

APPROACHES AND TOOLS

The following section summarizes some of the key capacity needs that have been identified by conference presenters as significant barriers standing in the way of the successful integrated management of transboundary coastal areas. It includes tools and approaches that have been developed, implemented and tested by the participants of the MANAGING SHARED WATERS conference to address these needs.

In their struggle to address environmental challenges, coastal managers and stakeholders are often limited in their actions by a lack of capacity to deal with the issues at hand. For the purposes of discussion, these capacity needs have been grouped into four categories:

1. The capacity to **educate, train and raise awareness** through a fostering of knowledge and understanding of the issues and the development of practical skills and expertise to deal with them.
2. The capacity to develop effective **institutional and participatory frameworks** to legislate, regulate and achieve compliance.
3. The capacity to **measure and understand** coastal ecosystems through monitoring, research and technology development.
4. The capacity to deliver effective and affordable **infrastructure, products and services** that will support sustainable coastal zone management.

A primary objective of the *MANAGING SHARED WATERS* International Conference is to share best practices from successful initiatives around the globe in an effort to improve overall capacity for sustainable transboundary coastal management. While many of the general challenges related to transboundary coastal zones are shared, most of the specific capacity needs and solutions will be regionally defined. Each coastal region has its own unique physical conditions, ecological features and processes, management and planning concerns, land, water and resource use patterns, socioeconomic context, culture and history to take into account. However, coastal managers and stakeholders can still derive tremendous benefits from the exchange of information on tools and approaches to common challenges. There is also much that the freshwater and marine coastal communities can learn from each other.

To this end, the abstracts of the afternoon paper presentations, workshops and seminars delivered at *MANAGING SHARED WATERS* have been included for easy reference. All abstracts have been grouped according to the capacity building theme identified by the author. These abstracts have been designed in such a way that the reader can easily gain a sense of the challenge faced, the type of tool or approach used and the strengths of this approach. A contact name for each abstract is also included as a source of further information.

Education, Training, Awareness Raising

In order to fully understand the dynamics of coastal issues and address the challenges facing them, coastal stakeholders, policy makers and managers require better understanding of all aspects of the issue at hand. This capacity can be gained through formal or informal education and training programmes covering a broad range of activities. It can be directed at a wide variety of audiences ranging from the public to scientists to decision-makers. It can be passed onto others through community awareness raising, advocacy and outreach. Raising public awareness is critically important to build support around initiatives and implement change. Direct stakeholder participation in decision-making processes can also lead to more extensive understanding of the concerns and challenges involved in an issue by all parties.

The underlying goal of all of these activities is to build capacity to address coastal resources in a way that supports human and environmental health and sustainable and integrated resource management. This can be achieved by increasing understanding and acceptance in the community and by developing skills to support all aspects of management. The benefits include quicker and more accurate identification of the problem, more innovative management solutions and strategies, improved recognition of stakeholder needs and enhanced buy-in.

Formal and informal education and training are the most obvious and direct mechanisms for increasing awareness and improving overall understanding. Children and resource users are the most common targets of education campaigns. But more recognition is being paid to the training needs of decision-makers. Gender-based training and training based on indigenous knowledge are also widely used. The role of **advocacy groups** in securing and increasing public awareness of water and coastal challenges is another important element for improving overall understanding.

More inclusive decision-making processes allow stakeholders to become more aware of the growing pressures on valuable and vulnerable coastal resources and their collective responsibility to manage these challenges. Identifying and utilizing the strengths and resources of the local stakeholders also lends credibility to the management approaches and provides them with broad-based community support. Beyond inclusive decision-making approaches, are tools which **empower the community** directly to make better decisions at the local level using local knowledge and expertise.

Creating effective mechanisms for **ongoing stakeholder dialogue** will facilitate continuous learning. Innovative communications tools (Internet linkages and television broadcasts) are increasingly being utilized in addition to the more traditional and still highly effective approaches (news letters, pamphlets, stewardship guides).

The abstracts in this section provide some insight into different approaches being used to address capacity needs for education, training and awareness raising in different freshwater and marine coastal regions around the world.

Examples of capacity needs identified by *MANAGING SHARED WATERS* participants:

- better understanding of coastal issues by all sectors all stakeholders;
- more productive participation;
- mechanisms for gaining appropriate input from all sectors of society;
- internet linkages between stakeholders;
- communication tools to improve public awareness;
- training for decision makers;
- funding for advocacy groups; and,
- greater recognition of the resource users needs and needs of all stakeholders.

Examples of tools and approaches for improving capacity:

- Education kits (hard copy and electronic) using local examples to illustrate potential impacts of climate change;
- Coastal zone stewardship guides (hard copy and web-based) providing highly illustrated and easy to understand description of coastal zone planning considerations for landowners;
- Children's water festivals utilizing hands-on activities to teach water-related themes;
- Marine Mammal Monitoring Project promotes stewardship through information available at marinas and in boating courses;
- Fish Art Project confers in-depth knowledge of marine life through art classes;
- Assessment of the current status of training needs and opportunities for coastal decision-makers;
- Dissemination of marine education through radio, television and newspaper advertisements;
- Gender-sensitive mass awareness raising programmes concerning freshwater and sanitation;
- Forage Fish Project educates and involves local residents as volunteers in surveying beaches to identify forage fish spawning sites;
- Community based research leading to the development of a coastal management strategy;
- Traditional and local-based management; and,
- National alliance of community-based marine sanctuary managers.

Training Today's Coastal and Marine Managers from the Western Indian Ocean (WIO) Region on Coastal Zone Management (CZM)

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Challenge: Natural processes modify the coastal zone and it is affected by man's activities to a large extent as it supports much of the world's population. A management of coastal areas acquires prime importance in the strategic planning towards a healthier and sustainable tomorrow. The ultimate challenge of CZM is to find the right approaches to maintain the needs and options of present and future generations at a sustainable level.

Description: This proposal describes the need for training coastal and marine managers from the WIO region on CZM. A case study of Shanzu-Bamburi area in Kenya's north coast is given. The overall strategy in CZM is to attempt to define the prime issues, the viable policies and regulatory actions. Altogether these provide the long-term development of the coastal area of the WIO region.

Application: The research is based upon scientific principles, traditional practices and recognition of social realities. Management schemes for sustainable development involve the control and restraint of human actions so as to assure greater benefits to all communities for now and future. A well thought-conceived coastal strategy is required for the prevailing unique coastal regions of the world to guarantee sustainable form of development and a healthy society to exist and grow beyond the 21st century. The technique used include classroom study, propaganda through TV, radio, newspapers and brochures, publicity through scientific publications, holding field demonstrations, open meetings, seminars, workshops and conferences.

Strengths: Already local and regional courses, seminars, familiarization tours, workshops and mobilization of community through local leaders have been done for coastal and marine managers. After such trainings the managers then pass on this information to their staff members.

Capacity Needs: Steps should be taken for training and imparting more education on CZM to a large number of managers, technocrats and scientists from the WIO region since most of the vulnerable coastal zones of the world are located in this region. It is suggested that better results would evolve from planning and management in the WIO region through locally qualified personnel receiving training and education on a regional basis with international support. It is true that in developing countries the lack of management skills (due to lack of proper training) reflects a lack of accepting the strategies of CZM as practiced elsewhere.

Key Words: training, education, coastal zone

Empowering Communities and Developing Sustainable Livelihoods Towards Coastal Resources Management

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Challenge: In 1995, the Community-based Coastal Resources Management (CBCRM) was implemented in the communities of Bolinao in Pangasinan, Philippines by forging partnership on a tripartite basis that includes two academic institutions and one non-government organization. These institutions have facilitated the formation of different fishers' organizations, installed livelihood projects and established resource management initiatives such as mangrove reforestation and marine protected area. By the end of 1997, however, when the different institutions moved out of the area, community organizations were visibly observed to be weakening.

Description: The commencement of the second phase of the CBCRM project in 1999 spearheaded by Haribon Foundation in order to gain a deeper understanding of what makes a livelihood initiative successful and how this contributes to the sustainability of the CBCRM initiative. The coastal environment of Bolinao has been said to be responsible in recruitment of marine species in the entire Lingayen Gulf.

Application: Organizational assessments and presentation of coastal situational analysis were made along with the baseline socio-economic survey and focus group discussions conducted in the area made the community aware of the important role of community organizing, participatory action research and environmental education. Community organizers coming from the local sites were trained in organizational and natural resource management. The so-called local community organizers (LCOs) have facilitated their respective

organizations in research processes undertaken by the local volunteer research partners who gained insights on their territorial boundaries through resource assessment and mapping.

Strengths: Coastal communities have integrated what they have learned in order to come up with their respective sustainable livelihood framework. Adjacent communities even formed their organizations, not because of environmental issues, but because they have seen how effective the local community organizing and community works as a sustaining mechanism to improve the impact of environmental initiatives. These have laid evidence that LCOs work as facilitators in order to ensure the sustainability of their respective organizations and livelihoods that includes coastal and marine protected area management. Value-formation also played an important role in realizing their goals.

Capacity Needs: While more effective organizations have been set-up with functioning leaders and committed and skilled LCOs and researchers, they must contend with the forces beyond its control. Focusing on fishery resource-based while strengthening economic and financial sustainability will allow them to sustain their coastal resources management supported by conducive local and national fishery and coastal management regulations

Key Words: coastal resource management, community empowerment, Lingayen Gulf, Philippines, sustainable livelihood

Implications of Climate Change to Local Coastal Communities: The Lake Huron Example

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Challenge: Climate change poses one of the greatest environmental and social threats to society. This message is extremely difficult to comprehend and visualize when it is referenced to global action to a global issue. How do you raise awareness and educate residents of coastal communities on the topic of climate change. How do you inspire local action and adaptation of the local residents to the potential impacts to the largest freshwater system in the world: the North American Great Lakes. How do you highlight and explain the potential impacts of an emerging coastline (due to falling water levels) when the saltwater coastlines are submerging (due to rising sea levels) caused by the implications of climate change.

Description: This presentation will focus on the research and presentation of climate change impacts to the Lake Huron community by a non-profit, non-government organization focused on the conservation of the coastal environment of the second largest lake in the Great Lakes system — Lake Huron. Specific target groups were identified and projects undertaken to educate and raise the level of awareness of this issue.

Application: A case study using GIS technology illustrates how lower water levels will impact the operation of the deep water port at the Lake Huron coastal community of Goderich. The Port of Goderich hosts the only deep water port on the lake and the largest salt mine in North America. A second example of raising the level of awareness uses an education

kit produced by the same non-profit organization. The kit for elementary school children uses local Lake Huron examples to illustrate potential impacts and adaptation strategies. This education kit uses written and digital format presentation to portray the climate change scenarios and generate thoughtful discussion on the topic by the students.

Strengths: The two examples of education and raising awareness assist in bringing the global issue down to the local level using local sites and familiar examples that community members can relate to and identify with. Local examples will empower residents by arming them with information that can be used to illustrate potential impacts. Empowering local communities and residents will improve the chances of action by local, provincial and national politicians. The two examples target the financial implications to a community surrounding a shipping port and target the curiosity of school aged children through a multi-media education kit.

Capacity Needs: This presentation illustrates how education and awareness raising on the topic of climate change can be accomplished using local examples to empower local residents. Two target groups are used to ensure the message reaches the greatest number of residents regarding the implications of climate change. The implications are to a tangible feature that is nearby and vitally important to the social and financial health of the region — the Lake Huron coastline.

Forging New Partnerships to Enhance Training Opportunities for Lake Erie Coastal Zone Decision Makers

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Challenge: The Ohio Lake Erie basin is home to hundreds of jurisdictions, organizations and agencies, all with decision makers who affect conditions in the Ohio Lake Erie basin coastal and riparian zones. Many of these decision makers operate at the local level, and many are elected officials or volunteer for governmental responsibility. The kind and level of knowledge these decision makers possess will have a direct influence on the land use, resource management and economic decisions these entities take. It is not clear how these decision makers gain relevant information, what kind of information they possess or need, and what mechanisms are the most effective in transferring relevant information to these decision makers.

Description: This presentation focuses on a recent partnership created as part of Ohio's coastal training initiative (CTI), which has been to improve the status of coastal zone management training programs and information availability in the Ohio Lake Erie basin. The CTI partners are Ohio Department of Natural Resources/Coastal Zone Management Office, the Ohio Sea Grant program at Ohio State University, and the Old Woman Creek National Estuary Reserve on Lake Erie. This partnership was formed to create a comprehensive training program on coastal management for decision makers. CTI has in turn formed a partnership with the Great Lakes/US EPA Environmental Finance Center at Cleveland State University.

Application: Cleveland State University's Great Lake Environmental Finance Center is conducting baseline research on the current status of training opportunities (types of

programs, locations, providers, etc.) and a needs assessment of coastal decision makers in the Ohio Lake Erie basin. Together these two sets of data will allow CTI partners to develop a training program that fills in existing gaps in training and coordinates activities to improve knowledge among decision makers of available coastal training opportunities.

Strengths: Strong partnerships can achieve greater effectiveness at lower transaction costs. The partnership between Ohio's CTI participants and a US EPA-funded Environmental Finance Center creates a multiple-agency focal point for dispersal of training information. The university's research capacity provides value. The CTI and university anticipate a continued partnership in developing new curriculum for training and enhanced outreach efforts to coastal decision makers.

Capacity Needs: Local decision makers often have inadequate knowledge of coastal ecosystem function and the value of coastal management. They also must balance coastal management with economic and social priorities. Diffuse information about training opportunities is often not readily available to local decision makers or to state agencies seeking to expand training opportunities. The partnerships and activities described in this presentation will enhance the capacity of CTI agencies to deliver effective training programs and improve the ability of decision makers to gain access to critical coastal resource management information.

Key Words: Ohio Coastal Training Initiative, partnerships, coastal resource decision makers, training

Sustainable Coastal Development: Perspectives of Local Knowledge and Community-based Co-management in Southeast Asian Coastal Community

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Challenge: Local knowledge about the environment and natural resources is being shown to be an important asset in coastal communities. Such knowledge provides the basis for traditional community-based management systems, and its acquisition, use and transmission are extremely relevant to livelihoods in subsistence fishing over most of the world, especially in Southeast Asian Coastal Community. Presently community-based coastal resource management, particularly fisheries management is an alternative of sustainable development in coastal communities of Southeast Asia, especially in Bangladesh. In Bangladesh, traditional local knowledge and community-based participatory management are extremely successful for sustainable development in some localised area of coastal community. This management with scientific input is now expanding to other coastal communities of Bangladesh.

Description: The paper will analyse the successful of sustainable development in coastal communities of Bangladesh and identify the different factors behind this successful history. Finally, the paper will recommend a policy framework on how overall coastal Bangladesh and other Southeast Asian coastal community will enjoy the opportunity of sustainable development.

Application: The key sustainable development planning and management issues are formal and informal education, awareness, community consultation, community participation and implementation of local community-based rules and legislation, which cover the nature conservancy as well.

Strength: Coastal environment is the most resourceful and productive zone in the world. On the other hand, most Southeast Asian coastal communities are in great risk due to climate change and other anthropogenic disturbance. Therefore it needs to become sustainable the coastal environment, because rest of the world human population depends on the sustainability of the coastal environment.

Capacity Needs: Financial support and technical help including need-based education are the important factors to achieve the sustainability of the Southeast Asian coastal communities. Strong decision-making processes from local, national and international community will strengthen to the achievement of the coastal sustainable development. Institutional and research involvement are other factors to implement this process.

Key Words: Local knowledge, Community-based participatory management, Southeast Asia and Bangladesh

The Decreasing Water Levels in the Great Lakes and the St. Lawrence: Rising to the Challenge

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Challenge: The Great Lakes contain almost one fifth of all the surface freshwater in the world. However, the quantity of water flowing from the Great Lakes into the St. Lawrence has slightly diminished from year to year for several decades and this situation has become a cause for concern. The low water levels affect the hydroelectric, maritime and boating industries as well as the general public who cares about the state of these watersheds. The project entitled "La baisse des niveaux... un défi à relever" was initiated to interest grade 9 and 10 high school students, the stakeholders of tomorrow, in water discharge management by the IJC's International St. Lawrence River Board of Control and in the overall water level situation in Lake Ontario and the St. Lawrence River. In the fall of 2001, each of the 24 schools scattered between Toronto and Trois-Rivières that participated in the project received a kit containing a series of fact sheets, maps and objects related to the water level issues as well as an investigation book to complete during the winter months. Upon completion of their work, the students have been invited to the Biosphere to share their experience and discuss their opinions at a meeting to be held in mid-April 2002.

Description: The presentation will focus on the project organization, the selection of the schools, the elaboration of the information kits distributed, the unfolding of the April meeting and the overall results obtained with the 650 students who participated in the project.

Application: All national and binational government agencies and community groups are preoccupied by the water level issues in the Great Lakes and the St. Lawrence River. The International Joint Commission has initiated a series of studies that focus on these issues. As

well, the community groups have been consulted to understand their concerns about the present and future situation. The project "La baisse des niveaux d'eau" has been initiated as a pilot project aiming at a group of young citizens, namely grade 9 and 10 high school students, that will face important environmental issues in their adult life and will have to participate in the decision making process over the next decades.

Strengths: To show the importance of the water level issues in the Great Lakes and the St. Lawrence, the project "La baisse des niveaux d'eau" was based on the active participation of the students and teachers. The information kit distributed to the schools was designed and assembled in a way that makes it attractive, informative and reusable. It contains all the necessary material to understand the issues the project focused on. A second important component of the project will be the April meeting that will allow to the participant that attended to share their experience and discuss the strengths and weaknesses of the project.

Capacity Needs: It is likely that water level issues will become more and more important in the future. Water shortages and extreme levels will become common and society will have to make important decisions on what will be the best way to manage the water discharge and levels in Lake Ontario and the St. Lawrence River. Innovative ways to consult the public and give citizens the opportunity to express their concerns should be considered, including projects such as "La baisse des niveaux d'eau" initiated by the Environment Canada's Biosphere.

Key Words: Great Lakes, Lake Ontario, St. Lawrence River, water levels, high school students

Involving the Community in the Wise Use of Water in the Great Lakes Basin

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Challenge: Recently, potential large-scale withdrawals and exports of Great Lakes water have highlighted the threat to this finite water resource. Documenting the harm of such withdrawals at a basin-wide level is a daunting task due to the seasonal fluctuations of lake levels and flows that respond to global level phenomena such as climate change and are only indirectly linked to large-scale water withdrawals. Harm is apparent however at the local level. For example, local level water withdrawals and diversions have caused wells to run dry in South Elgin, Illinois and have reduced stream levels in the Tay River Watershed of Ontario. The effect of local level water withdrawals and diversions are thus an important indicator on the effect of withdrawals for the basin as a whole as many of these water usages may affect tributary water sources to the Great Lakes. These local level water usages also directly affect communities and it is at this level that interventions on the wise use of water can begin to make a difference.

Description: This special session or seminar will focus on raising the issue of local level water withdrawals and scarcity in the tributary waters of the Great Lakes. As the ultimate users of water, the public forms the nexus for agricultural, industrial and municipal uses of water. Moreover, the public is also concerned about water for ecosystem needs such as those for wetland, shoreline and aquatic habitats. Directly involving the community in addressing the threats facing the basin must encompass an understanding of these concerns. The challenge thus facing decision-makers and local, regional, national and international stakeholders is how best to incorporate community concerns, priorities and patterns of water use in integrated water resource planning.

Applications: Components of this presentation will include the development of a framework for addressing community-defined indicators for use and conservation of water. Based on

community and stakeholder concerns, the framework will address mechanisms for community involvement in water use planning, decision-making and policy. A key concept will be the “scaling-up” of community input to policies currently being developed at the regional, national and international levels. One such development is the implementation of water use standards outlined in Annex 2001, an addendum to the Great Lakes Charter. Successful implementation of the directives of the Annex must incorporate community concerns, priorities and needs. In addition, documentation of community water use behavior through representative case studies for each state and province will demonstrate the variation in water use across communities, livelihoods (urban, agricultural and industrial) and the needs of the ecosystem.

Strengths: The development of a community derived framework on water use in the Great Lakes basin will provide a sound foundation for decisions on how and where water is used within the basin. More importantly this framework will serve to create a system whereby water use policies fully integrate community-derived indicators on water use and water use behavior. Such measures can also serve to inform and educate communities about the affects of water use at the local level and its connection to the functioning of the basin as a whole.

Capacity Needs: The use and management of water occurs at multiple spatio-temporal scales and often in complex ways. At the heart of this complexity are the needs of water for people and the ecosystem. Involving the community in formulating sound policy frameworks that at their core meet the needs, priorities and concerns of the communities and ecosystem they are mandated to serve and protect, are integral to sound water management

Key Words: community involvement, local level water withdrawals, ecosystem needs, water shortages, Great Lakes

Water, Sanitation and the Struggle of Coastal Women in Bangladesh

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Introduction: Bangladesh is a highly density populated country where women constitute half of the total population. About 80% of the total population are living in the rural area that includes coastal belt as well. Customarily women are the main responsible persons for household management in Bangladesh that includes family health as well as sanitation facilities. They are the caretakers of children and old aged family members, and the ones who have to ensure that their families have required water though sufficient fresh water is not available in the rural area, especially in the coastal belt of Bangladesh.

Historical Context: Traditionally rural people depended on surface water for drinking and other domestic uses. In the flat delta areas they built their homes on earthen mounds to protect them from flooding, making a pond for water storage in the process. As the population grew the ponds and other open water bodies got more and more polluted by organic waste. As a result about three decades ago deaths due to waterborne diseases were very high. More recently the use of fertilizers and pesticides in agriculture, chemicals in industry and petroleum products in transport has lead to chemical population of surface water. Gradually open water bodies are being reducing for urbanization and constructing more houses, markets, roads etc. To make people aware of the dangers of using surface water for drinking, government and non-government agencies have made an all-out effort and the campaigns encouraged rural people to use tube-well water, as it was free of bacteriological/organic contamination. But the people live in the coastal belt have problem getting fresh water even underground due to highly concentrated iron and salinity in the groundwater particularly in the southern part of the country.

Present Condition: Women are facing problem for having sufficient fresh water for domestic use that includes cooking food, washing utensils and clothes, wash hands before eating and after defecation, bathing,

vegetables gardening, pond fish culture, etc. those influences family health and nutrition of individual member. They have to collect water from different sources (i.e. pond, river, canal, tube-well, etc.) that depends on access to the sources and seasonal changes. In most cases sources of water are long distance one, so that coastal women have to struggle every day for transportation of water from the sources to the household. Because during monsoon they have water in everywhere but that are polluted. On the other hand most of the ponds and canals become droughty during dry season. So women or girl child of coastal area have to collect fresh water from long distance sources and that makes their lives difficult due to hard work and long working hour as they could not ignore any other routine work. In the coastal area surface water from sea is salty and groundwater sinking by tube-well either salty or content iron in many cases. So that source of fresh water is limited. Now a day, they are facing new problem due to arsenic contamination of ground water. Iron and salinity problem comparatively easy to identify by seeing change colour or taste but arsenic could be identified only after chemical test of contaminated water. The water from many tube-wells is contaminated with arsenic, in some cases over 10 times the WHO standard.

Field Observation: Women are concerned about water quality and adequate sanitation facilities. But they are not willing for frequent changes of facilities as it influences their life style and they had to change their behavioral attitude that also related to the privacy matter. Coastal women would accept any positive change related to fresh water adequate sanitation facilities, if it does not contradict existing belief, and if it is economically viable and finally if it could be made available at the individual household level. So providing greater access to safe water supply and adequate sanitation facilities in rural and coastal area people will be expected to have a tremendous effect on women's health and family welfare as well as profound impact on the nation human resources capability.

The Development of Environmental Education in the Coastal Zone of Cienfuegos Province, Cuba

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Challenge: Programmes on integrated coastal management are carried in Cuba to make an economical and social development preserving the environment. However, the change of the public and decisionmakers mentality need the application of programs on environmental education in the coastal communities.

Description: This paper addresses the information about the efforts, results obtained and needs to implement formal and informal educative programmes directed to different coastal community sectors in the Province of Cienfuegos.

Application: Several organizations work in the informal education on the preservation of the coastal zone, attending clubs with primary school children and executing courses for managers of enterprises. The Cienfuegos' Naval Museum opened a Bay Room and is executing activities with the community. Radio and television programmes about coastal issues had been broadcast in the province and in a national television channel. Coastal affairs were discussed in the Provincial Assembly of the Popular Power. Community projects with educational orientation are developing in coastal areas of the province. As part of the formal education, thesis for graduate students had been carried as well as the graduation of three students with the degree of Master in Marine Management in Dalhousie University, Nova Scotia, Canada. A course of Master in Marine Management is carried in Cienfuegos University as part of a joint project executed by Cubans and Canadian universities.

Strengths: There are the political will and increasing government proceeding in the context of Popular Councils that permits the development of community work on coastal affairs. There are organizations with the mandate of execute management plans at local levels. The Strategy for Environmental Education had been elaborate for the province with goals and actions directed to the treatment of the problems in the local context. There are studies about Cienfuegos Bay and other coastal areas and several organizations had been participating in joint efforts looking for solutions of coastal problems. The divulging of environmental issues by the media at national level is increasing and local coastal themes could be introduced in the provincial radio, television and newspaper.

Capacity Needs: The qualification of technical people, decisionmakers, functionaries and managers that act in the coastal zone and the educators that should discuss those themes in the education of childrens, young people and future professionals requires solutions for material needs. The development of community projects in the coastal zone is in their first steps, they need time for development and are also limited by material needs.

Key Words: Environmental education, coastal zone, Cienfuegos Province, Cuba

Children's Water Education Council, Children's Water Festival

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Description: The presentation will give an overview of how the Council promotes educating children across Ontario through community based festivals. In 2001, six Ontario communities hosted a week long festival. A water festival utilize 40 hands-on activity centres to teach five water themes; water technology, water science, water attitude, water conservation, and water protection. The activity centres are interactive and fun for the students in grade three to six who attend. Students receive several key messages: use water wisely, protect your water supply and examine the relationship between water and technology, and the role of water in the ecosystem. The learning centres incorporate current curriculum requirements with hands-on learning. During the presentation participants will gain a knowledge of the importance of our most precious resource, water. Their will be three segments; a visual presentation on water facts; a hands-on demonstration of the activity centres; a question and answer period

Application: The Children's Water Education Council will give an overview of the importance of water education at a community level. Through interactive, interesting and fun activity centres participants will learn more about the importance to yourselves as individuals and to society at large. The

Children's Water Festival have been occurring across the province since 1994, since that time they have grown in numbers. In 2002, eight communities will be hosting a festival. The model has been created it is our goal to increase the number of festivals throughout the province. A handbook has been developed to assist new interested groups to start this process of hosting a Festival in their community.

Strengths: The Children's Water Festivals have been in the province for nine years. Since the inception in 1994, the number of festivals has increased to eight. In 2002, over 32,000 children will be reached through these programs. Our main goal is education, we feel we have been successful is reaching our mandate. We will continue to support new communities interested in hosting a Children's Water Festival in their community.

Capacity Building: The goal is to foster decision makers, initiate the process of behavioural change and to empower children to initiate change within their homes, schools and communities. To encourage children to become catalysts for change by taking information and new found respect back to their own environments within the North American Great Lakes Region.

Marine Environmental Education in the San Juan Islands

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Challenge: San Juan County, consisting of hundreds of islands, rocks and reefs, is situated in northwestern Washington State, where Puget Sound joins the Strait of Juan de Fuca and the Strait of Georgia. This island community has been active in citizen-driven marine conservation, of which marine environmental education is an integral part. The San Juan community strives for marine conservation through local efforts and through collaboration with the Canadian Gulf Islands in the Orca Pass Transborder Stewardship Area Initiative. While the San Juans becomes a conservation role model for many, its marine environmental education efforts have not yet been studied. Such a study can reveal valuable information regarding what measures are effective and what challenges are expected in community-based environmental education, which is relevant for any marine conservation initiatives that seek to gain public involvement and support.

Description: This presentation highlights two marine environmental education projects, with contrasting learner groups, as examples that illustrate the process of marine environmental education in the San Juans. The Forage Fish Project educates and involves adult local residents as volunteers in surveying beaches to identify forage fish spawning sites. The Fish Art Project used the nearby marine environment as an integrating context for formal education in a 4th, 5th and 6th-grade class in a local school.

Application: These two projects result in enhanced public awareness of the local marine ecosystem, which is the basis of public support for an ecosystem-based approach to marine conservation as opposed to a species-specific

approach. Through the collaboration of local citizens, NGO and state agency, the Forage Fish Project yields scientific information about forage fish spawning locations, which can subsequently be protected through legal measures. Students in the Fish Art Project gained in-depth knowledge about marine life through hands-on experiences and produced detailed life-size drawings of local fishes, which were later used in other education media.

Strengths: By engaging local residents in a scientific inquiry which, in fact, could be accomplished solely by scientists, the Forage Fish Project succeeds in educating lay people about the importance of some traditionally overlooked components of the ecosystem. The Fish Art Project entailed integrating various subjects in a study of marine life, which education literature shows is more effective than the conventional subject-by-subject instruction method. Both projects incorporate hands-on participation and interaction with nature, which enhance positive attitudes, actions and commitment to help solve environmental problems.

Capacity Needs: Sustaining local-scale, community-based education programs, which includes the continuation of financial and human resources, is challenging. Mechanisms for expanding the volunteer base of the Forage Fish Project and for tailoring the Fish Art Project to future classes need to be developed. Exchange of lessons learned from these and other similar education programs should be facilitated.

Key Words: environmental education, San Juan, community-based

Coastal Shore Stewardship Guide for Canada's Pacific Coast

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Challenge: Continued growth and intense activity within the coastal zone is threatening the health of BC's coastal areas — and the species that inhabit them. For local and regional governments who are managing these land-based activities there is little practical direction on how land use planning affects coastal systems. This guide provides a practical science based approach to coastal planning that supports the sound management of coastal systems using the planning and land management tools of local governments.

Description: Developed by the BC Stewardship Technical Committee, the guide will inform local government decision-makers, coastal landowners, and coastal resource users about the complex biophysical processes and the potential impacts of inappropriate shore development. The Coastal Shore Stewardship Guide provides highly illustrated and easily understandable description of basic physical and biological background, as well as focused content on coastal zone planning considerations, stewardship accounting, and the description of how landowner and local government decisions affect shoreline processes.

Application: The Coastal Shore Stewardship Guide will be completed by the summer of 2002, and will be promoted and distributed through a series of workshops throughout the province. A web-based version of the document, including an interactive database, will be made available through the www.stewardshipcentre.bc.ca web site. Building on the success of previous Stewardship Series products, it is anticipated

that local government planners will use the guide on a daily basis in their front counter discussions with members of the public and coastal landowners who are requesting advice on land development issues.

Strengths: Building understanding and support among the planning and development communities about coastal issues is a significant task. To achieve this objective, the guide uses a highly illustrated and engaging format. Information is presented in point form and descriptions are brief and precise. Key points are highlighted and reinforced. Most importantly, the document is written from the point of view of the land managers that it seeks to address. Subjects are laid out in a form that matches local government process. Information about coastal issues is designed to fit into various planning stages easily and directly. Additionally, the printed document is supported by a dynamic web resource that allows access at 'the teachable moment'. The dynamic website is easily refreshed and kept current within a complex and changing regulatory environment. Developed around a vigorous interagency partnership, the guide is expected to contribute significantly to local capacity and expertise on coastal processes.

Capacity Needs: Can the Coastal Shore Stewardship Guide serve as a template for developing similar tools for Integrated Management in other regions of Canada and other parts of the world? Ideas for effective promotion and distribution of the current Guide would be useful to the developers of the Guide.

Institutional and Participatory Frameworks

Institutional capacity needs associated with the shared management of water resources are significant. There exist a large number of barriers to successful co-management. These barriers can be political, social, economic and cultural. Challenges related to co-management include: disputes over allocation of resources, enforcement responsibilities, coordination of policy and science, and sharing of data and information amongst others. Each of these can be addressed with appropriate and innovative institutional and participatory frameworks.

Mechanisms for establishing the rules and principals for **governance** of shared waters and their related coastal regions are critical. Close cooperation and coordination between governing parties is needed to successfully set priorities and achieve successful results. Strong **partnerships** with all other sectors of society are also a critical key to success, particularly when relying on these sectors for the implementation of programmes.

Institutional arrangements that encourage collaboration and reinforce these partnerships are proving to work best. These arrangements range from those formalized in law to those developed on a voluntary basis. Whichever form they take, the most successful institutional arrangements for shared waters establish many, if not all, of the following:

- common goals and objectives;
- binding regulations governing allocation and use;
- a mechanism for dispute resolution;
- a governing or oversight body;
- a network for continuous data and information exchange;
- a delivery mechanism for joint programmes.

Also critical is the establishment of a mechanism for ensuring that all shared interests are represented and that their concerns are integrated. In shared coastal regions, stakeholders will often have very different and conflicting interests. The challenge is to balance the legitimate needs and interests of the individual users with the collective interest of the health of the coastal ecosystem and community for the long-term. An integrated approach is needed to harmonize these interests, build consensus and resolve conflicts. This process should be as inclusive and transparent as possible.

Participatory planning is one tool to ensure that: inter-sectoral interests are well-understood; costs and benefits are analyzed; trade-offs recognized; alternatives discussed; and priorities and strategies identified. Participatory frameworks can take several forms, such as stakeholder advisory committees and round-tables; but, in order to fulfil their objectives, all interests must have an equal footing. In any framework, special attention must be paid to participant's access to resources and any unbalanced power-relations, both of which can be serious impediments to any participatory process.

The abstracts in this section provide some insight into different approaches being used to address capacity needs related to institutional and participatory frameworks.

**Examples of capacity needs identified by
MANAGING SHARED WATERS participants:**

- dispute resolution mechanisms;
- guidelines for allocation and use;
- enforcement regimes;
- governance and partnership models;
- consensus-building tools;
- mechanisms for ensuring all shared interests are represented; and,
- co-management strategies development.

**Examples of tools and approaches for
improving capacity:**

- stakeholder advisory councils;
- ecosystem-based watershed plans;
- community action plans;
- integrated management ;
- participatory planning;
- international treaties, agreements and protocols;
- multi-sectoral management programmes;
- international and regional management bodies; and,
- community-based enforcement initiatives.

Institutional and Participatory Framework for the Sustainable Development for Water Supply and Sanitation

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We say, “we are what we eat,” and so we could also say, “we are what we drink.” Water is needed for the existence of all forms of life on this planet. Water, which is the source of our life, is used for all aspects of human activities such as disposal and transfer waste heating, cooling, cleaning etc. Our ancestors had great respect towards water, the boon for mankind, and always worshipped this precious resource. Though water is precious, it’s not always treated neither as such nor readily available to all. The rapid population growth along with poverty, urbanization, and industrialization pollutes this life substance and therefore disturbs the ecological balance of water supply. Through careless use of mineral resources, water crises arise. More than 20% of the world’s population are excluded from their right of access to safe drinking water and more than half a billion people live without access to a sanitation system.

Inadequate water supply is not only causing the mortality rate to increase in developing countries, where it is 10 times higher than in other countries, but is also the cause of 10% of all disease. Lots of time and energy is consumed to fulfill this basic need for water. The reason for water scarcity in developing countries is mostly due to the mismanagement and inadequate allocation of resources and weak governance. That’s why institutional and participatory frameworks play an important role. By improving the ability of people to wisely manage the production and consumption of their resources, they can maintain a better livelihood.

Water and Sanitation: Access to water and sanitation is not simply a technical and financial issue, it is also a crucial component of social and economic development. The status of water resources plays a vital role in determining the sustainability of a production

system. So water is the media of sustainable development. Using appropriate technologies that are capacity building can be extended sustainable and socially acceptable services.

Institutional Framework: Local level institutions (formation of Water Users group) legally authorized and empowered and supported by donor agency, NGOs, government and politics are successfully establishing a strong institution for the sustainable development of local Infrastructures, resources and services. Organized and constitutionally strong local institutions play an active role by using appropriate technology and local resources. The community managed projects have the sense of responsibility, ownership, gender balance and, cost sharing, optimum cost effectiveness, efficient construction maintenance and operation.

Participatory Approach: However past experience proved that the water supply schemes designed in partnership with the local community groups together with NGOs and donors are more successful and sustainable than the projects designed and implemented by the central government. Traditionally the provision of water supply and sanitation services were the responsibilities of the government. It was considered unjust and inappropriate to hand over the public good to the private sector. Nevertheless, in recent years, private sector participation is increasing and well empowered and legalized institutions at the local level are essential for efficient management, which is supported by donor agencies, government and NGOs. Projects demanded by fully participating communities can encourage the involvement of private sectors and can provide the people what they need to improve their living.

Towards an Integrated Community-based Fisheries Compliance and Enforcement Mechanisms in San Miguel Bay, Philippines

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Challenge: It is a growing recognition in coastal and fisheries resource management that non-state/user actors, particularly coastal communities, play a critical role in the proper management and efficient utilization of fisheries resources. Through the Philippine Local Government Code and Philippine Fisheries Code of 1998, coastal communities and local fisherfolks are empowered to assist in the implementation and enforcement of policies, laws, and regulations relating to the management of fisheries resources. However, in a common resource like San Miguel Bay, Philippines, enforcement of fisheries regulations towards self-compliance can be more than problematic because of conflicting jurisdiction and application of different standards, rules, and regulations. It is imperative to have an integrated fisheries enforcement regime in the bay whereby clear jurisdictional provisions are established, policies, standards, and regulations on fisheries management are harmonized, conduct of monitoring activities are coordinated, and greater participation of coastal communities are encouraged and enhanced, between and among the surrounding coastal municipalities.

