

**EXPLORING LINKS BETWEEN CITIZEN ENVIRONMENTAL
MONITORING AND DECISION MAKING:
THREE CANADIAN CASE EXAMPLES**

by
Carol Hunsberger

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Author's declaration for electronic submission of a thesis

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Abstract

Environmental decision making processes are subject to diverse and at times conflicting pressures. On one hand, an enlightenment perspective places high value on scientific information about complex environmental phenomena, thus encouraging highly trained experts to perform research, interpret results, and provide advice to decision makers. On the other, international and domestic efforts to apply the concept of sustainable development tend to promote an enhanced role for non-expert knowledge and increased opportunities for public participation in decisions that affect local environments and livelihoods. Complicating this scenario further are debates within governments about how to allocate limited resources for environmental research and management.

Citizen environmental monitoring initiatives provide an opportunity to examine these considerations as they play out in a variety of settings. From local, grassroots citizen groups to regional networks with government support, a wide range of monitoring programs exist that involve volunteers in gathering environmental information using scientific methods. Many groups attempt to apply their findings to planning initiatives, policy development or environmental law enforcement at local or regional levels. These efforts may blur the distinction between scientific and local knowledge, while raising questions about the relative legitimacy of experts and citizens as producers of knowledge for use in environmental decision making.

Using a case study approach, this thesis explores factors affecting the application of information gathered through citizen environmental monitoring programs to decision making processes and outcomes in Comox Valley, British Columbia, and Hamilton and Muskoka, Ontario. Semi-formal interviews were conducted in all three locations with coordinators of citizen groups that perform environmental monitoring, as well as with government representatives who have some involvement with the same citizen monitoring initiatives.

Key themes affecting the use of citizen monitoring information emerged from the study, including political will on the part of local decision makers, scientific rigour and data quality of citizen monitoring efforts, and perceived legitimacy of citizen groups in terms of their organizational stability and reputations. Suggestions are presented for overcoming obstacles in each of these areas. The research also identifies further issues that affect the application of citizen-collected data such as the level of matching between the information priorities of citizen groups and governments, as well as collaborative arrangements between program partners. On these issues, interviewees shared their ideal scenarios for citizen monitoring programs with respect to funding, partnership strategies, and best roles for volunteers, citizen groups, and governments who are involved in citizen environmental monitoring programs.

Based on the findings of this study, it is recommended that future research investigate further the issues of power sharing, agenda setting, and mutual trust between citizen groups and governments at the local level.

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Dedication

To the memory of my father, Bruce Elgin Hunsberger.

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List of Acronyms

BSSAG	Baynes Sound Stewardship Action Group
CCMN	Canadian Community Monitoring Network
CNF	Canadian Nature Federation
DFO	Department of Fisheries and Oceans
EMAN	Ecological Monitoring and Assessment Network
GIS	Geographic Information System
GPS	Global Positioning System
MLA	Muskoka Lakes Association
MOE	Ontario Ministry of the Environment
NGO	Non-Government Organization
QA	Quality Assurance
QC	Quality Control
US EPA	United States Environmental Protection Agency
WATER	Watershed Action Toward Environmental Responsibility

1.0 INTRODUCTION

1.1 Background

Decision making institutions in government and, to a lesser extent, industry, are increasingly embracing the concept of sustainability. While multiple interpretations of sustainability exist¹, it is generally accepted that the idea includes increased attention to environmental well being as an integrated component of social and economic well being, together with opportunities for public participation in decision making.

Governments have endorsed guidelines for increasing public access to decision making on environmental matters through international agreements such as the 1992 Rio Declaration on Environment and Development (Principle 10). At the same time, observers have noted that decision making processes are increasingly driven by expert input, with citizen participation apparently languishing in the face of growing complexity of governance issues, information overload, and disconnection from the social and economic processes that support basic human needs (Fischer 2000).

Grassroots citizen² groups have sprung up to address environmental issues at local, regional, and international levels, indicating interest among some members of the public in advocating for, or participating in, alternative approaches to environmental governance. Among the activities that such groups can undertake is environmental monitoring, defined here as *primary investigation into environmental conditions through repeated sampling or observations of particular indicators*. Participants in monitoring programs are directly involved in the production of knowledge about environmental conditions, which can then be applied to decision making processes. At the same time, monitoring programs that involve community members in problem identification and

¹ “Sustainable development” is defined by the 1987 report *Our Common Future* as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (United Nations World Commission on Environment and Development 1987). Various definitions and models have subsequently been developed to illustrate the relationships between social, economic, and environmental considerations associated with sustainability (see for example Gibson 2004).

² The term “citizen” is used here and throughout the thesis as a means of referring to a person who does not have a formal role within government institutions, and is not related to citizenship status.

information gathering have the potential to “democratize” scientific processes and help participants to become familiar with scientific knowledge as part of their culture (Heiman 1997). Groups performing chemical, physical, biological or ecological monitoring as one of their major activities are referred to here as “citizen monitoring groups,” and comprise the focus of this study.

In Canada, the number of active citizen monitoring groups is growing, while government participation in environmental monitoring activities is generally declining (Savan et al. 2003). For example, after a history of incremental increases in funding, the Ontario Ministry of the Environment (and Energy) experienced a budget and staff cut of approximately one third over a two-year period from 1996-1997, with one result being a decrease in government capacity to monitor pollution (Krajnc 2000). While reduced government investment and involvement in environmental activities is one possible reason for the expansion of citizen monitoring programs, other reasons are suggested in a literature review prepared for the Canadian Ecological Monitoring and Assessment Network and Canadian Nature Federation, two organizations dedicated to providing tools for community-based monitoring on a national scale. These reasons include perceived inadequacy of governmental monitoring to address complex local information needs, recognition that citizens and stakeholders should be involved in sustainability-based planning exercises, and citizen motivations including a desire to protect valued natural areas from perceived threats and to participate in environmental decision making processes (Pollock et al. 2003a).

Citizen monitoring can be seen as a means of increasing environmental knowledge and expanding public awareness about issues of concern; indeed, some citizen monitoring groups view public education as their main purpose (Noss 2001). But beyond these benefits, citizen monitoring also has the potential to inform and improve decision making by integrating local knowledge with scientific research methods, leading to the identification, verification, and eventual correction of problems related to environmental mismanagement, and helping to ensure that a broader spectrum of people contribute to decision making processes and outcomes (Heiman 1997). After conducting a two-year

study of a volunteer stream monitoring program in the state of Virginia, two academics with backgrounds in biological monitoring conclude: "If volunteer biological monitoring programs are carefully analyzed, modified where necessary, validated, and then strictly adhered to, professional biologists and others in regulatory and natural resource agencies should accept the results, be confident about using them, and be grateful for the assistance" (Engel & Voshell 2002). Based on examples in the literature and empirical experience, citizen monitoring programs appear to hold some promise for advancing understanding of locally defined environmental problems, and giving members of the public a way to contribute their knowledge to decision making processes (see for example Bliss et al. 2001; Heiman 1997; Savan et al. 2003).

Unfortunately, relationships between decision makers and citizen monitoring groups are not always smooth. Questions about the quality of volunteer-collected data, difficulties in establishing and maintaining communication between stakeholder groups, disparities in the level of power held by citizens and decision makers, lack of connection between citizen monitoring goals and government information needs, and non-use of information in decision making are just a few of the factors that complicate the acceptance and application of citizen-collected information by decision makers (Au et al. 2000; Bliss et al. 2001; O'Rourke & Macey 2003; Pollock et al. 2003b). As well, citizen groups face a variety of challenges related to their own organizational stability, including securing adequate long-term funding, establishing a committed volunteer base, and building capacity to manage, interpret and present research findings in meaningful ways (O'Rourke & Macey 2003; Pollock et al. 2003b; Roberts 1991; Stokes & Havas 1990).

This study explores the experiences of citizen monitoring groups and decision makers in three Canadian communities: Comox Valley (British Columbia), Hamilton and Muskoka (Ontario). Particular attention is given to specific instances where citizen monitoring outcomes in these locations were linked to decision making or regulatory outcomes.

1.2 Research problem and rationale

Citizen monitoring offers the opportunity for examination of some important theoretical and empirical questions related to knowledge production, community capacity building, public engagement, education, citizen empowerment, and environmental governance. Questions related to volunteer data quality, motivations and empowerment have been explored fairly extensively in the literature (see for example Bliss et al. 2001; Engel & Voshell 2002; Lukasik 2002; Penrose & Call 1995; Savan et al. 2003). At this point however, less research has focused on explicit links between citizen monitoring efforts and specific instances of decision making (for an exception, see Pollock et al. 2003b). This research seeks to address this gap by exploring citizen environmental monitoring in terms of its potential to serve as a form of public participation in knowledge creation that can be applied to inform environmental decision making. Specifically, this study seeks to draw lessons from cases where citizen monitoring groups have achieved some degree of success at linking their results to decision making processes, and to identify factors that have facilitated or impeded their progress in this regard. It is argued here that applying the results of citizen monitoring programs to decision making processes can (though does not by definition) advance principles of sustainability as defined by Gibson (2002)³.

The research questions have been:

- What *kinds* of success at linking citizen environmental monitoring to decision making were achieved in the case study communities?
- For the cases considered, what factors and strategies served as enablers or obstacles with respect to the application of citizen monitoring results to decision making?
- What *degree* of impact did the case study citizen monitoring groups have on decision making processes?
- What lessons can be drawn from the findings in order to inform future citizen monitoring efforts?

In addition to the thematic gap described above, this research also addresses a geographic gap in the literature. Much of the published research on citizen environmental monitoring

³ These principles include: ecological integrity, democracy and civility, precaution, equity, efficiency, and human sufficiency and opportunity. These are discussed further in section 2.1.2.

comes from the United States and, to a lesser extent, the United Kingdom. These findings are not necessarily transferable to the Canadian context because circumstances vary in different national settings. For example, citizen monitoring in the United States is largely centralized through the United States Environmental Protection Agency (EPA), while at this time Canada has no comparable national coordinating body for citizen monitoring efforts. A broad network of citizen monitoring programs seems to be emerging in Canada through initiatives such as the Canadian Community Monitoring Network, Ontario Benthos Biomonitoring Network and Watershed Report Card, but early indications show differences between this type of network and the EPA model. Notably, leadership for the emerging Canadian network appears to be coming from non-government organizations rather than a central government agency (Whitelaw 2004). Studying the research question within the Canadian context has the potential to uncover political and geographic considerations that are unique to Canada and that may serve to encourage or obstruct the use of citizen monitoring outcomes to inform decision making.

1.3 Overview of the thesis

This chapter has introduced the context and rationale for a study of citizen environmental monitoring groups and attempts to apply their findings to decision making processes and outcomes. The following chapters explore this topic through a general literature review followed by a more focused primary investigation into citizen monitoring programs and outcomes in three Canadian communities.

Chapter 2 reviews literature on the topics of public participation and sustainability in governance, science as a form of knowledge creation, the role of citizens and scientific experts in decision making, and citizen environmental monitoring as a practical application of theories of citizen science.

Chapter 3 explains the methodological approach and research techniques that are employed in the study, considers the role of the researcher, and discusses limitations of the research project.

Chapter 4 introduces the case study communities of Comox Valley, Hamilton, and Muskoka. It identifies each location's general features, citizen monitoring programs and outcomes, and factors that have apparently facilitated or impeded success at applying monitoring results to specific instances of decision making.

Chapter 5 takes an in depth look at three major groups of factors that influence the use of citizen monitoring results in the case studies, focusing on the theme areas of political will, scientific rigour, and the reputation of citizen monitoring groups.

Chapter 6 examines another group of issues influencing the application of citizen monitoring outcomes to decision making processes, with attention to information needs and partnership arrangements. Interviewees' perspectives on the best roles for volunteer, non-government organization, and government actor groups involved in citizen monitoring activities are presented, together with ideal scenarios for fostering successful citizen monitoring programs.

Chapter 7 returns to the original research questions in order to situate the research findings within the relevant body of literature. Recommendations for practice are offered at community, municipal, provincial, national, and societal units of analysis, and questions emerging from the study are offered as prompts for future research in this field.

2.0 CITIZEN MONITORING AND DECISION MAKING

Major concepts relevant to this research include citizen participation, decision making, environmental monitoring, knowledge creation, and sustainability. This chapter discusses connections between these concepts as they are presented in literature from the fields of epistemology, sociology of scientific knowledge, and interdisciplinary academics. Section 2.1 presents arguments related to public participation and concepts of sustainability in governance. Section 2.2 examines the roles of science and expertise in society and decision making, considers alternative views of knowledge production, and discusses the potential for citizen contributions to environmental decision making through science-based activities (a form of knowledge creation) in this context. Section 2.3 focuses on citizen environmental monitoring as a particular means for citizens to contribute environmental knowledge to decision making processes.

2.1 Public participation and sustainable governance

The following sections describe debates related to public participation and sustainability in decision making processes. Section 2.1.1 discusses theoretical developments and examples related to public participation in environmental governance, including several types of roles that citizens have (and have not) played to date with respect to environmental decision making. Section 2.1.2 examines the concept of sustainability and its implications for governance processes.

2.1.1 Public participation in environmental governance

Several international agreements, including the 2002 World Summit on Sustainable Development Implementation Plan (Paragraph 119), the 1998 Aarhus Convention, and the 1992 Rio Declaration on Environment and Development (Principle 10), emphasize the importance of opportunities for citizens to participate in decisions about matters affecting the environment. The principles expressed in these documents rest on the twin observations that environment and livelihood concerns are closely – if not indivisibly – linked, and that environmental decisions tend to be better and more acceptable to the public if they are undertaken with citizen input (Petkova et al. 2002).

After studying the impacts of focus groups on environmental planning in the United Kingdom, however, Davies (1999) notes that even when citizen input is sought, the public's "non-material" values are often excluded from planning processes. In particular, values about nature and undeveloped common spaces that are based on their spiritual, social or inherent worth tend to be discounted by policy makers (Davies 1999). Along similar lines, citizen concerns about perceived threats to environmental features or human health may also be discounted as reactionary expressions of self-interest, sometimes termed "NIMBY syndrome" (for "not in my backyard") (Wolsink 1994).

In Canada, two "waves" of encouragement for citizen involvement in environmental decision making at the federal level, in the early 1970s and in the early 1990s, have each receded over time (Parson 2000). Some have argued for increased government support of public participation initiatives based on the hypothesis that citizen involvement can help to bring values and ethical considerations to greater prominence in deliberations (Parson 2000). Others, however have described potential for increased public participation to create an imbalance in Canadian environmental governance, causing over-regulation in areas that attract a high level of public interest, and under-regulation on matters with a low public profile (Green 1997).

One avenue for public participation in environmental decisions involves inviting citizens to comment on proposals while they are undergoing environmental review. Mechanisms for encouraging this type of participation exist in the form of opportunities to respond to information made accessible through, for example, the public registry created to satisfy requirements of the *Canadian Environmental Assessment Act* (Boyd 2003), as well as Ontario's Environmental Bill of Rights. However, citizens can move beyond this level to play a more direct role in supporting decision making throughout the full cycle from monitoring existing conditions through objective setting and planning for new initiatives and monitoring the results. One observer notes that "public participation in natural resource-related issues is currently experiencing a paradigm shift from the adversarial,

top-down, public meeting approach to a collaborative, bottom-up, citizen-led and citizen-organized approach” (Griffin 1999: 505).

Questions can be raised about which citizens have opportunities to participate in environmental decision making. Some existing mechanisms only permit the participation of members of the public who can prove that they will be affected by the outcome of a particular decision, as is the case with provincial environmental assessment law in Alberta (Boyd 2003). A contrasting view is that all citizens should have equal rights to participate in decision making. In other words, if citizen involvement exercises only include citizens who have a direct interest in environmental decisions, then these processes are reduced to stakeholder debates that fail to consider “broader public welfare and the ethics of state conduct” (Parson 2000: S138).

As an example of local decision making that integrates broad citizen participation, Weber (2003) describes a movement towards “grassroots ecosystem management” in several rural communities in the Western United States. This model involves “an ongoing, collaborative governance arrangement in which inclusive coalitions of the unlike come together in a deliberative format to resolve policy problems affecting the environment, economy, and community (or communities) of a particular place” (Weber 2003: 3). Such an approach has been used to address conflicts in resource dependent communities such as Quincy, California, where the development of a mutually acceptable forestry plan challenged conventional assumptions that decentralized governance processes lack accountability to the public and are dominated by narrow, often industrial, self-interest (Weber 2003).

Programs that encourage citizens to assume an active role in not just deliberation, but also knowledge creation to support environmental decision making, are consistent with the principles set out by Beanlands and Duinker (1983) for citizen involvement in ecosystem assessment. Relying on information gathered by citizens to inform policy and management decisions also profoundly challenges the top-down flow of information that characterizes expert-led decision making structures. In this way, a continuous, two-way

exchange of knowledge between citizens and decision-makers becomes possible (de Neufville 1985). This will be elaborated further in the section on knowledge creation.

In addition to fostering decisions that are stronger and more locally acceptable (Petkova et al. 2002), public involvement in environmental undertakings can provide further benefits. These have been expressed as increased public education and heightened awareness of local issues; capacity building, which may in turn lead to stewardship programs or greater political participation in other areas; and, in the case of monitoring activities, more data collected at a lower cost than conventional research can supply (Au et al. 2000; EMAN CO and CNF 2003; O'Rourke & Macey 2003).

2.1.2 Sustainability-centred governance

While numerous definitions of sustainability exist, a sustainable society will be considered here to exhibit the principles of ecological integrity, democracy and civility, precaution, equity, efficiency, and human sufficiency and opportunity (Gibson 2002). The implications of moving from conventional to sustainability-centred environmental governance centre on the need to integrate human and biophysical factors over the long and short term. A sustainable approach is also one that acknowledges the importance of locally relevant decision making, informed by public involvement (Robinson et al. 1990) as well as “expert” perspectives.

Citizen involvement in environmental initiatives can contribute to the achievement of a sustainable society through its processes as well as its outcomes. A major goal of grassroots monitoring is to protect environmental integrity by gathering information that can be used to make responsible decisions about managing or protecting land and resources (Fleming & Henkel 2001). However, the means by which this information is gathered and shared should also be visible, participatory, and consistent with the principle of social equity (Bliss et al. 2001). Ultimately, the application of citizen-collected data by decision makers also depends on the adoption of a precautionary approach⁴.

⁴ The 1990 Bergen Declaration presents the precautionary principle as follows: “In order to achieve sustainable development, policies must be based on the Precautionary Principle. Environmental measures

2.2 Knowledge production to inform decision making

Because scientific advances have often been linked to causes of environmental problems as well as their detection and strategies for addressing them, “science and technology are fundamental to environmental politics and policy making” (Fischer 2000: 90). Environmental monitoring is a special form of knowledge production that involves taking repeated measurements of certain parameters in order to track changes in those parameters over time. Monitoring can help to assess the effectiveness of policy mechanisms or pieces of legislation, determine the level of compliance with regulatory measures, and serve as an “early warning” by detecting environmental change (Hellawell 1991: 3-4).

Citizen groups can seek to contribute to environmental decision making by undertaking science-based investigations including monitoring. The following sections discuss theoretical perspectives on the nature and production of scientific knowledge, the position of science in society and decision making, challenges to the authority of science, and alternative forms of knowledge production. Two major positions are presented on appropriate roles for citizens with respect to participation in science and knowledge creation.

2.2.1 Science in society and decision making

Science can be viewed as both a result and a process, as “a body of ‘facts’ about the world and as a framework for rational thought” (Irwin 1995: 1). Gathering information through observation, testing it through controlled experimentation, challenging it through peer review, and using it to derive explanations for phenomena are generally recognized components of the scientific method of inquiry (Bauer 1992, de Neufville 1985). The role of science in society can be linked to a positivist or “enlightenment” worldview. Positivism includes the ideas that objective (value-free) truth exists, that complex

must anticipate, prevent and attack the causes of environmental degradation. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation” (UNECE 1990, in Mitchell 2002: 34).

situations can be understood by breaking them into parts, and that useful information can be derived through deduction and controlled measurement (de Neufville 1985: 4). Further, scientists are expected to strive for objectivity, either through neutral detachment from their own research, or through the critical input of the peer review process (Bauer 1992).

