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National CABIN Science Forum Proceedings, November 17-18, 2010 - Vancouver, British Columbia

Canada

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Acknowledgements

The first National Canadian Aquatic Biomonitoring Network (CABIN) Science Forum was implemented following discussions regarding partner involvement and user engagement with CABIN users. We appreciate and thank them for their inspiration which precipitated this forum.

The Forum was organized by Stephanie Strachan, Sheena Pappas, Mia Edbrooke, Philip Chau, and Beverly McNaughton of Environment Canada (EC), Freshwater Quality Monitoring and Surveillance - Pacific and Yukon, and Jean-Francois Bibeault, Freshwater Quality Monitoring and Surveillance - Atlantic, CABIN National Program Lead. Valuable contributions were also received from the EC CABIN National Team, including Joseph Culp, Donald Baird, Lesley Carter, Vincent Mercier, Alain Armellin, Tim Pascoe, Emily McIvor, and Nancy Glozier.

Preface

The Canadian Aquatic Biomonitoring Network (CABIN) is an aquatic biological monitoring program for assessing the health of freshwater ecosystems in Canada. The Canadian Aquatic Biomonitoring Network is based on a network-of-networks approach for inter-agency collaboration and data-sharing to achieve consistent and comparable reporting on freshwater ecosystem health in Canada. The CABIN program (i.e., online resources, training, protocols, regional coordination, and quality assurance and quality control) is maintained by Environment Canada (EC) to support the comparable collection, assessment, and reporting of biomonitoring information for all network participants.

The CABIN stream biomonitoring program originated in the Fraser River Basin, British Columbia (BC), in the mid 1990's and has expanded rapidly throughout the province and Yukon, making Vancouver the ideal location for the first national gathering of CABIN users. Environment Canada hosted the National CABIN Science Forum on November 17 and 18, 2010 in Vancouver, BC and virtually via webinar to enhance network collaboration and to advance the program.

Specific goals of the forum included:

- To provide an opportunity for CABIN users to learn about different applications of the program in a variety of sectors, the associated successes and the challenges, and the future directions of the program.

To provide a forum for CABIN users to interact and collaborate with other members of the network.

To provide an opportunity for information exchange and collaboration among CABIN users and the EC CABIN National Team to address user needs.

- To provide a formalized avenue for communication among users and to provide documentation of CABIN program applications and user discussions to the entire network.

The two day forum included a day of presentations by CABIN users and a day of interactive discussions among participants on topics of interest related to the implementation and future directions of program. The user presentations demonstrated the application and implementation of the CABIN stream bioassessment method in a variety of sectors. Presentations focused on the successes, challenges, potential solutions as well as CABIN program research directions.

This document summarizes the proceedings of the inaugural National CABIN Science Forum. These proceedings are being distributed in the interest of CABIN user needs and increasing understanding and knowledge of the issues discussed at the CABIN Science Forum. The forum was funded by EC and these proceedings have been prepared by the EC CABIN National Team.

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CABIN SCIENCE FORUM 2010

Vancouver Convention Centre, 1055 Canada Place, Vancouver, BC

Final Agenda

Wednesday November 17, 8:30 – 4:30 ***RM 121 & 122***

8:15 – 8:50 **Registration**

PRESENTATION SESSION 1

8:50 **Welcome**
Stephanie Strachan, Environment Canada, CABIN Program - Pacific and Yukon Lead

9:00 **CABIN Introduction**
Jean Francois Bibeault, Environment Canada, National CABIN Program Lead

9:15 **The Use of CABIN in Yukon: Past, Present and Future**
Robert Thomson, Government of Yukon, John L. Bailey, GHOST Environmental Consulting Inc., Trefor B. Reynoldson, GHOST Environmental Consulting Inc., and Robert C. Bailey, Cape Breton University

9:30 **Successes and Challenges of CABIN application in Newfoundland and Labrador**
Joanne Sweeney and Kyla Brake, Newfoundland Labrador Department of Environment and Conservation

9:45 **Adoption of CABIN into British Columbia's Provincial Biomonitoring Program**
Leon Gaber, BC Ministry of Environment - Victoria

10:00 **Transitioning from Surber and BIBI monitoring to CABIN**
Vic Jensen, BC Ministry of Environment - Penticton

10:15 **Benthic community structure and associated environmental variables of the Kingston Inner Harbour: a comparison of the BEAST approach with ordination techniques using Non-metric Multidimensional Scaling (NMDS)**
Michels, A. T. Laing V. Paquin and K.Reimer, Royal Military College Environmental Sciences Group, Royal Military College - Kingston

10:30 – 11:00 **Coffee Break** (coffee and tea available)

PRESENTATION SESSION 2

11:00 **Successes and Challenges of CABIN application by the Forestry and Mining Industry in Skeena Region**
AJ Downie, BC Ministry of Environment - Smithers

11:15 **RCA and CABIN usage for the Environmental Effects Monitoring (EEM) Program in the Upper Fraser**
Janice Boyd, Environment Canada

11:30 **Evaluating the impacts of mining on the ecological integrity of streams in the South Nahanni Watershed**
Garry Scrimgeour, Parks Canada

11:45 **CABIN: a Tool for Ecological Integrity Monitoring at Kouchibouguac National Park**
Pippi Lawn, Parks Canada
11:30

12:00 – 1:15 **Lunch Break** (on your own)

PRESENTATION SESSION 3

1:15 **Citizen Science and CABIN**
Jim and Laura Duncan, Columbia Basin Water Quality Network

1:30 **Using CABIN as a tool for teaching river ecology to high school students *and* using CABIN to expand fisheries based river restoration science**
Jennifer Yeow, Slocan River Streamkeepers

1:45 **Development of CABIN Field Training for northern communities: Update from pilot training programs**
Nancy Glozier, Stephanie Strachan, Lesley Carter, Sarah Hall, Joseph Culp, Rob Kent, and Rob Phillips, Environment Canada

2:15 **Wetland protocol development for CABIN**
Emily McIvor, Environment Canada – Prairie and Northern, Alain Armellin, Environment Canada – Quebec, and Denis Lacroix, Environment Canada – Yukon

2:30 – 3:00 **Coffee Break** (coffee and tea available)

PRESENTATION SESSION 4

3:00 **Extending the Geographic Range of RCA Bioassessment Models: A pan-western model for western and northern Canada (a cautionary tale)**
Trefor B. Reynoldson and John L. Bailey, GHOST Environmental Consulting Inc., Robert C. Bailey, Cape Breton University, Leon Gaber, BC Ministry of Environment, Garry Scrimgeour, Parks Canada, and Adam Yates, Environment Canada

3:15 **Development and testing of reference condition models for river biomonitoring: a case study in Atlantic Canada**
Wendy Monk, University of New Brunswick

3:30 **Development of a Riverine Benthic Invertebrate Tool to Support the Definition of Hydroecological Management Guidelines: The Canadian Ecological Flow Index (CEFI)**
David Armanini, Environment Canada National Water Research Institute, Canadian Rivers Institute – University of New Brunswick

3:45 **Biomonitoring 2.0: CABIN of the future**
Donald Baird, Environment Canada

4:00 **Wrap-up and overview for discussion groups**

4:15 **Adjorn**

4:30 **Optional Mixer** – Elephant and Castle Pub and Restaurant, 385 Burrard Street @ Hastings

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Thursday, November 18, 9:00-3:30 ***RM 115, 116 & 117***

DISCUSSION GROUPS *(refer to following page)*

9:00 **Discussion Topic 1 - Mayfly room (RM 115)**
Discussion Topic 2 - Dragonfly room (RM 116)
Discussion Topic 3 - Caddisfly room (RM 117)

10:30 - 11:00 **Coffee Break** (coffee and tea available)

11:00 **Discussion Topic 4 - Mayfly room (RM 115)**
Discussion Topic 5 - Dragonfly room (RM 116)
Discussion Topic 6 - Caddisfly room (RM 117)

12:00 **Lunch Break** (on your own)

RM 121 & 122

1:30 **Summary of discussion topics, other items for discussion and wrap-up**

3:30 **Adjorn**

Discussion Topics

Discussion topics will be arranged based on the demand and interest of those in attendance. We recognize that every user has different interests in CABIN and different priorities to discuss at this forum. Potential topics for discussion are identified below. We will arrange the discussion topics based on the greatest interests such that there will be 6 topics, 3 in the 1st half of the morning and 3 in the 2nd half after coffee break. The recap of each topic will be discussed with the entire group in the afternoon. Other questions or points of discussion can also be brought forward at this time.

1. Field Protocols
According to you what are the three main challenges or problems we should be solving? Are the difficulties with the aspects of the standard CABIN protocol for wadeable streams? Do we need new/updated protocols? If yes, for what purpose?

2. Future Research
What additional information or knowledge would you need to do a CABIN assessment? Are there new techniques that you know and want to share that could work with CABIN protocols/data? What science priority would you suggest?

3. Database Functionality
What problems are users currently experiencing entering and exporting data? How could the CABIN database be made more user friendly? Do you have ideas for improving the communication of problems and concerns between the database users and the technical administrators?

4. Analytical Tools Functionality
Are the data analysis tools currently available in CABIN useful? What improvements to the current data analysis tools would you like to see?

5. Laboratory Requirements
What problems or concerns do you have with the existing approach for taxonomy? Are you able to archive your samples? Are there clarifications about the CABIN sample processing requirements needed? Are there concerns about comparability of other sample processing methods?

6. QAQC Protocols
How do you consider uncertainties about data and measurement? Would a data quality flag help you in deciding what shared data you would and wouldn't use? If so, what would this flag look like? Would a field auditing protocol be something that should be developed that all CABIN users should adhere to?

7. User Engagement and Communication
How can users best engage others who may be valuable contributors to the CABIN Network? How can users best exchange CABIN related information with Environment Canada and among CABIN users? How can network collaboration be enhanced?

