CITIZEN-BASED MONITORING AND LAKEWIDE MANAGEMENT: RECOMMENDATIONS FOR INFORMATION SHARING AND PARTNERSHIP DEVELOPMENT IN THE LAKE SUPERIOR BASIN

by

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ABSTRACT

The Lake Superior Basin has a diverse range of stakeholder partnerships and citizen based monitoring programs focused on ecosystem protection, restoration and management. This research explores how partnerships for environmental citizen-based monitoring can contribute to information sharing and successful lakewide management within the Lake Superior Basin. This goal was achieved by fulfilling the following objectives:

1) To collect an inventory of citizen-based ecological monitoring programs around the Lake Superior Basin;
2) To explore the dynamics (strengths and weaknesses) of multi-scale partnership development and information sharing in the Lake Superior Basin;
3) To identify a framework for adaptive, ecosystem-based management partnerships in the Lake Superior Basin;
4) To compile recommendations for partnership development that improves citizen-based monitoring and information sharing in lakewide management.

Results were compiled based on a qualitative theme analysis and were gathered through a three stage data collection process including an emailed survey, 22 individual, semi-structured interviews and participant observation at a Lake Superior workshop in September of 2011. These results were then compared to the literature review on partnership development, citizen-based environmental monitoring and their role in ecosystem-based adaptive management. This comparison begins to highlight the strengths and weaknesses of current partnerships in citizen-based monitoring and multi-scale collaborative resource management efforts. Citizen-based monitoring (CBM) inventory results show a variety of interest groups and organizations engaged with the incorporation of CBM into their monitoring and restoration activities, however, further collaboration and communication across jurisdictional and geographical boundaries may offer

potential benefits in the reduction of duplicated efforts, development of common monitoring methodologies, and availability of information. The role of multi-scale, binational partnerships is of vital importance in implementing an ecosystem approach to the management of Lake Superior and for the Laurentian Great Lakes system and can further development of multi-stakeholder management efforts of cross-jurisdictional water resources around the world.

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CHAPTER 1
INTRODUCTION

1.1 AN INTRODUCTION TO PARTNERSHIPS FOR GREAT LAKES MANAGEMENT

The Great Lakes region encompasses two Canadian provinces (Ontario and Quebec) and eight U.S. states (Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin).

Source: Great Lakes Information Network

These water bodies account for approximately 21% of the world's surface freshwater supply and 84% of North America's surface freshwater supply. The five primary lakes of Superior, Michigan, Huron, Erie, Ontario and their watersheds (the St. Lawrence River and several other major river systems) combine to form the largest group of freshwater lakes in the world (U.S. EPA 2012). The lakes provide a vital resource not only as a freshwater drinking source but as an important trade and shipping route linking these communities together. The Great Lakes Basin covers approximately 94,000 square miles (244,000 square kilometers) and is home to more than 30 million people (25 million in the U.S. and 8.5 million in Canada). The

system provides water for consumption, transportation, power, recreation, habitat for a variety of aquatic and terrestrial species and additionally, forms the basis for a large part of the physical and cultural heritage of North America (U.S. EPA 2012). Due to these characteristics, multiple uses and values, the protection of these vast inland seas needs to be a top priority, not only for people living within the basin, but for communities and water managers around the world. For the past few decades there has been concern over an ever growing human population and unsustainable use of these water resources. In order to address the complexity involved with transboundary water governance in the Great Lakes Basin, community stakeholders and decision-makers are seeking to integrate multi-sector, collaborative ecosystem-based management initiatives to better implement activities focused on the restoration and protection of freshwater resources into the future.

The formation of partnerships and collaborative efforts, among diverse groups of stakeholders impacting water resources, is a key first step in actualizing this goal. The focus of this research, therefore, is to identify and explore the strengths and challenges of existing and emerging partnerships involved in transboundary water resource management. This will be focused on a case study of binational agreements, programs and initiatives pertaining to the Lake Superior Basin.

Lake Superior is the largest of the North American Great Lakes and is currently one of the most pristine and unique ecosystems in North America (Lake Superior Lakewide Management Plan Annual Report 2010). It has not undergone the same level of development and degradation as other Great Lakes but is impacted by past, present and emerging issues common to the other Great Lakes including: aquatic invasive species, impacts from mining and industrial processes, lake level variability, warming surface water temperatures, mercury

contaminated sediment, harmful chemical contaminants, beach safety, impacts on recreation, anthropogenic impacts on fish and wildlife habitat and health, natural hazards such as flooding and erosion, and impacts from climate change. For this reason, the motivation to partner and better manage the greatest of the Great Lakes is a high priority among decision-makers and Lake Superior coastal communities and if successful, can be used as a model for adaptive ecosystem based management for other regions.

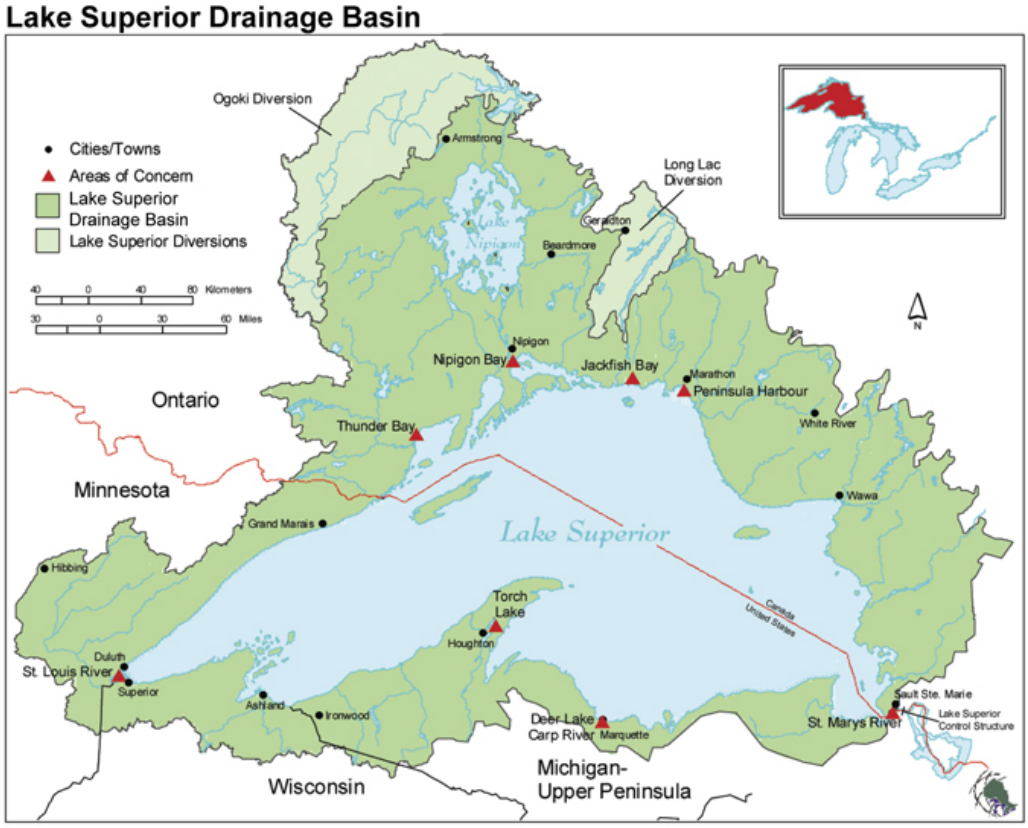
Through the International Joint Commission (IJC), and the federal and provincial/state governments of Canada and the United States, the goal listed in the Lake Superior Lakewide Management Plan (LaMP) is to incorporate an ecosystem based management approach by promoting multi-stakeholder cooperation and transparency between governments, grassroots organizations, scientists, industry, Indigenous Peoples, local communities and other interest groups to address Lake Superior stresses impacting environmental and human health (Lake Superior LaMP Annual Report 2011). The plan also seeks to promote resilience thinking and sustainable practices for water resource governance and use into the future. However, it is unclear if the effectiveness and benefits of these partnerships are being realized at all levels of management and by all stakeholders from the local to the international levels. This research seeks to provide a framework for the development of effective partnerships in ecosystem management and to uncover the key strengths and challenges of current partnerships to manage Lake Superior from an adaptive, ecosystem management perspective. For the purpose of this research, the term ecosystem can be referred to by its definition by Vallentyne (1988) as "a sub-division of the biosphere with boundaries which are arbitrarily defined according to some particular purpose or purposes in hand" (Vallentyne 1988, pg. 3). Because the case study area for this research is focused within the North American Great Lakes Basin, the term ecosystem

can be further defined by its characteristics identified in the Great Lakes Water Quality Agreement (1978), as "the interacting components of air, land, water, and living organisms, including humans" (GLWQA 1978). Within the Lake Superior watershed, including the surrounding tributaries and landscapes, are the U.S. states of Michigan, Minnesota, Wisconsin and the Canadian province of Ontario. The ecosystem based management approach can then be defined as "an integrated set of policies and managerial practices that relate people to ecosystems of which they are part-rather than to external resources or environments with which they interact" (Vallentyne & Hamilton 1987, pg.7). These complex and sometimes controversial terms which include collaborative ecosystem management and the adaptive management principle will be further explored in Chapter 2: Literature Review.

1.2 CASE STUDY: LAKE SUPERIOR LAKEWIDE MANAGEMENT

The Lake Superior Basin was chosen as a study area for this research based on its characteristics as a vast and complex watershed that spans two countries and crosses many political jurisdictions. This watershed is unique as the largest of the Great Lakes, surface area of 31,700 square miles, with a fairly low population density. On the U.S. side of the border there are approximately 444,000 citizens and on the Canadian side there are approx. 229,000 (NOAA Great Lakes Environmental Research Lab, 2012). These characteristics provide an ideal setting to explore how diverse stakeholders establish partnerships to address common concerns affecting a resource that accounts for nearly 10% of the world's fresh surface water and feeds into the largest group of freshwater lakes in the world. Figure 1.1 shows a map of the study area including the geographical distribution of population concentrations within the Lake Superior Basin.

Figure 1.1 Lake Superior Drainage Basin



Source: Environment Canada 2012

The Lake Superior Basin has many stakeholder partnerships that seek to promote citizen engagement, ecological monitoring and improve environmental management and restoration activities. The Lake Superior Binational Forum, for example, is an international group composed of 12 Canadian and 12 American stakeholders representing various sectors and interest groups. The Binational Forum upholds the ideals of the Lakewide Management Plan, which is an adaptive management plan for restoring and protecting the Lake Superior ecosystem. It is coordinated by Canadian and U.S. federal, state, provincial, Native American and First Nations governments. The Binational Forum fosters public involvement and information sharing between

the various interest groups involved in Lake Superior restoration, protection, and management (Lake Superior LaMP Annual Report 2011). "The Lake Superior Binational Program, under which the Lakewide Management Plan (LaMP) is implemented, is a collaborative effort between Canada and the United States that identifies, addresses, and monitors progress on environmental issues affecting Lake Superior. It includes the LaMP as well as the Zero Discharge Demonstration Program that aims to virtually eliminate nine critical chemical pollutants in the basin" (Lake Superior LaMP Annual Report 2011, pg 2).

Within this government-driven hierarchy there are also numerous state/province level partnerships and stakeholders such as partnerships between government programs and academic institutions, community grassroots organizations, environmental groups and businesses, non-profit organizations, Indigenous Peoples and scientific research communuty. At the regional and local levels there are yet more partnerships within communities and academia that function under watershed councils, non-profit, grassroots and research institutions that address lakewide issues and monitoring from a community-based "boots on the ground" perspective.

1.3 PROBLEM STATEMENT AND OBJECTIVES

In response to growing concern by communities and decision-makers in Canada and the United States about the future health and sustainability of Lake Superior, there has been an increase in the involvement of environmental and community organizations as well as a political push for decision-makers to collaboratively work towards assessing, restoring and monitoring degraded areas within the watershed (Soltis 2012). As a result, there has been a trend towards promoting citizen involvement in resource management, not only in an advisory/public-input capacity, but as an additional means of collecting data and tracking environmental issues and

trends in support of scientific research and decision-making. However, there is a gap between the desire for increased citizen involvement and the practice and implementation of collaborative projects and goals. This gap is in large part due to difficulty in resource allocation including funding and training for volunteers and building in citizen participation into existing programs and institutions (Sharpe and Conrad 2006). The centralized, hierarchical and fragmented manner, in which anthropogenic impacts have been monitored and managed in the past, continues to impede an effective framework for collaborative ecosystem management into the future that includes a strong community component. This reality may require a different kind of partnership framework and decision-making structure centered on a more cooperative approach (Barlow 2012; Sharpe and Conrad 2006)

The purpose of this research is, therefore, to explore how multi-stakeholder partnerships can better support citizen-based monitoring and lakewide management goals. This will be achieved through the following objectives:

1) To collect an inventory of citizen-based ecological monitoring programs around the Lake Superior Basin;
2) To explore the dynamics (strengths and weaknesses) of multi-scale partnerships and information sharing in the Lake Superior Basin;
3) To develop a framework for adaptive, ecosystem-based management partnerships in the Lake Superior Basin;
4) To provide recommendations for partnership development that improves citizen-based monitoring and information sharing in lakewide management.

The methods used to achieve these objectives involved an examination of multi-stakeholder partnerships at three levels. The citizen-based monitoring groups around the lake,

the Lake Superior Binational Forum as a liaison between stakeholder groups, and the governmental and nongovernmental organizations in Canada and the United States involved with the Lake Superior Lakewide Management Plan (LaMP). This was achieved through the following methods:

Step 1: An emailed survey sent to individuals and groups involved with citizen-based environmental monitoring programs in the Lake Superior Basin in Ontario, Minnesota, Michigan and Wisconsin. Results from the survey were used to begin to compile an inventory of citizen-based monitoring programs within the Lake Superior Basin and to establish a baseline data set for what partnerships and community initiatives currently exist in the chosen study area.

Step 2: A series of 22 individual semi-structured interviews involving participants from three distinct stakeholder groups including: Lake Superior Binational Forum, Federal, Provincial/State and local government representatives involved with Lake Superior restoration, protection and management and representatives from citizen-based monitoring programs within the Lake Superior Basin identified through the survey used for Step 1. The interviews provided the researcher with a broad data set from a diverse range of stakeholder perspectives used to explore the dynamics of multi-level partnerships and collaborative processes. This was then used to inform the framework for how adaptive, ecosystem-based management partnerships function within the Lake Superior Basin.

Step 3: Participant Observation at a workshop entitled, "Mobilizing Decisions to Improve the Health of Lake Superior," held in September 2011 in Thunder Bay, Ontario, which included many of the same participant stakeholder perspectives as Step 2, but this time in a group setting. This third stage of data collection assisted the researcher in gaining a comprehensive view of how a diverse range of stakeholder interest groups work together towards shared goals of

restoring the degraded areas around Lake Superior and implementing measures to protect ecosystem health into the future.

1.4 ORGANIZATION OF THE THESIS

This research is organized into six chapters. Chapter 1 introduces the topic and outlines the purpose and objectives for this research. Chapter 2 consists of an extensive literature review exploring the role of partnerships for environmental citizen-based monitoring and information sharing in managing a transboundary water resource. Chapter 3 describes the research methodologies used to collect data as they fit into the four research objectives. Chapter 4 describes the results and data analysis from the survey, interviews and participant observation and Chapter 5 consists of a discussion of the findings from the literature and data collection processes. Chapter 6 offers a conclusion of the research and includes recommendations for partnership development to support citizen-based ecological monitoring and information sharing processes for Lake Superior lakewide management.

CHAPTER 2

PARTNERSHIPS FOR CITIZEN-BASED MONITORING AND COLLABORATIVE TRANSBOUNDARY WATER MANAGEMENT: A LITERATURE REVIEW

2.1 INTRODUCTION

The literature reviewed in the following sections is rooted in the exploration of collaborative institutional arrangements for managing natural resources in large scale, complex environmental and political settings, across diverse political jurisdictions and with the incorporation of multi-stakeholder and public involvement (Heikkila et al. 2005). A collaborative approach to natural resource management is growing as a way to address complex and uncertain

environmental concerns (Conley *et al*. 2003). Multi-scale partnerships and multi-stakeholder collaborative initiatives are being incorporated into decision-making processes in the Great Lakes region as a way to work across jurisdictions and explore new ways in which to address stressors on shared natural resources. Some of the questions being asked by stakeholder interest groups are:

- How effective are organizations in making and implementing decisions to protect and restore degraded areas on an ecosystem scale?
- Is multi-scale collaborative resource management improving the ways in which we address complex and uncertain ecological issues?
- Are partnerships in water resource management living up to their goals and fulfilling their mandates, whether through the hierarchical and centralized government managements, or through horizontal and decentralized grassroots community organizations?
- What are our shared goals and values that bring together diverse groups of stakeholder perspectives and how does each group contribute collectively to improve the management process leading to a healthier environment? (Conley *et al.* 2003).

The questions listed above are just a glimpse of some of the concerns that decision-makers and resource managers at multiple levels of involvement in the Great Lakes Region are being asked to address by Great Lakes stakeholders.

Before partnerships can be evaluated, they first have to be defined within the context in which they are being used. For the purposes of this research, partnerships are based on collaborative efforts to implement an ecosystem-based approach to transboundary water management through maximizing community-based efforts in support of the overall decision-

making process (Conley *et al.* 2003). Conley et al. (2003) defines the use of partnerships for collaborative natural resource management as a multi-dimensional decision-making process that includes public participation and incorporates a range of approaches and techniques. Throughout the assessment of these types of partnerships and organizations, evaluation is based on the effectiveness and broad based representation of multiple viewpoints and expertise, how decisions are made, and how results of actions are measured (Conley et al. 2003).

2.2 TRANSBOUNDARY WATER RESOURCE MANAGEMENT: A RESILIENCE PERSPECTIVE

The exploration of multi-scale partnership development in transboundary water management, in particular, has become a growing field of interest as organizations engage one another in meaningful communication for the purposes of coordinating restoration and monitoring efforts through collective program development among federal, provincial and local community levels of involvement. These strategic efforts are also beginning to be articulated in the literature as prominent components of building community resilience (Folke *et al*. 2006; Berkes *et al*. 2006; Olsson *et al*. 2004). There are many ways to look at and define resilience but within the context of this research, community resilience can be defined as "the capacity of a system to absorb disturbance and still retain its basic function" (Walker et al. 2006). This term is slowly beginning to be used to describe the essence of adaptive ecosystem management that has been popular for the past decade (Olsson *et al.* 2004). A resilience perspective, for example, can be used to achieve an understanding of the dynamics of social ecological systems (Folke 2006) and therefore requires a shift in management and collaboration towards an emphasis on non-linear dynamics between stakeholder groups and elements, cross communication between jurisdictional thresholds, and thinking through uncertainty (Folke *et al.* 2006; Olsson *et al* . 2004; Berkes 2006).