Description: This paper presents an assessment of existing community-based fisheries enforcement initiatives in the seven coastal municipalities of San Miguel Bay, examination of national and local laws and policies on enforcement involving non-state actors, and presentation of policy recommendations towards an integrated community-based fisheries compliance and enforcement regime for the Bay. Fisheries enforcement techniques currently applied in each municipality as well as critical issues, constraints, and prospects for integrated enforcement are also discussed.

Application: Despite the plethora of Philippine fisheries laws and regulations at the national and local levels, the country is still in need of a comprehensive set of enforceable mechanisms to ensure compliance at the local level. The framework for integrated fisheries compliance and enforcement in San Miguel Bay may also serve as a model for other bays or gulfs of the country.

Strengths: The current system of governance over coastal and fisheries resources in the country recognizes and encourages cooperation among coastal municipalities sharing a common resource. This serves as the basis for coming up with an integrated community-based fisheries enforcement mechanism. The paper clearly describes and presents (using statistical data) the levels of fisheries enforcement and compliance between the seven municipalities.

Capacity Needs: Since coastal resource users are now empowered to enforce fisheries laws and regulations within their territorial waters, it is imperative to provide them with required technical, financial, and political supports.

Key Words: integrated fisheries enforcement, compliance, community-based enforcement, San Miguel

To and Fro: Community Perception of Fishing Pressure Along Naf River Territory of Bangladesh and Myanmar

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Rapid mechanization, capital influx and many other demographic-economic peculiarities in a multi-species set-up of coastal Bangladesh contributed to eventually turn towards a 'malthusian trend' of resource exploitation. Aggravated situation is observed in case of small-scale fishermen of Teknaf coast of Bangladesh who, even a few years back, enjoyed a long ribbon of fishing ground along with those of Myanmar. Perceiving a 'to and fro' movement of shoals of jew fishes, shads, mackerel and tuna, fishers from both sides started frenzied fishing. The oversimplified goal of reaping as much as possible from the

sea in a multi-faceted nature of social and economic well-being, variation in efficiency of mechanized boats, anomalies in fishing regulations, mistrust among fishers etc. led to 'gear war' in the transboundary coastal waters of Bangladesh and Myanmar. This paper examines the importance of adopting an effective trust-based mechanism for the transboundary fishing regulation to minimize the omnipresent sources of conflicts between fishers of the two countries with the common objective of striving for optimal resource utilization.

Salinity Matters in Sustainability: An Analysis of Shrimp and Carp Culture in the Coastal Areas of Bangladesh

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Shrimp culture is a money-spinning activity in the coastal areas of Bangladesh. There has been a massive horizontal expansion of shrimp culture with a geometric progression trend in the last three decades in the coastal areas of the country giving rise to many potential conflicts in tandem. Rampant destruction of mangrove habitat for shrimp culture has already transformed a multi-use coastal resource base into a privately owned single-use with the shape of 'aquatic desert.' Potential conflicts between shrimp growers and artisanal fishers exist as the huge numbers of the later group faced declining catch per unit effort (CPUE). Wholesale gathering of millions of shrimp larvae for stocking purpose in ponds by coastal vulnerable class from the wild and subsequent destruction of billions of commercially important finfish and shellfish fry, targeted by small-scale fishermen in sub-adult and adult stages attributed to this problem. Use right conflicts are also prominent between 'elite shrimp growers' and 'marginal paddy farmers,'

the former impairs the water quality needed for terrestrial traditional agriculture and animal husbandry. It is argued that conflicts which are 'global in formulation' and driven by the 'political economy' of the country fetched a pauperization process at the grassroots level through which social stratification with a wider income and power differential undergoes silently where 'big guys win over every conflict with small guys.'

On the other hand, it is evident that behind the salinity zone in the same coastal areas, polyculture of Indian major carps, freshwater prawn and tilapia in different combinations proved to be sustainable, affordable and environment friendly without 'dwarfing or downplaying' other interests. This paper also comes out with substantial rethinking of production practices and some specific suggestions with focus on community based zoning and planning.

Implication for the Use of Water in Urban Areas

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Summary: World population is growing at 1.6% annually, even though the growth rate is falling, we can expect the total to rise from about 5.3 billion to over 8 billion in 2020. Virtually all of the increase will be located in the poorer countries especially within the tropics and furthermore most of the increase in the foreseeable future will be in Urban, not rural. Therefore the management of water resources will become increasingly complex, especially in the regions where precipitation is low, highly seasonal and or very variable. To rural (agricultural) needs, urban needs and water requirements to maintain ecosystems will require the skills of the engineers and sensible water pricing policies, plus hard thought about the priorities for water use.

Pressure on Water Supplies: Several trends are putting increasing pressure on water supplies: population and income growth, the trend to spatial concentration of people, the widening range of uses to which water is put, and the need to disperse and to transport water products of all kinds. To begin to consider these matters, something must be said about the growth and the location of population, at present and for the foreseeable future as to enable proper planning.

A very large proportion of the world's existing population, and the great bulk of the prospective increase, is located within the tropics and therefore in hot climates, which range from the semi-desert and desert conditions of the African Sahel to the extremely wet conditions of Bangladesh. But even where there is an overall abundance of water, even excess, seasonal drought is common. Furthermore, much of the tropical

area of the globe is characterized by extremely heavy precipitation, with the implication that the control, and hence use of water is much less tractable than is the case in the temperate climate of Western Europe.

Every bit as important is the rapid urbanization that is going on in the less developed countries of the world. An estimate for past and future years of the proportion of the population residing in urban areas. There is a long-standing urbanization trend, which is manifest in all the major world regions, and that the most rapid urbanization is occurring in the less developed countries. Although these broad averages hide much diversity, the estimates available for 200 separate countries show that increases in urbanization into the next century are to be expected in all but six countries — and all of these are already 100% urban (e.g., Cairo in Egypt, Johannesburg in South Africa and other many coastal cities.

So strong is the urbanization trend that in the foreseeable future all the increment in world population will live in towns. The United Nations estimates that the total rural population in the world will reach a peak in 2010 at 3.13 billion and will thereafter begin to decline slightly. This decline has been in evidence in the more developed regions since 1950; in the less developed regions, the absolute decline of rural population will occur after 2015. By major geographical area, it is only in Africa that the rural population will continue to rise in absolute terms throughout the period to 2020; even in Asia, the peak will be reached in 2005 and thereafter the absolute number of rural dwellers in that region will decline.

Naturally Connecting Canadians: Oceans Sector Stewardship

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Challenge: A United Nations report entitled *A Sea of Troubles*, (2001) states that despite a general increase in awareness and concern for the health of the oceans, they are in fact under ever-increasing pressures. The Report cites a number of failings in oceans management as causal factors, including: poor governance that is not based on an integrated ecosystem approach and does not engage stakeholders; a lack of coordination between international programmes and institutions; inadequate financing; weak national structures and instruments; deficient information and a lack of scientific certainty; a lack of coordination between scientists and policy makers; and insufficient public awareness.

Description: This presentation will focus on the efforts that the federal government is taking at the national level to improve and promote oceans governance. The Department of Fisheries and Oceans is responsible for taking the lead on developing an integrated oceans management strategy. A discussion on the development of the strategy, including federal and intergovernmental cooperation and collaboration, oceans stewardship, and integrated management planning, will be provided.

Application: Implementing new approaches to oceans governance, focusing primarily on improved capacity for stewardship initiatives at the local level, will ensure greater enhancement, conservation and protection of Canada's oceans. The federal government intends to forge new working partnerships with

national organizations and provinces/regions that work closely with communities so as to access a greater number of local community groups and local governments. The intent is to improve the stewardship capacity at the local level through more comprehensive governance mechanisms. This will increase public awareness and education on oceans and thereby improve the overall state of Canada's oceans.

Strengths: The Oceans Act (1997) has provided the legislative backing to allow the federal government to take action to protect Canada's oceans. Oceans governance is a key component of Canada's Oceans Strategy and as such gives impetus to the development of a cohesive national plan.

Capacity Needs: Greater attention on improved oceans governance and development of stewardship initiatives both internal and external to the federal government is needed. Presently, local communities lack the necessary tools and resources to adequately conserve, protect and enhance Canada's oceans. Through the roll out of Canada's Oceans Strategy, it is anticipated that new partnerships between government and NGO's, Aboriginal people, and industry will be forged to allow for all parties to work together with a common goal of improving the state of Canada's oceans.

Key Words: oceans governance, stewardship, public awareness and education, Canada's Oceans Strategy

The Human Components and Connections within the West Harbour Area

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Challenge: Hamilton Harbour is at the western tip of Lake Ontario in the heart of an industrial urban area. Polluted water and degraded ecosystem problems are now being addressed. With the completion of a 3.4 km (2 mi.) harbour waterfront trail, people are flocking to the waterfront and demanding a continuation of the trail toward industrial use lands and improved connections to the downtown core. There are conflicting needs between the existing neighbourhood, the changing land uses and the water's edge which is a critical and sensitive ecologically important place. With recent additions to City ownership of waterfront properties, there are new opportunities to define and act on a long-term holistic planning strategy that reflects the complex human and ecological issues that need to be addressed due to increasing development pressures on this unique area. We will attempt to address these urban waterfront issues with an integrated multi-stakeholder approach.

Description: This seminar is designed to garner the expertise of the participants and provide input to the City of Hamilton's master planning exercise for the enhancement of the waterfront. The first session will outline the context and special issues and the second, we will form task groups to enable small group working sessions. The results will then be submitted to the City. The master plan will be presented for public comment in 2003.

Application: The City of Hamilton's award winning VISION 2020 Initiative and the Hamilton Harbour Remedial Action Plan (RAP) have made key contributions toward making Hamilton a sustainable community. International and local experts and citizens will bring their unique knowledge and experience to work through the special issues in the study area. The participatory framework will result in an on-the-ground application of two broad, comprehensive public policies: RAP and VISION 2020,

Strengths: Hamilton is an Agenda 21 sustainable community and a popular model for participatory frameworks. By bringing many sectors of society to the table and by using the consensus decision making approach, local, provincial and national governments, agencies, educational institutions, industry, business, and grass roots organizations can create a plan that has community support. The Hamilton Harbour RAP focuses attention on shared solutions. Shared solutions through consensus and the recognition of the interrelationship between human and ecosystem needs are foundations of sustainability and the focus of the Hamilton Harbour RAP and the VISION 2020 initiative.

Capacity Needs: Significant actions have resulted in measurable improvements, however the difficult challenges remain. By working on the specific issue of conflicting needs at the water's edge, we hope to learn from international experience and then apply the knowledge to this and other projects.

The IJC's Contribution to Water Quality and Public Health, 1912–1972

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Challenge: Aside from diminishing the contribution of earlier generations who endeavored, often, though not exclusively, under the auspices of the International Joint Commission to safeguard the quality of waters around the Great Lakes, the tendency to forget history deprives those currently concerned with the well-being of the Great Lakes of a proper appreciation of the societal and institutional context within which they are working. The widespread perception that environmentalism, inspired by Rachel Carson's enormously influential work, *Silent Spring*, emerged during the 1960s has produced a number of misunderstandings. One consequence is the common assumption that serious remedial efforts focusing on water quality in the Great Lakes date from the Great Lakes Water Quality Agreement.

Description: This presentation draws on the author's research into water quality and public health concerns of the IJC from 1912 to 1972, and the manner in which activity initiated and carried out at the international level influenced developments in certain Great Lakes jurisdictions, notably Ontario.

Application: There are practical insights to be gleaned about the authority, effectiveness, and credibility of institutions from an analysis of their evolution and previous accomplishments. In the case of the IJC, the legacy may also be seen in some respects as enriching and validating current efforts to safeguard water quality. Water quality challenges of the magnitude faced in the Great Lakes will not be solved today. And they will not be solved tomorrow. They will only be overcome by vigilance, foresight and endurance. The track record is therefore an important element for enhancing future prospects.

Capacity Needs: To what extent can a proper appreciation of past environmental and public health accomplishments often pioneered through the work of researchers and investigators associated with the IJC contribute to public and governmental support for continuing efforts to safeguard water quality? When momentum is lost from time to time, how can it be revived? When major opportunities emerge, how can steps be taken to ensure potential benefits are realized?

Key Words: Great Lakes, International Joint Commission, Water Quality, Public Health, History

Towards Interdisciplinary Action: Measuring Environmental Impacts and Social and Economic Benefits of Marine Protected Areas — The Case of Apo Island

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Challenge: The establishment of marine protected areas (MPAs) has emerged as a very popular strategy worldwide to address the issues of coastal resource degradation, depletion of fish stocks, and increasing poverty of small fishers. There are more than 1,300 MPAs of varying sizes worldwide, but less than 25% are managed to some extent. Moreover, most MPA studies focus only on the biophysical (i.e., corals, fishes) environment; actual social and economic benefits derived by small fishers and coastal residents are very rarely measured. Many MPAs therefore are seen as biased towards conservation and are anti-people, leading to local opposition to MPAs, and further increasing coastal resource use conflicts instead of resolving them.

Description: This presentation will focus on the processes and outputs from a study conducted to measure the social and economic benefits of a successful MPA in the Philippines, and compare such to the environmental benefits. The study sought to answer the question: Do MPAs actually benefit local fishers and coastal stakeholders, or are they useful for resource conservation only? Local residents and representative stakeholders (e.g., local governments, tourist resorts and dive shop operators, ferry boat operators) were interviewed to determine the actual benefits that they derived from the MPA. A before-and-after analysis of the environmental, social, and economic benefits attributable to the MPA was conducted.

Application: The methodologies used to analyze the processes in establishing the MPA and in analyzing its social and economic impacts will be useful in determining the same impacts in other MPAs, to serve as inputs in coastal planning and policy setting. The processes and results of the study contributed to more participatory and interactive decision-making in the area, and provided more focus and directions to local actors and decision-makers.

Strengths: The study demonstrates how social and economic tools could integrate with natural sciences (e.g., marine science) towards deriving a holistic and integrative framework for evaluation of a critical resource rehabilitation strategy. It provides impetus for more interdisciplinary studies, and the conscious incorporation of community knowledge in project planning, implementation, and monitoring.

Capacity Needs: Proposed/applied resource management strategies need adequate frameworks for evaluation to determine their actual impacts vis-à-vis their original objectives. The development and actual application of practicable methods and tools for incorporating various disciplines in monitoring MPAs and other strategies as applied in this study are critical for decision making. Trainings on such frameworks and cross-exposure among disciplines is vital for the sustainability of resource management strategies.

Managing Great Lakes Shorelines in Ontario: Policy, Principles and Practice

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In 1986, following annually recurring and extensive shoreline damages, MNR was identified as the lead provincial agency with overall government responsibility for natural hazards and shoreline management on the Great Lakes and St. Lawrence River. Responsibilities included the establishment of policy, planning and guidelines for long-term and cost-effective management of the shoreline. The Provincial Shoreline Management Program was developed, promoting comprehensive and integrated management strategies to address environmental and social issues and risks associated with shoreline hazards such as flooding, erosion and dynamic beaches. The Province delegated conservation authorities with responsibilities for developing shoreline management plans, identifying hazardous lands and regulating shoreline activities. Through recent changes in the Planning Act and the

Provincial Policy Statement, municipalities have assumed this responsibility. Because of conservation authority expertise and prior involvement in delivery of shoreline management programs, a number of municipalities have entered into agreements with conservation authorities to provide environmental planning services. This paper will describe the Provincial Shoreline Management Program and supporting policies and standards and will examine opportunities to improve program delivery. The paper will also profile the application of provincial policy through case study of shoreline management approaches instituted by Conservation Halton. Conservation Halton encompasses the municipalities of Burlington and Oakville, two of the fastest growing areas in the GTA, posing additional challenges and stresses for the implementation of provincial policy.

ICZM Initiatives in Bangladesh

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Challenge: Coastal area of Bangladesh is ecologically sensitive and climatically extremely vulnerable. It has a highly dynamic estuary, with continuous process of land accretion and erosion and many isolated islands. The area experiences severe cyclonic storms and tidal surges. The Global climatic changes are emerging as the most challenging to low-lying coastal Bangladesh. The coastal area is also rich with both renewable and non-renewable resources. The Sundarbans, a world heritage site, is known as the single largest stretch of productive mangrove forest in the world. For the local inhabitants, the low-lying flat plains supports crop production, livestock rearing, salt production, shrimp culture, ship-breaking activities, harbor activities and different types of industries. Because of its multiple vulnerabilities and opportunities, there are at least 30 different, public, NGO and donor supported projects. However, these projects are mostly uni-sectoral and sometimes conflicting in nature. Harmonization between projects, policies, legal and institutional setup is seen as crucial for coastal development.

Description: This presentation discusses the problems and prospects of ICZM in Bangladesh and the process to be adopted for preparing the document on the Coastal Development Strategy in Bangladesh. The Government of Bangladesh has established the Program Development Office for a three-year period. This is to help transform the practice of marine and coastal resources in a way to support sustainable development and poverty reduction of the communities of the region.

Application: The main output will be a Coastal Development Strategy. It will be based on alternative courses of action including concrete priority activities. Such a strategy would be based on, and integrate the five 'building blocks', which form outputs in themselves. These are: a) Coastal Zone Policy, b) A Priority Investment Program, c) Improvement of Community Capacities to Enhance Livelihood, d) Enabling Institutional and Legal Environment and e) Integrated Coastal Resources Knowledge Base.

Strength: In order to approach sustainable institutional set-up, internalization within public agencies is planned. However, partnership arrangements with on-going projects, NGOs and private sector are also being worked out. Inter-Ministerial technical and Steering committees are expected to guide policy decisions.

Capacity Needs: Pro-active interaction, workshops, thematic meetings, focal groups, databases and website are some of the measures to create general awareness to ICZM concepts. These activities have already been started. Capacity building, training and involvement of community organizations are key elements, which will be implemented in phases. Hydro-morphological modeling, satellite imagery and other decision support tools are being used in the planning phase.

Key Words: policy, strategy, management, harmonization, partnership, livelihood and knowledge base

On Institutional Frameworks of Transboundary Ecosystem Management in Guanting Basin in China

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Challenge: Guanting reservoir was built on Yongding River in 1954, which was located in Hebei Province that is 80km west of Beijing city. Guanting reservoir basin controls 430,000 km² catchment areas, which is 92.8% of total catchment areas of Yongding River. The upstream areas shared by Inner-Mongolia, Shanxi, Hebei, Beijing separately, involved 32 counties and cities. Therefore, the Guanting reservoir basin is a trans-administerial region basin. GuanTing reservoir is vital for Beijing's economic development because it is one of two water supply sources. But because the rapidly industry development in upstream, GuanTing reservoir has been polluted seriously and cannot bring into play any more. It is time to construct a transboundary management institution to manage the Guanting basin efficiently.

Description: This presentation will focus on the characteristic analysis of current management institution of water basin in China and Guanting basin case studies. Some management issues resulting from ecosystem polluted have been analyzed here. Firstly, the status quo of Guanting basin management has been evaluated in the case study. Then, by using successful transboundary management models in other countries for reference, some suggestions for future institution constructing included developing policy and management ordinance in Guanting water basin have been point out.

Application: With the economy rapidly developing in China, many rivers have been polluted in different extents. The water use conflicts between upstream and downstream become more and more serious. How to set up a high efficient and powerful institution to manage the transboundary conflicts is an important key in planning and management of water basin such as Yellow River and Yangzi River basin. The institution models that involved extensive engagement of government agencies and basin wide community groups in this research are examples for other transboundary ecosystem management.

Strengths: This scientific research and study is in an attempt to better understand the status quo and its problems of transboundary ecosystem management. The case studies clearly demonstrate the importance of stakeholder engagements and macro-management of government in the planning and management process.

Capacity Needs: The education and adult training is important to raise community awareness in the management process. In order to improve decision-making, Information sharing system within and between communities and different administerial regions should be set up in implementing management actions. The establishment of innovative institutional arrangements should be considered, including possible evaluation of the roles of existing organizations and local, regional, national, and transboundary institutional frameworks.

Key Words: transboundary ecosystems management, institutional frameworks, GuanTing water basin

Implementation of Canada's National Programme of Action for the Protection of the Marine Environment from Land-Based Activities

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The marine coastal environment comprises a highly productive and biodiverse ecosystem. Yet, this diversity is under threat globally from various activities. While the source of such activities is wide-ranging, approximately 80% of the pollution load originates from land-based activities. This has led to the realization that what we do on land ultimately affects the marine environment.

In response to this recognition, Canada and 108 other maritime nations adopted the *Global Programme of Action for the Protection of the Marine Environment from Land-based Activities* (GPA) in Washington, DC, in November 1995. Developed under the auspices of UNEP, this international agreement calls on participating countries to develop national and regional programmes of action to protect human health and the environment, through the prevention, reduction and control of land-based activities that contribute to the degradation of the marine environment.

In response to this international call for action, *Canada's National Programme of Action for the Protection of the Marine Environment from Land-*

based Activities (NPA) was released in June 2000. Canada's NPA is a national plan to meet domestic and international commitments to: prevent marine pollution from land-based activities and protect coastal habitat from land-based activities. Since the release of the NPA, governments have turned their attention to implementation by working to integrate the NPA's goals and objectives into existing programs and activities. The key coordinating mechanism for overseeing the implementation of Canada's NPA is the federal-provincial-territorial NPA Advisory Committee.

As Canada continues to move forward with NPA implementation, it faces a host of opportunities and challenges. Included in these challenges is the need to expand partnerships with organizations with an interest in marine environmental pollution prevention and protection of coastal habitat. This recognizes that all stakeholders must be involved early in the implementation process to ensure programme effectiveness and success. This presentation will briefly reflect on the NPA development process and describe implementation next steps.

Jamaica's Agreement with Columbia and the establishment of the First Legal Joint Management Regime in the Caribbean

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Over the last twenty years Jamaica in recognition of the need to manage its marine resources has embarked on a number of initiatives. Chief among these are the declaration of Jamaica as an archipelagic state, the negotiation of delimitation agreements and the establishment of a Council on Oceans and Coastal Zone Management. At present Jamaica's maritime space is approximately twenty four (24) times the size of its landmass. The need to manage marine resources has therefore become a major challenge. The government of Jamaica in its efforts to define the extent of its exclusive economic zone, and to address the management of shared waters and resources has entered into delimitation talks with Cuba to the North, Columbia to the South, Nicaragua and Honduras to the South West and the Cayman Islands to the North West.

Negotiations are necessary as the outer limits of our exclusive economic zone impinges on the EEZ of other states. To date, negotiations with Cuba and Columbia have produced agreements on the delimitation of the Maritime Boundaries between the two states. Though contact has been made with Haiti, negotiations have not yet begun. This presentation will look at the delimitation agreement with Columbia as a tool in the management of shared waters and marine resources. It should be noted that not all countries have accepted Jamaica's claim to archipelagic status.

The agreement with Columbia presents novel challenges. It represents the only agreement in the entire Caribbean Region that establishes a legal joint regime area within which both countries exercise joint control. Within this joint regime area, both countries have the right to carry out scientific research, preserve and

protect the marine environment and conserve the living resources. The agreement establishes a Joint Commission made up of representatives of each state. The agreement between Columbia presents novel challenges as the area under joint management includes the Alice Shoal over which Jamaica has traditionally claimed jurisdiction and which is noted for its diversity in fisheries resources as well as other marine resources. The joint regime area also includes the two cays of Baja Nuevo and the Seranilla Bank over which Columbia now claims exclusive jurisdiction but whose landmass and territorial sea are excluded from the concept of shared resources within the joint Regime Area although traditionally, Jamaican fishers fished on both Baja Nuevo and Seranilla. Alice Shoal is shared by both states.

Challenges: The establishment of the Joint Regime Area has implications for the exploitation of marine resources. At present there is an established quota system for the exploitation of fisheries resources. There is however insufficient data on the types and stock abundance of the resources to be found in the area. Research is now being undertaken which looks at the potential for exploitation of trap fisheries. Another challenge is in the area of enforcement. Given the lack of sufficient resources the enforcement within this joint regime area is bound to be challenging.

One of the many challenges associated with this agreement is the articulation of the modalities involved in any joint effort at the management of shared resources. One issue for example is how will the parties address the management of straddling or highly migratory fish stocks. This subject is not specifically addressed in the agreement.

Habitat Conservation and Stewardship Program: Lessons Learned

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Challenge: Fisheries and Oceans Canada (DFO) past efforts in public involvement have focused on the bio-technical elements of fish production (i.e., building hatcheries, spawning channels and stream restoration projects). This complimented the regulatory and enforcement approach to managing fish resources. However, there is a growing understanding that citizens can be playing a more significant role in preventing habitat loss through their involvement in planning processes, advocacy and improving their land-use practices. The public desire to get involved in proactive habitat protection, combined with decades of continued loss of fish habitat has forced DFO to recognise that the Department needs to adopt a “new way of doing business.” This new direction is manifested in DFO’s Habitat Conservation and Stewardship Program.

Description: This presentation will provide the *Lessons Learned* from the Habitat Conservation and Stewardship Program (HCSP). HCSP is a participatory framework for engaging community and represents a new way of doing business for DFO. This new style of management focuses on providing funding for ‘Stewards’ to work proactively with industry and communities to develop local capacity to protect and steward fish habitat rather than on funding capital projects (e.g., hatcheries and restoration projects). Stewards form a support network and help to build partnerships for fish habitat protection, conservation and stewardship.

Application: Stewards are hired, with DFO funding, by Community Partners to enhance habitat protection and expand community capacity to steward fish habitat resources. Stewards enable community groups to incorporate fish habitat protection requirements into local land and water use plans and improve habitat mapping and inventory data required for land management and resource planning. They encourage

community groups to participate in local stream surveillance and monitoring programs and to enhance and restore habitats as part of watershed management plan(s). Stewards attempt to increase public and stakeholder awareness of fish habitat requirements and provide technical information, advice, and support to partners and communities.

Strengths: HCSP demonstrates a model of how community groups can be positively engaged to protect fish habitat through partnership building. Partnerships have helped to foster a stewardship ethic and increased the desire to care and advocate for the fisheries resource in communities. The partnership model was a welcomed approach to working with local government and industry, as opposed to DFOs traditional enforcement approach. Stewards are successful at building both bridges amongst different levels of government and stakeholders and community capacity to care for the fisheries resource. HCSP allowed some DFO staff and offices to build better communication linkages with community, as well as gaining a better understanding of their community and landowner issues.

Capacity Needs: Time, resources and skills are the largest capacity needs for HCSP. Social change takes time. The Department needs to recognise the benefit of community involvement and communities need time to build their capacity for and understand their role managing our fisheries resources. DFO staff time is over committed by duties related to enforcing the *Fisheries Act*. Therefore, any new community-based programs and/or funding must compete with these interests. On the other hand, many community groups do not understand their role as advocates as opposed to pseudo biologists. Both government and community need to be trained and skilled in how to attain social change.

Institutional Dimensions of Shared Resource Management: Upstream-Downstream Problems and the Pacific Salmon

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Challenge: Pacific salmon (*Oncorhynchus* sp.) represent one of the most significant fishery resources in North America. With importance that far surpasses mere economic value, salmon hold a preeminent position in many indigenous societies of the Pacific Northwest, critical as a subsistence and ceremonial food. Salmon fishing is also a popular recreational activity. Finally, as anadromous species, salmon play a critical role in the ecology of coastal and riparian ecosystems. In recent years, salmon populations have declined. Some have become extinct and many are now listed as threatened or endangered under the US Endangered Species Act. It is time to examine the institutions implicated in threatening salmon populations as well as those charged with their management, to see if these regimes can be redesigned to produce outcomes that are both sustainable and equitable.

Description: This presentation examines the impacts that changes in institutions, technologies and markets have had on the use and management of a shared resource, the Pacific Salmon, focusing specifically on the management and allocation of salmon in a variety of fisheries in international, federal, and state, marine and fresh waters. Two case studies will be examined, one focusing on salmon stocks from the Puget Sound region of Washington state and a second on salmon stocks from the Kuskokwim River in western Alaska. In both areas, cooperative approaches to management have emerged.

Application: Salmon pose an interesting twist on traditional upstream-downstream problems. Cooperative management. On the Kuskokwim, the Kuskokwim River Salmon Management Working Group was formed in 1987, providing a forum for various fishing interests to participate in the management of in-river salmon fisheries. In Puget Sound, the state of Washington and 20 northwest tribes have instituted a court-ordered co-management regime.

Strengths: This research has shown that the functional, spatial and social dimensions of an institution must match the biophysical nature of the problem if an institutional fix to these problems is to be achieved. The different trajectories of human production systems and environmental change can rapidly reconfigure upstream-downstream problems in coupled human/natural systems. Institutions need built-in flexibility in order to respond effectively to the new dimensions of problems in a constantly changing world. Ensuring that all stakeholders are represented and brought together is also critical. In this respect, cooperative management approaches have proved valuable.

Capacity Needs: Institutions play important roles in both causing and developing solutions to environmental problems. Institutional design is a critical aspect of the effectiveness of these regimes. This paper examines the institutional dimensions of the salmon problem and offers several prescriptions for institutional redesign to enhance the sustainable and equitable use of salmon in the North Pacific region.

Key Words: Pacific salmon, co-management, fisheries management

The Nile Basin Initiative: NGO Involvement and Capacity Building

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Challenge: Incorporating active NGOs in the Nile Basin Initiative process.

Description: The paper will discuss the issues of involvement of NGOs in the Nile Basin Initiative, the institutional barriers to effective involvement of active NGOs in the process and provides recommendations and an alternative feasible line of action.

Application: A frame for establishing an organizational framework that would support real involvement of NGOs (local, regional and International) in the Nile Basin Initiative.

Strengths: The approach proposed provides real autonomy of NGO involvement in the Nile Basin Initiative with no government control. The approach would give NGOs an equal standing as a real partner to the governments and institutions involved allowing frank discussion of issues and allowing the NGOs to play an active role in conflict resolution, education and awareness raising.

Capacity Needs: Administrative, financial and communication support

Key Words: Transboundary, Nile Basin, NGO, participation

Assessing Public Involvement and Influence on Canada's Decision to Extend the Oil and Gas Moratorium on Georges Bank

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Challenge: The involvement of societal stakeholders around a given policy issue to inform the decision-making process has been embraced as an underlying principle in both “hard” and “soft” instruments relating to ocean use and space in Canada. Under the best of circumstances, it is a challenge to identify and balance potential efficiency gains associated with applying this principle with potential efficiency losses associated with irreconcilable value sets held by an increasingly heterogeneous grouping of stakeholders. When a public review panel is added to the process surrounding policy level decision-making, the challenge to reaching a well-informed and balanced decision increases in complexity.

Description: This presentation will focus on an assessment of the relative power and interrelationships of actors, including US-based actors, involved with the 1999 Canadian public review process surrounding the Georges Bank oil and gas moratorium debate. The purpose is to understand when and why actors might clash and/or modify their positions on specific policy issues. The assessment will include both a quantitative analysis and a qualitative evaluation of the participating actors' attempts to influence the debate and subsequent decision.

Application: The underlying hypothesis is that actors will behave in a manner consistent with achieving their underlying values, preferences and criteria. Given the conflicting multi-user nature of Canada's ocean environment, an

increased understanding of the power and interrelationships of actors that repeatedly interact over marine-related issues pertaining to Canada's east coast has the potential to significantly improve policy clarity and predictability for all parties.

Strengths: The analysis recognizes the interdependence of a 'structuralist' and a 'learning' approach to understanding the behavior of actors involved in policy issues on Canada's east coast. As such, the analysis identifies characteristics displayed by each actor ('structuralist' approach) while also identifying the values, preferences and criteria of each actor involved in the policy issue ('learning' approach), so as to predict each actor's behavior in subsequent policy debates.

Capacity Needs: Soliciting public input is an important and increasingly expected practice in public policy decision-making. However, the distinction between public input that improves the quality of the decision (technical considerations) from input that increases its acceptability (public values considerations) must be clearly made and understood by decision-makers, participating actors and the public at large. Processes must be designed and implemented to maximize the value of the contribution made during public reviews and the subsequent appropriate uptake of that information into decision making.

Key Words: policy networks, public review, oil and gas moratorium, Georges Bank

The Nile Basin Initiative and Implementation

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Challenge: The Nile Basin serves as a highly volatile area of shared water resources, and has serious conflict potential, specifically between Egypt, Sudan, and Ethiopia. With the increasing demands from significant and rapid increases in population, greater food insecurity, and severe recurrent droughts, the need for regional cooperation of the Nile River provides the greatest source of possible resolve to the many challenges facing the region. The Nile Basin Initiative, lead by the World Bank, was established to create regional cooperation through sustainable and equitable development, as well as through confidence building among the respective governments.

Description: This presentation will focus on the problems facing the successful implementation of the Nile Basin Initiative. These include the involvement of third parties, such as the World Bank and other institutions outside of the region, the absence of a strong non-governmental organization presence, and the fragile aspects of Nile Basin politics.

Application: This work provides important information regarding what will and will not enable the Nile Basin Initiative to accurately fulfill its goals. In addition, it provides insider opinion of those working alongside the Initiative, regarding the cooperation of the regional governments, and in particular Egypt and Ethiopia. It also presents possible features of an initiative in the Nile Basin with long-term success.

Strengths: Incorporation of statements from donors, governments, and NGOs regarding the successes and failures of the Nile Basin Initiative. Illustrates the contradictory actions of the governments and the World Bank, particularly regarding the World Bank's Operational Directive 7.50, which provides regional power over the Nile waters to Egypt despite objectives of equitable development.

Capacity Needs: The Initiative needs to focus its programs on the introduction of environmentally sound agricultural practices through water conservation, seasonal crop development, and land preservation. Restructure of potential projects, which include the development of hydroelectric power plants and large-scale irrigation schemes, to reduce the potential for ethnic conflicts as a result of migration to others areas. The establishment of regional organizations separate from World Bank involvement, as well as any other international donor partner, to better address the actual concerns of the region without interference on political and economic issues.

Intergovernmental Relations in Great Lakes Fishery Management

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Challenge: Fishery management on the Great Lakes occurs within a politically fragmented regime. Retaining primary management authority are the eight states, the province of Ontario, and tribal authorities. Federal agencies in the United States and Canada, and the bi-national Great Lakes Fishery Commission, also have limited management roles. However, no centralized authority exists to bind agencies or to enforce decisions. Instead, the sub-national jurisdictions have the right to manage their waters in the manner they choose. To foster cooperation, the management agencies have agreed to and operate under *A Joint Strategic Plan for Management of Great Lakes Fisheries* and use “lake committees” as their forum for cross-boundary consensus decision making. This presentation examines how state, provincial, tribal, and federal management agencies in the Great Lakes region together implement consensus-based, non-binding management of the Great Lakes fishery.

Description: This presentation focuses on the sub-national and federal Great Lakes fishery management regime and discusses the management principles outlined in *A Joint Strategic Plan for Management of Great Lakes Fisheries*. The elements or strategies of the plan and their implementation are described and analyzed.

Application: The Joint Strategic Plan provides a Great Lakes fishery management regime for the development of basin-wide fishery policy and decisions across a politically fragmented landscape. The management agencies rely on non-binding agreements and consensus-based institutions to develop and implement common policies. The nature of the institutions and the principles behind the institutions determine the level of cooperation that occurs on the Great Lakes and, ultimately, the success of the management initiatives.

Strengths: Decentralized fishery management authority for the Great Lakes as vested into sub-national governments demonstrates the need for a basin-wide cooperative management regime. The Joint Strategic Plan and the lake committee process demonstrate that sub-national governments can use non-binding, consensus-based institutions to cooperate and to develop and implement common management policies.

Capacity Needs: The capacity of sub-national governments to operate under non-binding, consensus-based institutions has grown over the past twenty years and is viewed as a success. Understanding the underlying governmental relational elements such as communications should help to identify essential processes that undergird the success and help in translation to management of other multi-jurisdictional fisheries.

Key Words: transboundary, Great Lakes, institutions, management, federalism

Water Use and Ecosystem Restoration: An Agenda

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Challenge: Human interaction with nature usually leads to degradation of the natural world. The environmental reforms of recent decades have in general led only to a slowing of that degradation. Population growth and growing per-capita consumption make further slowing of degradation less likely and its re-acceleration possible. The foreseeable end point of human activity remains a breakdown of the natural functions that support life. Can society set ground rules for interacting with nature that affirmatively restores natural functioning rather than merely limiting the damage to it? Can multiple jurisdictions work together to do so?

Description: Water use is a case in point. Five environmental organizations in the Great Lakes/St. Lawrence River basin, with advice from many others, have proposed an agenda for the provinces, states, and federal and native governments to use in reforming regional water use. The agenda is a set of principles for assessing the ability of proposed reforms to restore basin hydrological and therefore ecosystem functioning. The agenda can be found online at: <http://www.glu.org/swtf/> and [ecosystem%20agenda.htm](http://www.glu.org/swtf/andecosystem%20agenda.htm)

Application: Water use reform is urgent in many parts of the world. In the Great Lakes/St. Lawrence River basin, the premiers and governors of the region's provinces and states are contemplating comprehensive, collective water use reform via the so-called Annex 2001

process. For the governments, the agenda is a means for guiding their work; for environmental organizations, the agenda is a means for critiquing government plans and implementation; for the public, the agenda is a means for holding government accountable for its management of an important part of the natural world.

Strengths: The now widely accepted goal of ecosystem protection has postponed the date of system collapse but offers no guarantees that it can be averted. The goal of restoration offers the possibility of averting system collapse. The public and environmental organizations can participate more constructively in water use reform efforts if they have a roadmap to its possibilities. The agenda is such a roadmap.

Capacity Needs: Government is not well-equipped to address long-term problems if doing so causes perceptible short-term sacrifice by the public or its economic institutions. Such sacrifice can be requested only in the context of widespread understanding of the consequences of inaction for our children and their offspring. The region needs to embark on a comprehensive campaign to educate the public and its community leaders about the long-term dangers to water system functioning caused by poor management of human water uses.