8. Training and Certification
Is certification a sufficient tool to give you confidence with data? Are refresher courses needed? Are there any suggestions to improve training and certification?

Presentation Abstracts

Presentation Session 1

Welcome and Forum Overview

Stephanie Strachan, Environment Canada, stephanie.strachan@ec.gc.ca

Stephanie has been involved in the CABIN program since its research stages in 1994. She has been working in the Freshwater Quality Monitoring and Surveillance Section in Vancouver since 1997. She received a B.Sc. from the University of Windsor in the Great Lakes Environmental Studies Co-Op program in 1995. She received her M.Sc. in Zoology from the University of Western Ontario in 1998 where she worked on the Fraser River Biomonitoring Program which evolved into the present day CABIN program.

The invitation for this Forum was initially sent to nearly 500 registered CABIN users and those users were encouraged to forward the invite to others non-CABIN users who might be interested in the CABIN program. The National CABIN Science Forum was a resounding success with 150 registered participants from all provinces, Yukon and Northwest Territories. Approximately 100 people were in attendance and 50 via the webinar format. Sixty-five percent of participants were CABIN users/partners and 35% were people interested in getting involved in the CABIN program, highlighting the fact that this Forum was an important venue for user engagement. The forum was also a first ever occasion to have a national transfer of knowledge between CABIN 'pioneers' involved in the early stages of research and development and the more recent users and partners.

In order to encourage and facilitate participation from across the country, a webinar was offered for the first day of the Forum. The webinar allowed webinar attendees to hear about different applications of the CABIN program and also to ask questions. The webinar was a successful cost-effective way to include a wider audience from across the country as 34% participated via webinar. Not surprisingly about 60% of registrations were from BC however, as mentioned all provinces as well as the Yukon and Northwest Territories were represented.

Registrants were widely distributed among a variety of affiliations with approximately 23% from Environment Canada, 23% from provincial, territorial or municipal governments, 24% from environmental consulting firms, 9% from Parks Canada, 9% from Community Groups, 8% from universities and colleges and 4% from other Federal Departments.

The organizers were aware that attendees would be interested in discussing a variety of topics. As a result, on the first day the organizers asked attendees to indicate their top four choices for discussion from a list of eight potential topics. This allowed the pre-arrangement of the discussions sessions, based on user identified topics, to ensure the greatest participation.

CABIN Introduction

Jean-Francois Bibeault, Environment Canada, jean-francois.bibeault@ec.gc.ca

Jean-Francois is presently the EC CABIN National Program Lead and Freshwater Quality Monitoring and Surveillance Section – Atlantic, Acting Manager. He is also the EC National Lead of the Water Quality Indicators for the Canadian Environmental Sustainable Development Indicators initiative.

A general overview of EC CABIN program context, priorities and recent development were given as a general introduction for the forum. CABIN has formally been recognized as a Water Science & Technology priority for EC this year, and is now fully part of the EC monitoring strategy (as effect based monitoring). In that context, this first national science forum was intended to share knowledge and discuss challenges and opportunities that lay ahead.

One of the key aspects of the CABIN program for EC is the importance of dealing with critical areas (e.g., oil sands) and trans-boundary waters (as part of the federal mandate) which are areas where EC needs first to improve the program coverage. Besides the geographical scope, recent efforts have supported field work and data collection, the optimization of Quality Assurance and Quality Control (QA/QC) to support data management capacity (e.g., data integrity and access), targeted training for key audiences, improvement of reporting (e.g., field sampling and laboratory manuals are available on-line), developing new online summary content (initial content will be available on-line before March 2011), and development of new reference conditions models (e.g., Atlantic).

As some more immediate challenges, we foresee enhancing Reference Condition Approach (RCA) model comparability at multiple-scales and the standardization of rules (watersheds, international and inter-provincial waters), mobilizing the larger research community through the newly developed Science and Technical Advisory Group (STAG), improving the linkage with users on a frequent basis, and, over time, making better connections with other programs and supporting decision-making (e.g., development of ecosystem-watersheds targets).

The Use of CABIN in Yukon: Past, Present and Future

Robert Thomson, Government of Yukon, robert.thomson@gov.yk.ca and;

Rob moved to the Yukon in 1977. After working for the Northern Affairs Program as a hydrology technologist, he became a mining inspector in 1992. He was acting Manager of the Mining Inspection Division when responsibility for natural resource management was transferred from Northern Affairs to the Yukon government in 2003. After a rewarding stint as Executive Director of the Yukon Placer Secretariat, in September 2009 he returned to the world of regulatory law enforcement and his current role as Director of the Client Services and Inspections Branch in the Department of Energy, Mines and Resources.

John L. Bailey, GHOST Environmental Consulting Inc., jbailey@northwestel.net
Co-authors: Trefor B. Reynoldson, GHOST Environmental Consulting Inc., and Robert C. Bailey, Cape Breton University

John received his B.Sc. in Zoology from the University of Guelph and his Ph.D. in Biology from the University of Western Ontario. He is currently president and a senior scientist at GHOST Environmental Consulting. John began his career with the Ontario Ministry of Natural Resources in the mid-1970s, followed by eight years with the Department of Renewable Resources. John moved to Whitehorse, Yukon in 1989 to establish GHOST Environmental Consulting and is still based there.

Reference Condition Approach (RCA) stream sampling in the Yukon was initiated in the early 1990s by the University of Western Ontario (UWO) and undertaken in earnest beginning in 2002. By 2006, more than 90 reference stream sites had been sampled and collaboration among the UWO and federal and territorial agencies was initiated following a decision to use RCA to monitor watershed health under the new Fish Habitat Management System for Yukon Placer Mining. This regulatory system includes an adaptive management process that incorporates traditional knowledge and the results of annual water quality objectives monitoring, aquatic health monitoring and economic health monitoring programs. Stream data from the Yukon and an initial Yukon RCA model was uploaded to CABIN in 2006. The model has been revised twice and more than 250 reference sites are now in the CABIN data base. This collaboration has grown to include several First Nation governments and some private consultants and significant effort has been devoted to training and RCA programme design. The aim for the future of in the Yukon is to continue this collaborative approach for stream sampling and assessment and to expand it to include wetland and lake system bioassessment programmes, both of which are currently under development.

Successes and Challenges of CABIN application in Newfoundland and Labrador

Joanne Sweeney, Newfoundland Labrador Department of Environment and Conservation joannesweeney@gov.nl.ca

Joanne is a graduate of St. Mary's University in Halifax with a B.Sc.degree. Graduate of the Environmental Health Program at Ryerson; has been employed as an Environmental Scientist with the Newfoundland and Labrador Department of Environment and Conservation since 2001.

Kyla Brake, Newfoundland Labrador Department of Environment and Conservation kbrake@gov.nl.ca

Kyla is a graduate of Memorial University, St. John's, with a B.Sc. (Honors) and Masters in Environmental Science; has been employed as a Water Quality Specialist with the Newfoundland and Labrador Department of Environment and Conservation since 2008, and is the current coordinator of CABIN in Newfoundland Labrador.

The Water Resources Management Division of the Newfoundland and Labrador Department of Environment and Conservation has been a participant of the CABIN program since 2008. The program was introduced to fill a gap in biological monitoring, and falls under the Water Quality Monitoring Agreement program, in partnership with Environment Canada. Newfoundland and Labrador (NL) has taken a "start small and grow" approach to CABIN, establishing nine CABIN reference stations in 2008, six in 2009, and 25 more reference stations in 2010. During the 2010 CABIN season, NL focused on filling geographical and geological data gaps for reference stations, and established the first four CABIN reference stations in the Labrador portion of the province. While CABIN has not yet been integrated into industry partnerships that

currently exist under the Real Time Water Quality Monitoring Network, several reference stations have been established upstream from industrial activities, leaving potential for industry partnerships in the establishment of downstream test sites. The major CABIN challenges in NL are resource constraints, and the accessibility of suitable CABIN sites. In 2011, NL will strive to move forward into the testing and implementation phase, generation of useful products from the accumulated data, and integration of sampling methods.

Adoption of CABIN into British Columbia's Provincial Biomonitoring Program

Leon Gaber, BC Ministry of Environment, leon.gaber@gov.bc.ca

Leon received his undergraduate degree in Agroecology from the University of Manitoba. After several years of living abroad he moved to British Columbia where he received his Masters in Biology from the University of Victoria researching the impacts of agricultural intensification on stream condition. He has been the BC government's provincial aquatic biomonitoring science specialist since graduating.

The British Columbia government has been conducting lotic biomonitoring in various forms for several decades. Typically project based using a variety of different sampling and analytical protocols, results were not comparable project to project or region to region. To rectify this shortcoming and allow for larger scale questions about stream condition to be addressed, a provincially standardized lotic biomonitoring program based on the CABIN approach has been created. This program is based on the pooled resources of all its partners, allowing a much more robust program than would have been feasible as a strictly BC government program. This provincial program features a number of regional reference condition approach (RCA) models as well as a variety of innovations such as several GIS based programs to aid in finding reference sites as well as collecting information about sample sites. The creation of this program has and continues to be faced with a variety of challenges such as verifying identical protocols provincially, ensuring continued funding, and convincing decision and policy makers to adopt the use of the program within standard government procedures and regulations. Despite these challenges, BC's provincial biomonitoring program has and continues to allow the assessment of stream condition in a defensible and cost effective manner.

Transitioning from Surber and BIBI monitoring to CABIN

Vic Jensen, BC Ministry of Environment, vic.jensen@gov.bc.ca

Vic received a Bachelor of Science in Marine Biology from the University of Victoria in 1977 and bravely went back after many years to achieve his Masters in Environmental Science in 2010 from the University of British Columbia Okanagan. He is the Senior Environmental Impact Biologist with the BC Ministry of Environment in Penticton and has been there since 1979. His work focuses on assessments using benthic invertebrates, water and sediment characteristics, to document the cumulative effects of multiple stressors on aquatic ecosystems in Okanagan area.