The importance of integrating and utilizing both federal and local capacity to build community resilience in a watershed, for example, has been explained in studies by Olsson, Folke and Berkes through their work on adaptive co-management for building resilience in social ecological systems. These researchers argue that, because ecosystems are complex, ever changing, and require flexible governance with the ability to respond to environmental feedback, it is essential to broaden the scope of governmental decision making from single issue or resource focus to a broad set of issues related to an ecosystem across scales, and from individual stakeholder focuses to broad group multi-sector involvement (Olsson *et al.* 2004).

The work being implemented today in the Great Lakes region should therefore build on both historical and current initiatives and legislations with the goal of creating a politically cooperative environment where transboundary water resources are managed collectively across local, municipal, regional and federal jurisdictions in Canada and the United States.

According to Olsson *et al.* (2004), the building blocks of multi-scale collaborative governance require the following:

- Shared vision among partners;
- Established leadership;
- Trust between stakeholder groups;
- Legislation that creates social space for ecosystem management;
- Funding sufficient to address and support remedial action and ecological change over time;
- Capacity building to establish monitoring of the remedial actions and response to social feedback from stakeholders;
- Successful information flow across jurisdictions/knowledge sources;
- Collaborative learning and program adaptability;

Governance of large-scale water resources in the Great Lakes region has begun include broad based multi-stakeholder approach with emphasis on community participation and input in the decision-making process**.** This is being emphasized through programming within organizations like the National Oceanic and Atmospheric Administration (NOAA), the United

States Environmental Protection Agency (EPA) and Environment Canada (EC), at the federal level, and by state/provincial efforts on a regional scale (Verweij 2000). To fit the context of Great Lakes Basin governance, for example, collaborative resource management can be defined as: a group of diverse stakeholders, including both resource users and government agencies working together to resolve shared dilemmas (Heikkila *et al*. 2005). The establishment of collaborative multi-scale partnerships in transboundary water management is becoming common and is increasingly replacing traditional centralized top-down decision making processes that have historically been employed. The benefits of this cooperative form of governance include: the capacity to adapt to changing physical condition of the resource, the promotion of public participation and dialogue among diverse viewpoints, and enhanced social capital (Heikkila et al. 2005). There are also some limitations so the decentralized broad-approach which may include: difficulty in coordinating across programs and projects leading to program fragmentation and isolation, lack of a standard approach to addressing environmental issues, limited financial and material resources for implementing restoration and monitoring and in some cases, lack of coordination between scientific expertise and decision-making (Sharpe and Conrad 2006).

2.3 CITIZEN-BASED ECOLOGICAL MONITORING

The importance of environmental monitoring in watershed management is argued by many as a vital piece of ecosystem restoration and management, but only recently has it been incorporated into programming and decision-making processes (Pollock *et al.* 2002, Hunsberger *et al.* 2005). Traditional approaches to monitoring have been justified to keep managers aware of ecosystem impacts and health by identifying trends and changes in that particular environment over a period of time. The longer the time monitored, the more useful the data has become (Great Lakes Inventory 2006). The data collected from monitoring programs is of use to

scientists and decision-makers in establishing baseline conditions, tracking trends over time, deciding on regulatory requirements and in addressing scientific questions that help us manage the anthropogenic impacts on our watersheds and to protect their beneficial uses to the humans and wildlife (Vaughan *et al.* 2001). Consistent and comprehensive monitoring programs help to detect even subtle changes to a particular environment that may have long-term negative consequences if not addressed (Vaughan *et al*. 2001, Hunsberger *et al*. 2005).

More recently, the inclusion of adaptive ecosystem management has integrated monitoring into the 'trial and error' of learning how to effectively manage programs for improving environmental conditions, and for learning from management mistakes and implementing contingency plans (MacKenzie 1996). This focus allows for management stakeholders to understand their role, or niche, in collaborative management and requires that all levels of stakeholders involve their knowledge and data collection in the learning approach to ecosystem management (MacKenzie 1996). While the benefits to collaborative ecological monitoring programs are abundant today, (Hunsberger *et al.* 2003), there are an equally abundant number of challenges that these programs face as a result of lack of integration of monitoring efforts and lessons learned.

One of the principle challenges to water resource management is the coordination between restoration goals and monitoring activities (Pollock *et al.* 2005) For example, monitoring in the Great Lakes has been shown to benefit water resources through comprehensive and coordinated monitoring and restoration efforts that include: the ability to set fish consumption guidelines, promote better understanding of fish health, further protection of wetlands and wildlife habitat, work towards securing safe air and drinking water across jurisdictional boundaries, monitoring and restoring public beaches to limit, or in some cases

eliminate beach closures, address and control the introduction and spread of aquatic invasive species, develop and maintain the high water quality standards for which we depend for future generations and many more (Great Lakes Inventory 2006). However, much of these successes have been achieved without an understanding of the contributions of broad based multi-stakeholder participation in monitoring. Water stewards and users, and any other interested parties for that matter, need to be involved throughout the process in order to achieve better communication and environmental literacy and to support policies being made require integrated compliance (Savan *et al*. 2003). Furthermore, the use of a diverse range of stakeholder in community-based involvement can better support decision makers in the varying degrees of planning, project and policy development, implementation and monitoring at local, regional, national and international watershed scales through building capacity at the grassroots level (Earle *et al*. 2006).

Partnership development and citizen-based ecological monitoring (CBM), has become an instrumental component of collaborative water resource management in the Great Lakes Basin. Involving local communities in restoration and monitoring activities lends strength to data collected over time and support for policies involved in water resource restoration and protection. CBM fosters two-way communication and learning between scientists and citizens in an active process to foster mutual understanding, inclusion of local and scientific knowledge, and to build trust and accountability among diverse stakeholder perspectives (Whitelaw *et al*. 2003)

Integrated (horizontal and vertical scales) water management cannot operate effectively without reliable information on environmental changes and the root causes of those changes. Ecological monitoring programs represent a valued source of information for tracking

environmental trends over time, which if done in a coordinated manner, can lead to more comprehensive and effective decision making and remediation around specific contaminated areas (Vos *et al.* 1999; Sharpe and Conrad 2006).

Governments, academics and scientists alike are increasingly interested in gaining more public participation in environmental monitoring and management (Sharpe and Conrad 2006). Citizen-based ecological monitoring, when partnered with scientific training, equipment and expertise, produces broad based credible research and data that is able to benefit from scientific and local knowledge for an overall vital contribution to ecosystem/watershed management (Savan *et al.* 2003). Citizen-based ecological monitoring may have the capacity to benefit communities in which it is applied on many levels. Studies show that certain environmental decisions, policies and partnerships are achieved, understood, and accepted in a community if citizen involvement has been incorporated in the process in some capacity (Petkova *et al.* 2002).

According to Whitelaw *et al*. (2003), citizen-based ecological monitoring can be defined as "a process where concerned citizens, government agencies, industry, academia, community groups, local institutions and scientific researchers collaborate to monitor, track and respond to issues of common community concern" (Whitelaw *et al.* 2003, p. 410). As part of the partnership development process, CBM plays an integral role in identifying and tracking indicators for watershed health. In recent years, more attention and interest has been focused on utilizing volunteer collected data to assist and improve comprehensive watershed policy and decision making. According to a study conducted on citizen motivations in ecological and policy monitoring, looking at Oak Ridge Moraine Case study in 2007 from the University of Waterloo, the growing interest and establishment of CBM programs in North America is largely attributed to federal government cutbacks of environmental activities and programs. One

observation is that although governmental monitoring produces high quality information, it is not always able to implement monitoring on the scale needed to meet goals outlined for successful ecosystem management to track ecological trends over time and assess completed restoration projects (DaSilva 2007). These goals include the delivery of accessible, usable and timely information and feedback that effective environmental decision making requires (Whitelaw *et al.* 2003). Aside from being able to fill some gaps in governmental funding and personnel capacity and availability to conduct frequent and comprehensive ecological monitoring, citizen involvement in restoration and monitoring programs has fostered greater awareness of local issues, increased public education about watershed health, fostered the potential for growth of environmental stewardship programs and the opportunity to build and maintain partnerships and communication with large scale political decision-making groups, who then provide support for the management of particular issues (DaSilva 2007). Other potential benefits of CBM programs include: cost savings to governmental agencies as well as the flexibility of volunteers to work outside regular office hours, the collection of a wide range of data able to supplement agency collected data, and hands-on community outreach and education which helps to build environmental literacy from the ground up (Whitelaw *et al.* 2003). Benefits to non-governmental or grassroots organizations and communities include: increased potential for social learning and empowerment in the decision-making process in their local areas. Development of these partnerships creates the capacity for program growth that further engages community volunteers and forms networks between agencies and stakeholder groups within existing institutions to address other social, economic and environmental issues (Cuthill 2000; Stokes *et al*. 1990; Whitelaw *et al*. 2003).

2.4 PARTNERSHIPS

There have been numerous studies that have explored partnership dynamics in many different disciplines (Lowndes 2001; Kernaghan 1993; Folke 2004). However, very little is known about how multi-scale partnerships are formed in collaborative resource management and if they truly are based on established relationships where the outcomes from the decisions made are shared (Environment Canada cited in Kernaghan 1993). There is little understanding of how partnerships are managed or evolve to efficiently and effectively build upon resources and knowledge from scientists, community-based knowledge and organizations through intentional programs that address common issues to meet shared goals.

Often, partnerships are simply described as a means of bringing people together in order to discuss or exchange information (Lowndes 2001). The role of citizen participation in the decisions made around shared water resources is described by Arnstein (1969) who provides a model of how power can be redistributed through negotiation between local citizens and decision-making agencies (Arnstein 1969). According to Arnstein's Ladder of Citizen Participation (1969) "citizen participation is citizen power" and is the redistribution of power where stakeholder perspectives that are commonly excluded from political and economic decision-making processes are now being deliberately included (Arnstein 1969; p. 2-4).

Government/citizen partnerships have been credited for achieving planning and shared decision-making through shared responsibilities in planning committees and established mechanisms for resolving conflicts. These partnership types tend to be most effective with an organized power base within a community where citizen leaders are accountable and have access to financial resources and expertise from different sectors. What is still needed, is a collective and ongoing understanding of the various roles of each partner, as well as clarified expectations

of all of the stakeholder groups who make it possible to manage complex issues in cross jurisdictional management of a water resource (Moore *et al.* 2003; Carpenter 1999).

In North America, for example, Great Lakes resource management includes many different types of partnerships that are established based on specific goals in an agreement or needs within an organization. Every partnership has unique elements depending on members and the type of role that each partner is asked to play in the overall decision-making process. The table below shows some common partnership types found in Great Lakes restoration, and management programs and citizen-based monitoring organizations. The table is arranged by partnership type, definition and characteristics. Information on these partnership types has been drawn from a number of sources that explore partnership dynamics and is applied by the researcher to a transboundary water resource management context (Rodal & Mulder 1993; Ontario Ministry of Natural Resources 1992; Kernaghan 1993; Environment Canada 1992; Long and Arnold 1995 as cited by Nancy Powell Quinn 2007).

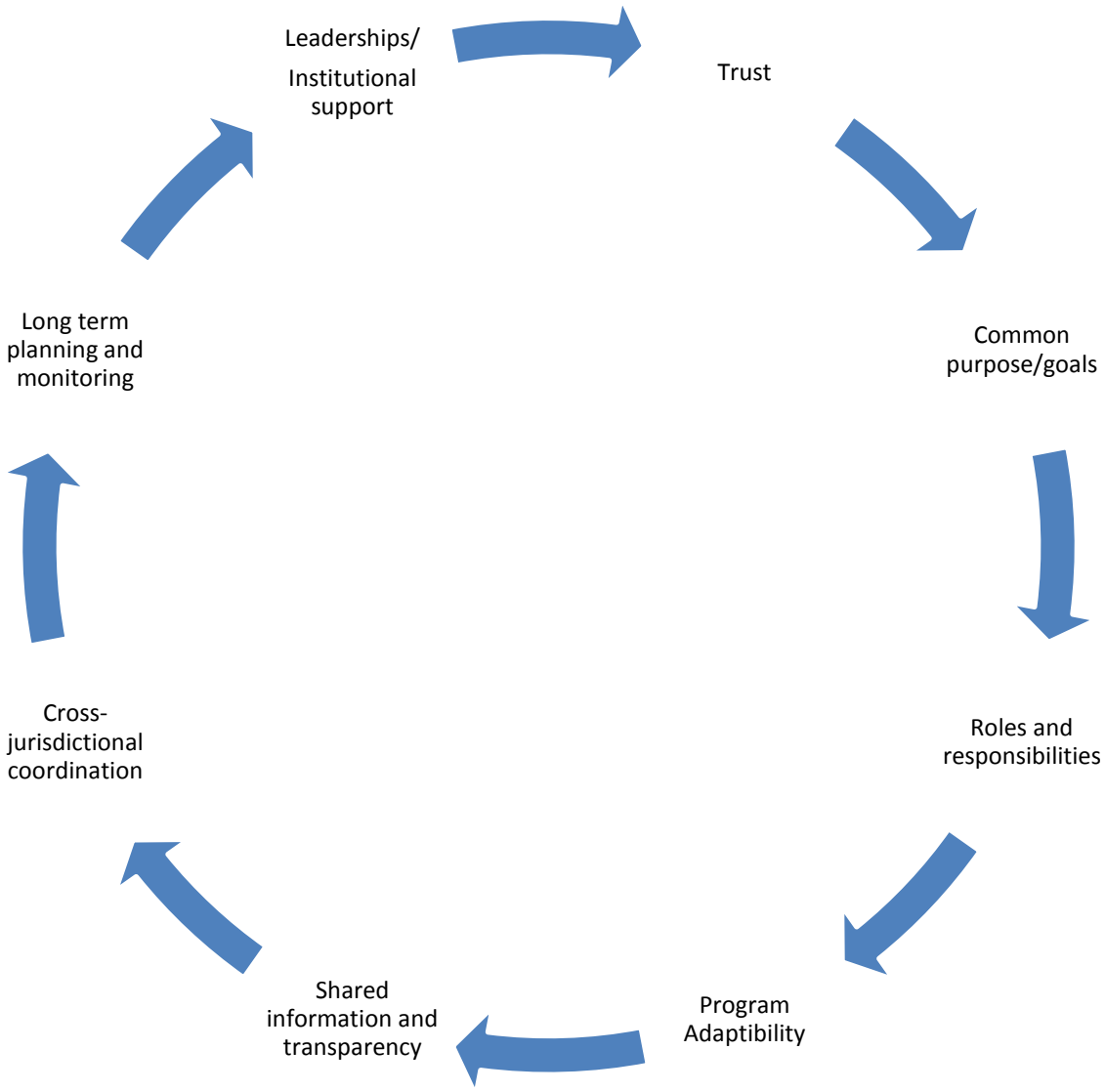
Table 2.1 Common Partnership Types in Transboundary Water Resource Management

Type of Partnership	Definition	Characteristics
Consultative	A public organization solicits information and advice from external sources for input on policy and program development, delivery, evaluation and adjustment and to legitimize decisions.	Public advisory and government retains control, ownership and risk.
Contributory	Partners monetarily support an activity have little to no operational involvement.	Shared support and the government retains control while the contributors may have influence.
Operational	Partners work cooperatively to share resources and exchange information to achieve similar goals and objectives.	Shared work load, government retains control, and partners influence decision making through involvement.
Collaborative	Each partner is encouraged to exercise power in decision making in policy development, planning, program design and delivery, evaluation and adjustment.	Shared decision making power, ownership and risk.

Source: Compiled from the following cited by Nancy Powell Quinn, 2007: Rodal and Mulder, 1993, Ontario Ministry of Natural Resources, 1992, Kernaghan, 1993, Environment Canada, 1992, Long and Arnold, 1995, Mitchell 1997, Ekos Research Associates, 1998)

Although there is much debate about specific definitions of partnerships, there are a series of key elements that many agree upon. Most successful partnerships contain some or all of the following elements: common goals or objectives, shared risks, costs and benefits, shared accountability/responsibility, multi-stakeholder input in strategy planning, development and implementation in addressing an identified issue or focus, and improved effectiveness and power of partners and their representative organizations through collaboration (Ekos Research Associates 1998 cited by Powell Quinn 2007). A role that public/private partnerships play is to help coordinate diverse stakeholder viewpoints as well as provide the ability to adapt to changing conditions and provide support and feedback to decision makers while keeping the public involved throughout (Casey 2008). Successful partnerships that are able to work within a multi-jurisdictional and multi-stakeholder environment also require: communication among all stakeholder groups, shared accountability and trust building, clearly defined roles and responsibilities, established long term goals and monitoring programs, the ability to be flexible and adapt to organizational and environmental variability, the ability to negotiate and reach decisions with feasible deliverables and measurable outcomes, strong leadership and institutional linkages. Figure 2.1 below shows a flow chart showing characteristics identified by researchers as elements needed for creating successful collaborative partnerships.

Figure 2.1 Partnership Characteristics Flow Chart (Casey 2008; Moore & Koontz 2003; Carpenter 1999)



Increasingly, multi-stakeholder/agency partnerships have been created in resource management in recent years due, in part, to a growing public interest and pressure to see outcomes and progress in resource restoration and protection (Moore and Koontz 2003). When private organizations partner with public volunteer groups, there is an opportunity to utilize local knowledge and resources to implement smaller scale restoration and monitoring projects, while

coordinating and contributing to large scale policy making over the whole resource with more effectiveness than a single agency acting alone. The formation of linkages between citizen groups and scientific expertise is also important, because it merges the motivations of volunteers interested in protecting their local environment with the proper training and equipment necessary to produce credible data that can then be used to enhance decision/policy making (Moore *et al*. 2003; Carpenter 1999)

Participatory evaluations by members of a partnership are often able to provide useful feedback for future actions and identify large issues impeding a specific action by the partnership. Surveys, case studies and meta-analysis can provide specific questions and observations able to address the larger issues in policy-making in resource management (Conley *et al.* 2003). Many common issues that partnerships run into in resource management include multiple jurisdictions' ability to cooperatively work toward a common goal (Hildebrand 2002). The use of partnerships in ecosystem management can also be referred to as soft management, which describes the partnerships' ability to implement cooperative arrangements with many interest groups who often lack regulation and enforcement. They instead focus on information sharing, joint policy-making and participation at many levels of involvement (Hildebrand 2002).

Partnerships in resource management have also been evaluated on their ability to implement plans to improve the environment, protect the ecosystem from further damage from exploitation, to improve water quality and protect biological diversity and to preserve soil and water resources (Casey 2008; Bertram 2000; Savan *et al*. 2003; Moore *et al*. 2003; Carpenter 1999).

