

# **Nearshore Marine Ecological Monitoring Workshop**

## **Proceedings of the First Workshop on Nearshore Marine Monitoring**

Bedford Institute of Oceanography, Halifax, NS –February 7<sup>th</sup> – February 9<sup>th</sup> 2006

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### **Disclaimer:**

This report describes the outcomes of the presentations and the collective breakout and plenary discussions at the Nearshore Marine Monitoring workshop. It does not necessarily reflect the views of any single organization or the members of the workshop planning committee.

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## **Executive Summary**

A number of groups and communities engaged in monitoring activities in nearshore marine environments across Canada have expressed concern that these activities lack coordination, accepted protocols and standards, and integration such as have benefited monitoring initiatives in terrestrial and freshwater environments. To address this concern, Environment Canada's Ecological Monitoring and Assessment Network (EMAN) Coordinating Office worked with the Department of Fisheries and Oceans, Parks Canada and non-governmental organization representatives to organise a national workshop on nearshore marine ecological monitoring. Between February 7-9 2006 over 170 representatives of community groups, NGOs, aboriginal groups, industry and other organisations from all coastal areas of Canada participated in a full agenda of invited presentations, plenary discussions, breakout sessions, and poster sessions at the Bedford Institute of Oceanography in Dartmouth, Nova Scotia. Objectives of the workshop were to:

- Improve communication among monitoring groups working on nearshore marine/estuarine ecosystems in the various coastal regions of Canada
- Improve understanding among participants of various nearshore marine monitoring approaches, protocols and their strengths and limitations
- Improve understanding among participants of the types of nearshore marine monitoring information that various decision-maker/coastal stewards are seeking
- Facilitate development of frameworks, best practices, tools and resources to ensure that nearshore monitoring is responsive to clear goals, data are scientifically valid, and results are broadly accessible
- Facilitate integration among community based monitoring groups and professional scientists in the nearshore marine community
- Develop consensus on a path forward to improve the coordination of nearshore marine monitoring and the comparability of information gathered

Over twenty papers and 35 posters were presented which described the information needs of decision-makers at various scales, possible indicators that could be monitored, best practices, metadata management issues and lessons learned. Participants had the opportunity to discuss the types of nearshore information they needed and common challenges faces by coastal monitoring organizations in delivering such information in plenary and small group breakout sessions. The following recommendations were offered to improve coordination of nearshore marine monitoring and the effectiveness of current monitoring programs:

### **1. Publication of a workshop report:**

Participants felt it important to capture the presentations, discussions and conclusions of the workshop in a document that could serve as a benchmark against which to measure progress and which could be shared broadly.

### **2. Prepare an inventory of ongoing monitoring programs**

The workshop and report began an inventory of nearshore marine monitoring initiatives throughout Canada. Participants felt it would be very useful to expand this inventory to be comprehensive and broadly available. The inventory would provide rapid access to sources of environmental information, would foster collaboration, and minimize duplication. The inventory could be web-based, geographically referenced and would provide metadata, meaning descriptions of the kind of information being collected, rather than providing the information itself.

### **3. Identification of data gaps**

Another important step identified throughout the workshop is the need to better define information gaps for coastal monitoring data. The preparation and maintenance of a

comprehensive inventory of monitoring programs would facilitate this analysis and could assist government agencies and other leaders in assigning monitoring priorities.

#### **4. Development of monitoring indicators and protocols**

It will be important to develop a suite of understandable indicators for tracking coastal ecosystem change and standard protocols for monitoring the nearshore marine environment. A tiered approach may be most appropriate, in which overall coastal health is addressed with one set of indicators, and other sets of indicators are used to address particular questions or concerns that may arise.

#### **5. Formation of a National Steering Committee**

To ensure delivery of the above recommendations, participants recommended the formation of a National Steering Committee which could lead actions to improve the coordination of nearshore marine monitoring. This committee could then also lead in the organization of regular nearshore marine monitoring workshops both regionally and nationally, as well as ensuring that decisions makers from all levels of government including First Nations, industry and non-governmental environmental organisations are represented. While broad representation will ultimately be required for this Committee, initially participants look to the EMAN office of Environment Canada for leadership in instituting the committee, preparing its Terms of Reference, and resourcing its initiatives. To this end an interim Steering Committee was constituted immediately following the workshop.

#### **6. Develop a Canadian model for nearshore monitoring**

Participants saw value in the Committee coordinating a review of international models for nearshore marine monitoring with the goal of developing a Canadian model for sustaining a coordinated nearshore monitoring network. This network might include the development of a web based forum or bulletin board for networking among monitoring practitioners.

#### **7. Provision of dedicated funding**

A recurrent issue raised throughout the workshop was the need to secure adequate and predictable funding to support coastal monitoring. This might proceed in two steps: 1) interim funding for existing programs (identified in the inventory proposed under recommendation #2); and, 2) appropriate, dedicated resourcing of a national monitoring network (described under recommendation #6).

#### **8. Prepare water quality standards for the neashore marine environment**

Workshop participants felt strongly that there is an urgent need to expand the Canadian Council of Ministers of the Environment (CCME) guidelines to marine waters. Such guidelines would facilitate identification of “hotspots” that could be prioritized on a regional and national basis.