Accurately determining stream health is critical to water resource management within the Okanagan Basin where valley bottom landscapes are rapidly being urbanized. Initial assessments in 2004 using a locally calibrated Benthic Index of Biotic Integrity (B-IBI)

identified many urban streams in poor or very poor condition. This information has guided stormwater management planning efforts within the Basin. An incremental transition to CABIN methods began in 2005 to enable broader spatial comparisons. Comparison of collection methods determined B-IBI scores were not significantly different between samples collected by B-IBI (210µm Surber) and CABIN (400µm kicknet) methods. Assessment of pre 2005 Surber data using the Fraser Georgia Basin model in CABIN yielded stream stress scores equivalent to the Okanagan B-IBI scores in 28% comparisons and within 1 stress category in 83% of the comparisons. Improved stream health score correspondence occurs between the Okanagan B-IBI and the recently developed Columbia-Okanagan (CO) model in CABIN. CO model scores are the same or within 1 stress unit of Okanagan B-IBI scores in 47% and 94% comparisons respectively. CO model scores tend to be less conservative than B-IBI scores. Further assessment is required to understand the sensitivity of CABIN assessments to changing stream condition. Enabling full metric calculation within CABIN would facilitate re-calibration of the Okanagan B-IBI and enable water resource managers to more fully assess stream condition using a variety of complementary tools.

Benthic community impairment in the Kingston Inner Harbour (KIH): comparison of CABIN results with multivariate analyses

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Co-authors: T. Laing, V. Paquin and K.Reimer

Astrid graduated from the University of Freiberg, Germany, in limnology in 1996 where she studied the effects of sewage on diatoms in Costa Rican streams. In 2002 she completed her Ph.D. in biological monitoring using diatoms at a university in Costa Rica. From there she completed a Post Doc. at Queen's University in the Paleoecological Environmental Assessment and Research Lab investigating millennial shifts in drought conditions on the prairies. Astrid has been the Senior Researcher at the Environmental Sciences Group at Royal Military College in Kingston, ON since 2006.

Benthic communities in the Kingston Inner Harbour (KIH) are dominated by organisms that are tolerant of organic (i.e., nutrient) pollution. The BEnthic Assessment of SedimenT (BEAST) analysis indicates that the benthic community at most stations in the impacted area of the KIH is severely stressed, but suggests that the upstream reference sites are also in a stressed condition. Observed differences in the CABIN results are challenging to explain. Multivariate analyses based on Non-metric Multi Dimensional Scaling (N-MDS) suggest that stations within the impacted area are significantly different than reference stations. Differences in the macroinvertebrate community structure can be explained by environmental parameters related to habitat, and to contaminant variables such as sediment chromium concentrations. Multivariate analysis is a powerful technique it helps to identify the environmental variables best explaining the benthic community patterns.

Presentation Session 2

Applying CABIN in Northwest British Columbia: Successes and Challenges

AJ Downie, BC Ministry of Environment, aj.downie@gov.bc.ca

AJ is the Environmental Quality Section Head in the Skeena Regional office of the BC Ministry of Environment. He has been involved in CABIN biomonitoring work in Northwestern BC since the province first began to experiment with CABIN protocols in 2004. He began as a field technician, and later became a project manager. He has recently been certified as a CABIN field trainer, and will be offering field certification courses in Northern BC in the future.

The Skeena Region Ministry of Environment started biomonitoring with benthic macroinvertebrates in the late 1990's. In 2004, a five year multi-stakeholder effort was initiated to develop an RCA predictive model for use in Northwestern BC. The SkeenaBEAST predictive model was originally created in 2007, and was rebuilt in 2009 to correct some data errors and add new reference sites. The model has recently been uploaded into CABIN, and is now available for use.

Although CABIN assessments are not yet being widely used to support decision-making in Northwestern BC, interest in the tool has been expressed by some companies in the forestry and mining sectors. In the Kalum Forest District near Terrace, forest licensees have recently collaborated to support the continued development of RCA in their chart areas, and it is hoped that CABIN assessments will become an indicator for ongoing monitoring. A number of proposed mining projects in the Skeena Region have also begun experimenting with CABIN sampling protocols. Although they haven't yet committed to using the RCA study design for their Environmental Effects Monitoring (EEM) programs, they are augmenting their traditional Before-After-Control-Impact (BACI) design Hess sampling efforts with Kicknet sampling at some sites. Until the SkeenaBEAST reference site dataset includes more sites in areas typical of their proposed mine sites, there will likely be some resistance to transition to CABIN assessments. In addition, work may be needed to ensure access to consistent, high quality Geographic Information System analysis so that the SkeenaBEAST predictive model can be used.

RCA and CABIN usage for the Environmental Effects Monitoring (EEM) Program in the Upper Fraser

Janice Boyd, Environment Canada, janice.boyd@ec.gc.ca

Janice received her B.Sc. from the University of Western Ontario. She started a M.Sc. in Resource Management Program at SFU in 1998 as also with Environment Canada in 1998 doing coastal surveys. This field work made it difficult to do a degree too so she picked money over a diploma and has been with EC ever since - 23 years; Janice has been working on the Environmental Effects Monitoring Program since 1996 and she is the EEM regional coordinator for Pulp and Paper.

When Environmental Effects Monitoring (EEM) program under the federal *Pulp and Paper Effluent Regulations* (PPER) met the reference condition approach (RCA) and the Canadian Aquatic Biomonitoring Network (CABIN) it shifted traditional sampling

design at mills in the upper Fraser River. Shifting to new or different methods depends in part on how well current methods work and the need or ease to change methods. The 1992 PPER required subject pulp and paper mills to conduct EEM to determine if regulated limits adequately protect fish, fish habitat (benthos) and the use of fisheries resources in the receiving environment. Most mills use the traditional control/impact (C/I) study design and samplers to assess potential effects on benthic invertebrate communities in mill-effluent exposed areas compared to reference areas. A project under Environment Canada's Fraser River Action Plan (FRAP) applied the RCA to establish sampling protocols and an RCA predictive model to assess potential areas of impairment to invertebrate communities in the upper Fraser River catchment. Environment Canada's EEM technical guidance added RCA as a study design option in the program's in 1997 although no guidance on how to use to meet EEM requirements. When mills discharging to the upper Fraser River conducted their EEM studies in Cycles 2 and 3 using the C/I design with artificial substrates and modified Hess sampler, Environment Canada conducted kick-net sampling at the same stations to apply the Fraser RCA model to assess potential effects. Premature removal of the artificial samplers in Cycle 1 and the rising river in Cycles 2 washing out samples precluded their using those results for EEM results and instead analysed modified Hess samples. Kick-net sampling demonstrated the advantage of sampling deeper water, not so recently wetted, with a rising river. Effects results of C/I and RCA were comparable and the mills incorporated kick-net sampling and RCA into their Cycle 4 programs. The EEM program is also developing more guidance for using RCA and CABIN for benthic invertebrate studies.

Evaluating the impacts of mining on the ecological integrity of streams in the South Nahanni Watershed

Garry Scrimgeour, Parks Canada, garry.scrimgeour@pc.gc.ca

Garry has 25 years of experience in aquatic research, monitoring and environmental impact assessment. His current work revolves around the development of aquatic monitoring programs, and completing environmental assessments and restoration activities of surface waters· He holds a Ph.D. from the University of Calgary, adjunct professorships at the University of Alberta, University of Waterloo, and at the University of Lethbridge. He has served as an Associate Editor for the Journal of the North American Benthological Society since 2003. He has published many peer reviewed scientific papers, research reports, and book chapters.

The Reference Condition Approach (RCA) is becoming an increasingly popular stream assessment tool. As a partner in the Canadian Aquatic Biomonitoring Program (CABIN), Parks Canada Agency is using the RCA to: i) assess potential impairment due to industrial activities and ii) to support the development of a long-term surface water monitoring program for the South Nahanni Watershed. The South Nahanni Watershed, the majority of which comprises the Nahanni National Park Reserve, located in the Northwest Territories of Canada, includes an operational tungsten mine, and an advanced lead-zinc-silver copper exploration mine. Both operations discharge to tributaries of the South Nahanni River that eventually flow through Nahanni National Park Reserve. We collected water, benthic macroinvertebrates and select habitat variables from 118 sites throughout the South Nahanni Watershed in 2008 and 2009, and applied a RCA to assess stream health. We present a preliminary assessment of the effects of each mining

operation on stream integrity and link these possible impacts to concentrations of select contaminants within the stream food-web.

CABIN: a Tool for Ecological Integrity Monitoring at Kouchibouguac National Park

Pippi Lawn, Parks Canada, pippilawn@gmail.com

Pippi works seasonally as a Resource Conservation Technician for Parks Canada at Kouchibouguac National Park. She is involved in implementing and conducting field work for a variety of monitoring projects that assess the ecological integrity of Park ecosystems, including CABIN, bog vegetation, forest plots and invasive plants. In her off-season, she lives in rainy Bamfield on the west coast of Vancouver Island. Prior to commencing with Parks Canada in 2006, she was a project coordinator for many years with the Marine Botany Group at the University of Queensland, Australia.

In Kouchibouguac National Park, New Brunswick, CABIN is being applied as one of several measures to assess freshwater ecosystem health as part of the Park's ecological integrity monitoring program. The purpose of this on-going program is to evaluate ecological integrity condition and trends, facilitating early detection of impairment and rapid management responses. CABIN monitoring has been carried out in Kouchibouguac National Park since 2008, in partnership with the local community catchment group, 'Les Amis de la Kouchibouguacis'. Permanent sites have been established in all the major water courses running through the Park and these are revisited for CABIN sampling annually. This presentation outlines the key elements of our CABIN monitoring program, how it contributes to our assessment of freshwater ecological integrity and the successes and challenges we have encountered along the way.

