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EXAMINING THE HEALTH OF THE HUDSON BAY ECOSYSTEM. PROCEEDINGS OF THE WESTERN HUDSON BAY WORKSHOP, WINNIPEG, MB, OCTOBER 25-26, 2000

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EXECUTIVE SUMMARY

A workshop entitled "Examining the Health of the Hudson Bay Ecosystem" was held October 25-26 in Winnipeg, Manitoba. The purpose of the workshop was to describe and assess the current health of the Hudson Bay ecosystem, to identify marine environmental quality indicators, and to develop an approach to identify research needs and address priorities. The workshop was scheduled to allow the attendance of participants with a wide range of interests, including those who had attended the workshop, Charting a Coordinated Approach to Management for the Western Hudson Bay Region, at the same location the previous three days.

One of the primary objectives of the workshop was to provide participants with an understanding of the Oceans Management Programs of Fisheries and Oceans Canada (DFO). Under the new *Oceans Act*, the department is charged with leading and facilitating the development and implementation of integrated management plans for marine, coastal and estuarine areas. The Marine Environmental Quality (MEQ) program is intended to assess and monitor the marine environment, particularly in areas subject to planning for integrated ocean management. The program also supports monitoring ecosystem health within marine protected areas.

Participants with a wide range of local and scientific knowledge gathered to share their understanding of the current state of knowledge of the Hudson Bay ecosystem. Participants discussed the needs of an MEQ program, and the process of selecting MEQ indicators in the development of a marine environmental quality program. As cooperative ocean planning proceeds for the region, the MEQ program is envisaged as integral to sound management decision-making.

To set the stage for working group discussions, a series of presentations were provided. Topics included: the current state of knowledge on the physical oceanography, fishes, marine mammals, contaminants, direct and indirect sources of change to the Hudson Bay and the role of traditional knowledge in assessing and monitoring marine environmental quality. Following overviews of the current state, presenters outlined information gaps, research needs, and potential candidate indicators of ecosystem health.

Following the presentations, participants formed working groups to discuss and advise on: 1) identification of key issues and research priorities; 2) identification of potential marine environmental quality indicators; and 3) actions required to develop a coordinated approach to research. Each working group was assigned a specific theme to focus their discussions. The five themes were: 1) water quality and contaminants; 2) marine mammals and fish; 3) direct and indirect environmental change; 4) traditional knowledge; and 5) community participation.

A long list of recommendations and key ideas was generated from the working groups and plenary sessions. However, a number of messages were repeated time and again. They are summarized as follows:

1. To adequately select indicators, and develop a monitoring program that would meet MEQ objectives, all disciplines of the Hudson Bay ecosystem require more research. The research that has been done is fragmented and not readily available. A whole ecosystem approach should be adopted in the development of future research on the Bay.

2. There is a need to respect and recognize the combined contributions of traditional and scientific knowledge in understanding the Hudson Bay ecosystem. The local people are the "front line" surveillance and monitoring resources, providing a cost effective and knowledgeable contribution to research on the Hudson Bay.

3. Research should be relevant and add value to the objectives of the communities and stakeholders as well as to the marine environmental quality objectives. Communities are willing to become involved and are interested in participating in setting priorities, conducting research and monitoring.

4. Information should be shared and research findings communicated back to the communities in a way that is clear, understandable and put in concepts most relevant to that community.

In conclusion, it was clear that all participants are interested in the marine environmental health of the Hudson Bay region. Participants see the merit in working collaboratively towards conducting research, the selection of indicators and the development of programs to monitor the health of the Hudson Bay ecosystem.

DFO will continue to build a marine environmental quality program that is both science and community-based, as an integral component of future coordinated management plans for the region.

RÉSUMÉ

Un atelier intitulé « Examen de l'état de santé de l'écosystème de la baie d'Hudson » a eu lieu les 25 et 26 octobre à Winnipeg, au Manitoba. L'objectif de l'atelier était de décrire et d'évaluer l'état de santé actuel de l'écosystème de la baie d'Hudson, afin de dégager les indicateurs de qualité du milieu marin et de cerner les besoins en matière de recherche et d'en abordes les priorités. L'atelier a été prévu de façon à permettre la présence des participants de l'atelier intitulé Vers une démarche de gestion coordonnée du secteur ouest de la baie d'Hudson, ayant eu lieu les trois jours précédents au même endroit.

L'un des principaux objectifs de l'atelier était de permettre aux participants de comprendre les programmes de gestion des océans de Pêches et Océans Canada (MPO). En vertu de la nouvelle Loi sur les océans, le ministère doit mener et favoriser l'élaboration et la mise en œuvre de plans de gestion intégrée pour les aires marines, côtières et estuariennes. Le Programme de qualité du milieu marin (QMM) vise à évaluer et à surveiller le milieu marin, particulièrement dans les zones faisant l'objet de planification à des fins de gestion intégrée des océans. Le programme vise également à surveiller la santé des écosystèmes dans les zones de protection marines.

Les participants ayant de vastes connaissances locales et scientifiques se sont réunis pour partager leur vision commune de l'état actuel des connaissances sur l'écosystème de la baie d'Hudson. Ils ont discuté du besoin d'un programme de QMM et du processus de sélection des indicateurs de QMM dans l'élaboration d'un programme de qualité du milieu marin. Alors que la planification coopérative d'activités pour la région touchant les océans se poursuit, on prévoit que le programme de QMM sera une partie intégrante d'un processus décisionnel d'une gestion saine.

Afin de préparer la voie aux discussions des groupes de travail, on a présenté une série d'exposés. On a traité entre autres de l'état actuel des connaissances sur l'océanographie physique, des poissons, des mammifères marins, des contaminants, des sources directes et indirectes de changements à la baie d'Hudson et du rôle des connaissances traditionnelles dans l'évaluation et la surveillance de la qualité du milieu marin. Après le survol de l'état actuel des connaissances, les présentateurs ont décrit les lacunes, les besoins en recherche et les indicateurs possibles de la santé des écosystèmes.

Après les exposés, les participants se sont réunis en groupes de travail pour discuter des points suivants : 1) la définition de questions clés et des priorités de recherche ; 2) la définition d'indicateurs possibles de qualité du milieu marin ; et 3) les mesures nécessaires pour mettre au point une démarche coordonnée pour la recherche. Chaque groupe de travail devait axer ses discussions sur un thème spécifique : 1) la qualité de l'eau et les contaminants ; 2) les mammifères marins et les poissons ; 3) les changements environnementaux directs et indirects ; 4) la connaissance traditionnelle ; et 5) la participation communautaire.

Les discussions des groupes de travail et les séances plénières ont permis de dresser une longue liste de recommandations et d'idées importantes. Toutefois, un certain nombre de messages ont été répétés à maintes reprises, dont voici le résumé :

1. Afin de choisir adéquatement les indicateurs et d'élaborer un programme de surveillance qui réponde aux objectifs de QMM, on doit effectuer une recherche plus poussée de toutes les disciplines de l'écosystème de la baie d'Hudson. Les recherches qui ont été faites sont fragmentées et ne sont pas rapidement et facilement utilisables. On devrait adopter une approche écosystémique complète pour l'élaboration de prochaines recherches dans la baie.

2. Il faut respecter et reconnaître les contributions combinées de connaissances traditionnelles et scientifiques dans la vision commune de l'écosystème de la baie d'Hudson. La population locale constitue la ressource de « première ligne » en matière de surveillance et de contrôle, fournissant une contribution rentable et bien informée aux recherches sur la baie d'Hudson.