“Enlightenment” thought suggests that science represents the way towards progress, and that any friction between science and the public is due to either irrationality or a lack of understanding on the part of the public (Irwin 1995: 14). Several further premises characterize this perception of the relationship between citizens and science. These include that the public is largely ignorant of scientific principles, that economic growth and other forms of “human improvement” are hampered as a result, that increasing the public’s “scientific literacy” would lead to more rational – even more ethical – decisions, and that improved scientific knowledge would cause greater public support for science (Irwin 1995: 14; Bauer 1992: 12-13).

The resulting assumption is that widespread ignorance about science exists, and should be addressed through improved public education conducted by experts. When applied, this belief establishes a pattern of top-down communication that is not conducive to citizen participation in public affairs. Irwin (1995) asserts that when environmental issues are presented as predominantly technical in nature, most of the population is accorded “an essentially ‘passive’ status – as *witnesses* rather than active participants” (Irwin 1995: 78, emphasis in original). In addition to alienating the public with respect to participation in public debate, the positivist view of science also legitimizes distance between the researcher and the decision maker, as well as between research results and a basis for context-specific action (de Neufville 1985).

The relationship between citizens, scientific knowledge and decision-making has been presented another way. Pierce et al. describe the “postindustrial quandary” as the increasing demand for public influence on the policy process, coupled with the increasing complexity and technical sophistication of public policy issues (1992: 14-15). Pierce et

al. propose four models for resolving this dilemma: status quo, elite guarantees, public rehabilitation, and interest groups (Pierce et al. 1992:15-18), each one guided by assumptions about the public's ability to learn and apply scientific knowledge. The status quo position maintains that citizens do not need to understand science in order to participate in decision making; instead, their contributions should take the form of value preferences leading to electoral decisions. The "elite guarantees" scenario sees an even heavier reliance on expert-led decision making as the most appropriate course of action, since from this perspective "it is largely a waste of time to attempt to educate the public in the complexities of modern-day policy issues" (Pierce et al. 1992: 16). The public rehabilitation model recognizes the value of citizen input as well as the public's ability to learn about technical issues, suggesting that relevant information and the means to participate in policy processes should be made available to the public. Finally, according to Pierce et al. (1992), interest groups serve as a "substitute mechanism" that can take the place of official political processes as a means for citizens to achieve policy outcomes consistent with their values, be they based in self-interest or public interest. While this interpretation provides several possible ways of examining the role of citizens in complex decision making, it leaves little room for collaborative approaches in which citizen groups and governments work together to define agendas and priorities (Whitelaw 2004).

In broad terms, science has been described as a cultural framework that is accompanied by "the modern emphasis on the competent and empowered individual, nation-state, and rationalized organization as the dramatic 'actors' in social life" (Drori et al. 2003: 2). Scientific knowledge has gained such global acceptance as "the most authoritative kind of reality" (Drori et al. 2003) that it can be difficult to challenge the authority of science, and be taken seriously, without using tactics that belong to it. After considering a series of intellectual critiques of science, a team of Stanford sociologists commented, "The attacks themselves tend to employ the language, claims, methods, and theories of science" (Drori et al. 2003: 5). These observations suggest that scientific knowledge and expertise are accorded a high level of recognition and respect in society, with somewhat bleak implications for public participation in decision making.

2.2.2 Challenges to reliance on expert-led science

The preceding section outlined positivist and enlightenment views of science, and the value that these perspectives assign to technical experts. That it is possible, or even desirable, to achieve positivist ideals is now widely contested. Many dispute that scientific processes can yield “facts” on the grounds that science is a social institution that produces consensual rather than objective knowledge (Bauer 1992), when indeed there is consensus to be found. The positivist view that scientists are objective creators of knowledge ignores the possibility that social and cultural factors influence people who are engaged in the scientific process (Lewontin 1991). This section presents several related critiques of science as an authoritative force in society. These include concerns over a lack of objectivity and consensus in science; conflicts of interest and declining public trust; and concerns over the use of scientific information.

Lack of objectivity, certainty, and consensus in science

Constructivists hold that from the initial selection of research topics to the eventual conclusions, every step of the scientific process is steered in some way by personal, social, financial or political preferences: “Despite its claims to be above society, science... is a supremely social institution, reflecting and reinforcing the dominant values and views of society at each historical epoch” (Lewontin 1991: 9). The supposed neutrality of science is compromised by the reality that scientists live their lives embedded in a particular social and political setting, and as a result, “view nature through a lens that has been molded by their social experience” (Lewontin 1991: 3). More bluntly, Tesh summarizes the constructionist position by saying that “pure, objective knowledge is impossible” (Tesh 1999: 42).

In addition to the impacts that social assumptions have on scientific research, Irwin (1995) chronicles several other forms of uncertainty that may reduce public acceptance of scientific authority and the applicability of scientific knowledge to environmental decision making. Among these, pragmatic uncertainty results from scientists being asked to provide guidance without enough time, equipment or resources to develop an informed position. Theoretical uncertainty occurs when an issue is situated in a field where there is no established body of theory, or where knowledge is fragmented because many

disciplines are involved. Uncertainty due to complexity refers to expectations that scientists will be able to produce models of intricate, “real world” phenomena that involve many variables, rather than isolating variables for study within controlled laboratory conditions. Finally, concerns with the “margins of observability” are that trace environmental impacts are difficult to measure or assess with confidence (Irwin 1995: 56-58). All of these types of uncertainty are particularly relevant to the environmental realm, where policy input is often sought on newly emerging concerns on short notice or with little prior investment in research. As well, Fischer (2000) observes that unlike other types of social issues that are centred around moral debates, environmental discourse and policy formation tend to be disproportionately focused on “facts” (Fischer 2000: 90), thus leading to a heavy reliance on scientific information while downplaying the importance of values and other relevant social considerations.

Challenges have been made to the adequacy of the peer review process as a “filter” for new knowledge. Critical evaluation by other scientists can be seen as compensation for the failure of individual scientists to be objective about their work (Bauer 1992). However, if peer assessment is limited to small pockets of scientists who hold similar ideas and values, then biases may be perpetuated over time and scale (Bauer 1992). Decisions as to whether individuals are qualified to offer peer review are made by others in the same field, with the result that “the peer review process is one in which quality and control mutually re-enforce each other” (Gibbons et al. 1994: 8). Taken together, these arguments undermine trust in scientific knowledge and expertise as the products of objective individuals and institutions.

Conflicts of interest and lack of public trust

“Enlightenment” hopes for public acceptance of expert-led science can be dampened by scepticism if the public believes that “experts” have ties to government or corporate agendas. Irwin (1995) documents public perceptions of the relative trustworthiness of various authorities in two communities where “hazardous industry” operates (Irwin 1995: 93). Interviews with citizens revealed that the source of information about the safety of the industrial sites was considered vital to assessing the credibility of the information

itself. Citizens expressed concerns that “the company” might have “co-opted” scientists, leading to the perception that “technical statements... need to be treated with the same intelligent caution that one would treat the statements of a politician or neighbour” (Irwin 1995: 98-99).

Along these lines, Lewontin writes that “science is molded by society because it is a human productive activity that takes time and money, and so is guided by and directed by those forces in the world that have control over money and time” (Lewontin 1991: 3). Bauer outlines several scenarios for conflict of interest on the part of medical or academic researchers, where financial or even compassionate interests on the part of the scientist may influence research outcomes (Bauer 1992). Similar fears of corporate influence have permeated the environmental sector, where government-sponsored monitoring in Ontario has been drastically reduced since 1996 (Savan et al. 2003). A trend towards voluntary compliance and self-reporting has led to fewer cases of government investigation and enforcement where water quality is compromised (Savan et al. 2003: 561). Some citizen monitoring groups have emerged out of this climate of distrust (Savan et al. 2003), suggesting that in Ontario as well as the United States, there is a desire among citizens to act as “watchdogs” investigating whether or not officials provide accurate information about pollutant releases (O'Rourke & Macey 2003).

Concerns over the use of scientific information

Once research has been conducted, further debates arise over the ways in which scientific claims are used to inform and defend public policy. Critics have argued that even when decision makers have access to relevant information, they do not necessarily apply it in the course of their work (de Neufville 1985). De Neufville provides three possible explanations for failure to use research outcomes in decision making: the “partisan,” “two-worlds,” and “enlightenment” arguments (de Neufville 1985: 2).

The partisan view holds that decision makers may choose to use only data that support a position they have already developed, overlooking other information (de Neufville 1985: 2). Further, policy makers may use scientific information in order to steer public debate

in a particular direction, serving as “ammunition for the defence of certain social positions” (Irwin 1995: 138). In these cases, scientific knowledge can be used selectively to manipulate public opinion and build support for pre-determined government positions. Such charges of partiality have also been made against citizen groups. That is, members of the public may undertake or commission scientific investigations in order to validate a problem that they have already identified (Irwin 1995, Stokes and Havas 1990), thus seeking information to back up a position that they have already formed.

The “two-worlds” argument maintains that researchers and decision makers often have different assumptions, problem definitions, timelines, and considerations, thus rendering research outcomes irrelevant to the needs of policy makers when the two groups work separately from one another (de Neufville 1985: 2). Like the models presented by Pierce et al. (1992), this position assumes little or no collaboration with respect to setting decision making agendas and priorities. Finally, the “enlightenment” perspective on the use of information argues that while research results may not be used directly in policy formation, they can still play an important role in shaping decision makers’ thinking (de Neufville 1995). This role for research is consistent with the “agenda setting” function described by Tesh (1999).

2.2.3 Alternative views of knowledge production

In light of these problems associated with expert-led science, several responses have been put forward. With respect to citizen involvement, two major alternatives to positivist knowledge production emerge. First, citizens can take on the role of scientific investigators, thereby producing their own “independent” information and challenging the reliance on experts to create and disseminate knowledge. Such initiatives often involve close collaboration with scientists from government or academic affiliations. This approach could be called “citizen science” or “science for the people” (Irwin 1995), and will be discussed later in the chapter. Second, citizens can challenge the reliance on scientific knowledge by contributing non-scientific forms of knowledge to environmental management and policy debates. This section focuses on local and interpretive knowledge as alternatives to scientific knowledge.

There is often a rich vernacular understanding of the immediate natural environment, but public agencies are usually not prepared to include less formalized and anecdotal knowledge in their decision making because it is hard to combine with the formal scientific protocols governing quality assurance and quality control. Consequently, potentially valuable data is overlooked. (Fleming & Henkel 2001: 457)

Citizens may possess non-scientific knowledge that has the potential to inform decision making processes. This may take the form of local knowledge of geographic features, history, community values and public health patterns. Under some conditions, local knowledge can be equal or superior in quality to technical information collected by external experts (Holden 2000). For example, on Galiano Island, British Columbia, scientists and air photo interpreters conducted a land-use classification exercise for the Canadian Wildlife Service. The process involved quality control procedures designed to maximize internal consistency, but did not allow for field visits to any of the sites under study. Local citizens who were familiar with the area later found that the product of this work contained many inaccuracies (Holden 2000). In this case, community knowledge served as an important check on government-collected data.

In another discussion on forms of knowledge, de Neufville (1985) contrasts interpretive (or phenomenological) and positivist forms of knowledge, evaluating the potential of each to inform policy action. Unlike the positivist model already discussed, interpretive knowledge focuses on understanding situations in particular localities rather than making universal generalizations, seeks both citizen and “client” understandings of meaning, and often takes the form of qualitative stories (de Neufville 1985). De Neufville argues that stories are an important form of information, even within a positivist framework, claiming that “when data or research findings of the positivist kind do serve as rallying cries for political action, they are generally accompanied by stories and explanations” (de Neufville 1985: 12). In this way, anecdotal knowledge can be seen as a useful complement to scientific data, as well as a valuable form of knowledge in its own right.

In a discussion of risk perception, Tesh (1999) contends that lay people can “employ a broader and richer kind of rationality” than risk assessment experts. Citizen perspectives

on the relative risk of various technologies may include value concerns such as equity, fairness, costs and benefits (Tesh 1999: 40). This suggests that citizen opposition to potentially hazardous developments is not always or only a reactionary response based on ignorance of science, but that it may take into account a broader set of considerations that are more consistent with the concept of sustainability than scientific assessments alone.

2.2.4 Citizens, science and knowledge production

The ideas discussed in the previous sections represent a theoretical perspective that provides grounds for decision making institutions to broaden their definitions of legitimate knowledge. However, while academics and the public are often sceptical about the infallibility of scientific knowledge, positivist perspectives continue to enjoy a position of high importance in decision making (Holden 2000). In a context where knowledge gained through scientific investigation is accorded high priority in decision making processes, many have called for greater incorporation of democratic principles into scientific institutions and processes. In this vein, Holden (2000) argues that a positivist approach to decision making “can be dangerous and undemocratic, discouraging non-experts from either personal involvement or the incorporation of their non-quantifiable values into decision making” (Holden 2000: 288).

The concepts of “civic science” and “citizen science” have emerged alongside these recommendations for increased transparency and participation in science. “Civic science” includes a range of strategies “to increase public participation in the production and use of scientific knowledge... In this perspective, citizens and the public have a stake in the science-politics interface, which can no longer be viewed as an exclusive domain for scientific experts and policy makers only” (Backstrand 2003: 24).

The term “citizen science,” which is oriented towards similar goals, has two embedded meanings: first, it “evokes a science which assists the needs and concerns of citizens;” second, it “implies a form of science developed and enacted by citizens themselves” (Irwin 1995: xi). These two definitions suggest different courses of action for citizens who wish to use science as a tool for contributing to decision making in a democratic

society, one implying the use of science *for* citizens; the other, *by* citizens. Each is explored in the following sections.

Science for citizens

Some citizen groups may attempt to present credible scientific knowledge to decision makers by forming alliances with scientists or other experts in a given field. These partnerships are so common that Tesh contends, “in controversies over exposure to environmental pollution, we are not seeing a conflict between citizens and experts but between two groups of experts” (Tesh 1999: 43). Citizen groups may hire experts to produce a report on a given topic. These researchers may choose to base their work on a different data set than government researchers, but follow similar methods, thus reaching a different conclusion that can nonetheless be argued is as “scientifically valid” as the government position (Tesh 1999). In such cases, “the dilemma for agencies is not how to combine two distinct kinds of reasoning. The dilemma is what to do when experts disagree” (Tesh 1999: 53). Such attempts to match expertise with counter-expertise may arise out of expectations that citizens must carry the burden of proof if they are to contribute to decision making (Irwin 1995). Unaffiliated citizens may find the necessary depth and detail of investigation to be beyond their unassisted reach (Tesh 1999).

Quite apart from being solicited by citizen groups, some researchers make their own attempts to bring marginalized perspectives or issues into the mainstream through what Fischer (2000) terms “advocacy research.” This approach rejects the premise that information is value-free, and instead explicitly ties the process of knowledge production (through professional research) to a particular interpretation of the public interest, or political argument (Fischer 2000). While its proponents see advocacy research as a means of giving voice to conventionally excluded perspectives through rigorous inquiry and bringing them into public debate, critics have commented that such attempts at expert research “for citizens” do not always end up advancing positions that reflect the views of the group in question (Fischer 2000).

An interesting variation on this strategy can be found in the “Science Shops” programs that have been established in several European countries (Irwin 1995). These initiatives

aim to link academic researchers with members of the public who have questions about scientific or technical matters (Irwin 1995). In this way, citizens make inquiries on issues that are important to them. Interestingly, in the Science Shops, many researchers only agreed to participate in the program if they were assured that their role would be limited to the provision of scientific information, and that they would have nothing to do with political or social questions (Irwin 1995). This position reflects the researchers' assumption that scientific findings are value-free and divorced from social reality, thus widening the divide between knowledge production and application.

The approach of hiring experts to build a case in support of the public interest is consistent with the enlightenment view that experts are best suited to provide information to a curious but ignorant public. As well, experts' reluctance to enter the political arena in the case of the Science Shops reinforces the positivist separation between information providers and decision makers.

Another vision of "science for citizens" is provided by sustainability science. This broad concept involves increasing the transparency and relevance of science by involving the public in deliberations about the applications of science (Backstrand 2003). While this expands the role of the public in one stage of science-based decision making, it essentially keeps the stages of knowledge production and validation within the realm of interdisciplinary experts (Backstrand 2003).

Science by citizens

As an alternative to working with experts to draw attention to environmental concerns or deliberate about scientific applications, citizen groups may choose to undertake scientific investigations as "lay people." Adopting a perspective that values citizens as producers of legitimate scientific knowledge has several implications. First, assumptions about acceptable roles and research capabilities of the public must be redefined. Such an approach depends on erasing the sharp distinction between "public" and "scientist," picturing instead a range of expertise and experience that can contribute to environmental research (Francis 1991). Second, the role of science in society must be re-envisioned so that it seems both possible and desirable for citizens to investigate questions of concern

using scientific methods: "Scientific knowledge acquired through actual participation becomes a part of a people's culture, no longer an alien product to be accepted as an article of faith" (Heiman 1997: 297).

Citizen participation in all stages of knowledge production, from identifying a research problem through to gathering, interpreting, and applying results, offers democratic benefits by recognizing a public role in setting the agenda for decision making. The following section focuses on citizen environmental monitoring as one form of participatory science that citizens can undertake in order to inform decision making. This topic is the primary area of investigation for this research project.

2.3 Citizen environmental monitoring

Citizen monitoring (also called community-based monitoring) refers to a range of activities through which concerned citizens gather and record systematic observations about environmental or social conditions, often in collaboration with government, industry, academia or community institutions (Whitelaw et al. 2002). To date, the majority of citizen monitoring groups in Canada have focused their attention on elements of the natural environment, studying physical, chemical, or biological (also called ecological) indicators of environmental health. However, some communities are beginning to monitor a broader set of concerns in order to gauge changes in sustainability practices or quality of life (Parlee 1998). Such broad-based monitoring efforts may be designed to measure progress towards sustainability goals. For example, the main objective of community-based ecosystem monitoring has been defined as "identifying and observing the social and ecological components of a community in order to understand how they fit together and function as a system" (Bliss et al. 2001: 144).

Citizen participation in environmental monitoring is reported to be increasing (Au et al. 2000). While there is no complete listing of citizen monitoring groups in Canada at this time, one online directory hosted by Stewardship Canada⁵ currently lists 260 citizen

⁵ Stewardship Canada provides a directory of programs and groups that are affiliated with Wildlife Habitat Canada's Citizen Science Project, an attempt to build volunteer capacity for stewarding local environments

science initiatives across the country that are involved in monitoring air, land, species, sustainability, and water parameters (Stewardship Canada 2004). The actual number of groups that conduct citizen monitoring is much higher, since this directory does not include schools that conduct monitoring activities or individual groups that participate in broader programs that are already listed. Pollock et al. (2003) identify four reasons for recent growth in the number of citizen monitoring groups: reduced government involvement in environmental activities including monitoring as a result of financial cutbacks, perceived inadequacy of governmental monitoring to address complex local information needs, recognition that citizens and stakeholders should be involved in sustainability-based planning exercises, and citizen motivations including a desire to protect valued natural areas from perceived threats and to participate in environmental decision making processes.

Increased community involvement in environmental assessment and monitoring can help to address an identified need for continuous, low-cost information that can be used to predict environmental effects and inform land management decisions (Fleming & Henkel 2001). Citizen monitoring and other citizen-led science programs pose a challenge to conventional views of risk communication by giving citizens the role of transmitters as well as receivers of knowledge (Tesh 1999). This approach fits with the interpretive perspective described earlier, which calls for turning knowledge creation and communication into “a two-way transaction rather than a one-way communication from expert to layman” (de Neufville 1985: 11). The following sections review literature on four areas related to citizen monitoring: purpose and motivations, data reliability, partnership models, and empowerment.

2.3.1 Purpose and motivations

Participants in citizen monitoring programs show an active interest in environmental affairs. Individuals may be motivated to participate in community-based ecosystem monitoring out of concern for special places that are perceived to be under threat or a

by providing monitoring protocols, training, tools and resources for citizen scientists (Stewardship Canada 2004). For more detail, see also <http://www.kc-citizenscience.net/index.jsp>.

desire to collect baseline data in order to take part in planning, community development, or ecosystem management processes (Bliss et al. 2001). Some citizen monitoring groups focus their efforts on educational goals, empowerment, or local problem identification, while others seek to apply their monitoring results to conservation, regulatory, policy, or legal initiatives (Savan et al. 2003). Some citizen monitoring programs are said to arise out of public mistrust of governments and “experts” in the environmental realm (Au et al. 2000). Bliss et al. (2001) write, the “theme of accountability – of individuals, communities, and governments – pervades discussions of monitoring and ecosystem management” (Bliss et al. 2001: 145).