Presentation Session 3

Citizen Science and CABIN

Jim and Laura Duncan, Columbia Basin Water Quality Network, waterjim@shaw.ca

Laura and Jim are staff of Mainstreams Environmental Society based in Kimberley, BC. They provide program services in water education, water monitoring and aquatic habitat restoration. They have been coordinating the Columbia Basin Water Quality Monitoring project, through Mainstreams, from its inception in 2007.

Citizen Science and CABIN is about the story of community-based watershed groups building their capacity to conduct a coordinated water quality monitoring program. The Columbia Basin Water Quality Monitoring project began in 2007 and is moving into its 4th year with four watershed groups in the West Kootenay and four in the East Kootenay. The presentation will highlight achievements related to three goals; (1) Adopt a monitoring system that is scientifically viable and can be put in place by non-scientists, (2) Establish a system of storing a sharing local watershed monitoring data through web technology, and (3) Engage local communities with the project.

Using CABIN as a tool for teaching river ecology to high school students **and** *using CABIN to expand fisheries based river restoration science*

Jennifer Yeow, Slocan River Streamkeepers, passlab@xplornet.com

Jen received academic training in marine biology and her career has been in microbiology and food chemistry. After moving to the Kootenays over 20 years ago, Jen and her husband, Tony set up a small laboratory and began testing water and measuring flow on creeks. Jen's main interest is in working with community groups to monitor flow and assess water quality. In the Slocan Valley, this means she is labelled an "environmentalist".

The Slocan River Streamkeepers mission is to protect and restore aquatic and riparian ecosystems by promoting community stewardship, education, monitoring key aquatic indicators and engaging in river restoration. For the last 5 years, Streamkeepers have used the CABIN protocol as a tool to teach biology 11 students concepts of aquatic ecology. The Field Protocol is useful in teaching scientific data collection and the use of taxonomic keys to identify insects. Students have an opportunity to "work with" the data assessing the dominance of certain taxa and see correlations between temperature, insects and fish numbers. The program is well received and meets "Prescribed Learning Outcomes" for the Biology 11 course. Local high school teachers have now incorporated CABIN into their yearly curricula. Streamkeepers are also using CABIN to study invertebrate populations in Slocan River side channels. The program is a component of baseline monitoring for Columbia Power Corporation and is being done prior to opening side channels to enhance habitat for rainbow trout. Streamkeepers maintain that invertebrate analyses give a more comprehensive view of ecosystem function when compared with "fish numbers based" data alone. The rationale is that many invertebrates (e.g., Mayflies, Stoneflies & Caddisflies) are food sources for the target fish.

Development of CABIN Field Training for northern communities: Update from pilot training programs

Nancy Glozier, Environment Canada, nancy.glozier@ec.gc.ca
Co-authors: Stephanie Strachan, Lesley Carter, Sarah Hall, Joseph Culp, Rob Kent, and Rob Phillips, Environment Canada

Nancy graduated from the University of Calgary with a B.Sc. in Zoology and a M. Sc. degree in Aquatic Ecology in 1989. She has worked on aquatic related projects for 30 years ranging from fish habitat assessments and trap netting, to field and laboratory research on flatworms, leeches, zooplankton, and benthic invertebrates. She has been with Environment Canada in Saskatoon for 20 years where her focus has been research and development of new tools for assessments of contaminants, stream and wetland community mesocosms, and the development of standardized field assessments for stream benthic invertebrate communities. Nancy has also been a long standing member of the National Environmental Effects Monitoring (EEM) Science Committee.

Traditional CABIN field certification courses are being delivered across Canada on an annual basis. However, completion of the first two on-line CABIN modules (http://ec.gc.ca/rcba-cabin/) is a requirement to attend these field courses. Through the International Polar Year (IPY) project on Capacity Building and Outreach for northern communities, several field training courses have been delivered in northern communities during the previous several years. Feed back from these and other community level courses are as follows; 1) there is a demonstrated interest in being able to apply CABIN at the community level and to contribute to large scale models, 2) the logistics of CABIN outreach training workshops in remote northern location is challenging, 3) the ability to deliver the training course content without the need to complete the preliminary online modules has been identified as a NEED for remote northern communities, and finally, 4) locally relevant "case studies" would be beneficial for community groups to help in the understanding of the value of biomonitoring assessments provided through the national CABIN program.

To begin to address these issues, a pilot, three day CABIN field certification course was recently provided to Dehcho community members on and around the shores of the beautiful Kakisa Lake, NT. The program was delivered in partnership with the Dehcho First Nation's Aboriginal Aquatic Resources and Oceans Management Program (AAROM) and partially funded by EC using IPY resources. Designed to meet the specific needs of local participants, EC staff provided customized and complimentary in-class and field training sessions on each of the three days. Classroom based training activities were delivered at the Kakisa Lake band council office and three unique field training sites were selected for hands-on demonstration and training purposes. Instructors and participants were initially welcomed by Chief Lloyd Chicot with opening remarks from George Low, the Dehcho AAROM program coordinator. The CABIN training was led by Nancy Glozier and Sarah Hall with additional support provided from EC's Yellowknife biologists Kerry Pippy and Annie Levasseur. Recently certified John Blyth from Aurora College as well as AAROM technician Mike Low, were also available to provide assistance to participants and gain their own training experience. All staff and learners were given on-site accommodations and catering, supported by the Dehcho First

Nations, which further supported the successful delivery of the content and facilitated the development of a strong rapport between instructors and participants. Furthermore, a small stream, Axe Handle Creek, was sampled at several locations upstream and downstream of a disturbance and the data gathered will be used in future training courses as a locally relevant example of how CABIN biomonitoring can be used to assess water quality.

Key next steps include the developed of a face to face approach for the delivery of the first two CABIN modules including testing for content knowledge and field protocol, and development of local case study examples. This will be done in part by soliciting feedback from students, trainers, community members on the proposed approaches.

Wetland protocol development for CABIN

Emily McIvor, Environment Canada, emily.mcivor@ec.gc.ca
Co-authors: Alain Armellin and Denis Lacroix, Environment Canada

Emily has been working for EC in Saskatoon since 2005, has been involved in CABIN sampling for streams, CABIN training, development of CABIN models and wetland sampling for Alberta, Saskatchewan, Manitoba, NWT and Nunavut.

Wetlands are some of the most biologically productive ecosystems. They are a major source of aquatic biodiversity covering 1.2 million kilometres in Canada. They are a significant portion of our fresh water systems and as a result there is a need for protocol development to address the water quality and aquatic health of wetlands. Three wetland protocols within Environment Canada are currently in various stages of development. Pacific and Yukon began wetland sampling in the summer of 2010 and collected a total of 15 sites. Prairie and Northern began wetland sampling in 2008 in the prairie potholes region and has collected a total of 38 sites. Quebec began sampling wetlands in 2004 and has collected a total of 150 sites from the riverine wetlands along Lake Saint-Pierre. The results of these studies and the collaboration between the three regions will contribute to the goal of a general wetland protocol to be used in CABIN.

Presentation Session 4

Extending the Geographic Range of RCA Bioassessment Models: A pan-western model for western and northern Canada (a cautionary tale)

Trefor B. Reynoldson, GHOST Environmental Consulting Inc,
Co-authors: John L. Bailey, GHOST Environmental Consulting Inc., Robert C. Bailey, Cape Breton University, Leon Gaber, BC Ministry of Environment, Garry Scrimgeour, Parks Canada, and Adam Yates, Environment Canada

Trefor received his Ph.D. from the University of Lancaster, UK in 1983 and his M.Sc. in aquatic ecology from the University of Calgary in 1974. He was a Research Scientist at Environment Canada's National Water Research Institute from 1987 until his retirement in 2004. Prior to that, he worked for 10 years with Alberta Environment and for three years with the International Joint Commission. He is now a senior scientist at GHOST Environmental Consulting and an adjunct professor at Acadia University in Nova Scotia. His research is focused on using benthic macroinvertebrate communities in diagnostic environmental assessment, and the RCA that he formalized as the basis CABIN assessments. D.r Reynoldson's expertise lies in the application of multivariate analysis of macroinvertebrate data, and to linking community level effects to lower biological scales. He has also worked in developing numeric biological criteria.

The spatial application of a given RCA programme is generally determined by the programme's objectives and defined by drainage basin or political or environmental boundaries. However, the requirement for bioassessment is not restricted to those boundaries. While the application of RCA models is not recommended outside of the boundaries of the geographic area encompassed by the reference sites, it is reasonable to assume that a model could apply outside the area if environmental conditions are similar. In this study we attempted to describe the spatial extent of RCA model application. We assembled benthic macroinvertebrate sampling and habitat data from reference condition approach programs in the Fraser River and Skeena Regions in British Columbia, the Yukon River Basin in Yukon and Mackenzie River Basin in the Northwest Territories. Identical candidate predictors and methods were used to develop reference condition approach models and bioassessments for each of the four basins and a "pan-western Canada" model and bioassessment based on a consolidation of the data from all the basins. Test sites from each basin were evaluated using the basin model and the pan-western Canada model and the results compared. Our initial conclusion was that overall the pan-western Canadian bioassessment is concordant with the basin bioassessments 46% of the time. 11% of the sites were identified as different to reference when they were not (equivalent to Type 1 error) and 43% failed to detect a difference detected by the basin model. However, this analysis requires repeating as subsequently we were informed that the data from two basins were collected using different laboratory methods. Therefore, the conclusions from this analysis cannot be supported at this time and the study will be repeated using data currently in preparation from the Nahanni together with the Fraser and Yukon data sets. While we are confident that the study approach is valid, this does demonstrate the importance of following a standard set of protocols in programmes such as CABIN.