3. Les recherches doivent être pertinentes et ajouter de la valeur aux objectifs des collectivités et des intervenants, ainsi qu'aux objectifs de qualité du milieu marin. Les collectivités veulent s'impliquer et participer à l'établissement des priorités, à la réalisation de recherches et à la surveillance.

4. On devrait partager les renseignements et communiquer les résultats de recherche de façon claire et compréhensible et aborder les questions les plus pertinentes pour chaque collectivité.

Pour conclure, il est évident que tous les participants s'intéressent à la santé du milieu marin de la baie d'Hudson. Les participants constatent les avantages qu'apporte la collaboration pour la réalisation de recherches, la sélection d'indicateurs et l'élaboration de programmes visant à surveiller la santé de l'écosystème de la baie d'Hudson.

Le MPO continue de mettre au point un programme de qualité du milieu marin, à la fois communautaire et scientifique, qui sera un élément intégral de futurs plans de gestion coordonnée pour la région.

ACKNOWLEDGEMENTS

Oceans staff from Fisheries and Oceans Canada (DFO) in Winnipeg, Yellowknife and Iqaluit would like to thank the 70 participants at the Hudson Bay Marine Environmental Quality Workshop for stimulating a renewed interest in the marine environmental health of the Hudson Bay region.

From community representatives to scientific specialists, the participants brought enthusiasm, passion and the willingness to work together on the important topic of marine environmental health. The workshop provided a unique opportunity to share common interests, experiences and knowledge. The participants' work serves as a benchmark to guide the development of future research and the establishment of monitoring programs in support of a coordinated approach to management in the Hudson Bay region.

The workshop benefited from the facilitation skills of Andy Swiderski and Jim Micak. Working group facilitators met tight timelines, all the while contributing valuable feedback to the plenary session. We owe them a debt of gratitude for their energy, good humor and willingness to adapt to changes in schedule. The notetakers demonstrated patience and perseverance, producing final notes within two days of the meeting. This enabled us to produce the proceedings in a timely way. We acknowledge the work of the translators for their energy and staying power throughout the plenary sessions.

A special thanks to Donn Pirie and Oksana Banias for their outstanding efforts in organizing the workshop and preparing the workshop report. We also thank Sharon Leonhard and Amalia Pempengco who coordinated workshop communications, Sara Melnyk and Brenda Webster who assisted with the workshop registration, and Marta Wojnarowska who organized the poster displays. Thank you to Ole Nielsen and Patt Hall for their critical reviews of this manuscript report.

Finally, we would like to thank our sponsors: Manitoba Conservation, Nunavut Tunngavik Incorporated, Nunavut Community Government and Transportation, Nunavut Wildlife Management Board, Manitoba Hydro and the University of Manitoba Centre for Earth Observation Science.

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Le personnel de Pêches et des Océans, Direction des océans, travaillant à Winnipeg, Yellowknife et Iqaluit, tient à remercier les 70 participants de l'atelier sur la qualité du milieu marin de la baie d'Hudson d'avoir entraîné un regain d'intérêt pour la santé du milieu marin de la région de la baie d'Hudson.

Les participants, des représentants communautaires et des spécialistes scientifiques, ont fait part de leur enthousiasme, de leur passion et de leur désir de travailler ensemble sur l'importante question de la santé du milieu marin. L'atelier a donné une occasion unique de partager des intérêts communs, des expériences et des connaissances. Le travail des participants servira de point de repère pour guider la réalisation de prochaines recherches et la mise en œuvre de programmes de surveillance en vue d'appuyer une démarche coordonnée pour la gestion dans la région de la baie d'Hudson.

Les participants à l'atelier ont profité des talents d'animateur d'Andy Swiderski et de Jim Micak. Malgré des délais serrés, les animateurs des groupes de travail ont pu faire des commentaires constructifs lors de la séance plénière. Nous tenons à souligner leur dynamisme, leur bonne humeur et leur capacité de s'adapter aux changements d'horaire. Les preneurs de notes ont fait preuve de patience et de persévérance, rédigeant les notes finales deux jours après la réunion. Nous avons ainsi pu publier les comptes rendus de façon opportune. Nous reconnaissons le travail des traducteurs qui ont su faire preuve de dynamisme et d'endurance au cours des séances plénières.

Nous tenons à remercier tout spécialement Donn Pirie et Oksana Banias des efforts exceptionnels qu'ils ont déployés pour organiser l'atelier et en préparer le rapport. Nous voulons aussi remercier Sharon Leonhard et Amalia Pempengco qui ont coordonné les communications tout au long de l'atelier et Marta Wojnarowska qui s'est occupée des affiches. Nous remercions Ole Nielsen et Patt Hall pour leur analyse critique de ce rapport.

Finalement, nous remercions nos commanditaires : Conservation Manitoba, Nunavut Tunngavik Incorporated, Administrations communautaires et Transports Nunavut, le Conseil de gestion des ressources fauniques du Nunavut, Hydro-Manitoba, et le Centre for Earth Observation Science de l'Université du Manitoba.

LIST OF ACRONYMS

AVHRR	Advanced Very High Resolution Radiometer
C-GOOS	Canadian Global Ocean Observing System
DDT	Dichlorodiphenyltrichloroethane
IM	Integrated Management
MEQ	Marine Environmental Quality
MPA	Marine Protected Area
OMS	Ocean Management System
PCBs	Polychlorinated Biphenyls
TEK	Traditional Ecological Knowledge

DEFINITIONS

advection - the horizontal transfer of a property such as heat, caused by air movement.

anadromous - used to describe fish such as salmon and shad that return from the sea to the rivers where they were born in order to breed.

benthic - relating to or characteristic of the bottom of a sea, lake, or deep river, or the animals and plants that live there.

brine rejection – a physical process in which salt is removed from the water as it forms sea ice. As a result, sea ice has a lower salt concentration than the water below it.

Chlordane - a thick, toxic, colorless to amber-colored liquid that is used as an insecticide and a fumigant. Chlordane has been found to be so highly toxic to humans that it has been outlawed in some U.S. states.

convection - circulatory movement in a liquid or gas, resulting from regions of different temperatures and different densities rising and falling in response to gravity.

cyclonic - storm systems or currents that rotate counterclockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere around and toward a low pressure center.

DDT – a colourless chemical pesticide used to eliminate disease-carrying and crop-eating insects.

discharge - the volume of water in a river flowing past a particular point during a specific time interval.

dissolved oxygen - the volume of oxygen that is contained in water. Oxygen enters the water by photosynthesis of aquatic biota and by the transfer of oxygen across the air-water interface. The amount of oxygen that can be held by the water depends on the water temperature, salinity, and pressure.

embayments - a bay in a coastline.

estuary - the wide lower course of a river where the tide flows in, causing fresh and salt water to mix.

PCBs - a compound that is used in electrical insulators, flame retardants, and plasticizers. PCB is a hazardous pollutant that is difficult to dispose of safely and has been banned in several countries.

sonar - a system that determines the position of unseen underwater objects by transmitting sound waves and measuring the time it takes for their echo to return after hitting the object.

toxaphene - an insecticide used primarily to control insect pests on cotton and other crops, to control insect pests on livestock and to kill unwanted fish species in lakes.

vagility - able to move around within a specific environment.

1.0. INTRODUCTION

1.1. WORKSHOP PURPOSE AND OBJECTIVES

Fisheries and Oceans Canada (DFO), Oceans Programs Division, Marine Environmental Quality Program, held a workshop entitled "Examining the Health of the Hudson Bay Ecosystem" October 25th-26th, 2000 in Winnipeg, Manitoba.