In order to achieve their desired outcomes, citizen monitoring groups employ a range of strategies. Several monitoring approaches have been identified in the literature and grouped into four categories: government-led, interpretive, advocacy, and multiparty monitoring (Pollock et al. 2003a). Briefly, government-led monitoring tends to target early identification of ecosystem changes and to build long-term data sets; interpretive monitoring prioritizes educational benefits for its participants; advocacy monitoring allows citizen groups to focus on issues of local concern and apply pressure for corrective actions to be taken; and multiparty monitoring involves a cooperative attempt between stakeholder groups to address deficiencies in environmental or social monitoring programs (Pollock et al. 2003a). Further comments on each approach are provided below.

Long-term, government-led citizen monitoring projects have contributed to the publication of scholarly journal articles, as well as the development of habitat management recommendations and conservation plans (Bonney 2001). For example, a recent study of bird populations using data collected by a network of volunteer citizen scientists has contributed to the understanding of long-term and seasonal trends in the spread of disease among North American house finches (Altizer et al. 2004). This approach to ecological monitoring seeks to identify general trends over time, with the interpretation of results often linked to non-point sources of pollution or cumulative effects of many activities.

Interpretive monitoring programs exist largely for educational purposes, espousing the idea that “even if the data he or she collects are never used, the amateur naturalist is a better citizen of the planet” for having participated in information gathering about the natural world (Noss 2001: 17).

Citizen monitoring groups must determine the scope of their activities based on local priorities. Where suspected environmental problems exist, these may compel a group to pursue advocacy, or reactive, monitoring in order to focus attention on specific areas. This type of investigation can lead to enforcement of regulations and specific actions to correct violations, as with the water quality monitoring program in Hamilton, Ontario described by Au et al. (2000). Another example of this approach can be found in “community environmental policing” programs through which residents identify air quality violations near industrial developments in parts of the United States (O’Rourke & Macey 2003).

As an example of multiparty monitoring, Canada’s Ecological Monitoring and Assessment Network (EMAN) seeks to employ community-based, multi-stakeholder monitoring as a means of linking ongoing monitoring to local information needs in a process it calls “demand-driven science” (LTER 2002). In addition to locally-defined monitoring programs, EMAN encourages the use of the Nature Watch monitoring protocols (co-produced by the Canadian Nature Federation) to produce multi-year monitoring of ice cover, vegetation, and wildlife across the country that is not being provided by government agencies, so that scientists can interpret environmental trends and share their findings with decision makers (Ecological Monitoring and Assessment Network 2004).

2.3.2 Data reliability

Opinions differ on the value of data collected by volunteers in community-based monitoring programs. Some have gone so far as to suggest that “large-scale questions about environmental change can be answered only by combining the observations of citizen scientists across the continent” (Bonney 2001). Others concede that volunteer

monitoring studies can contribute to the scientific effort by collecting data on private property that would otherwise be inaccessible to scientists (Marra & Reitsma 2001), or on a spatial scale that is beyond the feasible reach of expert researchers (Brown 2001).

Adding to the view that citizen monitoring produces information where otherwise there would be none, one program coordinator notes, "In terms of baseline information you can't beat it. How are you going to get a bunch of Ph.D. candidates combing the landscape for fisher sign?" (in Brown 2001: 33). In other words, some information is better than no information, and even limited or variable data can increase our understanding of ecosystem conditions (Nicholson et al. 2002). The argument that data of all sorts should be considered when making environmental decisions is roughly consistent with the precautionary principle. This idea – that when uncertainty exists, available information should be used to devise a course of action that minimizes the risk of environmental harm – has been presented as a basis for policies that support sustainable development (Mitchell 2002).

Despite claims that citizen-collected data are valuable regardless of their scope and accuracy, various analysts maintain that in order to be integrated meaningfully into decision making processes, it is essential that these data also be valued in terms of their validity and reliability (Engel & Voshell 2002; Heiman 1997; Mayfield et al. 2001; Penrose & Call 1995).

In an effort to assess the scientific value of citizen monitoring outcomes, numerous studies have compared the accuracy of volunteer-collected and expert-collected monitoring data. Among these, varying results have been reported. In some cases and for certain parameters, volunteer results have been deemed to be reasonably accurate (Nicholson et al 2002). Another study concludes that "...properly trained community volunteers can provide data that are as rigorous and reliable as data provided by paid professionals" (Heiman 1997: 296). Others report that volunteer data had a higher degree of variability than professional data and were therefore less reliable. However, these differences were most pronounced where volunteers used different methods or equipment

than professionals, suggesting that instruments with a lower degree of precision or methods requiring a higher level of estimation may have led to the observed disparities in results, rather than researcher incompetence (Engel & Voshell 2002; Mayfield et al. 2001; Nicholson et al. 2002).

High quality data in the context of community-based ecosystem monitoring have been defined as “complete records that include both qualitative and quantitative observations (data) and information about the data needed to assess its quality (metadata), such as who collected the data, dates and locations of observations, methods used, and other information” (Bliss et al. 2001: 154-5). Thorough documentation of the monitoring process is thus one important way to allow for increased confidence in the reliability of monitoring data. Gaweda (2002) notes that consistency, use of standardized methods, and comparability to other assessments are other key characteristics of high quality data from volunteer monitoring programs.

The literature identifies several factors that support the collection of high quality data through citizen monitoring programs. Among these are field and technical training for volunteers (Gaweda 2002; Penrose & Call 1995), quality control checks performed by people who are internal and external to the program (Gaweda 2002; Heiman 1997), frequent communication between volunteer monitors and professional scientists (Penrose & Call 1995), and where applicable, use of sampling equipment that minimizes the need for estimation (Nicholson et al. 2002).

Standardization of methods helps to increase the usefulness of monitoring results. “Use of standardized protocols that have been tested for use across Canada... allow(s) for integration across and comparison between various communities, which contributes to our understanding of broad issues such as climate change and biodiversity. Locally relevant protocols support progress toward sustainability by monitoring issues of specific community relevance” (Pollock et al. 2003b). The Ecological Monitoring and Assessment Network, the Canadian Nature Federation, and other organizations at federal, provincial and regional levels are working to create standardized protocols and tools to

support consistent and reliable science-based environmental monitoring across Canada (LTER 2002).

When evaluating the scientific value of citizen monitoring data, it is important to consider the uses to which those data will be applied. “Sufficiently accurate means adequate for the purpose intended” (Au et al. 2000); if “the methods match the objectives” of a program, then it is not necessary for citizen monitoring to achieve the same level of rigour as professional monitoring (Bliss et al. 2001). Volunteer monitoring groups can choose from a range of protocols that regulators recognize as having different functions or “tiers” (Penrose & Call 1995). For example, information that is collected in order to identify problems requires a lower level of rigour than that collected to serve as legal evidence. Given the level of sophistication that is required to produce expert-quality data, when it comes to water quality analysis, “most citizen monitoring groups opt to provide a warning of problematic water quality rather than a rigorous and exact indication of precise water chemistry measures” (Savan et al. 2003: 564).

Information that is collected by volunteers can serve as a “red flag,” identifying sites with unusual conditions that may warrant follow-up investigation by professionals (Savan et al. 2003, Nicholson et al. 2002). Along these lines, the coordinator of a community stream monitoring team asserts, “volunteer data are really useful at the ‘reconnaissance’ level. Volunteers can put a stream into a major category – good, medium, degraded. For fine precision, you need professional data” (Ely 2001).

2.3.3 Partnership models and citizen empowerment

Many citizen monitoring groups work in partnership with government or academic institutions (Savan et al. 2003). Affiliation with a university, water testing lab or other institution can provide middle ground between reliance on experts to conduct and communicate research, and full autonomy of citizen groups. Universities can provide important support to citizen groups in the form of access to facilities, advice, research grants, and some measure of credibility to citizen monitoring programs (Savan et al. 2003). Two examples of monitoring programs in Ontario that have received technical

support through partnerships with universities are Citizens' Environment Watch in Toronto (Savan et al. 2003) and Watershed Action Towards Environmental Responsibility (WATER) in Hamilton (Au et al. 2000: see also section 4.2.3).

Along with the need to find a level of scientific rigour that is appropriate for both official recognition and the practicalities of citizen-based monitoring, citizen monitoring groups face the question of how closely to interact with government and/or corporate institutions. On one hand, citizen science groups may want to work closely with decision makers in order to maintain access to them and possibly to receive funding or other forms of support (Lukasik 1993). On the other hand, citizen scientists may prefer to remain at arm's length from officials, avoiding all ties with government or corporate decision makers in order to maintain their status as independent "watchdogs" (Savan et al. 2003, Au et al. 2000). The latter appears to be the case with "bucket brigade" air quality sampling in parts of the United States, where citizens conduct reactive monitoring in the hope of keeping both industry and government on their toes (O'Rourke & Macey 2003).

In the context of community-based monitoring groups, several types of partnership with government actors are possible. Lukasik (1993) offers "environmental co-production" as a framework for considering partnerships between governments and citizen monitoring groups. The stages in her environmental co-production continuum range from minimal group-government relations at one extreme, to "environmental co-production partnership" at the other. Intermediate stages include data advocacy (a form of public pressure exerted from outside of the government system), and government support of a monitoring group accompanied by no use, general use, or local use of its data (Lukasik 1993: 194-198).

Some governments and biologists now seek partnerships with volunteer groups with the result that the citizen groups and government agencies that are involved each tend to influence the priorities and activities of the other (Whitelaw 2004). From a regulatory biologist's perspective, Penrose and Call (1995) encourage biologists to take a more active role in training and encouraging volunteers. Canada's Ecological Monitoring and

Assessment Network promotes monitoring programs that involve both government and community organizations and are designed to address areas of concern at a local level so that “the partners become autonomous through their knowledge” (LTER 2002: 2).

Participants in grassroots environmental programs including monitoring can achieve collective benefits through a process of empowerment, in which enlightenment is connected to action (Lukasik 2002). As an example, a study of a volunteer air quality monitoring program near industrial sites in California and Louisiana concludes that “the most wide-ranging effect of the [program] on local residents can be inferred from how they collectively represent their transition from victims to agents of change” (O'Rourke & Macey 2003: 398). Some argue that knowledge can be equated with power; thus, by enabling members of the public to generate new knowledge, citizen monitoring programs can lead to “shifts in the locus of power” (Bliss et al. 2001: 147). Conventional power holders may resist such challenges to the current distribution of political power, and be unreceptive to citizen monitoring programs as a result (Au et al. 2000; Bliss et al. 2001).

2.3.4 Challenges faced by citizen monitoring groups

Citizen monitoring groups face several challenges as they attempt to reach their goals. In the literature, these are identified as:

- Securing long-term support and commitment from stakeholders and governments (Pollock et al. 2003b);
- Managing power relations with regulatory agencies or industry (Au et al. 2000; Bliss et al. 2001);
- Increasing the level of volunteer commitment (Stokes & Havas 1990);
- Communicating with agencies, securing funding, and establishing legitimacy (O'Rourke & Macey 2003);
- Improving data reliability (Stokes & Havas 1990), in part by addressing shortcomings in information gathering techniques by volunteers including the “weekend effect” (a data set that is temporally skewed or inconsistent), failure to link simple observations

with complex causes or consequences, and insufficient attention to recording an organism's environment (Roberts 1991);

- Finding or developing standardized methods for conducting monitoring activities, managing data, and interpreting results in terms of ecological thresholds for parameters of local priority (Pollock et al. 2003b);
- Addressing concerns about objectivity (Stokes & Havas 1990): "Objectivity can be difficult to achieve. For example, certain citizens' groups that are formed in a climate of activism, may feel compelled to dramatize or 'expose' a problem, and this clearly can invalidate the findings" (Stokes & Havas 1990);
- Identifying local decision makers' information needs and linking monitoring results to decision making structures in order to achieve influence (Pollock et al. 2003b);
- Integrating all available information in order to assess local sustainability in a comprehensive manner (Pollock et al. 2003b).

This list suggests that citizen monitoring programs face challenges related to gathering and interpreting data, making timely and relevant recommendations to decision makers, establishing a positive reputation that supports the formation of mutually beneficial partnerships with governments, and ensuring long-term organizational stability in the form of human and financial resources.

2.4 Summary

This chapter has presented the theoretical basis and major concepts involved in the research. Theories and international agreements about sustainability and democracy serve to establish public participation in decision making as an important component of sustainability-centred governance, particularly where environmental issues are concerned. Literature from the fields of epistemology and sociology provide a lens through which to critique the role of science and expertise in society, and to explore alternative approaches to knowledge production that allow or encourage a greater role for citizens. Finally, citizen environmental monitoring serves as the focal point for the primary research to follow, as it represents a particular form of public participation in environmental knowledge production, agenda setting, and decision making.

3.0 METHODS

This chapter explains the approach, techniques and criteria for making decisions that have been employed in the primary research. Section 3.1 presents qualitative and case study approaches as the methodological foundations for the study. Section 3.2 describes criteria that were used to select case study communities and summarizes key characteristics of individual interviewees in terms of their gender and affiliation with government or non-government agencies. Section 3.3 discusses specific data collection and analysis techniques that were used in the research. Section 3.4 examines my own role as the researcher and considers the ways in which my prior experiences and ideas might have affected the research outcomes. Finally, section 3.5 presents areas of weakness that place limitations on the study.

3.1 Methodological approach

This study is qualitative and inductive in nature. The primary research discussed here has centred on collecting data on the experiences and perspectives of individuals who have had involvement with citizen monitoring initiatives and decision making processes. The study is also informed, however, by deductive studies where these are available in the secondary literature (see for example Au et al. 2000; Engel & Voshell 2002; Nicholson et al. 2002).

This research follows an exploratory case study approach. This strategy was chosen because the interactions between citizen monitoring groups and government bodies fit the description of “complex social phenomena” that are best understood through case-based investigation (Yin 2003). The study was designed to identify issues of priority, conflicts, and constructive ideas from the perspectives of its participants, rather than to describe, explain or “solve” a narrowly defined problem. Consistent with purposive research aims, the intent of this work is less “to generalize to a larger population than it is to gain a deeper understanding of types” (Neuman 2003: 213). It is hoped that this study can be seen as an investigation of citizen monitoring experiences in diverse settings, which in turn may help to determine criteria for a future, more comprehensive study.

3.2 Selection of case studies and interviewees

In order to explore a range of factors that facilitated and impeded citizen monitoring groups attempting to participate in particular instances of decision making, I chose to investigate multiple case studies. Based on the time and resource limitations of this master's-level study, I decided to focus on three communities.

Case study communities were sought where information that was collected through citizen environmental monitoring had been applied to a specific instance of governmental decision making, such as the development or application of legislation or policies. The goal of studying groups with this characteristic meant that purposive sampling, or using the researcher's judgment to select cases of particular types for in-depth study (Neuman 2003: 213), was most appropriate. Because no complete directory of Canadian citizen monitoring groups exists⁶, it was not possible to review potential cases with full knowledge of all possible communities that might have met the research objectives. Instead, potential case studies were identified through a combination of a literature survey, an Internet search, and telephone and email inquiries. The possibilities were narrowed down to groups that met the following criteria:

- Citizen monitoring results have been applied to specific decision making or regulatory enforcement initiatives, generally through government processes;
- Partnerships exist between government and non-government organizations to incorporate citizen monitoring data into watershed or land use planning;
- Attention is directed to water quality as one parameter for investigation;
- Consideration is given to both human and biophysical variables (i.e. relevant groups are working towards a vision of broader sustainability);
- Cases represent a diversity of geographic locations and community characteristics;
- and
- Prospective participants show willingness and enthusiasm to take part in the study.

⁶ As mentioned in section 2.3, a partial directory compiled by Stewardship Canada currently includes approximately 260 citizen science initiatives involved in various types of environmental monitoring. To my knowledge, however, this directory was not publicly available at the outset of the study.

Out of seven communities that originally appeared to match the study objectives and responded to telephone or e-mail contact, four were rejected because they failed to meet at least one of the above criteria. Of these, one had achieved policy influence through citizen efforts that were primarily focused on mapping, rather than monitoring; one had launched a successful lawsuit in a case of water pollution, but lacked an ongoing citizen-based monitoring program; and two used water quality monitoring as a means to pressure private companies, rather than governments, to change their policies and practices.

The three selected communities are Hamilton and Muskoka, Ontario, and Comox Valley, British Columbia. These areas meet the selection criteria, and represent a suitable range of experiences and applications for citizen environmental monitoring. In each case study community, it quickly became apparent that several citizen groups were working, individually and interactively, towards similar goals. Each case can thus be considered to involve more than one unit of analysis (Yin 2003: 43).

While there are similarities between the cases under study, the political climate, goals, strategies and achievements vary greatly from one to the next. No attempt was made to find cases that were “as similar as possible” in terms of community size, demographics, ecosystem type or location. Such a strategy might have led to overly generalized conclusions that undermined the importance of context. The approach that was chosen is consistent with the Pollock et al.’s (2003b) observation that unique local characteristics are highly important to the design and delivery of citizen monitoring programs from one community to the next.

Within each case study community, potential interviewees were identified through telephone and e-mail communication. Relevant government representatives were nearly all identified by non-government interviewees who were contacted first. Individuals were selected to participate in the study as key informants if they fell into one of two categories:

- Those who currently or previously held a leadership role within a citizen group whose activities included environmental monitoring; or
- Representatives of any level of government who had some involvement with local citizen monitoring programs or results.

Of twenty-three individuals who fit one of these descriptions and were contacted to participate in the study, twenty were interviewed. Overall, eleven of these were affiliated with government bodies, while nine were affiliated with non-government organizations that involved members of the public in environmental monitoring. Table 3.1 summarizes the number and affiliations of interviewees in each case study location.

Table 3.1: Interviewees by case study location and affiliation

Location	Govt.	NGO	Total
Comox Valley	5	4	9
Hamilton	3	3	6
Muskoka	3	2	5
TOTAL	11	9	20

Gender was not used as a determining factor to screen participants in the study; however the resulting (opportunistic) gender balance was roughly equal in the study. Key informants included men and women in nearly equal numbers in both the government and non-government categories of respondents, as shown in Table 3.2. Because of the small sample size in this study, and because the gender balance was not skewed, results were not separated for analysis according to gender.

Table 3.2: Interviewees by gender and affiliation

Gender	Govt.	NGO	Total
Female	6	4	10
Male	5	5	10

This study was approved by the Office of Research Ethics at the University of Waterloo. Interviewees provided written consent to participate in the study and to have their

interviews audiotaped with the knowledge that their statements would not be treated anonymously, i.e. that they would be identified and their comments attributed to them.

3.3 Data collection and analysis

Primary data collection took the form of key informant interviews. Most interviews were conducted in person, while one occurred by telephone. All key informant interviews were audiotaped, and took place during the months of September and October, 2003. The interviews were semi-structured, meaning that guiding questions tended to vary somewhat, depending on context. Sample interview questions for government and non-government representatives are listed in Appendix A.

Because the interviews were spread out over time, responses that were given in earlier interviews may have affected the questions and prompts that were used in later ones. The Comox Valley interviews were conducted first, Hamilton second, and Muskoka third. As well, within each case study the interview questions were refined over time so that they would be more closely tailored to the local situation. While this means that not all interviews were conducted in exactly the same way, this process of evolving interview questions can be considered part of the “nonlinear path” that characterizes qualitative research (Neuman 2003: 141).

Interestingly, the nature of the interviews varied in a way that was broadly consistent with the interviewee’s role as either an NGO or a government representative. NGO coordinators tended to give much longer answers that addressed multiple topics, with fewer interjections by the interviewer. By contrast, government interviewees tended to provide shorter answers that addressed only one specific question or prompt.

Interviews were transcribed and analyzed for recurring themes using open, axial and selective coding (Neuman 2003: 442-445). During and after the first pass through the interview transcripts, a list of major themes was drafted. Unique features of each case study were noted, as were perspectives that were conspicuously absent or only weakly represented in the data set. During the second pass through the data, interview responses

were grouped by theme, and more attention was focused on comparing government and non-government perspectives on each theme, both within and across the case studies. The third pass through the data enabled the themes to be linked into the developing arguments of the thesis and related to themes and ideas encountered in the literature. At this stage, specific examples and quotations illustrating the major themes were also chosen from the data set.

When sorting and analysing interview data, criteria were developed for determining their significance. Ideas were considered to be significant if they were:

- Identified or discussed by multiple interviewees, particularly across case studies and affiliations,
- Mentioned multiple times by a single participant,
- Presented as prominent or important in the literature, and/or
- Unique in perspective or insight.