Key Words: Great Lakes, hydrological functioning, ecosystem restoration, water use, water management

Preserving Water for a Sustainable Development: African Great Lakes Region (Central Africa)

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Challenge: The African Great Lakes Region has a crucial problem of water though one may find in it many waters. There are many lakes, many rivers, many springs and the rain falls so much. In African Great Lakes Region, when we say that water challenges human life, one may hear and understand that it is a false assertion. He can not realise that in Burundi, Democratic Republic of Congo (ex-Zaire), Rwanda and Uganda plains and depressions are waterless. Only high mountains have water. This is a natural fact. As result, all development sides that use water face crucial problems. In plains and depressions, it is difficult to build a better habitat for construction needs water. Since the population is not able to ameliorate their habitat, there is no sustainable development. The high mountains of African Great Lakes Region are covered by "crête Zaire-Nile" includes Kibira forest in Burundi, Nyungwe forest, Giswati forest and virunga forest in Rwanda, Virunga forest in Uganda and Equatorial forest in DR of Congo and we know that there is no human life in forest and so isn't there any sustainable human development.

Description: Almost all the African Great Lakes Region lakes are not navigable. A lake that is 2km wide and 5km long can never be of a great importance in navigability. It is a big bathing pool and not a lake. This is the case of lakes Cohoha south, Rweru and Kanzigiri in Burundi, Muhazi, Ihema, Burera and Buhondo in Rwanda. Although, those lakes are not navigable like Tanganika lake for DR of Congo and Burundi, like Kivu lake for DR of Congo

and Rwanda or like Victoria lake and Albert lake in Uganda. Only lakes Tanganika; Kivu and Victoria are navigable and assume a great importance to the countries of a health economy. In African Great Lakes Region; there are some areas where water is a shortage of water while else where water is full. Although it is true that the high mountains are full of water, this is not supplied the same way. Depending to the shape of the hill; people in these areas have different access to water. Some get it too far while others get it nearer. Further more water causes problems when it flows in exceeding quantity. This occurs especially during the rain season. It causes erosion and inondation diving people of hunger stake. The follow up of this situation is the human starvation. So people dying of hunger are never able to work for a sustainable development. In African Great Lakes Region, worse again is the shortage of clean drinking water for human beings and animals. People drink unclean water and so catch illnesses of diarrhea or worms. They become weak to work for development. Another problem is that, in African Great Lakes Region, there are water that are barren. Instead of constituting a source of food, it is the opposite. We can find lakes such as Cohoha South and North, Rweru, Kivu, Burera, Buhondo and rivers such as Ruvubu; Akanyaru and Akagera don't contain much and varied fish. It may sound incredible but it is true. They are useless to man. How useless they appear to man in struggle for a sustainable development.

The Role Of The Ontario Public Advisory Council (OPAC)

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Challenge: The Great Lakes/St. Lawrence Basin represents one of the world's largest and most significant coastal ecosystems shared by 2 countries — Canada and the United States of America. As resources shrink and water quality issues are low on the governments' agendas, it is time to address the accountability, and the state of the clean up from the citizens' point of view and involvement.

Description: This presentation will focus on the results, approaches and successes to date from 4 Areas of Concern involved in the Great Lakes/St. Lawrence River Basin — 4 Canadian citizens and 4 US citizens (to be decided later).

Application: Important issues of addressing resources, partnerships, capacity building, broadening/recruiting/maintaining an enthusiastic volunteer base, increasing public education/communications and awareness will be highlighted.

Strengths: Water quality issues/concerns have increased with less and less monitoring and resources from the agencies. Progress requires new initiatives to fund increased public education and consultation, as well as a broader base of participants from the public and private sectors through the facilitation of the International Joint Commission.

Capacity Needs: Establish a cyberspace network linking educators, scientists, industry, agencies, funders and community organizations to provide information exchange and communication tools for programmes for public awareness for implementing the Clean Up actions. Develop consistent monitoring methods with common indicators assessing improvement in local and international transboundary coastal ecosystems.

Purposes, Values, Roles and Responsibilities of the Detroit River Canadian Cleanup Committee (DRCCC)

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Membership in the DRCCC is open to all citizens residing in the Detroit River watershed. Meetings of the main committee and sub-committees are open to the public, US residents are welcome.

Purpose of the Committee: In meeting the spirit of the Canada-US Great Lakes Water Quality Agreement, the purpose of the DRCCC is to clean up, enhance and sustain the ecosystem of the Detroit River and its watersheds.

Values: The DRCCC believes that a common framework of common values is an essential foundation for the development and maintenance of a strong, teamwork environment and effective partnerships. The Cleanup Committee will apply the following values in all aspects of carrying out its business.

- Openness — communicating and sharing ideas;
- Clarity — using appropriate communications skills to bring about clear understanding;
- Sensitivity — caring for and being responsive to the needs of others in a respectful manner;
- Action — establishing priorities and undertaking initiatives based on desired goals;

- Integrity — ensuring that actions or decisions do not compromise fundamental values or principles;
- Trust — believing and having confidence in each other to achieve our goals;
- Flexibility — being adaptable and willing to change;
- Decisiveness — making decisions in a timely manner; and,
- Commitment — being prepared to help each other to make things happen.

Cleanup Roles and Responsibilities: On June 10, 1998 these roles and responsibilities were adopted for the DRCCC:

- Coordinate Canadian cleanup and enhancement activities;
- Promote partnerships;
- Develop a multi-year plan and budget that is project and program driven and reviewed annually;
- Report regularly to the community;
- Establish time lines to measure progress;
- Encourage volunteer groups such as Friends of Canard River, Little River, Turkey Creek;
- Coordinate and consult with US counterparts on bi-national issues;
- Provide advice on bi-national issues such as delisting criteria, outreach activities; and,
- Identify and pursue funding sources.

Designing a Collaborative Process for Integrated Oceans Management: The Eastern Scotian Shelf Experience

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Challenge: The Eastern Scotian Shelf Integrated Management (ESSIM) Initiative is designing a collaborative planning process to develop and implement an integrated oceans management plan for the eastern Scotian Shelf area (off Nova Scotia). This large oceans management area possesses important living and non-living marine resources, high biological productivity and diversity, and increasing levels of multiple use and competition for ocean space and resources. In its capacity to lead and facilitate in the development of integrated management plans under the 1997 *Oceans Act*, Fisheries and Oceans Canada (DFO) is working with a broad range of interests through the Initiative, including federal and provincial departments, First Nations, municipal and local planning authorities, oceans industry and resource use sectors, coastal communities, environmental interest groups, and university researchers. The overall vision of the Initiative is to achieve environmental, economic, social/community, and institutional sustainability in the eastern Scotian Shelf area.

Description: This presentation will provide an overview of the ESSIM experience, including ongoing work to define and assess the oceans management area in terms of oceans use, ecosystem understanding, and oceans management and planning requirements. The presentation will also look at the design of a collaborative, multi-interest management and planning structure and process for the initiative. Finally, the presentation will identify the key elements of the future integrated oceans management plan for the eastern Scotian Shelf area.

Application: The ESSIM Initiative is providing practical guidance for integrated oceans management and planning in Canada. It is working to define and operationalize the

principles of the *Oceans Act*, including the development and application of ecosystem objectives and precautionary approaches for oceans management. A fundamental requirement for the Initiative is to move forward through the collaborative approach — an inclusive and transparent planning process that involves all interested and affected parties. The future oceans management plan will include a balanced set of ecosystem, social, economic and institutional objectives and management strategies, as well as spatial and temporal planning approaches to address multiple oceans use.

Strengths: The Initiative is receiving strong levels of support and involvement from affected communities of interest. A joint federal-provincial working group has been established to move the Initiative forward within government and to address policy and regulatory coordination for oceans management. Ongoing information sharing and dialogue with partner groups is providing important input to current proposals for the collaborative planning structure and the oceans management plan. The Initiative is also serving as a catalyst for ecosystem-based science and research activities in the region.

Capacity Needs: In addition to significant knowledge gaps in relation to ecosystem objectives, the key challenge faced by the ESSIM Initiative is the development of a functional institutional process for collaborative planning. This involves the need for effective, sustainable linkages and networks within and among the diverse communities of interest involved in the ESSIM process.

Key Words: integrated oceans management, sustainability objectives, collaborative approach, eastern Scotian Shelf, *Oceans Act*

The Canada-United States Gulf of Maine Program — Twelve Years of Transboundary Collaboration in a Shared Ecosystem

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Challenge: Canada and the United States share jurisdiction and interest in the transboundary Gulf of Maine region on the northeast coast of North America. Bordered by three American states and two Canadian provinces and divided by an international boundary that spans its terrestrial, freshwater and marine territory, this region is nevertheless one unified ecosystem. With a full suite of extant state, provincial and federal programs, laws and institutions for the region, what role is there for an additional, non-statutory transboundary body that focuses on collaboration and joint action rather than regulation and specific departmental mandates?

Description: This session will focus on the nature of the transboundary institutional arrangement that has evolved in the Gulf of Maine ecosystem. Established in 1989 by the Governors and Premiers of the five jurisdictions and developed over the past twelve years, the provincial, state and federal players with primary responsibility for the health of the ecosystem and its sustainable development, have worked collaboratively to develop a common vision, mission, goals, objectives, strategies and targeted actions. The Gulf of Maine Council is the common forum for the 15 participating agencies to come together to address those issues that are common to this ecosystem and that cannot be solved, or even adequately addressed, through the efforts of one jurisdiction alone, or by acting independently.

Application: The provincial, state and federal partners involved in the Gulf of Maine program have decided to put the political borders that divide this region into the background, in favour of the natural boundaries that define the region. The Gulf of Maine program operates on the premise that many of the natural resources, important species and critical habitats, as well as the distribution and impacts of pollution and environmental degradation, are transboundary in nature and can only be addressed effectively through a collaborative, transboundary approach.

Strengths: Twelve years of collaborative planning, decision making and joint action speak volumes about the strength of the Gulf of Maine Council and its transboundary program. As a program established and led by the provincial and state governments, and with active, yet informal federal involvement, it presents an innovative form of governance that can effectively address and make progress on key transboundary issues in this ecosystem.

Capacity Needs: A dozen years of collaborative work among a variety of individuals and institutions throughout the Gulf, has fostered a greater appreciation of the problems, challenges and approaches used to address key Gulf issues. Continuous learning — about each other, these key challenges, and the most effective means of solving priority issues — remains the watchword for this program.

Key Words: Gulf of Maine, transboundary, coastal ecosystems, collaborative management

Water Resources Sector and Future Climate Change: Bangladesh Perspective

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Of the world's total water-body, a very little portion (about 1%) is available for effective human use. In the changing environment, it is again being depleted day by day, according to UN projection by the year 2025 about 44% of the projected 10 billion population of the world will live in the countries with water availability at or below the water stress level.

Change in global climate might further complicate the situation in different regions of the world as well. For the last one and a half centuries, the average temperature of the earth has increased about 0.5C. It is predicted that it will rise by 0.30C per decade resulting in a 1 C increase in parth temperature by the year 2025. Alarmingly, it has already been observed that the 1998 had the warmest mean temperature in the history of instrumental record since mid 1800s. The following year 1999 and 2000 were also among the top ten warmest years of history.

Such a rapid change in global temperature had introduced significant awareness among water professionals worldwide. Since the beginning of concern over global warming, it has been widely recognized that the changes in hydrology and water resources could potentially have very significant impacts across many sectors of economy, society and environment. The much talked about Sea Level Rise is an example of the consequence of climate change on the hydrological cycle. Likewise, in a number of ways, the hydrological system of a region can be affected by the future climate change includes change in water balance of the hydrological cycle, water demand nature and water quality. However, the magnitude of impact might differ among different sectors and regions different ways depending or its sensitivity to climatic parameters.

There are a number of recent studies that have attempted to focus on the impact of global climate change on global as well as regional water resources. In this case the catchment scale hydrological ... with climate change scenarios derived from the General Circulation Model (GCM). Some of the GCM used for purpose include Maxplank Institute for Meteorology (MPI) United Kingdom Meteorological Office (UKMO) Geophysical Fluid Dynamics Laboratory (GFDL) and HadCM2 of Hadle Center, UK. The GCM outputs usually show the variation of different climatic and hydrological parameters in a course spatial resolution worldwide.

To forecast on local impacts those GCM outputs are required of analyze in a smaller scale. Some of the GCM outputs analyzed specifically in the Bangladesh context reveal that the water resource sector of Bangladesh might be seriously affected by the future climatic changes. Impact of climate change in the water resource sector of Bangladesh in again important due to its unsuitable geographical location. The flat plain of Bangladesh is located just at the foot of the Himalayan mountains. Of the total 56 of its main rivers, 54 original at that mountainous region. So the global climate change, which might affect the Himalayan region will ultimately affect the water resources sector of Bangladesh. Being located at the edge of funnel shaped ocean system the Bay of Bengal, Bangladesh is highly susceptible to the future effects of sea level rise, salt water intrusion, cyclone and storm surges too.

A Case Study of Legal and Institutional Aspects of the Okavango River Basin in Southern Africa

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Challenge: The majority of large rivers in Southern Africa are shared by three or more countries, and as the region's water resources come under growing development pressure, the importance of establishing effective national and regional methods and institutions for sustainably managing these resources will increase greatly. From economic, ecological and human welfare perspectives, the Okavango River Basin is arguably one of the most important transboundary natural resources in the region. Owing to the basin's remoteness and history of conflict, the Okavango was spared much of the destructive developments that other rivers in the region have suffered. As a result, the relatively pristine Okavango ecosystem continues to provide significant benefits to the region much as it has done for centuries. As we enter the new millennium, however, it is clear that the health of the Okavango River Basin is threatened as riparian states increasingly turn to the Okavango to support their growing populations and economies.

Description: This presentation will examine the management of the international freshwater resources; special focus is on the institutional aspects linked to the physical and developmental pre-requisites of the Okavango river basin and how effective management of international river basin could be approached.

Application: For the sustainable management of the river basin, the three Okavango Basin states signed an agreement in 1994 that formed the Permanent Okavango River Basin Commission (OKACOM). In addition to committing the riparian states to managing the Okavango River based on the principles of equity, sustainability and openness, the 1994 OKACOM agreement requires OKACOM to develop an integrated basinwide management plan. Because the Okavango is one of the first international river basins in Southern Africa

that has a functioning river basin commission that includes all riparian states, the importance of OKACOM establishing a regional precedent for managing the river in a participatory and sustainable manner cannot be overstated.

Strengths: The case study clearly demonstrates efforts to establish a collaborative mechanism for joint management that have been made both at bilateral and multilateral level by the riparian states. In another effort towards co-management of the basin, in 1997 the Okavango Liaison Group, a temporary, catalytic network of non-governmental organizations (NGOs), initiated a public outreach program "The Every River Has Its People" project, which is a coordinated set of activities, aimed at promoting the sustainable co-management of the Okavango River Basin through facilitating effective stakeholder participation in basin planning and management processes.

Capacity Needs: Unfortunately, although many in the Okavango River Basin recognize the importance of participatory management, efforts in the basin remain largely non-participatory. Two significant obstacles block the way to successful co-management of the basin. First, many riparian communities and other stakeholders lack the capacity to effectively participate in the management of the resource, and second, there is no existing system to facilitate non-governmental stakeholders to play their role. Hence these barriers will need to be overcome for sustainable management of natural resources in the Okavango River Basin.

Key Words: Water resources management, International river basin, Institutional arrangement, co-management of river basin, Bilateral and Multilateral cooperation, Okavango river basin

Sustainable Development Polices for Chongming, Changxing, and Hengsha Islands

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Challenge: The rural Chongming, Changxing and Hengsha Islands in the Yangtze delta are facing intense development pressure because of their proximity to the rapidly urbanizing Shanghai metro region. Currently accessible only by ferry, the islands will soon be linked directly to the mainland by China's new East Coast Highway system. The Municipality of Shanghai desires that the islands (especially Chongming, with a population of over 700,000) be developed in a sustainable manner, consistent with the city's new master plan (2000–2020), and elicited advice from a consortium of foreign and domestic universities, including the University of Illinois at Chicago.

Description: The presentation will focus on recommendations for the creation of a more sustainable development strategy for the three estuarine islands that reflects the Shanghai region's emerging economic needs, while protecting and enhancing the islands' sensitive environmental resources (including an existing national wildlife refuge).

Application: The proposed regional economic strategy involves shifting municipal development policy from Shanghai's traditional industrial development objectives to a more balanced mix (including expansion of tourism), and shifting the islands' traditional agricultural production to more market-competitive activities (including silviculture). Such changes would also enhance the existing ecological functions of the islands by providing a greater range of habitats. In undertaking this investment policy, the

Municipality must take into account the two major environmental factors likely to affect the Yangtze delta: the Three Gorges Dam project and global climate change. The islands' segment of the East Coast Highway system should also employ sustainable transportation principles, including multi-tier and multi-modal network design, TDM and ITS. These strategies could be applicable to guide island development in most Asian estuaries facing intense development pressures.

Strengths: The sustainable development recommendations propose a shift to silviculture, to conform to national reforestation policies as well as to provide a model for carbon sequestration incentives through the Clean Development Mechanism of the Kyoto Protocol on Global Climate Change. Rising sea levels are also likely to exacerbate saltwater intrusion and flood hazard problems, suggesting that the creation of freshwater lagoons along the upgradient edge of the islands may help maintain the aquifer's hydraulic gradient while buffering new development against coastal storm damage. Finally, greater sewage treatment investments could be justified by pending treaties to control invasive species and pathogens.

Capacity Needs: More information is needed as to vehicle reliability, infrastructure investment needs, and dam and climate change impacts. Integrated surface and ground water modeling will also be needed to address aquifer drawdown, subsidence, flood hazard, and saltwater intrusion problems.

Cross Border Local Government Partnerships as a Strategy for Sustainable Management of Lake Victoria Shared Water Resources

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Challenge: Lake Victoria, situated in the heart of Africa is the second largest fresh water body in the World. It is shared by the riparian countries of Kenya, Uganda and Tanzania in the ratios of 6%, 45% and 51% respectively. The lake supports about 30 million people who depend on it for their livelihood. However, it is now under threat because of environmental degradation and poverty. The increase in human activity resulting from rapid population growth, urbanization and the rural-urban migration have all resulted in heavy pollution of lake waters, over exploitation of natural resources especially fisheries, wetlands and forests. Poor land use practices have resulted in wide spread poverty and unemployment.

The decentralization policy, which is being adopted by the three states, empowers the local authorities to determine the development agenda for their respective local governments. Therefore besides efforts by central governments, cooperation amongst local authorities is necessary to ensure coordinated and sustainable development.

Description: This paper focuses on the efforts and initiatives by the leadership of local authorities in the Lake Victoria Basin aimed at promoting sustainable and coordinated development in the region with special emphasis on environmental management. Challenges, opportunities and threats to the efforts by the local governments in managing cross boarder shared water resources are discussed.

Application: Some 52 local authorities in Kenya, Uganda and Tanzania have come together under an organization called the Lake Victoria Region Local Authorities Cooperation, having realized the commonalties and similarities in the problems facing the local authorities, and in recognition of the many and varied environmental, economic and social challenges facing the lakeshore region.

Strengths: The struggle to reduce poverty and ensure sustainable development in Africa is fast gaining ground. Politico-administrative and managerial structural strategies being used include decentralization and local governance among others. These empower local governments/communities to directly engage and participate in identifying problems, strategies, and plan and mobilize resources and energies both locally and internationally. The multi-level capacity for collaboration, cooperation and linkages that facilitates the coordination of efforts of different levels of governments or authorities gives added opportunity in the management of shared water resources, poverty reduction and sustainable development. Recognition by the EAC and bilateral donor agencies demonstrates the potential opportunities seen in this initiative.

Capacity Needs: Local governments lack capacity in many respects and this also depends on whether they are urban or rural. Although legal frameworks exist for cooperation in the individual member countries and authorities, harmonization of certain policies may be required. Institutional and human capacity needs to be built in full and participatory democracy. Project planning and management by communities, natural resources management and urban planning. Consistent methods and standards for information collection processing, packaging and dissemination need to be developed. Further strengthening of the financial resource capacity and management skills of local governments as major players in the development arena is needed. Institutional arrangements that ensure collaboration and partnerships between central and local government projects addressing environmental and sustainable development concerns in the Lake Victoria region need to be strengthened.

Global Programme of Action for Protection of the Marine Environment from Land-Based Activities

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Challenge: The majority of marine pollution originates from land based sources. According to a recent report by GI7ISAMP entitled “Protecting the Oceans from Land-based Activities” the negative effects of land based activities on oceans and coasts are growing in both scale and type causing increased damage to the marine environment. The significant negative implications for human health, poverty alleviation, food security and safety and for affected industries are of major global importance.

Description: In response to calls for “urgent action” to address the serious problem of land based marine pollution 108 governments and the European Commission adopted the GPA in Washington in 1995. The GPA is a non-legally binding agreement that urges countries to develop national and regional programmes of action to prevent, reduce and control land based activities that threaten the health and productivity of the world’s oceans. This presentation will focus on the results of the first intergovernmental review (IGR) of the GPA that took place in Montreal November 26–30 2001 as expressed in the meeting’s Montreal Declaration, as well as considerations of next steps for advancing implementation of the GPA.

Application: In order to advance the implementation of the GPA action needs to be taken to strengthen ocean and coastal governance, such as the application of effective institutional and legal frameworks for sustainable coastal management. This includes strengthening institutional cooperation

between river, port and coastal water authorities at the national and regional levels and incorporating coastal management considerations into legislation and regulations for watershed management. Also important are efforts to strengthen the capacity of local and national authorities to obtain and utilize sound scientific information to enable integrated decision making with stakeholder participation.

Strengths: The GPA advocates and provides the framework for a comprehensive multi-sectoral approach to land based pollution. It calls for action to integrate land, coastal and marine management and incorporate GPA aims and objectives into programmes, plans and activities at the local, national, regional and international level. Such a framework for international cooperation is particularly useful for shared transboundary resources.

Capacity Needs: Explore and develop public-private partnerships, strengthen regional and international cooperation and collaboration, increase capacity for developing countries with particular attention to technology transfer and the sharing of information and knowledge, work to increase scientific expertise and improve state of the oceans reporting, develop necessary institutional arrangements at the national and regional levels to ensure coordination and cooperation, continue to raise awareness of the challenge of land based pollution to the marine environment.

Key Words: global/national programme of action, pollution, land based, sewage,

Building Capacity for Sustainability in the Georgia Basin/Puget Sound Ecosystem

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Challenge: The Georgia Basin/Puget Sound ecosystem is a transboundary region of incredible natural wealth, economic potential and 'quality of life' opportunities. It is also, however, a region under significant environmental stress due to the negative effects of population growth and urbanization. All predictions point to a continued high rate of growth and urban sprawl challenging the capacity of governments, stakeholders and residents' to develop and implement coordinated solutions for a sustainable future. The Georgia Basin Ecosystem Initiative (GBEI) serves as an ecosystem-based management framework to support the decision-making process required to address the region's sustainable development challenges.

Description: Ecosystem initiatives are cooperative efforts which address complex sustainable development issues identified by the partners. Building capacity, a constituency for change and alliances for action with a wide range of interests, are critical components to ecosystem-based management. Effective community action also plays an integral role. The GBEI is one of five ecosystem initiatives supported by Environment Canada in partnership with other federal, provincial and local agencies and First Nations. Other initiatives are supported on the Atlantic Coast, St. Lawrence River, Great Lakes and Canada's North.

Application: Since the launch of the GBEI in December 1998, significant progress has been made in developing and delivering collaborative programs to support the goals of achieving clean air, achieving clean water, protecting habitats and species, and encouraging sustainable communities in the Georgia Basin. Programs aimed at supporting communities in meeting sustainability objectives, such as by providing information to enable better incorporation of environmental values into regional district growth strategies and waste management plans, local community plans and day-to-day decision making.

Strengths: The initial phase of the GBEI has resulted in the sharing of a wide range of capacity building tools through information development and exchange and workshops on topics such as ecosystem indicators, Smart Growth practices leadership and innovation for urban sustainability and stormwater management. The initiative has supported pilot projects such as the green development project in East Clayton (City of Surrey) and the Greater Vancouver Biodiversity Conservation Pilot, as well as the development of Best Practices and improved a stakeholder access to needed ecosystem information.

In addition to specific projects, the GBEI has been instrumental in building a strong degree of cooperation, trust and information exchange among scientific and policy personnel within Environment Canada, with other federal departments and provincial ministries, and increasingly with the United States in the Puget Sound portion of the Georgia Basin/Puget Sound ecosystem. These linkages and experience will place the region in a good position to address its shared challenges in the years ahead.

Capacity Needs: As the stresses on the shared transboundary ecosystem increase, as our understanding of issues and governance needs moves towards a broader, integrative sustainability model, and the GBEI itself moves into its next phase of program delivery, capacity-building including mechanisms to support decision-makers in local government and community planning processes, will be an increasingly important component of the initiative.

Keywords: ecosystem initiatives, sustainable development, sustainability, indicators, capacity-building, transboundary, Georgia Basin/Puget Sound

Managing Contaminated Sediments in Shared Jurisdictions

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It is a well-established fact that contaminated sediments pose a significant risk to the quality and the overall ecosystems of the water bodies. As a result, managing and handling of sediments have traditionally been highly controlled and regulated activities everywhere. Accordingly, the management of contaminated sediments does present a formidable challenge to the proponents and agencies, both in the private and the public sector, responsible for dealing with this issue. In the Great Lakes basin, this task becomes even more daunting in view of the bi-national and multi-jurisdictional nature of these water bodies. Two federal governments, Canada and the U.S., the province of Ontario and eight States exercise varying degrees of control Great Lakes. In addition, Canada and the United States have signed a Great Lakes Water Quality Agreement by which the two countries have very publicly undertaken to work together towards the preservation and the enhancement of the shared ecosystem.

The overlapping jurisdictions have resulted in a multitude of guidelines, criteria, rules, acts and regulations for the handling and management of the contaminated sediments, either in-situ or as dredged material in the Great Lakes. In addition to the bi-national obligations and the regulatory framework, public and the stakeholder participation is also an integral part of the decision making process with respect to both the short and the long-term management of contaminated sediments.

The paper will provide an overview of the current practices with respect to the managing of contaminated sediments that are in place in the Canadian sections of the Great Lakes. The bulk of the “contaminated” sediments in the form of dredged material is disposed of in specially constructed upland or in-water ‘confined disposal facilities’ (CDFs). The paper will attempt to examine the complexities involved, and, in particular, the issues of long term environmental impacts, sustainability and liabilities associated with the CDFs.

Transboundary Management Problems in the World's Largest Mangrove Ecosystem: The Sundarbans of Bangladesh and India

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Challenge: The “Sundarbans” means beautiful forest. It is the largest mangrove ecosystem in the world covering an area of about 10,000 km². It contains a large variety of genera and species of plants, wildlife and astonishing biodiversity. It is home to over 200 bird species, 43 mammal species, 52 reptile and amphibian species, rare freshwater crocodiles and the world largest tiger population. This unique ecosystem stretches across two countries Bangladesh and India. It is situated to the north of the Bay of Bengal. Due to its great ecological significance the Sundarbans was declared as World Heritage Site and Biosphere Reserve. However, the future of the Sundarbans remains uncertain. This is due to the increasing rate of exploitation and sectoral, rather than holistic resources management. Recently, the Bangladesh government signed a production sharing contract with two oil companies to begin oil and gas exploration in the Sundarbans. Besides these problems, the two countries have different management schemes and little cooperation to manage the Sundarbans as a whole.

Description: This presentation will focus on the present status of the Sundarbans and its protection and restoration issues. It will also address the different management schemas followed by the two countries for the management of the single ecosystem. The presentation will describe how the management of the Sundarbans under the two different schemas adversely affects its biodiversity and ecosystem vitality.

Application: Techniques for the restoration and protection of the Sundarbans and its wide range of flora and fauna are critically examined. The management of mangrove forest, wildlife, fisheries, utilization of land form the sea, community participation in the

management process, integrated social forestry and alternative livelihood are assessed in the context of the Sundarbans. Transboundary management issues are evaluated through consulting the different agencies and the NGOs of both countries those are involved in the Sundarbans management.

Strengths: This study is an attempt to foster better understanding of the complexity of the mangrove ecosystem. The limitation of existing management practice are identified. This research also identifies the problems associated with uncoordinated management of shared ecosystem. It demonstrates the importance of integrated, cooperative and joint planning and management. Lessons learned from the management of this binational shared ecosystem can be applied to many other protected areas that are shared by more than one country. In this study, it is recognized that the participation of local communities plays a vital role in shared ecosystem management, especially where poverty and population growth take on alarming dimensions.

Capacity Needs: Poverty and high population growth are major problems in terms of the protection and restoration of the Sundarbans. These problems might be minimized through introducing micro-credit programs. Establishment of a binational institute is essential to resolve these transboundary conflicts and to undertake joint planning and management schemes regarding the shared Sundarbans. Political, social and religious barriers between the two countries should be dealt with co-operatively to ensure the preservation and sound management of the Sundarbans.

Key Words: Sundarbans, large mangrove ecosystem, transboundary management

Oil and Gas in Sundarbans: Effects of Hydrocarbon Operations in the World's Largest Mangrove Ecosystem

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Challenge: Sundarbans mangrove ecosystem, the world largest mangrove forest in Bangladesh, is one of the most productive and biologically diverse wetlands in the world. This unique coastal tropical forest is among the most threatened habitats on earth. Its importance lies in its floristic composition, resource and economic value and precious wildlife habitats, in particular rare tiger habitat, and areas suitable for estuarine crocodiles, and fresh water dolphins.

In order to improve a struggling economy, the Bangladesh government has been looking into using the oil and gas resources in the country. The most terrestrial and offshore areas of Bangladesh have been divided into 23 blocks and are gradually being leased to multinational oil and gas companies. The government recently completed initial signing of a production sharing contract with Shell Oil Company and Cairn Energy to begin oil and gas exploration in block # 5 of the within Sundarbans. The companies plan to conduct seismic and aerial surveys. In Bangladesh the gas and oil exploration business is in its infancy and therefore environmental impacts have not yet been felt. Oil and gas exploration might pose a new and, for the most part, unknown threat to the Sundarbans ecosystem.

Description: Oil and gas development activities may result in a wide range of effects on the soil, mangrove vegetation, and fisheries and wildlife of the Sundarbans. In this paper we plan to critically examine the present status of the Sundarbans and assess the potential threat of oil and gas exploration. In addition

we will present a brief mitigation plan which could be used to minimize potential impacts.

Application: This work is not intended for use in deciding whether or not to allow oil and gas development in Sundarbans but rather, to aid in the identification of potential problems, to increase the manager's awareness of the implications of development, and to provide information that may facilitate minimization of harmful effects.

Strengths: There has been a very limited amount of research done so far to determine the effects of oil and gas exploration in mangroves ecosystems. This work can serve as a basis for understanding the effects of oil and gas in complex mangrove ecosystems. The addressed mitigation plan will be helpful for minimizing potential damages from development.

Capacity Needs: Specific information presented in this paper is intended as background data. Resource managers will need to make judgments based on professional expertise. This study has been conducted with aid of reviews in scientific literature, magazines, unpublished materials and personal experience. Multidisciplinary and long-term research work is needed, which will address the impacts of oil and gas operation on mangrove forests, fisheries, wildlife and other resources of the Sundarbans.

Key Words: Sundarbans, mangrove ecosystem, oil and gas, environmental effects

Successful Ontario Partnerships Enhance Protection and Conservation of the Great Lakes Basin Ecosystem

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Challenge: Canada and Ontario share responsibility for one of the world's most precious and unique natural resources, the Great Lakes. Ontario is a leader for the Great Lakes at the provincial level. The challenge is that no one organization has the mandate or ability to manage the Great Lakes in their entirety. Meeting Ontario's objectives to protect and conserve the Great Lakes will be enhanced through partnerships with Great Lakes stakeholders.

Description: For over thirty years the Canadian and Ontario governments have worked together to implement the Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem (COA). COA is an Agreement outlining actions to restore, protect and conserve the Great Lakes Basin ecosystem.

The purpose of this presentation is to demonstrate how, through partnerships, Ontario is meeting its commitments under COA in order to protect and conserve the Great Lakes Basin. A variety of partnerships will be highlighted that focus on: habitat restoration through the protection of a significant woodland; monitoring and reporting efforts in the Great Lakes and inland lakes within the Great Lakes Basin; and the protection of groundwater quality and quantity within the Great Lakes Basin.

Application: On April 11, 2002, the Ontario Ministry of the Environment announced that the province is investing \$50 million over the next 5 years in Great Lakes clean-up and protection in support of COA. This new funding will allow Ontario to forge partnerships with municipalities, universities, conservation authorities, and others to develop local ability to manage environmental projects and secure additional funding for environment

stewardship projects (e.g., stream rehabilitation, pollution prevention, outreach activities).

Great Lakes clean-up is a multi-government, multi-partner activity involving a wide range of stakeholders. To restore the Great Lakes Basin Ecosystem will require the cooperation of all the Basin's citizens including industries, businesses and non-government organizations, aboriginal people, as well as all levels of government.

Significant progress has been made toward restoring the health of the Great Lakes Ecosystem. With the cooperation of the Great Lakes area residents and industry, Ontario will work in a cooperative and coordinated fashion to achieve the vision of a healthy, prosperous and sustainable Great Lakes Basin Ecosystem.

Capacity Needs: Water quality in the Great Lakes continues to improve through clean-up activities carried out by all Great Lakes stakeholders, including industries, municipalities and local communities. While the Great Lakes are cleaner than they have been in decades, more work needs to be done.

It is clear that in order to achieve the Province's objectives in protecting the Great Lakes, it is critical to promote local leadership to manage and sustain clean-up and protection at the local level. It is becoming increasingly important to work with local agencies and organizations to identify measures that will prevent the Great Lakes basin from being further degraded. In order to maintain momentum and ensure that the people who are helping to restore the Great Lakes are committed to sustaining it for the future, fostering successful, mutually-beneficial partnerships must remain an on-going priority for the Province.

Shoal Lake Watershed Management Plan: Many Governments, Many Issues, One Plan

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Challenge: The Shoal Lake watershed straddles the Ontario-Manitoba border and is part of the larger transboundary Rainy River–Lake of the Woods–Winnipeg River Drainage Basin. The watershed is home to two First Nation communities and an all-seasons resort community. It also possesses significant forest, mineral, fisheries, aquatic plant and recreational resources, and is the sole source of drinking water supply for the City of Winnipeg (the population of 630,000 is served by an intrabasin diversion through a 150km long aqueduct). Escalating conflicts, over the past two decades, in finding a workable balance among resource development, sustainable community life, and environmental protection interests eventually led the partner governments to empower a Working Group with the task of developing a comprehensive watershed management plan.

Description: The presentation will focus on the people and process involved in building the watershed management plan including creation of a watershed vision; establishment of guiding principles; formulation of goals, objectives and management strategies; the use of stakeholder outreach and involvement; and finally development of targeted recommendations. The recommendations address the major themes of ensuring water quality protection, sustaining water resources, building healthy and viable communities, achieving ecological sustainability, restoring sustainable fisheries, and working through cooperative management. Products also included the successful transfer and calibration of an existing lakeshore development capacity model and a water budget model. A brief description of the development history of the watershed and of the key issues that brought the partners together help set the context.

Application: The ecologically based watershed approach is rapidly becoming the tool of choice in planning and managing for a sustainable future. The Shoal Lake example should provide a useful model for application to other watersheds, both large and small. It may be particularly helpful in situations involving indigenous peoples whose culture and livelihood are strongly connected to water.

Strengths: The Shoal Lake case study illustrates how sound science, partner goodwill, dedicated individuals, process facilitation, adequate resourcing, and meaningful stakeholder involvement brought together using a relatively straight-forward planning model can produce workable solutions to some very complex and divisive issues involving freshwater and aquatic resources.

Capacity Needs: As with any plan early attention needs to be given to setting priorities and moving forward with implementing the recommendations (i.e. it is important to sustain the goodwill and momentum established through the Working Group). Efforts must continue to be made to build stronger links between local First Nations traditional ecological knowledge and conventional science and to more fully involve stakeholders in monitoring and reporting on watershed health.

Key Words: watershed management, transboundary, First Nations, fisheries, water

Caspian Sea: Potential and Strategies for the Application of Scientific Research in Coastal Zone Management

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Challenge: The Caspian Sea is the largest enclosed water body on Earth, with about 10 million people living in its coastal zone. Controversy of social, economical and political interests of the five bordering countries (Azerbaijan, Iran, Kazakhstan, Russia and Turkmenistan) is aggravated by the complexity of legal issues concerning the sea status and rapid intensification of use of natural resources, especially in the Northern Caspian, where oil prospecting activities are under way. Substantial changes in the sea level affect social and economic activity in the coastal areas. Dramatic increase of human pressure on the fragile marine ecosystems demand new approaches for sustainable and efficient management of shared waters.

Description: We will present problems and potential for application of scientific research in the coastal zone management in the context of the existing environmental, social, economical and political problems. Special emphasis will be given to the assessment of recent changes in the sea level, ice conditions and water quality using a wide range of research methods, and impact of these changes on sea ecosystems and human activities.

Application: Study of changing environmental conditions is among primary concerns for various national and international programs. One of the most important parameters is the sea level, whose interannual changes are significant and hard to forecast. Recent sea level rise has already put in danger many

housing and industrial areas constructed during period of low sea level position. Another important issue is a warming signal in observations of the Caspian ice cover, clearly evident during last several anomalously mild winters. A sharp decrease in ice cover area affects breeding habits and living conditions of the Caspian seal — the only mammal in the sea, that mate and have offspring on ice. Complex operational monitoring of these and other parameters will benefit various stakeholders.