## **Preface**

A Nearshore Marine Ecological Monitoring Workshop was held in Halifax from February 7<sup>th</sup> to February 9<sup>th</sup>, 2006 at the Bedford Institute of Oceanography, Halifax, Nova Scotia. It was organized in response to communication and collaboration needs expressed by groups and communities engaged in monitoring activities in nearshore marine environments across Canada.

A Steering Committee guided by Environment Canada's Ecological Monitoring and Assessment Network (EMAN) Coordinating Office in collaboration with the Department of Fisheries and Oceans, Parks Canada and non-governmental organization representatives designed a workshop that included a combination of invited presentations, plenary discussion, breakout sessions and poster sessions. In advance of the workshop, preliminary inventories of nearshore marine monitoring were conducted for the Pacific, Arctic and Atlantic coasts and presented within the workshop. Appendix A acknowledges those who have contributed to the implementation of the workshop.

Over 170 representatives from community groups, NGOs, government, aboriginal groups, industry and other organizations attended the session. Such an overwhelming response outlines the existing need for better communication and exchange among those involved in monitoring in nearshore environments.

Over twenty papers (Appendix B) and 35 posters (Appendix C) were presented by participants from the Pacific, Arctic and Atlantic coast lines of Canada and even from inland which described the information needs of decision-makers at various scales, possible indicators that could be monitored, best practices, metadata management issues and lessons learned. Participants had the opportunity to discuss the types of nearshore information they needed and common challenges faces by coastal monitoring organizations in delivering such information in plenary and small group breakout sessions. As well, they generated recommendations to improve coordination of nearshore marine monitoring and the effectiveness of current monitoring programs.

## **Workshop Rationale**

Informed decisions in support of a sustainable nearshore marine environment are predicated upon an excellent monitoring system capable of generating accessible, relevant data and timely reports on the status of and trends in nearshore marine ecosystems at various scales of resolution. Monitoring can be costly and the funds and capacity directed toward monitoring are often limited. Improving communication and coordination among monitoring agencies helps to maximize the investment into monitoring and increase its effectiveness by:

- Sharing protocols, tools, approaches and lessons learned so that monitoring organizations do not need to reinvent the wheel:
- Reducing duplication of effort: and,
- Generating consistent, comparable data which can be aggregated (or disaggregated) at various scales to allow for broader (or narrower) analysis of trends, among other benefits.

Monitoring agencies and organizations need to assume the responsibility of effectively communicating their monitoring results to those who need it to manage adaptively and holistically. A greater understanding of the needs of decision-makers for monitoring information and tools for better delivering monitoring science are required.

### Objectives

This workshop was designed to facilitate collaboration and coordination among groups conducting monitoring in nearshore marine environments across Canada. The planning committee aimed to achieve the following results:

- Improved communication among monitoring groups working on nearshore marine/estuarine ecosystems in the various coastal regions of Canada
- Improved understanding among participants of various nearshore marine monitoring approaches, protocols and their strengths and limitations
- Improved understanding among participants of the types of nearshore marine monitoring information that various decision-maker/coastal stewards are seeking
- Frameworks, best practices, tools and resources to ensure nearshore monitoring is responsive to clear goals and scientifically valid are shared
- Increased integration among community based monitoring groups and professional scientists in the nearshore marine community
- A recommended path forward to improve the coordination of nearshore marine monitoring and the comparability of information.

### Scope

The workshop focused on monitoring in nearshore marine and estuarine environments as well as the intersection of community-based monitoring with scientific/professional monitoring. The workshop addressed offshore and land-based monitoring activities which are relevant to nearshore marine environment, but concentrated primarily on the nearshore marine environment itself. The workshop did not consider freshwater ecosystems upstream from estuaries.

## Key Definitions used in the workshop

Coastal areas: Areas within 60 km of the coast.

Community-based monitoring: A process where concerned citizens, government agencies, industry, academia, community groups and local institutions collaborate to monitor, track and respond to issues of common community concern.<sup>1</sup>

Decision-maker: Individuals or bodies whose choices have a key impact on a system. Decision-makers include resource managers, management boards, policy-makers, planners, scientists, industry, and citizens.

Ecosystem Health: A stable and sustainable system maintaining its organization and autonomy over time and its resilience to stress.<sup>2</sup>

Indicator: Variables whose purpose is to measure change in a given phenomenon or process.<sup>3</sup> They have three main functions: simplification, quantification and communication.<sup>4</sup>

Inventory / Survey : The systematic measuring of ecosystem attributes.<sup>5</sup> Generally, a survey refers to a one time initiative to gather baseline information. Repeated surveys of the same features over time to track change would be considered monitoring.

Marine Environmental Quality: MEQ is the condition of a particular marine environment measured in relation to each of its intended uses and functions.<sup>6</sup> It denotes historical recorded change in the condition, whereas marine environmental health is the present condition and the direction of change.