In general, the discussion chapters were drafted so that within each major theme, ideas are presented in order of declining significance according to these criteria.

3.4 Role of the researcher

The way in which a researcher presents him- or herself to respondents can have a significant effect on the outcome of a study (Fontana & Frey 1994: 367). As the researcher who conducted these semi-structured interviews, it is important for me to reflect on the role that my own position and views may have played in influencing what information participants chose to share, and what information they may have chosen to withhold.

From the time of initial contact with a potential participant through to the beginning of an interview, I explained my role as that of a master's student investigating citizen monitoring groups and their attempts to play a role in decision making, with the goal of identifying factors that facilitated or impeded their success. I hoped that this (truthful)

position was neutral enough that respondents who might have experienced conflict between government agencies and citizen groups would not feel that I was aligned with one “side” or the other. If interviewees asked me questions about my background (e.g. whether I had studied natural sciences, whether I was familiar with certain monitoring parameters and techniques, or whether I had worked with volunteers in the past), I was forthright about the nature of my undergraduate studies (in environmental sciences) and my onetime role as a leader of a youth air and water quality monitoring program run by a small NGO in Toronto. In some cases I also drew on these experiences when prompting respondents in specific topic areas, for example, when discussing difficulties in establishing cause-and-effect relationships or specific thresholds through ecological monitoring, or challenges related to quality assurance/quality control measures when working with volunteers.

Even though few academics now treat detached objectivity as possible to achieve in a research context, it became clear to me that several participants in this study do believe in – and have high expectations for – information that is “impartial,” “unbiased,” or free from attachment to any particular “agenda.” Realizing this, I attempted to present myself in a way that was as balanced and non-leading as possible, in order to accommodate diverse perspectives. I approached interviews in a non-confrontational and balanced manner, and took special care in phrasing questions. Often, this meant asking participants to describe “ideal scenarios” or solutions to challenges that they described. Addressing potentially sensitive or political topics using open-ended questions like these was one way in which I tried to ensure that my own ideas did not limit or compromise the results of the study.

In addition to my own past experiences, when I designed and conducted the interviews I was also potentially biased unconsciously by conclusions that I had read in the literature or heard anecdotally from others working in the field of citizen monitoring. In other words, there was some danger of “seeking what I expected to find.” However, I was surprised many times by the responses that both government and non-government participants provided. The emergence of these unanticipated views led me to conclusions

that I would not have predicted at the beginning of the study, and reassured me that I had not (unconsciously) steered the research outcomes with too heavy a hand.

3.5 Limitations

I acknowledge that by focusing on cases where citizen groups have already achieved a measure of success at linking monitoring results to decision making, certain types of citizen monitoring groups have been excluded from the study. These include groups that are too new or inexperienced to have achieved success, groups that conduct their activities where decision makers are politically unreceptive to applying their findings, and groups that have long-term or otherwise ambitious aims that cannot be readily accommodated within existing political frameworks.

It was not possible to interview every individual who met the criteria for participation in the study. Some had moved on to new positions in the time since their involvement with citizen monitoring initiatives. Others declined to participate or simply were not available for an interview during the time of the study. The data set is therefore not as complete as it otherwise might have been.

Along these lines, at the outset of the study I defined “decision makers” from a government perspective. I tried to choose groups that focused their efforts on government, rather than corporate, decision makers in order to increase the number of common elements between my case study communities, and I relied on referrals from other participants to identify government representatives who had played a role in citizen monitoring initiatives in each case. As a result of this process, the participants I have termed “government representatives” or “decision makers” largely turned out to be planners or community liaison staff. As I progressed through the data analysis it became apparent that other types of decision makers were also relevant to citizen monitoring programs: elected municipal councillors, mayors, and private landowners were reported to have impacts on the outcomes of policy and stewardship initiatives. I acknowledge the lack of participation of elected politicians and landowners as a gap in my interview data set.

A further limitation is that two of the interviews involved more than one participant at a time. In both cases, I arrived expecting (and having arranged) to interview the participants separately, only to find that the interviewees had re-aligned their schedules so that I would meet with them together. I acknowledge that group interviews tend to have different characteristics than individual interviews. On the positive side, group interviews can offer flexibility and richness of information, stimulate respondents, help respondents to recall information, and yield cumulative and elaborative responses. Drawbacks include that participants in group interviews may suppress sensitive information, “group-think” may override individual views, and respondents may participate unequally (Fontana & Frey 1994: 365). The resulting mix of individual and group interviews may have created inconsistencies within the study that would have been better avoided.

4.0 CASE STUDY OVERVIEWS

This chapter is devoted to presenting profiles of the three case studies: Comox Valley, Hamilton, and Muskoka. For each, a general description of the community is provided. Particular citizen groups and monitoring programs that have contributed to local environmental policies, actions or management strategies are then described. An explanation of who was interviewed (in terms of government, NGO, or academic affiliations) is provided. Finally, citizen monitoring programs and contributions within each case are examined with attention to how closely each program matched the original selection criteria. Emergent factors affecting the use of volunteer-collected information in decision making are summarized in a table at the end of each case description.

4.1 Comox Valley, British Columbia

Comox Valley is located on the east coast of Vancouver Island within the Regional District of Comox-Strathcona, approximately 100km northwest of Nanaimo. The valley's total population is just over 60,000, with the largest settlements being the city of Courtenay, the town of Comox, and the village of Cumberland (Comox Valley Tourism 2003). The area's natural features include mountains, forests, and close proximity to the ocean. The resulting combination of aesthetic appeal and natural resource wealth has drawn both retirees and those in the resource industry to the valley. One interviewee described the consequent social dynamics as an "us and them" scenario, with environmental and economic priorities traditionally pitted against each other (Pinho 2003).

Comox Valley is home to a rich and interesting history of citizen participation in environmental management. Volunteers have supplied monitoring and mapping information that has informed land use decisions, formed the basis of a watershed management plan, and prompted remedial action to correct cross-connections between sewage and stormwater pipes. Working relationships have been forged between NGOs, the general public, and four levels of government.



Figure 4.1: Comox Valley and surrounding areas (from Comox Valley Airport n.d.)

Several citizen groups have worked to collect environmental information so that it may be presented to decision makers and used to encourage residents to adopt stewardship practices. In their efforts to establish credibility, each group’s work has proved to be complementary to the others. This section describes citizen involvement in three such non-governmental organizations in Comox Valley: Comox Valley Project Watershed Society (Project Watershed), the Baynes Sound Stewardship Action Group (BSSAG), and the Millard/Piercy Watershed Stewards.

Interviewees in Comox Valley included coordinators for each of these three citizen groups (two in the case of Project Watershed) and staff representatives from the City of Courtenay, Regional District of Comox-Strathcona, BC Ministry of Agriculture, Food and Fisheries, BC Ministry of Water, Land and Air Protection, and federal Department of Fisheries and Oceans (Comox branch). Each of the government representatives was identified by an NGO coordinator as having been directly involved in the creation or implementation of the Millard/Piercy Watershed Management Plan, which served as the starting point for this case investigation.

4.1.1 Comox Valley Project Watershed Society

In 1992, the federal Department of Fisheries and Oceans (DFO) set out to improve habitat protection for coho salmon in the Strait of Georgia. A pilot project was initiated in the Comox Valley on Vancouver Island with the goal of designing a community-based framework for water and watershed stewardship. A yearlong public consultation process developed a twelve-point framework for community stewardship and led directly to the formation of the Comox Valley Watershed Assembly. At a conference in 1995 government representatives and local citizens adopted “process guidelines” to serve as a means for conflict resolution and shared decision making on land and water issues. The broad goal of the Assembly was to resolve problems so that water and watersheds could be used sustainably. The Assembly continues to meet approximately nine times per year (Hilliari 2003).

Another outcome of the pilot project was the formation of the Comox Valley Project Watershed Society (“Project Watershed”). The group’s mission is to “promote community stewardship of Comox Valley watersheds through education, information, and action” (Hilliari 2003). The group’s activities over the years have included citizen-based water quality monitoring and landholder contact to promote stewardship. The organization now focuses on Geographic Information Systems (GIS) mapping of streams, wetlands and environmentally sensitive areas and continues to provide stewardship information to landholders and the general public. Their on-the-ground work to verify the locations of streams and wetlands is incorporated into a habitat atlas, which is shared among local governments and senior agencies (Hilliari 2003).

The initial goal of Project Watershed’s mapping work was to document previously unrecorded mapping information for watercourse locations. Various methodologies have been implemented over the years, culminating in high-end Global Positioning Systems (GPS) with accompanying data entered into a hand-held data logger (Ellefson 2003). Volunteers were the first ones to collect data for Project Watershed, using methods outlined by the Stream Keepers (Chamberlain 2003). However, following concerns about the quality and range of coverage of volunteer data, Project Watershed began to employ

re-trained fishers to perform the bulk of the mapping work (Chamberlain 2003). Currently, the organization's paid staff conduct highly technical GPS surveys, accompanied by volunteers who take on the role of assistants and contribute anecdotal information about the area under study (Chamberlain 2003).

The data collected through the mapping program are provided to the Regional District of Comox-Strathcona and incorporated into a legal document called the Sensitive Habitat Atlas. This atlas is part of the Region's legislation, and is consulted for local land use planning decisions. For example, when a proposed development falls within a certain distance of a stream, the developer must apply for a development permit (Mewett 2003). The Sensitive Habitat Atlas in Comox-Strathcona served as a pilot project within the province, and now other regional districts are working to develop their own atlases (Chamberlain 2003).

Although Project Watershed now employs paid staff to collect its GIS data and involves volunteers in more of an assistant capacity, government employees continue to cite the quality of Project Watershed's work when asked what gives them confidence in citizen-collected data. In one case, the Regional District hired Project Watershed to collect mapping information (Mewett 2003), demonstrating the regional government's level of comfort with respect to the quality of this non-profit organization's work.

4.1.2 Baynes Sound Stewardship Action Group

The Baynes Sound stretches 30 km from Comox Harbour to Deep Bay, bounded by Vancouver Island on one side and Denman Island on the other (Pinho 2003). In 1998, this area produced 40% of British Columbia's total shellfish yield (Comox Valley Economic Development Society, in Pinho 2001). Citizen monitoring efforts in areas surrounding Baynes Sound have led to remedial water quality action at the municipal level.

In 1994, two groups formed in response to concerns that water pollution was threatening valuable shellfish production in the sound (Pinho 2001). The Baynes Sound Round Table, comprised of government and industry representatives, was formed to deal with broad

political and jurisdictional concerns. By contrast, the Baynes Sound Stewardship Action Group (BSSAG) included a broader membership from government, industry, and community groups, with a mandate to pursue on-the-ground actions to restore water quality (Pinho 2003, 2001).

In 1996, BSSAG launched a Storm Water Monitoring program with the goals of determining the sources of water pollution through citizen involvement, assigning priority to these sources, and bringing the results to the attention of local governments (Pinho 2001). A paid coordinator, funded primarily through Eco Action Environment Canada, trained and oversaw approximately 40 volunteer monitors. These citizens collected water samples from 55 storm water outfalls on a monthly basis, testing the water for temperature, pH, greases, oils, and detergents (Pinho 2003). The samples were then sent to a laboratory for bacteriological testing.

Laboratory results showed that 16 of the storm drains contained fecal coliform bacteria in high enough numbers to pose a risk to shellfish or human health (Pinho 2001). This suggested that raw sewage was entering local waterways through the storm water system. Visual observations, where volunteers noted the presence of items such as toilet paper and tampons in the water, supported the hypothesis that cross-connections between household sanitary sewers and storm water outfalls were a major cause of pollution. In response to this evidence, the City of Courtenay conducted an investigation that involved smoke testing and dye testing in order to pinpoint the sources of pollution. These methods identified specific locations where plumbing errors had incorrectly connected residential sewage pipes to municipal storm water pipes (Pinho 2003).

The City of Courtenay and the Town of Comox subsequently took action to address the problem, correcting over 80 of these cross-connections (Pinho 2003). For the City of Courtenay, this meant investing approximately \$250,000 in equipment and infrastructure upgrades (Crawford 2003).

The Baynes Sound Stewardship Action Group has undertaken other projects designed to involve citizens in reducing bacteriological water pollution. These include:

- Public education encouraging citizens to learn about their septic systems, and to have their systems properly inspected and maintained;
- Landowner contact to encourage agricultural practices that minimize waste runoff; and
- Efforts to provide pump-out facilities at docks so that boat wastes can be sent to a sewage treatment plant, rather than discharged directly into Baynes Sound.

4.1.3 Millard/Piercy Watershed Stewards

The Millard/Piercy Watershed Stewards have employed a broad range of tactics for learning about and tracking the health of their watershed. Led by two paid coordinators, approximately 50 volunteers take part in collecting water quality samples, mapping riparian profiles and locations of fish, monitoring flows, counting fish spawners and fry, checking groundwater levels, conducting bird surveys, and performing restoration work (Smailes 2003b). The Stewards also arranged to have the watershed flown in order to obtain air photographs, and used this information to calculate the percentage of land in the watershed covered by impervious surfaces (Smailes 2003b). The organization aims to use this information to apply political pressure for responsible development guidance and controls in the face of an anticipated development “boom” in the watershed (Smailes 2003b). As the group’s coordinator stated, “We’re wanting to change the way development happens in this watershed” (Smailes 2003a).

From 1998-2001, The Millard/Piercy Watershed Stewards worked with four levels of government (municipal, regional, provincial, and federal) and the general public to produce a Watershed Management Plan. This process involved a series of public consultations, focus groups, and meetings of an Advisory Committee (Millard/Piercy Watershed Stewards 2001). The resulting document outlines a strategy for achieving the vision, “to restore and protect the health of the Millard/Piercy Watershed”

(Millard/Piercy Watershed Stewards 2001), and is largely based on information gathered by volunteers (Smailes 2003b).

At the Regional District level, information from the Watershed Management Plan has been used to make decisions about development permits (Mewett 2003). Outside of Comox-Strathcona, the Millard/Piercy plan has been referenced in another regional district's new liquid waste management plan (Chamberlain 2003). Provincially, Millard/Piercy's work has been identified as contributing to British Columbia's storm water management plan (Henigman 2003). But at the municipal level, the Stewards are still working to encourage the City of Courtenay to turn its principles into specific policies, and to coordinate its environmental protection policies with those of the region (Smailes 2003a).

The Millard/Piercy Watershed Stewards hope to strengthen future iterations of the plan by linking tasks more specifically to individuals responsible for achieving them, and by attaching firm timelines to these assignments (Smailes 2003a). Meanwhile, the extent to which local governments will incorporate parts of the plan into future versions of Official Community Plans remains to be seen.

4.1.4 Comox Valley and the selection criteria

Citizen monitoring programs in Comox Valley have involved cooperation with government agencies through round table and advisory committee arrangements. Citizen involvement has been a feature of local monitoring and mapping efforts in the area for over a decade, placing program coordinators in a good position to reflect on factors that have promoted and inhibited their progress over the years. Participation in policy and planning exercises through citizen monitoring programs apparently has led to some influence at the levels of municipal and regional governance, but coordinators of citizen efforts acknowledge this as a potential area for further progress. Monitoring programs have largely focused on biophysical parameters via water quality and land use issues to date, although the priorities for investigation have been determined at least in part by broader social agendas (e.g. protection of economically productive shellfish leases).

Interviewees identified the following positive outcomes of citizen monitoring and mapping programs in Comox Valley that were directly related to decision making:

- Sewer infrastructure problems were investigated and corrected by municipalities (i.e. the City of Courtenay and Town of Comox have repaired over 80 cross-connections)
- Standards for mapping were established for the regional Sensitive Habitat Atlas
- Stewardship projects were launched
- Monitoring partnerships were formed, especially with farms
- The regional government now consults Project Watershed for mapping information
- Further studies were undertaken
- A provincial storm water guide was informed by the Millard/Piercy Stewards' work
- Mapping information is used in the region's Sensitive Habitat Atlas (a legal document with implications for development permits)
- The Millard/Piercy Watershed Management plan was cited in a regional liquid waste management plan

As well, interviewees stated that citizen monitoring efforts in Comox Valley had some indirect effects on decision making including:

- “Nudging,” pressure on municipal councils
- Community education and increased support for environmental protection measures
- Ongoing advocacy using information gathered and analysed by volunteers

Table 4.1 summarizes factors that interviewees identified as facilitating or impeding the use of citizen monitoring in decision making in Comox Valley. These themes will be discussed in more detail in Chapter 5.

Table 4.1: Enablers and obstacles for the use of Comox Valley citizen monitoring data in decision making

Enablers	Obstacles
<ul style="list-style-type: none"> • Use of existing political process (Baynes Sound) • Non-confrontational partnerships (stakeholders working together) • Strong volunteer base including many retirees with expertise • Perception of high data quality • Monitoring groups have established positive reputations, community support over time • Cooperation of provincial government official (Baynes Sound) • Separation of political and action groups (Baynes Sound) 	<ul style="list-style-type: none"> • Lack of official plan review that could incorporate watershed plan recommendations • Lack of money for municipality to implement changes • Lack of political will (from citizen perspective) • Potential “bias” of citizen groups (from government perspective) • Inter-jurisdictional difficulties • Volunteer data quality not assured • Watershed plan: not enough specific roles and tasks with timelines • Long vetting process for mapping standards • Difficulty in securing ongoing funding

4.2 Hamilton, Ontario

The City of Hamilton is located in southern Ontario on the western shore of Lake Ontario. In January 2001, the former municipalities of Hamilton, Stoney Creek, Ancaster, Dundas, Glanbrook and Flamborough amalgamated to form the new City of Hamilton, with a total population of 490,268 (Statistics Canada 2001).

Hamilton has long been an active industrial centre, with two large steel operations figuring prominently in the local economy. The continuing legacy of contaminants and waste stemming from such industrial activity in the city and harbour led one interviewee to describe Hamilton as “a city in crisis, environmentally” (McHattie 2003).



Figure 4.2: Hamilton and surrounding area (Ministry of Transportation Ontario 2003)

Consistent with the perception that the city’s environmental situation requires urgent attention, citizen monitoring efforts in Hamilton have tended to follow a “hot spot” or “quick hit” approach (Lukasik 2003, McHattie 2003). Citizen-led environmental investigations have focused on specific areas of concern, often with the goal of exposing pollution infractions and initiating the enforcement of environmental law. These efforts have culminated in several actions including: a private prosecution of the City of Hamilton over leachate from the Rennie Street landfill site under the federal Fisheries Act, the Ministry of the Environment writing multiple orders against the City for discharging pollutants from other points along Red Hill Creek, and a fine levied against private industry for water pollution identified and reported by an observant citizen (Lukasik 2003). However, citizen monitoring has also figured into more cooperative environmental processes by identifying environmentally significant areas that fit into protection measures within the city’s Official Plan. As well, efforts are currently underway to incorporate citizen-collected information into Vision 2020, a document that guides and encourages sustainable decision making at the municipal level.

The following sections discuss the monitoring activities of the Hamilton Naturalists' Club, Environment Hamilton, Watershed Action Towards Environmental Responsibility (WATER), and the Vision 2020 initiative. It is worth mentioning that Hamilton is home to a wide range of citizen groups that are dedicated to taking action on environmental issues using a variety of tactics (see Lukasik 2002 for elaboration on five active groups working in the Red Hill Valley alone). In other words, monitoring programs represent only one of many grassroots approaches to understanding and protecting valued environmental features in Hamilton.

Interviewees in Hamilton include two NGO coordinators representing Environment Hamilton and the Hamilton Naturalists' Club, a professor from McMaster University who coordinates WATER, the City of Hamilton's Vision 2020 coordinator, and two representatives from the federal Ecological Monitoring and Assessment Network (EMAN). EMAN has played two roles in citizen monitoring efforts in Hamilton: first, the agency funded a regional coordinator from Hamilton to participate in the pilot year of its Canadian Community Monitoring Network initiative; second, EMAN is a partner in the Vision 2020 exercise.

4.2.1 Hamilton Naturalists' Club

The Hamilton Naturalists' Club, founded in 1919, is part of a network of 130 natural history groups affiliated with Ontario Nature (formerly the Federation of Ontario Naturalists). In 1990, the Hamilton Naturalists' Club's involvement in protecting natural areas took a new form: the group began to sponsor biological inventories of significant natural areas, which were subsequently protected through the city's official plan (McHattie 2003). While professional biologists conducted the bulk of the research, the Naturalists' Club initiated the project, raised funds to hire the researchers, and chaired the steering committee (McHattie 2003). The City of Hamilton, Hamilton Conservation Authority and other agencies have worked together on the undertaking.