2.5 NORTH AMERICAN GREAT LAKES: THE LAKE SUPERIOR CASE STUDY

The Great Lakes of North America form the largest group of freshwater lakes in the world accounting for more than 21% of the world's surface freshwater and nearly 95% of North

America's surface freshwater. Collaborative partnerships become essential to manage this ecosystem as the Great Lakes are bordered by two Canadian provinces, Ontario and Quebec and eight U.S. states, Minnesota, Wisconsin, Michigan, Illinois, Indiana, Ohio, Pennsylvania and New York (Great Lakes Information Network 2012).

There tends to be a common misconception about the superabundance of fresh water that the North American Great Lakes offer. Governments, scientists and grassroots organizations are all working towards correcting this misconception and bringing more education and awareness about the issues that threaten the biological integrity of these resources. Lake Superior, the coldest and deepest of the Great Lakes, is viewed as the most pristine, and for that reason has been chosen as a zero discharge demonstration area by the governments of Canada and the United States. Some of the issues that Lake Superior faces include water level variability, pollution (historical and current), wetland loss, aquatic invasive species and climate change impacts including warming surface water temperatures and reduced ice cover over the winter months (NOAA Great Lakes Environmental Research Laboratory 2012).

International waterways require many different pollution prevention measures. "End of pipe", "collect and contain" and "release and dilute" strategies are not the solution, and are more costly, both monetarily and ecosystem-wise, than pollution prevention and zero discharge goals. Pollution prevention includes sewage and industrial effluent abatement, erosion control, agrichemical runoff reduction, groundwater contamination, and remediation of bottom sediments (Duda 1994).

In the last thirty years there have been dramatic improvements in the Great Lakes pollution levels. However, there is still much to be done. Residues of substances like PCBs, dioxins, furans, agrichemicals and mercury still permeate many areas of the ecosystem. Areas of

Concern (AOC) came about in the mid 1980's as a means to address the most highly degraded areas. In these targeted areas, remedial action plans have been developed for each AOC, as well as, Lakewide Management Plans (LaMPs) for basin-wide, ecosystem approach to address environmental issues in each of the Great Lakes.

Despite the improvements that have been made, there are still many concerns over water quality in the Great Lakes Basin (Verweij 2000). Toxic contaminants stored in bottom sediments remain a primary concern for the AOCs, and contaminated groundwater continues to make its way into streams and rivers flowing into the lakes. Some key elements identified for the future success of joint institutions for pollution prevention include: Collaborative pollution prevention initiatives throughout the Great Lakes Basin, the ability to address high priority issue areas such as the AOCs through cooperative ecosystem based approaches, instituting an independent organization to supervise the joint agreements, having a concise written document outlining objectives, encouraging public, stakeholder and inter-jurisdictional involvement, ensuring credibility and installing checks and balances within the existing institutions (Verweij 2000).

To address the issues threatening the Great Lakes, the two nations charged with the restoration, protection, monitoring and management are beginning to move away from a traditional top-down approach to a more collaborative, basin wide approach to managing the ecosystem as a whole. In North America and throughout the developed world, resource managers and scholars are learning that point source pollution focus alone may not be the most effective strategy to manage a natural resource that crosses political boundaries and jurisdictions (Verweij 2000). Pollution prevention and protection of the entire ecosystem, rather, have become more of a focus for these collaborative efforts. The Great Lakes Basin is often used as an

example by water resource managers and policy makers as a location where international initiatives and collaborative pollution prevention goals are being applied to address water quality issues. In the last thirty years there have been dramatic improvements in Great Lakes pollution levels. However, in many cases the goals for overall protection and restoration for the region have fallen short. Addressing some of the more complex and uncertain issues on a basin-wide scale has become a main concern and topic of discussion for both communities centered on the Great Lakes and for governments charged with their care.

2.5.1 TRANSBOUNDARY MANAGEMENT OF THE GREAT LAKES

There are many agreements between the stakeholders in charge of managing the Great Lakes Basin, the most well-known being the Great Lakes Water Quality Agreement of 1978 (GLWQA). The GLWQA is a binational agreement between Canada and the United States with the purpose to "restore and maintain the chemical, physical, and biological integrity of the waters of the Great Lakes Basin ecosystem" (Krantzberg 2008). The GLWQA amending protocol of September 7, 2012, reaffirms the commitments of Canada and the United States to achieve the goals of the 1978 Agreement but also to update and strengthen the Agreement to more effectively address current impacts on Great Lakes water quality and anticipated impacts from aquatic invasive species and climate change (GLWQA 2012 protocol). Through the GLWQA, a Lakewide Management Plan (LaMP) was created for each of the Great Lakes as a way to tailor restoration and protection goals to the needs of that particular region. Each Lakewide Management Plan (LaMP) includes a Remedial Action Plan, created to address 43 Areas of Concern around the Great Lakes that have been classified as areas with severe environmental contamination in need of remedial action (Barlow 2012). Also included in the GLWQA 2012 Protocol is an extension of the ecosystem-based management approach to include nearshore

areas as well as mid lakes areas. Near shore areas have been added based on the recognition that they are a major source of drinking water for communities in the Great Lakes, as well as a major area for commerce and recreation and a link between watersheds and open waters of the Great Lakes (2012 GLWQA Preamble). The Great Lakes Charter, signed in 1985 is a cooperative agreement between the United States and Canada as a means to update the 1909 Boundary Waters Treaty and to "establish new mechanisms for co-managing the Great Lakes" in order to address growing concern about both historical and continued deterioration of the lakes' ecosystem and to address the lakes as one integrated watershed. Other primary goals of the Charter were to conserve the water levels and lake flows and to preserve ecosystem integrity and balance. The Water Resources Development Act was passed by the U.S. Congress one year later. This act requires unanimous consent between all of the governors of the Great Lakes states before any new water diversion out of the basin can occur (Great Lakes Charter Findings).

The International Joint Commission (IJC) is a binational institution with the goal of implementing ecosystem development and furthering policy development (Krantzberg 2008). Another purpose of the IJC is to help the parties involved in governing the Great Lakes Basin to coordinate and exchange information over the use of our shared water resources that cross multiple jurisdictions. The IJC creates unique opportunities for Great Lakes environmental organizations, such as offering triennial conferences at which citizen groups, governmental agencies, academics and scientists come together to share information and comment on progress made by Canada and the United States in addressing issues included in the 2012 Protocol Great Lakes Water Quality Agreement (GLWQA). These collected reports are taken back to governmental decision-makers, the public and the media. Initiatives under the IJC include the significance of multimedia pollution prevention measures to address toxic substances and the use

of ecosystem approaches on catchments. The advantage occurs in implementing joint institutions between countries to facilitate progress, creating checks and balances, fostering public participation and establishing credibility through joint fact finding (Berkes *et al*. 2007).

Great Lakes United formed in 1982, sparked the cooperation and organization of other environmental groups who, since its creation, have gained a large degree of influence over policy and decision-makers throughout the region and across the Canada/U.S. border. Great Lakes environmental associations have also had a large degree of access to intergovernmental decision-making, and, under the Administrative Procedure Act 1946, it is obligatory for US agencies to seek public input whenever they explore new policies and laws. Therefore, on the U.S. side of the Great Lakes, agencies are unable to develop new water protection policies without extensive public hearings and involvement of environmental stakeholders (Verweij 2000).

In many instances in the Great Lakes Region, the scientific study, political will, and available financial resources for dealing with lake-wide management are not sufficient for implementing the actions needed to fully restore and protect the watershed (Borre 1999). Marco Verweij in the book entitled Transboundary Environmental Problems and Cultural Theory: The Protection of the Rhine and the Great Lakes, identifies the following elements included in many Great Lakes initiatives that set them apart from other transboundary agreements throughout the world. All strive for the overall protection and restoration of the region, but still need further development and assessment to be able to meet their goals.

- The existence of the IJC and other international partnerships and agreements that have stemmed from it;
- Organized environmental groups that have access to political decision-making;
- Citizen involvement and push for restoration and monitoring in their watersheds;
- International environmental treaties that are more strict and influential than other transboundary resource management treaties in existence;
- Long standing international cooperation between Canada and the U.S.

Despite having these promising agreements and policies in place, targeted restoration and monitoring goals for the 43 designated Areas of Concern has been slow and progress in delisting these degraded areas has not been achieved. Many of the involved stakeholders are attempting to find out what limitations still exist and how to move beyond setting goals to achieving measurable outcomes (Verweij 2000).

Additional needs identified by stakeholders in the successful restoration and management of shared water resources include: Increased transparency between organizations, cooperation, checks and balances within the institutions, incorporation of community based traditional knowledge and values and enhancement of public participation in meeting identified goals (Berkes *et al.* 2007). According to one source on governing international water resources, there are three pillars of success for promoting involvement on many levels in the decision making process of resource management (Bruch 1994). These are creating access to information, creating checks and balances to ensure access to justice, and finally, improving long term assessment and monitoring of decisions and completed restoration projects. It is not a question of whether or not more comprehensive involvement is needed, but rather, how to make information more accessible, and how to better encourage and utilize community based input (MacKenzie 2008).

One long standing initiative for the strengthening multi-stakeholder participation in the Lake Superior Basin is the Lake Superior Binational Forum. The Forum was established through the Great Lakes Binational Program and acts as a liaison between a diverse group of stakeholders involved in implementing an ecosystem approach for managing the watershed and upholding the goals of the lakewide management plan to restore and protect the Lake Superior Basin. The Lake Superior Binational Forum is a multi-stakeholder group made up of 12 Canadian and 12

United States members representing a variety of interests including recreational interests, health, Indigenous Peoples, industry, academia, environmental/grassroots, government and community groups.

The Binational Forum grew out of the International Joint Commission (IJC) recommendation that Lake Superior become a "demonstration area, where no point source discharge of any toxic substance will be permitted" (LaMP 2011). A Charter for the Lake Superior Binational Forum was adopted on April 1, 1995, that identified the role of the Forum to "develop and further the goals of the Binational Program to restore and protect the Lake Superior basin, review projects, budgets and activities undertaken by the governments that were signatory to the Binational Program, the Lake Superior Task Force and Superior Workgroup and identify obstacles and solutions to the achievement of goals of the Binational Program" (LSBF Charter, 1995). The Forum also serves as a source of information and stakeholder input for the communities of the Basin on environmental issues that impact the water quality of Lake Superior and the surrounding lands and tributaries.

Originally, the relationship of the Forum with the governments of Canada and the United States was a partnership where the Forum acted as a liaison between scientists, decision-makers and Lake Superior coastal communities. This was implemented through public input sessions held around the Lake where input was communicated to the Lake Superior Task Force and Workgroup. The Forum was funded by the governments of Canada and the U.S. through Environment Canada (EC) and the Environmental Protection Agency (U.S. EPA) for meeting and conference expenses, travel and accommodation for forum members, administrative support and program development (Charter, 1995). The role of the Superior Work Group was to respond to issues identified through Forum activities to share information about the status or action being

taken by decision makers to address particular environmental concerns. In recent years the role of the forum has been in a state of transition and in 2011 went through major organizational change after funding on the Canadian side was cut. Through this time of organizational change, the Lake Superior Binational Forum is seeking to diversify partnerships and expand into new partnerships with community groups, research institutions and decision-makers. Instead of having sole focus on holding public input sessions, the forum has become increasingly involved in projects and partnership development to address the need for outcome based project design and implementation through inter-jurisdictional communication and collaborative decision-making (LSBF 2011).

2.6 SUMMARY

The purpose of developing agreements based around theories such as the ecosystem approach, or community resilience, is to create a cooperative institutional structure, promote stakeholder participation, share knowledge and enhance transparency and integration between organizations (Gerlak 2008). The creation of the International Joint Commission (IJC) through the Boundary Waters Treaty of 1909 was paramount in setting a process for resolving disputes between Canada and the United States over shared resources around the Great Lakes (Krantzberg 2008). The Great Lakes are governed by developed nations with many different communities who have vested interests in the future health of the ecosystem. Instead of simply leaving the job of protecting the environment to the government, people have begun to view the responsibility as a shared effort between governments, industry, Indigenous Peoples, private stakeholders, public citizens and scientists (Krantzberg 2008). However, coordination of efforts between diverse

stakeholder groups can present a challenge for decision-making and timely implementation of projects on a broad scale throughout the Great Lakes Region.

In order to restore degraded areas and protect the future integrity of this ecosystem, governments, NGOs, scientists and coastal communities need to adopt adaptive integrative approaches to management (Vallentyne 2007). In many of the great lakes of the world, concerned citizens, grassroots environmental organizations, natural resource scientists and governments have been working to find an effective approach to protecting and managing our freshwater resources. Many theories have arisen, such as the ecosystem or watershed approach. However, in many cases, the existing hierarchical institutional frameworks have not been sufficient to implement this type of large scale and complex management. The framework for lake-wide management has been rapidly evolving in recent years, along with increased visibility to the public and involvement in resource protection and management in the Great Lakes region. Institutions worldwide are establishing various adaptive methodologies for governing transboundary water resources. Addressing these complex issues on an ecosystem scale has become a focus for future governance and protection in the Great Lakes Basin.

Much can be learned by researching the partnerships and initiatives involved in water resource management in the Great Lakes Basin. By examining the history and development, policy, structure and funding of the current partnerships and management initiatives, the strengths and weaknesses of existing engagement mechanisms can be explored leading to identification of future needs and recommendations for cooperative ecosystem management in the Great Lakes and for transboundary water resources throughout the world.

CHAPTER 3
METHODS

3.1 INTRODUCTION

Three methodologies were used in the data collection for this research on how partnerships for environmental citizen-based monitoring (CBM) may contribute to improved lakewide management. Data collection was carried out in three stages. Stage 1 consisted of a survey being emailed to Lake Superior Binational Forum and Citizen-Based Monitoring participants in order to collect a baseline data set on CBM programs in the Lake Superior Basin. 40 surveys were emailed, ten were forwarded to additional participants and sixteen surveys were completed and returned to the researcher. Stage 2 sought to build a more detailed data set through the use of 22 individual semi-structured interviews with participants representing a diverse range of stakeholder interest groups involved with Lake Superior restoration, monitoring and management. These stakeholder groups included local, regional and federal government perspectives from Canada and the United States, CBM programs around the Lake Superior Basin and members of the Lake Superior Binational Forum. Stage 3 concluded the data collection process through the use of participant observation at the "Mobilizing Decisions to Improve the Health of Lake Superior" workshop facilitated by Dr. Robert Stewart, Dr. Graham Strickert and Dr. Lori Bradford from the Geography Department at Lakehead University, and funded by the Social Sciences Research Council of Canada (SSHRC) in September of 2011. This workshop involved participants from around Lake Superior representing grassroots community groups, governmental decision making organizations, business and academia from Canada and the United States. Through the three stages, mixed methods approach, the researcher was able to gather a broad yet detailed data set addressing the following objectives:

1. To collect an inventory of citizen-based ecological monitoring programs around the Lake Superior Basin;
2. To explore the dynamics (strengths and weaknesses) of multi-scale partnerships and information sharing in the Lake Superior Basin;
3. To develop a framework for adaptive, ecosystem-based management partnerships in the Lake Superior Basin;
4. To provide recommendations for partnership development that improves citizen-based monitoring and information sharing in lakewide management.

By looking at both the literature and theory behind multi-scale partnership development and ecosystem-based management practices, and through the exploration of partnership dynamics within Lake Superior CBM programs, the Lake Superior Binational Forum, and additional stakeholder interest groups, the research assessed the effectiveness of existing partnerships in their collaborative efforts by employing a qualitative theme data analysis of the interview transcripts and workshop observation notes to provide a comprehensive assessment and list of recommendations to enhance partnerships for information sharing and decision-making in the Lake Superior region.

This chapter outlines the data collection that took place from April-October 2011 and the analysis of that data leading into the results chapter. The chapter is divided into the following sections:

- Introduction and rationale for the use of a mixed methods approach;
- Breakdown of methodologies linked to the research objectives;
- Overview of the case study as it relates to the chosen methodologies;

- Detailed description of the data collection process broken down into three steps corresponding with the three methodologies used;
- Anonymity and confidentiality of participants, and;
- Data analysis process.

3.2 A MIXED METHODS APPROACH

A mixed methods approach was chosen in order to fully address the complexities within the partnerships and collaborative processes of Lake Superior restoration, monitoring and management. Data was collected by utilizing three methodologies to explore the roles of CBM, multi-stakeholder partnerships and binational decision making processes. The first methodology helped to build a baseline data set of current CBM programs in the Lake Superior Basin identify a starting point for what CBM exists within the Lake Superior watershed. The second methodology was used to gather more in-depth information through the use of individual semi-structured interviews. The third and final methodology helped to show linkages between the processes in Lake Superior protection, restoration and management efforts.

The use of a survey to collect a baseline data set in Stage 1 was chosen because it could be widely distributed to a fairly large group of people in spread out locations throughout the Lake Superior Basin requesting basic information about CBM programs. The information gathered through the survey was used to identify key groups that could later be approached as potential participants for an interview for Stage 2 of the data collection process (Gray 2009).

Stage 2 consisted of 22 individual semi-structured interviews. Interviews allowed the researcher to speak interactively with respondents and enabled the researcher to gather valuable data while encouraging a more conversational tone, promoting more interaction between the interviewer and participant supporting free flowing dialogue and information exchange

(Valentine 1997). Semi-structured interviews were chosen for the second stage of data collection above other interview techniques, because the use of semi-structured interviews enabled the participants to express complexities within the question and offer further conversation, which was able to lead to in-depth information being gathered by the researcher (Valentine 1997). In semi-structured interviews, the researcher asks more broad-based questions, leaving room for the respondent to speak freely, which furthers interaction between the researcher and those being interviewed. The role of the researcher during the interviews was to facilitate a conversational environment, where the participant felt comfortable to speak freely and the researcher was able to learn from the participant's expertise and insight.

Those who participated in the interviews for Stage 2 of the data collection process were from a variety of backgrounds with various perspectives and expertise. This was another reason that the researcher chose a semi-structured interview technique so as to allow each participant to expand on any particular area depending on their comfort level and area of interest. One advantage of this technique is that participants have the opportunity to raise issues that the interviewer may not have anticipated. One disadvantage of this technique is that the data collected is not easily quantifiable due to the fluid nature of the interview; therefore, it cannot be replicated, as every interview is unique and flows with the needs that the situation calls for (Valentine 1997).

