (D. Muir) – I am seeking money from a new funding program for mesocosm work using flame retardants.

   b) Data sharing and modelling

   (M. Paterson) – Both data sharing and modelling are communication issues. We have to determine EC's needs and who is interested in using ELA data.

   (R. Hesslein) – We can do more than tell people the data exist. We could distribute CDs of the ELA database to everyone at this meeting. But can EC people assess what's available? Communication should go back to Susan Kasian.

   (M. Lyng) – The availability of the ELA data should be mentioned in the EC Newsletter.

   c) Archiving

   (R. Hesslein) – Give some thought to including material from elsewhere (e.g., the Arctic, Lake Winnipeg) in the interests of expanding outward from the ELA material.

   d) METAALICUS and aquaculture

   (M. Paterson) – It's hard to find EC people in this room for these projects. For example, the aquaculture project is interested in studying water movement under the pens. Who in EC would be interested in this?

   e) Final comments on short-term programs

   (S. Page) – The EC website has a section on its researchers. DFO needs something similar.

3. Long-term projects

A lively discussion (recounted below) led to the identification of four priority long-term projects, and the engines associated with these projects (Table 2).

(L. Wassenaar) – We need a centrepiece project, common to both departments, that is related to issues of national importance. I suggest nutrients and nitrogen storage.

(D. Muir) – I suggest we align things with EC programs that have new money: a) chemical management, b) clean air, and c) climate change/greenhouse gases. A bactericide addition is valuable, and air quality ties in with METAALICUS.

(S. Cosens) – DFO favours studies on population-level effects on fish. Fish are involved in the three study lines suggested by Derek, but this has to be brought out more clearly.

(S. Schiff) – I think climate studies should be on the priority list.

(N. Glozier) – Eutrophication should be linked to Lake Winnipeg.

(M. Paterson) – What is meant by "air quality"?

(T. Clair) – It includes acid rain and METAALICUS.

(S. McLeod) – Now that we have identified four priorities for study, and contact people for each priority (Table 2), those people need to start by better focussing each topic.

(M. Paterson, M. Shepherd, S. McLeod, and S. Cosens) – Suggestions for focussing:

a) Who are the interested parties (i.e., who needs the information and for what purpose)?
b) What are the sources of funding?
c) What are the information objectives of the study (i.e., to understand aquatic responses to...)?
d) How do the study objectives fit departmental mandates?

The following individuals were tasked with better focussing each of the priority study areas:

- nutrient management – Michael Stainton
- chemical fates/effects – Derek Muir
- air quality – Tom Clair and Mike Paterson
- climate – Paul Blanchfield and Rick Bourbonniere.

Structure of the ELA Science Management Committee

The intent of this part of the workshop was to develop a structure and mode of operation of the ELA Science Management Committee identified in the MOU (Appendix 2). A provisional structure was recommended (Table 3), only after a long and frustrating discussion. The Committee's operating characteristics were left until the first full meeting of the Committee. The following is a record of the discussion leading to the development of a provisional Committee structure.

(M. Paterson) – He started the discussion by expanding on the MOU (Appendix 11), and asked the following key questions:

a) Are there other functions for the Committee not on the list (see Appendix 11)?

b) Who should be on the Committee? Possibilities:

- Real Property representative,
- Operations Manager – presently John Shearer,
- scientists, and
- managers – for DFO, this would likely be the Regional Director of Science (RDS)

(M. Stainton) – Will this Committee guide and endorse research at ELA or just facilitate it? The person involved in preparing the MOU should know the intent.

(R. Hesslein) – The first thing to decide is what the Science Management Committee will do. If we focus on the third entry ("Develop and review science proposals before they go to the ELA Management Board"; Appendix 11) then the job of the Science Management Committee is science, and it needs scientists. If the Science Management Committee is to deal with operations, then a different composition is needed.

(S. Cosens) – The third entry is key. One of the functions from the DFO side is to decide if a proposal meets DFO mandate. The Committee should be composed of scientists and managers.

(L. Wassenaar) – Is the Committee's function to **develop** or solicit/accept/review proposals? The rest is operational.

(S. Page) – Maybe two different committees are needed? Overseeing day-to-day operations is different from developing proposals.

(K. Mills) – I agree that the third entry is important, and recommend that the RDS be involved because the RDS's implicit approval of a project is needed anyway.

(S. McLeod) – Given the importance placed on communication at this workshop, should this function be added to the Committee's responsibilities?

(Several workshop participants voiced their agreement with this point.)

(V. Williams) – Maybe the Committee should issue a quarterly report to keep EC and DFO drafters of the MOU in the loop?

(M. Stainton) – I agree that communication is important. Should communication be included under the "umbrella" agreement discussed on day 1? The structure of the Committee may need to be adjusted: director level to meet once per year, a group concerned with operations, data sharing, etc. to meet twice per year?

(S. McLeod) – The Committee could meet twice per year, once at the senior level.

(S. Cosens) – We need two different sets of people.

(S. McLeod) – Leave out operations?

(S. Cosens) – Yes.

(M. Amrani) – The Committee operation needs a buy-in from managers as well as scientists.

(R. Hesslein) – DFO still owns the facility and Real Property runs it. I'm not sure how recommendations to change the facility will work. Science is equally balanced as defined. It's probably better to leave Real Property out of the Committee. I would like to see the Committee recommend what is required to make proposals/projects successful. A fundamental change in the facility to achieve scientific objectives is okay.

(T. Clair) – There are really two functions being talked about here: a policy function (= the 3rd entry in Appendix 11) and operations (i.e., the users group). These two groups will probably not interact. It's important to take care of the third entry.

(J. Shearer) – Be careful about separating these functions. Someone has to deal with everyday details of camp operation, and needs to be able to say "no" to some people. Focussing on science only without details of operations is not wise.

(T. Clair) – What about university people? Should they not be somehow included in operations?

(S. Cosens) – They are not really co-managing the facility. Maybe we need a technical subcommittee (i.e., a subset of the Science Management Committee to report to the Science Management Committee)?

(M. Turner) – A technical subcommittee would need to meet more frequently. Operations should be delegated to someone (I agree with J. Shearer). However, science management should be split from operations; operations should not be part of the Committee. Senior managers need to be engaged on the Committee.

(D. Muir) – I think we are jumping the gun. There are no EC projects out at ELA right now, and they are not likely for a while. The third entry is important. Director-level people from EC are needed, one from the water side (John Carey?) and one from the

atmosphere side (not identified). I think an interim group should be formed to figure out how the Committee should work.

(S. McLeod) – Who should be from EC?

(D. Muir) – I can't say. John Carey would be ideal. It's easier to identify scientists than managers. I think John Carey should identify the science people, with advice from EC colleagues.

(D. Rosenberg) – Let me propose a straw-man committee structure to break the impasse:

- senior managers – one from EC and one from DFO,
- scientists – one from EC and one from DFO,
- Operations Manager, and
- Real Property representative.

(R. Bourbonniere) – More scientists are needed.

(S. McLeod) – The Committee needs more than one scientist from each department, and an upper-level manager should decide who those scientists should be.

(R. Hesslein) – David Rosenberg's proposal has unequal representation and it distorts the weighting away from science. I suggest operations be left out; such a person can be invited.

(S. McLeod) – How about one manager and two scientists from each department?

(M. Paterson) – The Operations Manager gets paid by both departments.

(S. McLeod) – Let's leave out the Operations Manager and the Real Property representative. Let's go with one manager and two scientists from each department.

(General agreement from the group followed, and Table 3 was developed).

(M. Paterson) – We should wait to get management on board and then have the first organizational meeting of the Committee.

(S. Cosens) – What's the Committee's first task?

(S. McLeod) – Process. How does the Committee work and what does it do?

Special Needs: Communication, etc.

This part of the workshop was added by Sheldon McLeod who felt that the need for better communication between the two departments was a recurring concern of workshop participants. The recommendations that flowed out of the discussion are summarized in Table 4. The main points from the discussion follow:

(S. McLeod) – Here is a sample of comments made during the workshop that led me to believe that communication between departments is a concern:

- EC won't know what opportunities are available at ELA.
- EC won't know what data are available at ELA.
- We don't know what each other does.
- What does upper management think about what we plan to do?
- Universities are not included in our plans.

It's clear you need help with communications. Who are the targets and how do you address them? Do your departments have the capability to address these concerns?

(T. Clair) – Use departmental newsletters for a joint announcement. A lot of communication will be incremental. Managers and bench-level researchers need to be aware of the EC–DFO partnership. Also, give some thought to modifying the ELA website.

(S. McLeod) – Who would do this?

(J. Shearer) – I maintain the ELA website. It's not an official government website (because it does not have a French version). I can update it, but both departments may be nervous.

(D. Muir) – EC communication people are keen to put this type of information on the EC website.

(J. Shearer) – DFO was approached to update the ELA website but no resources were available.

(S. Cosens) – I'll look into an official DFO website for ELA.

(M. Paterson) – The ELA group is easy to communicate with because it's a compact group. EC is a large, diffuse group, and that's a problem. I have three questions:

1. Should we hold an annual meeting with EC and the universities to discuss projects?
2. Should I be going to Burlington and Saskatoon to give seminars (because this workshop has missed lots of people in EC)?
3. How can we get EC researchers out to see the ELA site?

(P. Blanchfield) – We could hold an annual meeting at ELA.

(D. Muir) – I agree with the annual meeting idea, and the idea of giving an overview seminar on ELA research in Burlington (before mid-June).

(M. Shepherd) – The Burlington seminar needs to be a single event to include both atmospheric and water researchers in EC (they are currently split into separate buildings).

(N. Glozier) – A similar seminar should also be given in Saskatoon.

(M. Shepherd) – Stress that Mike's seminars in Burlington and Saskatoon are opportunities to discuss joint research.

(M. Stainton) – As an overt gesture of goodwill, standalone copies of the ELA database should be provided to EC researchers.

(M. Paterson) – The database could be put on a CD or on the ELA ftp site.

(M. Lyng) – Availability of the database could be mentioned in the EC Newsletter.

(C. Spence) – This group is a research network, and we need a network manager to facilitate communication among EC, DFO, and the universities.

(M. Paterson) – This is a good idea, but it's a lot of work and an ELA person is not available. I will take the idea to the Science Management Committee.

(M. Paterson) – I'd like to ask Sherry Schiff to address the role of universities in the EC–DFO partnership at ELA.

(S. Schiff) – Universities are good at renewal and the mentoring process. "We work for free". The partnership provides opportunities to get young people aboard. University people usually need a two-year window to get involved. Universities should be included in the communication plan, which needs to be active, and I support the idea of a network manager.

(S. McLeod) – My final comments include two tasks:

1. Preparation of a "to do" list arising from the workshop, to be distributed to everyone at the workshop (see Appendix 12).
2. Mike Paterson needs to be the point person for the Science Management Committee, until the Committee is established.

(M. Paterson) – He closed the workshop by thanking everyone for attending and saying that ELA was a jewel with a lot to contribute to science in Canada. He hoped the EC people at the workshop would take this message home.

CONCLUSIONS

The workshop produced the following recommendations meant to facilitate the EC–DFO partnership at ELA:

1. An umbrella agreement between EC and DFO is needed to circumvent administrative barriers.

2. A counterpart to the ELA leader (currently Mike Paterson) needs to be found in EC.
3. This EC "scientific champion" should ideally be located at the FWI.
4. The rationales for the priority long-term cooperative research projects chosen need to be focussed.
5. The provisional structure of the ELA Science Management Committee needs to be approved and outstanding appointments completed. The functioning of this Committee needs to be developed more fully.
6. Communication between the tightly focussed ELA group and its more diffuse EC partners needs to be improved, and universities need to be included.

RECENT DEVELOPMENTS

This section was added to update progress of the EC–DFO partnership between the workshop and the end of December 2007. Information is organized under three headings: 1) collaborative research at ELA, 2) administrative arrangements, and 3) communication.

COLLABORATIVE RESEARCH AT ELA

Murray MacKay (EC, Downsview) in 2007 installed a raft measuring surface water temperatures on Lake 239, with the aim of improving existing climate models. He also began collaborative research with Mike Paterson and Ray Hesslein on the effects of changes in climate and water chemistry on lake thermal structure and fish habitat availability. In 2008, Dr. MacKay plans to expand his modelling efforts to include the Lake 239 watershed.

Chris Spence (EC, Saskatoon) visited ELA in 2007 to explore the possibility of establishing further hydrological metering of small streams. In collaboration with Ken

Beaty, Paul Blanchfield, Michael Turner, and Mike Paterson, he submitted a proposal to the Ontario Best in Science Program to initiate a whole-stream diversion project to assess the potential impacts of changes in precipitation, hydrologic connectivity, or bulk water removals on hydrology, water chemistry, and fish distribution.

Derek Muir (EC, Burlington), in collaboration with Mike Paterson, Vince Palace, and Gregg Tomy (all DFO, Winnipeg) and Diane Orihel (University of Alberta), received funding for a mesocosm study examining the chemical fate and toxicity to fish of brominated flame retardants. This project was initiated in 2007, and is currently ongoing. Drs Muir and Paterson also plan to submit a proposal to continue mercury research at ELA as part of the METAALICUS project.