By 2003, this project had increased the number of environmentally significant areas identified and protected through the City's official plan from 37 to 69, with an additional

20 sites going through the protection process (McHattie 2003). The biological inventories have also led to changes that go beyond simply protecting individual natural areas. As a result of these activities, the City has begun to discuss broader approaches to environmental protection, including the importance of linkages, wildlife corridors, and even a natural heritage system for Hamilton (McHattie 2003).

Over time, the inventory project has become more institutionalized within the City of Hamilton. Whereas in 1990 the Naturalists' Club took primary responsibility for fundraising and coordinating the project, in each subsequent inventory, City staff members have become more involved in writing funding proposals and managing the project (McHattie 2003). In this way, an idea that originally came from a citizen group has become "part of the way we do business in the City of Hamilton" (McHattie 2003).

4.2.2 Environment Hamilton

Environment Hamilton is a not-for-profit organization that formed after a group of citizens pushed for the remediation of the Rennie Street landfill site in East Hamilton. Following a water quality investigation, Lynda Lukasik initiated a private prosecution against the City of Hamilton. The City was fined approximately \$300,000 under the federal *Fisheries Act*. Through a fine-sharing clause, a portion of the fine was awarded to the citizen prosecutor, and has subsequently been used to fund a variety of local environmental projects including the creation of Environment Hamilton (Lukasik 2003).

Citizen monitoring is a major area of activity for Environment Hamilton. In an effort to identify point sources of water and air pollution, the group has encouraged visual monitoring of pipes, outfalls and industrial stacks. Citizens have called provincial and municipal "spill lines" to report suspected problems, in some cases eventually causing the provincial Ministry of the Environment to send an abatement officer to follow up on their complaints (Lukasik 2003). Environment Hamilton has also been an active partner with WATER (described below), helping to guide science-based student research towards local areas of water quality concern, and applying their results to press for remediation of polluted sites. As the Executive Director of Environment Hamilton asserted about the

organization's monitoring work, "People aren't out there doing crazy things; they're just pressuring the government to enforce the environmental laws that we have in place right now" (Lukasik 2003).

During the summer of 2002, Environment Hamilton patrolled Hamilton Harbour in a boat donated by Lake Ontario Keeper, involving citizens in identifying potential pollution problems and collecting water samples following proper techniques (Environment Hamilton n.d.). However, due to a shortage of funding, this program was not repeated in the summer of 2003 (Lukasik 2003).

Environment Hamilton has also been heavily involved in efforts to protect the Red Hill Valley from the construction of a proposed expressway. One way in which citizen monitoring entered into this project was by sending highly skilled birders from the Hamilton Naturalists' Club to conduct a survey of part of the Valley that was slated to be levelled in order to permit expressway construction. These volunteers discovered several species of migratory birds nesting on the site and notified authorities through the Canadian Wildlife Service. The City sent its own biologists to conduct a follow-up survey, and confirmed that their construction plans would be in contravention of the federal *Migratory Birds Act* (Lukasik 2003). Construction was stopped (at least temporarily) as a result.

While Environment Hamilton has focused mainly on "hot spot" monitoring to date, it has also entered into a partnership with the Canadian Nature Federation (CNF) and Ecological Monitoring and Assessment Network (EMAN) to promote long-term ecological monitoring through the Canadian Community Monitoring Network. As described in section 4.2.4, one extension of this work is to try to integrate ongoing, citizen-collected monitoring data into the City of Hamilton's Vision 2020 program.

4.2.3 Watershed Action Towards Environmental Responsibility (WATER)

Since 1993, Hamilton has been home to a unique program that brings together community groups, high schools, and a university to investigate local water quality concerns. Dr. George Sorger of McMaster University initiated and continues to lead the WATER program, which he based on the philosophy of social projection as practiced in Latin America. Social projection requires students to perform community work in the area of their studies, thus encouraging them to become better citizens by applying their expertise to real-life problems (Sorger 2003). A second benefit of this approach is that through their involvement, participating students become interested in the problems of their country (Sorger 2003).

In Hamilton, this strategy is directed at high school students for three reasons: first, they are perceived by the public to be politically impartial; second, they are integrated into their home communities (unlike university students, who have often moved to a new community to pursue their studies); and third, high schools in Canada are likely to own the equipment needed to perform basic water quality testing (Au et al. 2000). Through the program, a citizens' group identifies areas within the city where they suspect that water pollution is occurring. Dr. Sorger, together with undergraduate teaching assistants, trains participating high school students in basic water quality assessment techniques including tests for total coliforms, *E. coli*, phosphorus, ammonia, dissolved oxygen, and toxicity (Sorger 2003). The high school students collect samples from the (usually three) study sites and analyse them in a laboratory at the university. When their investigation is complete, the high school students present their results back to the group that identified the study sites. If the research concludes that a problem exists, then the citizens' group may use the data to press for corrective action.

In the first year of the program, the students reported that the City of Hamilton was violating pollution regulations. The citizens' group that had requested the research used the information to successfully sue the City. The year after the City was ordered to resolve the problem, the students returned to the same study site and found that the problem had been significantly, if not perfectly, corrected (Sorger 2003). Through a

combination of the students' data and citizen monitoring, the Ontario Ministry of the Environment had enough evidence to justify conducting their own investigation. In 2001, this led to the MOE writing four orders against the City of Hamilton. These required the City to examine every discharge point into Red Hill Creek, identify causes of chemical and bacteriological contamination, and fix the problems (Lukasik 2003). While this represents perhaps the program's greatest single success, the combination of student and citizen monitoring efforts has led to water quality improvements in several other instances (Lukasik 2003).

The goals of the WATER program go beyond correcting environmental infractions. Its education and awareness raising components are considered equally, if not more, important (Sorger 2003). Connecting students with the community through problem-based research is seen as a way to "nurture socially responsible scientists" (Lukasik 2003). While many of the students who take part in the program are initially more interested in science than in community issues, through their experiences they "hopefully become more conscious of how science can serve the environment" (Sorger 2003).

4.2.4 Vision 2020

Vision 2020 is a document that outlines the City of Hamilton's commitment to work for sustainability by integrating environmental, social and economic factors in decision-making. Vision 2020 and its companion programs are designed to provide frameworks and guidance for incorporating sustainable thinking into all of the City's documents and programs (Harvey 2003). Hamilton defines sustainable development as "a positive change which does not undermine the environment or social systems on which we depend" (Vision 2020 2003).

In 1992, consultations were held between citizens, municipal staff and councillors to produce a vision of how they wanted Hamilton to look in the year 2020 (Vision 2020 2003). The resulting Vision 2020 document was released the same year, and has since gone through 5-year and 10-year reviews (Harvey 2003). In 2001 the new (amalgamated) City Council adopted Vision 2020 as "the shared vision between the City and the

community and business” (Harvey 2003), effectively accepting it as a basis for decision-making. The City stated its commitment to sustainable development in its strategic plan titled “Mission, Vision, Values and Goals” (Vision 2020 2003: 2).

One way in which the City measures its progress towards the vision of sustainability is through its Sustainable Indicator program (Harvey 2003). Through this program, the City produces an annual report showing trends in indicators from 14 areas identified in Vision 2020 as being important to sustainability. Data for the Sustainable Indicator program currently come from private organizations and public agencies, such as the Social Planning and Research Council (Harvey 2003). However, efforts are currently underway to introduce new indicators to the program that would rely on citizen monitoring (McHattie 2003). The City of Hamilton, Environment Hamilton and EMAN have discussed ways to choose indicators that are both locally meaningful and researchable using EMAN protocols (Lukasik 2003, McHattie 2003). The idea is that citizens will not only help to select which indicators are used to measure Hamilton’s sustainability, but they will also have a role to play in collecting the data used to measure progress.

By adopting Vision 2020 through City Council, the City of Hamilton has committed to applying its principles in all areas of decision making. So far, the principles have emerged in the City’s new growth management study design, approved in October 2003 (Harvey 2003). However, other areas remain up for review. While Vision 2020 was well integrated into the Official Plan for the former region, meaning that its principles were part of legislation, the City of Hamilton is now developing a new Official Plan for the amalgamated City, and has yet to decide to what degree it will incorporate Vision 2020 (Lukasik 2003). Until the City enshrines the document in its municipal plan and bylaws and gives it authenticity by assigning enough staff to oversee its implementation, there is a danger that Vision 2020 will be largely symbolic (McHattie 2003).

4.2.5 Hamilton and the selection criteria

Citizen monitoring efforts in Hamilton have contributed to the enforcement of regulations and remediation of polluted sites. These outcomes represent success at identifying

particular sources of pollution and facilitating regulatory processes, particularly related to urban surface water quality. This approach is largely consistent with the “community environmental policing” strategy employed by “bucket brigades” in the United States, where citizens are encouraged to define problems and demand improvements to local industrial practices in cooperation with local NGOs (O'Rourke & Macey 2003). This approach is discussed further in section 5.2.2 on strategic approaches to monitoring.

To date, citizen monitoring contributions to policy development and/or planning exercises in Hamilton have been less pronounced, although participation in the Canadian Community Monitoring Network and the Vision 2020 program represent recent gestures towards advancing a long-term monitoring approach. Monitoring efforts in Hamilton have so far included social parameters only in the form of links between human and environmental health.

Interviewees identified the following positive outcomes of citizen monitoring in Hamilton with respect to decision making:

- Legal action regarding the Rennie Street landfill resulted in a fine against the City of Hamilton
- Data collected by students and citizen groups prompted a Ministry of the Environment order for the City to examine all of its discharges into Red Hill Creek
- A private company was fined \$15,000 after citizens identified it as a source of water pollution
- Amateur birders identified migratory birds in the Red Hill Valley; cutting in one area that was slated for expressway construction was staved off as a result
- Naturalists' Club inventories led to protection of natural areas through Official Plan
- Inventory work prompted new discussions of corridors and linkages
- Plans are being made to link citizen data to decision making through Vision 2020
- Student work on water pollution from a pipe led to a lawsuit; the City subsequently fixed the problem

As in Comox Valley, interviewees also reported intangible outcomes of citizen monitoring. Industry knows that citizens are watching, for example through the Pipe Watch program (Lukasik 2003), and may act with greater caution as a result.

It appears that the relationships between citizen groups and government agencies in Hamilton have been more adversarial than cooperative, with citizen groups having implicated the City of Hamilton in more than one pollution scenario. In particular, citizen group coordinators spoke repeatedly about power imbalances between citizens and governments, stating that political objectives at the municipal level served to impede meaningful public participation as well as sustainability-oriented policies and practices. The themes of political will and partnerships between citizen groups and governments are discussed in greater detail in chapter 5.

Table 4.2 summarizes citizen monitoring enablers and obstacles that interviewees identified in Hamilton.

Table 4.2: Enablers and obstacles for the use of Hamilton citizen monitoring data in decision making

Enablers	Obstacles
<ul style="list-style-type: none"> • Use of existing environmental laws to address pollution incidents (Environment Hamilton) • Use of existing municipal framework (Official Plan) for protecting natural areas (Naturalists' Club) • Persistence, long-term commitment of volunteers, citizen groups • Cooperation of government official (Environment Hamilton – provincial abatement officer) • Data quality, knowledge enhanced by partnerships with lawyers, academics (Environment Hamilton) • Institutionalization of monitoring program within City (Naturalists' Club) 	<ul style="list-style-type: none"> • Lack of political will from citizen perspective (councillors can ignore monitoring data, Vision 2020) • Need to reaffirm 2020 in Official Plan for amalgamated city • Vision 2020 symbolic only without money, staff time committed to it • Citizen groups not able to investigate all suspected problems • MOE has not always followed up after writing orders against the City • Funding shortages have impeded or ended monitoring programs • Private prosecutions are too much work and too costly to pursue regularly

4.3 Muskoka, Ontario

Muskoka District spreads over a system of lakes and rivers in central Ontario. Encompassing several townships, including Gravenhurst, Bracebridge, and Huntsville, Muskoka stretches from the edge of Georgian Bay in the west, to the boundary of Algonquin Park in the east. Six area municipalities combine to form Muskoka.

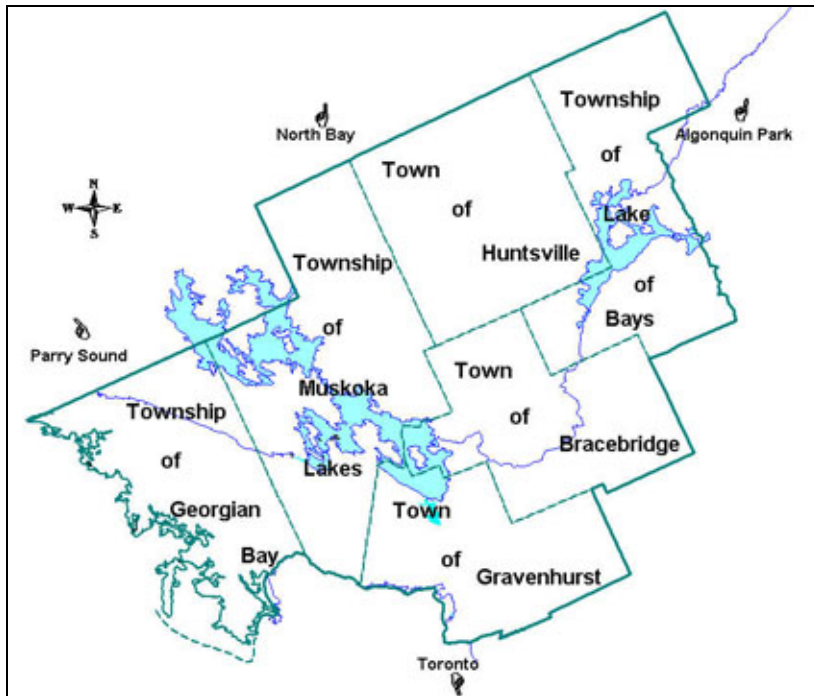


Figure 4.3: Townships of Muskoka (District Municipality of Muskoka 2004)

Muskoka’s population represents a mix of permanent and seasonal residents, with an increasing number of retirees choosing to make the area their primary home (Boivin 2003). The area’s beauty and nature-related recreational opportunities mean that many cottagers and residents who have chosen to live in Muskoka place a high value on its natural features. This value manifests itself in more than one way: as an ethic based on enhanced awareness of environmental issues (Black 2003), as a business strategy designed to satisfy summer residents by protecting environmental quality (Black 2003), and as a “summer playground” mindset among seasonal residents, who want to relax during their vacations, and perceive environmental conditions in Muskoka to be so much more pristine than the cities where they live that they see little need for concern (Brouse 2003, Mann 2003).

High property taxes mean that Muskoka's waterfront residents tend to come from higher-income, higher-education backgrounds than the general population (Boivin 2003). This group includes professionals with advanced technical expertise who have acted as advisors to local monitoring programs (Brouse 2003). As well, some residents have strong political connections, and may be able to influence a provincial agenda if they feel strongly enough about an issue (Brouse 2003). Of the three case studies examined here, this combination of relative wealth and political clout is unique to Muskoka.

Ratepayer associations have historically spearheaded monitoring programs in Muskoka, often with the assistance of professional consultants. Recently, through a partnership between the District Municipality of Muskoka and the Muskoka Heritage Foundation, the Muskoka Watershed Council has initiated the process of developing a more coordinated monitoring program across Muskoka.

The following sections describe community monitoring efforts on the part of the Muskoka Lakes Association, the District Municipality of Muskoka, and the Muskoka Watershed Council. Interviewees include representatives from each of these groups. Because the Watershed Council functions as a close collaboration between government and non-government representatives, the division between these two groups of respondents is less clear in Muskoka than in the two cases described above. Also, the small community size often results in the same individuals holding key roles within multiple organizations (for example, the Watershed Council and Regional Health Unit).

4.3.1 Muskoka Lakes Association

With approximately 3000 members, the Muskoka Lakes Association (MLA) is one of the largest ratepayer associations in the region. Founded in 1894, the MLA's membership includes residents of three major lakes (Muskoka, Joseph and Rousseau) and four townships (Muskoka Lakes, Bracebridge, Gravenhurst, and Seguin) (Muskoka Lakes Association 2004). Its activities appeal to a broad spectrum of interests, ranging from social events such as curling bonspiels and antique boat shows, to political involvements such as advocating for property tax reform (Logan 2003a). The organization strives to

protect Muskoka Lakes' residents and environmental features through a constitutional commitment to "uniting together all those interested in the three lakes, Muskoka, Rosseau and Joseph, and their vicinities, for the purpose of preserving the healthful, sanitary condition and scenic beauty of the vicinity" (Muskoka Lakes Association 2004).

The MLA recognizes surface water quality as a central determinant of quality of life in Muskoka (Muskoka Lakes Association 2004). In 2001, the association contracted Gartner Lee Ltd., an environmental consulting firm, to design a water quality monitoring program focused on "how human land uses and land-based activities affect the quality of surface water in the nearshore zone" (Muskoka Lakes Association 2004). The resulting program was intended to satisfy research-oriented objectives, with monitoring parameters that included *E. coli*, total coliform bacteria, phosphorous, periphyton, turbidity, and temperature (Logan 2003a).

In 2002, the MLA sponsored a master's-level research project with the goal of turning Gartner Lee's work into a community-based monitoring initiative (Logan 2003a). The researcher designed a model for participatory planning that is based on citizen science and locally relevant to Muskoka Lakes (Muskoka Lakes Association 2004). The program consists of seven stages for community-based planning: anecdotal observation, development of hypothesis, collection of meaningful data, scientific knowledge generation, knowledge sharing, behaviour change, and mitigation of initial concerns (Logan 2003b). This approach allows greater public access to scientific knowledge than conventional rational planning methods, while at the same time using established criteria to express concerns identified by the community (Logan 2003b). The researcher has subsequently been hired as a consultant for the MLA to implement the program in upcoming years.

The MLA's goals for community-based monitoring are to support sustainable (or "responsible") development, especially of waterfront properties; to save money by involving volunteers in monitoring; to engage the public in the MLA's activities; and to increase interest and membership in the MLA (Logan 2003a). The MLA monitoring

program works through a process of collecting water samples in the field and taking them to a laboratory for analysis. Volunteers are involved in several aspects of the program, including sample collection, delivery of samples to the lab, equipment preparation, and in some cases, the actual testing of samples. The program was expanded from 70 sites in 2002 to 114 sites in 2003, with a focus on investigating residential impacts in order to learn about appropriate levels of development (Muskoka Lakes Association 2004).

By the fall of 2003, the MLA had collected two years' worth of data through its community-based water quality monitoring program. While the MLA has presented its program to each of the town councils of its members, and the townships have expressed interest in working to use MLA data to inform planning processes, the resulting data have not yet been used as the basis for any specific decisions (Logan 2003). This can largely be attributed to the early stage of the program's development; since the second year's monitoring results still need approval from the organization's board of directors before they can be publicly released, the program has delivered only one set of data to date (Logan 2003). Optimism remains high that the MLA monitoring program may have a positive impact on local decision making over the long term.

4.3.2 Muskoka Watershed Council

The Muskoka Watershed Council formed in 2001 as a joint undertaking between the District of Muskoka and the Muskoka Heritage Foundation⁷. In an effort to address watershed problems in a co-operative manner by involving as many stakeholders as possible, the Council was designed to bring together elected representatives and volunteers (Black 2003). The Council's original executive committee consisted of 20 members, including four members from each of the two founding partners, in addition to representatives from cottager associations, ratepayer groups, homebuilders, small businesses, tourism, forestry, and other industries (Black 2003). The work of the Council

⁷ The Muskoka Heritage Foundation is a non-profit, charitable organization that was formed in 1987, "dedicated to the conservation of the built heritage and natural areas that define the unique identity of Muskoka" (Muskoka Heritage Foundation 2004). The District of Muskoka and the Muskoka Heritage Foundation have a fluid relationship in the sense that they cooperate closely and share staff on projects such as the Muskoka Watershed Council (Brouse 2003).

has moved from an original focus on sharing information and views on watershed health to raising public awareness and creating an indicators program that will make it possible to monitor watershed health on an ongoing basis (Black 2003).