Stage 3 consisted of the researcher using participant observation at a workshop entitled "Mobilizing Decisions to Improve the Health of Lake Superior" on September 17th and 18th 2011. The workshop was facilitated by Dr. Robert Stewart, Dr. Graham Strickert and Dr. Lori Bradford in the Geography Department of Lakehead University. Funding for the workshop was provided by the Social Sciences Research Council of Canada (SSHRC). Participant Observation

was utilized by the researcher along with a theme analysis that was compared with interview data throughout the two day event as a way to explore partnerships and collaborative resource management processes, the topics being explored were similar to those in Stage 2 but in a group setting. The objectives of the workshop were as follows:

1) To discover and explore ways of organizing, by connecting with stakeholders involved with protecting the Great Lakes;
2) To discuss the issues that are important to groups working to improve the health of Lake Superior;
3) To experience how diverse perspectives are linked to addressing lake issues, and;
4) To assemble and utilize diverse perspectives and approaches to improve decision-making around Lake Superior lakewide management

The objectives of the workshop and some of the themes that emerged from workshop group discussions paralleled the objectives and themes from the interviews in stage 2 of this research, thereby lending further support to the opinions and topics explored throughout the data collection process.

The three methodologies outlined above each served a specific purpose in addressing the four objectives outlined in the introduction of this chapter. The survey that was sent to citizen-based monitoring (CBM) programs in Minnesota, Wisconsin, Michigan and Ontario was used as a scoping exercise to address objective 1: To compile an inventory of CBM programs in the Lake Superior Basin. Objectives 2 and 3 were addressed through the use of individual semi-structured interviews and participant observation by exploring, in an open ended discussion type of setting, the dynamics (strengths and weaknesses) of multi-scale partnership dynamics and information sharing in the Lake Superior Basin. Data collected through the semi-structured

interviews and participant observation was analyzed using a qualitative theme analysis to address Objective 4: To provide recommendations for partnership development to support CBM and information sharing in lakewide management. Table 3.1 below shows a breakdown of participants for this research, the data collection process in which they participated, as well as how each particular methodology helped to fulfill the four objectives mentioned above.

Table 3.1 Methodologies and Research Objectives

Methodology	**Participant Group**	**Research Objectives**
Survey	CBM programs in MN, WI, MI and ON	**Objective 1**: Established a process for compiling an inventory of current CBM programs in the Lake Superior Basin
Semi-Structured Interviews	**Group 1**: Lake Superior Binational Forum **Group 2**: CBM program directors, scientists and volunteers **Group 3**: EC, MOE, EPA, WDNR, MPCA Federal, Provincial, State and local government representatives from MI, MN, WI and ON	**Objective 2**: Explore dynamics of multi-scale partnership and information sharing in the Lake Superior Basin **Objective 3**: Framework for adaptive, ecosystem-based management partnerships in the Lake Superior Basin
Participant Observation: "Mobilizing Decisions to Improve the Health of Lake Superior" workshop 2011	Stakeholders from public advisory and local community groups, recreation, business, academia, government, Indigenous Peoples, scientific researchers.	**Objective 4**: Provide recommendations for partnership development to improve CBM and info. sharing in lakewide management

3.3 CASE STUDY

The Lake Superior Binational Forum was chosen as a focus point for the case study on partnerships in Lake Superior lakewide management based on its characteristics of being an international organization with an agreement between two federal governments, (Canada and the United States), with the primary goal of promoting community involvement and multi-stakeholder collaboration and representation in the decision-making process for Lake Superior protection and restoration. The participants within the Binational Forum are representatives from a wide range of stakeholder interest groups that meet at various Lake Superior locations throughout the year to engage the public and act as a liaison between the state, regional and federal governments of the two countries, scientific researchers and Lake Superior coastal communities. Forum participation includes representatives from community-based environmental groups, academia, business, industry, recreation, governmental organizations and Indigenous communities located within the Lake Superior Basin.

By engaging with participants in the Binational Forum, government, academic, citizen and scientific interest groups, the researcher was able to gather a wide range of information leading to the assessment of partnerships within the study area as well as exploring the role of citizen-based monitoring in lakewide management.

3.4 DATA COLLECTION PROCESS ONE SURVEY

Surveys are research tools used to ask people to respond to the same set of questions in a predetermined order (Gray 2009). If the target group is large, surveys containing standardized questions with the goal of gathering a baseline data set for exploring relationships between wide ranges of variables are ideal. Some advantages of using this tool as a baseline data gathering

technique include: the ability to reach a wide target audience (multiple contacts at once) with minimal cost; the inflow of data is quick and comprehensive; respondents have the ability to complete the questionnaire at a time and place of their convenience, and; the set of questions offer minimal time requirements from participants and are relatively simple for the researcher to organize and code (Gray 2009) A survey was ideal for the stage 1 of the data collection process, because it allowed the researcher to obtain a starting point from range of participants leading into the second and third stages of data collection which obtained more focused and detailed information (Marshall *et al.* 2006).

The field work for this research began in April of 2011. In order to identify survey participants, the researcher conducted an online search of citizen-based monitoring (CBM) programs in the Lake Superior Watershed. Through recommendations and cold calling, the researcher began to contact CBM representatives with the emailed survey. In total 40 surveys were emailed to CBM contacts around the Lake Superior Basin. Sixteen surveys were completed and returned and ten were forwarded on to other participants. Survey results were used to begin to compile an inventory of CBM groups. By looking at the characteristics and geographical distribution of each identified CBM initiative, potential participants for stage two of the research process were identified (To view the survey see Appendix A). A limitation identified through the survey process was the small sample size and availability of information about CBM in the Lake Superior basin. This was determined to be in part due to the limited number of established CBM programs in the watershed and despite the limited number of completed surveys, led to the identification of information gaps and potential contacts to address questions during the interviews conducted in stage 2. This limitation also identified the need for

the researcher to meet participants where they were located to more successfully gather in depth information about partnerships and CBM around Lake Superior.

The survey for this research was constructed in Google Documents and the questions were developed based upon a citizen based water monitoring model used in the Alabama Water Watch Program, featured in the Volunteer Monitor, a Biennial Newsletter published by the United States Environmental Protection Agency (U.S. EPA). Table 3.3 below shows the themes identified through the Alabama Water Watch Program CBM Model which was used by the researcher to construct the questions for this survey.

Table 3.2 Water Watch CBM Model (Deutsch, 2009)

People + technology	Ensure that monitoring programs incorporate proper training and equipment for volunteers prior to monitoring activities.
Monitoring Approach	Create a standard monitoring approach in a study area (in this case the Lake Superior Basin)
Credible Data	Establish monitoring program from the ground up to build the capacity for volunteers to collect credible data used for informed decision making
Local Action to Knowledge	Use of local knowledge in communities to collaborate with scientific research programs. Coordinate across political boundaries and jurisdictions.
Sustainable Groups and Programs	Build adaptive resilient programs able to monitor long term to track ecological trends over time.

Source: " The Volunteer Monitor" Bill Deutsch, 2009

The survey for stage 1 of this research asked for the following information:

- Project name and location
- Type of monitoring done
- Funding and support resources/institutions
- Volunteer recruitment methods
- Training methods for volunteer monitors
- Data use and feedback to volunteer participants

- Coordination with other research, restoration and monitoring groups.

The data gathered in the survey helped to create a general sense of who is involved in Lake Superior restoration, management, protection and monitoring activities, where these programs are located and how they incorporate a citizen-volunteer component. Survey participants were also asked to recommend other potential participants who could then be contacted to participate in Stage 2 of the research process. Survey results and analysis are described in the following chapter and were used to start an inventory of CBM programs in the Lake Superior Basin in the 2011 year of monitoring (See Appendix E for CBM inventory).

3.4.1 DATA COLLECTION PROCESS TWO: INTERVIEWS

From May until September 2011, the researcher conducted individual semi-structured interviews in Marquette, MI, Thunder Bay, ON, Ashland, WI, Superior, WI, Duluth, MN, Grand Marais, MN and Sault Ste. Marie, ON and MI. Individuals who were interviewed represented a variety of stakeholder interest groups from Canada and the United States including government, grassroots organizations, industry, environmental interest groups, Indigenous Peoples, scientific research institutions, and academia. Interview participants were divided into three groups based on their affiliation with the Lake Superior Binational Forum, CBM programs or governmental organizations. Table 3.2 shows a breakdown of each interview participant group, the number of interview participants in that group, as well as their locations.

Table 3.3 Interview Participants:

Interview Group	Number of participants	Locations
Group 1: Lake Superior Binational Forum (LSBF)	9	Thunder Bay, ON Duluth, MN Superior, WI Marquette, MI Ashland, WI
Group 2: Citizen Based Monitoring Group (CBM)	9	Sault Ste. Marie, ON Sault Ste. Marie, MI Thunder Bay, ON Duluth, MN Grand Marais, MN Ashland, WI Superior, WI Marquette, MI
Group 3: Government (GOV)	4	Thunder Bay, ON Duluth, MN Superior, WI Phone interviews due to participant location

In all three interview groups, similar themes were explored through the questions asked, however, the manner and order in which the questions were posed varied based on the semi-structured nature of the interview. The purpose of using this type of interview technique was to create a more conversational tone, allowing the participant to expand on a certain issue or question based on their particular experience and comfort level.

Lake Superior Binational Forum interview participants were able to provide information and insight from within an organization dealing with diverse stakeholder representation, geographically spread out locations and multiple levels of involvement from the government and public sectors. They provided input and advice about what is needed in order to foster and maintain multi-stakeholder partnerships and mechanisms to improve information sharing and collaboration in Lake Superior and in some cases Great Lakes management. Binational Forum

participants were also able to provide input and advice about being a volunteer organization working across many political and geographical jurisdictions that partner with both government and communities to share information and to address Lake Superior issues on an ecosystem scale.

The second group of interviews involved participants from CBM groups identified and contacted through the survey in stage 1 of the research process and through recommendations from other interview and survey participants. CBM interview participants were able to provide the viewpoint from the local community perspective working in "on-the-ground" restoration and monitoring projects. CBM participants could give examples of the successes and shortfalls of citizen involvement in monitoring and its incorporation into decision-making and lakewide management. CBM interview participants were from organizations located in the Upper Peninsula of Michigan, Minnesota, Wisconsin and Ontario all working in locations within the Lake Superior watershed.

The third interview group involved representatives from government. Participants were representatives from Environment Canada (EC), the United States Environmental Protection Agency (EPA), the Ontario Ministry of the Environment (MOE), the Departments of Natural Resources (DNR) in Michigan and Wisconsin and the Minnesota Pollution Control Agency (MPCA). These representatives had the ability to provide information on the "big picture" goals and expectations of the Binational Forum as well as past, current and future collaborative management processes and citizen involvement in water resource management. Group 3 interview participants could also help to address some of the broad based concepts identified through the literature review about multi-scale partnership development and transboundary water resource management as it applies to the Great Lakes Region.

Interview questions were derived from the literature review on partnerships, collaborative governance processes and case studies on incorporating citizen involvement in natural resource restoration, monitoring and management. Interview questions were modeled after research on evaluating collaborative natural resource management by Conley *et al*. (2003) and research on Great Lakes Partnerships conducted by Bertram (2000), and illustrate the following concepts as important to partnership development in resource management:

- Identify main goals of the organization, explore how citizens become involved, determine some common motivations for citizen involvement, and clarify main expectations and desired impacts.
- Within the citizen-based monitoring groups, how is the data collected? How are volunteers trained? Is the gathered data used by decision makers? And how accessible is the information about the organization to the general public?
- What are the limitations of the organization? And what role does establishing institutional linkages and multi-stakeholder partnerships play in the end results of the projects?
- How do the partnerships approach large, uncertain issues surrounding ecosystem management and how do they implement regional plans on a local level?
- Do the partnerships maintain clearly feasible goals for implementing the ecosystem approach to management of Lake Superior? (Conley *et al.* 2003 & Bertram 2000).

Additional interview questions were formed based upon the questions asked in the survey from Stage 1 in order to gather more detail about CBM programs specific to the Lake Superior region (to see a list of interview questions see Appendix D). After the interviews were

completed, they were transcribed by the researcher and coded manually in an Excel Spreadsheet. Each interview was coded separately and then combined with the others to identify and compare common threads and themes. Interview results are described and discussed in the following three chapters.

3.4.2 DATA COLLECTION PROCESS THREE PARTICIPANT OBSERVATION

Participant Observation at the workshop entitled "Mobilizing Decisions to Improve the Health of Lake Superior" that took place in September of 2011 in Thunder Bay, Ontario helped the researcher to gain a "big picture" view of what is happening with partnerships in Lake Superior lakewide management by observing a diverse range of stakeholders in a group setting discussing Lake Superior issues and projects. This workshop involved approximately 60 participants from Canada, (and a few from the U.S), representing local Lake Superior community groups, business, federal, provincial and local governmental representatives, academia and scientific research groups, First Nations, Métis, the Lake Superior Binational Forum, North Shore of Lake Superior Remedial Action Plan and Public Advisory Committee members.

There was a great deal of overlap between the stakeholder groups who participated in the Stage 2 individual semi-structured interviews who also attended this workshop. This gave the researcher the opportunity to compare results from a similar set of participants exploring a similar set of themes as were addressed in an individual semi-structured interview context in a large group setting. Many of the responses and themes that emerged from the workshop sessions coincided with the themes and issue area focuses that emerged from stage 2. Goals and outcomes from the workshop included:

- Building confidence in being able to identify the approaches to Lake Superior issues from diverse perspectives and different ways of organizing

- The ability to use various organizational tools when addressing lake issues as well as methods for incorporating missing perspectives
- Exploring how to utilize different perspectives and approaches to share knowledge and increase effectiveness through: Decision-making, partnership development, coping with organizational change, and diversifying funding and support strategies

Notes from the workshop were summarized and compared to interview transcripts to see if there was a correlation between codes identified in the interviews and codes from workshop notes to discover if there was a difference between what participants said in an individual vs. group setting. Analysis of the survey, interview and workshop results will be further explained at the end of the chapter.

3.5 ANONYMITY AND CONFIDENTIALITY

All of the proposed methods and questions were reviewed by the Lakehead University Research Ethics Board prior to beginning the data collection process, including conducting interviews with human subjects. All information gathered through interviews and surveys remains confidential. The questions posed to respondents were of minimal risk and the respondents were guaranteed the freedom to speak openly and with total confidentiality.

3.6 DATA ANALYSIS

A qualitative theme analysis was applied to the three data sets for this research in order to fully explore partnership dynamics between the diverse range of stakeholders working on Lake Superior restoration, monitoring and management. The three data sets were gathered through a

survey, individual semi-structured interviews and participant observation. All data was analyzed manually through the identification of patterns, themes and recommendations from participants.

Data analysis consisted of the researcher summarizing the survey data into table format, transcribing the interviews and notes from the workshop, and then manually coding the data to identify themes from all three stages to compare and contrast leading to the identification of recommendations. Because of the limited sample size of the survey, results were used as a scoping exercise to begin an inventory of CBM groups in the Lake Superior basin, enabling the researcher to generate an overall sense of the data before identifying potential areas in need of further study leading into stages 2 and 3. Data from the survey on CBM within the Lake Superior Basin was compiled into table form showing the number of CBM groups that were identified through online research and through the emailed survey, where the program was located, and type of monitoring being carried out, funding and support resources, and instrumental partnerships for the program. The next step of data analysis involved coding the interview transcripts and notes from the workshop collected in stages 2 and 3 to identify and organize the material into categories of themes leading to an extensive examination and interpretation of the partnerships dynamics, commonalities and differences between participant responses.

Analysis of the data from stages 2 and 3 began with compiling the 22 interview transcripts, reading through and coding them manually for common themes, recommendations, and concerns that emerged through each discussion question. By using criteria for successful multi-scale partnerships identified in the literature on partnership development and resource management, performance indicators were identified and used to compare the data to the criteria in order to highlight common trends and themes from the interview transcripts.

Assessing the partnerships improvement in the overall ecological health of the Lake Superior Basin is not a viable form of measurement for this study, because there are no clear measurable goals for ecosystem management and community resilience on such a large scale in a two year period. Instead, the partnerships were assessed based on feedback from participants regarding the overall effectiveness of the partnerships involved with organizations like the Lake Superior Binational Forum, CBM programs, governance structures and transparency, information sharing and the scale of representation that is provided for all of those interested in the protection of the lake. Once feedback from the interviews was gathered, the data provided comprehensive ideas and patterns that were used to assess the current partnerships and provide recommendations for the future. Partnership development processes and lessons learned within the Lake Superior Binational Forum/CBM partnership case study can then be applied to other areas of the world forming partnerships around transboundary water resource management. Results and recommendations identified in this research are versatile in nature and have the ability to be applied in other settings.

All participants were asked the same questions, but in a semi-structured capacity, so as to create a more conversational tone and allow the participant to expand on a subject of their choosing. Groups 1 and 3 interview participants were able to provide a large scale context to the questions on partnership development and decision-making while Group 2 participants were able to provide a baseline of information on the role that citizen monitoring can play in the decision making process. The themes gathered from the survey, interviews and participant observation, when examined together, form a comprehensive view of the potential roles of multi scale partnerships both in a local Lake Superior context, focusing on monitoring and restoration, but

also offered a glimpse into some of the dynamics in multi-scale partnership development in transboundary water resource management as a whole.

CHAPTER 4
RESULTS

4.1 INTRODUCTION

Several overlying themes were identified from the three data sets gathered throughout this research. Data was gathered from the emailed survey for collecting an inventory of CBM programs in the Lake Superior Basin, semi-structured interviews with CBM participants, Lake Superior Binational Forum members and government representatives from Canada and the U.S. who are involved with Lake Superior lakewide management. The final data set revealed connecting themes from participants in the Lake Superior workshop in September 2011. Principle analysis themes are organized around the three data sets collected throughout the research process. Data from the survey and interviews shows the variety of CBM programs ranging from small, grassroots initiatives, conducting monitoring within a single stream, to state/province wide initiatives implemented through regional governments and used as an environmental education and scientific data supplementation tool for policy-making.

Semi-structured interviews conducted with three distinctive groups provided feedback about the role of multi-stakeholder partnerships in the Lake Superior Basin, lakewide management goals and initiatives, the role of community based monitoring organizations and volunteer collected data use, adaptive management goals and program resiliency.

Participant observation at the "Mobilizing Decisions to Improve the Health of Lake Superior" workshop in September 2011 showed connections between local initiatives and broad scale multi-jurisdictional governance structures by observing the interactions between Lake

Superior community representatives, local, regional, federal government perspectives, business, industry, scientific researcher and Binational partnership organization viewpoints. This data set helped to outline a framework of existing partnerships in the Lake Superior Basin and to identify areas for potential future collaborative partnerships and community engagement recommendations.