Monitoring: Monitoring is the regular observation, measuring and recording of key variables or specific phenomena. It is a process of routinely gathering information to measure, analyze and report on change.<sup>7</sup>

Nearshore: For the purposes of this workshop, the extent of the “nearshore” marine is defined as the geographic area which coastal community groups would be capable of monitoring. This includes monitoring conducted on the beach, in the intertidal zone, or using small rowboats or small motor boats.<sup>8</sup>

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<sup>1</sup> Improving Local Decision-Making through Community Based Monitoring: Toward a Canadian Community Monitoring Network. <http://www.ccmn.ca/english/library/ccmn.pdf>

<sup>2</sup> Costanza, R. (1992) Toward an operational definition of ecosystem health, in Ecosystem Health: New Goals for Environmental Management (Costanza, R., Norton, B.G. and Haskell, B.D., eds), pp. 239–256, Island Press.

<sup>3</sup> Kumar, Krishna. 1989. Indicators for Measuring Changes in Income, Food Availability and Consumption, and the Natural Resource Base. Vol. 12, AID Program Design and Evaluation Methodology Report. Washington, D.C.: Agency for International Development.

<sup>4</sup> Adriaanse, Albert. 1993. Environmental Policy Performance Indicators: A Study on the Development of Indicators for Environmental Policy in the Netherlands. The Hague: Sdu Uitgeverij Koninginnegracht.

<sup>5</sup> Dunster, Julian and Katherine. 1996. The Dictionary of Natural Resource Management. UBC Press.

<sup>6</sup> Wells, Peter. 2002. Assessing health of the Bay of Fundy – Concepts and Framework. Available from [http://www.gulfofmaine.org/nciw/bay\\_of\\_fundy.pdf](http://www.gulfofmaine.org/nciw/bay_of_fundy.pdf).

<sup>7</sup> Dunster, Julian and Katherine. 1996. The Dictionary of Natural Resource Management. UBC Press.

<sup>8</sup> Nearshore Marine Workshop Planning Committee. October 2005. Personnel communication.

## Introduction

Canada is a maritime nation. Eight out of ten provinces and all three territories border on at least one of three oceans: North Pacific, Arctic and North Atlantic. Canada has the longest coastline in the world, extending more than 243,792 km over 6 ½ time zones and 40 degrees of latitude, including islands.<sup>9</sup> Geologically and ecologically complex ecosystems along the coasts, such as estuaries and wetlands, connect inland freshwater systems to nearshore marine waters.

Approximately 7 million Canadians<sup>10</sup> (about 23% of the population) live in coastal areas. Populations on the Pacific coast are rapidly expanding; populations on the Atlantic and sparsely populated Arctic coasts are increasing more slowly and in some areas of the Atlantic coast, even declining. Ocean-based industries in Canada generate approximately \$20 billion in direct economic benefits.<sup>11</sup> However, the importance of the marine environment extends beyond economic value to a social and cultural significance for the people of Canada. For coastal residents of all cultural backgrounds, oceans are often an important source of food. There is an intimate link between the sustainable use of coastal resources, the health, productivity and biodiversity of the marine environment, and the health and well-being of coastal populations. For example, major changes in marine ecosystems, including the collapse of important groundfish stocks in the early 1990s, have had devastating effects on coastal communities in Atlantic Canada. At the same time, these impacts have raised awareness of the value and fragility of our marine living resources.

### Threats to the Nearshore Marine Environment in Canada

The major threats to the health, productivity and biodiversity of the marine environment result from human activities on land in coastal areas and further inland. It is widely accepted that some 80% of the pollution load in the oceans originates from land-based activities.<sup>12</sup> This includes municipal, industrial and agricultural wastes and runoff, as well as atmospheric deposition. These contaminants directly affect the most productive areas of the marine environment, including estuaries and nearshore coastal waters. The marine environment may also be threatened by physical alterations of the coastal zone, including alteration and destruction of habitats of vital importance.

### Shared responsibility

Municipal governments, industry, non-governmental organizations, communities, and individual Canadians are important partners in protecting the coastal and marine environment. Recognizing the value and contribution of community-based actions and stewardship programs, governments are working towards improving partnerships at the community level, building the capacity of these groups, and developing new, joint programs. Canadians are also taking it upon themselves to reduce their own impacts on the environment and share in the task of ensuring the sustainability of the coastal environment, as is witnessed by the growing number of environmental programs, best practices, and codes of conduct being initiated by communities, industry, non-governmental organizations, and the public.

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<sup>9</sup> "Facts about Canada: Coastline." ([atlas.gc.ca/english/facts/coastline.html](http://atlas.gc.ca/english/facts/coastline.html))

<sup>10</sup> "Ocean Facts." ([www.dfo-mpo.gc.ca/oceanscanada](http://www.dfo-mpo.gc.ca/oceanscanada))

<sup>11</sup> "Canada's Ocean Industries: Contributions to the Economy 1988-1998." Roger A. Stacey Consultants Ltd. March 2001.

<sup>12</sup> *The State of the Marine Environment*. Report #39. Joint Group of Experts on the Scientific Aspects of Marine Pollution, UNEP.1990.