Numerous other EC scientists contacted ELA personnel about the possibilities of using ELA data or the ELA facility to undertake research in 2008 and beyond.

ADMINISTRATIVE ARRANGEMENTS

DFO forwarded to EC a recommendation that the ELA Science Management Committee be composed of six representatives, including two scientists and one management representative from each department. Membership of this committee will be finalized in early 2008.

COMMUNICATION

Mike Paterson visited EC researchers at Downsview and Burlington in November 2007, and gave presentations on opportunities for research at ELA (see Appendix 12).

ACKNOWLEDGEMENTS

We thank EC and DFO researchers for taking the time to participate in the workshop. Sheldon McLeod facilitated the proceedings. Paul Blanchfield, Tom Clair,

Susan Cosens, and Ray Hesslein were breakout group reporters. Susan Kasian, Steve Page, John Shearer, and Mark Lyng were breakout group recorders. DFO strategic funding provided support for travel by EC participants and for the workshop facilities. We also thank Chris Baron and Helen Fast for reviewing the manuscript of this report.

Table 1. EC and DFO priority short-term projects and contacts for them.

Program	Contacts	
	EC	DFO
Mesocosm pilot studies	Derek Muir	Gregg Tomy Mike Paterson
Data sharing	Nancy Glozier Chris Lochler[1]	Susan Kasian
Modelling	Murray MacKay Chris Spence	Ray Hesslein Mark Lyng
Archiving	Derek Muir Sean Backus[2] Len Wassenaar?	Susan Kasian Vera Williams
METAALICUS	Tom Clair Derek Muir	Mike Paterson
Aquaculture	Mark McMaster[3]	Cheryl Podemski
Acidification recovery	Dean Jeffries Tom Clair	Michael Turner

[1] To be contacted by N. Glozier
[2] To be contacted by D. Muir
[3] To follow up with Murray Charleton's group

Table 2. EC and DFO priority long-term projects and contacts for them.

Program	Contacts	
	EC	DFO
Nutrient management	Susan Watson	Susan Cosens Michael Stainton
Chemical fates/effects	Cathy Banic[1]	Vince Palace[2]
Air quality	Tom Clair	Mike Paterson
Climate change	Rick Bourbonniere	Ray Hesslein Paul Blanchfield

[1] To be contacted by D. Muir
[2] To be contacted by M. Paterson

Table 3. Provisional structure of the ELA Science Management Committee[1].

Position	EC	DFO
Managers	?[2]	RDS – Michelle Wheatley
Scientists	?[3]	Mike Paterson (ELA Leader) Ray Hesslein (ELA Senior Scientist)

[1] To be co-chaired by one scientist from each of EC and DFO, or to have alternating chairmanship from year to year
[2] Derek Muir suggested John Carey, but needs to consult with him first
[3] The responsible EC manager needs to appoint two EC scientists

Table 4. Suggestions for improving communication between EC and DFO, and contact persons where applicable.

Communication mode	Contacts	
	EC	**DFO**
Newsletters	Paula Tozer[1]	Vera Williams(?)[2]
Websites	Alex Bielak[3]	John Shearer
Seminars	N/A	Mike Paterson[4]
Annual meetings[5]	Derek Muir	Paul Blanchfield
ELA database on CD	N/A	Susan Kasian
Hire a network manager	Chris Spence	Mike Paterson[6]

[1] To be contacted by R. Bourbonniere
[2] This name added as a possible contact after the workshop
[3] Suggested by D. Muir
[4] To give seminars in Burlington and Saskatoon before mid-June
[5] At ELA or in conjunction with existing conferences
[6] To take suggestion to Science Management Committee

APPENDIX 1: ACRONYMS USED IN THIS REPORT

ADM – Assistant Deputy Minister

CABIN – Canadian Aquatic Biomonitoring Network

CAPMON – Canadian Air and Precipitation Monitoring Network

CCFFR – Canadian Conference for Fisheries Research

CD – compact disk

CESI – Canadian Environmental Sustainability Indicators

CWS – Canadian Wildlife Service

DFO – Fisheries and Oceans Canada

DOC – dissolved organic carbon

DOM – dissolved organic matter

EDC – endocrine disrupting chemical

ELA – Experimental Lakes Area

EMAN – Environmental Monitoring and Assessment Network

EEM – Environmental Effects Monitoring

FLUDEX – Flooded Uplands Dynamics Experiment

FTE – full-time equivalent (a government term for personnel)

FWI – Freshwater Institute (DFO, Winnipeg)

HC – Health Canada

HR – Human Resources

IP – internet protocol

LTER – Long Term Ecological Research program (at ELA)

METAALICUS – Mercury Experiment to Assess Atmospheric Loading in Canada and the US

MOU – Memorandum of Understanding

NSERC – National Science and Engineering Research Council of Canada

OPSC – Outcome Project Sub-Component (of EC)

PAR – photosynthetically active radiation

PCBs – polychlorinated biphenyls

PMRA – Pesticide Management Regulatory Agency

POPs – persistent organic pollutants

POST DOC – postdoctoral fellow

RDS – Regional Director of Science (DFO)

SCUBA – self-contained underwater breathing apparatus

SMC – Science Management Committee (for ELA)

TB – Treasury Board

U of M – University of Manitoba

UV – ultraviolet light

APPENDIX 2:
MEMORANDUM OF UNDERSTANDING (MOU)
Between
Department of Fisheries and Oceans
and
Department of Environment

THIS MOU dated this 28th day of June , 2006 is in effect as of the , 2006

BETWEEN:

Her Majesty The Queen in Right of Canada as represented by the Minister of Fisheries and Oceans

(respectively, the "Minister" and "DFO")

AND:

as represented by the Minister of Environment

(respectively, the "Minister" and "EC")

1. **BACKGROUND:**

WHEREAS DFO has operated the Experimental Lakes Area (ELA) in northwestern Ontario pursuant to the Experimental Lakes Agreement (1983) between Canada and the Ontario Ministry of Natural Resources (OMNR);

AND WHEREAS DFO and Ontario have signed the Canada-Ontario Memorandum of Agreement for the Experimental Lakes Area (1993, amended 2000, and 2005);

AND WHEREAS DFO and EC share the common belief that there is a public and scientific benefit to be derived from joint DFO-EC operation of the ELA;

NOW THEREFORE the parties agree to develop this MOU to describe the management, operation and joint funding of the ELA.

2. INTERPRETATION

The parties agree that this MOU is expressed in broad terms on the understanding that specific details respecting governance, levels of service and costs relating thereto will be negotiated and settled as circumstances dictate, to accommodate the mutual expectations of the parties, and in accordance with previously established agreements with Ontario.

3. PURPOSE OF THE ELA

The ELA focuses on an ecosystem approach to experimentation, where small lakes are viewed as components of larger ecosystems encompassing the terrestrial drainage areas, including tributary and out flowing steams, the atmosphere above these surface features, and the bedrock, soils, groundwater and lake sediments underlying these areas. Activities or events within these drainage areas can have impacts within the lakes and on the biota inhabiting these lakes. The focus of scientific research and monitoring activities conducted at the ELA has been and shall continue to be the development of knowledge for the management, protection, and restoration of aquatic and terrestrial ecosystems.

4. DESCRIPTION OF THE ELA

The ELA is located in Northwestern Ontario approximately 50 km east of the City of Kenora. The ELA consists of a field station and a number of lakes, streams, and watersheds (Canada-Ontario MOA for ELA, 1993, amended 2000 and 2005). A number of these lakes and streams are designated with special status and are reserved for scientific experimentation and monitoring (Canada-Ontario MOA for ELA, 1993, amended 2000 and 2005). The ELA field station is a reserve of 11.58 ha that is located on the north shore of Boundary Lake (Ontario Gazetteer – $49^0$39' latitude, $93^0$43' longitude) and on the southwest shore of Lake 239 (Fisheries Research Board of Canada ELA Map, 1971). Title to the reserve site of the ELA field station was vested in Canada by Order-in-Council 144/79 dated 10th September 1980, and registered in the Land Registry Office for the Land Titles Division of Kenora as Plan 23R-4685. Conditions of title are outlined in Attachment B to that document.

There are also several other sites, located on crown land, that contain small field buildings and equipment owned and operated by DFO. There is a meteorological station located just north of the ELA field station reserve, which is jointly operated by DFO and EC. In addition, there are several communications towers located on crown land, under agreement with Ontario.

5. ROLES AND RESPONSIBILITIES

DFO and EC jointly agree to abide by and fulfill the obligations of Canada under the terms of the Canada-Ontario MOA for the Experimental Lakes Area (1993, amended 2000 and 2005) and any subsequent addendums to this agreement.

All research and related support activities within the ELA shall be conducted according to the laws and regulations of Canada and Ontario. (Canada-Ontario MOA, 1993, amended 2000 and 2005) outlines some of the responsibilities under existing provincial and federal environmental legislation.

DFO and EC shall be jointly responsible for all scientific operations at the ELA. This includes formulating, conducting, and coordinating scientific monitoring and experimental research at the ELA; obtaining approval for implementation of new research projects from Ontario; remediating experimental lakes, streams, or watersheds when this is necessary; reporting ELA research activities to Ontario and to the public, and managing the ELA field station.

DFO, through its Real Property sector, in consultation with Science managers, will manage the ELA field station and associated infrastructure, and be responsible for its operations and maintenance. Canada shall obtain appropriate permits or approvals from OMNR and OMOE prior to undertaking any such work on Crown land.

6. FEDERAL MANAGEMENT OF THE ELA SCIENCE ACTIVITIES.

It is understood that all equipment presently situated at the ELA field station and on crown land (as previously outlined) belongs to DFO. It is further understood that all equipment (including boats and motors), not owned by individual research groups or Real Property is available for all researchers to share and use while at the ELA. This does not include DFO trucks, cars. To the extent possible DFO and EC will strive to avoid duplication of equipment at the ELA field station and will seek opportunities to share equipment.

DFO and EC agree to set up a joint governance structure to manage and fund the operation of the ELA. DFO and EC will strike an ELA Science Management Committee to oversee joint federal responsibilities at the ELA, develop and enforce ELA policy, arrange data sharing, develop new science proposals, review science proposals before they go the ELA Management Board, and oversee day-to-day camp science activities and recommend action to both Real Property and the ELA Management Board. This ELA Science Management Committee would have equal representation from DFO and EC. The annual committee decisions would include, but not be limited to:

- Advising DFO Real Property of projected start and shut down dates for primary ELA field season;
- Advising DFO Real Property of which facilities (buildings) are required for specific dates;
- Advising DFO Real Property of which lakes require boats and motors and by which date;
- Advising Real Property of capital replacement needs (buildings/labs/equipment/boats/motors) at the ELA;
- Advising Real Property of any other key facility operational requirements;
- Advising DFO Real Property of required infrastructure/facility upgrades;
- Assigning lab and accommodation space in broad terms, with day-to-day allocations to be determined by the Science Program Manager.

7. FUNDING ARRANGEMENTS

The ELA Science Management Committee will meet at least twice per year to review and report progress on the implementation of this MOU. At these meetings, costs associated with the operation, maintenance and management of the ELA field station, and core science operations (food services, field operations, including fuel costs, communications and SCUBA and including direct management of these activities) will be reviewed and adjusted. DFO and EC agree to share equally the net costs of operating the ELA field station and providing core science operations at the ELA.

Real Property Costs: Management and Operation of the ELA Field Station.

The DFO and EC agree to equally share the base personnel, operational and maintenance costs of the ELA field station (Attachment A).

Field and Food Services at the ELA:

The DFO and EC agree to equally share the costs associated with continuing the provision of facilities science management, i.e. those day-to-day ELA science operations outside of Real Property responsibilities (Attachment B). This would include interfacing with Real Property to ensure that all ELA science operations run smoothly. This would include but not be limited to: writing and managing contracts for food services, managing the fleet of small craft (including annual re-capitalization), arranging for upgrades to trails and docks, overseeing the communications network at ELA and SCUBA operations.

The DFO and EC also agree to equally share the direct costs associated with, contract food services (Contract personnel, food and supplies), field services (boat maintenance, fuel/oil, trail and dock maintenance), communications (Network/Satellite/Tel/Fax), and SCUBA (Attachment B)

8. DISPUTE RESOLUTION

DFO and EC agree that they will each use best efforts to resolve through voluntary negotiations all matters in difference between them in relation to this MOU. The parties further agree that all such matters may be referred to arbitration if both parties so agree.

9. TERMINATION of the AGREEMENT

This Memorandum of Understanding shall remain in effect unless terminated on one year's written notice by any of the Parties to the others. Termination of this Memorandum of Understanding by any Party does not abrogate the responsibility of Canada, as provided in this Memorandum of Understanding, for remediation of ELA experiments and for rehabilitation of the ELA.

10. SIGNATORIES to the AGREEMENT

In witness whereof, the Parties hereto have affixed their hands.