Strengths: Changes in environmental conditions of the Caspian sea are being studied by implementing both conventional and innovative techniques, such as satellite observations and numerical modelling, in order to enlarge the scope of research and increases the value of results for operational decision making and risk management processes.

Capacity Needs: In the current conditions of dominance of short-term strategies over long-term ones and low public awareness and involvement, there is a clear need to intensify cooperation between scientists, decision makers and society, to better target scientific research for use in protection and management of coastal zone.

Key Words: transboundary, coastal zone, management, sea level, environmental conditions, Caspian Sea

Experiences with Transboundary Coastal Ecosystem Management in the Great Lakes

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Challenge: The Great Lakes represent one of the largest and most significant coastal ecosystems in the world shared by more than one nation. Within the Great Lakes basin, the United States and Canada have cooperated in a number of joint transboundary coastal ecosystem management initiatives, with considerable success. However, as new and complex concerns emerge, related to fluctuating water levels and water quality issues, it is time to examine and reflect upon the ability of public agencies, communities, and citizens to participate and influence decision-making at the transboundary scale.

Description: This presentation will focus on the planning process and results to date from two selected Great Lakes case studies. The first examines efforts to resolve planning and management issues resulting from fluctuating Great Lakes water levels. The second case study is the preparation of a Lakewide Management Plan to address wide water quality and related land use concerns.

Application: Important components of addressing key planning and management issues related to Great Lakes water levels and water quality have included scientific research and public consultation. The efforts have also involved extensive engagement of a range of major national and binational government agencies and basin wide community groups. The development of the Lakewide Management Plan (LAMP) for Lake Erie to address water quality concerns facilitated the establishment of the Lake Erie Public Forum to facilitate community and citizen involvement.

Strengths: Both issues have been the focus of scientific research and study in an attempt to better understand these complex issues within an ecosystem context. The case studies clearly demonstrate the importance of stakeholder engagements in the planning and management process. They demonstrate progress made through binational initiatives supported by key federal agencies in Canada and the United States and the involvement of the International Joint Commission.

Capacity Needs: Linking science to improve decision-making regarding land use planning and maintaining public awareness and education efforts are seen as continual concerns in implementing management actions. Geographic, political, social, cultural and economic differences between the two nations present barriers will need to be overcome for effective long term and proactive ecosystem based approaches. Consistent methods and standards for information and data collection, assessment and dissemination need development. The establishment of innovative institutional arrangements should be considered, including possible evaluation of the roles of existing bi-national organizations or establishment of a Great Lakes Transboundary Environmental Partnership to better address complex, wide ranging environmental issues within the basin.

Key Words: transboundary, coastal ecosystems, management, Great Lakes

Renewing Canada's National Fish Habitat Management Program

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Challenge: Responsibility for the conservation and protection of Canada's fish habitats that sustain the production of Canada's freshwater and marine fisheries resources rests with Fisheries and Oceans Canada's National Fish Habitat Management Program. The Program is based on one of Canada's oldest law and guided by a comprehensive and forward-looking policy framework. Since its inception in the 1970's the Program has had to adapt to respond to the challenges arising from Canada's growing population and economy and the effects these are having on fish habitat. By the late 1990's a number of major challenges had converged to bring the program to a crossroads.

Description: This presentation will provide an overview of the legal and policy frameworks that Canada has established for the sustainable management of its fish habitat resources; describe the evolution of the DFO Program put in place to implement the law and policy; identify key challenges and issues with respect to the implementation of the Program; and describe key initiatives of the department to renew the Program.

Application: The 1986 Policy for the Management of Fish Habitat provides the framework for the National Fish Habitat Management Program. The Policy's objective of "net gain" together with its guiding principle of "No Net Loss" and eight implementation strategies provide the foundation for the Program. The National Fish Habitat Management Program has over the years mainly focused on the two coasts of Canada

where the Department manages the fisheries. The Program is also responsible for conducting environmental assessments under the Canadian Environmental Assessment Act (CEAA) prior to the Department making regulatory decisions under several Acts.

Strengths: Through several major initiatives, the department began in 1999 a process of renewing its capacity to implement its National Fish Habitat Management Program. The past two years have been marked by fundamental changes in the way the National Fish Habitat Management Program operates. The Inland Strengthening Initiative has enabled the Department to more than double the Program's staff across Canada. The National Habitat Blueprint Initiative has defined a path forward for delivery of a more effective, efficient and consistent Program. Capacity Needs: A number of challenges remain in ensuring delivery of a Program that contributes to the conservation and protection of Canada's fish habitat resources. Among these are establishing sound and practical performance measures or indicators; having the scientific capacity to ensure sound decision-making; building strong and lasting partnerships; and developing internal and external capacity for stewardship; and developing and implementing partnering agreements with provinces, industry, non-government organizations and aboriginal people.

Key Words: Fisheries, Public and Private Partnerships, Watershed and Land Use Management

Implementing Canada's Ocean Act: Strategies and Priorities

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Challenge: Canada's oceans contribute daily to the lives of all Canadians and are vital to the economy, culture and environmental integrity of the country. Increasingly, oceans show the impacts of human activities, greater demands for their resources and conflicts due to multiple users of this environment. To implement recommendations in Agenda 21 regarding ocean management, in 1997 Canada adopted the *Oceans Act*. The Act sets out a commitment for the Minister of Fisheries and Oceans, on behalf of the Government of Canada, to develop and implement a national oceans management strategy in collaboration with Canadians. The strategy is based on the objective of sustainable development of oceans and relies on precautionary and ecosystem approaches. The strategy will achieve its objectives through integrated management, marine protected areas and programmes to maintain marine environmental quality. The key challenge is to implement a modern, innovative programme of ocean management in Canada.

Description: This presentation will give details of the oceans strategy and the principles and programmes on which it is based along with priorities that will be incorporated in the strategy action plan.

Application: People attending Coastal Zone Canada 2002 are an important audience and represent a key to public engagement in the oceans strategy and action plan. We will invite their participation in a discussion forum to explore implementation of the strategy, and the engagement of the Canadian public with this important innovation.

Strengths: To date, Canada's oceans management activities under the *Oceans Act* have focused on developing specific *Oceans Act* related programmes, such as Integrated Management and Marine Protected Areas. Experience to date in the development of these programmes has shown that stakeholder engagement is critical to their success, and also that many interested stakeholders are eager and willing to participate in implementation of *Oceans Act* programme.

Capacity Needs: The *Oceans Act* is an important innovation in the manner by which Canada manages its oceans, moving from a constituency-based user focus to a more holistic, integrated approach based on an understanding of the nature of the ocean environment and awareness of the needs of all ocean stakeholders. Implementing this change in approach will require cooperation between governments, ocean stakeholders and the Canadian public, the development of collaborative decision-making mechanisms, sharing of knowledge and information and the use of performance measures to monitor our progress.

A Review of the Current Management Strategies and Future Prospects of the Lake Victoria in East Africa

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Challenge: Lake Victoria is the second largest lake in the world. It is jointly owned by Kenya (6%), Uganda (45%) and Tanzania (49%). The lake is a reliable source of drinking water and fisheries generates employment to local people around it. For almost three decades each riparian state adopted its own management strategies of the lake independent of the other. That resulted into severe pollution of the lake from land-based anthropogenic activities. Although the tripartite Lake Victoria Management Project (LVEMP) has been in place since 1997 the lake still suffers from chronic pollution and waterweed invasion.

Description: This paper concentrates on the current pollution status and management approaches taken so far to control pollution, and also examines the existing institutional limitations that need to be taken into account in future plans.

Application: Since the inception of tripartite LVEMP each country has its own LVEMP national Secretariat to oversee management issue within national borders. The general approach has been to involve various national and international stakeholders. Water quality, fish stock population and water hyacinth have been monitored. Various NGOs and CBOs are involved in micro-projects so as to improve the living conditions of local people. Public education is given through seminars, workshops and other media channels and with

the help from donors training programmes are in place. Laws protecting the lake are enacted by each state that may not harmonious. In addition, national bureaucracy within the riparian states makes it difficult for decisions taken at regional LVEMP levels to be implemented at national level. It also affects smooth information flow from top organs to the implement units and vice versa.

Strengths: Involvement of various local, regional and international stakeholders has made it easier implementation of the project objectives. Universities and fish research institutions are at the forefront to monitor the quality of water and the ecology of the lake as whole. World Bank and other international funding agencies have supported necessary infrastructures for the projects and more expertises are recruited.

Capacity Needs: The peasants in villages have to be empowered to engage into sustainable crop production methods, improvement of fishing methods and improvement of municipal waste treatment infrastructures. Public awareness has to be an endless process and with the inception of East African Community it a high time to harmonize decision making institutions and legal regime for protection of the lake; and establish regional environmental fund to minimize donor dependence.

Capacity Building Towards Management of Coastal Resources: A Case Study in India Sunderbans

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Challenge: Indian Sunderbans features in the Global perspectives as one of the largest proglacial delta, with its long cast line with the coastal land lying below the MSL, vast mud flats with equinoctial tides and vast mangrove forest with rich biodiversity and large human population at the fringes. In spite of such unique features the coast is under threat due to a number of anthropic and non-anthropogenic interference. The delta is eroding, coastline is advancing/retarding with respect to the seashore, mangrove forest is declining with its genetic diversity along with other natural resources.

Description: These above issues gave a thrust to the planners, administrators and researchers to formulate appropriate strategy considering the Integrated Coastal Zone Management policy and the coastal stakeholders into confidence. This case study, in one hand, is an attempt to formulate a developmental strategy and, on the other, to implement such strategy with the direct involvement of the people along the coast.

Application: Following interaction with the local government, the Panchayat, the immediate areas of their concerns were identified following creating due awareness among them on the coastal resources, the environment, the policies and their probable role in the management of such resources in particular. Three such areas of intervention like: afforestation of degraded mudflats with, of course, mangroves *vis-à-vis* conservation of genotypes; greening of saline wastelands through introduction of salt tolerant crop; adoption of small brackish water aquaculture were prioritized and acted upon with active peoples participation.

Strengths: The above issues, the awareness and the active involvement of the people around formed the basis of this case study. The principles of mangrove afforestation, physiological aspects of mangroves and the species succession helped to demonstrate and develop a successful strategy to rehabilitate the mangrove tree genotypes in the degraded mudflats. The physiological aspects of halophytes and their seeds formed a scientific strength to this study. The need of small brackish water aquaculture following a cooperative approach helped to make this intervention successful and useful to the beneficiaries. The fallow, saline embankments of such aquaculture structure were successfully used to introduce salt tolerant fodder crop.

Capacity Needs: The awareness so generated, the involvement so developed, helped to identify the needs towards management of natural resources: land, water and the man power; to formulate the need based action strategy and to take the actions into their confidence for venturing into the interventions through their direct involvement. Integration between the local populace with their working power with their indigenous knowledge and the scientists with their technologies in hand has led to develop successful mangrove nursery technique, its afforestation methodology; adaptation of salt tolerant fodder crop following understanding the physiology of mangrove as well the identified halophytic fodder seeds and adoption of aquaculture to uplift the ecology and economy of the area of intervention in particular.

Key Words: Sunderbans, anthropic factor, resources, mangrove, fodder crop, rehabilitation, management

Institutional Frameworks for coastal zone management in the Beaufort Sea

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Challenge: The Beaufort Sea in the Arctic Ocean is roughly bisected by the Canada–United States boundary. In summer, bowhead and beluga whales migrate from the Bering Sea along the shelf break to the Canadian Beaufort Sea. In winter, land-fast ice along the entire coastline is a hunting area for polar bears. Significant oil and gas deposits on both sides of the international border underlie the Coastal shelf. Although there have been some transboundary coastal management initiatives, there is potential for increased international cooperation, particularly if a proposed offshore pipeline is developed along the coastal shelf to transport gas from Prudhoe Bay in Alaska to the Mackenzie Delta in Canada.

Description: This presentation will focus on some of the institutions responsible for coastal zone management on both sides of the border. The co-management framework that characterizes the Canadian approach will be contrasted with the more centrally directed management regime on the US coast. Emerging new forms of ocean governance that have been facilitated by the *Canada Oceans Act* will also be discussed.

Application: Transboundary cooperation in resource management has begun in the areas of scientific exchange and collaboration. Research on polar bears and beluga whales has resulted in a management agreement on bears and cooperative initiatives on whales. Scientific collaboration is continuing through international studies on contaminants and on the investigation of climate change and sea ice. International dialogue on Arctic resource management continues through the Arctic Council and its various programs.

Strengths: The ecosystem-based management approach, introduced by the *Canada Oceans Act*, reinforces the need to align national resource management outcomes when ecosystem processes cross national boundaries. A proposed offshore gas pipeline from Alaska to the Mackenzie Delta will require a coordinated approach to environmental impact assessment along the pipeline route. Circumpolar threats like contaminants have produced collaborative efforts to define the dimensions of the problem. Further collaboration on resource management should build upon these initiatives.

Capacity Needs: Examples of effective coastal zone management institutions can be found in both Alaska and the Canadian Northwest Territories. However, differences in economic, socio-cultural and political objectives result in different approaches to resource management. These differences need to be understood for collaboration on resource management issues to advance.

Key Words: Beaufort Sea, coastal ecosystems, management, transboundary, Arctic Ocean

New Directions in the IUCN Global Marine Programme

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Challenge: In spite of their importance, marine and coastal resources are declining at an unprecedented rate and the environment that we enjoy is degrading faster than we can ever imagine. Responding to the great need for conserving marine and coastal resources, IUCN established its first directed Marine Programme in 1985. IUCN believes that there must be a change in the way that we manage marine and coastal resources towards sustainability. This requires building of a new culture, tools and management mechanisms which balance conservation and sustainable use. It requires the development of new methodologies and indicators for assessing and evaluating productive capacities of ecosystems and matching these with human needs in an action-oriented manner.

Description: The main goal of the IUCN Marine Programme is to provide for the protection, restoration, wise use, understanding and enjoyment of the marine heritage of the world in perpetuity through the creation of a global, representative system of marine protected areas and through the management, in accordance with the principles of the World Conservation Strategy, of human activities that use or affect the marine environment.

Application: Since its inception, the IUCN Marine Programme has been involved in many field projects in Asia, the Middle East, Africa, the Mediterranean, Central and South America. In 1998, IUCN joined forces with WWF — The World Wide Fund for Nature to produce a common Marine Policy published under the title *Creating a Sea Change*. Under this policy, IUCN and WWF have committed to co-operate

with each other and with other concerned organisations to achieve 5 principal objectives: a global representative network of marine protected areas; conservation of threatened marine species; measures to ensure sustainable fisheries; reduction in marine pollution; and promotion of integrated coastal management. Each partner chooses to focus its efforts within these broader objectives. The Marine Programme areas of focus are therefore closely linked to this policy with, for example, some projects undertaken related to marine protected areas management, coral reefs degradation and sustainable fisheries and aquaculture.

Strengths: The strategy of the IUCN Marine Programme relies on a network approach with IUCN Members, Commissions and scientific experts and on the development of partnerships with NGOs, communities and government agencies, and increasingly the private sector.

Capacity Needs: Since its foundation, IUCN has always assisted developing countries in the management of their natural resources by providing them the same tools used in the more developed countries. Cooperation between countries is increasingly needed to improve knowledge and policy enforcement, as the main marine ecosystems problems are transboundary by nature.

Key Words: sustainable management, conservation, international, capacity building, coastal and marine environments, marine protected areas, fisheries, aquaculture, coral reefs

Transboundary Watershed and Coastal Management in North America and Europe: Examining the Hudson Bay and the Rhone River Watersheds and Adjacent Coasts

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Challenge: To understand and integrate transboundary watershed and coastal management in North America and Europe, and to learn from the differing approaches in the regions.

Description: Integrated watershed and coastal management is developing for the Hudson Bay and the Rhone River watersheds and adjacent coastal regions. The European Community has recently approved a water directive that incorporates a watershed approach and includes a coastal component, while further initiatives have been proposed for coastal management. The Rhone River drains multiple jurisdictions, and is heavily used by adjacent populations and agricultural and industrial concerns. The Rhone River flows into the Mediterranean Sea, with significant wildlife reserves, populations, and industries located in the estuary. As a result, management of the Rhone River watershed and adjacent coastal region is a pressing concern. In contrast, while the Hudson Bay watershed drains a significant portion of the continent, the drainage basin is not densely populated. Up to now, its waters have primarily been impacted by hydroelectric development, though alterations and flow reversals have been proposed for rivers located in the United States and draining into the watershed. The Hudson Bay watershed is subject to different regional land claims agreements which recognize water rights, transfer riparian and coastal lands, and establish joint management structures for lands, wildlife, and fresh and marine waters. Integrated management approaches are developing for portions of the Hudson Bay watershed which incorporate extensive local and governmental cooperation, and will consider future uses, alterations and environmental impacts on the watershed.

Application: The presentation will be of interest to parties involved in integrated watershed and coastal management in Hudson Bay watershed and Europe. The differing institutional frameworks, and economic instruments will be of interest to parties involved in watershed and coastal management in other regions of North America and the world.

Capacity Needs: The presentation will address and compare transboundary institutional and participatory frameworks for the Hudson Bay and Rhone River watersheds and adjacent coastal regions. This includes North America, Canadian and regional framework for the Hudson Bay watershed and the inland sea contained within the bay; and European and national institutional frameworks for the Rhone River watershed and adjacent coastal region of the Mediterranean. Each watershed and adjacent coastal region has a governmental and regulatory framework. However, there are useful analogies and comparisons between the different framework and approaches. Given the transboundary nature of the watershed, each framework incorporates several approaches to local consultation and participation, and the use of economic and legal instruments.

Key Words: transboundary, watersheds, coasts, management, Hudson Bay, Rhone River

The Canada/US Great Lakes Water Quality Agreement: A 30-Year Retrospective on the Shared Management of one of the World's Largest Freshwater Ecosystems

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Challenge: The Great Lakes constitute one of the largest systems of fresh surface water on earth. Rich in resources, the Great Lakes play a pivotal role in the health, culture and economic well being of 33 million people living in the basin. By the early 1970s, pollution in the Great Lakes had reached almost disastrous levels. In recognition of the urgent need to improve environmental conditions in the Great Lakes, Canada and the US signed the Great Lakes Water Quality Agreement (GLWQA) in 1972. The Agreement expresses the commitment of each country to restore and maintain the chemical, physical and biological integrity of the Great Lakes Basin ecosystem and includes a number of objectives and guidelines to achieve these goals. The Agreement has been amended twice, in 1978 and again in 1987.

In the 30 years since the GLWQA was signed, the Great Lakes have undergone a dramatic recovery. However, many major concerns, such as population growth, climate change, exotic species and pollution from non-point sources, have now been added to the existing environmental challenges of elimination of toxic chemicals and restoring Areas of Concern. This session will explore the strengths of the Agreement by reviewing its past, while also looking to its future and exploring its prospects for meeting tomorrow's challenges.

Description: This special session will include brief panel presentations followed by a group discussion.

Application: The GLWQA provides a strong example of international cooperation to manage and protect shared waters. Concern

over the quality and quantity of Great Lakes water continues to be a concern for basin residents. A healthy and sustainable Great Lakes Basin ecosystem requires continued commitment to the principles of the GLWQA.

Strengths: Significant progress has been made by Canada and the US in restoring Great Lakes water quality over the last 30 years. The Agreement reaffirms the rights and obligations of Canada and the United States under one of Canada's oldest international environmental agreements — The Boundary Waters Treaty of 1909. The Boundary Waters Treaty provides the principles and mechanisms to help resolve disputes and to prevent future ones, primarily those concerning water quantity and water quality along the boundary between Canada and the United States. Progress made by Canada and the US under the GLWQA is monitored and assessed by the International Joint Commission, a binational body with equal representation from both countries.

Capacity Needs: The GLWQA established specific Great Lakes water quality objectives and obligations for the governments of Canada and the US to meet. As an international agreement the GLWQA is a significant driver of positive environmental change in the Basin. However, restoring and maintaining water quality in the Great Lakes basin is a significant challenge requiring the cooperation of all levels of government, industry and basin residents. Ongoing commitment to the principles and the goals of the GLWQA by all of these parties is critical to achieving future progress.

Key Words: Great Lakes, water quality, toxic chemicals

Water Resource Management for the Great Lakes of Africa

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Summary: Water holds a unique position among the various natural resources of our planet. The ever-lasting process of the hydrological or water cycle implies the unity of natural water all over the world. The hydrological cycle involves all kinds of water resources (i.e., water of the atmosphere, oceans, of the earth's crust and biosphere).

The relationship between climate and the water-resource system on earth is unique in the sense that parts of the hydrological cycle, namely precipitation and evaporation are, at the same time, inherent parts of the climate and important characteristics of it. Furthermore, the hydrological processes as a transfer function from the climate system to the water resource system and vice versa, the function being part of either one of the two systems under different circumstances.

Water, as an essential factor of life, is also the most manageable natural resource. This renewable resource is capable of diversion, transport, storage and recycling. Because of these properties water is very useful for man. Its quality and distribution in time and space varies widely, but the total amount of the usable water remains constant. Thus, man is faced with a wide range of choices in managing his water resources. At the same time, however, many of these choices are mutually exclusive. Therefore any proposed course of action involving water resources should not be made in isolation but in full awareness of associated hydrological and ecological effects and under consideration of the other courses of action which will be excluded.

An intense development of industry and agriculture, population growth and cultivation of more land have resulted in a great increase in water use/demand all over the world, and in

changes of the hydrological regimes of water bodies.

In densely populated areas there are no large rivers where runoff is not affected by man's activity to some extent. Today water consumption makes up about 3,000km³/year while it was just 400km³/year at the beginning of this century. One of the most important topical problems in water resource assessment and water management planning is the evaluation of the amount of "irretrievable" water losses — water which does not return to the water source (e.g., water lost by evaporation, transpiration or as part of a final product). These processes cause a decrease in the amount of water which might be used for other needs within a particular river basin.

Man's activities have an even greater effect on the quality of water in rivers, lakes, reservoirs and aquifers. Today a pronounced decline of water quality is observed in many rivers, lakes and aquifers all over the world. The objective of mankind is to reduce the amount of increasing consumption of irretrievable water to maintain proper water quality in rivers and lakes, to prevent water deficits and loss of soil fertility. There is just one way to achieve this: planning and realizing measures for rational use and protection against pollution and depletion of the water resources available. The problem may only be solved by a reliable and properly organized assessment and monitoring of water resources and demands. The data obtained (data on water resources and their use, on the hydrological regime of water bodies and their chemistry) are the basis for any present and future planning of water resources development, project construction and operation of numerous hydraulic-engineering structures on rivers, lakes and reservoirs and the development of land use practices.

Great Lakes Heritage Coast

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Challenge: Ontario established the Great Lakes Heritage Coast concept through a major Crown land planning exercise in the late 1990s. This concept applies to 4200 km of coastal area from Port Severn in Georgian Bay to the Pigeon River on Lake Superior. The overall management intent is to protect its outstanding beauty and natural ecosystems; to promote its recreational and tourism potential; and to foster cooperation and partnerships in its planning and management.

The present challenge is to determine what needs to be done to meet the objectives for the area in a participatory and accountable manner. Are existing programs adequate, are new ones required? What infrastructure or support mechanisms are necessary? What is the role of governments (federal, provincial, municipal), First Nations, landowners, and non-government organizations? Are new delivery mechanisms required and what is feasible in the current fiscal environment.

Description: The presentation will discuss the multi-step, iterative process being used to develop future direction for the Heritage Coast including initial public consultations, government review and direction, concept development and approval, action plan development and implementation. It will discuss the range of opportunities for the coast as well as challenges identified to date.

Application: The initiative is a large scale regional planning exercise defining implementation strategies for potentially conflicting ecological and tourism development objectives; focusing on cooperative management amongst stakeholders; while retaining the appropriate level of accountability.

It is an example of how government may work with others in co-managing natural resources, coordinating programs, and supporting alternative, non-traditional delivery mechanisms. This approach may apply elsewhere where there is opportunity for co-operative management.

Strengths: The initiative has broad support of the public and government agencies as demonstrated through public consultations to date (see Charting the Course Report). It is consistent with overall government direction re partnering. There is a recognized need to address environmental, tourism and delivery needs from an overall coastal perspective.

Capacity Needs: There are many programs, agencies and jurisdictions active within the Heritage Coast. While there appears to be agreement on the direction for environmental protection, tourism promotion and partnership building, there will be a major challenge in determine how this is to be delivered and maintained amongst the many agencies, jurisdictions and stakeholders.

A New Approach to Water Management

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Challenge: To inject energy and enthusiasm for a new approach to water management back into society in general; to move from reactive management modes into a more thoughtful, steady, long-term, comprehensive approach to water management

Description: This session will present an analysis of the key historical issues, events and ideas surrounding water management including: catastrophic events, ideas/concepts/insights, institutional developments, legal/policy developments, literature, economic developments, public opinion and science,

Based on an examination of this background, the session then looks forward and will discuss ways to activate and energize the development of a new forward looking agenda.

Application: To maximize the use of ecological principles and ecosystem concepts to integrate water management into natural systems and cycles; to build a new policy programme “infrastructure”. The Round Table approach to shared goal setting and shared decision-making and action will be used to build consensus and motivate and engage stakeholders.

Strengths: Our approach will examine changes in the economic and policy environment surrounding water management and the reasons for loss of momentum on water issues; it will be based on the involvement of key stakeholders who have been involved in water management and others who should be involved in the “New Approach.” This work will be based on a positive, co-operation oriented model in contrast to traditional models that have sometimes been confrontational.

Capacity Needs: Linking science to improved decision-making regarding water management; maintaining public awareness and education efforts are seen as continual concerns in implementing a new approach agenda. The establishment of innovative institutional arrangements will be considered, including possible evaluation of the roles of existing institutions and agencies.

Key Words: water management, new approach, science, policy, education, information

Monitoring Whale Watching Activity in International Waters

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The waters of Canada's Pacific coast provide habitat for an extraordinary abundance and diversity of marine mammals and seabirds. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in November 2001, listed the southern resident population of north-eastern Pacific orcas as "Endangered."

The seemingly endless opportunities to encounter marine wildlife around southern British Columbia and Washington state have given rise to tremendous growth in commercial and recreational whale watching activities; estimated at USD\$68 million annually in British Columbia alone. This economic growth has increased the pressure on the resident orca population dramatically. To raise awareness and help reduce potentially harmful impacts from these threats, the Marine Mammal Monitoring Project (M3) has collaborated with several Canadian and US agencies to develop international guidelines for marine mammal viewing. The M3

stewardship patrol vessel provides an on-water presence around whale watching activities and allows crew members to record observations on vessels engaged in wildlife viewing. Compiled into a database, this information provides the basis for feedback reporting to industry, and allows for the accurate characterisation of marine mammal viewing activities to assist resource managers and key-decision-makers. In a dynamic environment with up to fifty vessels actively viewing as many as seventy-eight orcas, the challenges for accurate observation have led to new and innovative techniques for monitoring. As Canada and the US move towards the development of marine mammal viewing regulations, issues such as jurisdiction, human behaviour change, licensing of vessels, intensity of activity, acoustical implications, sanctuaries, bio-accumulation of toxics, recovery plans and enforcement are ahead.

Key Words: Whale watching, conservation

The Areas of Prime Concern (Zones d'intervention prioritaire (ZIP)) Program: Working with Communities to Protect and Enhance the St. Lawrence River

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Challenge: Over the last ten years, Environment Canada has been working with local communities along the St. Lawrence River. One of our main mechanisms for ensuring citizen participation and local stakeholder involvement in the region is the ZIP program (ZIP is short for Zone d'intervention prioritaire or Area of Prime Concern). Since 1993, 14 ZIP committees have been established under the St. Lawrence Vision 2000 Action Plan. We have seen important successes with this program but we also see the need to look ahead at how the program can evolve and improve.

Description: The presentation will cover the stages that each of the fourteen ZIP committees must go through such as the launch of regional assessment, the public consultations and the development of an Ecological Rehabilitation Action Plan (ERAP). An overview of the state of the implementation of ERAPs will follow. A brief picture will then be presented of how we are looking ahead with the program.

Application: This is a good example of how NGO and communities can work towards local actions on priority environmental problems.

Strengths: The ZIP program is a community-based process. ZIP committees have the ability to mobilize, and work jointly with, local communities to achieve common objectives and concrete results. Their creation stems from the will of local communities. ZIP committees carry out projects that entail concrete action, which gives them their own credibility in the community.

Capacity Needs: ZIP committees have expressed the need to have better mechanisms for measuring whether their environmental goals have been met and then afterwards for communicating their work to the public. They also find it difficult to keep their basic information for decision making up to date.

Key Words: Community-based, St. Lawrence

Developing the Integrated Coastal Zone Management (ICZM) in the North-West Russia

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Challenge: Administrative regions of the north-west Russia border the Baltic, the White and the Barents Seas. It is a vast area and the state of art in the field of ICZM is somewhat different in its various segments. The main problem here is the absence of special state agencies responsible for ICZM.

Description: Main actors in the field of ICZM in the north-west Russia are as follows: state committees for nature resources; non-governmental organisations (NGO); regional academic centres, research institutes and universities dealing with environmental problems; companies working on environmental issues for commercial profit; industrial enterprises active in coastal areas; non-organised public; international organisations (IUCN, EUCC, WWF, CCB, etc.).

Application: Committees for nature resources are responsible for providing the state environmental policy in a certain areas. NGO are mostly distributed in large centres. Research organisations are numerous but also prevail in big centres. Data that have been collected by them in many cases need to be brought in order and made available for further analyses. Environmental companies are usually well equipped with computers, office facilities and skilled personnel employed. Industrial enterprises are forced to deal with environmental problems due to Federal legislation. Non-organised public appears at the ICZM stage only in the case of ecologically dangerous industrial activity in its nearest surroundings. International organisations usually have partners in Russia and popularise the World (or European) nature protection approach among local authorities, specialists and population.

Strengths: NGO support studies on nature conservation, involve scientists and practical workers into environmental projects, assist authorities in realisation of Russia obligations in the international context, develop environmental education. Non-organised public influence the ICZM process mainly in the course of the EIA public hearings. Co-operation of Russian participants with international organisations is extremely fruitful for both sides.

Capacity Needs: Main obstacles for the development of ICZM in today Russia are as follows: system economical problems which caused a deficiency in financing of all kinds of activity including the nature conservation one; absence of effective arms and dodges of affecting on offices, entities, businessmen and private persons pressing them towards “nature-friendly” methods of management; lack of traditions of “ecological” behaviour among population; weak information of the ICZM participants of what and where is happening in this sphere.

Key Words: coastal ecosystems, management, the Baltic Sea, the White Sea, the Barents Seas

Towards Transboundary Democracy: A Participatory Practice for the Taku River Watershed

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Challenge: Participatory frameworks are a necessary and useful tool for creating solutions which stakeholders will agree to and maintain. The voices included in making a policy are more likely to be the ones who can live within its confines. However, there are many ways and types of participatory frameworks and it is important to develop one which will best meet the needs of the given situation and will not limit the scope of resolution.

Description: This presentation will focus on the vision of democratic process and its importance in creating a workable solution to multistakeholder conflict. In this context I will describe how I am working to create a democratic forum as a step towards resolution of the transboundary dispute over the Taku River of northern BC and Alaska.

Application: To work towards finding a resolution among the stakeholders on the Taku River, I am putting together a 'floating roundtable' which will raft down a section of the river while it meets. The 'citizens,' or stakeholders, will create together an arena for democracy where even the site itself has some of its own representation. This type of meeting is intended to bring all interested parties together in a way that encourages each to bear witness to the others' perspective, and by doing so to create solutions which are embedded with this recognition.

Strengths: There is an important difference between a democratic process and a multi stakeholder negotiation. In a democratic arena ideas and opinions can be shared and accounted for in such a way as to not limit the possibilities that can be created: there are no predetermined confines. In a negotiation, what is possible is already dictated by the interests, whether expressed or protected, of the parties at the table. In a situation with diverse and/or numerous stakeholders, such as a transboundary concern, pooling perspectives instead of trading demands is a much more powerful tool for innovative resolution.

Capacity Needs: The need for stakeholders to participate in creating and complying with policy is great. Any policy or agreement is only as good as the level of compliance maintained in its regard. But equally as important is the vision it incorporates, as this is what will measure its applicability to the situation. Democracy begins with the definition of 'citizenship' which shapes who become the parties at the table. It extends through the agenda to the format and to the implementation of resolutions.

Compatibilization of the Environmental Public Policies in the Management of the Brazilian Coastal Area: Case Study of the Litoral Center-north of Santa Catarina's State, Brazil

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Challenge: The central-north part of the Santa Catarina coastal area is currently undergoing an intense conurbation process, which started with the construction of the BR-101 road. This has led to an intense populational growth and thus to the disordered occupation of coastal plains, hills and beaches, which, in turn, have led to the contamination of hydric resources, disorderly occupation of space, reduction in fisheries, specially artisanal fisheries and loss of local culture, among other problems. The recent implantation of an integrated coastal zone management program by the federal and state governments is, therefore, a great challenge for these municipalities that unfortunately still do not possess a participative and integrated land and sea policies under sectorial and institutional point of view.

Description: The present work has as objective, the analyzes the instruments of the main federal public policies at the Brazilian coastal zone (Brazilian Coastal Zone Management Plan — Law 7661/88; National Politics of Water Resources — Law 9433/97, and the City Statute — Law 10.257/2001) in eight municipalities (Penha, Navegantes, Itajaí, Balneário Camboriú, Camboriú, Itapema, Porto Belo and Bombinhas) of this coastal section in order to understand the contact points and conflict in the respective municipal public politics. It also has as an objective implement these instruments at local level by the implementation of management plans, specially using educational practices.

Application: If well conducting by the local decision-makers, the application of the instruments of these federal public policies could constitutes an advance for the local coastal zone management program, by the fact that they consider an institutional and sectorial articulation as a participative and integrative process in order to orient for sustainable development.

Strengths: The present work can be considered a safe and effective way to implement the integrated coastal zone management plan as well serves as a model for other Brazilian coastal areas. If the instruments of these public policies were really implementing in regional and local scales along the time, it could change behavior of the local authorities.

Capacity Needs: As this area has an important role for the State economy, such as tourism, mariculture, fishery and port activities the application of these public policies will represent a change in their land and sea use as well as at institutional, legal and even technical level. It is important to consider an intra and inter institutional arrangements as well as financial support must be given for local universities as NGOs in order to implement local projects having as basis the instruments of these policies.

Key Words: Brazilian coastal public policies, integrated coastal zone management, Santa Catarina State

Transboundary Water Resources — Impact Assessment of Human Activities — The Global GIWA Project

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Challenge: The Global International Waters Assessment UNEP-GIWA examines and produces globally comparable assessments of the environmental stresses acting on all international transboundary waters throughout the world. The GIWA project will provide background and analytical information to identify priorities for funding of remedial and mitigatory actions that aim to achieve environmental benefits at national, regional and global levels. Through the work of GIWA, basic and currently inaccessible information will be obtained and made available to the public to increase the awareness of environmental and socio-economic problems in international waters, their societal causes and options for solving them.

Description: The presentations will focus on the methodology, assessment process and the preliminary results. The GIWA methodology has two stages. In the initial analytical stage, major environmental and socio-economic problems are identified through the processes of Scaling and Scoping and then the root causes of these problems are determined using Causal Chain Analyses. Afterwards, during the predictive stage, different scenarios will be developed to investigate the efficacy of various policy options for mitigating the impacts of problems occurring in transboundary waters.

Application: The GIWA assessment is currently being conducted in 66 sub-regions globally and requires access and extensive processing of data in all sub-regions simultaneously. The assessment is conducted by sub-regional task teams that are composed of local environmental scientists, socio-economists and other national and regional experts from the different nations in each sub-region. The GIWA assessment includes all forms of water including marine, coastal, fresh, surface and ground waters and glaciers.

Strengths: The assessment is a comprehensive analysis of the impacts of environmental problems in international waters on human society and nature, and of the root-causes behind those problems. The involvement of local experts provides a regional perspective and the coordinated global approach provides global comparability of results.

Capacity Needs: Such a comprehensive analysis demands a broad range of expertise from many different fields, particularly natural science, health, economy, limnology, oceanography, geology, hydrology and engineering.

Key Words: transboundary, marine ecosystems, assessment, freshwater systems

A Legacy Worth Protecting — Charting a Sustainable Course in the Great Lakes and St. Lawrence River Basin of Canada

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Challenge: Ensuring the sustainability of the home and life-support system for 16 million Canadians living in the world's largest freshwater ecosystem — the Great Lakes and St. Lawrence River Basin.

Description: This presentation summarizes the findings of a major audit conducted by the Commissioner of Environment and Sustainable Development (CESD) on the Canadian federal government's management of selected environment and sustainable development issues in the Basin. Specific subject areas reviewed included water management (including quality and quantity), agriculture (including manure management and soil erosion), fisheries (including exotic invasive species and habitat protection), species and spaces at risk (including wetlands, species at risk, and habitat stewardship), and institutional governance (including the federal government's ecosystem initiatives).

The audit found, on the plus side, that efforts by federal officials and scientists over past decades contributed significantly to many environmental improvements and innovations in the basin. However, the future of the basin is one of increasing pressures, threats, and complexities. For this reason, the global messages emerging from the audit, as set out below, are disturbing.

Important matters are adrift. Declining and unstable funding to federal departments has significantly impaired their ability to achieve their environmental objectives and meet Canada's international commitments. Some of the government's stated priorities and policies have not been resourced adequately, and so exist only on paper.

No apparent plan for the next generation of efforts. Federal actions on many of the problems in the basin have been short-term and, at times, unconnected. The actions have been necessary but, with no long-term strategy, it is hard to know where they are taking us. The federal government is uniquely positioned to take a basin-wide, long-term perspective, but so far it has not.