A broad range of interested parties and stakeholders participated in the workshop. Each participant had different needs and expectations, and each contributed their own knowledge and understanding of the Hudson Bay ecosystem to the workshop. The full list of workshop participants and invited parties is provided as Appendix A. Participants included:

- Community members
- Non-governmental organizations with regional interests
- Aboriginal governments, agencies, and organizations
- Federal and territorial government agencies
- Industry representatives

The purpose of the workshop was to describe and assess the current health of the Hudson Bay ecosystem, to identify Marine Environmental Quality (hereafter referred to as MEQ) indicators and to develop an approach for determining research needs and priorities. The three main workshop objectives were as follows:

1. To provide workshop participants with an understanding of the purpose, objectives, and components of the Oceans Management Programs, focusing specifically on the MEQ Program.
2. To describe and assess the current knowledge base regarding the health of the Hudson Bay ecosystem and explain the significance of this knowledge for MEQ. Presentations by scientists studying in the region provided all participants with information on the baseline conditions and assisted in the identification of MEQ research needs and priorities.
3. To promote discussion and obtain the advice of workshop participants regarding:

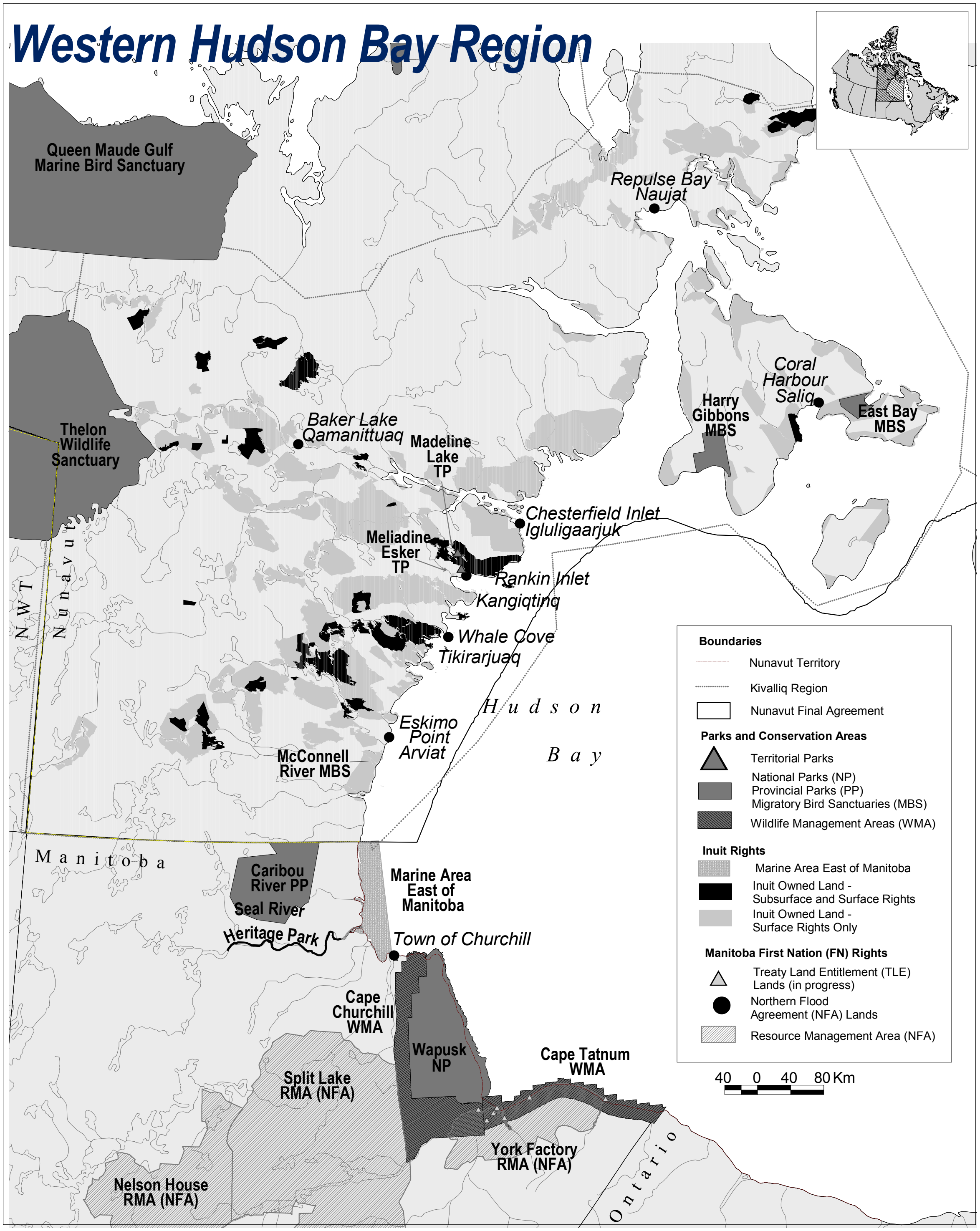
i. MEQ research priorities for the Hudson Bay ecosystem.
ii. Key considerations for development of a coordinated approach to MEQ research.
iii. Defining the nature of program partnerships, and the benefits of these partnerships to future cooperative management processes.
iv. The process for establishing MEQ indicators, and barriers preventing this process.
v. Identifying the next steps in developing MEQ indicators for the Hudson Bay ecosystem.

1.2. WORKSHOP AGENDA

On the evening of October 25th, Jack Mathias, Head of the Oceans Programs Division, DFO, provided workshop participants with the purpose, objectives and components of DFO's Oceans Management Programs. He also described the MEQ Program and its purpose, providing a common starting point for workshop discussions.

Beginning October 26th, the presentations by Peter Galbraith, Jim Reist, Pierre Richard, Lyle Lockhart, Peter Scott, Miriam Fleming, and Don Cobb described the current knowledge about the Hudson Bay ecosystem and the significance of this knowledge for MEQ.

Two breakout group sessions and a full plenary discussion filled the agenda for the remainder of the workshop. Participants discussed MEQ research priorities in the Hudson Bay Region, key considerations for the development of coordinated MEQ research, the nature of the linkages in the region, the process and barriers to identifying MEQ indicators, and future steps in developing MEQ indicators. The results of the group discussions were presented and discussed in the plenary session, and are summarized in this document.



Fisheries and Oceans Canada Pêches et Océans Canada

Canada

Figure I: Map of the Western Hudson Bay Region.

2.0.

3.0. WORKSHOP PRESENTATIONS

3.1. ESTABLISHING THE CONTEXT - AN INTRODUCTION TO CANADA'S OCEANS MANAGEMENT PROGRAMS

3.1.1. An Overview of the Oceans Management Program

Jack Mathias, Head - Oceans Programs Division,
Central and Arctic Region, Fisheries and Oceans Canada

The *Oceans Act* came into effect in January 1997. The Act is divided into three parts: (1) recognizing Canada's ocean jurisdiction; (2) the Oceans Management Strategy; and (3) consolidation of Federal responsibilities for Canada's oceans. The *Oceans Act* introduces three new program tools: Integrated Management (IM), Marine Environmental Quality (MEQ), and Marine Protected Areas (MPA).

The three main guiding principles of the Ocean Management Strategy are (1) sustainable development, (2) integrated management plans, with the emphasis on collaboration and citizen engagement, and (3) the precautionary approach. The OMS has several goals, namely: to replace the current fragmented approach with a collaborative integrated approach to oceans management; to expand working partnerships; to optimize economic potential while ensuring conservation and sustainability; and to position Canada as a world leader in oceans management.