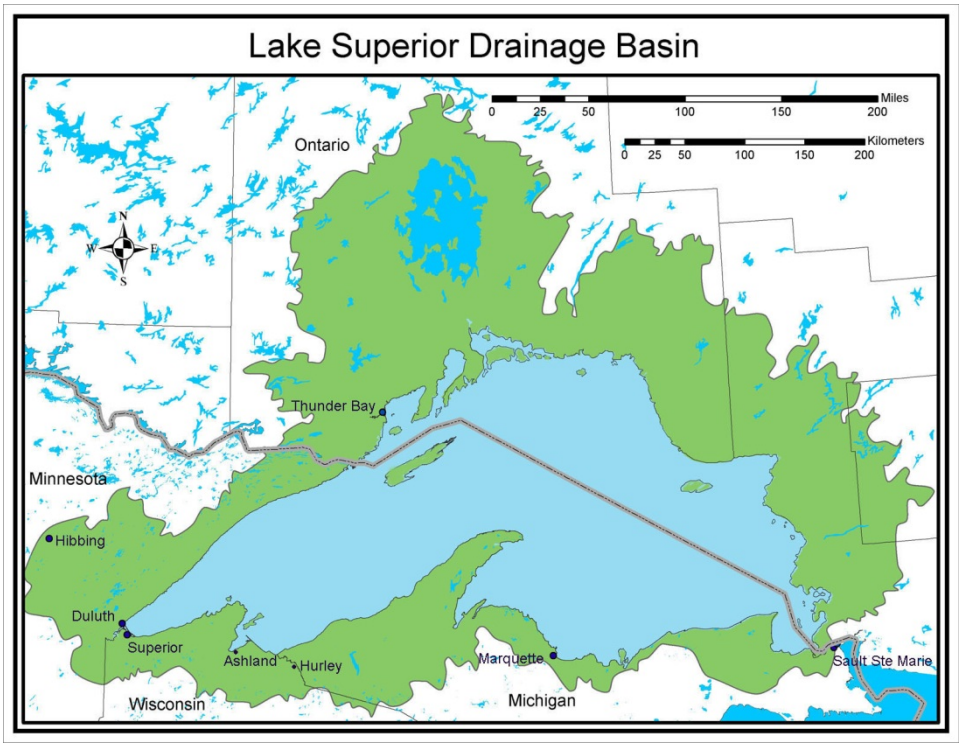
This chapter is organized into three main sections showing study results and data analysis. The first section explores the results from the emailed survey used to gather information about CBM in the Lake Superior Basin. The second section is based on the semi-structured interview and participant observation results and the final sections summarize the data analysis and provide an introduction into the Discussion Chapter.

4.2 STAGE 1: CITIZEN-BASED MONITORING IN THE LAKE SUPERIOR BASIN

Out of the 40 surveys emailed to CBM program participants, ten were forwarded to additional contacts and sixteen were completed and returned. The researcher compiled an inventory of CBM initiatives in the Lake Superior 2011 year of monitoring from survey results and from conducting additional online searches of CBM programs and web pages to fill in the gaps. Compiled survey and interview results show a broad range of CBM programs located within the Lake Superior Basin. Results also show that there are many different types of citizen-based monitoring and restoration initiatives located throughout the watershed. Although many CBM programs show similar end goals, environmental stressors, concerns, and focus areas, many of the programs differ in volunteer recruitment method, monitoring approach and the mechanisms used to incorporate citizen participation. Table 4.1 shows results of the survey from respondents of CBM programs located throughout the Lake Superior Basin in the 2011 year of

monitoring. The table breaks down the number of CBM programs by: a) location, b) monitoring category and number of programs carrying out that particular type of monitoring, c) the type of funding and support, and, d) data use. The categories of monitoring include: lake, river, stream, wetland monitoring, wildlife, plants, aquatic invasive species, beaches and weather and climate change. These monitoring initiatives are located within the Lake Superior watershed areas of Michigan, Wisconsin, Minnesota and Ontario (to view the complete CBM inventory, please see appendix E).

Figure 4.1 Lake Superior Drainage Basin



Source: University of Wisconsin Superior Sustainable Communities Capacity Center

Table 4.1 Lake Superior Citizen Based Monitoring Survey Results

Location	Monitoring Category	Type of Funding and Support	Volunteer recruitment and training	Data used for:
Ontario	Lakes: 6 Rivers, Streams, Wetlands: 6 Wildlife/Birds: 3 Aquatic Invasive Species: 2 Beaches: 3 Weather/Climate Change: 1	Mixed: federal/local government grants through academic institutions	Public outreach campaigns, workshops, stream cleanup events, Public Advisory Committees (PACs)	Local stewardship; education and awareness; to support governmental decision-making; and public advisory input
Michigan	Lakes: 3 Rivers, Streams and Wetlands: 10 Aquatic Invasive Species: 2 Beaches: 1 Plants: 2 Wildlife/Birds: 5 Weather/Climate Change: 3	Federal EPA, Local state govt., Grassroots Non-profit Academic Private Mixed	Academic student, workshops, Volunteers field days and events	Data used to support community environmental literacy and awareness through public education, local stewardship, and watershed cleanup initiatives
Minnesota	Lakes: 12 Rivers and Streams: 7 Aquatic Invasive Species: 5 Beaches: 3	Federal govt. Local state govt. Non-profit Grassroots Private	Local stewardship programs, workshops, academic programs, government-run volunteer recruitment,	Used to support government data sets; public education and awareness; used to provide

	Wildlife/Birds: 5 Watershed Groups: 4 Weather/Climate Change: 4	Academic Mixed	public education and awareness campaigns	information for decision-making; track trend and changes in local watersheds
Wisconsin	Lakes: 8 Rivers, Streams, Wetlands: 8 Beaches: 3 Aquatic Invasive Species: 6 Wildlife/Birds: 2 Plants: 2 Weather/Climate Change: 3	Federal govt. State govt. Academic Private Non-profit Grassroots Mixed	Local stewardship programs, workshops, academic school programs, government run volunteer recruitment, public education and awareness campaigns	Track trends over time and ecological change in a local area; Public education and awareness; Support decision-making processes

Results from the CBM inventory demonstrate an overall initiative by scientific research programs, government organizations and community grassroots efforts striving to incorporate a citizen component into their monitoring and restoration activities. Many large scale government based programs that incorporate a CBM component have many smaller locally-based projects all funded and trained from the same source. Examples of these "blanket" organizations that provide funding and technical support to locally based CBM and restoration programs include: Environment Canada, the Ministry of the Environment, the Ministry of Natural Resources, Minnesota, Wisconsin, and Michigan Departments of Natural Resources (DNR), Universities in the MI, WI, MN and ON, the U.S. Environmental Protection Agency (EPA), and the National Oceanic and Atmospheric Administration (NOAA). Geographic distribution of CBM programs

in the Lake Superior Basin was difficult to quantify due to the variety in type of monitoring being conducted, area being covered, geographic distribution and size of the monitoring program. Examples of the wide range of monitoring programs include the Bad River Watershed Association located in Ashland, WI, which focuses on restoration and monitoring within a single watershed and the Minnesota Pollution Control Agency which is a statewide organization that funds a number of monitoring and restoration projects throughout the region.

One difference, identified from the data for this study, between CBM in Ontario and the United States Lake Superior Border states of Michigan, Minnesota and Wisconsin was the number of people involved in monitoring activities. While community involvement in Lake Superior issues is valued on both sides of the Basin, the U.S. states tended to show more robust volunteer monitoring initiatives with more established, comprehensive training and data collection being offered to community volunteers. One limitation from this research was the relatively small sample size used to assess volunteer monitoring in the Lake Superior basin. Conclusions drawn from interview data was able to provide a snap shot of monitoring trends in the Lake Superior region, however, further research throughout the Great Lakes basin is necessary to provide a full analysis of the differences between the Canadian and United States approaches to Great Lakes ecological restoration, monitoring and governance.

CBM and Government interview participants agreed that volunteer recruitment across the Basin is usually conducted through an academic institution or government-based scientific research or public education and outreach program. Volunteer training mechanisms and resource tools include workshops, online training packages, and field trips with scientists, school programs, community presentations and webinars. Data collected by CBM is primarily used for supplementing monitoring data collected by trained scientists in research programs or as an

education/outreach tool used to build ecological literacy in a community to increase environmental awareness and build capacity.

In the U.S. states that border Lake Superior, CBM has become increasingly important for scientific research programs to collect data and to build capacity in environmental community outreach and education programming. CBM in Minnesota, Michigan and Wisconsin is used as an education outreach tool to increase environmental literacy in Lake Superior coastal communities and as a means to collect broad data sets to supplement remediation projects and for tracking environmental trends. CBM is used for tracking climate change impacts, spread of aquatic and terrestrial invasive species, basic water quality monitoring in inland lakes and streams and other community-based ecosystem restoration initiatives. The Bad River Watershed Association, located in Ashland, Wisconsin, for example, takes volunteers through the entire water quality data collection process from project design, data collection, analysis and volunteer feedback in one watershed. The St. Louis River Alliance, located in Duluth, MN is an organization that incorporates environmental advocacy, community outreach and education with field work such as invasive species monitoring. In Ontario, CBM appears to have a slightly different role. Public advisory committees, for example, may not have volunteers conducting field work and monitoring, but instead, volunteers provide feedback and local knowledge to remedial actions taking place within their region. Volunteers who participate in these advisory groups have a wide range of stakeholder representation and are able to voice local concerns and help identify information and resource needs in communities that can be isolated from the decision-making process due to their rural locations and smaller population concentrations. Feedback from public advisory groups helps to build capacity and gather support for restoration needs throughout the Lake Superior region. Other organizations that incorporate community

volunteers on the Canadian side of Lake Superior build environmental outreach and education capacity through wide-spread communication and trainings on local environmental issues.

Academic institutions and scientific research programs in universities play a key role in community participation in environmental monitoring, education and outreach in both Canada and the United States. Researchers at academic institutions are able to provide resources, scientific information and technical support for students entering the field and for citizens interested in becoming involved in their local environments. Universities are also able to secure and provide some funding towards training and supplies used to carry out monitoring and restoration projects.

Other cross border commonalities include the emphasized value placed on fostering more communication between environmental organizations, especially through digital forums, stories and online training tools to increase capacity for monitoring, volunteer training and data collection techniques as well as reducing fragmentation and isolation between programs. This helps spread the word about ongoing initiatives and provides linkages between programs that can then build off of each other to streamline the process and not have to "reinvent the wheel" with every new restoration or monitoring project. In both Canada and the United States, coastal communities, grassroots organizations, scientific researchers and local governments are being called upon to collaboratively implement Lake Superior restoration and monitoring activities across jurisdictions. Examples of this can be seen in federal grant opportunities outlining the need for multi-scale partnerships between federal, state/provincial and community based groups when developing environmental restoration and outreach programming.

4.3 STAGE 2: INTERVIEW RESULTS

Participants involved with monitoring programs identified in the CBM Inventory (See Appendix E) were contacted by the researcher to be potential participants in an individual semi-structured interview. Participants who participated in these interviews were able address questions about collaborative processes in ecosystem management, goals of incorporating communities in monitoring and decision making, some perceptions of past and current coordination mechanisms as well as offer some ideas to increase collaboration in resource management on local/regional/national and international scales. The data collected in the interviews revealed themes addressed through discussion-based questions on the following topics: 1) Goals of incorporating CBM into environmental restoration and monitoring programs, 2) How data is collected and used, 3) Program limitations, 4) Role of multi-stakeholder partnerships, 5) Volunteer motivations for joining monitoring and restoration activities, and 6) Goals for adaptive ecosystem management and binational coordination between Canada and the United States. Each general question category gave way to sub-themes and more in depth discussion based upon the participant's background and interests.

Interview results can be divided into three main groups: 1) Lake Superior Binational Forum interviews, 2) CBM participant interviews, and, 3) Government/Decision Maker perspective interviews. Lake Superior Binational Forum (LSBF) interviews focused primarily on the role that an organization such as the LSBF can play in the support and implementation of public outreach initiatives in the Lake Superior Lakewide Management Plan (LaMP) process. LSBF interview participants were able to speak from the perspective of a binational, volunteer organization working to coordinate among a diverse range of stakeholder viewpoints and knowledge backgrounds. Partnership development and cross border communication and

coordination were some primary discussion points during this set of interviews. LSBF participants outlined the need for continued technical and funding support for organizations such as this because they are vital for fostering two-way communication between communities, scientists and decision makers all working towards the same goals of Lake Superior restoration, protection and management.

Principle discussion topics that emerged from the CBM interviews focused on:

- Common motivations for citizens to participate in "on the ground" restoration and monitoring activities;
- Challenges for incorporating volunteer monitoring into resource management programs;
- Training mechanisms and tools used for monitoring activities;
- Use of CBM data for research and decision making, and;
- Discussion about mechanisms for communicating scientific information to non-scientist audiences, as well as, mechanisms for building environmental literacy and informed decision making within Lake Superior communities.

Interviews with government representative's primarily centered around discussion on engagement and coordination mechanisms for engaging grassroots level community input with regional, national and international environmental policy and decision making processes. Participants in this set of interviews all worked within the field of Great Lakes restoration and management at various levels. These participants were able to provide input about point source and non-point source issues in Lake Superior Areas of Concern (AOCs), as well as ecosystem goals for the Lakewide Management Plan and Great Lakes Water Quality Agreement, (GLWQA). One discussion point that emerged from these interviews was the idea of bridging

the gap between ecosystem based management, near shore and point source AOC focus. Participants involved with GLWQA, LaMP and AOC processes were able to speak to the development of binational partnerships at local, regional, national and international levels striving to implement an ecosystem-based approach to Lake Superior (Great Lakes) governance.

Interview results are broken down in the following sections based upon the question being discussed. Table 4.2 shows a breakdown of the interview questions asked, the common themes that emerged from each question and key participant responses in connection to the themes. Interview results will be further discussed in the following sections.

Table 4.2 Interview Results

Interview Question Category	**Major Theme**	**Sub Theme**	**Participants**
CBM Program goals	CBM has a supporting role in transboundary resource management Bridge gap between lakewide and point source restoration initiatives	Collection of a wide range of data over time Value of volunteers Network of communication between groups	Interview groups 1, 2 & 3 Interview groups 1, 2, 3 & participant observation
Volunteer motivations	Personal involvement in protection of local watersheds Be part of the process Education and awareness building Future planning	Draw attention to local watershed issues within a particular community. Provide useful data used for decision makers Protecting the resource for future generations	Interview groups 1, 2, & 3

Role of a binational organization in lakewide management	Partnership development and linkages between groups Diverse stakeholder collaboration Outside awareness and support	Multiple stakeholder collaboration Project implementation Long term support	Interview groups 1 &3
Volunteer collected data use	Need consistent volunteer training and data collection methods across basin Need increased collaboration between programs	Feedback with volunteers about data use Sense of ownership between volunteers and their local resources	Interview groups 1, 2, 3, and Participant Observation
Program limitations (CBM & LSBF)	Reliance on a single funding source and short term funding for long term projects Outside awareness and support in rural areas Volunteer commitment and leadership Need to reduce fragmentation and isolation between groups	Institutional linkages Program fragmentation across jurisdictional boundaries Lack of volunteer feedback about data use and progress Conflicting monitoring and training methodologies	Interview groups 1, 2, 3 & participant observation
Partnerships	Diversity of partners Role of each partner Collaboration, trust and accountability Public, private and mixed partnerships Decision-making/community communication as key to meeting the needs at	Strengthen science/policy and science/community partnerships Increase collaboration and transparency between science and policy community	Groups 1, 2, 3 and participant observation

	local, regional, national and international scales.		
Adaptive management and program resiliency	Long term planning Shared vision/goals Clearly defined roles and responsibilities among partners Helps build program resiliency Increase inter-jurisdictional collaboration Emphasis on diverse stakeholder involvement	Accomplish shared goals Need for clearly defined roles and responsibilities Local environmental concerns voiced through CBM Diversity funding sources Re-assess role of binational organizations Monitor and assess to show progress over time	Groups 1, 2, 3 and participant observation

4.3.1 CITIZEN-BASED MONITORING PROGRAM GOALS

When asked about program goals, interview participant's responses varied based on their affiliation with CBM, a government agency or as a Lake Superior Binational Forum participant. Themes that were identified by all groups included the emphasis and importance of public outreach and education around shared water resources, the clarification of how data is collected and what data is important for decision making, the identification and prioritization of Lake Superior issues and what expectations and goals exist for CBM, binational involvement and policy making. One theme that emerged from interviews with CBM program participants was to incorporate volunteer monitoring data into existing academic or other research programs

"through an educational lens" (Group 3 0020). This helps to build the capacity of a small program to increase environmental literacy in the community and bring visibility to environmental concerns.

4.3.2 DATA USE

CBM, government and LSBF interview participants were asked about the use of volunteer collected data for Lake Superior decision making. A principle theme that was identified was the role of volunteer monitoring data as a supplement to professionally collected data as a means to increase the capacity, data availability and range to help track environmental trends over time. "data collected through CBM programs could be extremely useful for looking at regional climate trends and looking at local climate change impacts for example" (Group 2 0007).

CBM has the ability to fit into many roles including increasing capacity to collect a wide range of data, track ecological trends over time in a local watershed, education and outreach for individuals and groups to increase the ecological literacy within a community, foster communication between scientists, decision makers and local community stakeholders and promote awareness and action for environmental restoration and protection. Incorporating a CBM monitoring component into scientific monitoring programs not only promotes awareness of local environmental issues, monitoring and restoration initiatives, but also supplies the organization with that link to local knowledge allowing researches to learn what priority issues are for the community where the monitoring activities are taking place.

4.3.3 VOLUNTEER MOTIVATIONS

When asked about common motivations for citizens to volunteer their time for a monitoring program, one interview participant commented that "many volunteers come out to

feel plugged into something to be involved with their resources. People are interested in working with scientists and resource managers to try and see the world through their eyes and how they approach problems. I think that one trick to increase volunteer involvement and commitment in monitoring programs is to try and figure out what motivates people to come out on their days off from work and then to find a way to give them what they need" (Group 2 0016).

A motivation identified by an interview participant from a government perspective was that CBM is needed more now because of shortages in personnel able to carry out monitoring activities, as well as limitations of resources and funding needed to carry out long term/broad scale monitoring for all of the locations needing attention throughout the Lake Superior Basin. This is an area where CBM could be further incorporated into governmental and scientific programs already in place in order to supplement decision-making by providing broad scale credible data that could then be used to identify priority areas in need of further attention (Summarized from Group 3 interviews).

4.3.4 PROGRAM LIMITATIONS AND CHALLENGES

When asked about what limitations there are for partnership development and multi-scale CBM coordination and communication within the Lake Superior Basin, one of the principle concerns identified by interview participants in all groups, was fragmentation between CBM organizations and lack of outside awareness and support of smaller, geographically isolated programs. One participant stated that "one of the main challenges is trying to figure out a way to bridge the gap between groups (geographically and across political jurisdictions). A particular challenge is the size of this (*Lake Superior)* Basin, which makes it difficult for people to successfully communicate and work together on projects when their respective locations are so spread out and isolated" (Group 3 0019). This concern was largely attributed not only to the difficulties in cross jurisdictional coordination, but also to the geographical distribution of

population concentrations and smaller rural communities. This was mentioned by a majority of interview participants.