Scientific research, monitoring, and information systems are limited. The government is missing some basic information it needs to measure the health of our environment, to understand existing and emerging pressures, and to gauge the effectiveness of the actions it takes. The quality of existing data sets is deteriorating; the federal capacity is going in the wrong direction.

A changing, waning, unclear federal role. The federal government has changed its role in fundamental ways. In some cases, it is retreating from important stated positions. Its commitments and priorities show a disquieting lack of transparency and clarity.

Application: The audit resulted in numerous findings and recommendations on how the federal government can improve its performance.

Capacity Needs: Action and renewed commitment is required by the federal government in many areas. At a high level, the following are things that the federal government can do better.

Coastal Integrated Management and Sustainable Development in Southeast Asian Countries: A Framework Option of Tidal Power

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Challenge: Coastal environment always recognised as an important buffer zone, most productive and resourceful environment in the world in terms of soil fertility, biodiversity and potential tidal power generation; and attractive with entrepreneur. For this, more than 50% of world population live in coastal environment. But most coastal peoples of South Asian developing country (SADC) are in great risk, due to vulnerability of natural disasters especially from cyclones and tidal surges; and in sometimes, from the effect of sea level rise. In general, maximum coastal area of SADC is protected by embankment and sluice gate for minimises the destruction of natural calamity. This embankment and sluice gate has a significant impact on the ecological, social, economic and cultural environment of coastal area. Because, a series of unplanned development has been established (e.g., shrimp aquaculture) after the construction of this infrastructure in most coastal area of SADC. Practically, shrimp aquaculture has more negatives impacted to the natural environment of India, the Philippines and Bangladesh.

Description: This paper will discuss the prospect and sustainability of coastal area of SADC through utilisation of tidal power concept by using a case study from coastal Bangladesh. Besides, the paper will discuss the global warming threats to coastal Bangladesh and how utilising the potentiality of tidal energy could mitigate the threat, because tidal power is a clean renewable energy. Finally the paper will recommend a policy framework for an integrated model of sustainable coastal development in the SADC.

Application: The important factors for implementing this concept are selection of locally available appropriate tidal wheel technology and public consultation with

participatory community based coastal resources management. However, achievement of sustainability of coastal sustainable development depends on effective government policy, regulatory actions and the cooperation of industry in utilising sound tidal technology in its planning, development and operations in coastal communities.

Strength: The concept has been developed by the strong scientific research, traditional knowledge of the coastal communities in SADC and existing tidal power plants around the world. Tidal power has extra benefit from 'clean development mechanisms' (CDM) point of view. By the CDM principle, definitely developed country will finance the conceptual tidal power project and thereby sustainability of the coastal area in SADC will be strengthened through environmental rehabilitation, economic improvement from greater wealth, electric power, diversification of production, and social gains to communities.

Capacity Needs: To achieve this coastal sustainability, it needs a strong commitment from the decision-making process in international, national and local levels to ensure the financial, technical and political support. Also it needs a mass-scale public awareness to the benefit of tidal power by using the existing infrastructure of coastal embankments and sluice gates. Institutional arrangement and collaborative environmental, geographical, political, social, cultural and economic assessment, monitoring, implementation and evaluation will bring the success to this model.

Key Words: Tidal power, Integration, Coastal resource management, Southeast Asian developing Country, Sustainable development and Clean development mechanisms

Transboundary Water Management as Base of Sustainable Development in Central Asia

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Water is a key to a sustainable development, it facilitates resolving social, economic and environmental needs. It is necessary for the health of people. Moreover, water is an economic and social good. Many people consider access to water, sanitation and communal life an integral part of human rights. No substitute exists for water. A man and other living organisms die without water, farmers cannot plant agricultural products.

After collapse of the Soviet Union, Central Asian states faced ecological problem of a global scale. Having no regional experience of water resources management and resolving large ecological problems, the countries faced the problem of water shortage and sharp deterioration of its quality.

The Aral Sea basin water deterioration is explained on one hand by intensive pure water extraction and throw of polluted waters into water reservoirs and water streams, and on another hand, excessive use of chemicals and uncontrolled utilization of agro and poisonous chemicals in agriculture. It is also connected with intensive pollution of a number of underground water deposits. As a result physical-chemical and biological-bacteriological indices of water quality seriously deteriorated and ecological sanitary situation aggravated in the number of districts.

Up to date in the region lacks scientifically substantiated water management strategy: economic levers and stimuli for the preservation and improvement of water; mechanism of payment for water utilization taking into account qualitative characteristics. Legislative-normative base for the introduction

of water quality criteria in industry, agriculture and communal sector is not perfect. As a result of economic difficulties and low technical supply water quality and quantity observation systems grow obsolete.

Water resources management should be implemented on the level of big rivers basins. As the countries of the Aral Sea basin are situated in various geographic conditions and the length of rivers running through these countries makes more than 3000 kilometres, they can be conditionally subdivided on resource-forming and resource-using parts. In the countries situated in the upper reaches (or resource-forming part) as a rule more than 90% of the territory serves for water flow formation. Sources of fresh waters, glaciers and snow, mountain lakes are situated here. Resource-forming part is more liable to natural disasters and suffers from annual natural disasters connected with water and causing tremendous damage to the national economy and the environment. The fertile layer of the soil and the flora is washed away, inhabited settlements, river-beds, water and other infrastructures are destroyed. In the resource-forming part of river basins, that have limited land resources and utilize small part of the formed water, mainly agriculture is developed, that mostly depends on weather conditions is a less profitable branch and the population of this part is more vulnerable.

At the same time in the resource-using part, that is not affected by natural disasters and utilizes a lion's share of the formed water industry is more developed and lower down the course of a river the population prosperity grows and its vulnerability decreases.

Participatory Coastal Development Planning as a Strategy for the Management of Trans-Municipal Coastal Zone

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Challenge: The coastal zone is home to rich and highly diverse marine habitats and resources. Various sectors (government, NGO, academe, fishers, business, etc.) however have different, and oftentimes conflicting interests on the uses of the coastal zone, e.g. socio-economic upliftment vs. environmental management. In the past, resource-uses allocated by the governments lead to habitat destruction and consequently resulted to poverty of the community. Moreover, the factors that affects the status, functions and roles of the coastal zone is not confined into a particular geo-political unit, but are rather inter-linked by various ecological processes. Thus if the coastal zone is to be sustainably managed, an integrated approach on both the environmental and socio-economic aspect among concerned geo-political units are therefore needed.

Description: Participatory coastal development planning (CDP) provides an opportunity to convene all concerned sectors, work together, propose and implement common strategies to manage the environment. The objective of the CDP is to harmonize resource uses and resolve resource-use conflicts among sectors and among geo-political units. This case study draws lessons from the experiences of the Marine Fisheries Resources Management Project in facilitating CDP formulation and implementation in three adjoining municipalities in Lingayen Gulf, northwestern Philippines.

Application: Representatives of all concerned stakeholders were convened to identify the various environmental and socio-economic issues and conflicts occurring in their respective municipality. Upon the facilitation of the development workers, various resource management options and strategies were presented and discussed. Appropriate resource management strategies were proposed by the group to resolve each identified issues and conflicts. The concerns of the local communities were likewise incorporated in suggesting a particular management strategy. Recommendations were then summarized and evolved into a proposed coastal development plan. Having fair representation from the different sectors, the proposed plan had support from the community that convinced the government to legislate and implement it. The plan however covers only a particular municipal jurisdiction and does not have control over other concerns from the neighboring municipalities.

Strengths: The tool presented was crucial in convening and mobilizing different sectors in three geo-political units to come and work together to implement integrated coastal management. It therefore harmonizes resource uses and resolves resource-use conflicts.

Capacity Needs: The success demonstrated in this case study shows the crucial role of adapting participatory coastal development planning in integrated coastal management. The success however is limited to a particular jurisdiction and therefore, can still be affected by various activities in the adjacent municipalities. In order to expand and optimize this success, there is therefore a need to facilitate trans-municipal participatory coastal development planning.

A Framework for Healthy Community Participation

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Challenge: With all of the changes which are taking place in the Great Lakes and all of the populations that are affected by those changes, how do we ensure that we are involving the whole community in information gathering and sharing and in policy and decision-making around the Great Lakes? There are many diverse communities of interest in Great Lakes issues. How do we identify those interest groups? How do we work with them to clarify their issues? How do we ensure that all groups have a voice and how do we resolve any conflict which might emerge? How do we ensure full community participation in the discussions and utilize all of the resources of our communities to tackle these very complex concerns

Description: This presentation will focus on the involvement processes which encourage groups to get involved and to share their expertise in a framework of healthy community principles. It will explore networking and communication processes that keep communities informed and participating and it will examine success stories of other communities where this type of framework has worked well.

Application: In a healthy communities framework, consultation, inclusion and community decision-making are key to the development of healthy public policy. In areas where these principles are implemented, there is broader capacity for resolving concerns in innovative and creative approaches. Using community-developed indicators also helps communities to evaluate the progress of their initiatives.

Strengths: Identifying and utilizing the strengths and resources of the whole community gives planning processes the broad-based community support that can make them work well. Keeping people informed and allowing for their input takes a carefully managed approach of inclusion and diverse communication strategies that is based on listening to the community.

Capacity Needs: Ensuring that all of the people and the groups in the community have an opportunity to offer their time, energy and resources requires a dedicated effort to inform, listen and plan around a healthy framework and a set of healthy community principles. Beyond that, it requires a commitment to developing healthy working partnerships and a commitment to resolving conflict for building community. Keeping a viable balance of the science, the ethics, the social capital and the diverse community interests is needed to develop relevant and strong environmental policies. Healthy Communities processes and principles can help to build and maintain the framework and foundation for healthy policy development.

Keywords: community, participation, healthy communities

Oceans Act Programs in Department of Fisheries and Oceans (DFO): An Ecosystem Approach to Sustainably Manage the Development of Marine and Coastal Environments

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Challenge: Canada's three oceans are facing environmental pressures due to the increasing development of human activities, either in coastal or offshore zones (e.g., land-based activities, shipping, fisheries, oil & gas, mining, aquaculture, ecotourism, among biggest issues).

Description: The first part of this presentation will provide an overview of Oceans Management new approaches within the Department of Fisheries & Oceans (DFO). In a second part we will detail the three core programs that are being undertaken under the *Oceans Act*, namely Integrated Management (IM), Marine Protected Areas (MPA) and Marine Environmental Quality (MEQ). These are integral parts of the ongoing Canada's Oceans Strategy that is based on the principles of sustainable development, integrated management and precautionary approach.

Application: DFO is supporting the ecosystem-based management approach, with two overarching ecosystem objectives: (1) the sustainability of human usage of environmental resources; (2) the conservation of species and habitats (specific objectives will be grouped into biodiversity, productivity and physical-chemical properties). These objectives should not be compromised as they describe desired conditions of the ecosystem and ensure its integrity. Ecosystem objectives will be established for Large Ocean Management Areas (LOMAs) that will ultimately cover all of Canada's estuarine, coastal and marine waters.

Strengths: (1) *Integrated Management* is a simple and common sense approach, a transparent and flexible planning tool that respects existing authorities and brings all stakeholders together to incorporate social, cultural, environmental, and economic values in the design and implementation of ocean use plans. To date, 21 IM areas have been initiated, the majority nested within four existing LOMAs (i.e., the *Central Coast*, *Beaufort Sea*, *Gulf of St. Lawrence* and *Eastern Scotia Shelf* IM areas).

(2) The main objective of the *Marine Protected Areas* program is to conserve and protect the ecological integrity of marine ecosystems, species, and habitats. Management plans for individual MPAs are developed in cooperation with local resource users, and interested parties. As a flexible approach to satisfy a range of needs, MPAs will differ from one another. However, the process for establishing an MPA follows several key steps, from the identification and initial screening of Areas of Interest (AOI) to the MPA designation by regulation. To date, there are 13 ongoing AOI projects in Canada's coastal zones. (3) Understanding and assessing the structure and function of marine ecosystems is considered as a core task of the *Marine Environmental Quality* program. The MEQ program provides national science-based coordination, performance measurement and guidance for helping the Oceans Act implementation. For example, MEQ is a key component for coordinating "Ecological assessment" for proposed MPAs. At the operational level, the establishment of MEQ objectives and the ecosystem assessment involve the set up of indicators that must be tracked over time, and associated monitoring programs. IM/MPA plans, and their associated MEQ components (i.e., indicators, reference points) will, in turn, influence human activities to better protect marine and coastal environments.

Capacity Needs: Now that the ecosystem-based management framework is well established, Oceans program activities and tools should be tested at the international, national and site-specific scales, by identifying areas for priority intervention; applying lessons learned; and refining processes. Next steps: to move toward ecosystem-scale IM planning through LOMAs; to develop a national MPA network; to make the MEQ program an operational framework as science support for Oceans Management activities.

Key Words: Oceans Act, Ecosystem-Based Management, Integrated Management, Marine Protected Areas, Marine Environmental Quality

Nutrient Management in Ontario

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Effective management of nutrients from agriculture can reduce impacts on water quality in the Great Lakes basin and coastal regions of the Great Lakes. Approaches to managing agricultural nutrients have evolved in jurisdictions in the Great Lakes over the last decade. Approaches to nutrient management in Ontario have evolved through a number of stages culminating in new provincial legislation, the proposed Nutrient Management Act.

The new legislation will:

- Set out a comprehensive and integrated approach to all land-applied materials containing nutrients relating to agriculture — including livestock manure, commercial fertilizer, municipal bio-solids, septage and industrial pulp and paper sludge.
- Ensure that all land-applied materials will be managed in a sustainable, beneficial manner which results in environmental protection.
- Provide for clear, province-wide standards so that farmers can invest with confidence in their businesses.
- Increase public confidence in a sustainable future for agricultural and rural development.

The proposed legislation would provide authority for regulations governing several areas including:

- mandatory Nutrient Management Plans;
- certification of commercial land applicators of materials containing nutrients;
- distance requirements for manure and bio-solids application near wells and waterways;
- banning the land application of untreated septage over a five-year period;
- establishing and delivering associated education, training and certification programs;
- establishing a database system to record land applications of materials containing nutrients, with an initial focus on bio-solids and manure; and,
- establishing minimum quality and application standards for land applied nutrients.

The bill would provide the authority to implement a risk-based approach to regulation. Different categories of operations would be regulated in different ways, focusing a greater level of attention and resources where the risk to the environment is greatest. The bill would provide for a framework to phase in standards over time, depending on the size of the operations and the kinds of practices that are carried out.

Delivering Successful Multi-Stakeholder Processes: Tools and Approaches that Work

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Challenge: Managing transboundary coastal ecosystems means rising to the challenge of also managing the varying interests, priorities, and issues held by a large range of stakeholders. Engaging in multistakeholder processes is viewed as an intimidating prospect for many. These processes are often seen as messy, uncontrollable, and fraught with opportunities for projects to go “off the rails.” There are a number of proven tools and approaches that help make multistakeholder processes work. Identifying, explaining, and demonstrating the application of these tools will support the efforts of those who are interested in working collaboratively to make the most of our shared waters.

Description: This presentation will focus on specific approaches and tools that can be used to deliver multistakeholder processes that are inclusive, accountable, and manageable. Discussion will focus on: strategies for managing the scope of discussion so that feedback focuses on the needs at hand; tools for obtaining and managing feedback on a range of topics from a number of sources; and issue identification, tracking, and resolution systems.

Application: These approaches and tools have been applied and proven their utility to a range of efforts — from local harbourfront projects to multilateral initiatives of international significance. Examples of participatory processes that will be used to demonstrate the application of different approaches and tools include: (1) working toward virtual elimination of persistent toxic substances in the Great Lakes; (2) negotiating the Ozone

Annex to the Canada-US Air Quality Agreement; (3) evaluating the varying support needs of developing countries working to implement the UN Convention on Biological Diversity; and (4) assessing the environmental impact of Toronto’s 2008 harbourfront-focused Olympic Bid.

Strengths: A key strength of these approaches and tools lies in their ease of use and applicability to projects ranging widely in scope, scale, and focus. The participatory processes reviewed clearly illustrate how obtaining feedback and advice from stakeholders with a broad range of interests and perspectives can be easily collected, analyzed, and acted upon within the bounds of any given initiative.

Capacity Needs: Decision-makers around the world — locally, regionally, nationally, and internationally — are regularly called upon to identify and act upon issues, opportunities, and challenges associated with implementing initiatives and taking action. The reality is that their decisions cannot be made in a vacuum. There are key stakeholders, both internal and external individuals and groups, whose fates are directly and indirectly linked to these decisions. These stakeholders have valuable knowledge to contribute to the strength and long-term sustainability of initiatives. Recognizing and tapping into these stakeholder assets — their knowledge, their experience, and their commitment to implementation — requires a new way of doing business. By identifying and sharing the tools that work, we are more able to take action.

Use of Economic Instruments for Integrated Coastal Zone Management in the Mediterranean

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Challenge: Land-based sources account for more than 80% of the total pollution load in the Mediterranean. Major sources of degradation of the Mediterranean marine environment are: municipal and industrial wastewater and solid waste, agricultural runoff, atmospheric deposition, and competing activities on the coast for the exploitation of natural resources. The Strategic Action Programme (SAP) was created with the aim to protect marine environment from the effects of harmful land-based activities. It is being carried within the framework of the Mediterranean Action Plan (MAP). One of the most important components of the project is the sub-project "Sustainability of SAP MED," aimed at stimulating the use of economic instruments in Mediterranean countries.

Description: This presentation will focus on the project, implemented by MAP's Priority Actions Programme (PAP/RAC), on the use of economic instruments in the region. First, it will identify and analyse the present use of these instruments in the countries of the region, with special emphasis on their use in reducing the coastal and marine pollution. In the second part, the first results of pilot projects on the application of economic instruments in six Mediterranean countries will be presented.

Application: Project aims at developing a sustainable financial platform for the continued implementation of the SAP in the longer term, and at incorporating the economic instruments at the national level in the National Action Plans to combat land-based pollution. The project is expected to develop administrative, legal and fiscal mechanisms for the sustainable financing of the implementation of SAP at country level, as

well as to enhance government capability to identify, develop and implement various types of economic instruments suitable for related country.

Strengths: An analysis of the application of economic instruments in coastal management in the Mediterranean countries was made in 1994. It has shown that these instruments were relatively widely used, although relatively narrow in their scope. This project is concentrated more on the instruments aimed at abating land-based pollution. The interest of the countries so far, shows a very clear tendency towards increasing political will to better implement the existing and to introduce new, more innovative, economic instruments.

Capacity Needs: The projects will stimulate generation of the political will for change; actual change in national legislation and regulation; change in management practices; improvement of environmental database; capacity building of national and local institutions; training of government officials and non-government stakeholders; public participation; co-operation with and training of NGOs; and networking. The project includes a number of training seminars and workshops aimed at developing pilot projects and increasing the capacity of national stakeholders to create and implement economic instruments.

Key Words: land-based sources of pollution, integrated coastal zone management, economic instruments, Mediterranean, Regional Seas

Strengthening Capacity for Management of Shared International Waters in the Gulf of Guinea Region: Contributions of the Gulf of Guinea LME Project

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Challenge: The Gulf of Guinea region represent one of the world's productive marine areas that is rich in fishery resources, oil and gas reserves, precious minerals and an important global reservoir of marine biological diversity. The international waters and its resources shared by several countries in the West and Central Africa region have provided a source of income for the inhabitants and supported the countries economies. The adjoining coastal areas are home to most of the regions industries and to a third of the population of approximately 300 million. Unfortunately, pollution from land-based sources (domestic & industrial) has impacted negatively on this international water leading to loss of fisheries and biological diversity, ecosystem degradation and eutrophication. As a result, the waterbody has been unable to continue to support the unsustainable exploitation of its resources leading to collapse of the fisheries sector and loss of income and employment thereby worsening the poverty situation in the region.

Description: This presentation will give an overview of the key management issues concerning water quality, living resources availability and coastal zone planning in the Gulf of Guinea region and the efforts of the countries to adopt common approaches to resolve the problems.

Application: The region has adopted a new approach in solving the perceived environmental problems. Management of the shared international waters has mostly involved collaborative scientific research, monitoring and assessment and public consultation and participation using the Large Marine Ecosystem approach. This was amply demonstrated in the communal project on water pollution control and biodiversity

conservation jointly undertaking by the countries in collaboration with some International organizations.

Strengths: Integrated Coastal Zone management and collaborative fisheries and water management has been the focus of several initiatives undertaken by donor organizations in the region in the past and have evoked a lot of scientific research and studies in attempts to reverse the degradation suffered by the coastal and marine environment in the region. The Gulf of Guinea Large Marine Ecosystem project and its multi-sectoral approach succeeded in further exposing to the countries the great advantages inherent in collaborative management.

Capacity Needs: Management actions to be undertaken by ecosystem planners, managers and scientists requires the support and participation of senior level government officials and the grassroots' in order to assure its sustainability. For ease of understanding and better appreciation, data to aide management decisions must be presented in a readable format to decision-makers. The dissemination of scientific results and data using Geographic Information Systems integrated to Information Communications Technology for ICZM has thus posed a continuous challenge to ecosystem practitioners in the region due to poor institutional capacity. Institutional capacity strengthening is thus considered of strategic importance in developing capacity for the management of the shared international waters and its abundant but fast depleting living resources and requires the assistance of international organizations.

Key Words: Gulf of Guinea, Coastal ecosystems, strengthening capacity, management

Watershed Management — The Holistic Approach

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Challenge: With the amalgamation of six municipalities into one, the “new” City of Hamilton is on the threshold of a new beginning. The Conservation Authority believes that the long term economic prosperity of the City will — to a large degree — depend on how Hamilton values and protects its natural resources. Accordingly, the Hamilton Conservation Authority, which covers a large portion of the City, has developed a 5-year action plan which it feels will contribute significantly to an environmentally healthy city. The 5-year plan offers a significant opportunity and challenge for two separate organizations (in this case, Hamilton and the Hamilton Conservation Authority) to effectively work together toward a common goal.

Description: The presentation will serve as an interesting case study of how a conservation authority can be a significant player in the development of an environmentally healthy city, which will result in social and economic benefits.

Application: This case study does not only apply to conservation authorities vis-a-vis their member municipalities, but to examples worldwide where a sincere desire to cooperate between different levels of government will result in outstanding accomplishments. Too often the opposite is true, i.e., turf protection and token ineffectual cooperation.

Strength: There is universal agreement that environmental management on a watershed basis is the world’s most innovative, accountable, cost-effective water protection system. The latest recommendations coming out of the inquiry following the Walkerton drinking water tragedy clearly recognizes the critical importance of watershed management in the protection of our water resource.

Capacity Needs: To maximize the benefits of watershed management will require a broad-based public awareness program. In spite of its obvious benefits, the concept is now well known among the public at large. Without this broad-based awareness the principles of watershed management, and their implementation, will be less effective than they would be otherwise.

Key Words: Watershed Management, Case Study

Integrated Management Despite Jurisdictional Internal Division of Coastal Ecosystems in New Zealand

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Challenge: To use integrated water management as a means of overcoming the statutory and administrative fragmentation of coastal ecosystems. This fragmentation exists despite attempts by the New Zealand (NZ) Resource Management Act 1991 to overcome it. To further refine an evolving NZ methodology for integrated (coastal) watershed management that involves all stakeholders and is led by a merging of Maori (NZ indigenous people), governmental, and community sectors. Parallel Maori and Governmental resource management frameworks for management of coastal ecosystems have always been present in NZ since colonization. The challenge is in combining the strengths of both frameworks to achieve the common goals of all sectors of society.

Description: The presentation will examine the requirements of the NZ Resource Management Act 1991 that create difficulties for holistic coastal management. As these difficulties cannot easily be remedied by further statutory amendment and institutional reform, NZ is developing and refining methods of integrated watershed management that promise to bring about holistic management despite the jurisdictional divisions.

Application: Case studies will be described to show both the adaptation or remoulding of a Canadian model to better fit the NZ bicultural context, and the development of site specific solutions for complex mixed use catchments, such as that of the Hauraki Gulf.

Strengths: The integrated watershed management method encourages collaborating stakeholders to analyze and plan for whole natural systems thereby overcoming sectoral focus on single problems or on those issues or physical modules for which they have jurisdictional responsibility. Having understood the whole, stakeholders can then contribute cooperatively according to resources, experience and statutory responsibility to the meeting of common goals.

Capacity Needs: Need to use the IWM method to facilitate the type of cross-boundary holistic management made possible by the Resource Management Act 1991. Need for Maori and Non-Maori New Zealanders to refine a shared resource management methodology that does not dis-empower either party. Need to collate and store divergent information on the natural environment in a form that is readily accessible to all stakeholders, thereby facilitating and accelerating the IWM process. Need to publicize successful community initiated and directed IWM projects as models to other NZ communities. Need for complementary Crown Research Institutes to overcome the competitive barriers to collaboration.

Managing Shared Waters and Sea Ranching: Lessons from a New Brunswick Case Study on Property Rights and Sustainable Community Development

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Challenge: The definition of boundaries, and of the rights associated with new or disappearing boundaries, can impact greatly the potential for the sustainable development of local communities. While this impact is often assessed in terms of economics or natural resource managerial impact, its impact on social capital and its components is often neglected.

Description: This presentation will focus on the tools that are used to assess the impact on local coastal communities of the appearance of new property rights on the sea. The Botsford community will be presented as a case study where the authors have been tracking the impact, on social capital, of the institutional changes that are linked with the development of sea ranching.

Application: Understanding the linkage between communities' social capital and changes of boundaries has the potential of contributing to policy that are linked with transboundary issues, multiple boundaries, and shifts of boundaries.

Key Words: transboundary, coastal ecosystems, management, Great Lakes

Integrated Ocean Management and Administrative Structures: A Case Study from the Southern Gulf of Saint Lawrence

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Challenge: Integrated ocean management involves, for public administrations, radical changes in terms of function. These changes will only take place if the administrative structure of this administration is compatible with the new functions. In Canada, the implementation of the Ocean Act calls for such an integrated ocean management approach. Nevertheless it is not obvious that the current administrative structure will be adapted to such a change.

Description: This presentation will focus on a new conceptual framework and its theoretical basis that will allow for an assessment of administrative structures in terms of their capacity to support changes linked with the implementation of integrated ocean management. The focus will there after shift to a specific case study where this approach is currently tested. Finally the conclusion will be drawn on the case study in order to analyze how transboundary issues may be integrated to the conceptual framework that is proposed.

Application: The analysis of the implementation of integrated ocean management has often neglected to specifically analyze how administrative structures may or may not play a role in facilitating this process. The framework that is presented and its application to the southern-gulf of the Saint Lawrence represents a step in analyzing whether transboundary integrated ocean management implementation will be supported, in terms of structure, by the administrative agencies that are involved

Strengths: While the conceptual and theoretical underpinnings of the framework that is proposed are fairly complex, the methodological tools are fairly easy to implement. If the proposed approach is deemed useful by the stakeholders involved in transboundary integrated ocean management, it could be easily instrumentalized and implemented.

Key Words: integrated ocean management, public administration, social structures

Towards Transboundary Coastal Ecosystem Management in the African Great Lakes — Lake Victoria Under Pressure

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Challenge: Lake Victoria is the second largest fresh Water Lake in the world shared by the three-tripartite countries: Kenya, Uganda and Tanzania. The deteriorating condition of Lake Victoria's environment and its diminishing biodiversity has become major concerns to these states that share its resources. Local communities who realized that they were no longer deriving enough benefit from its resources experienced the problems of Lake Victoria. There was a gradual reduction in the quantity and quality of the resources and noticeable water pollution. The deteriorating condition of Lake Victoria's environment and its diminishing biodiversity are major concerns of the three states that share its resources. During the last 20 years, the Lake Victoria fishery has been completely transformed. From being a local based fishery with little intervention and capital investment from outside, the present fishery is dominated by national and international capital penetrating the industry.

Description: This presentation will therefore focus on the intervention and results selected from case studies in Lake Victoria fisheries. Part one will deal with the community participation in fishery management. Part two will deal with impact of different key players in the planning and management of the Lake.

Application: However, the efforts made by LVEMP through the World Bank sponsored programme, may not ensure the sustainability of the programme if communities exploiting the Lake's resources are not drawn into its planning and implementation. Besides agricultural, industrial and other urban related activities, the bulk of environmental degradation activities are perpetrated by the communities themselves. Long lasting solution cannot be meaningfully sought without exploring, identifying and relieving the

pressures that force the people to adopt unsustainable exploitation of the resources of the Lake. Indeed, the situation in the region reveals that the bulk of environmental degradation is perpetrated by economic conditions of the rural poor, urban and peri-urban communities, which are compelled to exploit the resources in an unsustainable manner.

Strengths: The massive extraction of Nile perch to meet the demand of the modern export processing factories on the lake edges resulted on the near collapse of the fishing industry. This is clearly unsustainable and thousands of women around the lake have lost their jobs in marketing and processing fish. Therefore, many families have lost a major source of income. Nearly all the Nile perch caught goes to the fish processing factories and onto Europe, Japan and USA. There are almost no Nile perch for sale at the lake edge. Consequently, the local lakeside processing has collapsed. Many Kenyans along the lakeshore are now compelled to use the carcasses from the processing factories as their protein source. Every year the donors send inspectors to ensure, the factories are clean enough for exporting fillets. Are they aware of the loss of jobs and livelihoods they have contributed to create or the high level of malnutrition amongst children, and the illegal fishing techniques needed to feed the hungry factories? As the Nile perch fisher appears unsustainable, what will happen when the Nile perch stock runs out can the factories move on? What will be the impact of on Lake Resources? On poor farmers and fisherfolk who depend on fishing?

Capacity Needs: There is greater need to lobby and advocate for changes within the neighboring location within Lake Victoria region with the main focus on Fisheries Management and Environment.

Coastal Ecosystem Management in Rekawa Lagoon — Sri Lanka

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Challenge: The Coastal Ecosystem Management program of Sri Lanka has started in late nineteen seventies. The coastal ecosystem management initiatives taken have not been able to achieve the desired objectives at the local and community levels even though such initiatives have been based on well thought out national policies. The main reason for the failure has been the inability to mobilize the support and commitment of the local communities for planning and implementation process.

Description: This presentation will focus on the methodology adopted in mobilizing the stakeholders in decision making for the management of their own coastal ecosystems which are very important for their livelihood. It also addresses how to solve competing demands on coastal resources by planning for optimal and sustainable use through community participation. The constraints confronted throughout this process are also discussed.

Application: The Coast Conservation Department of Sri Lanka has accepted the policy of “Participatory Approach” for coastal ecosystem management at the local level with active involvement of the affected committees. This policy is implemented through Special Area Management (SAM) planning process. The SAM planning process actively encourages the local community groups to participate from the beginning as principal stakeholders in planning and implementation sessions with local and central government agencies. By taking a lead role in planning and management, community groups gain a sense

of ownership and can ensure that they share tangible benefits from project activities. Rekawa lagoon was one of the 2 pilot sites that SAM planning process tested in Sri Lanka, with financial & technical assistance by USAID.

Strength: This process has been implemented through a comprehensive research and awareness program during the initial stage of the planning process after a better understanding of the complex situation of the lagoon and its resources. The availability of relevant data and information of Rekawa area for past 30 years on the behavior of lagoon outlet, lagoon fishery, land use planning and salt water intrusion etc could be used in decision making. The involvement of dedicated community groups also a great strength for the success of this process.

Capacity Needs: In developing countries community initiatives needed to be reinforced by professional action even after the implementation of such projects. There is a constant need to keep the SAM planning alive, in the agency agenda until such time it can be absorbed. The linkages and bridges build within Rekawa NGO/community/government organizations is difficult to maintain due to the budgetary constraints after implementation. Therefore it is necessary to involve an external catalyst in keeping the process moving, especially within the extent of socio-cultural boundaries who can sustain an interface with the community groups.

Key Words: Management, Coastal ecosystems, Participatory approach, Competing demands

Measuring Watershed Health: Developing a Report Card on the Health of the Humber River Watershed

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Challenge: The Humber River Watershed covers 908 square kilometres and is the largest watershed in the Toronto region. The main branch of the river flows more than 120 kilometres from its source on the Niagara Escarpment and Oak Ridges Moraine to Lake Ontario. The East Humber originates in the kettle lakes region and the West Branch flows through the predominantly agricultural area of the Peel Plain.

Land use varies across the watershed. About 15% of the watershed is developed; 30% is developing or committed to development and 55% is rural. About 550,000 people live in the watershed. By 2011, the population is expected to grow to 725,000.

A new community-based action group — the Humber Watershed Alliance — was assembled by the TRCA in 1997 to implement the recommendations in *Legacy*. The Alliance was given a mandate to produce a report card — the first ever Report Card on the Health of the Humber River.

Description: The Humber Watershed Alliance adopted the first ever report card on the health of the Humber River watershed in January, 2000. The Humber Report Card provides an important initial assessment of the health of the watershed. It represents a baseline against which future progress will be measured.

The Humber Alliance selected 28 indicators in three major categories — Environment, Society and Economy, and Getting It Done — to assess the health of the watershed and the efforts being made to ensure the Humber will be healthy for future generations. Indicators were chosen that would clearly communicate conditions related to the natural heritage, human heritage and recreation values of the Humber watershed. Ratings were assigned to these indicators ranging from very good (A) to

extremely poor (F). In addition to current health, an indicator on whether conditions are getting better or worse are also provided. The report card does more than identify the good and bad news about topics such as terrestrial habitat, water quality or public green space. It sets targets for 5, 15 and 25 years from now, and it proposes how to get there.

Application: This report card is a call for protecting, restoring and celebrating the tremendous resources of the Humber River Watershed to all those who live in the watershed, work and do business here, drink the water and breathe the air, and enjoy its natural beauty.

The report card will be used to help set the future work plan for the Humber Watershed Alliance. The plan is to issue a report every three years to show what progress has been made at achieving the objectives set out in *Legacy: A Strategy for a Healthy Humber*.

Strengths: The Report Card was developed by a volunteer task force thereby increasing ownership for it. It is written for the general public in easy to understand language regarding current topics. It will form the basis of future work plans and guide the work of TRCA and other partners.

Capacity Needs: Translating scientific information into easy to understand information is achieved in the Report Card. Environmental, social and economic information is presented to build capacity amongst all watershed partners. The science, recommended targets, and actions improve decision-making and helps maintain public awareness and stewardship activities.

Key Words: Humber River, watershed management, report card, indicators

Community Action Sites: A Model for Implementing a Watershed Management Strategy

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Challenge: The Toronto and Region Conservation Authority recognized that the success of developing and implementing a Humber watershed management strategy lay in strong community support, so they immediately assembled a task force to guide the preparation of the document. The task force included watershed residents, elected officials, agency staff interest groups and business associations.

The Humber Watershed Task Force ultimately created *Legacy: A Strategy for a Healthy Humber* and its companion document, *A Call to Action*. These documents outlined a holistic vision and made recommendations to achieve a healthy ecosystem in the Humber River watershed.

During the preparation of the watershed management strategy, it was recognized that a method was needed to communicate the document in such a way that it would empower and win the support of the community to help implement the actions recommended in the strategy document.

Description: A Community Action Site model was developed and presented in *Legacy: A Strategy for a Healthy Humber*. Community Action Sites illustrate how an all-encompassing strategy document can be implemented through the integration of the environmental, social and economic needs and opportunities at specific locations.

Sites are selected that profile real locations, focus resources for immediate success and to demonstrate how actions can be achieved by working in partnership. Locations range from multi-faceted, million dollar, complex projects to simple, single-purpose sites. Regardless, the community participates in a visioning process, identifies needs and opportunities, and helps finalize a plan of action that reflects the community's priorities.

The evolution of Community Action Sites in the I-Lumber River watershed is examined. A brief description of the process, including visioning, site planning, implementation, and reporting is discussed.

Application: The Community Action Site model is applied across watersheds. Steering committees are assembled which include political representatives, agency staff, interest groups, businesses, academics and local residents. This group of individuals helps identify the issues, set objectives, devise action plans and assist with their implementation. Long term community support and investment is achieved to ensure the action plan is carried out. Efforts continue today to use the Community Action Site model to achieve the overall goals and objectives of the watershed strategy.

Strengths: Community Action Sites engage the local community and provide a forum for meaningful community involvement in the planning and implementation of watershed management projects. They aim to influence people's behaviour and encourage sustainability.

The Community Action Site model results in the public taking greater ownership in the long-term implementation of the project.

Capacity Needs: It is well understood that all sectors of society must contribute to achieving healthy watersheds. The model brings partners together to identify issues and objectives and establish action plans. The model builds community capacity by educating people, changing behaviours and securing a long-term commitment to environmental management at a local level.

Key Words: watershed, community planning, Humber River, sustainability

**National Recreational Fisheries Award Program —
Recognizing Stewardship in Canada**

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Description: This presentation will provide an overview of the National Recreational fisheries Award program. This Award is given by the Minister of Fisheries and Oceans to individuals or organizations who have made an outstanding contribution in areas such as: recreational community leadership, restoring and enhancing fisheries and fish habitat, or promoting conservation and stewardship of the recreational fishing resource and its habitat.

The program continues to build strong and lasting partnerships; and developing internal and external capacity for stewardship. The presentation will provide an overview of the benefits of the program to both the recipients and the department. A brief presentation of some of the outstanding projects which have received the National Awards will also be covered.

First Nations and Tribal Roles and Perspectives on Managing Shared Waters

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Water is a very important part of Aboriginal life — spiritually, culturally and traditionally. Many First Nation/Tribes are situated near a lake, river or stream, again illustrating the importance of water historically and currently to Aboriginal people.

This session will involve several Tribes/First Nation people presenting from a variety of perspectives their experience dealing with

water issues in their communities. The theme of this session is the sustainability of marine and freshwater coast regions and the capacity of Tribes/First Nations to address the challenges they face.

This session will provide conference participants with an opportunity to learn more about Aboriginal people and their relationship to water.