MEQ focuses on marine ecosystems. It involves developing an understanding of important ecological processes, critical habitats and key species in those habitats. MEQ combines scientific research with traditional ecological knowledge. An MEQ program is generally developed in support of an MPA or IM program. IM plans focus on the human uses of the ocean and involve resource use inventories, environmental impacts and consultation on human use conflicts. MPAs focus on ocean governance. They involve legislation, policies and regulations, and various institutions. These programs contribute toward establishing integrated management within a region.

The MEQ program collaborates with several ocean programs through partnering, participating and exchanging information and protocols. These programs range from international to local. At the international level, there is the Global Ocean Observing System, International Council for the Exploration of the Seas, and the Arctic Monitoring and Assessment Program. At the national level, there is the Canadian Environmental Assessment Process and the National Programme of Action for the Protection of the Marine Environment from Land-based Pollution. Regional programs include the Northern Ecosystem Initiative, Northern Contaminants Program and the Ecological Monitoring and Assessment Network. There are also local programs such as the Arctic Borderlands Ecological Knowledge Coop, Char and Beluga Monitoring Programs, and the Mackenzie Valley Cumulative Impact Monitoring Program.

As an example, the Tariuq (Ocean) Monitoring Program is being developed in conjunction with communities around the Beaufort Sea. This program will incorporate an agency partnership with a community approach. The program will combine scientific disciplines (e.g. monitoring of contaminants in biota and sediments, pathogens and litter) with local environmental knowledge and community-based monitoring. To date, workshops have been held in several communities, and work is progressing towards the identification of indicators of marine ecosystem health which could be monitored at the community level. The data generated from this monitoring will be maintained in a database and the information communicated back to the communities periodically.

3.2. UNDERSTANDING THE ENVIRONMENTAL, SOCIAL AND ECONOMICAL CONDITIONS OF THE HUDSON BAY ECOSYSTEM

3.2.1. A Review of the Physical and Chemical Oceanography of Hudson Bay

Peter Galbraith, Research Scientist,
Laurentian Region, Fisheries and Oceans Canada

This presentation quickly highlights the physical oceanography of the Hudson Bay and outlines the variables that we feel require monitoring.

The creation and melt of sea ice has a strong influence on the climate of Hudson Bay. It is completely ice-covered for 8 to 9 months of the year, with the thickness reaching a maximum at the end of April of 1.6 m averaged over the Bay, ranging from 1 m in the south to 2 m in the north.

The Hudson Bay watershed extends west to the continental divide of the Rocky Mountains, and the Mackenzie River watershed. It borders the St. Lawrence/Great Lakes watershed to the south. The annual **discharge** of runoff into Hudson Bay is twice the values for either the St. Lawrence or Mackenzie River systems.

The effect of ice on the fresh water content is twofold. Ice is created mostly in the northern areas and is **advected** to the south where most of the melt occurs, leading to a net transport of fresh water content to southern parts of the Bay. Secondly, **convective** mixing and **brine rejection** associated with ice formation, removes fresh water content from deep within the water column to the surface where it is immobilized as ice. The melt releases this fresh water at the surface resulting in a net vertical transport of fresh water content. The residence time of fresh water is 10.2 months in James Bay, and 6.6 years (8 times longer) in Hudson Bay as a whole.

Hudson Bay has a 2-layer system, with old waters at lower depths and ventilated waters in the top 100 m resulting from winter **convection**. The deep layer has origins in the Arctic Polar waters: its nutrient concentrations are similar to Arctic waters, but distinct from Atlantic waters. The Bay is deeper than the sill that separates it from Hudson Strait, which limits exchanges and renewal of deep waters. Ventilation times of 3 to 14 years have been calculated for deep waters.

The Bay has a **cyclonic** surface circulation of 5 cm/s in summer, forced by fresh water input. High runoff forcing in the summer causes a circulation of 19 cm/s in James Bay. On the Western Hudson Bay coast, the semi-diurnal component height of the tides is maximal at about

1.25m (measured from mean-level to crest). Tides may be observed in excess of 5m (measured crest to crest) in Western Hudson Bay.

Increased monitoring is needed to increase our knowledge of the Bay. Hardly any temperature-salinity data exists for monitoring inter-annual and inter-decadal variability, and is particularly scarce for the winter months. Dr. Humfrey Melling listed monitoring needs for Hudson Bay for C-GOOS which include: maintaining a sea-level station at Churchill (Western Hudson Bay is low-lying and subject to flooding and coastal erosion); deploying ice-profiling **sonars** to monitor both wave and ice extremes (wave severity could increase with decreasing ice cover); interpreting **AVHRR** and **Radarsat** remote sensing data for ice extent and sea-surface temperature (important for air-sea interaction and coastal erosion); surveying the bathymetry of the Bay (required for modeling); and monitoring bottom water temperatures (present low temperatures preserve subsea permafrost). Other monitoring needs include a freshwater runoff index, calculation of inflow from the Arctic Basin via Fury and Hecla Straits, monitoring of temperature and salinity off the outflow in Hudson Strait, remote sensing of surface temperature and ocean colour, and monitoring dissolved oxygen to understand bottom **convection**.

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3.2.2. An Overview of the Fishes of Hudson Bay, James Bay, and Hudson Strait

Jim Reist, Head - Arctic Fish Ecology,
Central and Arctic Region, Fisheries and Oceans Canada

Hudson Bay, James Bay and Hudson Strait are home to 55 marine, 6 **anadromous** (migrating from salt water to spawn in fresh water) and 37 freshwater species of fish. Many of these fish species could serve as good MEQ indicators. Indicator species, however, should have certain characteristics, including: a wide distribution, be easy to capture, be pivotal and/or integrative in the structure and function of the ecosystem, have **low vagility** (migrate over short distances during life) and have a well-known biology. An MEQ indicator species must also be relevant to the seasonal, locational or historical focus of the question.

Chars and whitefishes (*Salmonidae*), sticklebacks (*Gasterosteidae*), sculpins (*Cottidae*) and cods (*Gadidae*) could possibly serve as species for MEQ monitoring. All species are easily captured and have wide distributions. More specifically, chars and whitefishes and sculpins are important in fisheries, sticklebacks and sculpins have low **vagility** and chars/whitefishes and cods are important in food webs. Anadromous species (chars, whitefishes, sticklebacks) integrate aspects of freshwater, terrestrial and marine environments, thus may be particularly useful as MEQ indicators. Unfortunately, we have a poor understanding of distributions, biology and ecology, population structure and dynamics, and ecosystem interrelationships of most of the fish species in Hudson Bay. Disturbances and impacts both off and on shore and inland may be changing these characteristics, further limiting our understanding and opportunities for establishing baseline conditions.

Another important consideration for MEQ monitoring is that of the location to monitor. Ecological transition zones are good candidates for such monitoring. These are areas where distinct ecosystems meet. These areas tend to be high in productivity and biodiversity, due to their high physical structure and nutrient input. Examples of these in Hudson Bay include river **discharge** plumes and mixing zones, nearshore lagoons, **embayments**, barrier islands, ice edges, and shelf dropoffs. These areas are vital for many species in the area and should be examined for their potential for MEQ monitoring.

“Hudson Bay remains today one of the world’s last great inland seas for which the marine fauna has yet to be completely explored.” (Morin and Dodson 1986). Wise choices and progress towards identifying adequate indicator fish species will never be possible until their distribution, biology, role in the ecosystems and responses to impacts are all better known.