Witness as to execution by:

Dr. Wendy Watson-Wright,
Assistant Deputy Minister of Science
Department of Fisheries and Oceans Canada

Date

Witness as to execution by:

Dr. Brian Gray,
Assistant Deputy Minister, Science and Technology Branch,
Environment Canada

Date

APPENDIX 3: LIST OF ATTENDEES AT THE EC–DFO WORKSHOP, 27–28 FEBRUARY 2007, INN AT THE FORKS, WINNIPEG

Environment Canada

Mohamed Amrani	Water Quality Monitoring and Surveillance	Montreal, QC
Stephen Beauchamp	Air Quality Service	Dartmouth, NS
Rick Bourbonniere	Human Impacts on Aquatic Ecosystem Processes	Burlington, ON
Tom Clair	Cumulative Impacts on Aquatic Biodiversity	Fredericton, NB
Nancy Glozier	Water Quality Monitoring and Surveillance	Saskatoon, SK
Murray MacKay (Tuesday only)	Climate Research	Toronto, ON
Mark McMaster	Ecosystem Health Assessment	Burlington, ON
Derek Muir	Atmospheric Contaminant Impacts	Burlington, ON
Marjorie Shepherd	Measurements and Analysis Research	Downsview, ON
Chris Spence	Northern hydrologist	Saskatoon, SK
Len Wassenaar	Cumulative Impacts on Aquatic Biodiversity	Saskatoon, SK
Sue Watson (Tuesday only)	Lake Management Research	Burlington, ON

Academia

Mark Abrahams	Associate Dean of Science, University of Manitoba	Winnipeg, MB
Sherry Schiff	University of Waterloo	Waterloo, ON

Experimental Lakes Area and DFO

Ken Beaty	Hydrology and Meteorology
Paul Blanchfield	Fish ecology
Susan Cosens	Manager, Environmental Sciences Division
David Findlay	Phytoplankton ecology
Robert Fudge	Director, NCAAR (National Center for Arctic Aquatic Research Excellence)
Ray Hesslein	ELA Senior Scientist, Biogeochemistry and Stable isotopes
Susan Kasian	Data analysis and management; ELA Long Term Ecological Research (LTER) Program
Mark Lyng	Limnology, Hydrology and Meteorology
Andy Majewski	Fish ecology
Ken Mills	Fish populations
Steve Page	Water chemistry

Mike Paterson	ELA Section leader, Zooplankton ecology
John Shearer	ELA Operations Manager
Mike Stainton	Water chemistry
Michael Turner	Littoral ecology
Vera Williams	Science Liaison Officer

Facilitators

Sheldon McLeod	slmcleod consulting
David Rosenberg	Scientist Emeritus, DFO

APPENDIX 4: AGENDA FOR THE EC–DFO WORKSHOP, 27–28 FEBRUARY 2007, INN AT THE FORKS, WINNIPEG

Day One

0815 hr Coffee, Muffins, Registration

0830 hr Introductions and Background

Presentations (encouraging questions and commentary)

- Overview of EC-DFO agreement and of ELA and what it has to offer researchers – Mike Paterson
- Related Science Priorities in DFO – Susan Cosens
- Science Priorities in Environment Canada – Rick Bourbonniere & Derek Muir
- Brief Plenary Discussion on Apparent Overlaps and Opportunities

Noon Lunch

1300 hr Break-out Group Discussions (may start earlier)

- Explore how the needs of both parties could be best served by examining:
  - Where do the needs and capacity of DFO & EC overlap?
  - Where are the greatest potential opportunities for collaboration? Specifically, is there one or more experiments that might be undertaken at ELA?
  - What difficulties are there in making the partnership work? How can they be overcome?
  - What are the priorities both in terms of opportunities and in terms of resolving difficulties?

Plenary sharing of the results of the break-out group discussions and general related discussion

1630 hr Adjourn for Afternoon

1800 hr Evening meal and social event at Mike Paterson's home

Day Two - Morning

0830 hr Break-out Group Discussions

- Using output from earlier break-outs, each group will consider the "how tos" at a high level
  - How would the partnership work?
  - What would the collaborative mechanisms be?
  - What would Environment Canada do at ELA in 2007?
  - What other steps are needed?

Plenary sharing of the results of the break-out group discussions
Initial planning for next steps

- Who does what by when?

1200 hr Adjourn

APPENDIX 5

The Experimental Lakes Area (ELA)

Exploring partnerships

Prepared by Mike Paterson

ELA workshop

Feb. 27-28, 2007 Inn at the Forks

Key questions:

1) How can we develop the EC-DFO partnership at ELA to the best advantage of both departments?
2) What are the greatest opportunities for scientific collaboration between EC & DFO at ELA? How can we include academia?
3) What are the greatest potential difficulties and how can they be overcome?

Goal: Develop plan and establish next steps in making the EC-DFO agreement work

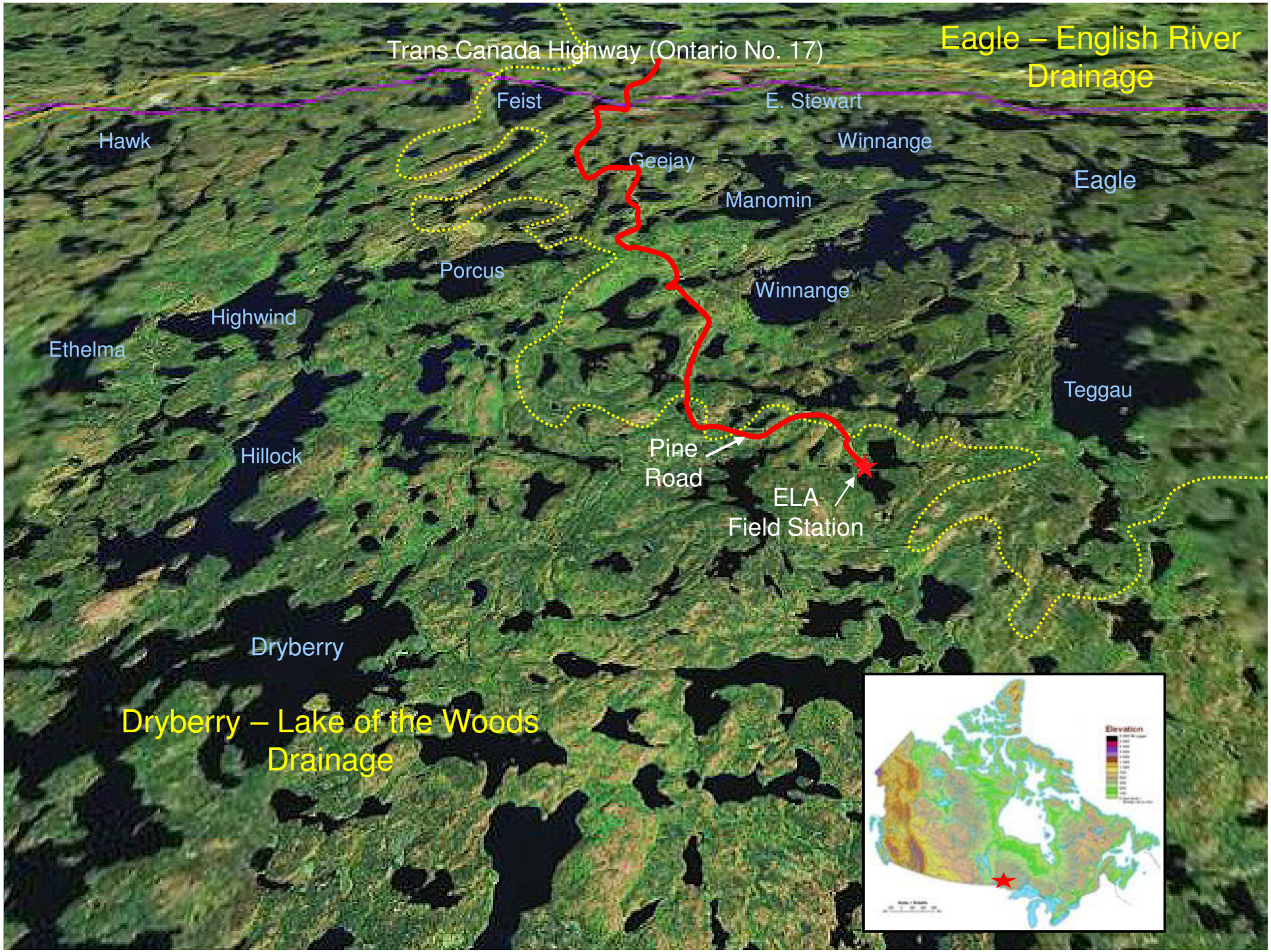
Introduction to ELA

- What is ELA?
- What are the opportunities for research at ELA?
- How does science at ELA currently function?
- What is the agreement between EC and DFO for ELA?

- PLEASE ASK QUESTIONS!

What is ELA and why is it unique?

- *Fully equipped, year-round field station*
- *58 designated, small lakes and their terrestrial drainage basins*
- *Ability to regularly conduct controlled, whole-ecosystem experiments*
- *Comprehensive, long-term data sets (38+ years) for multiple lake systems*
- *Multi-disciplinary team of researchers dedicated to undertaking research at the ELA site*


Trans Canada Highway (Ontario No. 17)
Eagle – English River Drainage
Feist
E. Stewart
Hawk
Winnange
Geejay
Eagle
Manomin
Porcus
Winnange
Highwind
Ethelma
Teggau
Hillock
Pine Road
ELA Field Station
Dryberry
Dryberry – Lake of the Woods Drainage
Elevation

Year-round Field Station

30 km, all weather, private access road

Self-contained, Fully-equipped

Facilities Renewal

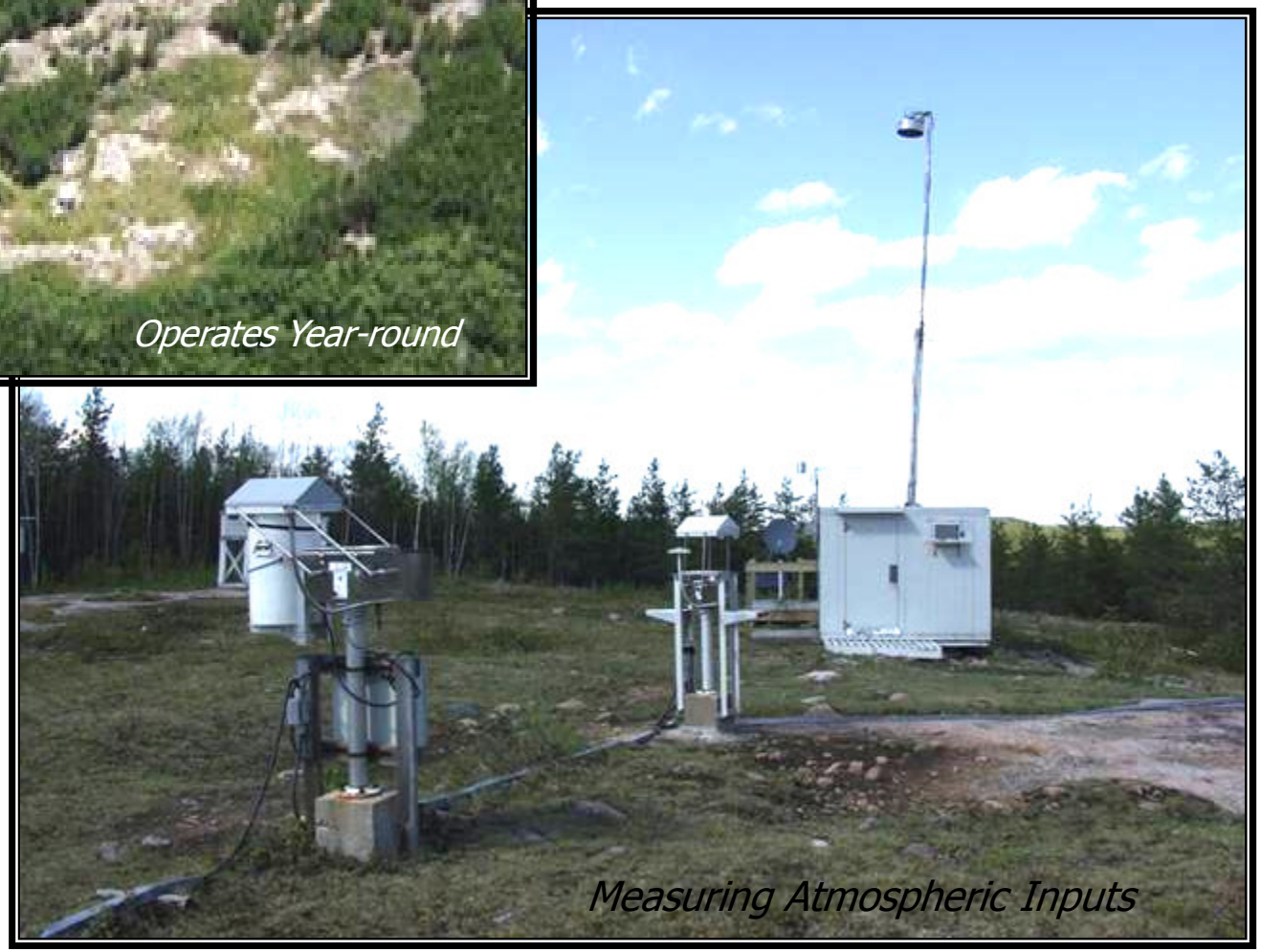
$4m –road and facility upgrades

Year-round Science Facility

- *Self-contained field station*
  - *Modern laboratories*
  - *Hg clean lab*
  - *Library and meeting rooms*
  - *Fully-equipped workshop*
  - *SCUBA support*
  - *Full food services*
  - *On-site living accommodations for 50 researchers*
- *Field Site Access*
  - *Trail network*
  - *all terrain field vehicles,*
  - *boats & motors*