Introduction of Minister's Advisory Council on Oceans

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Challenge: The Oceans Act passed in legislation in 1997 directs the Minister to collaborate with other Minister's boards and agencies of the Government of Canada, with provincial and territorial governments, and with affected aboriginal organizations, coastal communities and other persons and bodies in encouraging the development of a national strategy for the management of estuarine, coastal and marine ecosystems. The principles of sustainable development, the integrated management of ocean activities and the precautionary approach are the foundation upon which the Oceans Act is built.

Description: The presentation will introduce the Federal Minister of Fisheries and Oceans Advisory Council on Oceans. This council was announced at Coastal Zone Canada 2000 in St. John, New Brunswick by then Minister of Fisheries Herb Dhaliwal. The mandate of the council is to assist the Minister in fulfilling the Oceans Act by providing independent expert advice, in particular on balancing economic, environmental and social goals for sustainable development; managing increasing complexity and diversity of ocean uses; and engaging communities and stakeholders in making decisions that affect them.

Key Words: ocean's council, ministerial advice, sustainable development, integrated management, precautionary approach

Measuring and Understanding Coastal Ecosystems

Good decision-making relies on the availability of adequate, accurate and reliable information gathered from monitoring and research. In shared waters and shared coastal regions, the management of data and the information is a major challenge. However, the benefits of sharing this information between stakeholders are significant. Gathering all the data needed to support a sustainable management framework for shared waters is beyond the capacity of one agency. Partnering allows agencies to tap into each other's knowledge and technical capacities. It also creates a more efficient process, one which generates more relevant and comparable data, improves the understanding of all partners, and strengthens the arguments for action.

Coordination of research requires a **standardized method of collecting and organizing data**. There also needs to be a consensus amongst partners and interested stakeholders as to what information is necessary. Establishing **networks of researchers** who will identify the types of scientific and technical information necessary to support sound decisions, share this information once collected, and document information gaps and needs, are common approaches for ensuring this cooperation.

All information needs to be incorporated into a framework which is meaningful for all partners. Developing a set of **indicators** will allow data and information collected through various agencies to be analyzed and interpreted within a common framework. Indicators play a critical role in **decision-making frameworks** allowing decision-makers to access their progress and make appropriate adjustments to policy directions.

Indicators are also important mechanisms for **communicating the science** behind the issue. Decision-makers and resource users often lack the scientific know-how to make sound decisions. Scientists can explain present conditions, consequences of inaction, and possible solutions. But this information needs to be transferred in a way that is accessible to decision-makers and stakeholders at various levels of understanding.

The abstracts in this section provide some insight into different approaches being used to address capacity needs related to measuring and understanding coastal ecosystems.

Examples of capacity needs identified by *MANAGING SHARED WATERS* participants:

- funding for research and monitoring;
- baseline data to support sustainable solutions;
- better understanding of land-water interfaces;
- standardized data and collection methods;
- comprehensive data bases;
- dissemination mechanisms;
- decision-making frameworks;
- research networks;
- identification of knowledge gaps;
- partnering opportunities;
- communication tools for bridging science and policy; and,
- adaptation strategies.

Examples of tools and approaches for improving capacity:

- community-based and volunteer monitoring programmes to increase database and decrease costs;
- standardized ecosystem monitoring protocols;
- monitoring and research networks to share data;
- water resources decision-support system to support policy and programme decisions;
- environmental indicators to report on progress and communicate results;
- net-environment benefit analysis to assess costs of ecological changes; and,
- geo-spatial tools.

Remote Sensing as a Tool for Coastal Zone Management and Monitoring of Environmental Impacts in the Coastal Zone

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Challenge: The Colombian Caribbean Coast is quite a valuable natural resource for the country due to its natural and rich ecosystems, like mangroves reserves, beaches, coral reefs, and vegetation. Areas like Punta Barú gather most of these characteristics and this has put great pressure on the area mainly related to anthropogenic activities. Significant mangrove deforestation has been taking place in the last 15 years, which have caused several environmental impacts on this zone. The main cause for mangrove deforestation is the construction of shrimp ponds due to shrimp farming industry in this area. This mangrove deforestation has also increased problems of erosion and sedimentation as well as other men activities in the area like agriculture and urban development.

Description: Great effort has been put in order to determine and establish the main environmental impacts related to different kind of activities taking place in the area. Determination of sensitive areas, percentage of destroyed mangroves, possible endangered areas, etc, have been some of the results obtained by the application of remote sensing techniques. The products obtained by the analysis and treatment of satellite images have been a main input for the development of coastal management plans in the area.

Application: Use of modern techniques like remote sensing has been one of the main factors to take a forward step towards the achievement of serious plans regarding Coastal Management. A multi-temporal analysis of the land-use, in Pta. Baru was done mainly focused in environmental impacts caused by

anthropogenic activities. By the use of supervised classifications and satellite images some tendencies were identified as well as changes in the land-use of the area for a period of 12 years. Processes like erosion and sedimentation were also identified by the satellite images, and like this great changes on the morphology of the area were registered.

Strengths: A serious concern exists about the future of these areas, for this reason new techniques like satellite images (SPOT) have been applied with good results and in this way a more effective control and coastal management in the area is taking place. The use of SPOT images to study changes in the land-use of the area was a useful technique in order to determine patterns of human activities and suggest solutions for severe problems in the area.

Capacity Needs: Waking up of a serious environmental conscience both in the people and local authorities is the main objective of this case study, then the execution of serious coastal management plans and finally the effective application of these plans. Linking both technology and science in order to establish important aspects like the identification of sensitive areas and changes in land-use is basic for the correct decision making process of authorities and people involved in these coastal matters. For this reasons further efforts should be focused on the correct use of new tools and their products.

Key Words: coastal ecosystems, coastal management, remote sensing, Caribbean coast, mangrove deforestation, erosion, sedimentation

External Abnormalities in Brown Bullhead as an Indicator of PAH Exposure

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Challenge: Sediment contaminants, particularly polynuclear aromatic hydrocarbons (PAHs), have been one of the major problems in Areas of Concern (AOCs). In particular PAHs have been linked to both liver and skin tumors in fish, one of the impairments listed in designating locations as AOCs. While liver tumors have been widely researched, external lesions are less well described, and few long term studies are available. However these easily observable pathologies appear to be useful as an indicator of contaminant exposure and therefore of remediation success.

Description: External abnormalities including tumors (raised lesions) and barbel deformities (such as shortened, missing, or deformed barbels) were surveyed from 10 Lake Erie locations and detailed studies were made at five sites: the Detroit River, the Ottawa River, the Cuyahoga River, the Ashtabula River, and twice at Old Woman Creek (a reference site). Bile metabolites of PAH were also analyzed from the bullhead, and sediment samples were taken and analyzed from the locations. Raised lesions were found to be correlated with B(a)P wavelength metabolites (presumably longer chain carcinogens), while barbel deformities were found to be correlated with naphthalene wavelengths (shorter chain PAH). Barbel abnormalities were also more prevalent at locations such as the Ottawa River, where organochlorines were present at higher concentrations in the sediment. Historical data from Presque Isle Bay supports the use of these external lesions as bio-indicators of ecosystem recovery.

Application: An index of external abnormalities would provide a good monitoring mechanism for AOCs. Criteria as to the prevalence of such lesions at reference and contaminated locations would provide a basis for delisting AOCs after recovery. Different types of abnormalities, such as tumors and barbel deformities, could be used to determine which types of contaminants were primarily causing the pathology.

Strengths: Established criteria for external tumor prevalence and barbel abnormalities would help managers decide on the success of remedial efforts and the health of the fish populations. External abnormalities are easy to quantify grossly, and may, after sufficient correlation with histopathological diagnoses, provide a quick and inexpensive monitoring mechanism.

Capacity Needs: Information transfer among international researchers and further histopathology studies of external lesions are needed. Historical data bases need to be merged with more recent data. External lesion prevalence needs to be correlated with other bio-indicators to provide a more precise picture of the process of recovery in contaminated areas.

Liver Pathology of Brown Bullhead as an Indicator of PAH Exposure

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Challenge: PAH sediment contamination has been linked to liver tumors in brown bullhead from the Great Lakes, mummichog from the Elizabeth River, and English sole from Puget Sound to name only a few of the case histories. Also long term data bases from Puget Sound and from the Black River demonstrate that liver neoplasm prevalence is a good indicator of PAH exposure of fish. However historical and recent data are not always diagnosed using the same criteria, and historical quantification often consisted of a yes or no for each fish, rather than counts or areas of lesions.

Description: Archives of liver tissue from surveys in the 1980s exist and can be reexamined or in some cases re-cut to examine new material. These historical samples can then be re-diagnosed using contemporary criteria, and quantification of lesions can be made. In addition macrophage centers, a more sensitive bio-indicator of sediment PAH than neoplasms, can also be diagnosed and counted. Such quantification provides statistically stronger differentials for healthy versus exposed populations. Material from the Black River taken over two decades will be used to demonstrate the benefits of re-analysis and the usefulness of liver pathology as an indicator of PAH exposure of brown bullhead.

Application: Liver tumor prevalence is widely used as an impairment indicator in Areas of Concern. Levels of about 5% liver neoplasms are now presumed to be indistinguishable from background in the Great Lakes. New diagnoses and macrophage aggregate information could be applied to make liver pathology a more useful tool. Since liver samples have been taken from fish at a wide variety of AOCs, and since many samples are archived, the new diagnostic techniques would have widespread applicability.

Strengths: Quantification and the addition of macrophage aggregate numbers, as well as standardization of diagnosis between historical and modern samples, would enhance the ability of managers to accurately assess the progress of recovery following remediation. Quantification would enable the use of statistical comparisons including ANOVA, instead of relying on Chi Square distributions required by yes or no answers to questions.

Capacity: Diagnostic methods need to be standardized both in time and geographically around the Great Lakes. International researchers should coordinate their techniques and allow round robin exchanges and materials and diagnoses. Joint data bases should be established, particularly for brown bullhead and for white sucker, which are the two prevalent indicator species in the Great Lakes.

The Oceans Sector as a Contribution to the Economics of the Maritime Provinces

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Challenge: Policy formulation related to sustainable coastal economic development and ocean management in general is immeasurably improved by the provision of precise economic 'measurements' of the coastal and ocean sector. Until quite recently the relevant analyses were not available. An additional challenge has been the historic lack of attention paid by maritime governments to their coastal constituencies, probably because of the seemingly endemic employment problems. The increasingly apparent fragility of the coastal zone and its resources is changing those attitudes, however slowly.

Description: This presentation will describe three economic studies which have focussed on the coastal resources of the Maritime Provinces. The outcomes from the provincial studies will be compared with each other and also contrasted with other comparable studies in the US, Australia and the UK. The focus of the presentation will be on the results of traditional GDP and input/output analyses carried out for Nova Scotia (1998) and New Brunswick (2000). The newer paradigm of environmental economics will be introduced in the context of the most recent study for Prince Edward Island (2002).

Strengths: The basic data required for customary analyses is provided in the studies, which are the subject of this paper. However, the drawbacks of the methodology are clearly identified and a range of remedies is outlined, in particular the major components of environmental economics.

Capacity Needs: The introduction of standardised methods of economic analyses, within the context of sustainable development and ecological health, will require a fundamental change in mindset by those customarily responsible for the generation and application of economic information.

Key Words: economics, GDP, environment, coast, ocean, Maritime Provinces

The Atlantic Coastal Zone Information Steering Committee and Horizontality

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Challenge: Managers, scientists and other sectors of society are increasingly being asked to work across disciplinary boundaries. However, the management of horizontal initiatives is acknowledged to be a particularly onerous and a relatively uncharted task. The Canada Centre for Management and Development (CCMD) has recently undertaken a number of studies to address the many issues peculiar to 'horizontality'. These issues include the pooling of financial and non-financial resources, staffing, accountability and planning.

Description: This presentation will describe the 10-year evolution of the Atlantic Coastal Zone Information Steering Committee (ACZISC) since it was formed in 1992. This inter-disciplinary and inter-agency committee is addressing the horizontal issues associated with building a coastal information infrastructure in Atlantic Canada and facilitating Integrated Coastal Management. The Secretariat is housed at the International Oceans Institute of Canada in Halifax.

Application: The ACZISC has been responsible for, or has contributed to, a series of horizontal outputs ranging from metadata for the region; numerous workshops related to coastal mapping and remote sensing; and coastal economic studies. In addition the Committee as a whole, or individual members, participate in most of the major coastal programmes in the Region.

Strengths: The relative longevity of the ACZISC is a testament to its success. The ACZISC was recently reviewed by the CCMD as one of its case studies in its ongoing research on 'horizontality'. And the confidence of the Committee in its current and future relevance was clearly defined in the recent and ongoing development of a strategic plan for the next ten years. This presentation will identify the Committee's major strengths in terms of 'outcomes.'

Capacity Needs: ICM is dependent on the availability of appropriate data and information and its dissemination; its wise utilisation and application is the ultimate and often most intractable of steps. The role of the ACZISC in promoting these functions and tasks will be described and assessed.

Key Words: Integrated Coastal Management, data, information, horizontality, Atlantic Canada

Management Strategies for Sustainable Exploitation of Red Algae, Gracilaria sp, An Aarophyte from Cienfuegos Bay, Cuba

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Cuba as an island state has seaweed resource available on all of its shorelines. The use and development of this resource has been only restricted to studies for knowing its potential exploitation. Although, the environmental management practices has not been adequate to achieve the goals of sustainable development, many efforts has been made in this sense, which brings favourable conditions for the seaweed case one they has never been exploited, so effective management plan could be applied. Among different places where seaweeds can be located, is Cienfuegos Bay (22°, 02' N Lat. and 80°, 27' W. Long.), one of the bays cleanest in the country in spite of the multiple uses it has, but it is considered a very complex ecosystem to manage.

Gracilaria sp is reported as one of the most abundant seaweeds in Cienfuegos Bay, even the more studied because of the wide use in the

territory and for its ecological function in this ecosystem. The main purpose of this paper is to propose a management plan for sustainable exploitation of this species since it is necessary to face of significant knowledge gaps before being commercially exploited. To achieve it, was used an Environmental Impact Assessment as a planning tools in which all the results from the studies done were analyzed looking at one activity in the area but as a big picture.

Among the result obtained, a phased process is development, which flows from the increasing knowledge utilizing new data, dealing with integration, stakeholders and solution to the environmental issues. The proposal of Management Plan has taken issues that looks beyond of the actual trends and environmental policies in Cuba with the purpose of to be sure of the success of the plan as a whole: ecological, economical and sociological areas.

Managing Water Quality in Hamilton Harbour: Past, Present and Future

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Challenge: Many of the large-scale pollution problems have been addressed in the Laurentian Great Lakes. Reductions in municipal and industrial effluents have improved water quality and aquatic bird populations have increased due to less contamination. Despite the overall progress a number of intensely polluted areas remain where there is a great deal of effort to develop and implement Remedial Action Plans. These “Areas of Concern” (AOC) are sometimes inter-National and sometimes inter-municipal resulting in complications in management decision making. The Hamilton Harbour AOC encompasses municipal and industrial pollution in an inter-municipal setting. The setting is such that remedial measures inside the harbour may bear on coastal water quality issues nearby in Lake Ontario. The challenge is to enable informed decision making towards efficient solutions based on scientific investigations of the harbour.

Description: The presentation will highlight scientific investigations and their links to planning and management for a better ecosystem in Hamilton Harbour. The main focus will be on municipal and industrial wastes and how studies on the condition of the harbour and its responses to pollution help bring about decisions to ameliorate the pollution through control of phosphorus, ammonia, metals, and the siting of discharges.

Application: Scientists were involved in development of the Remedial Action Plan from the beginning. The process demanded involvement of stakeholders around the harbour. The two groups came together in various fora. The scientists attempted to explain the conditions of the harbour, their present understanding, consequences of (in)actions, and projected improvements. The stakeholders approved contents of reports and settled on principles and recommendations. Since 1992 the plan has been in the implementation phase and scientific investigations have been instrumental in providing the evidence that convinces decision makers to fund improvements mainly to municipal infrastructure.

Strengths: The RAP is a community based process which presents a wide stakeholder interest to political decision makers. Over the years the scientific community has accepted the challenge of interacting with public groups to learn their concerns and to transmit scientific findings and recommendations.

Capacity Needs: Reconciliation of past inattention with planning further into the future requires a quantum jump in understanding and a determination to bring about change. Ongoing scientific effort is required to maintain information flow as funding decisions are periodically debated. The realization that municipal waste problems will never be eliminated is important to long term planning on how best to use water resources for sustainability.

Improving Environmental Management in the Great Lakes Region Using an Integrated Environmental Information System

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Challenge: In Canada and elsewhere, the emerging discourse on environmental management calls for a place-based, or watershed approach that is based on shared responsibility between government, the regulated community, NGOs, the scientific/technical community, and the public. As an important part of this shift, the development of integrated environmental information systems, that are publicly available, are an important foundation for environmental management. Transparent reporting programs are seen to help put public pressure on poorly performing industries, and play a key role in driving the transition of companies, industries, and economies towards the ultimate goals of continuous improvement and sustainable development. The public is seen as a “critical lever” in achieving better environmental outcomes.

To date, comprehensive environmental and health databases have yet to be integrated. The myriad of environmental information collected by all levels of government and by industry is underutilized and located in many different places. As a result, government, industry and communities are limited in their ability to use existing publicly available information to aid in decision-making and influence policy change.

Description: Powerful information technologies and software now make it possible to take the wealth of environment and health data collected by governments, industries, and even communities themselves, to link it together and create meaningful information about the state of the environment at the community level. Pollution Probe is therefore leading a new pilot initiative that will bring environment and health information to the community in a clear and simple format. The project will integrate publicly available data on water quality, air quality, industrial pollution and health.

As a partnership initiative with the Ontario Ministry of the Environment, Environment Canada, local industry and a local pilot community in the Great Lakes Region (Sarnia-Lambton), the project has four main objectives: 1) to collect and integrate a range of selected environmental data collected by government and industry, including relevant data from the US side of the border; 2) to work with a pilot community to determine their information needs and desired methods of outreach; 3) to develop a web-based user interface for the information based on the community’s stated needs, and to provide complementary forms of outreach; and, 4) to help the community use the information system to take actions that will lead to environmental improvements.

Application and Strengths: Together, industry and communities play a significant role in generating pollution into the water, air and land, which ultimately affects their health and well-being. By creating a meaningful environmental information system that the community wants and needs, the project will enable all stakeholders to share responsibility and take actions that will improve the environment and their health.

Capacity Needs: The project serves two key capacity needs. First, it will provide a tool for measuring and understanding the state of the environment of a coastal ecosystem in the Great Lakes region. Second, outreach activities related to the information system will be designed to provide learning opportunities and examples to help citizens, industry and governments make better decisions.

Key Words: access to and management of environmental data, place-based or watershed approach, public right-to-know; Great Lakes

Canada's Ecological Monitoring and Assessment Network: Cooperating in Providing Information for Ecozone and Local Ecosystem Management

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The Ecological Monitoring and Assessment Network's (EMAN) focus is the fostering of a scientifically sound, policy relevant ecosystem monitoring and research network based on; a network of case-study sites operated by a variety of partners and; developing a number of cooperative dispersed monitoring initiatives. These partnerships and initiatives will deliver unique and needed goods and services which include efficient and cost-effective timely reporting of status and trends to meet the requirements of adaptive management and responsive priority setting.

EMAN is developing a set of standardized measurements which can be carried out by interested sites, networks, and communities to establish whether and how local ecosystems are changing while at the same time contributing to timely status and trends reporting. These can serve as a basis for developing partnerships with a variety of protected areas. EMAN proposes cooperative development and implementation of a standard approach to ecosystem monitoring within such areas which includes cost-effective strategies, protocols, data management, interpretation and communication and which fills the information needs of local managers, associated communities, relevant supporting agencies and Environment Canada.

Development and Implementation of a Freshwater Conservation Blueprint for the Great Lakes Region

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Challenge: In 1996, The Nature Conservancy's Great Lakes Program launched a collaborative initiative to identify areas of biodiversity significance in the Great Lakes region. At that time, despite wide recognition that the habitats of the Great Lakes region support tremendous biological diversity, there existed no comprehensive vision for the conservation of these biological resources. The Nature Conservancy and its partners recognized the need to characterize the natural diversity of the region and to identify areas that need to be protected to conserve the region's native biodiversity.

Description: The Great Lakes ecoregional planning initiative is a systematic approach that considers elements of biodiversity — species, natural communities, and ecosystems — across their range and determines how much of and where these elements needed to be protected over the long term. Freshwater ecosystems, including tributary rivers, inland lakes, and coastal habitats, are explicitly addressed. The resulting conservation blueprint includes high quality examples of freshwater ecosystems. To date, the blueprint only includes areas in the US portion of the region. A complementary planning initiative is underway in the Canadian portion of the region.

Application: The Great Lakes conservation blueprint has already begun to direct where The Nature Conservancy and its conservation partners will focus limited time and resources. Developing a regional blueprint is only the first step toward conserving the freshwater diversity of the Great Lakes region. It outlines where to work, but only begins to identify the actions necessary to conserve freshwater biodiversity. The next step is to develop area-specific plans that provide critical details about local issues and opportunities that may threaten or facilitate the conservation of freshwater biodiversity. As, and even before these area-specific plans are developed, common issues and threats emerge that can lead to development of strategies that will benefit multiple areas. The Nature Conservancy has begun to develop and demonstrate strategies that address threats from invasive species, incompatible forest management practices, and hydrologic alterations that will benefit multiple areas in the blueprint.

Strengths: The Great Lakes ecoregional planning initiative included many partners and is only the beginning of many opportunities to work together to conserve Great Lakes biodiversity. The planning process created several products, including GIS tools, maps, databases, and summary documents that can be used for conservation planning and natural resource management. This conservation blueprint is already helping The Nature Conservancy and its partners determine how they can best work together to conserve Great Lakes biological diversity.

Water Resources Decision Support System for the Great Lakes

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Challenge: Increasing demands for Great Lakes water withdrawals — including in-basin consumptive uses and diversion to other basins — suggest the need for a scientifically sound and legally defensible decision making process to ensure the sustainable use, management and protection of the resource.

Description: The Great Lakes Commission is helping to lay the foundation for a decision support system to address issues of withdrawal, diversion and consumptive use of the waters of the Great Lakes Basin. Supported by the Great Lakes Protection Fund, the project responds to Directive #5 of Annex 2001 to the Great Lakes Charter, which commits the governors and premiers to the development of a decision support system to ensure access to, and use of best available information when considering water withdrawal requests that fall under their purview.

Three primary objectives are: a status assessment of basin surface and groundwater resources; an inventory of the sources and use of Great Lakes water; and an enhanced understanding of the ecological consequences of such use. The large-scale collaborative approach is led by a Project Management Team comprised of state, provincial, regional and federal officials with scientific, technical and policy responsibilities. A Stakeholders Advisory Committee contributes additional expertise from both governmental bodies and nongovernmental groups.

Application: A number of interim products have, or will soon be released, including a comprehensive, computerized water use data base; a descriptive inventory of Basin water conservation and management programs; a comprehensive literature review and analysis; a manual on computer models to assess ecological impacts; and a series of “essential questions” to further identify such impacts.

Strengths: The many interim products will be finalized and synthesized into a single report that state and provincial officials can use as a “toolkit” for decision support. The tool kit will include both conventional (i.e., hard copy) and electronic materials that will walk these officials through the steps that must be taken to access scientific and technical information that can inform the decision making process.

Capacity Needs: This effort is an initial step in the development of a decision support system. Its focus is on 1) identifying the types of scientific and technical data and information needed to support sound decisions; 2) documenting gaps in data and information needs; and 3) recommending approaches to addressing those gaps. Additional phases of this inquiry will be needed to generate and apply currently unavailable data and information.

Towards an Integrated Watershed Approach: Potential Effects of the Changing Land Use Pattern on the Mid-Southern Coast of Bahia, Brazil

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Challenge: A set of coastal watersheds known as the East Basins (EB) drain to the mid-southern coast of Bahia, Brazil. Their total drainage area covers 9,249 km² where about 800,000 inhabitants are distributed in 23 municipalities. Sand beaches, estuaries and mangroves characterize the coastal zone. Cocoa agriculture is the main land use in the EB and has historically had an outstanding role in the conservation of the natural landscape, since cacao plantations are grown under the shade of the Brazilian Atlantic Forest (one of the world's biodiversity hotspots). Recently, the cocoa cultivation area has been reduced by nearly one-third due to the low market prices and the infestation of a destroying fungus. The replacement of cocoa by other crops and by livestock can result in significant environmental changes. This issue has mainly been discussed, by government and non-government organizations, in terms of deforestation and loss of biological diversity of the Atlantic Forest. Little attention, if any, has been paid to the potential effects on the coastal zone. Therefore, adopting an integrated watershed approach that takes into account the coastal environment comes out as an important issue in the mid-southern coast of Bahia.

Description: This presentation aims at providing a preliminary overview of the potential adverse effects of land use changes on the mid-southern coast of Bahia. It reviews the current information and data available for the study area, focusing on the foreseen regional development scenario (*i.e.*, the replacement of cocoa agriculture) through a comprehensive approach that recognizes the watershed and the coastal zone as interdependent entities. The need for further studies to understand the linkages between watersheds and coastal systems is also discussed.

Application: The present study points out that both natural and social-economic coastal systems of the mid-southern coast of Bahia can be affected by changes in upstream land use. The exodus of rural population due to cocoa "crisis," for instance, has resulted in a pronounced urban expansion in the regional centers, such as the coastal city of Ilhéus, increasing poverty and forcing population to over-exploit the remaining resources. With this regard, mangroves and estuaries are the most threatened coastal ecosystems. The results from this study must be used to sensitize those dealing with inland and coastal issues to the need of adopting a watershed approach that incorporates the coastal dimension if the integrity of the coastal resource system is to be maintained.

Strengths: worldwide upstream and coastal issues have been managed apart until very recently. However, it is time to recognize the critical links between watersheds and coastal zones. This study demonstrates that the integrated watershed approach emerges as an adequate one to address comprehensively most of the coastal management questions and issues arising from the changing land use pattern in the mid-southern coast of Bahia.

Capacity Needs: In the mid-southern coast of Bahia, there is an imperative need to make aware the professionals concerned with the many dimensions of environmental management to the interdependence of watersheds and coastal zones, especially about the effects of inadequate inland development on the coastal and marine environments. Integration, or at least collaboration, of the professionals and sectors involved has to be promoted in order to make possible the sound management of coastal resources.

Key Words: coastal watersheds, upstream effects, coastal zone management, Bahia (Brazil)

Linking Research in Areas of Concern to Remedial Action Plans and Policy

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Challenge: Contaminated sediments have been identified at almost all the Great lakes "Areas of Concern." However, this designation is largely based upon chemical concentrations. In fact the issue is the significance of biological effects relating to those elevated concentrations. The challenge has been to identify indicators that will identify effects associated with the contaminants, establish numeric target values for the indicators, and integrating the different indicators into a management recommendation.

Description: The presentation will focus on the selected indicators and the associated targets and the development of a decision making framework. Results from Collingwood Harbour will be presented where this approach assisted in the delisting of the Harbour as an Area of Concern.

Application: The development of this decision making framework has been a long term effort and has resulted in the collaboration of Environment Canada and the Ontario Ministry of Environment in the development of a management tool that can be applied to all the Areas of Concern. This addresses the absence of a decision making process for making management decisions for contaminated sediment an issue identified by the International Joint Commission as one of the reasons for lack of progress on the resolution of contaminated sediments in Areas of Concern.

Strengths: It has been acknowledged by numerous authors and the IJC that multiple lines of evidence are required to assess the significance of problems associated with contaminated sediments. This decision making framework provides the context for providing the information from those multiple lines of evidence, and importantly integrating that into an appropriate decision. This provides a transparent linkage between science and improved decision making required in environmental management.

Capacity Needs: In order to implement this approach on a basin-wide basis there will need to be a consensus developed among the larger Great Lakes community that this approach is acceptable, and the necessary technical infrastructure will have to be developed and available to agencies at different levels. This provides a major challenge in transferring science capacity into agency use.

Key Words: sediments, Collingwood Harbour, Great Lakes, Areas of Concern, remediation

Sea Water Intrusion in Coastal Areas of Eritrea — A Case Study From Assab

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Challenge: Harsile coastal aquifer, about 7 km far from the Red Sea shoreline, has been an important source of water supply to Assab. The extraction of Harsile well field beyond the amount of natural recharge has resulted in the fast moving of seawater into the fresh aquifer zone. In effect, significant lowering of groundwater levels and water quality deterioration has been observed since time of exploitation. Unless otherwise, remedial measures are taken, these wells may become unacceptable sources for community water supply.

Description: This presentation will focus on the out come of the continuous monitoring of the water levels and water quality of the wells at the Harsile well field done by the Department of Water Resources, Government of Eritrea. Conductivity meter, depth meter and titrometer were employed

Application: The average groundwater level in 1963 was recorded to be 2m above mean sea level. However after extended period of over-pumping operations, in 2001, the level has been drawn down to 1m below mean sea level. Series measurements of water quality analysis indicated that the chloride content has increased tremendously from 50mg in 1963 to 500mg in 2001. Similar measurements of EC have shown changes from 450 to 1600 $\mu\text{S}/\text{cm}$ in the same range of periods.

Strengths: Since 1995, regular monitoring of water quality has been done which indicated the deterioration of water quality at the Harsile well field. The data collected have stimulated the awareness of the local people and government officials.

Capacity Needs: Uncontrolled over pumping leads to saline water intrusion in coastal aquifers. Therefore urgent step of regulating the rate and frequency of pumping has to be taken, which will lead to an ultimate groundwater abstraction management. Water supply need be regulated with seasonal weather conditions. The existing level of data collection, processing and dissemination need to develop by training concerned staff and equipping the department with better instruments and software. Moreover, the department of water resources should think of artificially recharging the aquifers at Harsile and assess for alternative water sources.

Key Words: salt water intrusion, water quality, Harsile

The Kano Plain of Kenya: The Trend Towards Increased Severity of the Flood Hazard

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Challenge: The Kano Plain of Kenya is bordered by Nyakach Bay and Winam Gulf of Lake Victoria. Depths of both the Bay and the Gulf have reduced substantially during the past four decades.

Serious flood conditions in the Kano Plain are associated with heavy rainfall in the upper catchments of rivers draining the Kano Plain. Here, the average rainfall usually exceeds 2000mm.

The near-flat terrain of the Kano Plain and the dense swamp vegetation of its low-lying areas led to the retardation of floodwater drainage and favoured the extensive spreading of floodwater. Besides, the low permeability of Kano Plains heavy clays soils impedes rapid drainage of floodwater into the lake and tends to prolong flood conditions.

Description: There are serious forms of direct and indirect losses occasioned by floods including loss of human and animal life; damage to crops and houses; interruption of transport and communications, deterioration of sanitary conditions and the outbreak of waterborne infectious diseases. Farm productivity is greatly reduced due to floods and poor drainage conditions. Major floods result in crop damage and drowning and post flood diseases of large herds of indigenous cattle, goats, sheep and chicken.

If the flood problem is overlooked, the Kano Plain is a region with extraordinary opportunities, particularly for crop production and fishing. It has good farm terrain, fertile soils, and surface and subsurface water resources are available.

Application: Government proposals include engineering structures such as upstream dams and reservoirs. These plans have been shelved due to lack of funds. Structural engineering techniques would help to regulate floods flows in part, but are not preventive in nature.

Strengths: There is a need to identify appropriate less expensive alternative ways of minimizing damages and suffering and increasing the productivity of the region, without creating volatile environmental conditions. Some alternative measures involve activities connected with catchment area land management, afforestation and control of deforestation and soil erosion. Emergency preparedness, response and recovery planning, flood forecasting and warning, as well as proper execution and management of such activities could help considerably in alleviating some problems created by floods.

Capacity Needs: The approach to planning and implementation should pay particular attention to the human and ecological dimensions of flood hazards and related activities, many of which have received little attention in the past. In determining the suitability of measures that are selected, the consequences of such measures on Kano Plains unique physical and socio-economic environment should be taken fully into account. The adoption of these measures should not create serious environmental instabilities, which are harmful in the short or long term. The optimal combination should minimize flood losses, help to increase the productivity of the region and be environmentally compatible.

Regional Freshwater Biodiversity Conservation Planning in The Nature Conservancy: History, Approaches and Tools for Ecoregional Planning

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Challenge: The Nature Conservancy has recognized that in order to achieve the goal of conserving the lands and waters necessary to protect the biodiversity of the Earth, an ecologically-based framework to assess the diversity and distribution of biodiversity is needed. Ecoregions provide a regional spatial assessment unit. Our goal is to develop plans to protect all of the biodiversity that resides within each ecoregion. This includes species, communities and ecosystems that represent not only those that are rare and endangered, but the common and representative components of biodiversity as well. We have developed approaches and GIS tools to create a regional, ecologically-based framework and to address the challenges associated with freshwater biodiversity conservation planning. These challenges include a deficiency of comprehensive maps of species distributions suitable for regional and finer-scale assessments, a lack of aquatic assemblage data, and lack of a standard way to describe and map freshwater ecosystem types and distributions.

Description: Freshwater biodiversity conservation planning requires developing spatially explicit assessment units and data that elucidate known and potential patterns of aquatic organisms, the ecological processes that are responsible for developing and maintaining biodiversity patterns, and the quality of and threats to aquatic biodiversity and habitats. We have developed a framework to subdivide the aquatic landscape into ecologically-based assessment units, select and map species targets, and we created a GIS-based classification system that describes and maps freshwater ecosystems according to their

landscape patterns of zoogeography, geomorphology, hydrologic regime, connectivity and drainage network position. This approach provides a way to characterize, map and better understand the complex aquatic landscapes and ecological patterns of regions throughout the world. In addition, we have developed GIS tools that evaluate landscape-based patterns of land use/cover, roads, water usage, dams, point sources, etc. in order to inform the assessment of the quality of and threats to freshwater ecosystems and their resident biodiversity.

Application: The Nature Conservancy has applied these methods with conservation and natural resource management partners in over 40 ecoregions in 12 countries. The approaches, data bases and maps provide a basis for freshwater conservation planning, and are also a useful framework for freshwater resource assessment and management. Characterizing and mapping the patterns and processes that result in natural biotic distributions and assessing the types and degrees of impacts to freshwater systems are critical to assessing the status of the integrity of the worlds freshwater ecosystems and developing management strategies to maintain and improve the condition of freshwater resources and biodiversity.

Strengths: This approach and set of tools provides a standard, yet flexible way for conservation and resource management groups to generate spatial information and databases on freshwater biodiversity and ecosystem distributions and condition. This information can be used for conservation planning, resource status assessment and management planning.

Investigating the Source of the Taste and Odour-causing Compound Geosmin in Nearshore Waters of Western of Lake Ontario

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Challenge: During the summers of 1998 and 1999 taste and odour problems, attributed to elevated levels of geosmin, were experienced at water treatment plants drawing water from the north shore of Lake Ontario. Geosmin, a naturally occurring compound, imparts an earthy taste and odour to water at low concentrations and can be difficult and costly to remove using conventional water treatment technologies. Monitoring after 1999, and a review of information from earlier years, suggests that a late-summer pulse in geosmin of varying intensity has occurred in several years. The source of geosmin, which is produced by cyanobacteria and actinomycete bacteria, remains uncertain despite efforts to identify the key producers.

Description: In 2000, the Ontario Ministry of the Environment joined with the Lake Ontario Taste and Odour Research Consortium, a collaboration of government and municipal participants, to investigate the cause of taste and odour problems in Lake Ontario. Taste and odour compound concentrations, phytoplankton composition and abundance of actinomycetes were measured in raw water samples from water treatment plants. Spatial distribution of geosmin in the nearshore waters in relation to physical, chemical and biological features was examined. In a related study the occurrence of taste and odour compounds from 1993–1999 were characterized by compiling data from water treatment facilities on Lake Ontario. In 2001 a sampling program examined contrasts in occurrence patterns of geosmin suggested by hypotheses from the previous years work.

Application: The occurrence of geosmin historically, and since 1999, suggests that the source of geosmin in western Lake Ontario is a widely distributed component of the phytoplankton. Previous geosmin episodes occurred primarily in August or September and when water temperatures at intakes were warm and similar to surface temperatures. In 2000 an increase in geosmin concentrations was observed in late August coincident with downwelling along the north shore. Fluctuation in geosmin concentrations were similar among intakes ranging from Cobourg to Hamilton. Several taxa of cyanobacteria represented in the phytoplankton data are being investigated.

Strengths: The collaboration fostered by the Taste and Odour Research Consortium (recently renamed as the Ontario Water Works Research Consortium) has enabled studies to proceed along the diverse lines of investigation required to address causality of taste and odour problems.

Capacity Needs: A better understanding of the occurrence of geosmin in western Lake Ontario would be of practical value in determining effective treatment and monitoring strategies to reduce taste and odour in drinking water. Further examination of the sources of geosmin hypothesized in studies to date is required.

The Application of GIS for Participatory Monitoring and Management of Pollution and Land Use Impacts in the Negombo Lagoon & Dandugam Oya River Basin

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Challenge: Negombo lagoon is one of the biggest & important lagoons in the country. It has been identified as a Wetland of International importance and thus included in the Directory of Asian Wetlands prepared in 1989. It provides permanent employment for nearly 3000 fisher families and their primary income is dependent entirely upon the fish & crustacean stocks live in the lagoon. However, its sustainable production of fish stocks entirely dependant on the mixing capacity with seawater and the quality of incoming water especially from the Dandugam Oya (river). A conservation management plan was also prepared in 1994 for the Negombo Lagoon.