Almost half of the interview participants commented on the "need for more mechanisms to coordinate" (Group 3 0015); "currently we don't do a great job at organizing volunteers as we don't have adequate mechanisms set up for supporting people in helping to conduct ecological restoration and monitoring in their watersheds. This is especially an issue for smaller communities where one volunteer steps forward to run a program or restoration project, but then gets overwhelmed with the amount of work and stress. Sometimes smaller scale river monitoring groups, for example, begin to feel as if they are all alone out there with no coordination with other groups or outside support" (Group 2 0017). "The challenge is that we do not currently have a good way to tie everything in together to streamline the process across the basin. We need to increase the support and coordination for volunteers groups to be able to better share ideas, resources, equipment, but that is the sort of invisible work that is difficult to secure funding for. These coordination mechanisms are the glue that holds everything together, but funders don't want to pay for the invisible work that is not as easily measured as opposed to the "shovel ready" on-the-ground projects with visible and measurable results" (Group 1 002 & Group 3 0019).

4.3.5 ROLE OF A BINATIONAL ORGANIZATION

The case study being looked at for the discussion on about partnerships for Lake Superior lakewide management was the Lake Superior Binational Forum, (LSBF). LSBF and government interview participants were able to provide feedback and insight into the role of a binational organization such as the LSBF in Lake Superior lakewide management processes. From a government interview participant perspective, some expectations for multi-stakeholder groups such as the LSBF include "an expectation for the Forum to not only act as an information liaison

between the communities and decision-makers, but to also become implementers of projects addressing lakewide management priorities" (Group 3 0011). "Organizations like the Forum are not regulatory body but are instead becoming more action oriented in helping to identify (local) projects getting the public involved and implementing some local small scale projects" (Group 3 0011). Another identified expectation for groups such as the LSBF, mentioned by LSBF interview participants, was for the Forum to actively uphold the ideals of the LaMP throughout the Lake Superior Basin. Comments about expectations and the role of multi-stakeholder partnerships such as the LSBF provided an overall view that these organizations should not only be a "one way" communication tool, but should provide a venue for engaging Lake Superior coastal communities to hear their concerns and questions about their local environment, as well as, share information from scientific researchers and policy-makers about the current state of the science and lakewide management goals and processes.

Another expectation identified by LSBF and government interview participants was for organizations such as the LSBF to play a role in the facilitation of cross jurisdictional communication, to gain input from diverse stakeholder perspectives and to develop partnerships throughout the Lake Superior and Great Lakes Basin (Compiled from Group 1 & 3 interviews). Discussion during interviews about the role of the LSBF in partnership development tended to focus on a change from the original role of the Forum to recent involvement in becoming project implementers and to have measurable results to bring back to funding agencies at the end of each fiscal year. A majority of Group 1 interview participants identified a major part of their role as Binational Forum members to be an information liaison between policy makers and local Lake Superior communities in addressing issues impacting Lake Superior health as well as helping to meet management and restoration goals.

There was a marked difference across jurisdictions in the opinion about the role of the Forum as project implementers. Interview participants representing the Canadian perspective viewed the role of organizations such as the Forum is liaisons connecting science, policy making and local community input through organization and implementation of public input forums. The emphasis from this jurisdictional perspective was on bringing attention to small rural communities, including First Nations, to bring outside support and funding to environmental restoration and protection. Project implementation was not seen as important on the Canadian side as on the U.S. side where funding for organizations such as the LSBF is more competitive. Interview participants from Michigan, Minnesota and Wisconsin also viewed the principle role of organizations such as the Forum as the interface between science, policy and local community input through facilitation of public input but also saw the value in moving towards local project implementation and partnership development with Lake Superior restoration initiatives. Throughout all of the jurisdictions, however, long-term funding stability was seen as a main concern to the future of organizations such as the forum as well as risk for volunteer burnout of participants.

4.3.6 LAKE SUPERIOR PARTNERSHIPS

As demonstrated in table 4.2 above, the interview question about partnerships revealed the following sub themes from interview participants: the definition of partnership types and role of partners was discussed extensively within the context of CBM and the Lake Superior Binational Forum. Key elements of successful partnerships that were mentioned included trust building between diverse stakeholder groups, public, private and mixed partnership types, the value of partnerships between policy and science, and science and community, which can lead to credible data collected by citizens used for decision-making, institutional and technical support

for project implementation, feedback for volunteers and input in decision-making and broad scale communication across political jurisdictions.

Partnerships between government and citizen groups and between government/academic institutions and citizen groups were identified by a majority of interview participants as key partnerships. Establishing partnerships from the ground up while forming and maintaining top down institutional support was mentioned in a majority of interviews as a key element for implementing successful monitoring programs contributing to lakewide management. A principle motivation for increasing CBM programs is to establish long term to self-sustaining organizations within a local watershed. When asked about training and equipment for volunteers, participants from Groups 1, 2, and 3 all mentioned scientific research and academic institutions as primary resources for running monitoring training programs and providing equipment for citizen volunteers. "The goal is to have these CBM programs become self-sustaining so that volunteers are involved in almost all aspects of data collection, analysis and information dissemination. There is a need to further develop partnerships between professional scientists working on restoration and monitoring programs and local community members working together in field and lab work, writing and data analysis. So far this has been a largely unknown concept, but interest and awareness has been growing. However, it all depends on folks interest and time commitment in the end. One key benefit of these collaborative partnerships is to increase education and awareness about local environmental issues, not only in a formal setting, but also through involvement in on-the-ground projects" (Group 2 0016).

4.3.7 ADAPTIVE CAPACITY AND PROGRAM RESILIENCY

Sub themes identified through the semi-structured interviews discussed goals for building program resiliency within Lake Superior lakewide management, building the adaptive capacity within an organization to be able to conduct long term planning for shared restoration and

monitoring goals, diversification of funding sources to be able to meet restoration needs and re-assessment of program priorities and roles as they fit within Lake Superior lakewide management processes. By increasing cross jurisdictional coordination and information sharing, stakeholder groups are more able to have access to wide ranges of data used for decision making and planning processes. By building adaptive capacity and program resilience at the community level through multi-scale partnership development for restoration and monitoring, increased support and attention is brought to local concerns and needs from regional national decision-making agencies.

4.4 PARTICIPANT OBSERVATION DATA ANALYSIS

Workshop results were analyzed using the same coding scheme as the semi-structured interviews. Participant observation was used to further explore partnerships dynamics and decision-making processes as well as relationships between diverse stakeholder groups across jurisdictional boundaries and in spread out geographical locations. Workshop results followed a similar trend as the interview identified themes, but due to the group setting, results were able to offer a more comprehensive view of the multitude of partnerships developed throughout the region working on Lake Superior lakewide and place-based restoration and monitoring activities, as well as, demonstrated how diverse stakeholder groups are able to collaborate. The objectives of the workshop focused on exploring ways of organizing by connecting with the diverse range of stakeholder groups, identify and discuss issues that are important to groups involved with the protection and management of Lake Superior, to explore how diverse perspectives are linked to address common Lake Superior issues, and to assemble and explore these diverse perspectives to improve engagement and decision making throughout the Lake Superior Basin.

The session that was of particular value to this research was the workshop breakout session with the Lake Superior Binational Forum representatives and other interested

stakeholders. This session focused on organizational change throughout the 20 years of the Forum's activities and how diverse stakeholder groups are able to work together in a Binational organization and the role of such as organization in helping to address lakewide management goals and initiatives.

When asked about how the Lake Superior Binational Forum works together, one workshop participant stated that "it's a group of diverse stakeholders able to work together through identified common goals such as addressing the pollution reduction goals, invasive species or climate change issues. We work together through community outreach to supplement Lake Superior stewardship programs etc. Each stakeholder perspective may have a unique objective but there are usually similarities. The thing that really ties all of these diverse perspectives together are the lakewide management and Binational Program goals which seek to ensure the long term health of the ecosystems. Shared goals help bring even the most diverse ways of organizing together" (Workshop Day 2 Group C 2011).

A principle need identified through Groups 1 and 3 interviews and Day 2 two workshop discussions about ways to cope with organizational change and diversification of funding options, was to have organizations such as the LSBF reevaluate their goals after so many years and to update and establish their organizational goals within the context of the Lakewide Management Plan processes. Potential actions identified through analysis of the interview and workshop data is included below:

- Establish partnerships with other cross jurisdictional Great Lakes organizations to increase communication and collaboration in initiatives addressing ecosystem restoration and health.

- Emphasis on strengthening the linkages between science, policy and community and to gain more political support and presence at Lake Superior (Great Lakes) events and public input meetings.
- Demonstrate progress made over the past 20 years and use to determine future goals and milestones, to clarify the program mandate and become more visible.
- Demonstrate value to partner and funding organizations by showing measurable results.
- Increase diversity of stakeholder representation in LSBF membership.
- Continue to encourage and support citizen-based initiatives in monitoring and restoration and public input throughout the Lake Superior Basin.

  (Day 2 of Lake Superior Workshop, 2011)

During workshop discussion sessions, trust building and accountability were mentioned as the backbone of multi-stakeholder partnership success in cross jurisdictional cooperation Great Lakes decision-making.

Results from the three data sets show a broad range of information and resource perspectives and recommendations for future collaborative partnership development in Lake Superior restoration, monitoring and governance. In the following chapter these results will be further discussed as to how they connect with the literature to provide a comprehensive perspective for continued partnership development and collaborative processes around the Lake Superior Basin.

CHAPTER 5
DISCUSSION

5.1 INTRODUCTION

Participant feedback from the emailed survey, interviews and participant observation outlined in the previous chapter can be connected with the literature on partnership development to provide insight and recommendations to enhance continued collaborative partnership development and CBM for Lake Superior lakewide management. This chapter is divided into three main sections: exploring partnerships in Lake Superior CBM programs, binational partnerships looking at the Lake Superior Binational Forum case example, and multi-scale partnerships in lakewide, transboundary water resource management. Recommendations from this study can be used not only in the Lake Superior Region but can help to support partnership development in other areas.

5.2 PARTNERSHIPS IN CITIZEN-BASED ECOLOGICAL MONITORING

Citizen volunteers have been a part of scientific research since the 1700's in both a formal and informal capacity. Some examples of this early "citizen science" included European bird surveys reported from backyard birders, citizen astronomers and weather watchers (Williams 2013). Today, many national and regional programs are incorporating local community involvement in environmental monitoring and restoration activities as a means to enhance environmental education and awareness, to build capacity and communication between scientists, educators, policy makers and community-based volunteers. Another point that was emphasized through the literature and data was the need for capacity building at the community, regional, national and cross border levels of involvement. It is a growing opinion that citizen volunteers are often able to cover more ground and gather a wide range of data helping scientists

and decision makers to better track trends over time. Themes identified through this research support the perspective that CBM has the capability to supplement scientific or government based research programs that increasingly struggle with project funding shortfalls and personnel capacity. Incorporating volunteers into monitoring and restoration projects can help to increase environmental awareness and education, and collaboration among citizens, scientists and policy makers. In the Great Lakes region, there are many scientific research, academic, and decision-making organizations looking to increase information sharing and inter-jurisdictional involvement to support environmental literacy building and resource management. Participants in the research all emphasized the importance of continued partnership development throughout the Great Lakes Region through the implementation of more community-based initiatives, including CBM, as a means to form linkages and enhance communication across jurisdictions and between diverse stakeholder groups.

The data collected through this research on CBM and partnerships in Lake Superior lakewide management support what Olsson *et al.* 2004 refers to as the building blocks of multi-scale collaborative governance mentioned in Chapter 2. A summary of these building blocks for successful partnership development include the following elements:

- Establishment of common goals or a shared vision among partners,
- Identified leadership and clarification of individual partner roles and responsibilities within an organization,
- Build trust and accountability among stakeholder groups,
- Capacity building within legislation to create social space and institutional support for ecosystem based management,
- Stable, long-term funding in order to address and support remedial action and cope with ecological and organizational change,
- Build capacity within monitoring programs to address community identified issues,
- Generate information flow across jurisdictions and different knowledge sources,
- Foster collaborative learning, program adaptability and resiliency (Olsson *et al*. 2004)

The data collected throughout this research supports the above partnership building blocks through the identification of similar goals and themes in Lake Superior Basin partnerships. This is included in CBM programs, Lake Superior Binational Forum and restoration activities and community-based, regional, national and binational stakeholders implementing projects to improve community resiliency, ecosystem function and sustainability over time.

Value placed on Great Lakes resources (environmental, social and economic) creates a space for diverse stakeholders to come together for the common goal of Great Lakes protection, restoration and management for future generations. However, through this research, and in the literature on partnership development, a principle gap impeding the success of broad scale restoration is the lack of capacity and institutional support in planning and implementing projects, monitoring and assessment over a long period of time. "Despite all of the (binational and regional) agreements that have been established to help govern the Great Lakes, we are still not collaborating and communicating enough to actually get things done on a system-wide scale" (Group 1 009). Ecological restoration and monitoring projects that include a citizen/community outreach component, at both large and small scales, builds capacity for public education and community engagement, fosters collaborative ongoing partnerships, increases ecological literacy and helps to create visibility and draw attention to areas in need of further assessment by policy makers (Whitelaw et al. 2003). By establishing long term, stable monitoring programs, we have the ability to build up community resilience and adaptive capacity to environmental change.

There is a growing interest in research on the benefits of incorporating CBM into restoration and research programs. Some of the benefits of CBM may include: Development of community outreach and education tools used to foster greater understanding of the linkages between ecological systems and anthropogenic impacts on natural resources, discovering new

ways to build awareness of local watershed issues and to increase public involvement and support of policies and restoration activities around a particular watershed (O'Rourke and Macey 2003). Involvement in restoration and monitoring projects in a local watershed also can create a sense of ownership or empowerment for volunteers with their surrounding environment (Group 2 0016). According to Whitelaw *et al*. (2003) "Citizen-Based Monitoring empowers many stakeholders to participate in the quest for achieving long term sustainability" (Whitelaw *et al*. 2003). A study conducted by Petkova *et al*. (2002) refers to an emerging idea that often, decisions made about the management of local ecosystems tend to be more acceptable to the public who reside in that area if they have had a chance to be involved in some way throughout the decision making process, whether it be through a public advisory group, stream or watershed restoration project, beach or park cleanup effort, or any number of small scale or large scale restoration and monitoring activities (Whitelaw *et al.* 2003; Petkova *et al.* 2002).

Partnerships built through watershed stewardship programs including CBM initiatives have the ability to draw political support as well as support from other organizations and agencies that may not have otherwise become involved in a particular area, therefore increasing the ability of a local citizen group or stewardship organization to have a stronger influence on decisions made in their region. CBM programs provide volunteers with on the ground experience where they are able to generate scientific knowledge. This helps to build trust and accountability between diverse stakeholder groups, fosters greater understanding of how ecosystems function and as well as create leadership opportunities within local communities enhancing the scientific adaptive capacity within that community (Pollock and Whitelaw 2005).

Despite the multiple and cascading benefits to CBM there are also a few challenges and limitations mentioned in the literature and identified by participants in CBM in the Lake Superior

region. For example, some scientists and policy makers may not view citizen collected data as credible enough because of the wide range of volunteer training approaches and monitoring methodologies across a particular area. In some programs around Lake Superior, volunteers have access to more robust training and are supplied with technical support and implementation assistance from experienced scientists, while other programs may have a more limited capacity to conduct volunteer training and for carrying out more complex monitoring activities. Through discussion of these limitations, a need was identified to more clearly define the goals of having a CBM component in a research or restoration program. Having outcome based projects may help to clarify the type and amount of monitoring that needs to be carried out and what training, funding and equipment requirements there are.

Isolation and fragmentation between volunteer monitoring programs can also be a challenge, especially in smaller watersheds and more rural areas. These isolated initiatives may not have the support or funding necessary for long term stability and it often falls on a few individuals to carry out time consuming and expensive monitoring and restoration projects. Another barrier to long term success of some CBM programs is lack of coordination and communication between groups where some smaller initiatives may not be aware of each other's activities and may not have access to adequate funding, training expertise, monitoring equipment and resources needed to carry out a particular activity. Currently, there is no standard approach to incorporating volunteers into monitoring and restoration activities, leading to varying methodologies for collecting data and in some cases lack of long term volunteer and leadership commitment. This lack of a coordinated approach to citizen training and monitoring methods can sometimes lead to program accountability and data credibility issues. Time commitment and leadership capacity can also become a challenge for smaller CBM initiatives. "Volunteer

burnout" becomes a primary challenge for some groups when monitoring activities fall on a few individuals without having sufficient support. Many programs lack the capacity to be able to address all of the "invisible work" that goes into establishing a long term, stable, monitoring program such as fundraising, grant writing, volunteer recruitment and training, data collection and analysis, assessment of activities, gaining access to necessary resources and materials for project implementation and follow up with volunteers and decision-makers. All of these tasks can lead to volunteer burnout if the CBM program does not have established leadership, protocols and institutional support as well as networking and information sharing with other similar monitoring programs.

Feedback and communication with volunteers and partner organizations is key to any CBM program as it magnifies how volunteer efforts contribute to and benefit ecosystem restoration, protection and management promoting resilient and sustainable monitoring programs. Many volunteers want to know that the data that they are helping to collect is useful for the overall process of ecosystem restoration, protection and management (Group 1 & 3 Interviews).

Through the literature on governance in the Great Lakes region supported by interview data in this Lake Superior case study, a few key differences between Canada and the U.S. in the approach to incorporating community involvement into Lake Superior restoration, monitoring and management can be identified. For example, in the Ontario portion of the Lake Superior Basin, there tends to be a stronger focus on public advisory groups while on the U.S. side there are more volunteers involved directly with monitoring and restoration projects on the ground. One approach is not necessarily better than the other; however, each approach has different benefits and limitations. For example, Public Advisory Groups that may not involve volunteers

in direct restoration and monitoring activities cost less and take less time commitment from researchers, scientists and decision makers to train and supply equipment for volunteers. One down side of this is that volunteers may not be as involved or committed over the long term than if they were more directly involved with the resource through monitoring activities. Both the Canadian and U.S. approaches to building community involvement in Lake Superior restoration and monitoring support the elements identified in the literature as benefits including: building capacity on the local level for community support in restoration and monitoring activities in their watershed, growing environmental literacy within communities, increasing communication between scientists, decision makers and community stakeholders and growing outside support and awareness of issues in more rural regions, such as the Canadian North Shore of Lake Superior (Petkova *et al*. 2002 and Savan *et al*. 2003).