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3.2.3. An Overview of the Marine Mammals of Hudson Bay
Pierre Richard, Marine Mammal Stock Assessment Biologist,
Central and Arctic Region, Fisheries and Oceans Canada

Marine mammals of Hudson Bay are vitally important as a food or economic source to the people of the region. Of those, the most important species in my view are the ringed seal, bearded seal and beluga whale. They are numerous and have extensive distributions in the Bay and therefore may be good indicators of MEQ. They are also the most important species to the local population.

Both ringed and bearded seals are year-round inhabitants of the Bay. Ringed seals eat fish and crustaceans while bearded seals eat mainly molluscs. Their distribution extends across the entire Bay. Their populations are estimated at 500,000 and 50,000-100,000 respectively.

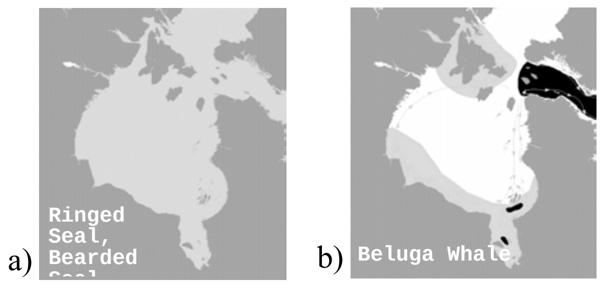

Figure II: (a) Range of Ringed Seal, Bearded Seal and Polar Bear in Hudson Bay; (b) Range of Beluga Whale in Hudson Bay.

Beluga whales are migratory, and occupy Hudson Bay and James Bay mainly in the summer months. They feed on many type of prey, fish, crustaceans and molluscs. Their population in the Bay is estimated to exceed 30,000. Their population trend is thought to be stable for the most part although there are concerns with the eastern Hudson Bay belugas.

Harp seals, harbour seals, bowhead whales, narwhals, walrus, polar bears and killer whales are also present in the region.

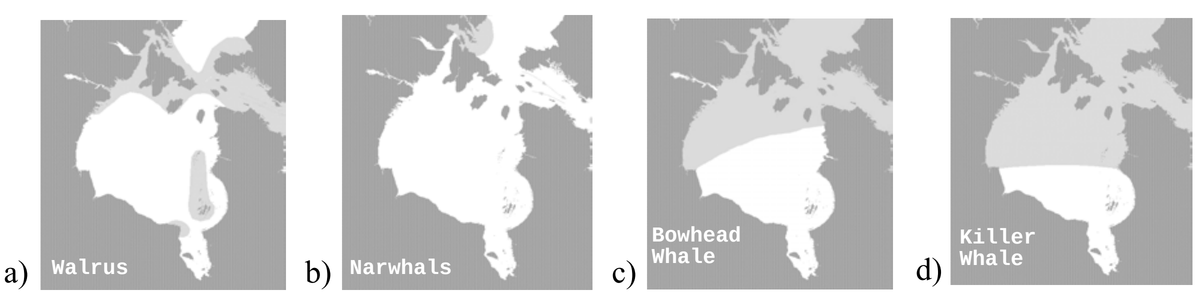

Figure III: (a) Range of Walrus in Hudson Bay; (b) Range of Narwhal in Hudson Bay; (c) Range of Bowhead Whale in Hudson Bay; (d) Range of Killer Whale in Hudson Bay.

Polar bears are year-round residents which number about 2500 animals in the Bay. Their numbers may be on the decline due to the shortened ice season resulting from climate change. As predators of marine mammals, ringed seals in particular, they may also serve as good MEQ indicators.

Narwhals range over northern Hudson Bay in summer and some may winter there. They number about 2000. They eat fish, molluscs and crustaceans. Their trend is not known at present but is thought to be stable.

Walrus may also be year-round inhabitants, though they most often are seen in the summer months. They eat almost exclusively molluscs, but some eat seals and whales. There are more than 1500 walrus in the Bay and their trend may be stable.

Harbour and harp seals have a limited distribution in Hudson Bay. Both species feed mainly on fish. Harbour seals, resident all year, number in the hundreds, while the harp seals which migrate into the Bay in summer are in the thousands. The population trend of harbour seals is unknown, but harp seal numbers are on the increase.

Bowhead whales also inhabit the Bay in the summer and some remain in winter. They number in the hundreds and their population is increasing. They feed exclusively on small planktonic crustaceans.

Killer whales are often seen in the northern parts of the Bay, although they number only in the low tens. Their presence is important, because they are, with polar bears, top predators of the other marine mammal species.

Marine mammals of Hudson Bay may be facing emerging risks that affect their health and population size. In my view, these risks are probably in decreasing order of importance: climate change, contaminants, increased hunting and mineral development and shipping. The effects of these disturbances on marine mammal populations are largely unknown although there are signs that climate change has already caused a decline in the health and reproduction of polar bears.

In my opinion, monitoring of the status of important species (ringed seal, bearded seal, beluga and perhaps polar bears) and their contaminant load are research priorities that should be further examined as indicators of the MEQ of the Hudson Bay region. Furthermore, marine ecological research to understand physical and biological habitat correlates of marine mammals is highly desirable and could serve to monitor the state of their habitat as an additional indicator of MEQ.

3.2.4. A Description of Contaminants in Hudson Bay

Lyle Lockhart, Arctic Contaminants Research Scientist,
Central and Arctic Region, Fisheries and Oceans Canada

The interest in chemical contaminants in the Hudson Bay is driven by several important observations. High levels of **PCBs** in human milk in coastal communities of northern Quebec, high proportions of people in the region with blood mercury over the normal range, and increasing mercury levels in some birds and mammals have been observed.

Food is believed to be the predominant source of these contaminants to the people of Hudson Bay. Development activities including hydroelectricity developments, mining for metals and uranium, transportation spills, and inactive municipal, industrial and military sites have also been identified as potential causes of contamination.

Data on muscle mercury levels in Northwest Territory lake fish species and mercury levels in Hudson Bay beluga, ringed seal and **benthic** animals show increased mercury levels. Mercury is also present in snow meltwater and air samples of the region. Other contaminants have been found in beluga blubber (**toxaphene**, **PCBs**, **DDT**, **Chlordane**) across the Northwest Territories and Hudson Bay. Abnormal lead concentrations have been found in Hudson Bay sediments.

It is not known how these contaminants will affect the animals and humans who feed on the animals of the region. Many knowledge gaps exist in the understanding of chemical contamination in Hudson Bay. Additional toxicology studies are required for both animals and humans: there are many contaminants in water, snow and marine fish that have not been identified and require additional research and assessment; the temporal changes in contaminant levels must be researched further to determine trends; more detailed geographic coverage that will be specific to the areas of concern is required; the pathways from the sources of contamination to the animals must be found; and both the natural and human sources of pollutants must be identified and analyzed

3.2.5. An Identification of the Direct and Indirect Influences Affecting Marine Environmental Quality in Hudson Bay

Peter Scott, Scientific Coordinator
Churchill Northern Studies Centre

3.2.5.1. Introduction

When we think about the overall marine environmental quality of Hudson Bay, we must consider the nature of Hudson Bay as well as the types and nature of each type of contaminant. Hudson Bay is a large basin which is filled with seawater from the Arctic Ocean which enters through Roes Welcome Sound. The water on the surface of the Bay is a mixture of seawater with fresh water that comes in from the large rivers entering Hudson Bay. The water circulates around in a counter-clockwise motion. In addition to trapping water, the Hudson Bay Basin also traps air and many of the particles (contaminants) within it. This indicates that we must consider a large range of long distance contaminants in addition to the local sources.