Description: This presentation will focus the planning process and results to date of an application of GIS for participatory monitoring and management of land use & pollution impacts on the water quality of Dandugam Oya (river) and eventually in the Negombo lagoon (coastal ecosystem). It examines the efforts taken to address the issue of industrial pollution of waters in the Dandugam Oya and eventually in the Negombo lagoon through a participatory approach by all stakeholders concerned.

Application: The goal of this study is to develop a methodology for safeguarding water & food security, both in the river basin & as well as the in the associated coastal ecosystem. The important components of addressing this issue and achieving the goal included scientific research, participating of stakeholders ranging from community members of the community organizations, environmental 'watch dog' organizations, industry managers, political authorities and law enforcement groups. The

development of a GIS database facilitates community & other interested parties for monitoring water quality and involve in decision making process to combat the issue of industrial pollution of river & lagoon water.

Strengths: Pollution of the waters in the Dandugam Oya (river) from clusters of industries located within the river basin and downstream pollution of the coastal lagoon have been the focus of this study in an attempt to understanding complex issues confronted by the people living in the area and developing a methodology in resolving the issues. This study clearly demonstrate the importance of passing down the computer driven, sophisticated, highly technical decision guiding tools (such as GIS) to grass root level (village level community groups) providing them an open platform for close interaction and as well as stakeholder involvement in planning & management process for progressing.

Capacity Needs: Use of GIS as a decision guiding instrument regarding the proper land use planning, and improving industrial process in the Dandugam Oya river basin are viewed as important efforts to secure water & food both in the river basin & associated coastal ecosystem of the Negombo Lagoon. Establishment of institutional arrangements among the central government, provincial administration, in partnership with community based organizations, which are operating at the bottom level better address the complex environmental issues in the coastal ecosystem of the Negombo lagoon.

Key Words: coastal ecosystem, participatory monitoring, decision guiding process, GIS

Using a Net Environmental Benefit Analysis Model as a Tool for Watershed Management and Natural Resource Stewardship: Great Lakes Basin Demonstration

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Challenge: The Great Lakes states and provinces share the goal to protect, conserve, improve and manage the waters and water-dependent natural resources of the Great Lakes Basin for the sustainable use and benefit of current and future generations. On June 18, 2001, the Great Lakes governors and premiers released a Supplementary Agreement to the Great Lakes Charter, Annex 2001, which updates how requests for all new water uses and diversions of water outside of the Great Lakes drainage basin will be addressed. Among other requirements, Annex 2001 requires that all new withdrawals and diversions, will not individually or cumulatively cause significant adverse impacts *and* will result in an improvement to the basin's waters and water dependent resources.

Description: The authors have developed a series of hypothetical cases that demonstrate how such improvements could be made, measured and evaluated using a Net Environmental Benefit Analysis (NEBA) framework and tools. These examples use a Habitat Equivalency Analysis (HEA) model, which provides a mathematical framework for scaling resource compensation to offset resource impacts and to measure improvement.

Application: The objective of the model is to determine the ecological value of the Great Lakes Basin to society that the proposed actions would yield. This is accomplished by determining the value of the ecological service flows over time from the natural resources of the Great Lakes Basin *with* the actions relative to the value of the ecological service flows over time from the natural resources of the Great

lakes Basin *without* the action. A positive environmental benefit results when the package of water conservation measures, actions to increase return flows, and water resource habitat restoration and protection measures generates water resource enhancements that more than off-set any water resource quality or quantity losses due to the new withdrawal or diversion.

Strengths: Besides providing a method to assess the ecological changes due to individual proposals, the NEBA framework is a heuristic tool to use in decision support system design, and offers a systematic way to identify research priorities. This technology has wide applicability and would easily transfer to other watershed management and natural resource stewardship applications.

Capacity Needs: Linking science to improve decision-making regarding new and increased existing water uses is perceived as a needed step in implementing the improvement standard under Annex 2001. Geographic, political, social, cultural and economic differences among the Great Lakes states and provinces present barriers that will need to be overcome for developing shared processes. The establishment of innovative institutional arrangements are under consideration. Consistent methods and standards for information and data collection, assessment and dissemination need development.

Key Words: ecological benefit, habitat equivalency analysis, environmental stewardship, Great Lakes Basin, water diversion, water withdrawal

Towards A Sustainable Framework for Water Management Within the Great Lakes Basin

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Challenge: In order to meet the needs of water demand while maintaining the sustainability of aquatic ecosystems, a sustainable framework for water allocation in the Great Lakes Basin is essential. Baseline data is one of the key pieces of information on which to base public policy decisions concerning the use and management of surface and groundwater resources in the Great Lakes region. The recent drought of 1998 through 1999, with the lowest water supplies in the Great Lakes Basin in over thirty years, has served as a reminder that water is a limited resource which must not be taken for granted. The additional threat of climate change augments the need to understand the diversities and sensitivities of our water resource system so it can be managed wisely.

Description: This presentation will focus on the planning process and results to date from a Canada-Ontario Water Use and Supply Project and its link to a broader basin-wide binational effort for the Great Lakes Basin. The primary objective of this Canada-Ontario project is to gain baseline information on water supply, use and demand at a sub-basin level, identify the ecological sensitivities of the system to changes in groundwater and surface water and make projections for the future including the potential impacts of climate change.

Application: The data, information and methodologies derived will give an overview and greater understanding of the status of the Great Lakes system with respect to its water resources and the sensitivities of the system on a sub-basin level and will be used to support the building of a sustainable framework for water management within the Canadian Great

Lakes Basin. The project is directly linked to a binational effort lead by the Great Lakes Commission to develop a Water Resources Management Decision Support System in support of Annex 2001 of the Great Lakes Charter.

Strengths: This project is a coordinated effort between Environment Canada, the Ontario Ministry of Natural Resources, the Ontario Ministry of Environment and Conservation Ontario, lead agencies in water management within the Great Lakes Basin. Working together, this project will create improved coordination with respect to data sharing, information exchange and competency building between the province, the federal government, and conservation authorities, and provide the data, information and methodologies needed for the development of a sustainable framework for water management within the Great Lakes Basin.

Capacity Needs: Information at a basin-wide scale is of insufficient detail to make regional and local decisions about the potential impacts of water withdrawals. Gathering all of the data and information required is beyond the capacity of any one agency. Consistent methods and standards for information and data collection need development. The data and information gathered needs to be incorporated into a meaningful framework that is accessible to decision-makers at various levels of government.

Key Words: surface water, groundwater, water management, water supply, water use, ecological sensitivities, Great Lakes, climate change

Spatial and Temporal Trends in Sediment Contamination in the Great Lakes

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Challenge: Contaminated sediments can be linked to the majority of impairments to beneficial uses in the Great Lakes and their associated Areas of Concern. There is evidence that sources and loadings in some areas of the Great Lakes Basin have decreased significantly since the advent of measure to reduce discharges. However, there is a paucity of contemporary data on lake-wide contaminant distributions. In recent years, a number of new contaminants of emerging concern have been identified, and information on their environment occurrence is required. In other cases, analytical methods have just recently evolved to a point where some contaminants can be accurately measured. Intensive lake-wide surveys encompassing bi-national jurisdictions require considerable infrastructure and are resource intensive.

Description: Environment Canada, together with its collaborating agencies, conducts lake-wide sediment surveys on a rotational basis. The most recent surveys were carried out in Lake Erie (1997), Lake Ontario (1998), Lake St. Clair (2001) and Lake Superior (2001). Both surficial sediments and core samples for the assessment of contamination with depth were collected and analyzed for a broad suite of contaminants. Contemporary spatial and temporal trends in sediment contamination will be presented for a variety of contaminants classes including polychlorinated biphenyls (PCBs), metals, polycyclic aromatic hydrocarbons (PAHs), and dioxins and furans.

Application: Information on the occurrence and spatial distribution of toxic substances furthers our understanding of the role human activities play in discharging chemicals to the environment, and can also serve as a benchmark in assessing contaminant discharge reduction strategies. Sediment contaminant levels can also be assessed against Federal and Provincial sediment quality guidelines for the protection of aquatic ecosystems. Sediment quality indices can be developed to enable categorization and ranking of sediment quality of broad geographical areas.

Strengths: Open-lake sediment quality data, when compared with sediment quality in Areas of Concern, allow for assessment of contaminated sediment issues within a regional context. Managers mandated with making decisions as to priority contaminant issues within watersheds can then use this information. Open-lake sediment quality data can also be easily integrated with information from other agencies that monitor nearshore environments and tributaries.

Capacity Needs: There is a need to commit to long-term research and monitoring of trends in sediment contamination in order to track progress toward the policies of zero discharge and virtual elimination. Coordination between Federal agencies in binational jurisdictions is needed to maximize the efficient use of resources and to avoid duplication of effort.

Key Words: Great Lakes, sediment, contaminants, management

The Environmental Effects Monitoring Program for the Pulp and Paper Industry — The Adult Fish Survey

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Challenge: The pulp and paper sector is one of the largest dischargers of liquid effluent into the Canadian environment. Research studies had indicated that some effluents were found to alter growth and reproductive performance of fish downstream of these effluents. There was a need for the development of a National monitoring program that evaluated the environmental effects of these effluents on the receiving environment.

Description: The Environmental Effects Monitoring (EEM) Program represented an industry-funded program that was designed to determine whether environmental effects might occur even when the facility was in compliance with existing pulp and paper effluent regulations. This presentation will focus on the wild fish results from the first two cycles of the EEM program.

Application: The Environmental Effects Monitoring Program has been successful to date for the pulp and paper sector, and has now been adapted for the metal mining industry. Results from these studies will be used to assess the existing regulations for each of the industries in terms of environmental effects in the receiving environment.

Strengths: The EEM program uses the responses of wild fish and benthic invertebrate communities to assess the effects of industrial effluents on the receiving environment. The wild fish responses have been compared to the benthic invertebrate responses and there was strong agreement between the two indicators of the health of the receiving environment. However, multivariate analyses also showed that each survey was describing different aspects of the environment and in this sense the two sections of the program were not redundant. Although studies are conducted on a site-specific basis, our National review of the results will be used to draw conclusions on the effects of these effluents countrywide.

Capacity Needs: Through the National EEM Office a national EEM committee and a science committee have been established to develop the program and to identify science needs and gaps. Although research is conducted by members of the science team to help advance the program, no dedicated research budget exists for refinement of the EEM tools which is clearly a capacity need for the program.

Key Words: Environmental Effects Monitoring, Pulp and paper effluents, Fish survey

The DPSIR Model — A Formula to Manage the Black Sea Coastal Ecosystem

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Challenge: The Black Sea ecological degradation has been a well-recognised environmental issue, the basin ranked among the most threatened water bodies in the World Ocean. Anthropogenic eutrophication, dramatic shift in biodiversity and communities structure, introduction of exotic species and over-fishing have been considered key ecological problems. The health control of the basin as related to the complex knowledge of interactions between physical, chemical and biological fields as well as to socio-economic drivers impose the need for better understanding of ecosystem performances and developing strategies for crisis management and policies for sustainable development.

Description: This presentation will focus on the architecture of an integrated socio-economic-environmental approach. The Driving Forces/Pressure/State/Impact/Response (DPSIR) indicator model has been recognized as the most appropriate way to structure environmental information for assessment of the ecological status of coastal marine ecosystems. The different phases of the application of DPSIR approach for the Bulgarian Black Sea coast are described. The selection of the parameters for each box of the model is presented, the emphasis put on the set of pressure/state descriptors and indicators in order to illustrate the essential role of environmental scientific expertise and knowledge for proper formulation of Black Sea ecological problems.

Application: The crucial role of the synergy of environmental, economic and social solutions is demonstrated for efficient environmental policy and public opinion adjustment to ensure sustainable perspective for the Black Sea coastal ecosystem.

Originally the water quality standards and regulations for the Black Sea basin, and the Bulgarian environmental legislation differed

significantly from that of the European. The enforcement of EU Water Directive impose the need for harmonisation with the EU regulations and standards, which has already been placed in the agenda of the Black Sea Action Plan, Black Sea Environmental Program and the Bulgarian Ministry of Environment and Water initiatives. At national level the proposed approach will help decision- and policy-makers to develop scientifically based strategies for reducing the effects of excess nutrients loads upon the ecosystem. The integration of stakeholders and policy-makers in this process will be a step forward to set-up a decision-support framework for combating the impact of eutrophication on the coastal sea as a part of the national strategy for sustainable development. At regional (Black Sea basin level) the study will serve as a “show-case” to assist implementation of the Black Sea Strategic Action Plan.

Capacity Needs: At regional level (Black Sea basin) the Joint ad hoc Working group between BSC and the ICPDR (1999) defined “the long-term objective is for all Black Sea basin countries to take measures to reduce nutrients to such levels, necessary to permit Black Sea ecosystem to recover to similar conditions as those observed in the 1960s.” At local level (Bulgarian environmental legislation) one of the key objectives is “to introduce new sectorial policies and legislation and a system of process, stress reduction and environmental status indicators for monitoring the effectiveness of measures to control eutrophication.” Thus to bridge science with policy and public awareness is a crucial step towards balancing economic development and coastal ecosystem functioning in a sustainable manner which is much of need of proper institutional building and setting an user-friendly information media in service of the regional and international scientific and socio-economic communities.

Key Words: indicators, coastal ecosystems, management, Black Sea

Managing the Catchment Area to Reduce Nutrient Levels in the Gulf of Riga, Baltic Sea

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Challenge: The Gulf of Riga (16,330 km²) is one of most eutrophicated areas of the Baltic Sea. The drainage basin exceeds more than eight times its size and is shared by 5 countries contributing to the joint pollution load to the Gulf. Increasing anthropogenic nutrient inputs under the former USSR reversed since the 1990s when both a collapse of the agricultural sector and essential upgrading of wastewater treatment facilities took place in the Eastern Baltic countries. Nevertheless, nutrient — particularly nitrogen — inputs to the Gulf via watercourses are still substantial due to loss of nutrients trapped in soils and because of transboundary pollution transfer. Co-operation in management of the shared large rivers Daugava and Lielupe by Latvia, Lithuania, Belarus and Russia is relevant to reduce pollution loading the Gulf of Riga.

Description: Trends in the long-term nutrient dynamics in the Gulf of Riga will be shown and the contribution of land-based and internal impacts will be discussed. Attempts to use budget modelling to quantify nutrient cycles and identify crucial biogeochemical processes in the Gulf will be demonstrated. The consequences of comprehensive international studies carried out separately within the watersheds of the Daugava and Lielupe River will be delivered in the context of both pollution transport and water management.

Application: The bilateral Latvian — Lithuanian Lielupe River Watershed Management Demonstration Project has been implemented under the Great Lakes — Baltic Sea Partnership Program. Before, Latvia and

Sweden initiated the Daugava Basin Project. As a result, a joint management plan for the Lielupe River Basin is prepared to be presented to stakeholders, and basin wide characterization of water quality and pollution sources is finalised for the watershed of the Daugava River.

Strengths: Present studies and achievements to understand the biogeochemical processes in the Gulf of Riga, factors controlling nutrient inputs to rivers as well as transport and modification of nutrients in watercourses and their estuaries favour treating the Gulf and its catchment area as a complex system. An integrated land use approach and water management should contribute to its safe functioning.

Capacity Needs: It is necessary to continue building up capacity for watershed management that aims to protect freshwater resources and their quality to provide long-term sustainability of the Gulf of Riga ecosystem and to meet simultaneously the EU Water Framework Directive. Only transboundary co-operation among the countries concerned warrants development of a successful river basin-oriented water management system. Also, further partnership programs with countries experienced in planning and implementation of sustainable management of freshwater resources and marine coastal ecosystems are of great importance.

Key Words: nutrients, watershed, Lielupe, Daugava, management, Gulf of Riga, Baltic Sea

North American Great Lakes: Coastal-Zone Management

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Challenge: A band of urban and industrial development, varying in width from a few kilometers to more than 20 kilometers, extends from about midway along the North Shore of Lake Ontario around the western end of the lake to the Niagara River on the south shore. This commercial and industrial heart of Canada, often called as Golden Horseshoe, is home of more than 4.5 million people (1996) or 15 percent of Canada's population, and includes the country's largest city, Toronto. The greatest impact of human activities, which effect even the largest lakes, occurs in the coastal zone.

Description: The coastal zone is an area of substantially different dynamic characteristics from the open lake. The coastal zone is generally considered to extend to about 10 to 15 kilometers offshore. The paper focuses on the operational and integrated approach to manage coastal zone of Great Lakes.

Application: The characterization of physical processes in the coastal areas of Lake Ontario is essential for sustainable use of fresh water resources, and dispersal of pollutants.

Strengths: This paper specifically addresses the limits of compatibility for water resources and sewerage outfalls in high activity areas through well documented experimental data and results and modelling.

Capacity Needs: Population and development estimates predicted that by the year 2011 western Lake Ontario region requires enhanced capacity of wastewater treatment facilities. In order to maintain the permissible effluent quality, an outfall has been proposed to be installed in the lake. This study aimed at providing the basic physical limnological processes and impact of the proposed sewage outfall in the western Lake Ontario. These are essential for developing an integrated approach towards the coastal zone management.

The Environmental Issues of the Georgian Bay Association

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Challenge: Water levels in the Great Lakes have a natural fluctuation and depending on the amount of anthropogenic influence the amount of fluctuation varies from one lake to another. Georgian Bay is part of the middle lakes system and as such has no control structures at its outflow. However, Lake Superior and Lake Ontario have major control structures at their outflow. The channels connecting the lakes are dredged by international agreement to a depth of 27 1/2 feet to maintain the Seaway channels.

However the water levels in Lake Huron/ Georgian Bay after approximately 30 years of above average levels suddenly over a three-year period dropped approximately 5 feet. The most immediate impact was in the enclosed protected bays where marinas had docks that were high and dry. The governments waived the normal approval process and allowed "emergency dredging." In some cases this allowed fine silt and clay to disperse in the water over large areas. Since many of our members had water intake pipes that were clogged and were unable to drink the water even if treated as the fine silt or clay could pick up heavy metals like lead or manganese we were asked to take a look at the immediate problem. In working with scientists we also realized that the impact of the low water levels on wetlands scattered along the rocky shorelines was dramatic.

Description: This presentation will focus on the actions taken by a volunteer not for profit organization with assistance from a charitable foundation and two universities. We will use leading edge technology to indicate change over time of wetlands to grass meadows. When aquatic life is forced out of a wetland adjacent to the granite shield, they cannot find similar suitable habitat on the steep granite shorelines.

It will involve the comparison use of overheads of colour air photographs, black and white historical air photos and satellite imagery (1 meter colour Ikonos satellite). We also have a 9 ft by 6ft colour printed satellite imagery of 100-square km. showing significant shoreline and wetlands.

Application: We will demonstrate impacts of low water levels on wetlands and the lack of government resources to deal with these issues. This imagery has been used to influence government decisions at local municipality, provincial, federal and international levels. We have partnered with Nipissing University and the University of Western Ontario on our wetlands research project and we will share that information.

Strengths: This will demonstrate the ability of volunteer stakeholders raising their own funds through its own charitable arm to effectively carry out important ecological monitoring and identification of problem work with limited funds to be used for planning and management processes at all levels of governments.

Capacity Needs: There has been virtually no wetlands assessment work done in Georgian Bay by any government agency. (I recently received a request from a university professor in the US who is doing wetland research for the Lake Huron Initiative and tried to get to Georgian Bay wetlands last summer to do some work but is now asking for our help. He heard me speak at the Lake Huron Workshop where I outlined our research.) This has resulted in very little wetland classification by government agencies to aid in key planning decisions. The establishment of partnerships between government agencies and stakeholders is the only way to solve these problems.

Study of the Water Quality on the Central Venezuelan Coast and its Relation with Human Health — Present Situation and Perspectives

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Challenge: The Central Venezuelan Coast Zone was severely damaged by flooding and torrential rains fallen on December 1999. Those rains and flooding changed dramatically the beach's morphology, bringing poverty and death to its inhabitants. The sewers water system has become a fundamental problem, mainly because it hasn't been repaired in most areas. Local inhabitants and tourists have no idea about the effect of those polluted waters in their health. Swimming areas, even though, have been prohibited by the Health Ministry, show full concurrence at holiday festivities. Skin infections, gastroenteritis, conjunctivitis, are some illnesses that affects swimmers. Really no formal study has been done about this subject, but only there are press releases. The fundamental idea of this project is create awareness in the people about the importance of cleaning the coast at environmental level and its direct benefits for swimmers health, tourism industry and economic reactivation. Also this project plans to request, through the newly educated communities, the government to recuperate all coastal waters.

Description: This study will approach the different communities, stating the problems that represent the sea usage for human health, its use for recreation or as a food source. Scientific research will be conducted for determining the water quality, the illnesses in swimmers, local inhabitants, as well as fisherman. Workshops will be conducted in all the communities explaining in full detail the project so they can give their full cooperation.

Application: Through workshops the results will be given to all the different communities, so that they can understand the relevance of having good quality of water, and using the strength of all the communities to demand the canalization of sewer water according to international rules, and the implementation of long run policies for the compliance of those rules.

Strengths: Through this scientific research the relation between sea water pollution, health, inhabitants and beaches will be corroborate. It will educate the population on conservationism and sustainability. Pressure the national government for cleaning and maintaining the coast at the present and the future.

Capacity Needs: Relate this Scientific Research with education, health, conservation, environmental engineering, and local government with the purpose of solving the sea water quality problem in the Central Venezuelan Coastal Zone and reactivating its economy, for elevating the quality of live of its inhabitants.

Key Words: water quality, water pollution, sustainability, education, health

Terrestrial Natural Heritage Strategy for the Toronto and Region Conservation Authority

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The Toronto and Region Conservation Authority (TRCA) is designing a methodology for reporting on the function of the total natural cover of a region as a unit rather than on the locations of “significant sites.” It also pays attention to species before they become rare. Twenty measures are reported on using information collected at the landscape, vegetation community and species scales. This is part of a Terrestrial Natural Heritage Strategy for the TRCA jurisdiction. The Strategy will include targets for a desired terrestrial natural system based on the amount, distribution, configuration, and surrounding land use of the natural cover. The Strategy aims to assist decision-makers and other stakeholders in prescribing change rather than reacting to it.

The TRCA jurisdiction abuts Lake Ontario and supports freshwater coastal habitats including dynamic sand beaches and dunes, and coastal wetlands. Communities are mapped according to the Province’s Ecological Land Classification (ELC) System, and species of flora and fauna are mapped according to TRCA ranks for sensitivity. A landscape analysis evaluates individual patches according to size, shape and land use influence. A connectivity measure is being developed as an important factor for plant populations along urban waterfronts. The findings will provide a focus on these coastal ecosystems along the Lake Ontario waterfront while contributing to the overall TRCA strategy. The measures will quantify the coastal findings in the context of the broader region and will be used in monitoring the implementation of strategies.

Coastal Erosion Processes at Ceará State, Brazil

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Challenge: The Ceará State coastal zone, Northeastern Brazil is now undergoing a series of erosion and silting problems both from geogenic and anthropogenic action. This is an area very looked after for tourist purposes which together with the new developments such as harbors, marinas, resorts, create problems statements. This involves native community, second residence, the environmentalists and challenges to governmental authorities which try to improve the regional economy. This is a strategic region as it is almost equidistant from Europe, USA, Africa, Argentina and West South America countries.

Description: This presentation will envisage two sets of study cases focusing the planning, installation and implementation of equipment over the last decades. It has been made a comparison between them and the present ones, throughout the shoreface behavior before and after these events. The natural geologic/sedimentary processes that are causing degradation and silting up are as well considered. The first study case besets the geogenic cases dealing with morphodynamic aspects of the cliffs and tabular features. The second study case refers to the new construction, installation and implementation of equipment leading to progressive events which aside the geophysics and geologic framework modifies the local scenario.

Application: It has been made a great deal of efforts to keep up with the erosive processes and how they are being transferred westward of the area. That is why during the last two years the study of wave climate, longshore currents and sediment transport evaluation were the main tools for ascertaining measures to prevention new degradation and mitigate those in progress. The Pecem harbor has just been implanted and is now planned its Industrial Complex which has arisen many discussions on the reality of localization and proper functionality.

Strengths: These processes have been focalized trying to make this coastal system more understandable under the point of view of practical works headed by entrepreneurs. At the same time it was an excellent manner of training graduate and post-graduate students and make them aware of the risks the population is undertaking.

Capacity Needs: The results and issues would reunite environmentalists, government and private promoter or organizers of an enterprise, scientists and technicians to work out a rational and adequate way of taking advantage of comprehension of these processes and consequently avoid waste of money, time, efforts and reach objectives in agreement to all of them and the environment.

Key Words: coastal ecosystems, management, erosion and silting, rehabilitation

Energy Metabolism during Environmental and Functional Stress of the South African Abalone *Haliotis midae*

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Abalone exposed to air incurred greater metabolic and structural stress in muscle than does abalone at rest. Since foot and shell adductor muscles texture and flavor affect economic values of *H. midae* the investigation sought evidence of differences attributable to transportation of the commercial South African abalone based on environmental and exercise inducement. This study was prompted by a conspicuous lack of information on biochemical aspects of *H. midae* during transportation. This paper then examines biochemical effects of transportation stress in live perlemoen, *H. midae*, shell adductor, foot and gill muscles under conditions designed to simulate those

experienced when live animals are air-freighted to overseas markets. During exercise, energy for muscle contribution was provided by the breakdown of arginine phosphate and glycogen. The adenylate energy charge did not show a significant decrease after energy exercise. Exercise caused a significant decline in arginine phosphate ($p < 0.01$). The energy demand was high and ATP was reduced, energy charge drastically decreased in the tissues. Besides glycogen, energy derived from the breakdown of arginine phosphate was used during simulation transportation, resulting in increases in arginine concentration in the shell adductor, foot and gill tissues.

Canadian Climate Impacts and Adaptation Research Network (C-CIARN) Focusing on adaptation to Climate Change along Great Lakes Shores

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Challenge: The purpose of the Canadian Climate Impacts and Adaptation Research Network (C-CIARN) Coastal Zone Sector is to develop a network of researchers and stakeholders who will improve our understanding of the vulnerabilities of the Canadian coasts to climate change and will identify the most significant impacts and adaptation options to future changes. A previous workshop dealing with these aspects highlighted the differences in physical character, natural processes, climate impacts and human pressures that exist between the four coastal regions of Canada, namely the Atlantic, Arctic, Pacific and Great Lakes. All of these regions include an international trans-border coastal area. The challenge for this session is to bring together people from both sides of the border who live or work on, and research or manage the Great Lakes shores to address the issue of responding to climate change.

Description: The session invites all persons who wish to participate in and contribute to the coastal impacts and adaptation research network. A list of potential impacts from climate change for the coastal zone of the Great Lakes will be presented for review. Canadian and American perspectives for adapting to these impacts along the shores of the Great Lakes will be presented by invited speakers followed by an open discussion on the strategies; associated knowledge gaps and implications of these strategies on other nearby or distant shores.

Application: The development of a network of contacts involved in climate change impacts and adaptation research and improved communication between these groups and individuals working, living, and managing the

coastal zone of the Great Lakes. A summary of discussions and recommendations from the session will be incorporated into the annual C-CIARN report to the Canadian federal government. The report will include a revised list of the impacts of climate change; the advantages and disadvantages of specific adaptation strategies and the priorities for future research. The report will be made available to potential funding agencies, monitoring and research organizations, public policy makers and concerned citizens.

Strengths: Potential impacts of climate change may be similar along both American and Canadian shores but adaptation options may be quite different. We propose that it will be more efficient to coordinate research activities related to climate change impacts and adaptation in the coastal zone. This approach will lead to a greater understanding of regional variations in vulnerabilities within the Great Lakes and will produce a richer variety of adaptation solutions. Establishing a common list of researchers and research priorities helps to identify and strengthen the need for action and will provide funding agencies with information they need to better focus their programs. The results will also be used in future workshops concerned with similar issues along other trans-boundary coastal areas of Canada.

Capacity Needs: The discussions will promote a network of researchers, policy makers and citizens concerned with climate change impacts and adaptation within the Great Lakes. Collaborative research will be promoted and funding agencies made aware of future research priorities related to impacts and adaptation to climate change in the coastal zone of the Great Lakes.

Development of Fathead Minnow Lifecycle Tests for Detection of Reproductive Toxicants in Effluents

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The goal of this study was to assess the use of fathead minnow full lifecycle assay for detection of known endocrine disrupting substances (EDS). As well, we wanted to determine whether this assay could detect reproductive effects on fish from exposure to potential weak EDS mixtures, such as pulp mill effluents. Fathead minnow eggs exposed to ethinylestradiol (EE2, 0–32 ng/L) or methyltestosterone (MT, 0–3.2 mg/L) in a flow-through exposure system showed dramatic changes in growth (length, weight) of fish at high concentrations. Changes were seen as soon as 30 days post-hatch, however the most sensitive indicators of reproductive change required full lifecycle exposures (150 days post-hatch). Egg fertilization was one of the most sensitive indicators, and was reduced in fish exposed to the lowest concentrations of EE2 (0.32 ng/L). Juvenile fish exposed to EE2 showed similar changes in fertilization success, but effects were not as dramatic as fish exposed for an entire lifecycle. Development of secondary sex characteristics was also a very sensitive indicator, with 30 day-old fish exposed to MT showing premature male sex characteristics such as tubercles. These changes were more dramatic in older fish (at 60 and 90

days post-hatch), which showed premature male sex characteristics at very low MT concentrations (32 ng/L). Physiological alterations at 150 days (changes in liver size, gonad size, fecundity) and sex ratios were less sensitive, with changes seen about 3.2 ng EE2/L. The assay, developed with known EDS, proved to be useful for detection of reproductive changes caused by real-life effluent mixtures. Lifecycle exposures of fathead minnow eggs to bleached sulphite mill effluent (BSME) showed the most sensitive endpoint to be egg laying (which was reduced in 10 % effluent and above). Changes in secondary sex characteristics, growth, and physiological changes were also seen. The full lifecycle assay provides a definitive test for reproductive/EDS effects, but it is a lengthy procedure. Shortening the test has been possible by using juvenile fish and following them to adulthood, as the most sensitive indicators that we have examined have been sex characteristics and reproduction. However, the trade-off for the shorter tests is a decrease in sensitivity.

Key Words: Fathead minnow, endocrine disruptor, pulp mill effluent

Ecological Risk Assessment of Contaminated Sediments at Lake Erie Areas of Concern

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Challenge: Within the last ten years through efforts of Remedial Action Plans (RAPs) and natural remediation, significant changes have occurred at several harbors, tributaries, and at the Areas of Concern (AOCs) on Lake Erie. Few studies have attempted to identify changes in sediment contaminants or impacts on fish populations. This information is necessary to evaluate use impairments of these AOCs for benefit of humans and ecological communities. A re-evaluation would help to ascertain if remedial activities and reductions in point source loading at several of the Lake Erie harbors and/or river systems have been successful.

Description: This presentation will focus on a multi-agency study to re-evaluate sediment contaminants and status of fish health and fish and invertebrate communities at Lake Erie AOCs. Lake Erie Ecological Investigations (LEEI) evaluated contaminants in sediments at Areas of Concern and reference sites in the Lake Erie basin. We applied ecological risk assessment techniques, including probabilistic risk assessment, to identify those contaminants posing a potential risk to the aquatic biota.

Application: Our ecological risk assessment of exposure and toxicity endpoints for Lake Erie AOCs determined the certainty of exceeding threshold effects concentrations for sediment toxicity at the nine AOCs and two reference sites for metals and several industrial chemicals, particularly PAHs. Sensitivity analysis showed those contaminant groups having the greatest impact on fish and invertebrate community biotic indices. Internal and external fish health measurements on brown bullhead were assessed against sediment and bile contaminants.

Strengths: This study determined that sediment contaminant levels and incidence of abnormalities in brown bullhead have generally decreased at the Black River, OH, a site highly contaminated with PAHs, since remediation. Probabilistic risk assessment provides predictive capability for biological improvements resulting from attainment of contaminant remediation. The tools developed in this investigation can be applied to AOCs throughout the Great Lakes and other aquatic areas.

Capacity Needs: Probabilistic risk assessment utilizing the suite of biological indicators in this study enables decision makers to make choices about levels of remediation to evaluate against costs of these remediation options. The Lake Erie Ecological Investigations provided a model of inter-institutional cooperation to attain goals of importance to managers and researchers in the Great Lakes.

Key Words: Lake Erie, Areas of Concern, Monte Carlo analysis, fish health

Black Sea: Problems, Needs and Potential for Coastal Zone Management

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Challenges: The Black sea is the largest meromictic water body on Earth, with great anthropogenic impact from many sources in European countries. The catchment basin of the Black Sea is over two million square kilometers covering 23 countries and about 162 million people in Europe and Asia Minor.

Controversy of social, economical and political interests of the six bordering countries (Romania, Bulgaria, Ukraine, Russia, Georgia and Turkey) is strengthened by the complexity of rapid intensification of use of natural resources.

A pollution level of the Black Sea exceeding the assimilating abilities of the sea ecological system, introduction of alien biological species, utilization of the natural sea resources in a volume exceeding their potential, etc., have during the last thirty years brought about great changes in the natural conditions of the seas.

Efforts are also being made to reduce the current levels of over-fishing and destructive fishing practices which, some experts claim, have seen catches in the Black Sea drop by a third from 814,000 tons in 1986 to some 523,000 tons.

Description: I will present environmental issues concerning shelf and coastal zone of the Black Sea and address interests and strategies of various stakeholders. Special attention will be given to the assessment of changing ecosystem parameters, such as biological components — benthos and plankton, water quality, aliens invaders and their impact on sea ecosystems and human activities.

Application: The concept of a sustainable development and research of coastal zone in Black Sea region should be a background for the ecological management strategy. One of the most important parameters is the ecosystem stability, whose changes are significant. The changes of the key ecosystem components may lead to the catastrophic transformation of sea nature and resources. Scientific monitoring of these components (key species ability and diversity) will benefit interested parties in all Black Sea nations.

Strengths: Catastrophic changes in environmental situation of the Black Sea have been studied by implementing complex and long-term researches, including studies of potential aliens species and their targets in the Black Sea.

Capacity Needs: Setting of relevant operational system for co-ordination of the activities of research institutions, decision- and policy-makers, municipalities, private sector and NGOs to better put their capabilities at the services of the ecological, social and economic needs of the region in conformity with the interests of Eastern Europe as a whole.

Key Words: ecosystem changes, shelf and coastal zone, management, environmental conditions, Black Sea

Do Physical Processes Control Taste and Odour in Lake Ontario?

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Challenge: During the late summer months drinking water from Lake Ontario is susceptible to earthy taste and odour (Tb). Although it is considered that this problem is non-toxic to humans, taste and odour of drinking water undermines consumer confidence and costs the water industry millions per annum. This water quality problem is detectable at low levels and is difficult to treat. The taste and odour is caused by geosmin, a secondary metabolite of Cynobacteria and Actinomycete bacteria. Based on evidence of geosmin concentrations and water temperatures at the intakes it was hypothesised that geosmin is produced in warm offshore waters and transported to the nearshore areas by down veiling circulation in the lake.

Description: In 2000 an intensive field investigation in the western end of Lake Ontario was undertaken to gain new information about the source and distribution of geosmin. As part of the investigation, current meters and temperature sensors were deployed at several water treatment plant intakes. A land based tower at Toronto Island Airport provided hourly wind speeds and directions from August 1 to September 30, 2000.

Application: The temperature variations along the north and western shores of Lake Ontario were found to be strongly linked to the winds from westerly directions causing upwelling and easterly winds inducing downwelling and warming of coastal waters. The strong and persistent winds from easterly directions on August 26, 2000 caused downwelling along the north shore and upwelling along the south-western shore of the lake. Satellite images during this period also showed a strong downwelling along the north shore and upwelling along the south shore of Lake Ontario. This wind driven circulation supports the hypothesis that geosmin was transported from offshore surface waters to the coastal waters along the north shore of Lake Ontario during taste and odour episodes.

Strengths: These insights about the physical mechanisms represent significant progress in this complex problem.

Development and Application of Ecosystem Health Indicators in the North American Great Lakes Basin

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Challenge: Assessing the health of the Great Lakes basin ecosystem is a significant challenge. The Lakes themselves contain one-fifth of the world's fresh surface water with over 17,000 kilometres of shoreline. The Basin consists of over 520,000 square kilometres of land with about 331 million people living there. The Basin (including the St. Lawrence River) is governed by two nations, eight states, two provinces, and hundreds of municipal and local governments. A set of Great Lakes Basin ecosystem indicators will enable the Great Lakes community to work together within a consistent framework to assess and monitor changes in the state of the ecosystem. Data collected through various government and non-government programs can be analysed, interpreted, and ecosystem health information characterized within a series of such indicators. A consensus by environmental management agencies and other interested stakeholders about what information is necessary and sufficient to characterize the state of Great Lakes ecosystem health, and to measure progress toward ecosystem goals, will facilitate more efficient monitoring and reporting programs.

Description: This Special Session will focus on the process of developing a list of ecosystem health indicators through the State of the Lakes Ecosystem Conferences, and will provide examples of results for several of the indicators.

Application: The purpose of the Great Lakes Water Quality Agreement (GLWQA) between the United States and Canada is "to restore and maintain the chemical, physical, and biological integrity of the waters of the Great Lakes Basin ecosystem" (United States and Canada, 1987). The two countries have spent billions of dollars and hundreds of thousands

of hours attempting to reverse the effects of cultural eutrophication, toxic chemical pollution, bacterial pollution, over-fishing, habitat destruction, and introduced species, and to prevent future problems from arising. Environmental and natural resource management agencies are now trying to demonstrate that past remediation programs have been successful, and that the results of future or continuing programs will be positive and proportionate to the resources expended (financial and personnel time). The reporting of information on indicators, on a regular basis will enable decision makers to assess their programs and modify as needed to advance further the restoration and maintenance of the Great Lakes Basin ecosystem.