In Canada and the U.S., most CBM initiatives are partnered or housed within an academic or scientific research institution and are funded through government or private foundation granting agencies. Volunteer recruitment methods vary from program to program across the region on both sides of the border, however, the use of the internet, and especially social media, has become a primary method to not only share information with the public, but also as a way to recruit volunteers for monitoring and restoration projects as well as spread awareness about environmental policy change and opportunities for public comment (Williams 2013).

One recommendation for CBM in the Lake Superior Basin identified by interview participants was to enhance partnership development and information sharing between CBM programs through mentoring. This was mentioned as a means to establish a collaborative network for CBM programs in the Great Lakes Basin to decrease program fragmentation and

group isolation so that smaller initiatives don't become lost in the process or overwhelmed by larger scale monitoring and restoration projects. Similar CBM initiatives could be grouped together through 'peer-mentoring" in order to support each other's efforts and to better provide feedback to volunteers and partner organizations. As part of a collaborative consortium of volunteers, scientists, educators and decision-makers, information can be shared across networks on project development and implementation, monitoring techniques, funding opportunities and sources, lessons learned and continuous needs assessment for communities to build off of previous and ongoing restoration and monitoring initiatives (Compiled from Group 1, 2, and 3 Interviews).

According to feedback from participants in CBM programs, decision making organizations and scientific researchers, the overall benefits of increasing community involvement in Lake Superior restoration and monitoring activities largely outweigh the drawbacks. There is rising interest and awareness for how CBM can be optimally utilized for Great Lakes governance, partnership development, and collaborative restoration and monitoring initiatives. The traditional top-down approach to water resource protection and management is undergoing a transition to focus more on a bottom-up approach, involving grassroots partnerships and incorporation of traditional knowledge and expertise in monitoring and restoration projects. Ecosystem management is built from collaborative partnerships between diverse stakeholders contributing to the protection, restoration and management of shared water resources.

5.3 BINATIONAL PARTNERSHIPS: THE LSBF CASE STUDY

The Lake Superior Binational Forum (LSBF) provided an ideal "case within a case" to examine Lake Superior multi-stakeholder partnership dynamics through its role as a binational

cooperative effort to address Lake Superior issues and uphold the ideals of the Lakewide Management Plan through community engagement and partnership development. The LSBF serves as an example of multi-stakeholder collaboration as a binational volunteer organization that received financial and institutional support from two federal governments of Canada and the United states for a twenty year period. The LSBF played a crucial role in the formation of partnerships and two-way communication and knowledge exchange by facilitating public involvement in support of lakewide management of a large and complex ecosystem that crosses multiple jurisdictions and geographic boundaries. Public involvement and multi-stakeholder partnership development throughout the Lake Superior Basin is a cornerstone on which the group is based. Some key organizational pillars as identified in the Forum's Charter and by its long term members are outlined below: (Lake Superior Binational Forum Charter 1995).

1. To hold regular public input sessions in Lake Superior communities;
2. Provide input from the public to decision-makers about community prioritized issue areas and to share information about lakewide management initiatives and restoration projects and milestones
3. To partner and have regular communication with Lake Superior regulatory entities including the Lake Superior Taskforce and Workgroup;
4. To take a leading role in addressing Lake Superior issues and actions;
5. To strengthen diversity through stakeholder member representation and utilize unique leverage as a binational organization to strengthen collaborative partnerships throughout the Lake Superior Basin;

6. To uphold, maintain and communicate Lake Superior Lakewide Management Plan (LaMP) goals as well as goals outlined in the Great Lakes Water Quality Agreement (GLWQA)

For 20 years, the LSBF worked to develop vital partnerships and foster cross border communication and collaboration with support from the two federal governments of Canada and the U.S., however, in 2010 and 2011, the LSBF encountered some barriers to continued institutional and funding support, which became especially apparent on the Canadian side of the Forum.

At the beginning of the LSBF program, it had a unique and influential capacity as a volunteer organization with a wide range of stakeholder representation, including community and environmental interests, academia, Indigenous Peoples, recreation and tourism, industry, scientist, and had partnerships with local, state/provincial, regional and national governmental agencies. The capacity to inform the decision-making process was strengthened by the diversity within the organization, "if a group with such a diverse range of perspectives could reach an agreement and come up with common goals or find common ground about issues facing the Lake, recommendations from a group like that carried a lot of weight when brought back to decision makers" (Group 1 004). The value of the LSBF was through its facilitation of public input sessions on Lake Superior issues through coordination and information sharing between local and regional restoration and decision making efforts.

A principle challenge that the Forum faced in 2010 and 2011 was its reliance on a single source of funding so when they encountered an imbalance in funding allocation between the Canadian and U.S. federal governments and funding cuts on the Canadian side, the continuation of the LSBF as a binational organization became a major concern. At the same time the LSBF

went through a period of organizational change with increased pressure from partner agencies to maintain their original function as a liaison between local communities and decision-makers, as well as take on the additional role of being project implementers. LSBF was not traditionally involved with implementing "on the ground" restoration and monitoring projects so as more funding became available for "shovel ready" projects and less for travel and facilitation of public input sessions, the Forum began to reassess their role within the Lake Superior Lakewide Management process to adapt to these changes.

During this time of organizational change, a classic case of "volunteer burnout" resulted as Forum volunteers worked to find the time to take on more tasks to keep the organization going. A lot of the "invisible work" that is so difficult to fund included continued partnership development, coordinating between local communities and decision makers, development of "fundable" projects and exploration of alternative funding sources as federal budgets continued to be cut.

Due to these limitations, as well as changes in the political climate, federal funding for the Canadian portion of the LSBF was cut and the organization has undergone extensive change from its original role. In order for multi-stakeholder, binational organizations such as the LSBF to re-establish themselves as intricate components within ecosystem based management, original goals would need to be assessed for strengths and weaknesses and redesigned to fit with current issues and characteristics of the region, as well as to expand and establish new objectives to increase stakeholder representation and partnerships to increase the adaptive capacity of the organization. Data from interviews with LSBF members revealed some contradictions in the expectations of the LSBF moving forward and the original role of the group as a liaison between science, policy and Lake Superior community stakeholders.

Collaborative partnerships provided through the LSBF are essential to Lake Superior lakewide management and continue to facilitate community involvement in the decision making process serving as a model for other organizations seeking to increase the linkages between coastal communities and decision-making organizations. After 20 years, LSBF members are still building partnerships and fostering collaboration and information sharing between diverse stakeholder groups. Organizations such as this have the capacity to be key players in ecosystem based management and restoration initiatives on local, regional and international levels and the LSBF continues to serve as a model for collaborative partnership development in transboundary water resource protection, restoration and management.

5.4 PARTNERSHIPS IN LAKEWIDE TRANSBOUNDARY WATER RESOURCE MANAGEMENT

In many ways, the North American Great Lakes region can be used as a model for inter-jurisdictional agreements and multi–stakeholder partnerships collaborating in transboundary water resource restoration, protection and governance (Bertram 2000). Some examples of these cross border agreements between Canada and the U.S. include: the International Joint Commission (IJC) which was established from the Boundary Waters treaty of 1909, the Great Lakes Water Quality Agreement 2012 Protocol (GLWQA) and the Great Lakes Charter in 1985. Additional multi-stakeholder organizations specific to Lake Superior restoration and protection include the Binational Program (1991) out of which the Lake Superior Binational Forum was established (Hildebrand 2002; Barlow 2012; Bertram 2000). The Binational Program to restore and protect Lake Superior focuses on bioaccumulative toxins through an ecosystem-based approach using the Lakewide Management Plan and multi-scale partnership development. These cross border agreements and partnerships are also involved with large scale multi-stakeholder cooperative initiatives at the grassroots community level through environmental organizations,

academic research institutions, community watershed associations, and are implemented at the local, state, regional, national and international scales.

One challenge that still exists for these partnerships is a streamlined method for sharing information and coordinating restoration and monitoring efforts on a basin-wide scale across jurisdictions. Many of these existing and emerging restoration and monitoring programs have similar goals of restoring degraded areas in the Great Lakes Region through both point source and lakewide and ecosystem-based approaches, however, gaps still exist in collaboration, accessibility of information and visibility of program activities and decision-making mechanisms. Some of the factors that contribute to continued coordination challenges include lack of long term, stable funding sources, fragmented institutional support for smaller programs in more rural areas, frequent personnel turnover and the uncertainty associated with many of the major environmental stressors including how to address climate change impacts on the Great Lakes ecosystems, how to address historical contaminants, introduction and spread of aquatic invasive species and jurisdictional differences between state and federal agencies, best community engagement mechanisms and long term restoration goals and strategies. These findings compare to the literature on partnership development according to Casey (2008) in the examination of the role that public/private partnerships play to help coordinate diverse stakeholder viewpoints and increase capacity to adapt to changing conditions, support two-way information exchange between communities, policies and science and encouraging community-based involvement throughout decision-making processes (Casey 2008).

One perspective is that the ways in which we view our watersheds needs to be changed before we will truly be able to meet our restoration and watershed protection goals. This "shared" Great Lakes perspective stems from the idea that the Great Lakes region should not

only be viewed as a product or cash commodity but rather as a shared and valued resource to be protected and preserved for future generations (Barlow 2012). One participant stated "if there was a way to operationalize prevention instead of only focusing on restoration more effectively it might be easier for us to move forward" (Group 1 002). "there are some really progressive things happening through Lake Superior programs (stormwater management, Low Impact Development, Green Infrastructure, pollution prevention etc.) but people need to realize that there is only so much damage that our (water) resources can sustain…we have only recently begun to significantly and on a large scale started to change our approach to managing water" (Group 3 0012).

This concept of promoting a more unified approach to water governance would involve a diverse range of stakeholder interest groups having the capacity and communication mechanisms to coordinate at both large and small scales (Moore & Koontz 2010). In the Lake Superior watershed alone, we find that there are many types of partnerships that are each able to play a particular role in transboundary water resource management. Partnerships tend to vary significantly in level of stakeholder involvement and collaboration with other groups. There are, however, general categories of partnerships that can be found in the Lake Superior region and include: Citizen-based groups composed primarily of community volunteers, agency based groups composed primarily of public representatives or governmental agencies, and mixed groups made up of a variety of stakeholders including, community, agency, academic, scientific and Indigenous Peoples (Moore and Koontz 2010). These three categories can be further broken down into the four partnership types introduced in Chapter 2. These include:

1. Consultative partnerships where an agency partners with a public group. The agency maintains primary control with public involvement in an advisory capacity. This type of

partnerships can be found in the Area of Concern process in Ontario in the form of Public Advisory Groups who participate in meetings and events concerning a particular region or area of concern and remediation planning process. These partnerships are beneficial for bridging the cap across jurisdictions or large geographic areas. The two way communication generated through consultative partnerships allows community stakeholders to voice their environmental concerns and to learn more about the decision making process while the agency partners have access to local knowledge about the resource and are held accountable for decision made around governing that resource.

2. Contributory partnerships share responsibility between partners; however, the agency partner retains primary control. In contributory partnerships, any additional partners have influence over decisions made. Contributory partnerships may be especially beneficial when focused on a smaller area or particular water resource issue. Partners are able to collaborate and share knowledge and expertise to collectively reach decisions and implement actions.
3. Operational partnerships have shared work, information and resources between partners. The agency still retains primary control however any partners are able to influence decision making through direct involvement with projects. Operational partnerships are most beneficial for monitoring activities over the long term. Agency partners are able to support restoration, monitoring and assessment activities while receiving help from partners to collect and analyze data helping to make more informed decision.
4. Collaborative partnerships where control is shared equally among all partners including shared ownership, accountability and risk. Collaborative partnerships can be found most often at the community grassroots level. Partners equally collaborate throughout the

process from project design, implementation, monitoring and assessment (Powell Quinn 2007).

All of these partnership types can be found in the Lake Superior Basin and include community involvement in some capacity. Successful multi-stakeholder partnership dynamics for transboundary water resource management depend largely on achieving a balance volunteer grassroots initiatives and top down governance and institutional support. All of these partnership types seek to more effectively bridge the gap between communities, scientists and policy when in addressing environmental issues. Partnership types can be developed based on the needs of a particular group, environmental issue, policy or region depending on capacity and support.

5.5 SUMMARY

Public involvement through grassroots organizations tackling restoration and monitoring projects throughout the Great Lakes Basin is one primary way to develop partnerships between local communities, scientists and policy makers to promote focus on local issues. From this research it has become evident that a majority of stakeholders agree that there needs to be more of a balance between large scale national and international policy and environmental regulation on a Great Lakes region-wide scale coordinated with local community-based restoration and monitoring efforts focused on a particular environmental issue in a particular watershed. These locally based programs have greater capacity to fit the needs of a particular watershed and tailor their goals and projects based on the unique geographic, environmental and political features of their community to establish long term programs able to track trends over time to support decision-making. Without locally based restoration and monitoring initiatives, many of the watersheds in need of attention would continue to go unnoticed in favor of larger scale

environmental stresses in more densely populated areas. With the overload of issues that need attention and funding for restoration, there is a lack of resources available to address everything from a top down perspective. It therefore falls to local officials, and communities to ensure that their particular areas do not go unnoticed.

At the same time, large scale support and coordination across an entire region is needed to make overall progress in meeting restoration and resource management goals. While it may take longer to implement projects and decisions on a national or international scale, it is important to address the Great Lakes as a whole and to understand the linkages between all variables to the overall health of the Lakes. It is also important to communicate the successes and value of small scale efforts into the large scale initiatives and that as a collective process, every bit helps. This is a particular challenge in the Lake Superior watershed which has wide geographic distribution and low population density along reaches of the shoreline leading to fragmentation and isolation between communities and restoration and monitoring programs. Cross boundary partnerships then become key in making sure that small scale efforts are recognized and that there is continuous communication and coordination between top down and bottom up efforts. In this capacity, partnerships between local, state, regional and federal governments and community based programs create the building blocks for success. Partnerships between scientists and policy makers are also essential to foster environmental literacy about the ecosystems in which we live and the linkages between humans and their environment (Bertram 2000; Axler 2006; Savan 2003).

CHAPTER 6
CONCLUSION

6.1: RECOMMENDATIONS FOR PARTNERSHIP DEVELOPMENT THAT IMPROVES CITIZEN-BASED ECOLOGICAL MONITORING AND INFORMATION SHARING IN LAKE SUPERIOR LAKEWIDE MANAGEMENT

The purpose of this study was to identify and explore partnership dynamics for environmental citizen based monitoring (CBM) in the Lake Superior Basin and its role in lakewide management of a transboundary water resource. The Lake Superior Basin was used as a study area looking at organizations such as the Lake Superior Binational Forum, citizen-based monitoring programs and governmental organizations all working toward the restoration, protection and lakewide management. The research question being explored focused on how partnerships for environmental citizen-based monitoring may contribute to or enhance ecosystem or lakewide management. This summary chapter is structured around the four objectives and how they were met throughout the course of this research.

The First Objective was to collect an inventory of citizen-based ecological monitoring programs around the Lake Superior Basin. This was achieved through data collected through an emailed survey and interviews with participants involved with environmental CBM programs in the Lake Superior Basin. Questions included in the survey were derived from the literature review on partnerships and CBM programs from around the world looking at common successes and limitations for community involvement in restoration, protection and monitoring activities. Results from the CBM inventory showed that ecological monitoring in any area, whether it is in a large transboundary watershed such as Lake Superior, or a small tributary, is essential for identifying long term restoration and protection goals and assessing restoration projects for improving future policies and approaches to water resource management. CBM increases monitoring capacity in a particular area to track trends over time, creates opportunities for

community involvement in watershed issues and decision making processes helping to build environmental literacy and adaptive capacity to cope with environmental change. Recommendations for continued CBM in the Lake Superior Basin include building capacity and collaboration at the local, regional, national and international levels to ensure that citizen monitoring volunteers receive robust training and have access to information and resources needed to carry out broad scale monitoring activities. Feedback for volunteers to let them know that their data is useful for policy making helps to encourage volunteer involvement and long term commitment for future monitoring and restoration projects in the Great Lakes Basin. Partnerships between local knowledge and expertise at the community level with institutional support and scientific research helps foster a more unified approach to restoring and managing shared water resources on an ecosystem scale. These partnerships including community involvement also help to bridge the gap between single focus, point source issues and lakewide management goals.

The second objective for this research was to explore the dynamics (strengths and weaknesses) of multi-scale partnership development and information sharing in the Lake Superior Basin. This was achieved through conducting semi-structured interviews and participant observation with participants from CBM program, Lake Superior Binational Forum stakeholders and government representatives from the regional and federal governments of Canada and the United States involved with Great Lakes (Lake Superior) governance. Additional stakeholder groups who contributed to the data collection process included: community environmental groups, business representatives, Indigenous Peoples, scientific researchers and academics working towards Lake Superior protection through restoration and monitoring activities. Existing partnership dynamics around Lake Superior restoration and

management are built upon multi-stakeholder communication networks to share information and collaborate on projects on a basin-wide scale across multiple jurisdictions. Partnerships between scientists, policy makers and Lake Superior coastal communities help to establish trust and accountability between differing perspectives to help identify shared priorities and establish restoration goals to build capacity for long term planning and protection of natural resources. Certain elements for successful partnership development were identified through the literature review and data collection leading into objective three of the research process: to identify a framework for adaptive, ecosystem-based management partnerships in the Lake Superior Basin. These elements for partnerships development include:

- The identification of a shared vision and goals among partners,
- Establishing leadership and long term partner commitment,
- Establishment of trust and accountability between stakeholder perspectives,
- Build capacity within governance structures and decision-making mechanisms to create space for broad scale ecosystem based management,
- Diversification of funding sources and support to increase the adaptive capacity of a program to be able to better meet the needs of a particular environmental issue within a Lake Superior coastal community,
- To build the capacity for more long term monitoring and assessment of remediation projects to be able to measure success over time, to improve restoration activities and to cope with environmental and organizational change, complexity and uncertainty.
- To improve communication and community engagement mechanisms to create transparency and visibility between stakeholder groups leading to improved

information flow and knowledge exchange on lessons learned to improve future processes.

- Build upon existing outreach and communication mechanisms to bridge the gap between broad scale, top-down federal and regional mandates for meeting water quality goals and community-based grassroots, bottom-up initiatives to address local environmental issues within a particular watershed (Ollson *et al*. 2004; Heikkila *et al.* 2005).

These elements contribute to a more stable and streamlined approach to address issues facing Lake Superior to decrease program fragmentation and overlap in restoration and monitoring activities.