Development and testing of reference condition models for river biomonitoring: a case study in Atlantic Canada

Wendy Monk, University of New Brunswick, wmonk@unb.ca

Wendy received her Ph.D. from the Department of Geography, Loughborough University, UK, in 2006. Since graduating, she has worked as a postdoctoral fellow with different researchers at the Canadian Rivers Institute based at the University of New Brunswick. This autumn, she started a position as a Canadian Government Laboratory Visiting Fellow with Environment Canada working with Dr. Donald Baird exploring large-scale ecohydrological patterns and biomonitoring issues.

In Canada, reference condition models developed at the regional scale are commonly used to assess of the ecological quality of rivers using benthic macroinvertebrate community structure. However, to date the development of a national scale model has been limited because of data paucity, geographical constraints and sample method inter-operability differences. In this project, we developed a novel approach to build scalable reference condition models, with potential large-scale applicability. To develop the model approach, we initially focused on biological data collected in rivers across Atlantic Canada paired with freely-available, nationally-consistent geographical information system (GIS) environmental data layers extracted at the watershed scale. A reference model was successfully developed using only GIS data as predictor variables. Results obtained were contrasted against a null model to avoid unnecessary development and implementation costs of model building. The developed reference condition model was successfully tested on a pilot dataset, although it performs similarly to the null model. Implications for future national-scale implementation of river biomonitoring are discussed in relation to the challenge of monitoring a large country with a significant proportion of remote areas.

Development of a Riverine Benthic Invertebrate Tool to Support the Definition of Hydroecological Management Guidelines: The Canadian Ecological Flow Index (CEFI)

David Armanini, University of New Brunswick, david.armanini@gmail.com

David obtained his Ph.D. at the Water Research Institute (Italy) in 2008 and has been working with Environment Canada at the Canadian Rivers Institute with Dr. Donald Baird, as part of the research team supporting the implementation of the CABIN program. He is now working at his own water consultancy, Prothea.

Anthropogenic pressure on flow regimes has been recognized as a leading threat to the health of Canadian river ecosystems and their protection requires guidelines based on sound science. To develop ecologically meaningful approaches for the management of riverine ecosystems the interaction between biota and flow variables is a critical step. However, this relationship is poorly understood and, as a consequence, over-simplistic hydrology-based guidelines for river management have been adopted without establishing clear indicators of their success or failure. Here, we support the improvement of guidelines for flow management by presenting a macroinvertebrate-based flow-sensitivity index for Canadian rivers. 2700 biological samples with associated

environmental variables were extracted from Environment Canada's Canadian Aquatic Biomonitoring Network (CABIN) database. In addition, a subset of biological data from British Columbia (BC) was associated with matching HYdrological DAta (HYDAT) stations. A Canadian Ecological Flow Index (CEFI) was developed based on current velocity preferences of common benthic invertebrate families. Tested in a multi-stressor environment, the index strongly responded to changes in hydraulic conditions. The index was further validated using two data sets from the west and east of Canada, indicating its potential nationwide applicability. By computing a set of Indicators of Hydrologic Alteration (IHA) metrics, the CEFI response to variation of main components of the hydrographs, expressed in terms of regime types, was highlighted for BC samples, testing the effectiveness of the index to reflect changes in complex flow regimes. In conclusion, we have developed a practical approach to evaluate relationships between hydrological regime and an important component of the river ecosystem measured in biomonitoring programs. This has facilitated the development of an index which has good potential as an indicator for the ecological effects of flow alteration. Moreover, we outline how the CEFI could be used as a tool for the development of holistic guidelines for the estimation of riverine flow needs.

Biomonitoring 2.0: CABIN of the future

Donald Baird, Environment Canada, djbaird@unb.ca,

Donald is a Research Scientist and a Research Professor at the University of New Brunswick. His research focuses on biodiversity assessment in freshwater ecosystems and environmental diagnostics. Donald was born in Scotland and became a Canadian citizen in 2010 to see the sun more often.

Canada's geographical remoteness is emphasized by its border-hugging population, and this is reflected in our limited knowledge of Canada's river ecosystems, which is constrained by sparse data and ephemeral monitoring networks. It is therefore no coincidence that Canada was the last G8 country to establish a national biomonitoring program for rivers, and faces an ongoing challenge to sustain it. The consequent challenge for scientists seeking to examine pattern and process in river ecosystems at a national scale is how to make the most of existing data, and how to leverage new technologies to do this, and to expand our knowledge, particularly in remote areas. Environment Canada is currently focused on harnessing the power of environmental genomics and Web 2.0/3.0 approaches as part of the future development of its national biomonitoring network. I will present examples of how these techniques are going to transform the way we do river science, improving our ability to protect river ecosystems under threat.

Discussion Topics

Database Functionality

Presented Questions:
What problems are users currently experiencing entering and exporting data?
How could the CABIN database be made more user friendly?
Do you have ideas for improving the communication of problems and concerns between the database users and the technical administrators?

Approximately 20 people participated in the *Database Functionality Discussion Session*, and the topics identified for discussion involved future changes to the CABIN database, bulk upload tools, data accessibility, communication among users and user priorities. Other items identified but not discussed included integration with GIS information, other related monitoring data, linkages to other databases, specialized field forms, and specific issues or errors.

Resources

Environment Canada has been aware, for sometime, of issues with the database that require attention. However, resource limitations have resulted in falling behind. Environment Canada's current list of actions will require 2.5 person years to get caught up. Currently, EC has one person in Atlantic region dedicated nearly 100% to updating the current layouts to the new government look and feel. This work will not be apparent to the user until it is finally launched sometime in 2011. This process will also allow the opportunity to do new site testing and fix any database issues. Environment Canada has also hired someone to primarily work on a bulk upload tool. This person will also work one day per week on minor issues and fixes.

Bulk Upload

Most of the people in the discussion group expressed an interest in participating in testing or commenting on the bulk upload template which would allow users to upload a large amount of data rather than manually entering each parameter. A distribution list of emails was compiled from this group to correspond during this process. This tool will allow users to upload habitat information into the CABIN database. Chemical and GIS variables are the highest priority with some ideas towards taxonomy which would involve consistency with Integrated Taxonomic Information System (ITIS) coding. The water chemistry data storage should now include detection limits. The template will have to be followed very closely as no unit converter is expected to be built in. The bulk upload tool will not overwrite existing data in the CABIN database. There was also a request for users to create their own habitat variables in the CABIN database. Other users expressed concerns about the redundancy of information with different habitat variable names. Currently, Tim Pascoe will enter new habitat variable as they are required/requested.

Communication among users

There was some concern about the resources required to implement and maintain an online discussion forum but use of a public listServ may be possible. The alternative may

be to implement a bug tracking system in the CABIN database where issues can be posted and users can see what is being resolved, the priority sequence and the expected timeline. This may also require a modification of the structure of the "news" section in the CABIN database. Also, an automated communication system was suggested which would send an email when maintenance or changes to the database would occur. This would allow us to be more proactive with communication. Users could unsubscribe to this if they wish. Users also expressed an interest in seeing the current "to do list" to determine if user priorities are aligned with what the EC CABIN team viewed as priorities.

Data Accessibility

The data export functionality is clunky and is on the priority list for redesign. This would allow data users to access the data that they are interested in and export the data in a useful way. Non-CABIN users only have access to metadata through CABIN which includes what parameters were collected, how often a sample was taken, what study it was from etc. The discussion of metadata is an important one but was not expanded on in this group. Actual data must be requested from the project authority, underlining the importance of identifying any change in the project authority to the regional CABIN leads. Spatial visualization of the CABIN data also requires substantial upgrade to take advantage of modern spatial tools. Some users expressed the desire to have GIS tools linked with CABIN such that with the submission of global positioning system (GPS) coordinates the upstream drainage basin could be delineated and the appropriate layers could be applied to acquire necessary site specific data. Currently this process can't be efficiently and accurately automated and is computing intensive therefore users will have to arrange the GIS analysis for their data.

Field Protocols

Presented Questions:
According to you what are the three main challenges or problems we should be solving?
Are the difficulties with the aspects of the standard CABIN protocol for wadeable streams?
Do we need new/updated protocols? If yes, for what purpose?

Over 20 people participated in the *Field Protocols Discussion Session.* Topics identified for discussion included the sampling of different stream types (i.e., non-wadeable, fragmented, or variable flow regimes), sampling in urban stream environments and selecting a sample reach within a sampling site. Sampling in critical or highly sensitive stream habitats and the cross-contamination between stream sites was discussed briefly.

Sampling in non-wadeable streams (i.e., large river systems)
Presently data for large river sites (both in terms of width and depth) are included in the CABIN database and sampled using a 'side shot' application of the CABIN field protocol. This technique involves the kick net sampler wading away from the stream bank either until the three minute kick period is complete or it is not possible to wade further (due to depth and flow conditions). It is often the case that a full bank-to-bank coverage of aquatic habitat is not achieved.

Information which distinguishes the 'side shot' sampling technique from sampling which takes place in smaller stream systems is not presently recorded in the CABIN database. Further information in terms of a clearer definition of 'non-wadeable' streams (e.g., is the river shallow and wide or deep and wide) would also be useful in the database. It would be possible to determine and distinguish sites presently within the CABIN database where 'site-shot' sampling was undertaken as the information likely rests with the project managers. It should be noted that large river systems are not considered wadeable streams in other Yukon CABIN type sampling. It was discussed and agreed to that large rivers should be distinguished from wadeable streams in the database so data users outside of the given project are aware of the modification in the sampling technique.

Until it is determined that the scale of a three minute kick net sample is appropriate in larger river situations this issue should be tagged for research. There is concern regarding the representativeness of the collected samples in larger rivers using the side-shot technique in relation to the habitat characteristics defined as characteristic of the reach (equal to six times bankfull width). In other words should the sampling effort be proportional to the scale of the site?