Meteorological Station

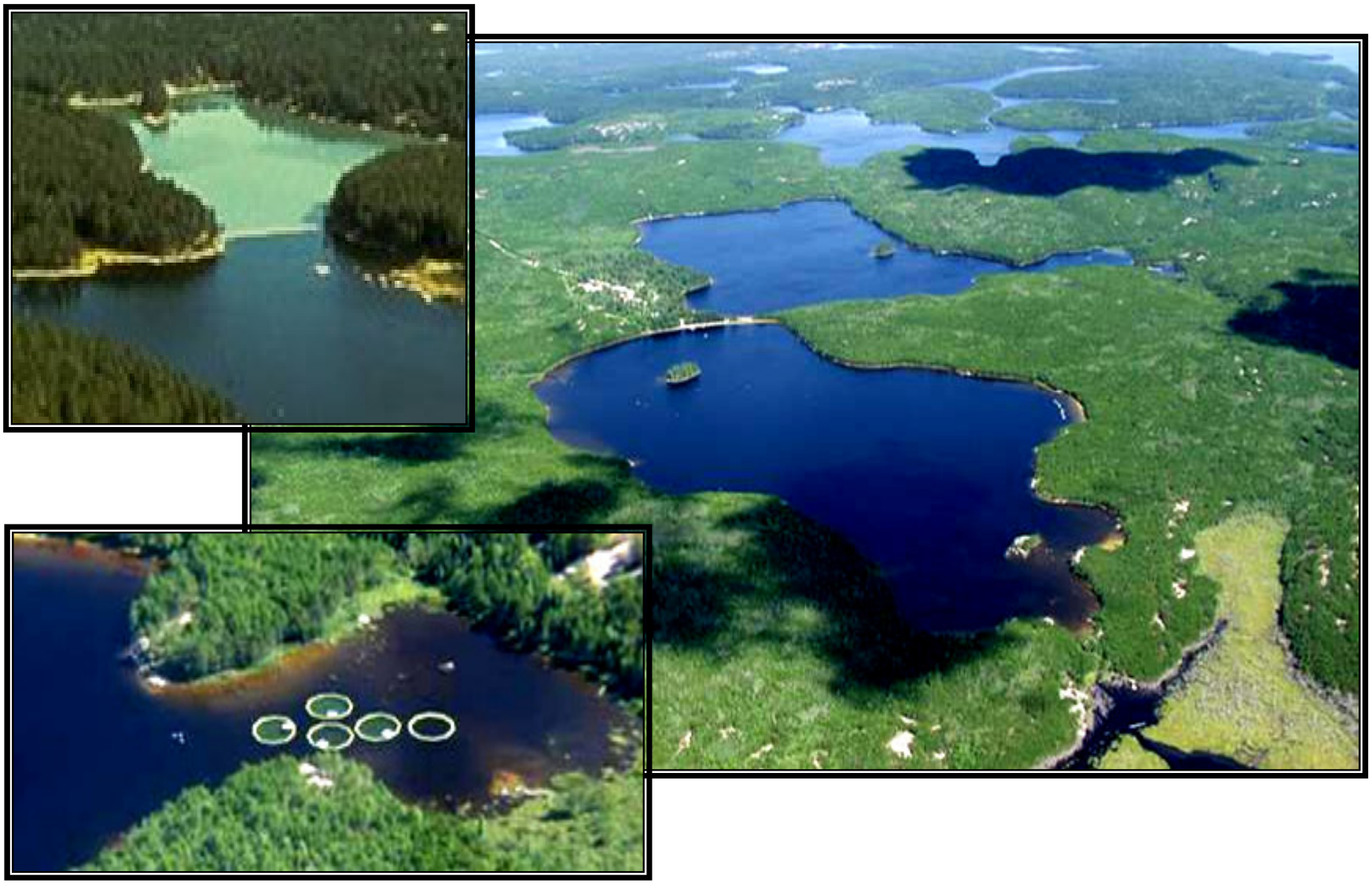
Since June 1969



Meteorological station

- *37-year continuous record*
- *Example of existing partnership with EC*

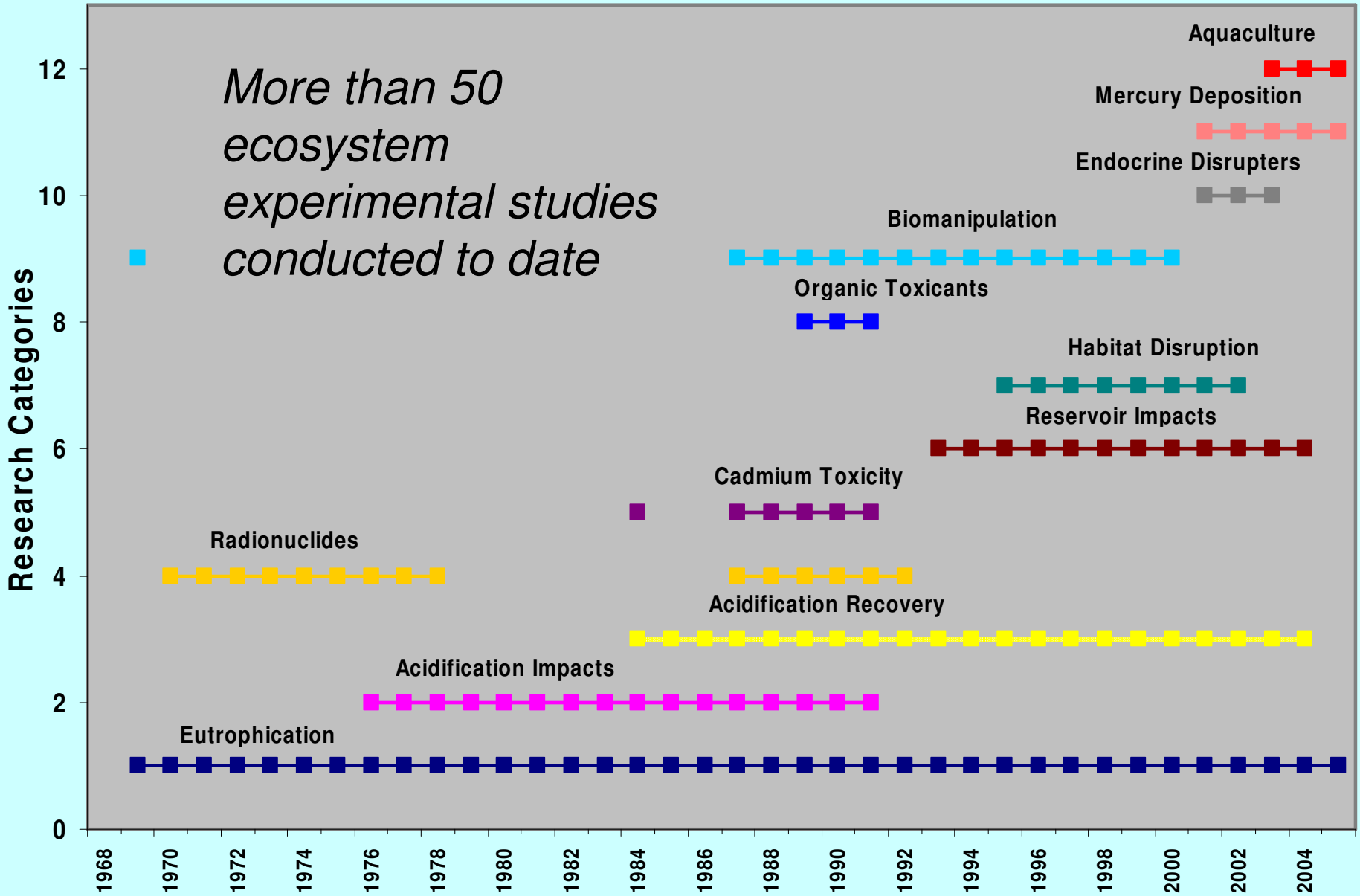
Small Lake Ecosystems



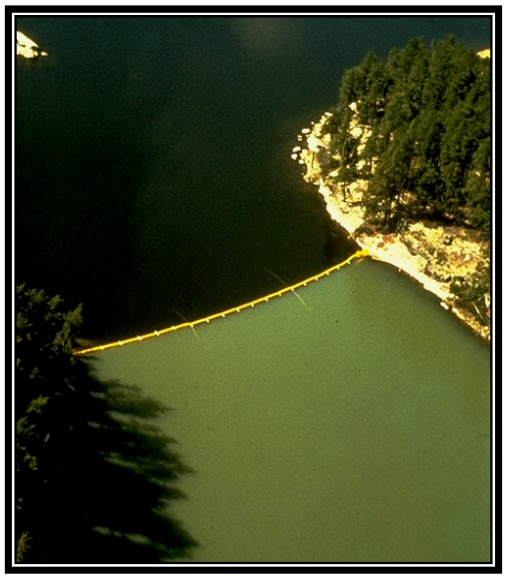
Whole-ecosystem experiments at ELA

- *The lakes at ELA are independently functioning ecosystems that are models of larger systems*
- *The lakes at ELA are pristine, unimpacted and amenable to controlled manipulation*
- *Whole-ecosystem experiments at ELA are particularly useful for understanding processes and for predicting indirect impacts (proven ability to extrapolate to other systems)*
- *This understanding is crucial for developing solutions to environmental problems*
- *Can directly test mitigation options*

Whole Ecosystem Experiments



Eutrophication studies



- *Original focus was eutrophication in the lower Great Lakes*
  - *Direct impact on policy*
- *Recent studies include:*
  - *effects of eutrophication on contaminant cycling*
  - *carbon sequestration*
  - *algal toxins*
  - *blue-green algae*

Acidification ("acid rain")

Starving Lake Trout

Simulating Atmospheric Acidification

Estrogen Experiment

2001-2003

Lake 260

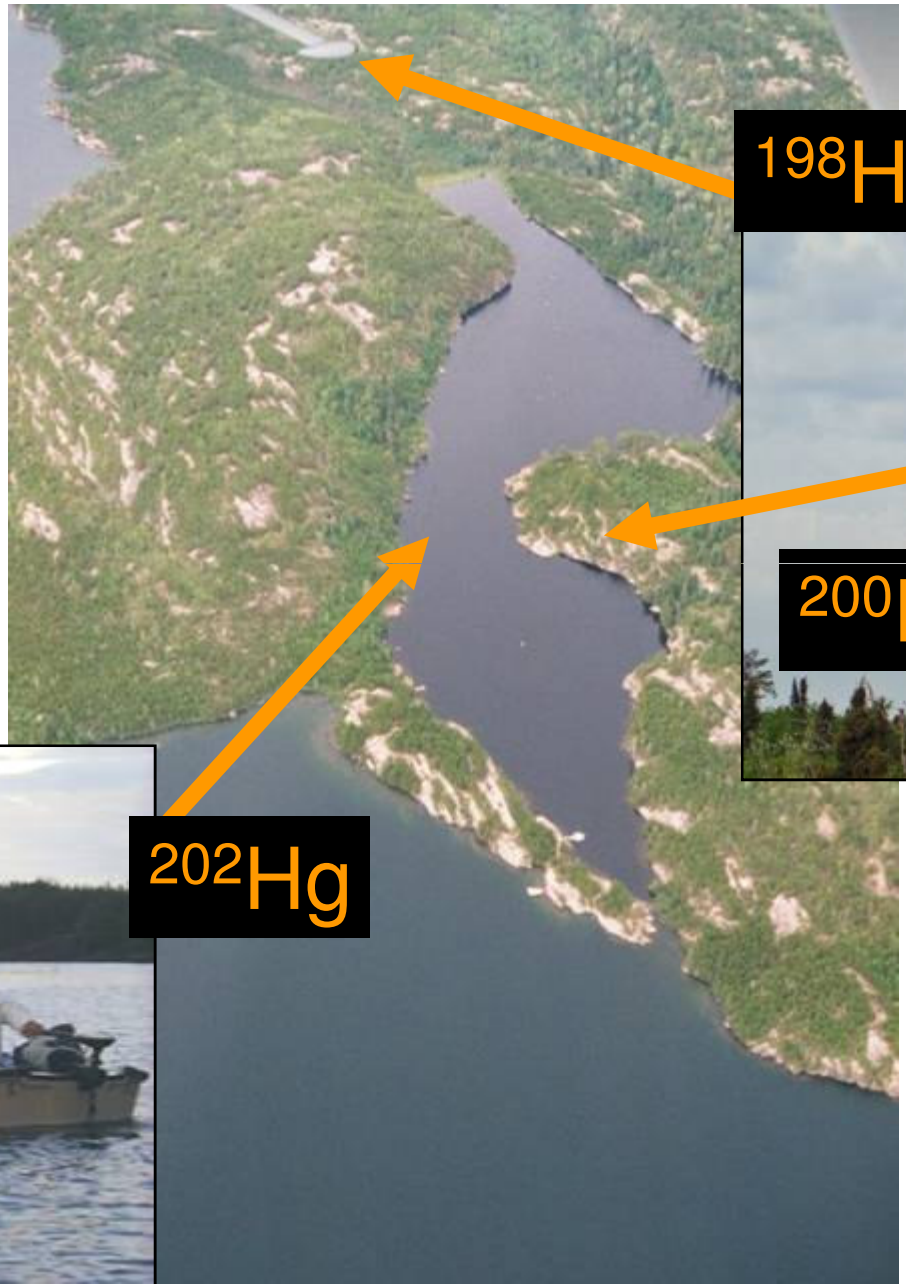
Adding Estrogen

Will the estrogen reduce populations of invertebrates, amphibians, and fish?