The final objective for this research was to identify recommendations for continued partnership development to enhance citizen-based monitoring and information sharing in Lake Superior lakewide management. Some recommendations for future success of partnership development and community involvement include:

- The formation of collaborative partnerships that organize monitoring efforts in key issue areas such as the Great Lakes designated Areas of Concern;
- Use of communication and peer mentoring networks to share information between individual monitoring and restoration initiatives and across jurisdictions and broad geographic areas;
- Conduct continuous needs assessment, reflection and evaluation within an organization to continue to adapt to the needs of a particular community and environment;

- Compile a monitoring inventory and communication network for each of the Great Lakes that can be regularly updated and used to form connections between similar groups and communicate lessons learned;
- Establish consistent and diverse funding sources to manage monitoring and restoration programs over time;
- Continuous communication in the field and use of technology tools for training and project implementation efficiency;
- Push for federal/regional/state decision makers to respond to monitoring needs and increase communication between local and regional efforts;
- Build coordination between local level community participation and basin-wide binational initiatives moving between point source restoration and lakewide/ecosystem based management (Recommendations compiled from Great Lakes Inventory 2006 and Groups 1, 2 & 3 Interviews 2011).

The importance of exploring partnership dynamics for water resource management is becoming more prominent in recent years due to increased emphasis on collaborative resource management and the role that local communities are beginning to play in restoring and protecting local watersheds. Community based groups have the resources and knowledge needed for place based collaborative management which can contribute to larger processes addressing Great Lakes restoration, monitoring and assessment. Local stakeholder involvement helps to build support and validity for watershed policies being made at the national and international levels. Around Lake Superior, in particular, considerable progress in instituting multi-stakeholder partnerships and public participation in lakewide management initiatives has been made. However, due to organizational and environmental change, many programs are looking for ways

to strengthen their partnerships and program resilience in order to implement more long term protection and management initiatives and to further involve communities living within these watersheds. Still more can be done to become collectively more adaptive to changing conditions and to learn from past initiatives to improve into the future.

FUTURE RESEARCH

Research on partnership development in resource management is a growing field and will continue to be valuable into the future. As political climates shift and more stress is placed on communities and water resources, it becomes increasingly important for diversifying partnerships to be more able to cope with environmental, economic and political change.

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Appendix A: Survey

Lake Superior Citizen-Based Monitoring Survey

The purpose of this survey is to establish a baseline of information on the monitoring projects and locations taking place in the Lake Superior basin. If you are interested in being a participant of this research, please fill out this form to the best of your ability, and forward this email on to anyone in your contacts list involved with citizen-monitoring in the Lake Superior watershed.

Name of organization?

Project title?

Project location? Please provide GPS co-ordinates if possible

Project description? Include Mission Statement if possible

Contact person: Last name

Contact person: First name

Contact person: Phone number

Project website?

Project funding source (check multiple if needed)

- Federal Government
- State/Provincial Government
- Foundations
- Donations
- Business
- Grass roots fundraising
- Local Government
- Memberships
- Other:

What year did this monitoring project begin?

How often does the monitoring take place?

What is the projected end point of the project?

How many people are involved with this program?

What is the status of the project?

- Planned
- Current
- Complete
- Cancelled
- Other:

What training is involved for monitors?

What type of data is collected?

- Water quality analytical
- Water quality quantitative (water transparency, debri...)
- Monitoring for chemical pollutants
- Aquatic Invasive Species
- Benthic macroinvertebrate biomonitoring
- Fish biomonitoring
- Other biomonitoring
- Other:

Appendix B: Interview Cover Letter

Date:

Dear Name of Potential Participant,

I would like to invite you to be a potential participant in a research project that is being conducted by MES candidate, Hilarie Sorensen, in the Environmental Studies Northern Environments and Cultures program at Lakehead University, Thunder Bay, Ontario, Canada. The purpose of this research is to further coordination and information availability in partnerships involved in citizen-based monitoring and lakewide management in the Lake Superior Basin. This research explores how partnerships for environmental citizen-based monitoring may lead to improved lakewide management within the Lake Superior Basin.

The objectives of this research are to: collect an inventory of citizen-based ecological monitoring programs around the Lake Superior Basin; to explore the dynamics (strengths and weaknesses) of multi-scale partnerships and information sharing in the Lake Superior Basin; to develop a framework for adaptive, ecosystem-based management partnerships in the Lake Superior Basin and finally; to provide recommendations for partnership development that improves citizen-based monitoring and information sharing in lakewide management.

I am requesting your potential participation in a semi-structured interview in order to gain information that I will use to provide recommendations for partnership development in citizen-based monitoring efforts in the Lake Superior Basin. The interview will take approximately 45 minutes and will be based on a broad set of open questions that may be expanded on. The nature of these questions will be semi-structured with no right answers and all responses will be accepted and kept confidential at the request of the participant. Your participation is completely voluntary, you may choose not to answer any question and you are free withdraw from the interview at any time. There are no risks associated with participation in this study and your participation would be extremely helpful and beneficial for the research. The information gained through these semi-structured interviews will be useful for helping me create a comprehensive idea of what partnerships in resource management need to be successful and how monitoring at the community level and partnerships formed between the various stakeholders contributes to successful lakewide management.

The interview will be tape recorded and then transcribed at Lakehead University. Anonymity and confidentially will be offered to you if you choose to participate and is completely voluntary. If you choose, your name, affiliation and contact information will not appear in any documents or presentations related to this research. Only the research team will have access to this information which will be stored in a locked filing cabinet in the lead researcher's office.

Once the project is completed the data will be stored for five years at Lakehead as per university policy. A final report of this project will be written at the completion of the data collection and analysis and will be made available to all participants at their request.

Please contact me or the lead researcher if any concerns over this project arise. The contact information for myself and my supervisor is provided below. This project has been approved by the Lakehead University Research Ethics Board; if you have any questions related to the ethics of the research please feel free to contact the board at 807-343-8283.

Thank you for your time and consideration.

Sincerely,

Hilarie Sorensen
PH: 218-343-2391
hsorense@lakeheadu.ca

Dr. Robert Stewart
PH: 807- 766-7181
rob.stewart@lakeheadu.ca

Appendix C: Interview Consent Form

Consent Form: Copy for Researcher

By signing this document, you are communicating your willingness to be a participant in this research and that you understand and agree to the following conditions:

1. Your participation in this research is voluntary and you are free to withdraw at any time.

2. You may choose to remain anonymous and confidentiality will be maintained throughout the research process and documents.

3. You consent to the interview being tape recorded.

4. You will have the opportunity to review transcripts of the interview to ensure accurate representation of your views.

5. The information that you provide will be potentially used to create documents for publication.

6. The data collected during the interviews will be stored at Lakehead University for 5 years.

7. Upon request you may receive a copy of the final report resulting from this research.

8. Upon request you may receive any publications that result from this research.

Participant: Researcher:

_____

Signature Signature

_____

Date Date

Appendix D: Interview Questions

Semi-structured questions used to generate discussion

What are the main goals of this program?

- How do citizens become involved?
- How are they trained?
- What can you tell me about some of the common motivations for citizens to become involved in this program?
- What are some of the expectations and desired impacts?
- Are there public outreach and awareness campaigns in this program?

Data collected

- What data is collected?
- How is it collected?
- How is it used?
- How accessible/available is information to the public?

What are some of the main limitations for this program?

- Multiple funding sources?
- Outside awareness and support?
- Institutional linkages

Role of partnerships

- Partnerships with government?
- Is this program primarily public, private, or mixed involvement?
- External linkages/support?
- Clearly defined roles and responsibilities
- Common vision/goals?

Resilience of the program

- Adaptability?
- Science/policy coordination
- Collaboration
- Long term planning
- Trust building
- Accountability

Appendix E
Lake Superior Watershed Citizen-Based Monitoring Inventory
2011 Year of Monitoring

MONITORING CATEGORIES	MINNESOTA	WEBSITE
LAKES	Citizen Lake and Stream Program	http://www.pca.state.mn.us/index.php/water/water-types-and-programs/surface-water/streams-and-rivers/citizen-stream-monitoring-program/citizen-stream-monitoring-program.html?menuid=&redirect=1
	MN Lake Superior Coastal Program	http://www.dnr.state.mn.us/waters/lakesuperior/index.html
	Large Lakes Observatory	http://www.d.umn.edu/llo/
	MN DNR Volunteering Opportunities	http://www.dnr.state.mn.us/volunteering/opps/index.html
	North Shore Stewardship Association	http://www.sugarloafnorthshore.org/
	MDNR	http://www.dnr.state.mn.us/lakes
	Minnesota Waters	www.minnesotawaters.org
	MPCA	http://www.pca.state.mn.us/index.php/water/water-monitoring-and-reporting/volunteer-water-monitoring/volunteer-surface-water-monitoring.html
	Lakewater Save Lake Superior Association	www.savelakesuperior.org
	MN Sea Grant	www.seagrant.umn.edu/newsletter/2011/06/aquatic_science_gets_hormonal.html
	Carlton County Citizen Lake Assessment Program	http://www.legacy.leg.mn/projects/carlton-county-citizen-lakes-monitoring-program
	Cook County Lake Associations	http://www.co.cook.mn.us/index.php/conservation-planning

	Natural Resources Research Institute	http://www.nrri.umn.edu/default/
RIVERS & STREAMS	Duluth Streams MPCA-Stream Monitoring St. Louis River Alliance Fond du Lac Flute Reed Partnership Knife River Stewardship Group	www.duluthstreams.org http://www.pca.state.mn.us/index.php/water/water-types-and-programs/surface-water/streams-and-rivers/citizen-stream-monitoring-program/citizen-stream-monitoring-program.html www.stlouisriver.org http://www.stlouisriver.org/staff2.html http://www.fdltcc.edu/academics/departments/special/stlouisriverwatch/ http://www.lakesuperiorstreams.org/northshore/fluteReed/partnership.html http://www.southstlouisswcd.org/knife_river.html
AQUATIC INVASIVE SPECIES	MDNR MN Pollution Control-Ballast Waters MN Waters MN Sea Grant Lake Access	http://www.dnr.state.mn.us/eco/invasives/index.html http://www.pca.state.mn.us/index.php/water/water-permits-and-rules/water-permits-and-forms/vessel-discharge-ballast-water-program.html?menuid=&redirect=1 www.minnesotawaters.org/what-we-do/issue-advocacy/ais www.seagrant.umn.edu/ais/superior_nonnatives www.lakeaccess.org/exotics.html
BEACHES	Great Lakes Alliance Beach Cleanups Surfrider MN Superior Chapter Adopt a Beach	www.greatlakes.org www.surfrider.org/MNsuperior www.greatlakes.org/adoptabeach
WILDLIFE/BIRDS	MN Audubon Society Lake Superior	www.mn.audubon.org/birds-science-education/important-bird-areas/ibas-minnesota www.lakesuperiornews.info/LifeStyles/Birds/Survey/tabid/169/

	Bird Survey Ducks Unlimited Trout Unlimited Hawk Ridge Nature Reserve	Default.aspx http://www.ducks.org/ http://www.tu.org/ http://www.northshoreinfo.com/hawkridge/
WATERSHED GROUPS	MN Association of Watershed Districts Flute Reed Watershed Partnership MDNR Lake Superior Streams-Watershed Associations	www.mnwatershed.org http://www.lakesuperiorstreams.org/northshore/fluteReed/partnership.html http://www.dnr.state.mn.us/watershed_tool/index.html www.lakesuperiorstreams.org/citizen
WETLANDS	MPCA	www.pca.state.mn.us/index.php/water/water-monitoring-and-reporting/biological-monitoring/wetland-monitoring/wetland-monitoring-plants.html
WEATHER AND CLIMATE CHANGE	Citizen Weather Observer Program MNgage-MN volunteer climate observing program MN Climatology Working Group MN Sea Grant-Rip Current Monitoring	http://wxqa.com/ http://climate.umn.edu/HIDENsityEdit/HIDENweb.htm http://climate.umn.edu/ http://www.seagrant.umn.edu/coastal_communities/

MONITORING CATEGORIES	**MICHIGAN**	**WEBSITE**
LAKES	Michigan Cooperative Lakes Monitoring Program Lake Superior Water Monitoring & Info.	www.micorps.net/lakeoverview.html http://www.michigantechlakesuperior.org/

	Center Water Clarity- Secchi disk on inland lakes	www.dioceseofnarquette.org
RIVERS, STREAMS AND WATERSHEDS	Superior Watershed Partnership Citizens guide to watershed protection MiCorps: Michigan Clean Water Corp Michigan Lakes and Streams Associations Yellow Dog Watershed Preserve Lake superior streams MDNR Natural Rivers Program Michigan's Blue Ribbon Trout Streams Trout Unlimited	www.superiorwatersheds.org http://www.watershedcouncil.org/resources%20and%20publications/files/Citizens%20Guide%20to%20Wetland%20Protection.pdf http://www.micorps.net/ http://www.mymlsa.org/# www.yellowdogwatershedpreserve.org www.lakesuperiorstreams.org/citizen www.michigan.gov/dnr/ www.trailstotrout.com/blueribbon.html www.michigantu.org
AQUATIC INVASIVE SPECIES	Tip of the Mitt-Watershed Council MI State University Extension	http://www.watershedcouncil.org/learn/aquatic%20invasive%20species/ http://web4.msue.msu.edu/mnfi/education/factsheets.cfm
BEACHES	Great Lakes Alliance Beach Cleanup	www.greatlakes.org
PLANTS	UP Tree Identification Fruit Tree Survey	http://uptreeid.com/ http://www.goodfruit.com/Good-Fruit-Grower/Web-2011/Fruit-tree-survey-in-Michigan-begins-October-1/

WILDLIFE/BIRDS	Lake Superior Bird Survey Loon Watch Whitefish Point Bird Observatory Keweenaw Raptor Survey DNR Michigan	http://www.lakesuperiornews.info/LifeStyles/Birds/Survey/tabid/169/Default.aspx http://www.michiganloons.com/loon_watch.html http://wpbo.org/ http://keweenawraptorsurvey.org/ http://www.michigan.gov/dnr/0,4570,7-153-10363_10856_10905---,00.html
WEATHER & CLIMATE CHANGE	Union of Concerned Scientists Midwest Regional Climate Center Great Lakes Regional Climate Assessment	http://www.ucsusa.org/greatlakes/glregionmic.html http://mcc.sws.uiuc.edu http://www.geo.msu.edu

MONITORING CATEGORIES	**WISCONSIN**	**WEBSITE**
LAKES	WDNR & UWEX Self Help Lake Monitoring Wisconsin Association of Lakes Bayfield County Lakes Forum Inland Sea Society Citizen Lake Monitoring Network of WI Lake Superior Research Institute	http://dnr.wi.gov/org/water/fhp/lakes/selfhelp/ www.wisconsinlakes.org www.bayfieldcountylakes.org www.inlandsea.org www.uwsp.edu/cnt/uwexlakes/clmn/ www.uwsuper.edu/lsri/index.cfm

	Citizen-based Water Monitoring	www.watermonitoring.uwex.edu/
	UWEX & DNR Community Stewardship Program	www.uwsp.edu/cnr/uwexlakes/clmn/ www.uwsp.edu/cnr/uwexlakes/CLMN/default.asp www.watermonitoring.uwex.edu/ www.uwex.edu/ces/
RIVERS, STREAMS, WATERSHEDS AND WETLANDS	WDNR & UWEX Water Action Volunteers Citizen Stream Monitoring	http://watermonitoring.uwex.edu/wav/monitoring/index.html
	Bad River Watershed Association	www.badriverwatershed.org
	River Alliance of Wisconsin	www.wisconsinrivers.org
	Friends of the Brule River	www.FriendsOfTheBrule.com
	Lake Superior Streams Association	www.lakesuperiorstreams.org/citizen
	Monitoring your wetland	http://wetlandmonitoring.uwex.edu/index.html
	National Estuarine Research Reserve	http://www.lsnerr.uwex.edu/
	EPA	http://water.epa.gov/type/wetlands/assessment/wi1.cfm
BEACHES	Adopt a Beach	http://www.greatlakes.org/Page.aspx?pid=525
	Wisconsin Beach Health	http://www.wibeaches.us/
	WDNR	http://dnr.wi.gov/org/water/wm/wqs/beaches/
AQUATIC INVASIVE	Clean Boats, Clean Waters	www.uwsp.edu/cnr/uwexlakes/cbcw/

SPECIES	WDNR AIS	http://www.dnr.state.wi.us/invasives/aquatic/
	Zebra Mussel Watch- UW Sea Grant	http://seagrant.wisc.edu/zebramussels/
	Invasive Plants Association of Wisconsin	www.ipaw.org http://seagrant.wisc.edu/zebramussels/
	Aquatic Invasive Species Task Force	http://www.dnr.state.wi.us/invasives/aquatic/
	WI Exotic Plants and Animals- WDNR	http://www.protectyourwaters.net http://dnr.wi.gov/invasives/
WILDLIFE/BIRDS	Lake Superior Bird Survey	www.lakesuperiornews.info/LifeStyles/Birds/Survey/tabid/169/Default.aspx
	LoonWatch	www.northland.edu/sigurd-olson-environmental-institute-loon-watch.htm
PLANTS	UWEX	http://forest.wisc.edu/extension/CD/
	WDNR	http://dnr.wi.gov/forestry/
WEATHER AND CLIMATE CHANGE	EPA	http://www.epa.gov/climatechange/
	The Climate Change Response Framework Project in Northern Wisconsin	http://www.nrs.fs.fed.us/niacs/climate/CNNF/
	Wisconsin Initiative on Climate Change Impacts	http://www.wicci.wisc.edu/climate-change.php

MONITORING CATEGORIES	ONTARIO	WEBSITE
LAKES	Lake Partner Program	www.ene.gov.on.ca/environment/en/local/lake_partner_program/index.htm

	North Shore of Lake Superior Remedial Action Plans	http://www.northshorerap.ca/
	Ontario Fisheries Management	www.mnr.gov.on.ca/en/Business/LetsFish/2ColumnSubPage/STEL02_166747/html
	Department of Fish and Oceans	www.dfo-mpo.gc.ca/index-eng.htm
	Chippewa Ottawa Resource Authority	www.1836cora.org
RIVERS, STREAMS AND WETLANDS	Sault Ste. Marie Region Conservation Authority	www.ssmrca.ca
	Lakehead Region Conservation Authority	www.lakeheadca.com
	EcoSuperior	www.ecosuperior.org
	Northshore Steelhead Association	http://www.northshoresteelhead.com/
	Earthwise Water Working Group- Stormwater with the City of Thunder Bay	www.earthwisethunderbay.com
	Thunder Bay District Stewardship Council	http://www.ontariostewardship.org/councils/thunderbay/
WILDLIFE/BIRDS	Bird Studies Canada	www.bsc-eoc.org
	Thunder Bay	www.tbfn.net

	Field Naturalists Parks Canada	 www.pc.gc.ca
AQUATIC INVASIVE SPECIES	EcoSuperior	
BEACHES	North Shore of Lake Superior Remedial Action Plan Ministry of the Environment Environment Canada	www.northshorerap.ca
WEATHER AND CLIMATE CHANGE	Environment Canada	