Strengths: Much work has been carried out on indicators both within and outside the Great Lakes Basin. The indicator work being described in this session was built upon the work of many organizations and individuals. Regular reporting of indicators will provide decision makers and the general public with easily understood information on progress on the Great Lakes Water Quality Agreement.

Capacity Needs: There is a need for monitoring in a number of areas (wetlands; terrestrial nearshore areas, land use) as well as expanded monitoring to ensure adequate geographic coverage for those indicators for which monitoring already is in place. Management of the data and information generated through an indicator reporting program is a major challenge facing both federal governments as well as the states, province, and other involved parties.

Key Words: indicators, Great Lakes, monitoring

The Estrogenic Effects of Hamilton Harbour Water on Rainbow Trout (*Oncorhynchus mykiss*)

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Challenge: Hamilton Harbour is highly impacted by industrial and domestic waste. It receives sewage treatment plant (STP) effluent from several communities including the cities of Burlington and Hamilton. There has been much recent concern over the potential estrogenicity of some components of STP effluents including natural estrogens and the alkylphenols and their degradation products. After some initial controversy it is now accepted that induction of the egg yolk precursor vitellogenin (Vg) in male or immature fish can indicate exposure to an estrogenic chemical. Substances or conditions that cause a fish's hormonal balance to become skewed in favour of estrogenicity could have a similar effect.

Description: The presentation will focus on the ability of Hamilton Harbour waters to induce vitellogenin (Vg) in juvenile fish. Vg was measured by ELISA. The induction of Vg in rain was confirmed by measurement of mRNA and by gel electrophoresis.

Application: In the first of three studies, rainbow trout were caged at six sites in Hamilton Harbour and Lake Ontario. Vg was measured in fish caged at sites in the Windermere Arm of the harbour. Those sites are within the zone of influence of Hamilton STP effluent and of several large industrial sites. In a second study, a group of rainbow trout was caged in the effluent mixing zone of the Burlington STP and another group was

concurrently exposed to a dilution series of effluent from the Burlington STP in the laboratory. Vg was induced in the laboratory exposed fish by 50% effluent, but not in the field exposed fish. In the third experiment, *in vitro* tests were used to trace the estrogenic potency though the Windermere Arm of the harbour and along the Red Hill Creek which feeds into it.

Strengths: The biological tools that we describe are cost effective, sensitive, reasonably rapid, and robust. They can be applied in other environmental scenarios to assess the estrogenic potency of wastewaters and contaminated sediments, for example. They can also be used to monitor the effectiveness of remedial action at areas of concern.

Capacity Needs: Providing the tools and tests needed to assess the potential of environmental estrogens and complex mixtures of chemicals to affect fish. Providing policy makers with sound data that will facilitate science based assessments of the extent of exposure of the biota to endocrine disrupting substances. Expansion of the tests to include other indicators of the possibly harmful sublethal effects of EDS and other chemicals of concern such as pharmaceuticals that can find their way into the aquatic environment.

Key Words: Hamilton Harbour, vitellogenin, sewage treatment plant effluent effects

Determination of the Most Sensitive Tree Species Against the Pollution Stress in the Southern Region of Iran

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Following the January 1991 war of Iraq against Kuwait, huge amounts of atmospheric pollutants were distributed in the region. Research conducted by international agencies and regional and national institutes have shown the extensive distribution of smoke and soot over the Persian Gulf and countries surrounding it. According to studies based on analysis and processing of about 1267 NOVA AVHRR satellite pictures, about 35% of the total atmospheric pollutants resulted from burning of 1 billion barrels of Kuwait oil had penetrated over Iran's territory. Additionally, oil pollution was received by mangrove forests and other trees in coastal areas. This study was conducted in order to test and to develop an enzymatic capable method of tracing specific pollution stress and looking for the most suitable tree species for similar studies.

Physiological equilibrium of organisms is regulated with enzymes as biocatalyst. In this research qualitative and quantitative enzyme studies have been done (PAGE method) on different tree species with 5 replicates as follows: *Avicennia marina*, *Acacia nilotica*, *Dalbergia sisoo*, *Pistacia atlantica* var. *mutica*, *Prosopis cineraria*, *Tamarix aphylla* and *Ziziphus spina-christi*. All of them have shown the enzymatic stress qualitatively and quantitatively. Results show that there is a wide range of reaction against the pollution stress, but it seems that *Ziziphus spina-christi* and *Avicennia marina* are the most sensitive species for this case of studies.

Assessment of Soil Water Erosion in Middle Mountains of Nepal on Catchment Scale Using GIS-based Models

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Challenge: Nepal is a mountainous land locked country with various altitudinal climatic regions. Slope steepness causes erosion problems in many regions of Nepal. In addition, over 90% of the mid-hill population of Nepal is composed of farming communities who reside in a very harsh topographical area, where soil loss is a big threat to their livelihood as Nepal is losing lots of lives and properties every year.

Description: This presentation will focus on the use of GIS based models to assess the soil erosion loss from the middle mountains of Nepal. Country being inaccessible and lack of sufficient fund to carry out the research in the context of soil erosion and landslides, the option of using models seems quite important. Research was carried out in the Jhikhu river basin (Watershed) of Nepal to test the suitability of the models.

Application: Major issue was to measure the soil loss from the Middle Mountains of Nepal, as it is one of the key factors causing loss of lives, production and properties. Identifying the risk zones so that proper prediction and management practice could be carried out. For this, Morgan, Morgan & Finney, Limburg Soil Erosion Model and Sediment Transport Model 2D were used.

Strengths: This study was one of the supportive works done in the sector of soil erosion and landslides in Nepal. Several organizations viz. JICA (Japan International Cooperation Agency), ICIMOD (International Center for Mountain Development) are working in this sector. This research work is one of the initiatives in this sector in Nepal.

Capacity Needs: Basic research, training and education are needed in the sector of Watershed and land use management. Inappropriate land use pattern in the harsh topography due to lack of knowledge need to be focused and in this line basic research and management based on the public private partnership has be brought in front. Community participation needs to be facilitated by supportive research. Emphasis on establishment of National Center for Research on Soil Erosion and Landslides (NCRSEL) has to be given.

Key Words: models, landslides, erosion, watershed

Relation of Reproductive Biomarkers in Brown Bullhead and Contaminated Sediments from Lake Erie Areas of Concern

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Challenge: Sediment contamination has been shown to be responsible for external and internal abnormalities in brown bullhead at Areas of Concern on the Great Lakes. Removal or other remediation processes may reduce the extent of anomalies; however, possible reproductive impairment from exposure to these sediments is not known.

Description: Endocrine biomarkers may be altered when fish are exposed to contaminated sediments that may be estrogenic or androgenic. We have been able to show correlations with exposure to PCBs and other organochlorine compounds and increased concentrations of the precursor to the egg protein (vitellogenin) in male fish. Other endocrine biomarkers include 17 Beta estradiol and 11-ketotestosterone. These parameters are measured in plasma from blood drawn from live fish and analyzed using RIA and ELISA techniques to evaluate exposure and potential reproductive impairment of male and female bullhead to contaminated sediments.

Application: Endocrine biomarkers in key indicator species, like brown bullhead, should be measured as part of monitoring efforts to determine if exposure to contaminants may impact the reproductive potential of resident fish. Other fish species in Areas of Concern in the Great Lakes Basin as well as other coastal locations where toxic contaminants are of concern may also utilize these procedures to look at ecosystem health. Other reproductive biomarkers are also being used at locations with elevated contaminants.

Strengths: The potential for reproduction of indicator species may susceptible to alteration. The reproductive potential of key recreational or commercial fish species that reside in areas with similar contaminant exposure may also be jeopardized. Analyses of the endocrine biomarkers may be utilized by decision-makers and managers to identify impacted areas and make more informed decisions for remedial action plans

Capacity: Use of the low cost biomarkers at locations with and without biological monitoring efforts is needed for assessment and for the decision making process. The biomarkers are critical to understand and link management and science to make the best management decisions.

Mapping the Gulf of Maine: Building the Link Between Marine Geology and Benthic Habitat to Improve Ocean Management

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Challenge: Off the Atlantic coast of North America, Canada and the United States share jurisdiction of the Gulf of Maine. This “sea within a sea” measures almost 91,000 square kilometres in size and has an average depth of 150 metres. The gulf exhibits a complex bathymetry of banks, basins, channels and ridges which reflect its geological history. The Geological Survey of Canada and the US Geological Survey have a long-standing legacy of marine geological studies in the gulf. Over the past five years, an integration of geoscience and marine biological information has led to a greater understanding of the diversity of benthic and pelagic habitats. Ocean management necessitates encapsulating this knowledge in the form of geological and habitat maps extending over the entire gulf.

Description: This presentation will highlight a new collaboration between researchers and managers entitled the Gulf of Maine Mapping Initiative (GOMI). GOMI has the ambitious, but very practical goal of mapping the entirety of the Gulf of Maine basin. This transboundary effort, initiated by the Gulf of Maine Council for the Marine Environment, will link the capabilities and expertise of the regions private and public sector with the immediate needs of coastal managers. In addition to undertaking extensive seafloor mapping utilizing a range of the latest technologies, this project will develop a suite of digital mapped products addressing the interests and needs of different end users. Visualization technologies will be employed to assist users in understanding the complex data.

Application: Detailed maps of bathymetry, sediment and habitat in the Gulf of Maine will provide a context for existing, ongoing and planned (Census of Marine Life) physical and biological oceanographic studies. This coordinated mapping effort and the resulting map products will enhance the research, management and private sectors in the Gulf of Maine. An increasing array of human uses of the Gulf of Maine including: oil and gas development, gas pipelines, fiber optic cables, aquaculture, commercial fishing, and wind power have accelerated the need to better understand the location, extent and sensitivity of ocean habitats. The regions interest in designating marine protected areas as well as federal concerns regarding national security will also be well served by this project.

Strengths: GOMI’s strength lies in the collaboration between researchers and managers as well as between the private and public sector. Additionally, the transboundary aspect of this project taps the enormous technical capacity on both sides of the border. Regional collaboration on GOMI will clearly result in cost savings, efficiency, and mapping standardization.

Capacity Needs: The GOMI project most directly addresses the capacity theme of “measuring and understanding coastal ecosystems,” specifically, through the development of tools and technologies to collect, and assess data, and manage them for effective decision-making.

Keywords: habitat mapping, Gulf of Maine, transboundary, regional seas

Tools for Great Lakes Stream Management at Multiple Spatial Scales

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Challenge: Ecosystems are organized hierarchically with large-scale features such as geology, topography, and climate limiting or determining finer-scale features such as channel form, structure, riparian conditions, and biological composition. Management of these systems can and should reflect that hierarchical reality. Tools that can determine the likelihood that a proposed development will cause an adverse ecosystem effect are required for ecosystem assessment and management.

Description: The Ontario Ministry of Natural Resources (OMNR) has recently developed a number of protocols for characterizing general biophysical attributes of streams. Biophysical criteria relevant to regional analyses of aquatic habitat were adapted from earlier work applied in large parts of the Great Lakes basin.

Application: Protocols relevant to data collection at various spatial scales were developed to enable characterization of site-level and landscape features influencing aquatic habitat. Data collected through the implementation of these protocols enabled us to identify relationships between biota and habitat features at various spatial scales.

Strengths: Comparing relationships between the site level biota, habitat and the landscape features at “reference” and “test” sites allowed us to characterize deviation in biophysical relationships from expected values owing to various types of ecosystem impairment. By plotting the measures of disturbance against the deviation from expected values we identified thresholds of change. These thresholds provide targets for managers, enable predictions of impacts and guidelines for a system response to ecosystem protection and restoration.

Capacity Needs: Spatially extensive and intensive biological and physical data are required for regional analyses. Ideally these data should be collected using comparable effort, methods and techniques. Mobilization of such data will support aquatic resource management efforts at various scales in the Great Lakes basin.

Key Words: ecosystem hierarchy, biophysical relationships, aquatic resource management, Great Lakes

Towards Ecosystem-based Measurement for Transboundary Watersheds in the Georgia Basin-Puget Sound Region

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Managing ecosystems that straddle political and particularly national boundaries can benefit from the development of common, or at least compatible, data and indicators. In addition to assisting in coordinated management strategies, transboundary reporting can also help to bring key, shared environmental issues and their causes to public attention.

The quest for coordinated monitoring and reporting is not new to Canada and the United States, but is relatively new in western North America, and there was initially only limited capacity to bring such information together. A three-year process that began with a substantial list of candidate indicators recently resulted in a first set of six Georgia Basin/Puget Sound Transboundary Ecosystem Indicators, with a publication and web site, released in April 2002. Perhaps the most important aspect of the project, however, is not the product, but rather in the process that had to be undertaken, and the lessons learned in overcoming the challenges to reporting within a transboundary, ecosystem approach.

During the past decade, there has been a considerable amount of indicator development, including interest in both standard environmental and broader sustainability indicators at all levels of government (national, provincial, regional/county and local). There are a number of ongoing pilot and functioning programs in both the Georgia Basin of British Columbia and the Puget Sound Region of Washington State. However, there had been only a few, tentative attempts to draw data together across jurisdictional boundaries.

There is general agreement on the main issues in the area, and even, to some extent, on how to measure and report on progress, but the capacity to develop a common set of indicators, that could be reported side by side, faced many hurdles. These included:

- Different and often incompatible approaches to all aspects of environmental monitoring, from the design of monitoring systems to parameters measured, time frames, analytical techniques used, and the definition of issues;
- Different institutional or governance goals, needs and responsibilities;
- Different legal frameworks on which management needs and monitoring are based;
- Different cultural contexts on both sides of the border;
- Low priority for a transboundary approach, especially for the state and provincial governments whose mandates are more constrained by national borders and subjected to increasingly scarce resources.

The completion of this first report has resulted in a much better understanding of organizational, political and technical hurdles that have to be overcome as a basis for ecosystem based management in the region. The challenging of conventional approaches and the development of working relations across organizations have inspired those involved to break down barriers to transboundary management of ecosystems that see no boundaries. There was also a conscious effort to see the indicators in a broader context, with concern for both past and future implications of environmental stresses in the face of continued growth in the primary causal factors: population and urban development.

Perhaps as important as the technical solutions, however, was the generating of the institutional capacity among scientific and policy colleagues, to work together in the interest of environmental protection and sustainability on both sides of the international boundary and effective working relationships among the federal, provincial, state and regional organizations involved.

Durham Region Coastal Wetlands Monitoring Project: A Cooperative Program to Monitor Coastal Wetland Health

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Challenge: Great Lakes wetlands are dynamic and complex ecosystems. Located at the intersection of land and water, they support a variety of essential ecological, social, and economic functions and values, including flood control, water quality improvement and provision of wildlife habitat. A healthy wetland effectively provides many of these values. As wetlands are degraded by human activities, their ability to provide these important functions is also impaired. Coastal wetlands located on the north shore of Lake Ontario, within the Regional Municipality of Durham, have been degraded through time in a variety of ways, and are under continued pressure due to population growth associated with the Greater Toronto Area. Maintaining key wetland functions and values in the face of rapidly urbanizing watersheds presents a formidable management challenge.

Description: This presentation will focus upon the process of developing a cooperative program for monitoring coastal wetland health. Partnerships and stakeholder involvement will be discussed, along with details of project design and implementation goals.

Application: From the monitoring data and health assessments generated by this project, appropriate biological goals can be set. Management resources could then be focused toward addressing the most serious factors affecting coastal wetland health in the Durham Region. Long term monitoring will also enable implementation of an adaptive management approach, whereby management actions can be assessed and adapted as necessary to meet wetland health objectives.

Strengths: A critical first step in conserving and restoring wetland functions is understanding the current capacity of a wetland to support various biological communities in relation to what would be expected of healthy wetlands in a specified region. The Durham Region Coastal Wetlands Monitoring Project is a multi-partner monitoring program designed to provide this information. Partners include federal and provincial government agencies, Conservation Authorities, universities, NGO's and private industry. By ensuring that all stakeholder interests are considered, and data are collected using standardized biological monitoring protocols, the project could become an implementation model for monitoring all coastal wetlands of the North American Great Lakes.

Capacity Needs: The success of a long-term program for monitoring coastal wetland health is dependent upon the cooperation and continued support of all interested environmental organizations and agencies. Specifically, there must be a willingness to invest staff expertise and equipment into the monitoring project over the long-term.

Key Words: coastal wetlands, health, monitoring, Durham Region, Great Lakes

Daily Chloride Contamination of Lake Ontario by Etobicoke Creek

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Challenges: How much salt (chloride) goes into the Etobicoke creek via surface (storm network) or ground water? Can surface water monitoring results be interpreted this way? Is it possible to assess daily dynamics of surface and groundwater chlorides based on the available monitoring database? These, and other, questions were raised within the framework of the Wet Weather Flow, Snow Disposal and Salt Management plans (City of Toronto). An attempt to quantitatively estimate daily dynamics of surface and groundwater contamination in a highly urbanized watershed (209 km²) was done using the only source of quality data — the monitoring database of Environment Canada (~1 sample/month). In winter, salt crystals and other chlorides are used for deicing, in summer for suppressing dust. How are the chlorides from these two sources distributed between surface and ground waters; how subsequently ends up in Lake Ontario?

Description: Separation of daily total flow into base-, intermediate- and surface-components using SimpleBase model was done to estimate the daily proportion of each in the total flow. Available Etobicoke Creek monitoring data for 1990–97 period were sorted by representing of the flow category in different seasons. For each category the concentration-discharge ratio's parameters were established by correlating daily total concentration with the available monitoring data. The average concentration of measured samples was 354 mg/L, obtained — 321 mg/L. Groundwater and storm water alone contribute ~30% and ~45%, respectively, of the estimated 30,000 tons of total chlorides brought annually by Etobicoke Creek into the Lake

Ontario. Average daily concentration of chlorides in the total flow for examined period was 297 mg/L, baseflow — 263 mg/L. This trend is expected to worsen in the future.

Application: The method and modeling employed here is an excellent planning and optimization tool to be used in connection with the Lake Ontario water quality improvement framework (i.e., surface/groundwater monitoring network and sampling optimization).

Strengths: Quantitatively accurate flow separation is a crucial parameter and a requirement if we are to be successful in linking climate change research with groundwater research. The combination of water quality and quantity components with climate features provides unique opportunities to assess past and present relationships. The great strength of this approach is that it allows us to predict changes to water quality in the context of climate change.

Capacity Needs: Monitoring data should be revised in order to estimate exact values of corresponding discharge at the moment of sampling. Differences between daily average and instant discharges can be a huge source of error in the concentration-discharge relations. This is a key issue for this method. To ensure high reliability it is necessary to do several more runs of the model for other watersheds after revision of the monitoring data.

Key Words: Salt management, flow separation, groundwater, surface water, daily loads of chlorides, water quality monitoring optimization, Lake Ontario

Monitoring the State of the St. Lawrence

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Challenge: Between Lake Ontario and the Atlantic Ocean, The St. Lawrence River's specific features — the currents and tides, the salinity of the water, the flora and the fauna — vary greatly.

Description: In order to assess and report on the state and the evolution of the St. Lawrence, federal (Environment Canada, Fisheries and Oceans Canada) and provincial (Quebec Ministry of the Environment, Quebec Wildlife and Parks Society) governmental organizations have united their expertise within a monitoring program.

A series of state indicators derived from 22 ongoing environmental monitoring activities is being developed. These activities fall into three basic components of the ecosystem: water (quantity and quality), sediment (quality) and biological resources (diversity and condition). Several variables related to toxics and physico-chemical characteristics are used to describe the quality of the different media. Water levels and discharges are monitored through an extensive hydrometric network. Biological resources are described at the habitat, community and species levels.

Application: Monitoring information has been used to draw this current picture. Data show that through the 1980s and 1990s, water quality has improved and toxic contamination has decreased in the St. Lawrence. Fish

consumption is now encouraged but recreational uses (bathing) are still impaired. Phosphorus, nitrogen and suspended solids concentrations as well as fecal contamination (coliforms) have decreased in the St. Lawrence River and its tributaries; loadings from municipal and industrial effluents have significantly decreased since 1980 following the implementation of the Quebec Wastewater Treatment Program (1978–2000). PCB and mercury levels in fishes have also decreased. The Beluga whale population is increasing despite a heavy body burden of organic toxics and high cancer frequency detected in dead animals. Gannet populations show a constant increase following losses observed in the '60s and '70s due to a heavy burden of DDT residues in their eggs. Similar trends are observed in the levels of toxics detected in the sediments. However, other problems (introduction of exotic species, loss of biodiversity, low water levels, erosion, changing land use, habitat fragmentation, etc.) are still causes for concerns.

Capacity Needs: In as much as data permits, efforts are invested to complement the indicators suite developed at the head of the basin in the North American Great Lakes. New partners from government and non-government organizations are expected to join this newly formed program and help complete the knowledge gaps identified by the experts.

Key Words: Monitoring, St. Lawrence

The Reference Condition Approach: On Trial in the Minas Basin

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The Reference Condition Approach is a method that has been developed to provide numeric targets for measuring conditions in the aquatic ecosystem based on taxonomic composition of the invertebrate community. The method is based on establishing the natural diversity in normal, or reference, conditions of community assemblages in the geographic region of concern and linking this to habitat attributes. Models are then developed from these reference databases that allow the prediction of the expected community assemblage at any specific site based on its habitat attributes. This method has been used successfully in national stream monitoring programmes in the United Kingdom and Australia, in large regional studies in Canada in the Fraser River basin, and the Great Lakes. However, all the studies to

date have focused on freshwater streams and lakes. A study is currently being undertaken in the Minas Basin intertidal area that will be the first test of this approach in a coastal marine environment. Progress so far has identified a stratification approach for distributing sampling resources to capture the range of assemblages that may occur in the Minas Basin. The habitat has been stratified using a multivariate approach, thus ensuring as much as possible that the range of biological variation is captured by the reference data set. As a management tool, this approach offers potential to be used for building predictive models, thereby enabling us to set marine environmental quality guidelines for the area.

Key Words: marine environmental quality, Minas Basin, reference condition approach

Characterizing and Conserving Aquatic Diversity in Complex Ecological and Institutional Settings — The Great Lakes Basin

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Challenge: The Canadian portion of the Great Lakes basin contains some of the largest and most intact aquatic habitat in the basin. Many of its nearshore, coastal and onshore freshwater habitats are unique in North America, and it is an area of species endemism in glaciated North America. A basin-wide, site-specific overview on the variety and extent of aquatic natural-heritage resources, or an analysis of the geography of conservation priorities, has not yet been conducted.

Description: This presentation will focus on the efforts to understand aquatic habitat diversity of the Ontario portion of the Great Lakes coastal and drainage area and mobilize these efforts to prioritize conservation planning initiatives. Institutional and partnership arrangements supporting this work will be described.

Application: The Great Lakes Aquatic Biodiversity Conservation Blueprint, while focussing on the Ontario portion of the basin, has adopted methods comparable to initiatives on the US portion of the Great Lakes basin and will support integration of findings from the entire region. Coordinating scientific research and application by partners for conservation requires robust technical tools, clear communication, and tactful presentation of findings and conservation portfolios. Formation of steering and technical committees with bi-national, multi-agency representation creates fora to reach consensus.

Strengths: Conservation of aquatic diversity is an objective shared by many individuals and organizations. The Great Lakes Aquatic Biodiversity Conservation Blueprint, through formal and informal partnerships, has the potential to draw on the policy development and planning capabilities of a governmental organization, the conceptual testing and verification inclinations of university academics, and the dynamic action of Non-governmental organizations to achieve focussed public interest. The development of robust, widely accepted technical tools for ecosystem evaluation and a transparent process for prioritizing conservation targets and objectives should facilitate the needs of a variety of organizations for protecting biodiversity.

Capacity Needs: Applying aquatic habitat classification and evaluation frameworks in standard ways will allow clearer communication among partner organizations and stakeholders. Standardized data collection, quality control, and storage and retrieval systems will lead to rapid and more precise interpretations of ecosystem conditions over large regions. Linking robust science to a dynamic conservation planning process will facilitate sound management decisions.

Key Words: ecoregional planning, aquatic habitat classification, partnerships, Great Lakes

Infrastructure, Products and Services

The provision of appropriate, affordable and reliable infrastructure, products and services is critical for supporting the sustainable use of shared waters. This is a large and complex grouping which can include: water infrastructure, water and wastewater treatment, water and energy conservation tools, pollution prevention tools, and recycling programs among others. These services can be provided by governments, the private sector, or both. In many regions, public-private partnerships have been established in an attempt to provide services that are more affordable and reliable; several different models are being used.

The successful delivery of infrastructure, products and services in any one coastal region is closely tied to the level of capacity in each of the other three areas — education and training, institutional and participatory frameworks, and measuring and understanding coastal ecosystems. For example, having the right level of technical training and skills is critical to develop appropriate infrastructure. Similarly, public input is needed to determine where best to direct services, while a sound legal framework is needed to provide guidelines for water distribution. Lastly, stable management structures are needed to deliver and coordinate programs and allocate funding.

As with the other three capacities, the provision of infrastructure, products and services will vary depending on the region. In the developed world, infrastructure and services are available, but are often aging. High costs associated with upgrading services or implementing innovative approaches can be an impediment to progress. For example, in

North America many major cities have sewage infrastructure that is over 30 years old. Replacing this infrastructure will cost many billions of dollars.

In the developing world, capacity is usually limited and, in some instances, woefully inadequate. This is often related to poor capacity in other areas, such as science and technical training. Steep costs and lack of reliable financing are also major impediments to delivering sustainable services in the less developed world.

The abstracts in this section provide some insight into different approaches being used to address capacity needs related to infrastructure, products and services.

Examples of capacity needs identified by *MANAGING SHARED WATERS* participants:

- affordable water services;
- water infrastructure upgrades;
- sewage treatment;
- reliable financing mechanisms;
- clean energy solutions; and,
- engagement of industry in developing sustainable solutions.

Examples of tools and approaches for improving capacity:

- sustainable asset management;
- full-cost pricing for service delivery; and,
- public-private partnerships.

Role of Specialist Firms and Advanced Hydraulic Analysis in Managing Shared Waters

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Challenge: The public and private sectors' increasing demands on freshwater bodies such as the Great Lakes and St Lawrence River call for timely, accurate and appropriate engineering advice from hydraulic specialists. International bodies usually turn to national or global engineering firms to access broad expertise, often with success, but perhaps at the expense of neglecting the targeted (practical and advanced) contributions that smaller, specialist firms provide for local and/or transboundary problems. The emergence of smaller firms proves they can add value by solving complex technical issues with an appropriate understanding of planning and political realities and direct involvement with the public.

Description: This presentation will focus on case studies to illustrate the role of specialist firms in solving complex problems and explaining results in simple language. Four types of case studies will be covered: 1) Two-dimensional flows; 2) outfall mixing and thermal plumes; 3) CSO abatement in Hamilton; and, 4) erosion/sedimentation in the coastal zone. These will illustrate how addressing local trans-boundary issues provides a backbone to solve other aspects of the problem and/or enrich public participation.

Application: Shared water management plans impact national and international water resources objectives yet they are based on local issues. The presentation will discuss specialist firms' contributions to the International Joint Commission (IJC) to address: 1) BOUNDARY WATER ISSUES in the St. Clair and St. Lawrence Rivers with respect to how ecosystem capacity is affected by '2D flow release from a dam' and 'thermal plume impact' from a plant, respectively; 2) POLLUTION CONTROL INITIATIVES in Lake Ontario including 'CSO abatement' and 'treatment plant capacity' upgrades in the City of Hamilton to improve water quality in the harbour; and, 3) COASTAL

SEDIMENTATION and LITTORAL POLLUTANT TRANSPORT in Lake Superior including 'long-term sand beach stability' and 'mercury capping' (for the Department of Fisheries of Oceans) and Lake Ontario ('wavebreak at river mouth' and 'shoreline erosion'). Contributions to problem-solving and communications 'capacity' will be identified.

Strengths: The case study outcomes illustrate that small specialist firms can play an important role to help resolve international problems by focusing efforts and public participation at the local level. Small specialist firms can contribute to multi-stakeholder discussions (which invariably include larger firms) by increasing technical strength and adding unique capabilities. Such firms are responsible for a large portion of engineering and IT research in-house (continually updating knowledge and software) and/or through programs like NRC-IRAP (Industrial Research Assistance Program) and AWWA's Research Foundation.

Capacity Needs: Small, specialist engineering firms contribute to the problem-solving capacity of agencies and governments by providing expertise and developing technical tools to address transboundary water management issues. Added-value solutions at the local level need to consider ecosystem viability, coastal and harbour pollution transport, impacts of waves and currents and community involvement. The public and private sectors rely on specific solutions to enhance the capacity of boundary waters to support ecosystems, shipping lanes, electric power, cooling and drinking water uses and effluent dispersion.

Key Words: transboundary waters, specialist consulting engineering firms, advanced hydraulics, coastal sediments, littoral pollutant transport, ecosystem capacity, International Joint Commission, Great Lakes

Toronto Region Sustainability Program: Results Achieved and Lessons Learned

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Challenge: Toronto's near shore ecosystem has seen the restoration of beneficial uses through remediation and sharing of information within and between Great Lakes Areas of Concern. We are now faced with the overall challenge of maintaining and sustaining beneficial uses, including the need to avoid future related problems associated with toxic discharges from sewer and storm water outlets and industrial facilities.

Description: The Toronto Region Sustainability Program is a cooperative effort, involving OCETA, Environment Canada, the Ontario Ministry of the Environment, and the City of Toronto, which is intended to advance the performance of small and medium manufacturing enterprises (SMEs) in the City in the areas of sustainable development and environmental performance. The Program assists industrial and some health care facilities in meeting the P2 planning requirements of the Toronto Sewer Use By-law and the Canadian Environmental Protection Act (CEPA), and leads to real environmental reductions in toxics, Smog precursors and hazardous wastes. The presentation will provide case studies and formal and anecdotal discussion of results achieved and lessons learned, some positive, some negative, and some humorous.

Application: The program delivers quantitative results for all program stakeholders, by systematically addressing barriers to pollution prevention action, using:

1. Financial incentive to share 50% of P2 assessment cost;
2. P2 Assessments conducted by pre-qualified consultants from roster;
3. Customized work plan that meets client needs and satisfies program objectives;
4. Action-oriented "how to" report; and,
5. Dedicated OCETA program management.

Strengths: OCETA has made good progress in working with the small and medium manufacturers in the City of Toronto. Manufacturing clients perceive a very high value in the program, which addresses the environmental priority needs of three levels of government. A wide variety of sectors have expressed interest in the program and have found it to be a cost effective mechanism for meeting the pollution prevention (P2) planning requirements of government while reducing costs, and improving environmental performance.

Capacity Needs: Small to Medium manufacturers are a significant source of pollutants and wastes toxics that impact on local, regional and global environment, including direct and indirect discharges, emissions to the atmosphere & hazardous wastes. Traditional government programs have not adequately addressed barriers that the SME community of manufacturers face; these barriers are sufficiently serious that only 15% of companies that receive technical assistance through traditional programs actually commit the capital to implement process improvements and changes.

Managing and Financing Canada's Drinking Water

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Challenge: Canada is one of the most water-rich nations in the world, with nearly eight percent of its surface area being covered by fresh water. But despite this relative abundance, Canada is struggling to provide its citizens with a clean and abundant drinking water supply. As the human population continues to rise, commercial and residential demand for water is increasing. At the same time, contamination from urban and suburban development, expanding agricultural and industrial operations as well as other sources, is decreasing the quality of our source water. Coupled with these concerns over source water contamination are serious budget constraints and an aging infrastructure. It is becoming increasingly difficult for municipal water managers to operate and maintain their systems, and provincial bodies are finding it difficult to effectively monitor drinking water conditions given their limited resources. It is unclear if the current management system in Canada is capable of providing the necessary funds and guidance to ensure that drinking water remains a sustainable resource.

Description: The presentation will provide an overview of drinking water management practices in other jurisdictions. The discussion will focus on government roles and responsibilities — including the policies, procedures and legislation that govern management decisions, as well as mechanisms available for financing drinking water systems. Attention will also be focused on source water protection activities and the implications for “sustainable asset management.”

Application: Regardless of the quantity and quality of freshwater resources within a jurisdiction, the costs of supplying, treating, and delivering water and wastewater can be great. As expenditures associated with new drinking water standards continue to rise, Canada is faced with the challenge of financing any necessary technological, structural and/or operational changes. When determining the level of funding required, there must be

consideration of not only the physical infrastructure and operational costs, but of the required managerial capacity to deliver water and water treatment services, and the water resource itself. A governing body must also adopt effective monitoring and enforcement practices under the direction of sound policy or legislation.

Strengths: Although there is no single model that can be emulated to form a comprehensive management system, there are some common characteristics that appear in other jurisdictions: enforceable national standards; designation of a lead drinking water agency; regulatory supervision and enforcement; issuance of consumer confidence reports; public involvement in the decision-making process; full-cost pricing systems; and, source water protection initiatives. Practices in other jurisdictions demonstrate the benefits of including these elements in a comprehensive drinking water management program.

Capacity Needs: The greatest challenge is in finding the combination of policies, practices and procedures that best suit the social, political, economic and environmental realities within a jurisdiction. In a country like Canada where freshwater resources appear to be both plentiful and of high quality, water must still be managed in precautionary manner if both present and future generations are to have access to safe and reliable drinking water. The establishment of national drinking water standards, a strong regulatory framework and supporting institutions, source water quality objectives, and a full cost pricing system should all be considered in a move towards sustainable asset management. A focus should be placed on integrating water management policies and fiscal policies to ensure management decisions reflect the most cost effective and sustainable solution.

Key Words: drinking water, management, financing, source water

Government Framework for Addressing SME Manufacturers

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Traditional government programs have historically been less than successful in engaging small-to-medium enterprises (SMEs). Encouraging manufacturing SMEs to improve their environmental performance, and to go “beyond compliance,” requires innovative approaches that focus on targeted high-risk industry sectors. By fostering partnerships with industry, industry associations, non-government organizations and other federal, provincial and municipal government counterparts, our departmental objectives can be advanced and promoted for the benefit of both Environment Canada, and Ontario’s manufacturing SMEs.

Environment Canada has two separate sustainable development programs in Ontario, designed to deliver quantitative results in many areas, including: energy efficiency; reduced GHG emissions; reduced air emissions; improved water utilization and point-source control; pollution prevention and cleaner production; improved toxic substance management and reductions in CEPA toxics; waste minimization; recycling of waste materials and eco-efficient re-use; and pollution prevention planning. This talk will focus on the genesis of our SME-focussed programs in the Great Lakes Basin, from the policy framework through to the program design and delivery mechanisms.

The Management and Financing of Drinking Water Systems: Sustainable Asset Management

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Challenge: The reliance of a community on its water system services is absolute. Adequate supplies of clean source water and an effective and efficient treatment system and distribution network are critical to the health, security and prosperity of a community, large or small. It is increasingly difficult for water system managers to provide safe drinking water to consumers in the face of pressures to maintain and operate a deteriorating infrastructure while responding to expansion demands for water, and being faced with unstable subsidy and funding systems.

Description: The provision of safe drinking water is an essential service that must be put on a steady, sustainable long-term funding basis. A *Sustainable Asset Management* model is proposed for the financing of drinking water systems. The model walks through the evaluation of the full life-cycle of a water system by asking six basic questions. A case study using the model is presented, focusing on the City of Hamilton water system.

Application and Strengths: Based on the principle of Full Cost-Accounting, the *Sustainable Asset Management* model provides a more systematic, long-term, anticipative and transparent approach to planning and decision-making. There are a number of supportive policy options that have been identified based on analysis of policies, practices and procedures in other jurisdictions and many are complementary to the sustainable asset management model.

Capacity Needs: The managers of drinking water supply systems need to take a long-term sustainable asset management approach and need to have the tools and models in order to develop a long-term, life-cycle approach to protection of these assets.

Key Words: infrastructure, asset management, sustainability

Improvement of Navigation and Transportation Aspect of the Bassac River, Vietnam

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Challenge: The Bassac River is considered to be a major (international) maritime route in the Lower Mekong Delta for the ports of Can Tho and My Thoi in Vietnam and a promising link to the Port of Phnom Penh in Cambodia. At present, major obstacles to navigation exist, including extensive shallow water, a very dynamic and constantly shifting shoals and ever changing navigable channel routes to the river at its mouth (the Dinh An estuary). For many years, the Dinh An Channel entrance have hampered marine access by marine vessels greater than 3,000 DWT to the port of Can Tho and upriver ports.

Description: This presentation will focus on the feasibility study on the improvement of navigation and transportation aspects of the Bassac River. Engineering options and alternative solutions to the navigational problem at the entrance of the Bassac River, as well as their technical, economical and commercial viability, will be presented.

Application: The Bassac River estuary is a typical macro-tidal estuary with significant seasonal variation of flow discharge. The morphological process in the wet season is River-dominated Delta process, of which river carries so much sediment to the coast that the deposition rate overwhelms the rate of re-working and removal due to local marine forces. However in dry season the river discharge is low and the tidal action may dominates. The method of analysis and proposed engineering solutions could be applied to many similar estuaries in the world.

Strengths: The study performed a systematic analysis, including information collection, field survey, traffic and cargo forecast, design depth and dredging requirement with the consideration of tide utilization, optimum alignment of the navigation channel, application of river training structures, capital and operational dredging estimation, engineering design, cost estimates, as well as an Integrated Marine/River Information Infrastructure (IMRII). Conceptual engineering design and cost estimates have been carried out. Also the study addressed the social and environmental issues related to the project.

Capacity Needs: Finding a long-term solution to the navigation problem at the entrance of Bassac river, which is technically and economically viable, requires an integrated scientific research and engineering design, which involving extensive oceanographic modelling, GIS application, information technology application.

Key Words: navigation, transportation, engineering design, information infrastructure, Bassac River, estuary, Vietnam, Cambodia