Mercury Deposition (METAALICUS)

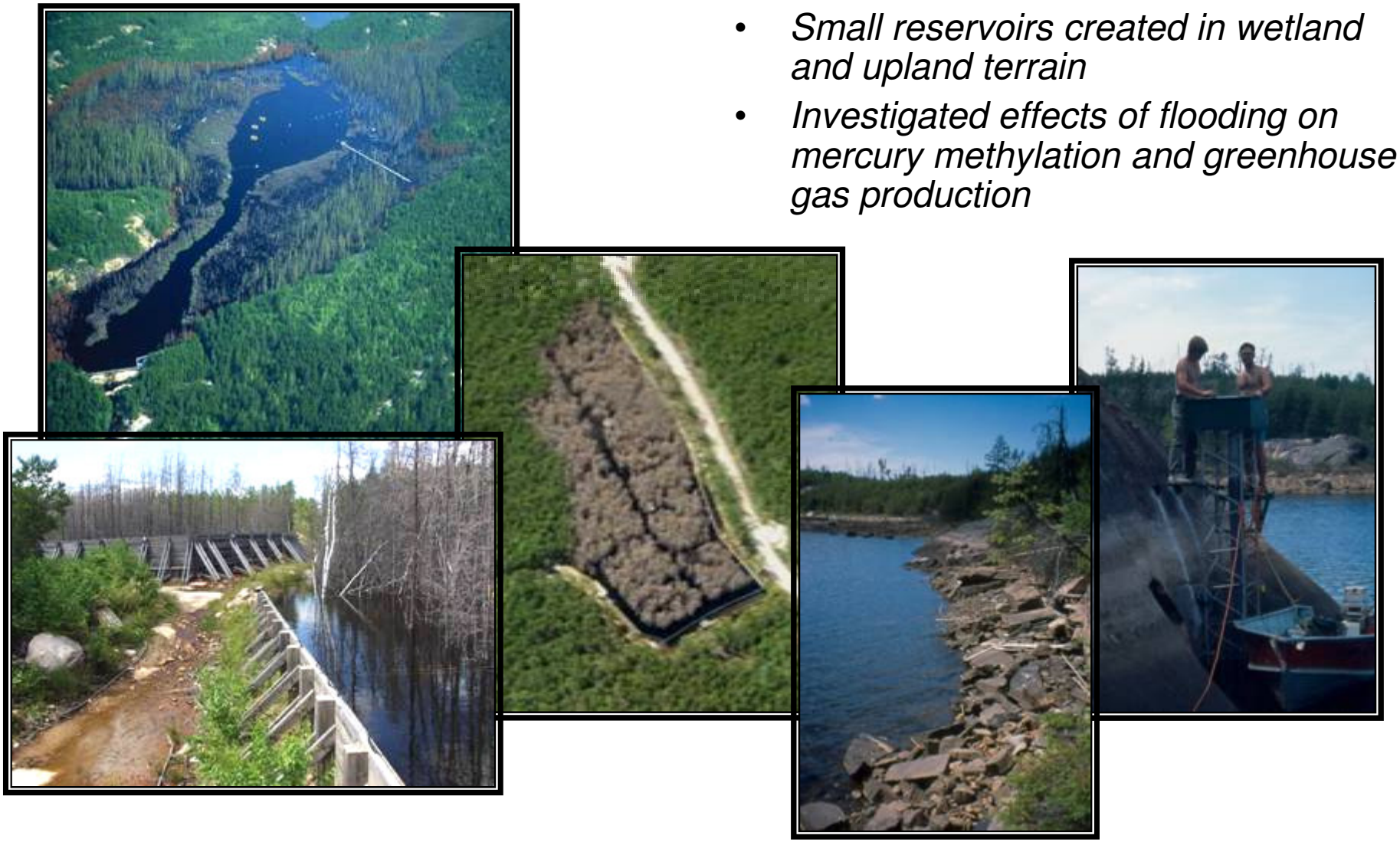
Will proposed changes in Hg emissions affect MeHg in fish?

How long will it take to see results of changing emissions?



Impacts of Hydroelectric Reservoirs

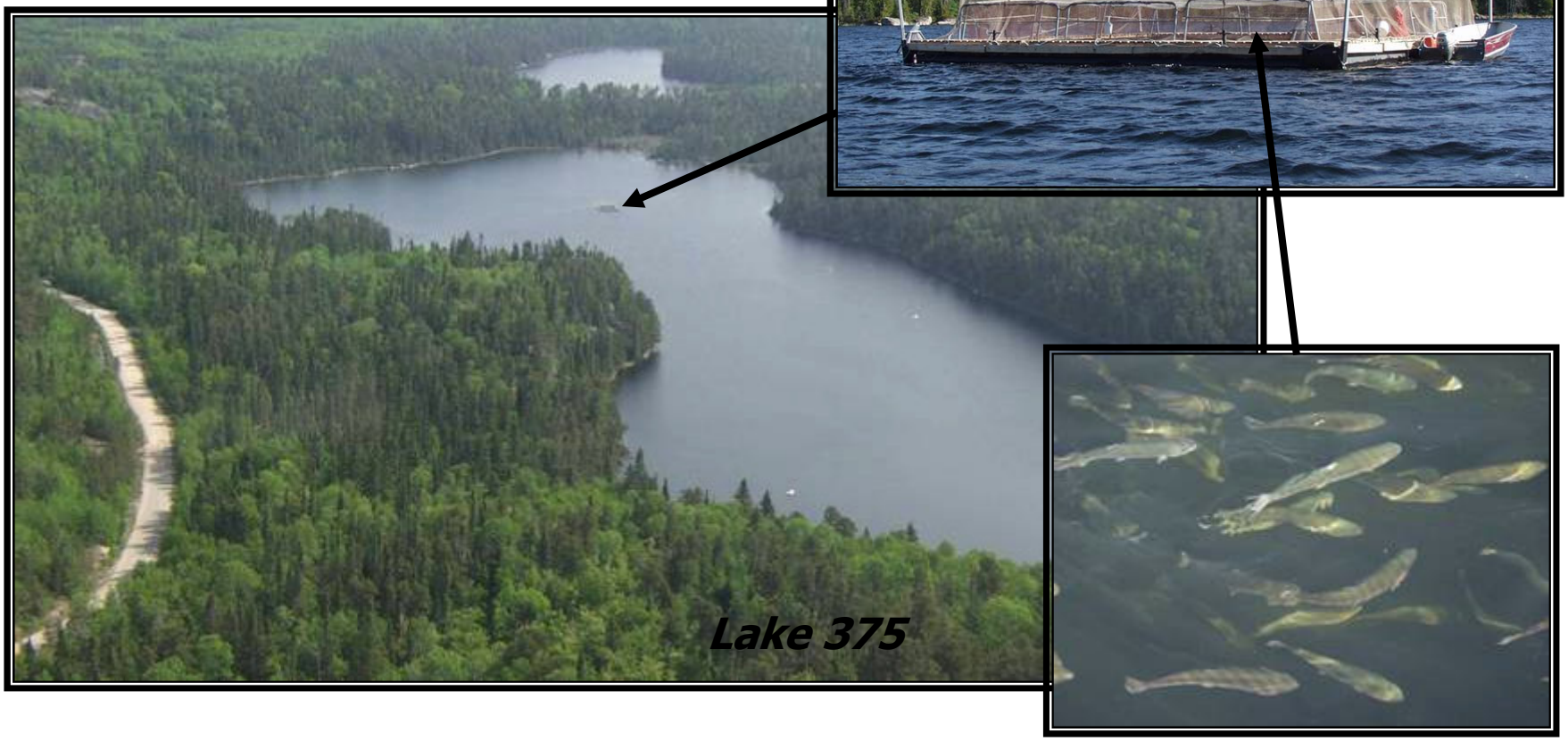
- *Small reservoirs created in wetland and upland terrain*
- *Investigated effects of flooding on mercury methylation and greenhouse gas production*