## **Overview of Canadian Nearshore Marine Monitoring Activities**

Surveys of near-shore marine monitoring programs in each of the coastal zone were initiated in late fall, 2005. The objective was to gain an initial overview of current programs and related projects conducted by all sectors in the region – government, community groups, multi-partner, industry/private sector and universities. Contributors to the surveys are thanked for their information and for their ongoing interest in ensuring the vitality of near-shore monitoring programs. The inventories are by no means exhaustive and not all sectors are reflected in each of the inventories.

### Atlantic Region

Two hundred and twenty one survey requests/forms were sent across the region. In response, 45 surveys (~20%) describing monitoring programs circa 2005-06 were received by the time of the February 2006 workshop – 21/88 from Nova Scotia; 18/94 from New Brunswick; 1/6 from Prince Edward Island; and 4/26 from Newfoundland and Labrador. The replies came from government (22), community groups (14); industry (2); university (8); and others (1). Hence, the survey to February, 2006, reported at the workshop, is not yet completed. There are an unknown number of other ongoing programs.

Government programs include those conducted by Fisheries and Oceans (DFO), Environment Canada (EC), the Canadian Food Inspection Agency (CFIA), and Parks Canada, and those of various provincial agencies.

Programs under Fisheries and Oceans include: Atlantic Zonal Monitoring Program (AZMP); the Gulf of Maine Ocean Observing System (GoMOOS), with various partners; tidal monitoring by the Canadian Hydrographic Service; monitoring phytoplankton i.e. the harmful algal bloom program; Rockweed monitoring; organochlorine chemical monitoring; benthic macro-faunal change monitoring associated with aquaculture; and faunal monitoring within the DFO marine protected areas program.

The economically vital and long-standing (since 1948) Canadian Shellfish Sanitation Program is conducted jointly by DFO, EC and CFIA. EC monitors fecal coliform in overlay waters of shellfish harvesting areas in support of this program and CFIA monitors biotoxins in shellfish. DFO opens and closes areas based on recommendations from EC and CFIA

Environment Canada's other monitoring programs include: chemical contaminants disposal at sea site monitoring; studies under the National Program of Action, especially for the effects of fish processing plant effluents; national ambient air quality monitoring and at least 13 wildlife conservation monitoring programs under the Canadian Wildlife Service.

Parks Canada's Atlantic Coastal Monitoring Programs are particularly numerous at the seven Atlantic National Parks.

Provincially, Newfoundland and Labrador conducts at least 5 programs of near-shore monitoring. Data on other provincial programs is as yet incomplete in this survey.

At least seven community-led monitoring programs or sets of programs are also being conducted e.g. such as those through ACAP (Atlantic Coastal Action Program). Also of note are multi-partner programs such as those being conducted on Sable Island, NS, monitoring weather and climate; trace contaminants in air and water; vegetation; birds; oil on beached birds; plastics; and the population status of ponies and grey seals. Industry led programs include Atlantic salmon monitoring; near-shore monitoring associated with the Sable Offshore Energy Project; and pulp and paper EEM. Finally, there are various university-led research-monitoring programs, such as those from McGill, Cape Breton and Dalhousie universities, with graduate training and community volunteer components.

The survey indicated that nearshore monitoring activity across the Atlantic Provinces is considerable, with a wide range of indicators being measured. However, knowledge and research can be spatially patchy and old/outdated in many areas.

#### Quebec province

The inventory conducted in Quebec region was limited and scope Responses from 15 monitoring projects were received (14 still on going) at the time of the workshop. Monitoring appears to be in its early stages as 43% (6/14) have been in operation for less than 3 years. The most longstanding program was initiated in 1975 (but halted from 1985 to 2005). The remaining were started in the nineties.

Six of the programs are governmental (5 DFO, 1 Hydrographic Service), four are academic (universities) and four are lead by community groups. The programs cover a broad variety of issues and techniques from oceanographic data collection (3) to marine mammals sightseeing reporting (2). Coastal erosion (2), habitat health (2), invasive species & biodiversity (2), capelin spawning activities (1), contaminants effects (1) and larval recruitment (1) are also being monitored. The Canadian Shellfish Sanitation Program (CSSP) is implemented in Quebec. EC monitors fecal coliform in overlay waters of shellfish harvesting areas in support of CSSP.

#### Arctic region

Over 100 survey forms were distributed. At the time of the workshop, 22 monitoring initiatives had been reported. Many arctic projects are research oriented and have high-end expense, expertise, and logistics. There are relatively few true long-term monitoring projects. There were nine ongoing programs identified, mostly focused on toxic contaminants.

Federal government programs are widely predominant with the federal government as lead on 18 initiatives. Academic institutions were involved in 11 of the initiatives and acted as the lead agency on four initiatives. Only three programs indicated the involvement of local and Aboriginal people as partners. There are eight programs which have International involvement.

The listed the follows objectives for their monitoring programs:

- Establish baseline conditions (18 )
- Feeding local decision making (15 )
- Academic Research (12 )
- Survey / Inventory (10 )
- Reporting (indicator work) (10 )
- Scientific Assessment (10 )
- Industrial Development (7 )
- Mapping (6)
- Other (less than 5 programs): Advocacy, Education / Outreach, Capacity Building, Land Use decisions

Many of the studies have multiple objectives. The most common parameters under study are oceanographic properties (mainly temperature and salinity), primary & secondary production, contaminants-pollutants in air or water, ice and snow properties (thickness, ice draft/drift), ecosystem health and bird and nest inventories/census.