3.2.5.2. The Contaminants

There are many different types of contaminants that can be considered. As of yet there are many unknown contaminants and man is creating new chemicals all the time so this grouping is not complete. However, most can be grouped into four main categories:

Organic contaminants like sewage or animal waste are usually produced from point sources within the Hudson Bay Region.

Heavy metals such as mercury, cadmium or zinc which occur in nature in small quantities but become more concentrated through activities such as mining, hydro-electric development, and pulp and paper mills.

Radiation may come from man made sources such as nuclear radiation. No level of radiation is safe and with depletion of the ozone layer in the north, natural levels of radiation are expected to increase as well.

Persistent organic pollutants (POPs) are man-made contaminants such as dioxin which, even though produced in very small quantities, concentrate up the food chain to become very toxic.

3.2.5.3. Where Airborne Contaminants Come From and How They Get Around

It is very hard to generalise about contaminants because each contaminant has a different behaviour and so each should be considered in a matrix like Figure IV separately. While Hudson Bay-wide sources are unlikely at this time, point sources can spread throughout the Bay if they are light enough to remain on the sea ice or in the upper layers of the water. In considering contaminants from outside the region, some arrive by water, some by air, and some by both. The airborne contaminants may arrive dispersed over the Bay, or in direct air streams from southern locations. The weather and climate patterns, the rock structure, and the ecosystems all have an important role in influencing the behaviour of these contaminants.

	IMPACT		
SOURCE	Point	Hudson Bay Wide	Global
Point	P-P	P-HB	P-G
Hudson Bay Wide	HB-P	HB-HB	HB-G
Global	G-P	G-HB	G-G

Figure IV: A matrix to consider contaminant sources and impacts. On the left is the source of contaminants while across the top is the impact.

A major consideration right now is the input of POPs and radioactive particles from global sources. This material is mostly output from highly industrial areas such as eastern Asia, eastern Europe and the northeastern United States. These contaminants disperse into the air throughout the planet. Many of these contaminants then drop out in the cold regions such as our north, and many also drop out in rainfall.

Getting the contaminants directly from the source, into Hudson Bay is not as simple as it seems. The dense, cold air over the northern part of the planet, known as the Arctic Air Mass, can act as a curtain to many airborne contaminants, and a screen door to others, which either prevents or reduces them from coming directly into Hudson Bay. In summer, the Arctic Air Mass has moved north to around the southern end of Hudson Bay. However, with global warming it has been moving much further north in the summer which would allow polluted southern air to get into Hudson Bay. A recent study on dioxin, one of the deadliest substances known to man, shows a marked decline in levels from Sanikiluaq, to Chesterfield Inlet which is almost always inside the Arctic Air Mass, and still more decline moving further north - away from the sources in the United States. Dioxins, and many similar contaminants, are highly volatile. That is they will bounce around in snow and ice. It is interesting to note that dioxin concentrations were twice as high in the water indicating that there may be a greater tendency to settle out in water during the ice-free period in summer. With global warming and a changing ice cover in Hudson Bay, there will a change in how and when contaminants get into the region.

Some of these contaminants biodeplete. That is, over time they become less concentrated. However, many will bioaccumulate. That is, as they become part of the food they concentrate. Consider during one year:

1 large polar bear (1000 lbs. in weight)
polar bear might eat 50 ringed seals
the ringed seals will eat 20,000 lbs. of fish
the fish will eat 200 tons of smaller fish and invertebrates
the smaller fish and invertebrates will eat 2000 tons of zooplankton
the zooplankton will eat 20,000 tons of phytoplankton

Bioaccumulation works so that a contaminant like dioxin that starts out at background level and is taken up by the phytoplankton will be concentrated 10 times in the zooplankton, 100 times in the smaller fish and invertebrates, 1000 times in the larger fish, 10,000 times in seal meat and 100,000 times in the polar bear. Because marine food chains are long, there is a strong tendency to concentrate in the meat, liver and fat of animals that are big predators.

By studying the top of the food chain such as polar bears we can begin to get an indication of how much bioaccumulation is going on in the whole system. Polar bears are the best indicators for this as, in addition to being the top of the food chain, there are only 3 populations on Hudson Bay and they move all over eating (sampling) the seals from everywhere. However, it would be very important to understand how Hudson Bay works so that we could interpret any bioaccumulation of the whole system. On the other hand, polar bears would not be very good indicators of local or point sources. Further, if it was important to know how much contaminants were concentrated lower in the food chain, such as in arctic charr for example, polar bears would not be a very good indicator.

3.2.5.4. Where Waterborne Contaminants Come From

The source of waterborne contaminants is also very complicated. The waters from the Arctic Ocean will bring a very small amount of contaminants from the north. Most waterborne contaminants will come from the rivers that flow into Hudson Bay. Airborne contaminants can fall anywhere in the area that drains into Hudson Bay and then work their way down stream. The western rivers, entering Hudson Bay from Churchill to Repulse Bay, are far from southern industrial development and have little industrial development themselves. The eastern rivers, in northern Quebec, are in a similar situation. However, the rivers from the Nelson, through James Bay, flow from the south. These southern rivers are close to industrial development, have industrial development, and other impacts such as hydro-electric development as well. Because the eastern and western rivers are acidic, they will carry only certain types of contaminants. The southern rivers begin as acidic and become peaty, and then become alkaline as the enter the Hudson Bay Lowlands. Whether a river is acidic, peaty, or alkaline will change how and what contaminants are transported to Hudson Bay. So that changing, climate and changing industrial environment in the south will have a strong impact on contaminant transport. Diversion of rivers for hydro-electric development will also have an impact on accumulation and transport of contaminants. Further, as the fresh water meets the sea water, the way contaminants are transported will change. At this time, it is not clear how all of these factors affect the health of Hudson Bay.

3.2.5.5. Biological Transports For Contaminants

Another way that contaminants can be transported into Hudson Bay is through animals. For example, geese that overwinter in the south may pick up large amounts of contaminants and bring them to Hudson Bay in their bodies during the summer. Likewise, migrating caribou, marine mammals like whales and seals, as well as schools of fish like cod, for example, may also transport contaminants into the Hudson Bay region.

3.2.5.6. Summary

Contaminants may be generated from points in Hudson Bay but most will be transported into the Bay through either air, water, or animal movements. Some airborne contaminants become diffused and enter in small quantities. Others enter in greater concentrations directly from sources in the south and this is partially dependent on the summer conditions and the present global warming. Waterborne contaminants enter from diffuse concentrations falling in the drainage area around Hudson Bay or from rivers with industrial development or near sources of industrial development. The movement of contaminants downstream will vary with the nature of the river and the ecosystems that it flows through. The input of contaminants is changing with southern industries, developments such as hydro-electric dams, and atmospheric circulation influenced by global warming.

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3.2.6. The Inclusion of Traditional Ecological Knowledge in a Marine Environmental Quality Program for the Hudson Bay Ecosystem
Miriam Fleming, Environmental Coordinator,
Municipality of Sanikiluaq

The Hudson Bay Traditional Ecological Knowledge Management Study describes important biological, physical and human ecological processes influencing the Hudson Bay, James Bay and Hudson Strait communities. The study also identifies ecological changes occurring in the Bays and surrounding lands, and assesses some effects of human activities on economically and ecologically important species. The study has been a success because it has been community driven: participants were empowered and they were provided the opportunity to meet with peers. Throughout the project there was a demonstrated concern by all participants for the health of the Hudson Bay ecosystem.