Sampling fragmented stream systems (i.e., braided river systems)
The sampling of fragmented stream systems (i.e., braided river systems) was the second discussion topic brought forward. Generally these systems have been treated as large river systems. Two techniques have been used to sample these river systems. The first technique integrates sampling across multiple braids whereby sampling is stratified by time across the number of channels present. In the second technique, sampling is focused on the main channel. This approach was applied to sites which were visited on a regular

basis because samplers were more familiar with the tendency of the flow path of the given system.

As with the large rivers, the most appropriate and standard sampling technique should be determined (i.e., should the sampling effort be integrated across the number of channels present?).

How do we sample ephemeral streams or stream with variable flow?
Conducting CABIN sampling in ephemeral streams was also discussed as this can be an issue in certain regions where the late summer early fall for reference models also coincides with intermittent flow in some streams. Presently such sites are recorded as ephemeral streams in mountain systems in the Yukon. In northern BC, ephemeral streams in flood plain environments are also encountered and temperature loggers have been distributed to have a better understanding prevailing pre-sampling conditions, as well as annual patterns. Situations where there is hydro-peaking or daily/weekly variation in the water levels was also raised.

Sampling in urban river environments
Several CABIN users presented the issue of sampling in urban or highly modified stream environments. Generally, carrying out the CABIN sampling protocol in these environments is often very difficult due to substrate types and channelization. Questions also arose in regard to identifying a representative reach in a highly modified system. Often there is a desire to track recovery due to remediation efforts in these systems. In these situations, it was recommended to consider the objectives of the monitoring program and select stream reaches accordingly.

Selecting a sample reach
Each of the above discussion topics closely relates to the issue of selecting a representative sample reach within a site. It was discussed that within the CABIN field manual selecting a sample reach and what area to sample within it for the kick sample was vaguely defined. A more prescriptive reach selection process with clearer guidelines could be added to the Manual to help address some of the issues presented above. Presently this step is left open for interpretation and may lead to discrepancies between samplers or sites if they don't already exist.

Sampling critical or highly sensitive habitats
Concerns were raised about the issue of sampling fragile, highly sensitive habitats or critical habitats for species at risk. This was particularly a concern for wetland habitats, although also for riverine habitats such as headwater streams and springs. There is a need to develop guidance for the application of CABIN methods in this important context, ensuring that sampling is minimally invasive, and that such habitats are adequately protected from potentially destructive sampling procedures.

Cross-contamination between stream sites
The usefulness and need for information regarding cross-contamination of invasive organisms (e.g. *Didymosphaenia geminata*) between stream sites was raised in general

field protocol discussions. This information is presently discussed in many of the CABIN field training sessions, however is not presently in the field manual. Options for providing this information will be discussed by the National CABIN Team, including revising the field manual and/or providing adequate linkages through the CABIN website.

User Engagement and Communication

Presented Questions:
How can users best engage others who may be valuable contributors to the CABIN Network?
How can users best exchange CABIN related information with Environment Canada and among CABIN users?
How can network collaboration be enhanced?

Approximately 15 people participated in the *User Engagement and Communication Discussion Session*. Due to the size of Canada, the CABIN website is a very important venue for communicating across the country. Users are interested in transferring knowledge and experiences but there is also a need for engaging new users.

Case Studies

Case studies could be a valuable way to communicate how CABIN is used in assessment and decision making across the country. It could illustrate how programs have transitioned from one biomonitoring approach to another or how it was used or could be used in environmental regulations/legislation. Currently BC is the only place where CABIN can be applied to legislation and the case studies here can be an important communication tool across the country. It would also be beneficial for showing "what's in it for me?" for potential users. A reference section to identify CABIN related reports would also be beneficial for users.

Communication Steering Group

If there was a Communication Steering Group of multiple users, this might help to develop and push for stronger national communication among users. There are a lot of EC and provincial CABIN users but how do we reach out to other organizations and governments to create partnerships? As more reference models are developed, there should be more interest as there is an established baseline. Engagement may require regionally based strategies to address the different needs or key players. The newly developed Science Advisory Group should also help to better communicate across Canada. They could work with the steering committee to communicate CABIN advancement and directions.

CABIN Ambassadors

One of the important points raised is how do we reach key players which are not aware or involved in CABIN but could benefit from it. To address this some users could act as CABIN ambassadors and spread the word about the benefits of CABIN. For example, there is widespread use of CABIN in BC due to the dedication and commitment of staff from BC Ministry of Environment, which are distributed in many regions of the province. This may be most effective by focusing on existing networks and associations. There was a definite absence of industry at the Science Forum and this is an area where engagement should be focused. An effort should be made to attend and present at industry focused meetings.

Communication Tools

Perhaps we need to expand the email distribution lists to non-registered users and create an online discussion forum. The development of quarterly newsletters to people who don't access the CABIN database may help inform on relevant activities, such as on-going research, model development, applications of CABIN, changes in protocols, meetings/courses and publications, and to develop other partnerships. This was the first National CABIN Science Forum and the attendance was very good. It was suggested that at a national scale it may only be possible every couple years but annual regional forums may help to increase awareness and develop more partnership. Future forums could be co-hosted by EC and other partners. CABIN technical reports, metadata and RCA model documentation are also important tools for communicating the benefits of CABIN. A listing of which users are working in which watersheds was also suggested to better coordinate activities or find opportunities to better collaborate. Another communication challenge raised was how to reach potential users who have little or no access to electronic information.

Analytical Tools Functionality

Presented Questions:
Are the data analysis tools currently available in CABIN useful?
What improvements to the current data analysis tools would you like to see?

Approximately 20 people participated in the *Analytical Tools Functionality Discussion Session*, and the topics identified for discussion involved metrics and reference group means, River Invertebrate Prediction and Classification System (RIVPACS) outputs, probability ellipses, graphics, assessing multiple test sites, other analytical tool or quantitative tests. Model building issues were specifically not discussed, as only a small subset of people have the experience and knowledge to contribute to this discussion, while many users have access to the tools. Therefore, we focused on the functionality of the analytical tools rather than the construction of them.

Analytical Projects

It is not obvious based on the layout of the Project front page what the purpose of the analytical project is. This layout is being redesigned so that an analysis project specifically for metrics alone (no reference model) is different than an analysis project containing BEAST analysis which does require a reference model. These will be more clearly delineated.

Metrics

Currently the metrics for reference sites can not be calculated and this needs to be fixed; whether it is just for a simple metrics project or whether it is for a BEAST project. The BEAST project statistical reference means must also be for the predicted group of reference sites, not the entire reference assemblage. It is not sufficient to simply acquire a dataset with calculated metrics for a particular reference model because models may change and minor adjustments may be made to the calculators. Therefore the calculations for reference sites must be updated on a regular schedule within the CABIN database.

For many years not all metrics were available for calculation even though they were displayed in CABIN. This was due to the lack of resources to properly test and validate the results. The ability to accurately calculate metrics at different levels of taxonomic resolutions needs to be validated as well. With the assistance of users with parallel datasets, this may be accomplished more quickly. The export feature for metrics results also needs to be made more user friendly.

The number of metrics submitted for calculation at one time was restricted to 5 to prevent load issues on the server. It is unlikely that colliding attempts and load issues are a problem now; therefore all metrics should be able to be submitted for calculation. All metrics are required when trying to do initial calibration for a BIBI approach.

RIVAPCS

Currently there are inconsistencies in the way the RIVAPCS results are presented. In the Analytical Tools Project they are reported simply as Observed:Expected (O:E) ratios and

the probability of occurrence for each taxon is not available. However, in the reporting tools this is available but the O:E ratios are not. These inconsistencies will be fixed so that all results are available whether you are viewing results in the analytical tools project or creating a report.

Probability ellipses

There has always been some discussion about the appropriateness of the confidence ellipses depending on the purpose of the work. There was a request to allow users to adjust the ellipses. However it is recognized that this can be somewhat dangerous if users are not fully aware of the significance of that change. Several suggestions were made to allow both the standard ellipses and user defined ellipses. One was to watermark the standard CABIN ellipses on any graph, another was to allow only specific permissions to specific users who demonstrated knowledge of the consequences, and another was to have specified ellipses for each reference model. All of these suggestions will likely be presented to the newly formed CABIN Science Advisory Group before any changes are made.

Graphics

The graphics/graphs within the CABIN analytical tools are unattractive. We have asked users to send examples of what they would like to visualize so these graphs can also be updated.

Resources for models and background statistics

The intention is to provide references to published papers or reports for reference models used by CABIN's Analytical Tools. However, not all models will have a formalized report or published paper such as model updates. Within the website, we would like to provide a basic and standard document for all reference models that has all the necessary information for users to understand what went into building the model.

Other users requested a primer on statistics, a glossary or FAQs as the time between taking the online training modules and using the CABIN tools may be significant. As all of these materials are available in the training modules (Module 4 and Module 5) and completing these modules is required before a user has access to the analytical tools, it was recommended that all participants save their training materials for reference later. We recognize that the modules have evolved since their inception in 2007 so we would make the current module content available for past participants who require access to the analytical tools.

Research & Future Directions

Presented Questions:
What additional information or knowledge would you need to do a CABIN assessment?
Are there new techniques that you know and want to share that could work with CABIN protocols/data?
What science priority would you suggest?

Close to 30 people participated in the *Research & Future Directions Discussion Session*. Topics identified for discussion as part of the session included ecosystem health and ecosystem process indicators, ecological end point comparisons, moving beyond providing information on ecosystem health to recommending actions for particular deviations from reference, temporal variability of reference models, optimal spatial scale and extent of reference models. Additional discussion also centered on how reference sites are defined and selected, data mining from the CABIN database and sampling in specific habitats or regions including lake sampling, and oil sands impacted environments.