The Watershed Council undertook public consultations in 2002 to determine what features people valued most highly as determinants of “quality of life” in Muskoka. The information gathered through this process was used to select indicators that will be included in a new Watershed Report Card. The major categories of valued features included clean water and air, healthy and sustainable natural areas, and sustainable community values (Muskoka Watershed Council 2003).

The Watershed Council is now at the stage of collecting data to support the development of this report card. Building on 25 years of seasonal water quality monitoring efforts by the District of Muskoka, the Council is now trying to broaden the focus of this work from chemical testing to ecological parameters through an enhanced water quality monitoring program (Brouse 2003). So far, this has taken the form of introducing lake associations to existing protocols for ecological monitoring, including those produced by EMAN, Bird Studies Canada, the Ontario Federation of Anglers and Hunters, and others (Brouse 2003). Of these existing programs, the Watershed Council has emphasized terrestrial and benthic invertebrate monitoring following EMAN protocols (Brouse 2003).

While the report card is still at an early stage of its evolution, its purpose is eventually to inform development strategies in Muskoka. The information created and presented through the watershed report card could then be applied to decisions about future development, much as data on phosphorus levels are currently used. As well, cottage associations could use the report card to fill information gaps when developing their lake plans (Mann 2003). The District Council sees the benefits of enhanced monitoring involving citizens as three-fold: the data, public education, and stewardship initiatives that emerge from these programs are all locally valuable (Brouse 2003).

Partnerships are strengthening between the Watershed Council and various lake associations. For example, the Muskoka Lakes Association has adopted a succession planning strategy whereby the vice-president of the MLA serves a two-year term on the Muskoka Watershed Council, then becomes the president of the MLA for two years, and finally joins the board of directors of the Muskoka Heritage Foundation as a past president of the MLA (Black 2003). This is one model for maintaining communication and understanding between the Watershed Council and its many partners.

4.3.3 Muskoka and the selection criteria

The links between citizen monitoring and decision-making in Muskoka are at a more preliminary stage than I originally thought when I selected this community as a case study. This means that there have been few real connections between citizen monitoring programs and decision making outcomes to report on so far. However, the case does show a strong emphasis on participatory investigation of water quality, and contains many features of interest. These include coordination of multiple, geographically-based citizen groups in a largely seasonal community, attempts to measure and manage for quality of life in locally-defined social and ecological terms, and efforts to build a long-term monitoring program that can satisfy information demands from a local application-based perspective as well as a comparative, scientific standpoint.

Interviewees in Muskoka described positive outcomes from citizen monitoring with respect to decision making as follows:

- Municipal councils are eager for data collected by the MLA
- A phosphorus model that estimates water quality impacts of shoreline development is supported by lake partner data and currently informs development decisions
- Monitoring is being performed in order to verify and improve the phosphorus model
- Monitoring influences individual lake plans in terms of development and stewardship
- Citizen monitoring may have influenced Lake of Bays in adopting a development permit system

Less tangibly, stakeholders are also optimistic about the future of the watershed report card as a tool to inform decision making. Citizen monitoring enablers and obstacles described by Muskoka interviewees are summarized in Table 4.3.

Table 4.3: Enablers and obstacles for the use of Muskoka citizen monitoring data in decision making

Enablers	Obstacles
<ul style="list-style-type: none"> • General agreement on importance of environmental protection in Muskoka (citizens and municipal governments) • Many retired volunteers with expertise, political influence • Higher-income demographic means funding is available for monitoring (e.g. through cottagers’ associations) • Good communication between stakeholder groups (some members have multiple roles) 	<ul style="list-style-type: none"> • MLA program too new for data to be applied • Slow uptake – data may not be applied for 5-10 years • Report card still being developed • Resistance to standardization from some groups that work independently • Some groups reluctant to share data

4.4 Summary

This chapter introduced the case study communities of Comox Valley, Hamilton and Muskoka, and provided an overview of citizen monitoring groups and initiatives in each place. The extent to which each community matched the original selection criteria was discussed, including specific outcomes of citizen monitoring activities with respect to decision making and law enforcement processes. Major themes, both positive and negative, affecting the application of these monitoring initiatives to decision making were identified. These include place-specific considerations such as the demographics of monitoring program participants and community members, as well as factors that were mentioned across more than one case, such as perceptions of data quality and benefits of partnerships. Chapters 5 and 6 will examine these themes in more detail and consider their connections to literature on monitoring, citizen science, and public participation in local governance.

5.0 FACTORS AFFECTING THE USE OF CITIZEN-COLLECTED INFORMATION IN DECISION MAKING

This chapter discusses major results of interest in this study: factors that case study interviewees identified as affecting the use of citizen-collected monitoring information in decision making processes. These are grouped into three major themes. Section 5.1 discusses the theme of political will, including government and non-government perceptions about governmental priorities, transparency and accountability in governance processes, the allocation of financial and human resources, and the distribution of power at municipal, regional, and provincial levels. Section 5.2 explores the theme of rigour, including perceptions about the quality of data and level of competence achieved by citizen groups, as well as strategic approaches to monitoring that allow groups to link their methods of inquiry with a specific purpose for undertaking environmental investigations.

In addition to political will and scientific rigour, several interview respondents identified a further set of considerations related to a citizen monitoring group's perceived legitimacy as a contributor of knowledge. These include outsiders' interpretations of the group's motives, agenda, and reputation. In the literature, I found only one example of the argument that decision makers may be unreceptive towards citizen monitoring results because of the group's perceived agenda (Stokes & Havas 1990). Primary research revealed this as a prominent theme, particularly in Comox Valley. Section 5.3 examines factors affecting a citizen group's legitimacy in terms of its agenda, community support, and longevity. Factors relating to organizational stability, including funding, are also discussed in section 5.3.

Chapter 6 will examine the interview results in the context of further issues affecting the application of citizen monitoring results, including information needs and gaps, strategies for aligning the information goals of citizen groups and decision makers, and partnerships. A discussion of benefits and features of successful partnerships between these actor groups, as well as obstacles impeding their formation, appears in chapter 6.

The major concepts discussed in this chapter – legitimacy, rigour, and trust – are relative, and their interpretation depends heavily on whose perspective is being considered. Here, legitimacy and rigour are largely considered from the perspective of decision makers. As discussed in section 5.1, interviewees perceived government officials as having ultimate power to accept or reject citizen group findings; if this is true, then their perceptions of legitimacy and rigour are of greater relevance to the use of citizen-collected information in decision making than are citizen groups’ perceptions of themselves. By contrast, trust is considered from multiple viewpoints (that of citizen groups, governments, and the broader public), since it affects the nature of relationships among all of these groups, as well as strategic decisions related to programs and funding.

5.1 Political will

Many participants stressed the importance of political will⁸ and the power of politicians as determinants of whether or not citizen monitoring results were integrated with decision making processes. The following sections discuss major issues related to political priorities in relation to citizen monitoring objectives and outcomes as voiced by case study interviewees. Because these considerations are locally specific, the three case studies are presented separately. In order to gain a more thorough understanding of each case study community, it would be useful to define what comprises and influences the general political agenda in each place. This task would have necessitated the use of several additional interview questions and interviews with more individuals; as a result, it is beyond the scope of this study. Instead, the factors discussed here focus on government and non-government perceptions of political priorities and power only as they relate to the implementation of citizen monitoring programs in the case study communities.

The theme of political will is under-represented in the literature on citizen monitoring, although it does appear in general discussions about decision maker use or non-use of information (see for example de Neufville 1985; Irwin 1995). As a result, I

⁸ Interpreted here as willingness of government officials to take a particular course of action based on its compatibility with current political goals, priorities or objectives.

underestimated the significance of political will when I designed the research questions. If I had anticipated the importance of this theme, I would have included at least one additional question about the compatibility (or lack thereof) between citizen group and government priorities and the implications for integrating citizen monitoring results with decision making.

Because no questions were explicitly posed on this topic, interviewees who talked about issues of political will did so spontaneously. That so many interviewees independently commented on the importance of political agendas and elected officials at local, regional and provincial levels with respect to the application of citizen monitoring results is a major finding of interest in this study.

5.1.1 Political will in Comox Valley

Both government and non-government interviewees offered perspectives on the power structures and political orientations of environmentally relevant government agencies in Comox Valley.

At municipal and regional levels, interviewees in Comox Valley suggested that citizen groups have limited power to influence decisions by providing monitoring information because decisions ultimately rest with elected officials who do not necessarily consider public input. A planner at the Regional District of Comox-Strathcona summed up this view by saying, “At the end of the day, the public do not make the decisions; it’s the bureaucrats, it’s the politicians who make the decisions” (Mewett 2003). In addition to the public, bureaucrats such as planners, who may recommend a certain course of action based in part on citizen monitoring contributions, may find that higher-level officials overlook their suggestions as well. A senior planner at the City of Courtenay stated, “We may want something in [the bylaws], but it’s got to be politically accepted at the top, so there may be a gap there” (Crawford 2003).

A provincial representative of the B.C. Ministry of Water, Land and Air Protection explicitly linked the use or non-use of citizen-collected data to the political orientation of

elected officials: “I think it’s a matter of the politics of the council of the day, whether they’re particularly green or not, and if they’re not, they tend to have all kinds of excuses about why they might not want to accept this information” (Henigman 2003). Along similar lines, the non-profit coordinator for the Baynes Sound stormwater monitoring initiative described early government responses to the volunteer program as dismissive: “they were inclined to ignore another group of citizens – whatever; neighbourhood watch – whatever; that kind of thing” (Pinho 2003).

Some offered suggestions regarding what might influence the political orientation of municipal and regional governments in Comox Valley. Municipally, political pressure was said to come from “the development side” – “they’re certainly looking at, and Council’s looking at, why do we need so much protection... they’ll push that way” (Crawford 2003). Regionally, a planner suggested that the planning agenda is more focused on social than environmental concerns: “My sense with planning in B.C. is that we make a lot of plans that have nothing to do with the environment” (Mewett 2003). Pressure to allow more urban development and to de-emphasize environmental protection objectives decreases the likelihood that government agencies will embrace more extensive information about local environments, including that gathered by volunteers, as a tool to guide decision making.

Further, a regional planner commented that government bureaucracies have “a built-in inertia, so to change the direction that you’re headed in to another direction takes a huge amount of energy to do that” (Mewett 2003). At the provincial level, such an energy-intensive shift of priorities was seen to have taken place since the election of Gordon Campbell’s Liberal government in 1996 (Mewett 2003). The Millard/Piercy Stewards’ coordinator observed, “in the past, not even that long ago, government was serving, trying to anyway, I think, the broader good. Or at least they seemed to. Maybe it was a mirage... now, in BC, government’s really fallen off” (Smailes 2003a). A political agenda that is perceived to be unfavourable towards the “broader good,” together with bureaucratic resistance to change, represents an obstacle for citizen groups that are

working to inform decision making by encouraging the use of information from unconventional sources.

Inter-jurisdictional issues were also seen to affect the application of citizen monitoring results in Comox Valley. Because British Columbia divested most of its authority over environmental review processes under the 1996 *Local Government Act* (Henigman 2003), the balance of power over land use decisions now resides at the municipal and regional levels. For groups such as the Millard/Piercy Watershed Stewards who conduct their monitoring and planning work on a watershed basis, this has led to inconsistent application of results. Because the City of Courtenay and the Regional District of Comox-Strathcona each have jurisdiction in parts of the watershed, recommendations from the Watershed Management Plan need to be integrated into two official community plans in order to be applied consistently across the watershed. So far, the City and Regional District have not coordinated their adoption of these recommendations (Smailes 2003b). The City of Courtenay acknowledged this gap by asking the public in a recent survey whether the City should participate more regionally in local land use planning activities. Project Watershed's coordinator had an immediate response: "Well of course they should! Why not? Why should they even be asking that?" (Chamberlain 2003).

People within, as well as outside, local governments identified a need for more consistent policies at municipal and regional levels. One municipal planner expressed frustration with the lack of alignment between City and Regional District bylaws regarding new residential developments. In cases where subdivisions are built just outside of municipal boundaries, they are not subject to municipal bylaws designed to protect watershed health (Crawford 2003). As well, the B.C. *Local Government Act* contains some quirks that may lead to inter-jurisdictional friction. For example, regional governments are not legally permitted to impose certain types of environmental measures, such as tree protection bylaws, that municipalities can use (Crawford 2003). Reluctance to harmonize legislation and strategic approaches on the part of different levels of government can thus impede consistent application of citizen monitoring information and recommendations.

The Comox Valley experience suggests that elected officials have the greatest amount of power when it comes to integrating citizen monitoring into environmental and land use decisions, particularly at municipal and regional levels. This power is subject to influence from development interests, complicated by jurisdictional divisions of authority within the same watershed, and entrenched through “inertia” or a bureaucratic resistance to change. While this is by no means an exhaustive list of factors affecting the political landscape in Comox Valley, all of these considerations have the potential to negatively affect the likelihood of citizen monitoring being adopted in decision making processes.

5.1.2 Political will in Hamilton

Political power and abuses of power were major themes throughout the interviews with non-government representatives in Hamilton. Unfortunately, very few comments on these topics were offered from a government perspective. As a result, this discussion is based mainly on comments from non-profit coordinators.

As in Comox Valley, interviewees in Hamilton stated that elected representatives hold most of the power for making local decisions (McHattie, Sorger 2003). One federal government representative observed that the power for making and implementing land use planning decisions – where citizen monitoring results can most appropriately be applied – rests primarily at the municipal level (Craig 2003).

Two interviewees stated that municipal politics in Hamilton are heavily influenced by business and development interests:

- “There’s a power structure in place in Hamilton that resides with the Chamber of Commerce, and the Hamilton Homeowners’ Association, and people like that. Those are the guys calling the shots. Even though it’s a fairly large city, there’s a small number of people controlling things, and they control the politicians as well, with campaign donations... and likely a lot more as well, in terms of money changing hands...” (McHattie 2003)
- “...particularly with politicians around here, they’re beholden to special interests. Those special interests don’t give two hoots about the environment, or about anybody

else except their own pockets. It's a policy of greed. And since they run things, greed has become god." (Sorger 2003)

The lone interviewee from the City of Hamilton stated that Vision 2020 has led to a higher level of community engagement in decision making processes, and that as a result, Hamilton's government is more "open and participatory" than that of other municipalities (Harvey 2003). In contrast to this view, non-government interviewees asserted that municipal councillors promote an agenda that takes power away from citizens, even when citizen input has been formally solicited.

- "the City and provincial government advise policies that cut back on things, and making certain priorities so important, make it very difficult for people concerned about the environment to have strong voices..." (Sorger 2003)
- "City Council in the year 2000 developed their own vision entirely, sitting around talking to each other with the Homebuilders' Association and the Chamber of Commerce. What happened to Vision 2020, which was developed as a citizen-based initiative?" (McHattie 2003)

These remarks reveal suspicion on the part of citizen monitoring group coordinators that the municipal government is willing to act on its stated commitment to public participation.

As in Comox Valley, interviewees raised the point that a gap may exist between municipal bureaucrats such as planners, who may champion community monitoring programs, and elected officials, who may concentrate on economics (Craig 2003). As a result, councillors may bypass suggestions from planners or other government employees that support environmental protection when they vote on decisions. One interviewee stated that input from expert scientists, too, may be discounted by municipal officials:

- "... the mayor and the guy who thinks he wants to be the mayor, have this maddening habit of pretending that scientists, even distinguished scientists' opinions about something that concerns them, are just an opinion equivalent to their own... 'Oh, you're entitled to your opinion, but you know, I'm entitled to mine, and what that means is I'm going to do this, because I have the power.'" (Sorger 2003)

This observation is consistent with the experience of Lois Gibbs, who pressed for the political decision to relocate citizens who lived near the Love Canal hazardous waste site. According to Heiman (1997), as a result of this process Gibbs came to realize that “the burden of proof in politics is less than that in science because, with politics, one tries to change public opinion rather than prove one’s case beyond the shadow of a doubt” (in Heiman 1997: 294). Likewise, interview results suggest that collecting scientific evidence of a problem is not always enough; in their efforts to trigger corrective action, those engaged in citizen monitoring in Hamilton have also struggled to influence the opinions of those in power.

The theme of power in Hamilton was linked to a sense of public mistrust of politicians. Citizen group leaders described a lack of transparency in municipal political processes that resulted in politicians saying one thing and doing another:

- “[Our municipality] can’t be trusted... They can say to us, ‘oh, we’re respecting all of the laws,’ but time and time again, we find examples where informed citizens are realizing they’re acting very differently than how they’re professing to be.” (Lukasik 2003)
- “It’s too easy for the council to ignore their own policies... [council’s stated commitment to sustainability is] political lip service.” (Lukasik 2003)

Non-government coordinators described City politics in Hamilton as prioritizing economic development over ecological or sustainability concerns, leading to an urban sprawl mentality (McHattie, Sorger 2003). In the words of one coordinator, “[The city’s] idea of progress is more highways and more buildings, less green... this City Hall is basically not interested in the environment...” (Sorger 2003).

Interviewees suggested that this political agenda manifested itself through a municipal neglect of environmental laws (Lukasik 2003), a tendency to try to hide water quality problems rather than fix them (McHattie 2003), and complicity between the City of Hamilton and Ontario Ministry of the Environment regarding non-enforcement of regulations (McHattie 2003):

- “... there was a whole lot of neglect on the part of the municipality; they just weren’t watching things. Basically because, I’m convinced, they made a decision that we’re putting a highway through here, so really, who cares what the state of this place is?” (Lukasik 2003)
- “...you’re relying on the people that are supposed to be dealing with this – the Ontario Ministry of the Environment – to do the right thing, to do their own sampling to check our work, and then to lay charges and pursue it in court. And they’re not doing that. And that’s also a function of the Harris/Eves government and cutbacks to MOE as well. And we think, cozy relationships between the MOE Hamilton office and the City of Hamilton... because it appears some of the inspectors are quite keen on this stuff, the field-level staff, but when it gets up to the management level, they’re not pursuing it.” (McHattie 2003)

Taken together, these statements produce a rather bleak picture of a municipal government that pursues an agenda fostering urban sprawl and neglect of environmental laws, operates with little public transparency, and responds to business and development interests but gives little consideration to citizen groups, expert scientists, or even its own visioning documents related to sustainability. Given that the citizen group coordinators saw governments as having ultimate decision making power coupled with priorities that diverge from those of environmental citizens’ groups, it is not surprising that their suggestions for producing more balanced and responsive decisions in Hamilton included changing the people who serve as municipal councillors. As one put it,

- “We’re looking to try to change the vote at City Council. And that vote is the same for lots of environmental stuff, and lots of social issues. The status quo doesn’t care about poverty, and it doesn’t care about pollution... well I suppose they care at some level, but they don’t act that way.” (McHattie 2003)
- “...cutting the feet out from under the power structure would be by removing the city councillors, and by getting a new council in place. And from there, I think the culture would begin to change. There would still be a lot of fighting from all, but at least the people who are putting their hands up at the right time in the city council would be different, and would be bringing forth resolutions to do positive things in the city, and not just reacting all the time.” (McHattie 2003)⁹

⁹ It is worth noting that at the time of the interviews, two of the non-government interviewees were running for seats on Hamilton’s city council. One of them (McHattie) was subsequently elected as a municipal councillor in November 2003.

Another citizen monitoring coordinator advocated using legal means to draw local politicians' attention to environmental considerations:

- “How do you deal with [the policy of greed]? I think, not killing people, but taking them to court, having the right lawyers, suing them, forcing them to pay attention to what they do.” (Sorger 2003)

Indeed, citizen groups have initiated successful legal actions against municipal and industrial polluters in Hamilton (see section 4.2). This suggests that citizen monitoring groups can achieve some measure of power over local environmental practices by using existing legal frameworks and environmental legislation, regardless of the political orientation of the current city council.

Non-government interviewees in Hamilton credited much of the city's environmental progress to the work of citizen organizations: “I think we've come a long way in the last 15 years from an environmental and sustainability perspective, entirely from the grassroots, not from the politicians. Things haven't changed at that level” (McHattie 2003). An optimistic extension of this view holds that citizens do have power to influence local political agendas: “Councillors only listen to their electorate, so it has to come from bottom-up... the federal government and provincial can say, you should be doing this, but unless it comes from their electorate, they often will not do it” (Craig 2003).