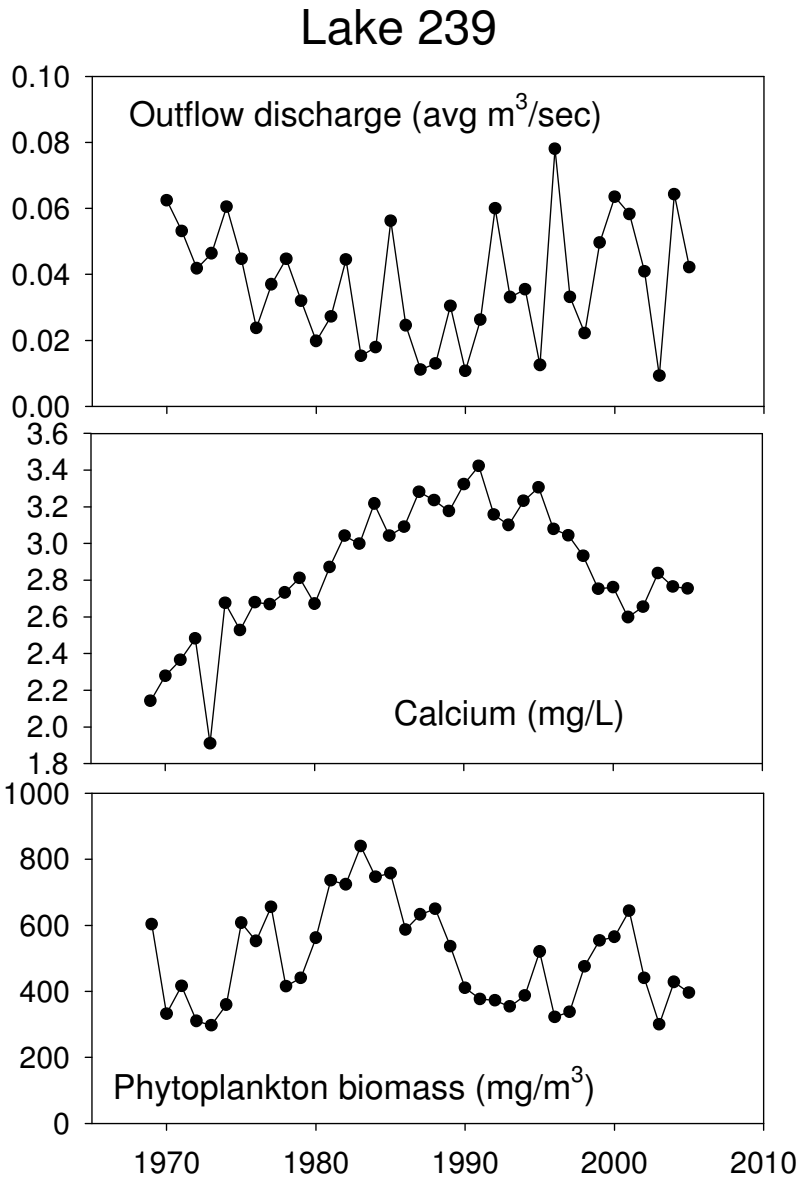
Effects of Macrophyte ("weed") Removal

Cage Aquaculture Study

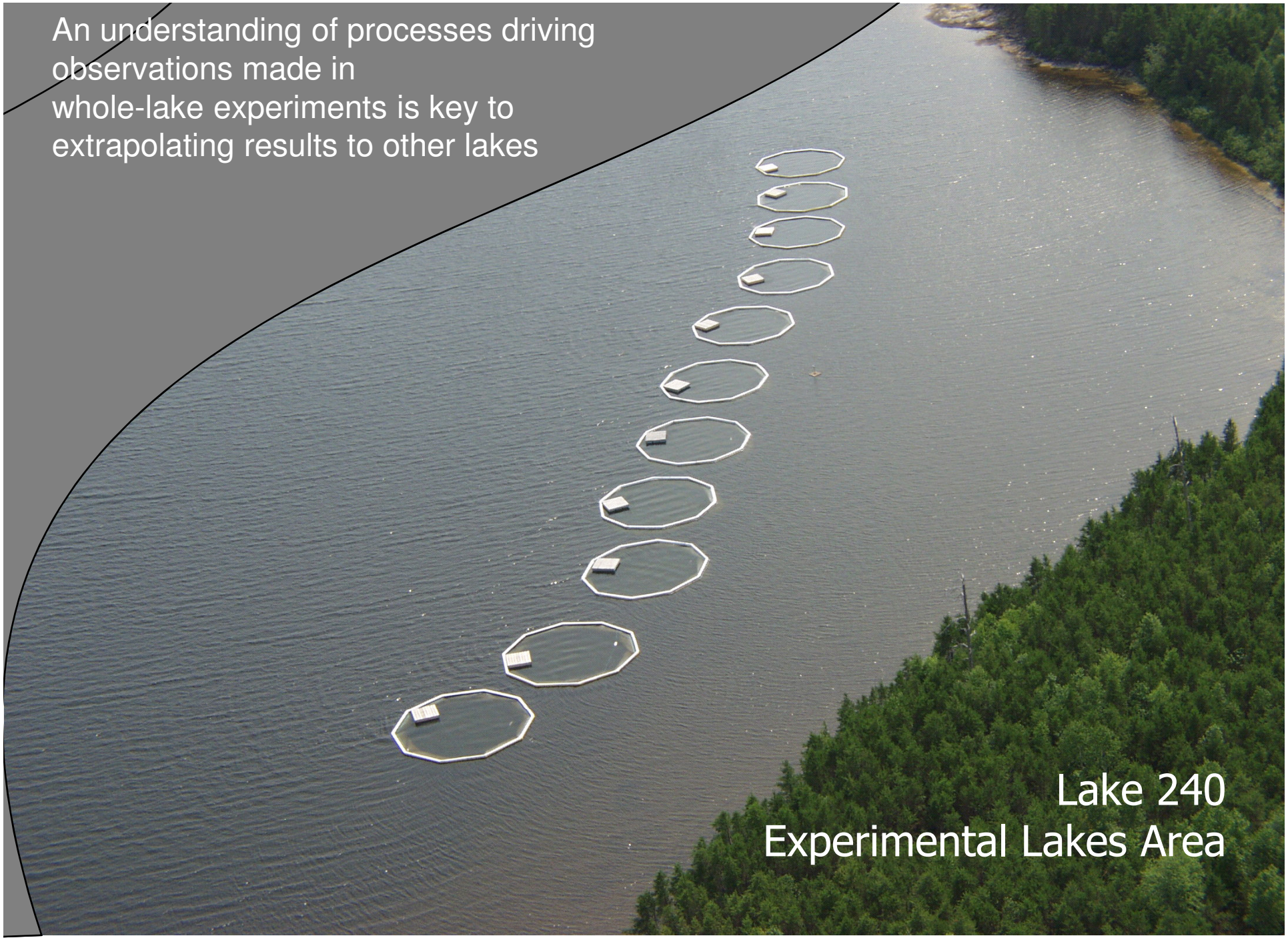
Effects on nutrients,
food web structure & fish behaviour



Long-term Ecological Monitoring



- *5 dedicated, long-term reference lakes*
- *Up to 38 consecutive years of monitoring on selected systems*
- *Meteorological data*
  - *CAPMoN station*
- *Multidisciplinary limnological data*
  - *Hydrological, physical, chemical, biological, etc*
- *Oracle data management system*


An understanding of processes driving observations made in whole-lake experiments is key to extrapolating results to other lakes
Lake 240
Experimental Lakes Area

How does science at ELA currently function?

DFO Research team

food web

algal ecology
Michael Turner, Dave Findlay

zooplankton ecology
Mike Paterson, Laurie Wesson

benthic ecology
Cheryl Podemski

fish ecology
Ken Mills, Sandy Chalanchuk,
Andy Majewski, Paul Blanchfield, Lori Tate

Fish physiology
Vince Palace

stable isotopes & biogeochemistry
Ray Hesslein, Morris Holoka

water chemistry

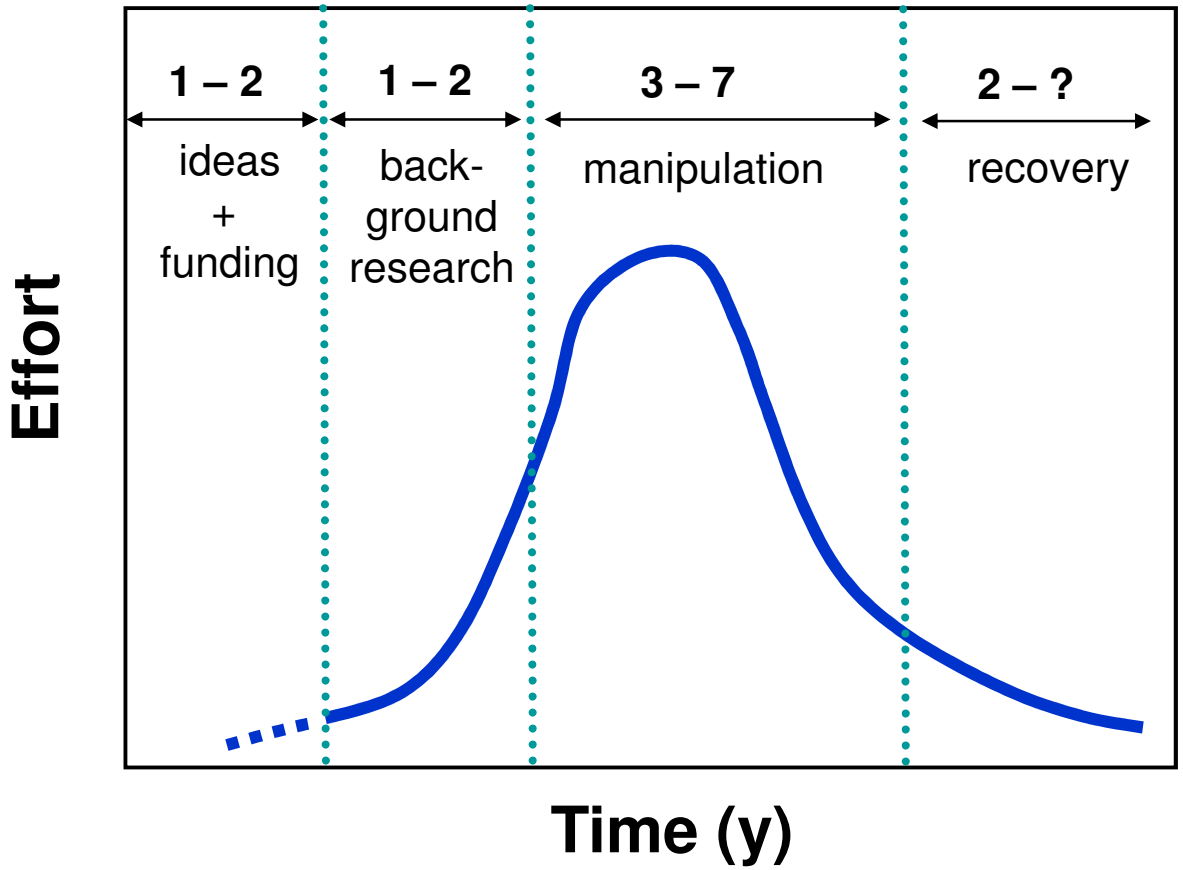
Mike Stainton, Steve Page, Ron Schade, Cory Anema

LTER

Mark Lyng (field program)
Ken Beaty (hydrology)
Susian Kasian (biometrics)
John Shearer (operations manager)

Experimental Lakes Area
Research and education to protect freshwater ecosystems, since 1968.
ELA

Anatomy of a whole ecosystem study



ELA Management Board

- *ELA is operated by Fisheries and Oceans Canada under a Memorandum of Agreement with the Ontario Ministries of Natural Resources and Environment*

- *All experiments must be approved by the ELA Management board*

ELA partnering

- major research partnerships (>45 in total)
  - Universities - >20 Canadian and US Universities
  - Industry - AECL, Hydro (MB, ON, QC), USA (EPRI)
  - EC, NRCan
- single agencies usually cannot provide funding for the duration of a whole-ecosystem study (>5 years)
- typically, research by the DFO group is strongly augmented by the participation of university and government researchers (and associated graduate students)

Examples of partnering in whole-ecosystem studies

Study	length (y)	Funding sources	Annual cost	Partici-pants	# grad students
EDC (K. Kidd)	7	DFO (ESSRF) Cdn. Network of Tox. Cent. American Chem. Council Shering Pharm./TSRI	$150 K	16 (DFO = 8)	2
Aqua-culture (C. Podemski)	8+	DFO (ACRDP) OMNR North. Ont. Aqua. Assoc. Martin Mills/Aquacage Fish.	$350 K	15 (DFO = 11)	5
Hg (J. Rudd/ R. Harris)	9+	DFO (ESSRF) NSERC /EC/4 Cdn. Univ. EPRI/USGS/US EPA/NOAA US Department of Energy	~$1.5 M	>20 (DFO = 7)	>7

Advantages of Increased Partnership Between DFO and EC

- *Whole-ecosystem freshwater research best conducted under auspices of multiple government departments*
- *Ideally, ELA would fit into a larger strategy to address whole-ecosystem, multiple impacts to freshwater*
  - *Strong links between researchers at ELA and those working on larger, geographically distributed systems (e.g Lake Winnipeg, Great Lakes, etc)*
- *Inclusion of universities and provincial agencies would further broaden base of expertise, funding opportunities, and ability to advise on policy*
- *The partnership 'whole' can be greater than the sum of its parts*

Advantages for Environment Canada

- *Mandate: EC mandate complements DFO mandate*
  - *much current ELA research already of interest to EC*
  - *EDCs, Hg, POPs, climate change, acidification recovery*
- *Opportunities: There are many new and different ecosystem studies that could be attempted at ELA*
- *Money: ELA Researchers have been very successful at obtaining funds for research (both from Canada and beyond)*
- *Long term database: large, very complete aquatic ecosystem database*
- *Expertise: DFO expertise complements EC expertise*

Advantages for Academic Partners

- *Faculty and students can participate in unique, high-quality, high-profile team-oriented, ecosystem research*
- *Attract money for research*
- *Enhanced government-university collaboration – potential to affect policy*
- *Many possibilities for conducting field courses*

EC-ELA agreement

- Signed by ADMs of Science for both EC & DFO – awaiting signature from EC Corporate Services

- Announced publicly at Montebello Science Priorities workshop

Key points of agreement

- DFO & EC agree to split the costs of operating ELA
- DFO retains ownership of ELA; RP manages facility
- "DFO and EC shall be jointly responsible for all scientific operations at the ELA"
  - Joint governance structure
  - Science Management Committee
- Researchers from each department are still beholden to their own department's mandate
  - We are not joining the mandates; instead seek areas of overlap

Summary

- Only facility of its kind – should have broader utilization
- There are many benefits for EC
  - One-of-a-kind capacity to undertake powerful, whole-ecosystem manipulations
  - Outstanding field facility – recently upgraded
  - Unique long-term data record with complete ecosystem coverage
  - Multidisciplinary team of experts
- Partnership with EC can greatly enhance the ability of ELA to undertake high-quality whole-ecosystem research on issues of national and international importance

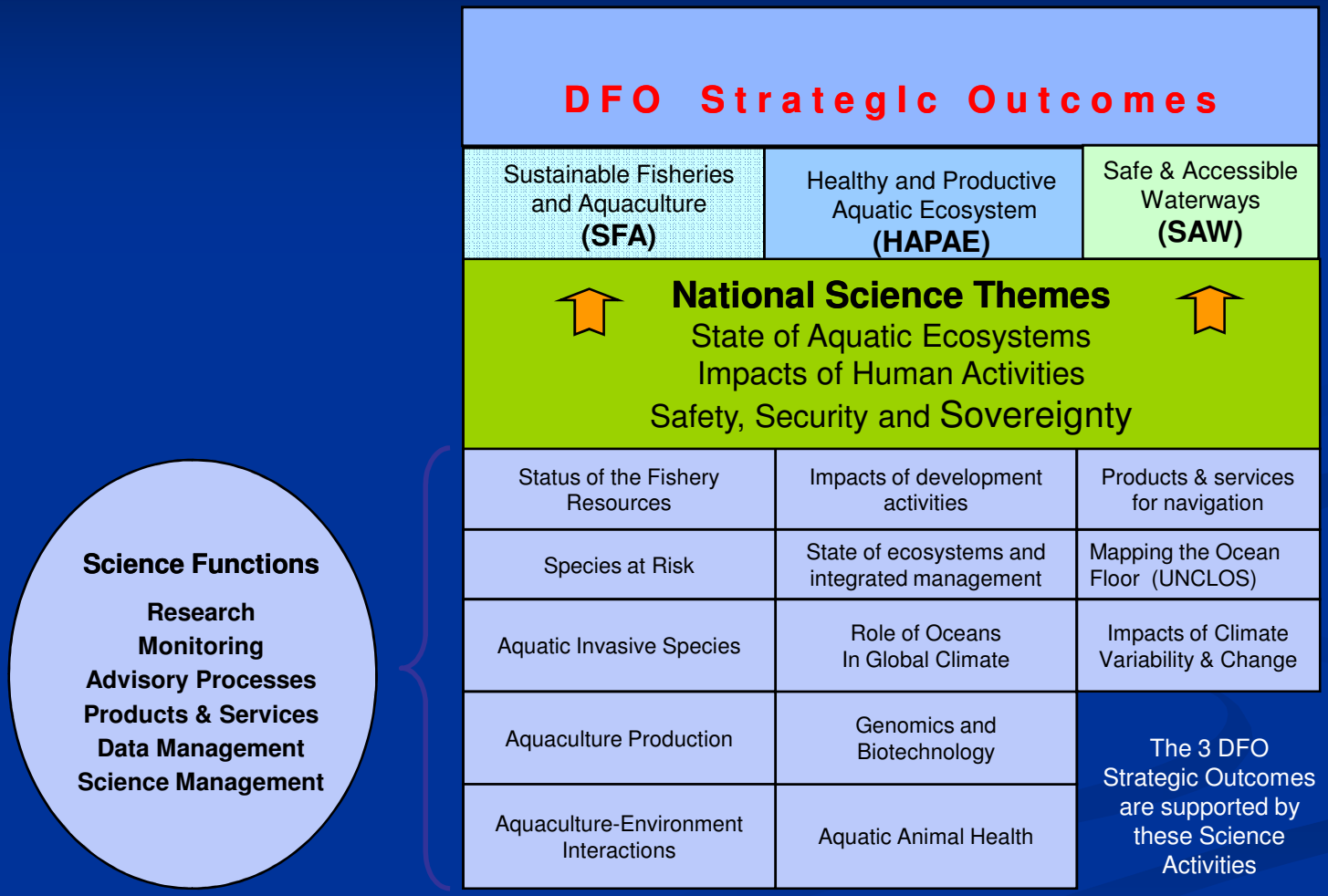

CANADA
DEPARTMENT OF THE ENVIRONMENT
FISHERIES AND MARINE SERVICE
EXPERIMENTAL LAKES AREA
TRAVEL BEYOND THIS POINT IS PROHIBITED
EXCEPT FOR AUTHORIZED VEHICLES
1979