Ecosystem health and ecosystem process indicators
Generally, interest was expressed in terms of going beyond the use of benthic macroinvertebrates in describing the river to examining other ecosystem measures. For example metabolism is widely used in other areas, such as New Zealand and Australia and is associated with low sampling (processing) cost, but high upfront infrastructure costs. Functional traits of the stream environment (benthic macroinvertebrates) are also important to capture, but not necessarily apparent in the current CABIN approach – they are not presently stored and available in the CABIN database. Species optima information was additionally pointed out for inclusion in the database and would improve diagnostic ability.

Ecological end point comparisons, exploring new and existing indicators
Another research issue discussed was on reviewing the present indicators used to monitor aquatic ecosystem health in Canada and comparing the information gathered. This information could be useful in evaluating whether a given indicator provides sufficient added value for additional efforts (e.g., DNA identification or lower taxonomic identification levels).

Move beyond providing information on ecosystem health to recommending actions for particular deviations from reference
The interest and need to investigate more into cause-effect scenarios for water quality condition was raised. Research could focus on taking the observed benthic community data to a new level of explanation by identifying cause of change. Further information on response patterns to stressors would assist in these evaluations.

An additional step in this analysis would be to provide information on which steps are necessary to remediate or move a site towards reference condition (according to RCA assessments).

Temporal variability of reference models (stochastic variability versus long term trends in temporal change)
The issue of temporal variability in reference models was also presented during this discussion. Presently a sub-set of reference sites are sampled on an on-going basis in order to evaluate temporal variability, however this data needs to be evaluated and results communicated.

For larger scale temporal variability (i.e., climate change) it should be determined if we have been gathering adequate information to investigate this question, and if not, what information is needed. An adequate long-term network needs to be defined to track climate change.

Optimal spatial scale and extent of reference models
Participants raised the question of how many models do we need in Canada for bioassessment purposes and what is the transferability of models across basins. This is presently an area of active research. Issues regarding larger scale models, which incorporate data from multiple models or basins, need to be resolved before full conclusions can be made. These issues include the accuracy of reference sites, methods used to select these sites and data comparability.

How reference sites are defined and selected
It was generally agreed that formally addressing the selection of reference sites will help to limit or remove some of the subjectivity that presently exists. Reviewing current research to formalize a more standardized approach will help to resolve situations where multiple parties or individuals are selecting reference sites for a given model.

Once a process has been formalized, reviewing an existing model with new reference site selection criteria may be useful in evaluating its application.

Data mining within the existing CABIN database
Caution was expressed when data mining the CABIN database. At times, it has been challenging to find a cohesive large scale dataset due to differences in sampling approaches, the availability of long term data and the general ‘patchiness’ of information which presently exists between studies.

Lakes (outside of the Great Lakes)
Generally it was expressed that the long term monitoring of lake systems is more problematic because of the variation between lakes and the difficulty in setting standards which have wide application. Lakes are presently included as part of the CABIN program, primarily sampled in the littoral zone and specifically in the Great Lakes.

Interest was expressed in addressing the application of the RCA for open water systems (using phytoplankton and zooplankton) as a large amount of data presently exists for lakes in coastal British Columbia, through work completed by the BC Ministry of Environment.

Oil Sands Impacted Environments
It was discussed briefly that the Regional Aquatics Monitoring Program (RAMP) biomonitoring program is very different from the CABIN program, and currently its benthic macroinvertebrate data are not usable for CABIN reference condition models. Environment Canada monitoring, in terms of a large-scale coordinated monitoring effort, has been fairly limited in this region, however is being reviewed at present.

Fish and benthic macroinvertebrate linkages
Some discussion occurred regarding marine derived nutrients and whether this information could be incorporated in the present CABIN sampling protocol or assessment for future needs. It was also suggested that fish presence information and trophic linkages be included.

Information regarding both fish and benthic macroinvertebrates may together give a broader picture of ecological flow needs.

Community Groups and CABIN
Finally, it was suggested by community group members that methods to better integrate community groups into the CABIN program in terms of the information they gather and potential future information to be gathered would be beneficial.

Quality Assurance and Quality Control Protocols

Presented Questions:
How do you consider uncertainties about data and measurement?
Would a data quality flag help you in deciding what shared data you would and wouldn't use?
If so, what would this flag look like?
Would a field auditing protocol be something that should be developed that all CABIN users should adhere to?

Approximately 15 people attended the *Quality Assurance and Quality Control Discussion Session*. The collection of data by different groups, field protocols, taxonomic data, taxonomists, and data entry were points of discussion for QA/QC. Quality assurance and quality control of the reference models or the test sites assessments was not addressed in the discussion group. It was identified that QA/QC generally needs more emphasis in each online training module.

Data Collection

Training is an important part of the CABIN program for the accreditation of all data collectors, including citizen scientists. In many agencies, but particularly citizen groups, there is a high turnover rate and, thus a need for frequent training. In addition, a field auditing process should be implemented to ensure that once they have left the training course they are collecting data consistently with others. Should there be an expiry date for training as there is for other certifications? If so, perhaps an online refresher course could be provided to renew certification.

There were questions about replications to verify the variability of the sample collection. Under CABIN protocol sample replicates can be collected for water chemistry but multiple kick samples at the same site are not true replicates and it is not clear if 'replicate kicks' would reflect the variability in the person sampling or the variability of the reach. In RCA replicates are at the scale of the stream and not the unit of the kick sample.

Taxonomy

Environment Canada does not provide training for taxonomy, it has relied on the North American Benthological Society (NABS) Certification Program. There is a lot of potential identification error for taxonomists at the genus/species level as well as immature and partial specimens. Is NABS certification enough? Is there national consistency in taxonomic data? There is inherent variability in taxonomist observation. There are also errors in subsampling, which likely creates the most significant errors in quantifying assemblages compared to taxonomic identification and sorting efficiency. Further guidance or requirements may be needed to ensure consistency and accuracy in sub-sampling. Often there is a need to tailor the level of taxonomic resolution depending on expertise and resources but if the CABIN protocol isn't followed then it is difficult to make any taxonomic comparisons.

Study design
There is limited monitoring guidance for sample design. The best way to allocate funding and resources depends on the question asked. Should we sample for 5 years and then assume habitat conditions are good and move to another stream? Is there a recent change that requires an increased sampling effort? Other factors such as hydrology should be looked at.

Data Entry
There are many people across Canada entering data and there are many upload errors from many different sources. The website has some measures to assess if data is entered correctly but some form of data entry QA/QC process should be implemented. Perhaps periodic internal audits would be helpful to locate errors and error rates by having a 3rd party check the data.

Non-conformance flags
Different lab methods have different error ranges and detection limits, which aren't reflected in the CABIN database. An accredited lab will be performing QA/QC of their analyses but there are other sources of error that wouldn't be detected by the lab (e.g., mislabelled of bottles, sample collection and storage). Common practices for assessing the quality of water chemistry data should be adopted. Deviation from the CABIN protocol at any level should be flagged.

Taxonomist communication and collaboration
It was suggested that the CABIN program could start a taxonomy steering committee or tie into existing national or North American taxonomic organizations to expand taxonomic communication and collaboration. For example, there is a taxonomic group in the US (the Northwest Assessment Group) and workshops are held annually.

A good idea may be to send out a 'round-robin' sample for everyone to identify but such a method may be difficult as the more samples are handled the more damage is done to the organisms. This might help determine discrepancies and serve as proficiency testing for taxonomists. This could be applied not just to CABIN taxonomy, but to EEM and other biomonitoring programs.

Taxonomists expressed an interest in communicating with the National CABIN Taxonomy Lab for issues such as QA/QC.

List of Participants

Name	*Affiliation*	*Name*	*Affiliation*
David Armanini	*Environment Canada, Canadian Rivers Institute*	**Nigel Fisher**	*Amec Earth & Environmental*
Alain Armellin	*Environment Canada*	**Jody Frenette**	*BC Ministry of Environment*
Robert Bailey	*Cape Breton University,*	**Liz Freyman**	*BC Ministry of Environment*
John L. Bailey	*GHOST - Environmental Consulting Inc.*	**Leon Gaber**	*BC Ministry of Environment*
Donald Baird	*Environment Canada*	**Carol Gilchrist**	*Banff National Park*
Rosie Barlak	*BC Ministry of Environment*	**Ginger Gill**	*North/South Consultants Inc.*
Shanoon Bennett	*Slocan Streamkeepers*	**Deborah Glanville**	*Environment Canada*
Jean-Francois Bibeault	*Environment Canada*	**Nancy Glozier**	*Environment Canada*
Janice Boyd	*Environment Canada*	**Robert Grace**	*BC Ministry of Environment*
Sarah Boyle	*Parks Canada*	**Kristie Heard**	*Environment Canada*
Joy Bruno	*Environment Canada*	**Judy Hillaby**	*Fisheries and Oceans Canada*
Kyla Brake	*Government of Newfoundland and Labrador*	**Tim Howay**	*Culex Environmental Ltd*
Alain Caissie	*Fundy National Park*	**Shelley Humphries**	*Parks Canada*
Lesley Carter	*Environment Canada*	**Martin Jean**	*Environment Canada*
Philip Chau	*Environment Canada*	**Vic Jensen**	*BC Ministry of Environment*
Krista Chin	*Rescan*	**Herb Klassen**	*Fisheries and Oceans Canada*
Joseph Culp	*Environment Canada*	**Denis Lacroix**	*Environment Canada*