Several of the initiatives cross ecoregion boundaries. In terms of location, eight of the initiatives are in the High Arctic Archipelago, five are in Lancaster Sound, five are in the Baffin Bay-Davis

Strait, seven are in the Beaufort complex, four are in the Hudson Complex, three are in the Arctic Basin and two are in Labrador.

### Pacific region

The inventory conducted in the Pacific Region focused on community based monitoring or citizen science. There were 22 respondents to the survey. Fifteen of the initiatives were identified as on-going programs. Of the 22 initiatives, ten of the programs are lead by community groups or non-governmental organizations. Two of the initiatives are led by academic institutions. Seven are lead by governments or government led collaborations such as the Community Mapping Network. In addition, the Environment Canada works through aboriginal groups, consultants, non-governmental organizations and academia to implement the Canadian Shellfish Sanitation Program on the B.C. coast.

Many of the organizations made an effort to share their data. Nine organizations noted that they have an Internet accessible database or data on-line while five others share their data with the government or through the Community Mapping Network and most distribute data and/or reports. Two organizations store their data using in house electronic files.

The most common parameters under study were

- intertidal habitat and species (5)
- birds (seabirds, songbirds, nesting health) 5
- fecal coliform levels and bacterial source tracking (5)
- marine mammals (2)
- trace metals/toxicology (2)

Other monitored parameters were ling cod egg masses, storm drain water quality, tree health, Eelgrass distribution and productivity, wildlife, biodiversity and plant distribution.

Workshop participants noted that there is very little long term nearshore trend data in the Pacific region. Studies are typically short in duration, seldom repeated at the same location, often biased for certain species or habitats, and often utilised a sampling protocol having a limited objective.

### **Workshop Presentations: Lessons learned related to nearshore marine monitoring**

The workshop presentations revealed many lessons learned as to elements of successful and sustainable monitoring programs.

#### Funding

Securing long term funding for nearshore habitat & ecosystem monitoring is an on-going challenge. Government support for community based monitoring varies over time. This results in increased costs because of need for re-training and disjointed delivery. Local and regional funding sources need to be secured to ensure longer term investment by coastal communities. Collaboration and partnership can leverage these resources.

#### Monitoring goals and design

Society is generally more interested in monitoring for impacts on human health not ecosystem health. It is often easier to sell monitoring of an icon (shellfish) species than an intangible concept such as ecosystem integrity. It is important to note that monitoring has value in and of itself, beyond the data which it generates, as it builds capacity and fosters advocacy for environmental concerns. The scope of monitoring initiative or network needs to be clearly articulated.

### Data Sharing

Monitoring agencies want to share their data. The barriers to sharing data willing to share data are often staff time and the technical capacity to implement data sharing. There is a need for data sharing agreements to clarify data ownership.

### Traditional Ecological Knowledge (TEK) and Local Ecological Knowledge (LEK)

In many cases, TEK from First Nations is not being collected or provided. There are trust issues inhibiting TEK sharing. LEK is being collected haphazardly, however it is moving toward standardization. LEK can be delicate to interpret: it is imperative to access the appropriate help to make sense of the findings.

### Community-based Monitoring

Community-based monitoring carries a considerable number of strengths and opportunities such as:

- Access to high quality knowledge and the development of local expertise;
- The ability to get the job done, through cost effective, flexible programs. Often these can be more sustainable on the long-term;
- The ability to provide a quick response to data anomalies;
- The ability to and long-term sustainability of monitoring projects;
- The ability to act as an honest broker within the community and to generate local support;
- Ability to address true community issues
- The generation of credible results with a high level of accuracy when provided with the right protocols, tools and training;
- Establishment of local support and collaboration among community stakeholders;
- Creation of employment and economic opportunities; and
- The potential to catalyze cultural change.
- Monitoring without community involvement can be like take snap shots

However, conducting ecosystem tracking activities with communities also holds its challenges. Training, retraining and quality control/quality assurance measures are essential to ensure that the data is valid. Communities also need access to capacity support, protocols geared to their skill level and tools. There must be a heavy investment into information feedback loops and communication to maintain the interest and engagement of volunteers and stakeholders. It is often hard to balance the need for funders and/or the government for strategic monitoring while addressing the interests and concerns of the community to maintain engagement.

Community monitoring in the north holds unique challenges such as expense (labour and travel among other costs) the difficulty of translating simple measures into scientifically defensible results, and the difficulty of securing the time of knowledgeable community individuals and scientific experts, who are in high demand. Local languages must be respected. Translation of documents and use of local interpreters is often necessary.

### Indicators

Several important lessons regarding the development of monitoring indicators were described. The key lessons were:

- Establish a well thought-out framework for selecting indicators.
- Solicit input from experts, as well as other relevant stakeholders, for your indicator selection
- Select indicators which can be tracked within the boundaries of available resources, equipment and training.
- Key on easily-recognizable species and collect samples for experts to analyze. Simple indicators that are relevant to local communities and the broader public are much more likely to survive.