APPENDIX 6

DFO Science after Renewal

An overview of current directions for Science in DFO and C&A Region.

Relevant – Aligned with mandate



Relevant – Responsive to priorities

- At its October 2005 meeting, the SMB provided clear direction on a limited number of priorities to guide the work of the Science Sector.
- Priorities include both "what" science does (substantive) and "how" it is done (process-based).
  - *what* :
    - **Science in Support of Ecosystem-Based Management**
    - Science for Sustainable Aquaculture
    - Science in Support of National Priorities
    - Science in Response to Special Needs
  - *how* :
    - **Managing Human Resources**
    - Integrated risk-management
    - Strategic five year Research Plan
    - Strategic communications / consultations
- The SMB confirmed that the highest priorities for Science should be:
  - science in support of ecosystem-based management
  - regeneration in light of changing / departing work force

Strategic Five Year Research Plan: Departmental Research Priorities*

The following Research Priorities will support the strategic agenda of DFO and the federal government for the next five years.

1. Sustainability of Fisheries Resources
2. Habitat and Population Linkages
3. Climate Change and Variability
4. Ecosystem Assessment and Management Strategies
5. Aquatic Invasive Species
6. Aquatic Animal Health
7. Sustainability of Aquaculture
8. Ecosystem Effects of Energy Production
9. Operational Oceanography
10. Emerging and Enabling Technologies for Regulatory Responsibilities

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*Some priorities have changed since presentation was given

Priority Areas

- Sustainability of Fisheries Resources
  - Changes in the productivity and resiliency of key species may have serious consequences for the dynamics of entire ecosystems and the sustainability of fishery resources.
  - Research is needed to better understand factors and processes controlling fish population and community productivity and to ensure effective management of fisheries.

- Habitat and Population Linkages
  - The alteration or destruction of fish habitat may have lasting effects on fish populations, ecosystem resilience, and the sustainability of resource uses.
  - Research is needed to better understand linkages between habitat productive capacity, population productivity, and biodiversity to be able to assess the effectiveness of mitigation and compensation measures for human activities.

Priority Areas

- Climate Change and Variability
  - As climate changes, biological and physical conditions in the oceans are modified, which affect the sustainability of human uses of aquatic resources, as well as the safety of coastal areas.
  - Research is needed to better understand, detect, and forecast changes and provide scientific information for developing adaptation strategies.

- Ecosystem Assessment and Management Strategies
  - Ensuring the sustainability of aquatic ecosystem requires an ecosystem approach to the management of individual and multiple humans activities.
  - Research is needed to:
    - develop and evaluate new approaches for ecosystem assessment (ex: robust methods and models) and
    - to develop effective and robust risk-based strategies and evaluate their performance for an ecosystem approach.

Priority Areas

- Aquatic Invasive Species
  - Aquatic invasive species (AIS) are one of the leading threats to aquatic biodiversity and ecosystem health and have significant impact of domestic fishery and aquaculture resources.
  - Research on AIS is required to support the development of a regulatory framework and guide the development and implementation of management measures.

- Aquatic Animal Health
  - Diseases, and particularly outbreaks, can have major ecological effects on aquatic resources and severe economic impacts for the sustainability of aquaculture species.
  - Research is needed on disease agents in nature and the potential risks and effects of disease transfer between fish.

Priority Areas

- Sustainability of Aquaculture
  - Long-term sustainability of aquaculture has to be based on ecologically appropriate production technology and environmentally sustainable practices.
  - Research is needed on the development of high efficiency and environmentally-friendly culture technology and environmental interactions.

- Ecosystem Effects of Energy Production
  - Energy development in Canada (mainly offshore oil and gas, hydroelectricity, and oil sands) is rapidly accelerating and is expected to be substantial in the near future.
  - Significant advances in research are needed to augment the existing knowledge base, evaluate risks, potential impacts, and mitigation options in these energy-related undertakings.

Priority Areas

- Operational Oceanography
  - Search and rescue operations, safe navigation, and the dispersion of pollutants and ballast water organisms all require now-casts and forecasts of the state of the ocean.
  - Research is needed to better understand oceanic processes and the ocean's circulation and to improve forecast of the ocean's present and future state

- Emerging and Enabling Technologies for Regulatory Responsibilities
  - Science support for DFO's regulatory and policy responsibilities often depends on advanced technologies. On the other hand, industry's use of new technologies may pose new challenges to DFO regulatory responsibilities.
  - Research on new technologies is needed to enhance the ability of Science of performing research to gain new knowledge, and understand the potential effects of some technologies, such as modified organisms.

The Way Forward: Our Regional Priorities

Ecosystem-based Management

Inland Waters

- enhance integrated advisory relationships with DFO Fish Habitat and Provinces identify and address priority fish habitat issues;
- Clarify role of DFO Science in freshwater ecosystem research;
- explore opportunities to collaborate with EC, other jurisdictions and universities to address emerging freshwater ecosystem and fisheries habitat issues (i.e. Lake Winnipeg);
- develop SARA, AIS, Aquaculture and monitoring programs that address priority issues
- Research focused on population dynamics and innovative control strategies (Sea Lamprey Program)

The Way Forward: Our Regional Priorities

Sustainable Aquaculture

- Science to assess ecosystem impacts and regulate the aquaculture industry is not well developed for freshwater;
- Work with industry and Aquaculture to identify and address priority research issues;
- Work with industry, the public and NGOs to improve public confidence in the environmental sustainability of aquaculture

The Way Forward: Our Regional Priorities

Integrated Risk Management

- Fully implement a process to determine program priorities.
- Provide research and advice in support of effective risk management and monitoring requirements for issues such as Aquatic Invasive Species, Aquaculture impacts and Oil and Gas development.

APPENDIX 7: BREAKOUT GROUPS FOR THE EC–DFO WORKSHOP, 27–28 FEBRUARY 2007, INN AT THE FORKS, WINNIPEG

Group 1	Group 2	Group 3	Group 4
Steve Beauchamp	Mohamed Amrani	Marjorie Shepherd	Nancy Glozier
Rick Bourbonniere	Derek Muir	Tom Clair[+]	Mark McMaster
Chris Spence	Murray MacKay	Len Wassenaar	Sue Watson
Sherry Schiff	Ray Hesslein[+]	Ken Mills	Michael Turner
Paul Blanchfield[+]	Ken Beaty	Mike Paterson	Susan Kasian*
Bob Fudge	Steve Page*	John Shearer*	Susan Cosens[+]
Mark Lyng*	Andy Majewski	Vera Williams	Dave Findlay
Mike Stainton	Mark Abrahams		

[+] = Reporter
* = Recorder

APPENDIX 8: GUIDANCE FOR SMALL GROUP DISCUSSIONS, DFO–EC WORKSHOP, 27 FEBRUARY 2007, INN AT THE FORKS, WINNIPEG

Facilitator

- You should try to get someone other than yourself to report back to the plenary, if possible. Usually, this solicitation is best done at the start of the session. You have already been assigned a recorder.
- You can decide in your own small group if it would be helpful to ask everyone to introduce themselves briefly. We will have done it in the large group, but you could ask them if they know each other or if they would like to go around the table.
- You have two hours for this session, including any break you decide to take as a small group
    - Take the break when it makes sense for your group, but please do not leave it for the end when we get back together in plenary..
- You have five questions, but the first three questions will demand the majority of your time. You may want to spend 20 – 25 minutes on each of the first three questions and shorten the discussion on the priority-setting tasks accordingly.
- In terms of approach to the discussion, it makes best sense to go through the questions in the same order they occur on the recording sheet:
    1. Where do needs and capacity overlap? What are the apparent synergies? Describe each opportunity.
    2. For each opportunity, identify one or more experiment or monitoring exercise which could be undertaken at ELA.
    3. Identify any difficulties. For each difficulty, suggest how it could be overcome.
    4. Which is the highest priority opportunity and why?
    5. Which is the highest priority difficulty (to solve) and why?
- Wind the discussion down by 3:15 p.m.
- Ensure that within this timeframe, you and the recorder and the reporter have put your heads together and clarified what is going to be reported.

Recorder

- Use the recording sheet provided.
- If you run out of space, use additional paper or the back of the recording sheets but key any additional notes back to the appropriate question with a number or letter, for example.
- Provide your record to Dave Rosenberg at the end of the session.

Reporter

- Be ready to share with the plenary the highest priority difficulty and the highest priority opportunity from the following perspectives:
    - Where the overlap or synergy is.
    - The experiment(s) or monitoring exercise(s) that would be appropriate.
    - Why it was seen by your group as the highest priority, and

    - What the difficulty is.
    - Why it is the highest priority to solve.
    - Suggestions for overcoming it.

APPENDIX 9: REVISED DAY 2 AGENDA, EC–DFO WORKSHOP, 28 FEBRUARY 2007, INN AT THE FORKS, WINNIPEG

Time	Item
0830 hr	Small Group reporting on Opportunities and Difficulties
0930 hr	Identification of key experiments to pursue o Identify champions/leads o Other desirable partners o Next steps Definition of the Science Management Committee o Required mandate o Any augmentation? o Identification of who should sit on the committee o Immediate next steps Other next steps or recommendations o Communication needs o Addressing the difficulties o What is the process? o Immediate next steps
Noon	Closing remarks and adjournment

APPENDIX 10: BREAKOUT GROUP REPORTS, EC–DFO Workshop, 28 FEBRUARY 2007, INN AT THE FORKS, WINNIPEG

A) Group 1 (Recorder: Mark Lyng, Reporter: Paul Blanchfield)

❖ **Where do the needs and capacity of DFO and EC overlap? Overlap and synergy**

Environment Canada	Fisheries and Oceans
✓ N of many	✓ N of one Scaling issue, ability to apply to N of many.
✓ Chemical exchange (energy transfer) between atmosphere, terrestrial, and lake processes Land–water interactions	✓ Whole-lake mass-balance approach
✓ Pathways to fish, mainly from deposition to water/terrestrial inputs	✓ Concentration in fish Endpoint is fish (mandated)
✓ Hydrometric modelling Large-scale and long-term Role of storage	✓ Hydrometric monitoring Small-scale and long-term
✓ Algal work (cyanophytes)	✓ Algal work (cyanophytes)
✓ Interests in ecosystem-based models	✓ Interests in ecosystem-based models (environmental predictors)

Comments:

Common interest in upscale and downscale approaches.
Ideal relationship for testing of models.
Data mining.
Value-added relationship, fills the gaps, beneficial to both parties.
Focused (ELA) vs diffuse (EC), an operational link!

❖ **Opportunities**

- Climate-related studies/manipulation
  - Stream diversion study
  - Snow cover manipulation study
  - Deepening of the thermocline
  - Keeping a lake free of ice (changes in water temp., productivity, etc.)