5.1.3 Political will in Muskoka

In contrast to Comox Valley and Hamilton, interviewees in Muskoka described a scenario of general agreement between local governments and citizen organizations on environmental priorities. Members of the Muskoka Watershed Council attributed this lack of conflict to a higher-than-average understanding of environmental health on the part of “the average citizen” (Black 2003), as well as a willingness to protect environmental quality on the part of local governments (Boivin 2003). An elected official from Lake of Bays said, “Once you've laid everything out on the table, be it at a council meeting or whatever, there's general consensus around the room that this is the right

thing to do...it's so difficult to reverse the impacts that man (sic) has on the environment, so let's prevent them before they occur" (Boivin 2003).

In terms of perceived authority, a consultant for the Muskoka Lakes Association suggested that seasonal residents tend not to identify with local governments in Muskoka, and instead regard cottagers' associations as principal decision makers (Logan 2003a). Cottagers' associations are voluntary organizations funded through membership fees, and large associations such as the Muskoka Lakes Association can have significantly more money to invest in monitoring programs than municipal or regional governments:

- "The MLA is an organization that people are members of, they pay membership fees, they want real data that's useful today, and they have money to invest in doing that. So there's more specific goals... nobody's a member of the Watershed Council, nobody pays you membership fees. You're accountable to everyone, which means you're kind of not accountable to anyone specifically..." (Logan 2003a)

This arrangement can create inter-jurisdictional challenges between local governments and cottagers' associations. Given that cottagers' associations are independently funded, they may forge ahead to conduct monitoring for their own purposes without coordinating their efforts with other associations or governments (Logan 2003). Now that the District of Muskoka is encouraging associations and townships to pursue monitoring that can feed into a common analysis framework, challenges are emerging with respect to convincing groups that have been operating independently to adopt compatible methods of collecting and storing data (Brouse 2003).

The unique demographics of Muskoka residents were also reported to affect the distribution of power in the region. As discussed in chapter 4, the relatively high proportion of high-income professionals (Boivin, Brouse 2003), retired people with technical expertise (Brouse, Boivin 2003), and residents with strong political connections in the area can allow Muskoka residents to influence provincial agendas on issues of concern (Brouse 2003).

A dissenting view in Muskoka holds that citizens can gain “too much” power over the local political agenda as a result of knowledge gained through monitoring (Logan 2003). This is discussed further in section 5.3 on perceptions of citizen group agendas.

5.2 Rigour

This section discusses the perceived value of citizen monitoring results in light of two factors: data quality¹⁰ and strategic approaches to monitoring. The measures that are taken in order to ensure that monitoring information meets scientific measures of quality, along with the strategy undertaken to produce information for a particular end use, together affect the rigour and applicability of citizen monitoring data.

As discussed in Chapter 2, the literature identifies the quality (or scientific value) of citizen monitoring data as a highly important factor affecting its use in decision making (Engel & Voshell 2002; Penrose & Call 1995). Multiple interview respondents from each of the case study communities shared this perspective and offered their perspectives on what tools and tactics increase the data quality of citizen monitoring. These are discussed in section 5.2.1.

The literature and interview data were also consistent in suggesting that the level of scientific rigour required in order for citizen monitoring to be considered credible depends on the intended use of the investigation. The case studies reveal a range of purposes for citizen-gathered data (e.g. identifying problems for follow-up investigation, informing land use decisions or watershed management, and tracking long-term trends) and at least two distinct strategies for gathering information (long-term and hot spot monitoring). These are discussed in section 5.2.2.

¹⁰ The term “data quality” is used here as shorthand for several criteria that are commonly associated with scientific rigour. Data with a higher degree of reliability, reproducibility, and accuracy are considered to be of higher quality.

5.2.1 Data quality

NGO and government interviewees in all three cases generally regarded the quality of citizen-collected data as important (Mewett, Hilliar, Hatfield, Henigman, Crawford, Pinho, Ellefson, Smailes, Chamberlain, Harvey, Craig, Lukasik, McHattie, Sorger, Logan, Brouse, Mann 2003). This is consistent with statements in the literature that citizen groups' ability to collect consistent, high-quality data is important to the formation of group-government partnerships (Lukasik 1993) as well as the use of this information in decision making (Engel & Voshell 2002; Heiman 1997; Penrose & Call 1995). In Comox Valley and Hamilton, interviewees pointed out that data quality is an important criterion for applying information that was collected by any agency, not just citizen groups (Hilliar, Henigman, Harvey 2003). Only one respondent, from Comox Valley, said that a high level of rigour is not expected for citizen-collected data. This was for two reasons: because the relevant government authority does not have enough information, expertise or capacity to challenge the data, and because there is no legislation in place requiring the use of community data (Mewett 2003).

Participants from each case acknowledged that variability exists in data collected by volunteers (Logan, Pinho, Harvey, Mann 2003), and one (Harvey 2003) asserted that this is true for data from any source (e.g. different municipalities measuring land use).

Interviewees identified several factors that can reduce the amount of variability and increase data quality in citizen monitoring results. These are summarized as:

- Protocols, standards, approved methods (QA)
- Consultation or partnerships with experts (QA)
- Volunteer training by “qualified” or “competent” staff (QA)
- Group longevity
- Systematic approach to data collection (QA)
- Coordinator to organize volunteers
- Follow-up monitoring, checking (QC)
- Perceived competence of volunteers

Some of these factors are consistent with the concepts of quality assurance and quality control as presented in literature. Quality assurance (QA) refers to an overall management system designed to assess data quality and ensure that it meets a desired standard with a certain level of confidence (Gaweda 2002). Relevant points identified through interviews include the use of protocols and methods, consultation with experts, volunteer training, and a systematic approach to data collection. Quality control (QC) refers to a suite of tests that can be performed in order to identify, reduce and control error, including internal checks by the a group on its own processes, and external checks by people outside of the program (Gaweda 2002). Follow-up monitoring and checks are the main points raised by interviewees that correspond to quality control.

Interviewees generally agreed that data quality is improved if citizen monitoring groups follow a sampling protocol, also expressed as “having standards in place” or using “recognized methods” for data collection (Mewett, Hilliar, Hatfield, Pinho, Smailes, Harvey, Craig, Lukasik, McHattie, Logan 2003). These protocols were seen to be most valuable to citizen groups if they outline methods that are relatively simple to follow (Craig 2003). One citizen group coordinator stated that it is important for groups to be able to adapt protocols to meet local needs (Smailes 2003a). For methods that were developed within the community, interviewees in Hamilton and Muskoka stated that exposing these methods to scientific peer review through academic publications or presentations helped to build recognition for locally generated protocols (Sorger, Logan 2003).

Consultation with professionals or experts was also seen to help improve the quality of citizen monitoring data by multiple interviewees in all case study locations (Henigman, Crawford, Lukasik, McHattie, Brouse, Logan, Boivin 2003). In Comox Valley and Muskoka, interviewees identified round table committees as a way to involve experts in an advisory role. Specific types of experts that were considered to be important partners included scientists and technical professionals (all cases), political representatives (Pinho 2003 – Comox Valley), lawyers (Lukasik 2003 – Hamilton), and academics (McHattie 2003 - Hamilton). In Muskoka, one interviewee indicated that community members with

relevant professional experience were able to provide much of this expertise in a volunteer capacity (Brouse 2003).

Another factor that interviewees identified as contributing to higher-quality data was training of data gatherers by people who themselves have a high level of training, which is linked to citizen groups having adequate resources to conduct this training (Mewett, Hatfield, Smailes, Chamberlain, Mann, Lukasik 2003). Case study strategies for training volunteers included teaching student volunteers about water quality assessment through a co-op placement in a university laboratory (WATER, Hamilton), partnering volunteer assistants with paid staff who perform more technical aspects of the work (Project Watershed Society, Comox Valley), and hiring one staff member to coordinate and train community groups in monitoring techniques (District of Muskoka). In Hamilton, one non-government interviewee stated that it is important not only to train volunteers in methods and approaches to monitoring, but also to provide them with a working knowledge of environmental law (Lukasik 2003).

Some interviewees identified group longevity as another factor influencing data quality, meaning a group's ability to build and maintain capacity for monitoring and training over several years (Mewett, Hilliar, Harvey 2003). This theme is discussed further in section 5.3 on citizen group reputations and organizational stability.

Interviewees also regarded data quality more highly if citizen monitoring programs adopted a systematic, rather than "ad hoc," approach to data collection (Hatfield, Chamberlain, Mann 2003). This includes consistency in spatial coverage (Chamberlain 2003) and the timing and temporal continuity of monitoring work (Mann 2003). In order to achieve consistency in these areas, interviewees suggested that citizen groups need to have a solid organizational structure (Henigman 2003) and design their programs around a clear purpose and strategy. Different monitoring strategies and their relationships to information needs as employed in the case studies are elaborated in section 5.2.2.

Interviewees identified follow-up monitoring or spot checking as an important element of programs that produce high quality data (Hilliari, Pinho, Mann 2003). This can be carried out either by a citizen group coordinator (an example of internal quality control) (Pinho 2003) or an outside agency such as government (external quality control) (Mann 2003).

Interviewees identified the importance of a citizen group coordinator who is able to organize volunteers and ensure consistent application of methods (Hatfield, Pinho 2003). A competent coordinator can help to provide training, group longevity, organizational structure, and internal quality control checks, thus contributing to several of the areas discussed above. Multiple interviewees stated that it was important for this coordinator to be paid in order to provide continuity and stability to volunteer monitoring programs (Chamberlain, Pinho, McHattie 2003).

Finally, interviewees identified decision makers' assumptions about the competence of volunteer data gatherers as a factor influencing perceptions of data quality. On the negative side, citizen group coordinators in Hamilton described experiences where decision makers had dismissed monitoring results apparently because of negative assumptions about the capabilities of student volunteers:

- "...government people look and say, 'that's a bunch of high school students going out there; what the hell do they know? They're not capable of doing this well.'" (Lukasik 2003)
- "they keep pretending that, no, no, it's just students... if they could possibly get away with it, they'd pretend they've never heard of things, even if they've been presented with it." (Sorger 2003)

These statements suggest that not all decision makers are interested in considering the possibility that volunteers, particularly students, are capable of performing respectable scientific research, even if they are trained and supervised by a university science professor (as they were in this example). One non-government interviewee offered hope that over time, decision makers become more willing to take citizen monitoring efforts seriously. However, turnover among government officials can set back the process of developing trust:

- “...pretty patronizing, insulting sorts of responses to citizens that we’ve had to contend with... once people know you, that goes away. But as soon as someone new comes on the scene, whether at the City or the Ministry, you’re often facing that whole struggle over again.” (Lukasik 2003)

The theme of how a citizen group establishes and maintains a positive reputation over time is discussed in section 5.3.

5.2.2 Purpose and strategy

Several interviewees stated that monitoring is more useful if it is driven by a purpose or question than if it is conducted for its own sake (Mewett, Hilliar, Lukasik, McHattie 2003). This position corresponds to the view that “monitoring is intrinsically purposeful... it is pointless to deploy effort in monitoring a situation over which one has no effective control or for which no response would be required” (Hellowell 1991: 3). By defining end uses for monitoring data before a program begins, a group can tailor its strategy to meet its objectives. In particular, programs can be designed so that the level of scientific rigour is appropriate for the intended use. This claim is supported by literature saying that monitoring programs should be designed and sampling methods chosen to meet specific objectives (Savan et al. 2003).

Interviewees suggested that a citizen group’s credibility is affected by the degree to which it matches its targeted uses for monitoring outcomes with an appropriate strategy for gathering and interpreting data. In other words, the level of scientific rigour and technical skill that citizen monitors require depends on the intended purpose of monitoring data. As a regional planner in Comox Valley observed, if citizen data are to be integrated into legislation or bureaucracy, then they need to meet a higher standard of rigour than if they are not (Mewett 2003). Similarly, a federal government representative in Comox Valley commented on the relative need for citizen monitoring to satisfy technical standards based on the desired application of results:

- “Provided that the data [a group is] collecting serves their purpose, it doesn’t matter whether it meets anybody’s standards... [on the other hand], if one of their purposes happens to be, they want to be able to take this information and take this guy to court, well then they want to make sure that they can follow the standards.” (Hilliar 2003)

This suggests that an organization's perceived credibility partly rests on its ability to recognize the appropriate uses and limitations of data collected using certain methods. For example, if a group uses simple methods that are more appropriate for problem identification, then it will lack credibility if it tries to promote the use of its data as the basis for legal action or the development of policy or legislation.

A consultant for the Muskoka Lakes Association offered another comment on the relationship between the purpose and rigour of citizen monitoring efforts:

- “What makes the data useful is how the community is able to use it... I see science as a way to understand the world, and so if your data helps you to do that in a replicable way, and sort of a transparent way, then it's useful data... there's always going to be some error. But I think that it's far outweighed by how the community is able to use the data, and how the data creates knowledge that helps people to understand the world.” (Logan 2003a)

One government representative summed up a similar position by saying that monitoring should be seen as a means to an end, rather than as an end in itself (Hilliar 2003). Several interviewees offered their perspectives on criteria for determining what the end, or purpose, of monitoring programs should be. One stated that citizen monitoring programs should link their purpose to opportunities for problem solving in the community because government agencies tend to have regulatory, rather than problem solving, mandates (Hilliar 2003). Community groups can therefore fill a void by using monitoring programs to understand and develop pro-active courses of action to address local challenges. Along similar lines, a citizen group coordinator in Hamilton stressed the need to link environmental changes detected through monitoring to decision points, or clear courses of action for decision makers (McHattie 2003). This goal favours the selection of indicators for which established thresholds exist, together with some understanding of the links between observed changes and identifiable stressors. A representative of EMAN agreed that in order to establish cause-and-effect relationships, a monitoring program must be designed specifically for this purpose (Craig 2003).

The interview results suggest that citizen monitoring activities in the case studies can be organized roughly into two strategic categories: long-term and “hot spot” monitoring. The characteristics of each strategy are summarized and compared in Table 5.1.

Table 5.1: Comparison of long-term and “hot spot” monitoring strategies

	Long-term	“Hot spot”
Purpose	Understanding relationships and changes over time; establishing baselines or thresholds	Investigating to identify (“red flag”) problems for correction or remediation
Situation	Ongoing Oriented towards understanding	Crisis Oriented towards intervention
Likely participants	Naturalists; “audience of the converted”; dedicated volunteers who understand that results will not be immediately meaningful	“New,” concerned people who may not have been involved in environmental issues before; may become more involved in future
Type of results	Trends, shifts in parameters over time, cumulative effects	Comparisons to established thresholds
Cause and effect	More difficult to establish direct cause and effect	Easier to establish cause and effect relationships
Time frame	Multi-year: meaning not apparent for some time	Weeks, months: results more immediate
Number of sites	As many sites as possible (broad coverage)	Fewer sites, chosen for specific reasons
Sampling frequency	Less frequent monitoring (seasonally, yearly)	More frequent monitoring (daily, weekly, monthly)
Possible decision making applications	Planning measures to protect valued features that are degenerating Harder to use legal mechanisms	Can be linked to clear courses of action, existing frameworks leading to correction, remediation, litigation Easier to use legal mechanisms
Case study examples	Millard/Piercy Stewards; Muskoka Lakes Association; District of Muskoka; Ecological Monitoring and Assessment Network; Vision 2020; Hamilton Naturalists’ Club; Pipe Watch/Stack Watch	Baynes Sound Stormwater Monitoring Program; Environment Hamilton; WATER (Hamilton)

Long-term monitoring

As described by interviewees, long-term monitoring is an approach geared towards identifying and tracking trends in parameters over a period of several years. The

EMAN/Canadian Nature Federation “Nature Watch” program¹¹ is an example of long-term ecological monitoring cited by interviewees. The EMAN suite of ecological monitoring protocols, which are intended for community-level use by citizens as well as multiple other monitoring agencies, are intended to follow a long-term approach (Doyle, Lukasik, McHattie 2003).

In light of the types of monitoring approaches discussed in the literature review, long-term monitoring as identified by participants in this research bears the closest resemblance to the “government-led” monitoring described by Pollock et al. (2003a). Shared characteristics between these approaches include a focus on detecting ecosystem changes in order to identify areas for further research, as well as to establish data sets that indicate trends over a period of many years “on information relevant to both government and citizens” (Pollock et al. 2003a). Examples of long-term monitoring in the case studies include the work of the Millard/Piercy Stewards, Muskoka Lakes Association, District of Muskoka, Ecological Monitoring and Assessment Network¹², and Vision 2020. As well, the Hamilton Naturalists’ Club inventories of sensitive areas and Environment Hamilton’s Pipe Watch/Stack Watch program exhibit features of long-term monitoring in that they involve repeated observations of non-problem areas over time, although these initiatives also share characteristics with advocacy monitoring (discussed in section 2.3.1 and below) in that they seek to connect monitoring outcomes with specific, existing frameworks for environmental protection and pollution reduction.

Interviewees from all three cases spoke to the need for information to be collected over the long term (i.e. several years) in order for it to be useful (Hatfield, Pinho, Craig, Sorger, Mann 2003):

¹¹ EMAN and the Canadian Nature Federation coordinate a series of monitoring programs under the umbrella title “Nature Watch,” encouraging citizens to observe and report on wildlife, plant and worm populations, as well as ice cover, on an annual basis. Sampling protocols are provided and results are shared on the Internet. For more information, see the Nature Watch website: <http://www.naturewatch.ca>.

¹² It is important to distinguish between EMAN’s Nature Watch program, which fits with government-led monitoring in its focus on tracking long-term trends in a standardized fashion, and its broader encouragement of locally designed monitoring programs, which more closely resembles multiparty monitoring and is based in part on lessons learned through the Canadian Community Monitoring Network pilot.

- “People are used to things happening fast, and then it’s all over, and we forget about it. Well that’s not the way things happen in the environment. So, something like an environmental watch has got to be an ongoing thing for a long time... people don’t pay enough attention to long term; they want to get this done now... It doesn’t work that way. It won’t get done now. It’s probably going to take forever. And when something does have value, you still have to keep on top of it, so that it doesn’t degenerate, right?” (Sorger 2003)

This outlook supports the selection of a long-term monitoring strategy. However, long-term monitoring does have drawbacks with regard to citizen involvement. Because patterns in the data may not become apparent for years, this monitoring strategy does not generate immediately meaningful results (Lukasik, McHattie, Brouse, Mann 2003). As one coordinator of Environment Hamilton put it, “EMAN hasn’t really been very good at answering the ‘so what?’ question” (McHattie 2003). This means that volunteers have to be both patient and dedicated to work on programs that will not tell them answers to their research questions at the end of the day. As a result, long-term monitoring programs may draw in volunteers who are already engaged in similar activities, such as naturalists and birdwatchers (Lukasik 2003). As well, in the absence of established thresholds and clear connections to existing decision making frameworks, it can be difficult to link long-term monitoring results to specific actions to mitigate or prevent environmental damage (McHattie 2003). In particular, it may be relatively difficult to trigger legal mechanisms using a long-term monitoring approach due to challenges associated with collecting data that meet the necessary quality standards over a long enough time scale.

“Hot spot” monitoring

“Hot spot” (or crisis driven) monitoring involves concentrating monitoring efforts on areas where pollution is suspected to occur, often with the goal of exposing problems so that actions may be taken to correct or remediate them (Lukasik, McHattie 2003). This strategy holds appeal for citizen monitoring groups in areas where environmental problems are thought to exist. The hot spot approach can be considered a form of “advocacy monitoring” as presented by Pollock et al. (2003a), with parallels to the community environmental policing model described by O’Rourke and Macey (2003). Community environmental policing is described as a form of reactive, “incident-oriented” monitoring that addresses symptoms, rather than root causes, of pollution

(O'Rourke & Macey 2003). Advocacy monitoring is an approach that zeroes in on areas of local concern, where “citizens concerned about an issue use monitoring data they understand to ‘push for appropriate action to be taken’” (Pollock et al. 2003a: 24). While relatively little credibility is assigned to this monitoring approach in the literature, the findings of this study suggest that hot spot monitoring can be effective in connecting observed environmental conditions with established thresholds and prompting remedial actions using existing legal mechanisms.

Several examples of hot spot monitoring can be found in the case studies, including the work of BSSAG, Environment Hamilton, and Watershed Action Towards Environmental Responsibility (WATER). Particularly in Hamilton, non-government interviewees saw a crisis driven approach to monitoring as highly relevant because the city has many problem areas that need attention (Lukasik, McHattie 2003):

- “When there’s a crisis in place, the [long-term] stuff becomes nice to do, not have to do... [with] long-term monitoring, we’re going to know what’s happening 25 years from now. That doesn’t do well in a situation where the City is planning on cutting down 40,000 trees in the Red Hill Valley this summer.” (McHattie 2003)

Because it compares observed results with known thresholds (McHattie 2003), hot spot monitoring can provide more immediate results than long-term monitoring. This characteristic, combined with a shorter time frame and smaller volume of data, may make it easier to trigger legal mechanisms using a hot spot, rather than long-term, monitoring approach.