- Conduct complementary monitoring, if possible. Collect samples and data that fill in gaps (e.g., ice thickness to complement satellite imagery of ice coverage).

### Keys to success

The following elements have shown to be successful in implementing sustainable and successful nearshore marine monitoring programs.

- Avoid top down approaches; build participation from the bottom up monitoring programs
- Engage a broad spectrum of stakeholders early. Maintain strong partnerships and communication with stakeholders.
- Set clear and articulate program goal(s) in consultation with all partners.
- Ensure that indicators are scientifically valid, appropriate to detect desired spatial and temporal changes, provide an early warning of change, integrated, affordable to implement, and relevant to community members.
- Protocols along tiers of expertise and allowing community members to selecting their own monitoring sites encourage participation.
- *Acquire baseline data at the beginning of the program.*
- Training is essential, including classroom, hands-on field training, and computer data entry. Repeat training is often required due to volunteer turnover and for QA/QC.
- Provide communities with access to capacity support, standards and tools (QA/QC, data, etc.) and build quality control checks into the program.
- Volunteers need to know that data will be used
- Volunteer recognition is essential.
- Feedback /communication loops need to be in place, used and fostered. Ensure regular and meaningful communication of progress and results among scientists and the community.
- Identify a program champion within the community/ organisation
- Complete follow-up scientific inventories at regular intervals to measure the success of the monitoring program and evaluate change in the system you are investigating.
- Expand slowly. Get the basics working first.
- Keep on top of the data.

## **Plenary Discussion Summary Report**

A plenary discussion allowed the participants to discuss challenges and possible solutions for nearshore marine monitoring initiatives. Highlights of this discussion are described below.

### Leadership

It is unclear to all who is currently leading nearshore marine monitoring and where one can find support for carrying out a monitoring program. This support must include access to scientific support, protocols, data banks, equipment, funding and an information exchange platform.

### Monitoring at Community and National Scales

Questions were raised as to whether communities are doing the government's job. Issues of local community concern are often not the same as those of federal agencies. Community groups questioned whether the national agencies would be willing to support local programs if the focus of the local efforts were not of primary concern for Canadian leaders. The participants also noted the challenge of maintaining long term monitoring programs given changes in political leadership.

Participants voiced that locally relevant concerns need to be integrated into regional and national programs and guided by federal and provincial agencies. As well, the value of citizen involvement in monitoring should be acknowledged by senior leadership.

### Funding

Due to current lack of financing even within governments, the participants asked how communities and NGOs will be able to access consistent and sustainable funding sources. Monitoring is a long-term process but there appears to be no clear support or program from which to secure funds for a long term project. Finding funding recurrently requires a lot of work and time that could be dedicated to a better use.

Participants suggested that governments should be part of the funding solution, but we cannot expect them to be able to support all of it. Industry could be engaged through corporate volunteerism and donations. This would be a way for them to demonstrate that they support sustainable development. The onus is on individual citizens and local communities to go directly to politicians, industries and foundations to advocate for money to better support long term monitoring programs.

### Indicators and Protocols

The participants noted that there is a need for standardization and information sharing so that monitoring agencies do not reinvent the wheel and to ensure that the data collected are credible, comparable and useful for decision-makers. However, it is not clear who should be responsible for protocol creation and training. It is unclear which indicators should be monitored or who would help to bring together scientists and decision-makers. The idea of creating monitoring councils was proposed as a possible solution. Such councils exist in other countries and are effective for exchanging ideas, improving coordination and enhancing programs. Also, the creation of a network of groups engaged in monitoring was proposed.

### Equipment

Equipment issues were also mentioned. Monitoring sometimes requires the use of expensive equipment that can be difficult to operate and subject to deterioration. Expertise in their use and technical support for maintenance and calibration would be helpful.

### Communication

A preliminary library of who is doing what on what was started in the process of preparing this workshop. The participants urged the committee to keep the library alive and updated. There are still lots of gaps in the inventory but to fill them and make them accessible to all requires time, dedication and server space. Different possibilities exist, including the use of the Stewardship Canada portal.

Going further than providing a list of organizations engaged in monitoring, the library could be an access point for base maps from all provinces with accessible metadata about each monitoring initiative.

### Community

The participants suggested that engaging local communities in monitoring is the only long term viable solution to protect the resource. Getting citizens involved will help to facilitate behaviour change. Volunteer involvement, training and management needs to be supported. Challenges include securing community buy-in, volunteer recognition and avoiding volunteer burn out. Improving communication of monitoring efforts among the community is one step.

## **Breakout Session Summary Report**

Facilitator : Peter Eaton

Rapporteurs : M. Doyle and F. Hazel

Highlights of the breakout discussions are presented below. The concepts and ideas for which a considerable amount of consensus among the breakout groups was reached are described.

### **1. What is the aim of nearshore marine monitoring?**

The sustainability of coastal communities and cultures, access to sustainable resources and uses (sport, recreation, subsistence), the protection of ecosystem and human health were mentioned as general aims. However, specific aims and goals will have to be identified by the communities and stakeholders to face local issues and be monitored in a way which can be integrated in a broader scale.