Name	*Affiliation*	*Name*	*Affiliation*
Rachel Darvill	*Water Quality Monitoring Network*	**Lisa Larson**	*Parks Canada*
John Deniseger	*BC Ministry of Environment*	**Pippi Lawn**	*Parks Canada*
Scott Denkers	*Hope Mountain Centre for Outdoor Learning*	**Heather Leschied**	*Wildsight*
Mélanie Desrosiers	*CEAEQ*	**Marie-Annie Levasseur**	*Environment Canada*
Tarik Dessouki	*BC Ministry of Environment*	**Patrick Lilley**	*Raincoast Applied Ecology*
Pier van Dishoeck	*Amec Earth & Environmental*	**Heather Lord**	*British Columbia Conservation Foundation*
Thibault Doix	*Living Streams Environmental Services*	**Nathalie Lowry**	*Fisheries and Oceans Canada*
Danusia Dolecki	*University of British Columbia*	**Jennifer Macdonald**	*Environment Canada*
Anita Doucet	*Les ami(e)s de la kouchibouguacis*	**Jason Macnair**	*Living Resources Environmental*
AJ Downie	*BC Ministry of Environment*	**Heather McDermott**	*Public Works and Government Services*
Jim Duncan	*Columbia Basin Water Quality Monitoring Project*	**Shanda McGraw**	*EcoAnalysts Inc.*
Laura Duncan	*Columbia Basin Water Quality Monitoring Project*	**Emily McIvor**	*Environment Canada*
Mia Edbrooke	*Environment Canada*	**Scott McMahon**	*Culex Environmental Ltd*
Deborah Epps	*BC Ministry of Environment*	**Beverly McNaughton**	*Environment Canada*
Vincent Mercier	*Environment Canada*	**Caroline Savage**	*Environment Canada*
Lindsay Merkel	*SMVRRA*	**Allison Schein**	*Canadian Rivers Institute*
Astrid Michels	*Environmental Sciences Group*	**Garry Scrimgeour**	*Parks Canada*
Nathan Millar	*Yukon Government, Environment*	**Shawn Seguin**	*Golder Associates Ltd.*
Heather Mitchell	*Columbia Basin Trust*	**Patrick Shaw**	*Environment Canada*

Name	*Affiliation*	*Name*	*Affiliation*
Wendy Monk	*Environment Canada, Canadian Rivers Institute*	**Jen Sheppard**	*Culex Environmental Ltd*
Carrie Morita	*BC Ministry of Environment*	**Andy Smith**	*National Defence*
Mike Nelson	*Cascade Environmental Resource Group Ltd.*	**Todd Smith**	*Environment Canada*
Karen Nickurak	*Columbia Basin Trust*	**Michael Sokal**	*BC Ministry of Environment*
Ann-Marie Norris	*Golder Associates Ltd.*	**Keith Somers**	*Ontario Ministry of the Environment*
Simon Norris	*Hillcrest Geographics*	**Danny St. Hilaire**	*BC Ministry of Environment*
Nicole Obee	*BC Ministry of Environment*	**Sara Stallard**	*Fish-Kissing Weasels Environmental*
Chantal Ouimet	*Parks Canada Agency*	**Stephanie Strachan**	*Environment Canada*
Sheena Pappas	*Environment Canada*	**Donna Strang**	*British Columbia Conservation Foundation*
Tim Pascoe	*Environment Canada*	**Joanne Sweeney**	*Government of Newfoundland and Labrador*
Lyne Pelletier	*Gouvernement du Québec*	**Jon Sweetman**	*Parks Canada*
Derek Petersen	*Parks Canada*	**Greg Tamblyn**	*BC Environment*
Chris Perrin	*Limnotek*	**Robert Thomson**	*Energy, Mines & Resources, Yukon Government*
Kerry Pippy	*Environment Canada*	**Derek Tripp**	*Fisheries Biologist*
May Quach	*AECOM*	**Kristen Vinke**	*University of Prince Edward Island*
Kirsty Quinlan	*Environmental Scientist*	**Pina Viola**	*Environment Canada*
Daniel Ramos-Espinoza	*InStream Fisheries Research Inc.*	**Jennie Wang**	*Environment Canada*
Pam Reece	*Rescan Environmental*	**Michael White**	*Laurentian University*

Name	*Affiliation*	*Name*	*Affiliation*
Laura Rempel	*Fisheries and Oceans Canada*	**Rob Wilson**	*Lake Simcoe Region Conservation Authority*
Trefor Reynoldson	*GHOST – Environmental Consulting Inc., Acadia University*	**Margaret Wright**	*Fisheries and Oceans Canada*
Agnes Richards	Environment Canada	**Cecilia Wong**	*Environment Canada*
Jeremy Roscoe	*BC Ministry of Environment*	**Isaac Wong**	*Environment Canada*
Andrea Ryan	*Environment Canada*	**Wanli Wu**	*Parks Canada*
Sue Salter	*Cordillera Consulting*	**Adam Yates**	*Environment Canada*
Chantal Sarrazin Delay	*Laurentian University*	**Jennifer Yeow**	*Slocan River Streamkeepers*
Jennifer Sarchuk	*AECOM*	**Norm Zirnhelt**	*Cariboo Environmental Quality Consulting Ltd.*

Note: Information for this list was based on that provided on registration forms. Several people participated in the webinar who did not register and therefore are not included in this list.

Appendix

Evaluation Summary

Nearly 150 individuals registered for the National CABIN Science Forum and the webinar. In the end, 133 people participated, 95 at the forum and 38 via webinar; 17 people who registered did not attend (3 forum, 14 webinar). We received evaluation forms from 54% of participants.

Evaluation Questions and Answers

General

Question - How did you hear about the Forum?
56% of attendees heard about the forum through the CABIN email distribution list.
28% heard about it from a colleague.
8% found out about the forum on the website.

Question - Are you currently a CABIN user?
72% of attendees were CABIN users.

Question - What was/were your main reason(s)/objective(s) for attending the Forum?
40% of attendees were interested in learning more about CABIN
18% were interested in networking with other users
9% were interested in the future directions

Presentation Sessions Day 1

Question - Did you find the presentations useful?
100% Yes; 0% No

Question - How would you rate the relevance of the topics discussed relative to your expectations?
49% Very relevant; 49% Relevant; 2% Not relevant

Question - Which presentations were most relevant to you?
14% CABIN of the Future
12% CABIN in National Parks
11% BIBI and CABIN comparison
10% Wetland protocol development
8% Extending the geographic range of RCA models
8% CABIN in the Yukon
11% all presentations

Question - Was the time for questions or comments adequate?
64% Yes; 34% No

Question - Were the quantity and variety of presentations appropriate?
87% Yes; 13% No

Comments
There was a preference expressed by a few participants for free flowing discussion and more time for detail in the presentations. As there were several pioneers and experts present, participants wanted to hear more from them during the Q&A periods. Concurrent sessions were suggested as a way to invite more speakers, have more time for presentations and focus on particular areas for particular users. However, the majority indicated that the allotted time was perfect and provided just enough information for participants to approach presenters during the breaks. Some participants acknowledged the trade-off between variety of presentations and depth of detail which could only be addressed by adding another day to the forum.

Discussion Group Session Day 2

Question - Which discussion Topics did you attend? (n=28 responses)
24% Field protocols
24% Future research
18% Database Functionality
16% Analytical Tools Functionality
9% QA/QC
9% User Engagement & Communication

Question - Did you find the discussion groups useful?
100% Yes; 0% No

Question - Was the length of the discussion group session appropriate?
89% Yes; 11% No

Comments
Some participants suggested that the discussion sessions were too short to create a dynamic discussion but understood the constraints while others thought the discussion sessions were too long. This is likely to be highly dependent on the topic and the participants in the groups. More afternoon discussions with only two concurrent sessions would have allowed the participants to contribute to more than two discussion groups. Some discussion groups were difficult due to the varied level of experience with CABIN so discussion groups based on different users was suggested.

Webinar Evaluation

Question - Were the instruction sent adequate to log in? (n=20 responses)
95% Yes; 5% No

Question - Did you have technical difficulties?
58% Yes; 42% No

Question - Was the teleconference option used if there were technical difficulties?
25% Yes; 0% No

Question - Was the webinar/teleconference audio and slide presentations clear and understandable from your remote location?
95% Yes; 5% No

Question - Did you participate in the question period through the webinar chat system?
25% Yes; 75% No

Question - Was this webinar format a satisfactory alternative to attending the forum in person?
95% Yes; 5% No

Comments
Audio in the beginning of the session and for the question periods was the most difficult but was improved as the sessions went on. Being able to see the speaker through video would have enhanced the experience by being able to see the visual cues if the speaker was using a laser pointer, for example.

Attending via webinar was very convenient and worthwhile and a great alternative. However, it does not allow for the networking component of such an event which is an important component.

Overall Impression

Question - Please rate your overall satisfactions with the facilities
69% Exceeded expectations; 27% Met expectations; 3% Did not meet expectations

Question - Did you think the use of a facilitator was effective?
91% Yes; 9% No

Question - Please rate your overall satisfaction with the CABIN Science Forum
63% Exceeded expectations; 37% Met expectations; 0% Did not meet expectations

Question - Please rate your overall satisfaction with the format of the Forum.
58% Exceeded expectations; 42% Met expectations; 0% Did not meet expectations

Question - Overall, based on your total experience at the conference, will you attend or recommend someone else attend a future forum?
100% Yes; 0% No

Question - What topics would you like to see addressed in the future?
40% Data interpretation and analysis
20% Case studies
16% Statistical power and modeling approaches
8% Management and decision making applications
8% GIS integration
8% More detail on field protocols

Comments
The format for the first CABIN Science Forum was good to get everyone up to speed and aware of what is going on. Perhaps in the future, fewer presentation or concurrent sessions with panel discussions may work well.

Several users expressed interest in participating in the implementation of future forums.

Several very positive testimonials were received for a variety of users expressing the value and effectiveness of the Forum for their existing program or the implementation of a biomonitoring program.

Several participants made reference to the announcement of the Science and Technical Advisory Group and their interest in advancements as a result. As well, the suggestion of a mulit-user steering committee was mentioned by a few participants to further advance the program.

Suggestions to rotate forums every couple of years around the country was common with several suggestions for the next one in the Atlantic provinces.