There are a number of factors that make traditional ecological knowledge valuable in understanding health and the changes in marine environmental quality. Good baseline information can be provided by active and retired hunters, trappers and fishers based on multi-year and year round observations. These TEK holders are also able to use elders' experience with an undisturbed environment as a benchmark against current conditions. The TEK holders are skilled naturalists with a solid understanding of natural occurrences and interactions in the region.

Inuit and First Nations of the region have used TEK for MEQ by assessing changes in the environment and wildlife. MEQ indicators have been used regarding sea mammals and birds. The species have been observed for changing behaviour, a change in diet, loss of fat content, and the quality of fur and skin conditions.

Several factors should be considered for including TEK in a MEQ program. These factors are: the effect of ecological changes on the quality of life for community residents as an indicator of MEQ; establishing a formal, community-based reporting system; and demonstrating respect for TEK holders. Other priorities include: recognizing TEK holders have expertise and indicators to monitor wildlife and environmental conditions; factoring in the costs of TEK monitoring; providing scientific feedback on TEK monitoring efforts; and creating sustainable opportunities for Inuit and First Nation youth.

"The environment is a growing field in terms of research and employment in the non-aboriginal world, but it is a diminishing field in the aboriginal world. The opportunities to earn a livelihood from the Hudson Bay environment are very limited in the year 2000. But my hope is that if new opportunities are created then maybe TEK will become part of the formal schooling of children, and the future will open up for them in more meaningful ways."

3.3. CONCLUSION OF SUMMARY PRESENTATIONS

3.3.1. Don Cobb, Marine Environmental Quality Coordinator Central and Arctic Region, Fisheries and Oceans Canada

It is important to recognize the contribution made by the researchers who participated in the Hudson Bay Programme toward accumulating knowledge of the region. This workshop should build upon the outcomes from that programme. In fact, several key players from that programme participated in the present workshop.

Perhaps one of the most consistent themes resulting from the presentations and discussions was the need to establish a link between traditional knowledge and scientific knowledge as we move forward towards establishing an MEQ Program.

The challenge for the remainder of the workshop is to focus the obvious interest and enthusiasm generated from these presentations into identifying research needs, exploring ways to work collaboratively in conducting research projects to fill the gaps and hopefully progress towards the identification of MEQ indicators.

4.0. SYNTHESIS OF GROUP DISCUSSIONS

4.1. INTRODUCTION

One of the objectives of this workshop was to obtain the advice and opinion of the participants regarding the key considerations in establishing a marine environmental quality research agenda for the Hudson Bay ecosystem. To obtain this advice, workshop participants were divided into five working groups. Each group was asked to provide advice regarding the following:

- Identification of key issues and research priorities.
- Identification of potential marine environmental quality indicators.
- Actions required to develop a coordinated approach to research.

Each working group was assigned one of five specific themes to focus their discussions, specifically:
Working Group #1-Water Quality and Contaminants
Working Group #2-Mammals and Fish
Working Group #3-Direct/Indirect Environmental Change
Working Group #4-Traditional Knowledge
Working Group #5-Community Participation

4.2. IDENTIFICATION OF KEY ISSUES AND RESEARCH PRIORITIES

4.2.1. Working Group #1 - Water Quality and Contaminants

Working group #1 produced a long list of potential research studies that would contribute to a better understanding of the nature and significance of contaminants in the waters of the Hudson Bay ecosystem. They determined that research is needed to gain better understandings of the sources and levels of contaminant inputs; the distribution and movement of contaminants within the Hudson Bay ecosystem; and the uptake and accumulation of contaminants within the food chain by fish, marine mammals and people. As well, research is needed to understand and assess the nature of current and future effects of contaminants on fish, marine mammals and people.

The development of a research agenda must be a comprehensive approach that considers the life-cycle of contaminants within Hudson Bay from point sources to food chain recipients.

The group identified three top priorities for research:
- Effects of contaminants on the quality of food taken from the Bay;
- Uptake and redistribution of contaminants; and
- Deposition of contaminants within sediments using sediment cores.

4.2.2. Working Group #2 - Mammals and Fish

Working group #2 felt that not enough information was available on mammals and fish to establish research priorities. The group focused its attention on describing the necessary components for developing a research plan. It was recommended that any research program needs to be responsive to the needs of both the people of the Bay and scientific interests.

The design of the research program should include a consultative process with all parties (communities, industry, government and environmental interests) identifying what is collectively considered as being important and specifying why the information is needed. Once this has been determined, research priorities can be set and studies initiated. The development of the research program should be a collaborative effort.

4.2.3. Working Group #3 - Direct/Indirect Environmental Change

Working group #3 identified several broad categories for potential research. An obvious and significant area for research was to better understand the significance and impact of climate change on the Hudson Bay ecosystem. Not only will climate change result in direct changes to the ecology of the Bay, there is likely to be significant indirect impacts on the Bay, these need to be studied and their significance understood. A second major category of research should focus on coastal zone issues. Change to permafrost conditions, modification to habitats and glacial uplift are all areas that require additional research.

It was recommended that research initiatives need to be better coordinated between and among governments and community interests. A collaborative approach that jointly identifies research needs is required. All research proposals should also include both scientific and traditional knowledge approaches, as appropriate for the subject to be studied.

4.2.4. Working Group #4 - Traditional Knowledge

Working group #4 generated a list of concerns and research needs related to the role and use of traditional knowledge. Traditional knowledge has an important role in research efforts providing insight on historical ecology, and rationale for current conditions and for detecting environmental change.

The following research priorities were identified:

- Review and compile all traditional knowledge currently available for use in research activities.
- Establish mechanisms to record and database the observations of environmental change and other research topics by local peoples and harvesters.
- Assess and monitor the quality of food from the Bay as consumed by people.
- Research historical ecology of fish and animals.
- Research the movements and migration patterns of species
- Assess the distributions of ice and snow, and study the implications of changes to this regime on the distribution of species.

4.2.5. Working Group #5 - Community Participation

Working group #5 produced a list of research priorities and important areas that need to be studied through additional research. The top priorities ranked in order of importance are:

- Define and establish a community consultation and decision-making framework.
- Communicate and translate research findings back to the communities, defining research results in terms relevant and meaningful for the local peoples.
- Design research projects which involve the communities. This would include hiring residents to work with scientists in carrying out research.
- Identify contaminants present in food from Hudson Bay that is consumed by local people and determine safe levels for consumption.
- Establish an environmental baseline of conditions in Hudson Bay.

Table I: Setting the Marine Environmental Quality Agenda: Needs and MEQ Indicators.