### **2. What are the needs for Nearshore marine monitoring?**

#### Information needed by decision-makers to improve coastal stewardship

Baseline data was identified as very important. Others identified needs were mapping, inventories of coastal resources, trend information, information that can highlight connection between issues, cost benefit analysis and options.

#### Characteristics of monitoring programs which meet these needs

Attendees suggested that monitoring programs need to be well planned, consistent, simple, and cost effective and be implemented as a long term program.

#### What do nearshore marine monitoring organizations need to deliver such information?

It was no surprise that the breakout sessions flagged consistent funding as essential. The participants noted that without any strong and committed funding support, it is impossible to build and deliver a long-term monitoring program. Communication was also highlighted as a pressing need. Communication between and among NGOs, governments and industries and the engagement of key stakeholders early in the monitoring process will allow not only for a strong scientific support but also increase buy-in for the program and trust in the data provided by the communities. This approach is often perceived as a non-intrusive and will help decision-makers and stakeholders to better respond to local issues.

A high level of consensus among participants was reached regarding the need for training and capacity building, support for data management, and the development of metadata standards and of standardized protocols that are not only relevant to the local context but still allow for comparison and integration on a broader scale.

Information about what works and what doesn't in nearshore marine monitoring (a suggestion was made to create a "Best practices manual") and effective monitoring strategies were identified as potentially helpful. The identification of common goals among stakeholders and the incorporation of traditional/ecological knowledge into monitoring programs were also highlighted.



### **3. What are the challenges faced by Nearshore Marine Monitoring Agencies?**

Again, funding arose as one of the most common and daunting challenges. Finding funding for an adequate monitoring program that would look at local issues seemed to be difficult as often the deliverables are not linked to the community priorities. The inaccessibility of financial support for travel expenses to communicate and exchange with others engaged in monitoring was also mentioned.

Other challenges raised were accessing relevant standardized protocols, the recruitment, training and retention of volunteers, lack of taxonomic expertise, challenges related to the establishment of multi-site partnerships, ensuring respect for cultural differences, providing timely feedback with regular reporting, difficulties in moving from providing reactive solutions to proactive ones and challenges in filling gaps in monitoring coverage.

#### What are the threats to Estuarine/Nearshore Marine Ecosystem Health?

The threats to the coastal environment identified by the most groups were pollution (land and ship based, contaminants) and eutrophication closely followed by climate change, urbanization, and loss of habitat. There was also strong consensus that erosion and sedimentation, invasive species, aquaculture and over fishing were key stressors.

Sewage and overflows problems, natural and anthropogenic stressors, depletion of food source, commercial by-catch and illegal fishing are also seen as threats.

#### What are the Key Changes Being Identified in Canada's Coastal Zones ?

Interestingly, no single phenomenon was strongly highlighted by all breakout groups. The key changes noted in the coastal regions include the following; an increase in invasive species, the shoreline development, changes in community structure, the decrease in fish stocks, Sea ice change, the decrease in eelgrass, the inability to pass on traditional knowledge, biodiversity & community shifts, changes in habitat quality, flooding, and economic changes in coastal communities from subsistence to cash based.

#### What are some essential measures/key indicators which should be monitored in the nearshore for early warning of change?

Many possible indicators were suggested, listed below in order of the degree of consensus among the breakout groups:

Water quality (physical & chemical parameters with ecological context instead of human health), physical changes to habitat, changes in biodiversity, species assemblage & richness, Keystone/indicator/sentinel species, Invasive species, Beach and shellfish closures, Urban development, Health of watersheds, Sediment, Ice cover, Pathology (both human and natural organisms), Coastal community population and well-being (sustainability of population growth), Marine Environmental Quality (MEQ) Indicators (DFO's Ocean Action Plan).

Some overall considerations related to standardization were flagged. Monitoring programs need to be relevant to scale, issue, context and local conditions which can be quite different among the three coastlines. The idea that the process and criteria for identifying indicators could be standardized was proposed, rather than the indicators themselves. The importance having a National standardized protocol with quality assurance and quality control was underlined. The protocol would have to be user friendly, take care of metadata and be accessible through an easy universal access.

#### **4. What can be done to make nearshore marine monitoring more effective?**

Discussions were held around the following questions; *what can be done to improve nearshore marine monitoring in Canada so as to better deliver the information needed by decision-makers? What are some of the possible solutions to the challenges faced by nearshore marine monitoring groups? What can be done to improve communication and coordination among nearshore marine monitoring agencies, organizations and communities locally, regionally and nationally?*

##### Partnerships

The participants strongly agreed that the engagement of academia of all levels (university, college, high school) with community groups helps to support long term monitoring. Using a bottom up approach while designing the program will help to bring local issues to the attention of policy makers and politicians and secure their buy-in.

Building partnerships locally and then laterally, adding one neighbouring monitoring initiative after another one was perceived as easier than trying a broader approach such as a regional or national partnership effort. Engaging industry was also pointed out as crucial, both for the trust building relationship that will follow and to allow the industry to react in a positive and adaptive manner to local concerns.