- Ecosystem modelling
- Nutrient manipulation
  - Septic systems
  - Wastewater impacts
  - Toxic algae
- Wetland Manipulation
  - Dry the system
  - Burn the system
  - Downstream impacts
- Greenhouse gas work
  - Possibility of a covered system
  - Artificial canopy
- Integrate ELA into the EC long-term monitoring program

❖ **Difficulties**

Problems:	**Solutions:**
• Capacity (facility, programs, individuals)	○ Adequate planning stage ▪ Appropriate timelines
• Funding	○ Adequate planning stage ▪ Appropriate timelines
• Succession planning	○ Renewal of workforce ▪ Involve universities
• Geographical location of ELA site with respect to EC personnel. (costly flights, travel time, planning)	○ Better efficiency ▪ Space at FWI for many ▪ Or an Operations Manager ▪ ELA on-site efficiency is extremely good ▪ Ability to share personnel (students) ▪ On-site Post Docs ▪ New technology is in place for static IP addressing of equipment, etc.
• Lack of familiarity with the database	○ Information via DFO contact ▪ Susan Kasian ▪ Website, newsletter
• Communication	○ Mechanisms ▪ Involve EC researchers and universities ▪ Joint Management Committee ▪ List serve ▪ Annual meetings ▪ Operations Manager ▪ Develop a communication tree (schematic)

❖ **Priorities**

➢ Short-term
- Communication
- Database mining
- Logistics and planning stages

➢ Long-term
- Communication (continuing)
- Database (continuing)
- Whole-lake studies with terrestrial aspects
  "Climate-related work"

B) Group 2 (Recorder: Steve Page, Reporter: Ray Hesslein)

Where do needs and capacity overlap?

DFO
- Whole-ecosystem research
- Data intensive
- DFO ecosystem -> fish production as end product
  i.e. not health for own sake, but for fish production
- Don't yet know $$ for priorities
- Fish physiology and health
  (Vince Palace and Mark McMaster)

EC
- Whole-ecosystem research
- Model rich – but not yet in aquatic environment: soon!
- EC more ecosystem quality issue/health: broader reason
- Climate research at ELA
- Site-specific studies
  2-3 lakes ->extrapolate to sites
- $300M – chemical research most to HC, some to EC
- Fish physiology and health
  (Vince Palace and Mark McMaster)

Capacity overlap?

DFO
- Analytical lab (water)
- Organic chemistry (general)
- Hydrology
- Met site
- Long-term data sets (ELA)

EC
- Analytical lab (water)
- Organic chem (Burlington)
- Hydrology
- Met site
- Long-term data sets (regions)

Q: Do we need a chemlab within DFO, when EC has many? Especially since DFO chemists are retiring? DFO lab research oriented also, but people are retiring.
Is there a plan? Should we be hiring fish biologists (for example) instead of chemists?
Option for methods development at U of M lab: $1M recently invested in infrastructure.

Apparent synergies?

- EC/DFO leads to a greater number of contacts and expertise for funding: could be a HUGE factor
- EC has staff in a lot of locations: could assist in regional collection of samples
- A lot of discussion concerning utilizing govt/university partnerships leading to good relationship with industry for NSERC funding
- Industrial research chair? ->leads to NSERC support

Experiments or monitoring

1. Chemical fate
   i.e. flame retardant bioavailability
   - multidisplinary
   - potential limnocorral experiment
   - answer EC question mainly and other stakeholders but DFO could word it for Fisheries Act
   - huge for Great Lakes concerns
   - if there was a spill, Fisheries Act would be cited

2. Canola or corn oil spill and/or disperants experiment
   - EC: stable isotopes: food web
   - dispersants: data on high ionic waters, nothing for fresh water
   - could study without oil

3. Fish stock recovery
   - lake trout? Long-term experiment
   - global issue: harvest/recovery

4. Nutrients
   - nutrients for enhancement of fish production
   - explore gradient: can we double P load? 3X? 5X?
   - productive management issue
   - for EC: environmental prediction; impact if climate changed

5. Climate changes effects
   - decrease stream inputs (divert flow)
   - increase in climate change effects
     - increase clarity, UV pen, increase H_2O temperature, etc.

6. Addition of bactericide to lakes
   - targets one level of food chain
   - triclosane (in toothpaste): biomagnifies slightly
   - like Hg issue, industry, government, academia involved potentially

7. The quick and easy:
   - utilize existing DFO database and work with EC modellers to calibrate climate models with lake components
   - small project -> high probability of success

8. Formalize archiving protocol for tissue and other archived samples
   - should be a priority
   - current researchers should identify what we have archived

9. Monitoring
   - do we need to revisit monitoring suite of analyses?
   - Add UV/PAR/total radiation to met site suite?

Difficulties

1. EC researchers potentially not "physically on site" due to current geographic separation
   - worries DFO staff, important for continued success of the ELA

2. Everyone already busy: who has time for new projects?
   - almost need a new generation of researchers with a clean slate or a commitment from upper management to staff at ELA

3. EC: office space alongside DFO at the FWI

4. Retirements->mentoring -> what kind of staff do we want to hire in future?

5. Per diems: to attract student-/professor-oriented programs

Highest priority opportunity

- DFO to discuss with EC modelling teams
  - What is required to calibrate EC models?
  - Can we use existing data to get off the ground?
  - Small project: high probability of success

- Document and secure the archives of the ELA
  - Especially before some data set holders retire

Highest priority difficulty

- EC champion is missing
  - Need a scientist champion, not a high-level manager
  - Champion to have enough time dedicated on site
  - ELA needs to be bought in at a high level
    ("Build the field, they will come")

- Solve cooperative efforts of endeavour

C) Group 3 (Recorder: John Shearer, Reporter: Tom Clair)

Where do needs and capacity overlap? What are the apparent synergies? Describe each opportunity:

1. Needs and capacity overlap with the met site (especially the CAPMON program) and with the hydrology network. There would probably be considerable interest at EC in the long-term data.
2. There are opportunities to strengthen monitoring programs at ELA with EC support.
3. Opportunities for experiments include:
   a) additions of stable isotopes of C, N, and O to a lake to test existing models of trophic fractionation and transfer
   b) greater participation in the METAALICUS study by EC; studies on the recovery of the Lake 658 system after stopping mercury additions
   c) studies on the effects of multiple stressors
   d) studies on the fate and toxic impacts of different contaminants, especially flame retardants and stain repellents
   e) Experiments on the effects of climate change such as thermocline deepening and changes in DOC
   f) Studies on eutrophication and links with Lake Winnipeg
   g) Acidification recovery
   h) Nitrogen fertilization of a whole ecosystem

For each opportunity, identify one or more experiment or monitoring exercise which could be undertaken at ELA.

1. There may be interest in expanding the Hg monitoring network to ELA.. There is also interest in expanding real-time monitoring.
2. There is interest at EC in strengthening the understanding of changes in chemistry and changes in biology.

For each identified difficulty, suggest how it could be overcome.

1. DFO needs to do a better job of justifying the need for ecosystem research at ELA. Many researchers at EC do not feel that ELA can be useful for solving problems of concern to them and that it is primarily a "niche" interest. Some important groups at EC (e.g. wildlife) were not included in the EC–DFO workshop.
2. Solution: There needs to be continued and improved communication between EC and DFO scientists with respect to ELA. This includes more workshops, presentations, and papers.
3. Most researchers at EC are overloaded and have limited resources. Any experiments proposed for ELA must strongly link to existing needs and workloads.

Which is the highest priority opportunity and why?

Group 3 did not prioritize the identified opportunities.

Which is the highest priority difficulty and why?

Communication was identified as the number one difficulty. There needs to be greater "buy-in" at EC that ELA is useful to them.

D) Group 4 (Recorder: Susan Kasian, Reporter: Sue Cosens)

1. **Where do needs and capacity overlap? What are the apparent synergies? Describe each opportunity:**
   - The group decided to constrain the discussion to ELA.
   - First attempt at addressing was to list needs of each.

DFO Needs	EC Needs
Ecosystem modelling	Has modelling capacity, needs long-term monitoring data for reporting on **status and trends** across the country. - particularly benthic/zoobenthic data - small lake data – has running water
Resources/expertise – capacity needs for new, expanded, and retirement replacements: - database management - hydrology - lower trophic level	Capacity issues - already fully committed - difficulty addressing non-Great Lakes freshwater issues (***__need to station a person in Winnipeg to be an equal partner__)

	Monitoring tools: -indicators for assessment, guidelines for development -links to population-level response = end points - **N.B. most EC work on running waters
First Nation involvement – address their issues	First Nation involvement – address their issues
Limited ability to take on new things	Limited ability to take on new things
Analytical capacity – limits	Analytical capacity – limits
Data comparability issues - consistent standards, calibrations between departments	Data comparability issues
Sample/tissue archiving	Sample/tissue archiving

Capacity overlap between ELA and EC:

- Field equipment
- Some scientific expertise
  - e.g. Vince Palace and Mark McMaster both have mandates for pesticide issues
  - eutrophication
- Eutrophication issues (?different strengths re: top down, bottom up)
- Overlapping mandate – Nancy Glozier and Mark McMaster don't see a clear division: e.g. EC can do fish population work.
  - impacts on biological parameters from pesticides, mines, pulp mills

2. For each opportunity, identify one or more experiment or monitoring exercise which could be undertaken at ELA.

List of opportunities/experiments:

- Eutrophication
  - cottage, watershed vs industrial point source
  - different types of waste
  - impacts of management strategies – will they make a difference? e.g. loading criteria, nutrient policies for Lake Winnipeg
- Validate EC models
  - use/expand ELA LTER monitoring data
- Monitoring acidification recovery
- Use ELA lakes to test end-point effects
- Terrestrial ecosystem investigations
  - e.g. insects – transfers from terrestrial to aquatic
- Ca depletion – particular southeastern lake issue
  - Has well water become Ca depleted?
- Climate impacts
  - lake levels, receding wetlands, water temperature
- Impacts of oil dispersants
- Flame retardants in the aquatic ecosystem
- Monitoring for pesticides
  - EC criticized for not collecting data/reporting on pesticides (Nancy Glozier)

3. For each identified difficulty, suggest how it could be overcome.

Difficulties:

- CAPACITY, CAPACITY, CAPACITY!!!
  - impending retirements
  - systemic barriers in both DFO and EC re: contracting, hiring, FTEs
  - EC on lock-down with limited authority to spend budgets
  - administrative overload
- EC can only apply to work on existing priorities
  - similar to DFO – even on joint projects, DFO people have to still work on DFO priorities
- Lack of long-term funding for monitoring, and even secure short-term funding (2–3 y).

Solutions:

- EC needs management to make a commitment to more than just the ELA facility
- Start submitting joint proposals for emerging issues
- Articulate/put pressure on management to lift road blocks.
  - communicate up the line
- Push for strategic funds to come with FTEs

4. Which is the highest priority opportunity and why?

No brainers – do right away:

- Share monitoring data from ELA
  - EC needs a small lakes site for national suite
  - validate various EC models
- Recovery from acidification monitoring – with EC funding?

Experiments – work on for future:

- Impacts of management strategies on eutrophication
- Climate impacts – water levels, water temperatures
- Terrestrial ecosystem – something?
  - involve Natural Resources, CWS

5. Which is the highest priority difficulty and why?

- Bureaucracy/administrative barriers
  - FTE caps, roadblocks to other hiring, security, renewal from retirements
- Long-term funding for monitoring

APPENDIX 11: STRUCTURE AND FUNCTION OF THE SCIENCE MANAGEMENT COMMITTEE (from page 3, paragraph 4 of the MOU, APPENDIX 2)

DFO and EC will form a Science Management Committee to:

- Develop ELA policy and oversee day-to-day camp activities
- Arrange data sharing
- Develop and review science proposals before they go to the ELA Management Board
- Recommend action to Real Property
- Review costs
- Meet at least twice annually
- Have equal EC–DFO representation
- Essential members: representative of RP, Operations Manager, and scientists?

APPENDIX 12: "TO DO" LIST STEMMING FROM THE EC–DFO WORKSHOP, 27–28 FEBRUARY 2007, INN AT THE FORKS, WINNIPEG

Person	Task
Short-term tasks	
1. Scientific Management Committee	
Susan Cosens, Mike Paterson	Finalize structure of Scientific Management Committee (SMC)
Derek Muir	Contact John Carey as to whether he would serve on the SMC and to appoint two EC scientists
Mike Paterson, Susan Cosens	Contact Michelle Wheatley about whether she would serve on the SMC and to appoint two DFO scientists
2. Communications	
Rick Bourbonniere, Derek Muir	Contact EC newsletter about an article on the EC–DFO MOU (already done)
Steve Page?	Develop list serve to facilitate the exchange of information between EC and DFO scientists on ELA
Susan Kasian	Circulate copies of the ELA database to EC researchers
John Shearer, Susan Cosens	Upgrade ELA website to reflect new EC–DFO MOU and improve the DFO website on the backgrounds of different ELA researchers
Derek Muir	Contact EC webmasters to upgrade EC website to reflect DFO–EC MOU
Mike Paterson	Give seminars in Burlington and Saskatoon on research possibilities at ELA
3. Research at ELA	
Mark McMaster, Cheryl Podemski?	Contact new representative from Murray Charleton's old group about possible aquaculture-related research at ELA
Derek Muir	Contact Cathy Banic about possible chemical fates research at ELA
Nancy Glozier	Contact national database sharing group about ELA data
Long-term tasks	
Mike Paterson?	Seek development of an EC–DFO umbrella agreement to facilitate HR and financial administration at ELA
Mike Paterson?	Hold annual meeting among researchers in EC and DFO concerning ELA