THEME	NEED	POTENTIAL MEQ INDICATOR
Water Quality and Contaminants	• Determine contamination levels of species used for human food sources; assess contamination spatially and temporally in the Bay • Uptake/distribution of contaminants in the food chain • Fluxes of contaminants – spatially and temporally	• Beluga • Ringed seal • Seabirds – migratory vs. non-migratory • Diseases of animals
Marine Mammals and Fish	• Establish a research plan • Determine possible sources of financial support • Determine how research will be conducted and by whom	• Fringe species • Ringed seals • Harp seals • Polar bears • Killer whales • Scientific and TEK involvement
Direct/Indirect Environmental Change	• Need additional baseline data with which to compare indicators • Include all of the Hudson Bay Region • Set up a coordinating body to monitor	
Traditional Knowledge	• Review traditional knowledge that is available • Capture the observations • Determine life histories of fish and animals • Determine movements and migration of species • Determine timing of ice/snow and distribution of the ice	• Indicators as recommended in "Voices from the Bay"
Community Participation	• Determine definition of "community consultation" and develop framework • Communication and translation • Involve community in designing research projects • Identify safe levels of contaminants for human consumption	• Track change in populations • Track deformities in species

5.0. WORKSHOP CONCLUSIONS AND SUMMARY

5.1. PROPOSED MARINE ENVIRONMENTAL QUALITY INDICATORS

The workshop participants provided a series of recommendations for both developing and applying MEQ indicators. The comments of the working groups focused on both the process of developing MEQ indicators and content considerations, specifically:

(a) a collaborative approach to selecting indicators;
(b) a collaborative effort for field observation and monitoring environmental change; and
(c) potential MEQ indicators for the Hudson Bay ecosystem.

The findings of the five working groups are summarized:

5.1.1. A Collaborative Approach to Selecting Indicators

It was proposed that the selection of MEQ indicators be a collaborative effort between the communities of the region and scientific interests. This collaborative approach was proposed since it was strongly felt that environmental monitoring should provide information in response to the important unanswered questions of both the communities and scientists. As research funds are limited, the moneys spent must be seen as providing value to those with an interest in the Bay. It was further proposed that workshop forums similar to this and the *Western Hudson Bay Workshop* be considered for jointly selecting indicators. For an indicator selection process to succeed, it must be linked to the proposed coordinated management approach for the Hudson Bay region. As such, the building of awareness and engaging of the communities and other interests in selecting indicators should be part of a broader Hudson Bay coordinated approach to communication and consultation. Once again, it was recommended that traditional knowledge and especially the contribution of First Nation and Inuit elders can be extremely valuable in identifying environmental indicators that provide information on environmental change.

5.1.2. A Collaborative Effort to Field Observation and Environmental Monitoring

Several of the working groups recommended that the local peoples inhabiting the region, hunters, trappers and fishermen, can serve as front line monitors of environmental change. These individuals visit the land on a regular basis and have a deep knowledge of the fish, animals and climate. They can identify if an animal is in poor health or encountering difficulty. They can observe change in species population and distribution. They also have a vital stake in the health of the fish and animals.

It was recommended that research and environmental monitoring programs be designed in collaboration with these harvesters and that they be included in the implementation as field observers and monitors. As part of the research and /or monitoring program design, consultations should be considered to ensure that these harvesters observe and report on matters of relevance to the programs.

5.1.3. Potential Marine Environmental Quality Indicators

The process for selecting indicators should include a preliminary step for determining whether the status of a fish or marine mammal under consideration as an indicator is declining, increasing or in stable condition. Understanding status will help guide the assessment of the value of the species as an indicator for detecting environmental change.

With respect to possible indicators, it was suggested that beluga whale and ring seals be considered. Their fat thickness indicates an ability to obtain food and demonstrates the bio-accumulation of contaminants. Seabirds could be used as indicators comparing contaminant levels between migratory and non-migratory species. Other suggested indicators included killer whale, polar bears, harp seal and various fish species. Examination of eyes for cataracts in animal and people may be a good indicator of ultra-violet intensity, an effect possibly caused by climate change. It was also recommended that the indicators listed in the book "Voices from the Bay" represents an excellent source of potential indicators and should be given full consideration.

5.2. ESTABLISHING A COORDINATED APPROACH TO RESEARCH

All working groups agreed that it was necessary for researchers, the communities of Hudson Bay and other interests to work together to establish a research agenda. The development of the research agenda should be part of the general framework of the proposed coordinated management approach for the Western Hudson Bay region. It was further suggested that a Marine Environmental Quality sub-committee could be established to guide the development of the program. This sub-committee should include members from both the scientific and local communities.

Approaching and involving the communities in setting research priorities and selecting marine environmental quality indicators was a recommended approach. Effective communication and consultation initiatives will be required to build an understanding of the program, to establish trust among participants and to engage the communities in design and implementation. The communities should participate in the identification of research questions relevant to them, and should participate in collecting data.

Last, the content of research must recognize the values, culture and traditions of both the First Nations of Manitoba and Inuit of Nunavut.

5.3. WORKSHOP CONCLUSIONS

The following is a summary of the key ideas and suggestions from the workshop discussion:

1) While there is some research data on environmental quality in the Hudson Bay ecosystem - there is a need for more and a need to learn more.

2) Research done to date is fragmented, not well shared or communicated with other researchers, stakeholders and communities on Hudson Bay.

3) Local resource users are the “front line” monitors of natural resources. Their contribution is reliable, knowledgeable and cost effective given the vast areas that are included in the Bay’s ecosystem.

4) There is a need to respect and recognize the combined contributions of traditional knowledge and scientific knowledge in understanding the Hudson Bay ecosystem and its value to the people who depend on it. When doing research, there should be a balance of the scientific approach and traditional approach. This is based upon the recognition of the unique contribution that each brings to increasing understanding.

5) A list of marine environmental research priorities that are important both for Hudson Bay residents and for scientific research purposes was identified. This list of priorities reflects the importance of understanding the entire ecosystem of Hudson Bay and the desire for meaningful environmental stewardship. As a general principle, research must be relevant and add value to understanding.

6) There is significant jurisdictional fragmentation in Hudson Bay and equally significant knowledge fragmentation. In many ways this is similar and consistent with Miriam Fleming’s observation about the fact that the holders of traditional knowledge can only understand the environment as a whole - not in fragmented pieces. What people define as important can become important.

7) Knowledge management involves a coherent process of observation, which can become data, which may become useful information, which may become actual knowledge that contributes to informed discussion, decision making and accountability.

8) The community/stakeholders are willing and interested to participate in research, environmental monitoring, surveillance, and to provide input as an early detection to environmental changes.

9) Research results should be communicated to the communities in a way that is clear, understandable and put in terms or concepts that are relevant to that community. Results must be communicated back to the communities.

10) Provide rationale for research in terms of benefits and value for the communities. If they understand the rationale and the value that it can bring, there is a better chance of support from the community. Research, whether marine environmental quality or other, should be responsive to the community/stakeholder needs and interests.

11) Management of Hudson Bay should be guided by a regional ecosystem based approach that understands the linkages within this vast and complex ecosystem.

12) Climate change is a major consideration, especially in terms of the potential effects on the marine ecosystem and the users of the resources of the Bay. There is a need to develop strategies to adapt to these changes.

13) Well-developed methods to be used to assess habitat degradation are needed.

14) The importance of a healthy food chain throughout the ecosystem is a high priority.

5.4. NEXT STEPS

Don Cobb of DFO provided closing comments. He expressed his appreciation for the hard work and contributions of the workshop participants. The findings and recommendations of the workshop will be reviewed by DFO to determine the next steps in establishing an MEQ agenda for the Hudson Bay. In particular, DFO will assess the outcomes of the workshop report, and begin discussions with communities on the best approach to establish an MEQ monitoring program in the context of the broader coordinated approach to the management of the Hudson Bay region.

One of the recommendations made by Nunavut participants at the workshops was that a key next step in developing a management plan for the Western Hudson Bay must be to consult with the Kivalliq Region (Western Hudson Bay) communities. Based on this recommendation, DFO staff visited Churchill, the Kivalliq communities and Iqaluit between March 7 and March 19, 2001 to conduct further consultations concerning appropriate next steps. It is anticipated that a Western Hudson Working Group will be formed in Fall 2001 to begin work on developing a management plan for the region.

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