##### Communication and networking

Two main solutions were proposed with general agreement among the group. The development of a website or electronic forum that could be used to share best practices, tutorials, tools and quality control standards would be greatly beneficial. But, as electronic media cannot reach everyone or allow sharing of experiences, workshops and forums such as this one are perceived as a must. It was strongly recommended to have a yearly workshop on nearshore marine monitoring, either for both the regional and the national level.

Better communication of monitoring results to decision-makers and the community is necessary. By inviting politicians and policy-makers to such a workshop, and to have them participate on the planning committee, not only would help raise their sensitivity to and education about the issues but would ensure their more active engagement.

##### Funding

Reliable and adequate funding once again reached a maximum consensus among attendants. This funding needs to be in support of the coordination and collaboration among nearshore marine groups as well as to support monitoring itself. It is suggested that communication on a regular basis to local communities be mandatory requirement for funding.

Possible funding options suggested were dues & membership fees, the use of in-kind resources, the combination of resources of many to achieve common goals, industry involvement and seeking more financial support from governments.

##### Protocols, training and data management

A literature review on available protocols followed by their examination and the recommendation of common standardized one to be used should be done in concert with the development of marine environmental quality indicators. Standard data formats, common software and access to GIS integrated maps are required

The creation of a National training centre for coastal marine monitoring would be helpful. Such a centre could build tools and train participants how to sample and to deliver an effective monitoring program.

### Networks

Networking was seen as a key mechanism to address challenges encountered by nearshore monitoring groups. This networking should not only be among people engaged in monitoring activities but should also include other relevant groups and agencies. It was underlined that establishing a network of networks would help in the implementation of a coordinated national coastal monitoring program. Such a network of networks will require the creation of a multi-stakeholder National Steering Committee. Governments, communities, industry and decision-makers representatives would help the committee define a common vision and support community-based approaches and initiatives. It was clearly stated that this committee should not become another layer of bureaucracy, and should cost little so as to redirect more money locally, capitalize on existing tools and indicators, and, while focusing on a national approach, should use a bottom up vision for its implementation.

Two models for coordinated monitoring were presented at the workshop. One is the ACAP program, a model for collaborative local monitoring efforts. The other is the US National Water Quality Monitoring Program, a national-scale program for standardized and coordinated water quality monitoring. Summaries of these models are attached in Appendix D.

## **Next Steps/Recommendations**

Following the discussion, several next steps were proposed as a path forward:

### **1. Publication of a workshop report:**

Participants felt it important to capture the presentations, discussions and conclusions of the workshop in a document that could serve as a benchmark against which to measure progress and which could be shared broadly.

### **2. Prepare an inventory of ongoing monitoring programs**

The workshop and report began an inventory of nearshore marine monitoring initiatives throughout Canada. Participants felt it would be very useful to expand this inventory to be comprehensive and broadly available. The inventory would provide rapid access to sources of environmental information, would foster collaboration, and minimize duplication. The inventory could be web-based, geographically referenced and would provide metadata, meaning descriptions of the kind of information being collected rather than providing the information itself.

### **3. Identification of data gaps**

Another important step identified throughout the workshop is the need to better define information gaps for coastal monitoring data. The preparation and maintenance of a comprehensive inventory of monitoring programs would facilitate this analysis and could assist government agencies and other leaders in assigning monitoring priorities.

### **4. Development of monitoring indicators and protocols**

It will be important to develop a suite of understandable indicators for tracking coastal ecosystem change and standard protocols for monitoring the nearshore marine environment. A tiered approach may be most appropriate, in which overall coastal health is addressed with one set of indicators, and other sets of indicators are used to address particular questions or concerns that may arise.

### **5. Formation of a National Steering Committee**

To ensure delivery of the above recommendations, participants recommended the formation of a National Steering Committee which could lead actions to improve the coordination of nearshore marine monitoring. This committee could then also lead in the organization of regular nearshore marine monitoring workshops both regionally and nationally, as well as ensuring that decisions makers from all levels of government including First Nations, industry and non-governmental environmental organisations are represented. While broad representation will ultimately be required for this Committee, initially participants look to the EMAN office of Environment Canada for leadership in instituting the committee, preparing its Terms of Reference, and resourcing its initiatives. To this end an interim Steering Committee was constituted immediately following the workshop.

#### **6. Develop a Canadian model for nearshore monitoring**

Participants saw value in the Committee coordinating a review of international models for nearshore marine monitoring with the goal of developing a Canadian model for sustaining a coordinated nearshore monitoring network. This network might include the development of a web based forum or bulletin board for networking among monitoring practitioners.

#### **7. Provision of dedicated funding**

A recurrent issue raised throughout the workshop was the need to secure adequate and predictable funding to support coastal monitoring. This might proceed in two steps: 1) interim funding for existing programs (identified in bullet 2); and, 2) appropriate, dedicated resourcing of a national monitoring network (bullet 6).

#### **8. Prepare water quality standards for the neashore marine environment**

Workshop participants felt strongly that there is an urgent need to expand the Canadian Council of Ministers of the Environment (CCME) guidelines to marine waters. Such guidelines would facilitate identification of “hotspots” that could be prioritized on a regional and national basis.