Participation in this type of program can be more rewarding for volunteers. Of the two approaches, hot spot monitoring may seem “more exciting” to participants (Lukasik 2003), and may generate more community interest than long-term monitoring (Doyle 2003). Compared to long-term monitoring, a crisis driven approach may be more likely to engage people who may not have been involved in environmental activities before, but are concerned about what is going on in their communities (Lukasik 2003). A broader spectrum of citizens may become involved, including lower-income residents who are affected by living near industrial developments (O'Rourke & Macey 2003).

Interviewees from Environment Hamilton expressed a desire to broaden the organization's activities to include some longer-term monitoring programs such as Pipe Watch and ongoing tributary monitoring (Lukasik 2003). One coordinator stated that the group would like to be pro-active (long-term) rather than reactive (crisis-based) in its approach to monitoring, but is "not there yet" due to the degraded state of the environment and currently unfavourable political climate in Hamilton (McHattie 2003).

On the topic of partnerships, interviewees explained that hot spot monitoring does not have to achieve its goals through adversarial relationships with decision makers. As an example, one explained how Environment Hamilton tries to adopt a fair approach with industry:

- "We have a meeting with the steel industry once in a while, and they know we're out there keeping an eye on things, but our attitude is, 'look – our goal isn't to close you down. Our goal is to ensure that as a responsible corporate citizen, you're not imposing any impacts on this community that you shouldn't be, and people have a right to learn how to track and to call in concerns when they have them'... we've never had that sort of hardened approach where, 'we're out to get you guys and we're going to do whatever it takes.' It's a very even-handed sort of approach where, if there's a problem that we're concerned about, we'll certainly speak up. At the same time, if industry is doing something positive, then we'll acknowledge that as well." (Lukasik 2003)

Along these lines, the Baynes Sound storm water monitoring initiative represents a case study example of crisis driven monitoring that involved explicit cooperation between citizen volunteers and government agencies, including the municipal governments that were eventually obligated to finance the necessary sewer infrastructure repairs identified through the program (Pinho 2003). At the same time, some citizen group coordinators who took part in hot spot monitoring expressed a desire to remain at arms' length from governments in terms of program direction as well as funding in order to maintain their independence from any possible influence by political interests (Lukasik, Sorger 2003). This theme is discussed further in section 5.3 on ideal funding scenarios.

A group's strategic approach to monitoring links its intended use of results, choice of methods, and the need for a certain level of scientific rigour. This research suggests that it

also sets boundaries on the range of decision making processes to which its results may be credibly applied.

5.3 Legitimacy

This section discusses how a citizen group's reputation can influence decision makers' willingness to apply their monitoring results. Facets of a citizen group's reputation that interviewees mentioned include its perceived agenda, level of public support, and longevity. This research suggests that organizational stability and the ability to secure ongoing funding play a major role in defining a group's legitimacy in the eyes of decision makers, with implications for the extent to which citizen monitoring results are integrated into decision making.

Agenda

Interviewees in Comox Valley and Muskoka offered perspectives on the perceived agendas of citizen monitoring groups. Several government representatives indicated that they felt citizen groups had the potential to produce "slanted" (Mewett 2003), "partial" (Hatfield 2003) or "partisan" (Logan 2003) results in order to satisfy objectives or mandates related to ecological preservation, which in turn negatively impacted their credibility. One commented on differences in the ways in which a citizen monitoring group and the farming community might perceive agricultural land use issues:

- "...there is that sort of impartiality issue... where you tend to work with a lot of stewardship groups that have a real ecological sort of basis... some of the farmers have said, 'we're doing something that from an ecological standpoint, some of these groups don't agree with... what's to say these groups aren't trying to make these numbers look bad?' ... Because the whole mandate of many of these [groups] is from a stewardship perspective, which is kind of preservation of the natural environment, and they're dealing with a lot of non-natural environments." (Hatfield 2003)

This interviewee went on to recommend that citizen groups follow standard protocols and involve all interested parties from the beginning stages of program development (Hatfield 2003) in an attempt to lessen this perceived gap in credibility. Another Comox Valley interviewee suggested that citizen groups in general (though not the ones studied here) might go so far as to report false data in order to achieve political goals:

- “I think the larger concern is not that citizens would collect data inaccurately, but that they would look at their collection with a particular slant... the bureaucratic perspective is that everything becomes really precious when you’re slogging around, it’s your watershed... there’s a concern that volunteers in the past have actually put fish into streams that didn’t previously have fish... It’s really quite, sort of, nefarious as opposed to just sloppy record keeping...” (Mewett 2003)

These comments imply that decision makers apply more than one kind of scrutiny to citizen groups. In addition to assessing their ability to collect information following recognized scientific methods, these remarks suggest that decision makers also call into question volunteers’ motives and intentions. Along similar lines, a planner in Comox Valley stated that while citizen groups may try to “do the right thing,” they have a tendency to make policy recommendations that are based on a different set of priorities than those held by municipal decision makers, saying: “the volunteer group will obviously want lots of protection, and feel they’ve got it justified; [it’s] politically obvious, [and] politicians have got to accept it” (Crawford 2003). This interviewee linked this observation to the idea of “ownership,” meaning that citizen monitoring groups become strongly attached to their work, and as a consequence may not be receptive to criticism of it (Crawford 2003).

In Muskoka, one interviewee expressed the view that citizens may try to use lake plans as a means of preventing unwanted future development on the lakes:

- “There’s a lot of emotion tied up in developments, usually... in the Muskoka Lakes, even if there’s rumours of somebody wanting to build, say, a golf course, people just freak out. And so, people try to express their concerns in terms of, say, water quality, because planning and land use decisions are based on water quality parameters... the interpretation of the results needs to be accurate, and non-partisan.” (Logan 2003a)

This interviewee stated that lake plans are often created through an elitist process of “brainstorming sessions leading to a statement of ‘what the people want.’” In such cases, science-based monitoring can serve as a way to “debunk a perceived agenda” that may form the foundation of a lake plan (Logan 2003a).

These statements reveal concern that without the perception of scientific credibility, citizen group activities may be seen to reflect the priorities of only a small portion of the community. The next section focuses on ways in which a citizen monitoring group can build community support, thus increasing its legitimacy as an information provider.

Community support

Few interviewees directly discussed the role of community support in contributing to a citizen monitoring group's reputation and credibility, but I have included this topic here because it appears to address some of the fears that government representatives expressed about perceived discrepancies between the priorities of a citizen environmental group and other citizens or stakeholder groups within the community.

A provincial government representative in British Columbia spoke of the need for citizen groups to have continuing involvement in, and support from, the community (Henigman 2003). According to this interviewee, establishing and maintaining an ongoing relationship with the wider public (not just the group's membership base) by holding public events and meetings allows a group to build trust within the community as well as with decision makers, thus overcoming the stigma of being labelled a "special interest group" (Henigman 2003) whose recommendations can be dismissed as coming from a small minority of the population.

In the absence of such trusting relationships, this interviewee remarked, "...we've certainly seen situations where the monitors tended not to be sensitive to individual landowners' concerns about confidentiality, and privacy..." (Henigman 2003). Positive examples of community relationship building were reported by representatives of the Baynes Sound Stewardship Action Group (Pinho 2003) and the Muskoka Watershed Council (Brouse 2003), both of whom stated that citizen monitoring and related educational activities had improved relationships between local organizations, residents and stakeholders. A provincial government representative also stated that at the beginning of the Baynes Sound storm water monitoring program, farmers worried that agriculture would be automatically implicated as a major polluter (Hatfield 2003). By adopting a

balanced and non-confrontational approach to monitoring, citizen monitors gained the trust and acceptance of the farming community (Hatfield 2003).

Some interviewees identified relationship building between participants and non-participants as a beneficial outcome of citizen monitoring programs. Two in Comox Valley stated that citizen monitoring establishes connections between people and builds community (Chamberlain 2003, Smailes 2003b), while another in Hamilton described citizen monitoring as a way to build social capital and community capacity (Doyle 2003).

Longevity

Interviewee responses suggest that a group's longevity – its ability to deliver programs and function reliably over a period of several years – is an important factor in establishing a positive reputation and acceptance among decision makers. Government representatives in Comox Valley and Hamilton alluded to the need for citizen groups to be “trustworthy,” or to have established a history of credible results (Mewett, Hilliar, Harvey, Lukasik 2003). As well, one noted that the quality of a group's work tends to improve with time and experience (Henigman 2003).

One Comox Valley interviewee observed that a citizen group needs to have a good reputation among funding agencies in order to secure ongoing financial support (Mewett 2003). Another referred to the importance of maintaining a constant presence in the community, saying that a group demonstrates through long-term commitment that it is “not just a fly-by-night group that's going to get everybody in an uproar and disappear next week” (Henigman 2003). A municipal representative from Hamilton said that if government agencies are to use citizen-collected data, they need assurance that long-term data collection by the citizen group is possible (Harvey 2003). Through these remarks, interviewees indicated that a citizen group needs to convince funding agencies, the general public, and decision makers that it is committed to carrying out its activities over the long term in order for its results to be accepted.

A Comox Valley coordinator stated that one way for citizen groups to establish a positive reputation among decision makers is to present their results to government in a professional manner, through formal presentations and brief reports with executive summaries. A paid coordinator is the ideal person to perform this key role (Pinho 2003).

In Comox Valley, some interviewees said that the Project Watershed Society had set a positive precedent regarding the ability of non-profit groups to collect reliable data (Mewett, Hilliar 2003). While none directly acknowledged the possibility, these positive experiences with an organization that was established several years earlier may have influenced decision makers' perspectives on the value of citizen environmental monitoring contributions by groups that emerged more recently, such as the Millard/Piercy Watershed Stewards. The following sections discuss factors that interviewees identified as supporting a citizen group's longevity, with emphasis on organizational stability and long-term funding.

Organizational stability and continuity

This research suggests that the longevity of an organization over time is determined in large part by its organizational stability, which is in turn supported by its ability to secure ongoing funding.

Aspects of organizational stability that interviewees identified include internal organizational structure and strong communication between group members (Henigman 2003), consistent volunteer participation from season to season and year to year (Hatfield 2003), steady interest in issues related to the group's mandate (Harvey 2003), and the participation of board members who have a clear understanding of the activities of their own group as well as those of similar groups in the area (Chamberlain 2003). Many interviewees asserted that a paid coordinator is central to an organization's success (Smailes 2003b, Hatfield, Pinho, Chamberlain, Lukasik, Doyle 2003). A full-time coordinator can promote consistency in the group's activities and prevent "haphazard" or "ad hoc" approaches to data collection (Hatfield 2003).

Some interviewees stated that it is possible for citizen groups to become over-reliant on a single leader or champion. The coordinator of Comox Valley Project Watershed Society highlighted the need for greater information sharing within groups by saying, “Project Watershed’s corporate knowledge is in my head” (Chamberlain 2003). Others stated that a change in leadership can be disruptive to a group even if it has enough funding to continue its activities (Harvey 2003), and that a turnover of group “champions” underscores the need for succession planning (Brouse, Black 2003). In addition to group coordinators, one interviewee mentioned that board members are also too thinly spread, since there are many groups that need board members and a relatively small pool of people who have enough time, energy, knowledge and aptitude to serve on the board of an environmental non-profit organization (Chamberlain 2003).

Funding

Interviewees from all cases generally agreed that long-term funding is needed for citizen monitoring programs, but only short-term funding tends to be available (Hatfield, Pinho, Ellefson, Chamberlain, Lukasik, McHattie, Black 2003). Two government interviewees stated explicitly that lack of secure funding undermines a group’s longevity, which lowers the level of government trust in citizen groups (Smailes 2003b, Harvey 2003). This section presents interviewees’ perspectives on the ways in which high levels of organizational stability and funding can positively affect decision makers’ willingness to accept and apply citizen monitoring results, and factors that appear to facilitate and impede the attainment and maintenance of organizational stability.

Funding for citizen monitoring is necessary to support a paid coordinator, the importance of which is discussed above. Operating funds are also used to satisfy equipment, training and other group needs. Some interviewees said that the involvement of volunteers is necessary (Hatfield 2003, Smailes 2003b), or at least helpful (Harvey 2003), in order to lower the cost of performing monitoring work. But volunteer labour still comes with a cost. One Comox Valley citizen monitoring coordinator stated that while volunteers are “a lot more affordable on one end, they’re more expensive on the coordinator end,”

because working with volunteers demands a substantial investment of time and energy from a program coordinator (Pinho 2003).

One interviewee stated that securing a higher level of funding can also improve the quality of monitoring results because data gatherers perform better if they are financially compensated for their efforts and supervised more closely (Chamberlain 2003). One government representative in Comox Valley stated that volunteer monitors “deserve” to be paid for their work, although it is hard to find money to do so (Hatfield 2003).

Citizen monitoring in Baynes Sound, as well as efforts to establish long-term ecological monitoring in Hamilton, suffered major setbacks when funding was no longer accessible (Pinho, McHattie 2003). Similarly, when funding was discontinued, a boat-based water quality monitoring program in Hamilton harbour failed to run for a second summer (Lukasik 2003). These case study experiences serve as evidence that when funding runs out, citizen monitoring programs may falter or be discontinued entirely.

If there is a shortage of funds, a group must make choices about how to allocate its resources. For example, one coordinator said that financial constraints caused her organization to skimp on program evaluation in spite of the knowledge that this is an important part of the program cycle (Pinho 2003). In Muskoka, one interviewee suggested that the level of available funding also affects the choice of programs that an organization pursues; if little funding is available, then low-cost monitoring programs such as wildlife watching may be chosen over more technically advanced programs (Logan 2003).

Interviewees described how the process of applying for short-term funding can lower a group’s capacity to deliver its own programs. Several agreed that the need to write funding proposals represents a drain on the program coordinator’s time and energy (Mewett, Henigman 2003, Smailes 2003b), while one stated that sharing this burden also contributes to burnout on the part of board members (Chamberlain 2003). One

coordinator in Comox Valley described the search for ongoing funding as an attempt to re-invent a program to make it sound new every two years (Pinho 2003).

Several interviewees agreed that at federal, provincial and municipal levels, governments are currently in a “trough” of low funding for community involvement (Chamberlain, Hatfield, Harvey, McHattie 2003). One citizen group coordinator in British Columbia claimed that provincial and federal cutbacks have had an impact on environmental programs (Pinho 2003). A representative from EMAN, a federal agency, offered the more optimistic view that while they are not popular, government cutbacks have prompted people to realize that environmental monitoring is a local responsibility (Craig 2003).

Interviewees from all three cases lamented that environmental initiatives have to compete with items such as economic development and infrastructure projects for the same municipal funds (McHattie, Mann 2003); in other words, taxes are not currently set up to fund monitoring activities (Henigman 2003). One federal government representative stated that monitoring and stewardship groups need a “long-term home” that will be there even when project funding cycles come to an end, and that existing government agencies may be too narrow to oversee a network of such “homes” or centres (Hilliar 2003). Along similar lines, two Comox Valley coordinators observed that due to centralized funding through the United States Environmental Protection Agency, American citizen monitoring groups are much better funded than Canadian ones (Chamberlain, Pinho 2003). At a local level, institutionalization helped to fund and continue work initiated by the Hamilton Naturalists’ Club, where bureaucrats from the City of Hamilton eventually became involved with fundraising for sensitive areas inventories (McHattie 2003).

In response to the question of who should fund citizen monitoring programs, interviewees provided a range of suggestions. Most popular was the idea of ongoing funding from multiple levels of government with contributions from federal, provincial, and local agencies (Smailes 2003b, Chamberlain, Craig, Doyle 2003). One interviewee described a funding model that would be based on a combination of provincial and federal funding (Mann 2003), while another felt that the provincial government should primarily be

responsible for funding front-line environmental research (Brouse 2003). Another idea was to adjust municipal taxes to include an explicit category for environmental initiatives (Boivin 2003). This system has already been implemented to pay for a program of septic inspections in the Muskoka township of Lake of Bays (Boivin 2003).

Other interviewees suggested that an appropriate way to fund citizen monitoring would be through “user pay” or membership organizations (Logan, Brouse 2003), as exemplified by residents’ groups such as the Muskoka Lakes Association. A citizen coordinator in Comox Valley voiced a similar desire for direct contributions (i.e. donations) from the public (Smailes 2003a).

In the course of one interview, I raised the additional possibility of holding project proponents partially responsible for funding citizen monitoring activities as part of the follow-up stage of formal environmental assessments. This idea was favourably received by the interviewee (Lukasik 2003).

Interviewees engaged in “hot spot” monitoring offered caveats related to government funding. Hamilton coordinators highlighted the need for government funding to be arm’s-length (Lukasik 2003), and have “no strings attached whatsoever” (Sorger 2003) in terms of expected outcomes. These comments reflect the view that governments should recognize the autonomy of citizen groups to pursue whatever monitoring activities they feel are important (Lukasik 2003).

5.4 Summary

This chapter has presented three categories of factors that affect the use of citizen monitoring information in decision making derived from the case studies: political will, rigour, and legitimacy. Section 5.1 discussed instances where divergent priorities between citizen groups and government agencies impeded the integration of citizen-collected information into decision making processes in Comox Valley and Hamilton. In Muskoka, general agreement on decision making priorities has led to the sense that

citizen groups and local governments are working towards compatible goals, thus creating a favourable environment for future application of volunteer monitoring results.

Section 5.2 highlighted factors contributing to the quality (rigour) of citizen monitoring data, including quality assurance and quality control mechanisms for boosting the scientific value and perceived credibility of this information. Long-term and hot spot approaches to monitoring were presented as strategies for matching an appropriate level of rigour with desired applications for citizen monitoring results.

Section 5.3 discussed issues related to the reputations of citizen groups based on their perceived agendas, level of public support, longevity and organizational stability. Funding and paid coordination were identified as key elements of highly regarded citizen organizations. Suggestions for resolving tension between the need for long-term funding and its lack of availability included new financial arrangements in support of citizen monitoring including multi-level government funding, reallocations of the municipal tax base, user-pay systems, and direct contributions from members of the public.

6.0 ISSUES OF APPLICATION

Political will, rigour and legitimacy are three major themes related to the use of citizen monitoring information in decision making that emerged from the case studies and have already been discussed. This chapter focuses on a further suite of issues affecting the application of citizen monitoring data. Section 6.1 considers the match between the information needs of citizen groups and decision makers, together with strategies for fitting monitoring programs with decision making frameworks. Section 6.2 discusses benefits, features and obstacles related to partnerships between citizen groups, government agencies and other stakeholders. Section 6.3 contains interviewees' perspectives on best roles for volunteers, NGOs, and governments involved with citizen monitoring. Finally, section 6.4 summarizes interviewees' ideal scenarios for strengthening and improving citizen monitoring.

6.1.1 Information needs

Section 5.2.2 presented the view that monitoring data are perceived to be more applicable to decision making if they are gathered to fulfill a specific purpose or information need. This section presents interviewees' views on the degree to which the information needs of citizen groups and decision makers in the case studies overlap, together with some benefits and dangers of attempting to align these needs more closely.

A regional planner in Comox Valley stated that citizen priorities are often disconnected from government information needs for specific decisions, with citizens tending to collect information on issues that are important to them and then presenting it to decision makers in the hope that it will be useful in some way (Mewett 2003). A similar pattern can be observed in Muskoka, where historically cottage associations have performed monitoring in order to inform local lake plans without feeding into regional initiatives. Likewise in Hamilton, citizen efforts to monitor pollution levels and assess the state of natural areas have been initiated primarily at the grassroots level (McHattie 2003), without direction from local governments.

Interviewees identified benefits and potential drawbacks associated with making citizen groups' and decision makers' information priorities overlap more than they currently do. On the positive side, this research suggests that monitoring can be conducted in a way that is applicable to decision making if citizen groups and decision makers agree early on what their collective information needs and gaps are, as well as how citizen monitoring might reasonably fill them. In support of this view, one Comox Valley government interviewee stated that since local governments do not perform much monitoring of their own, citizen monitoring has the potential to fill information gaps in general (Mewett 2003).

Several of these themes are echoed in the literature. Pollock et al. (2003b) conclude from an evaluation of the Canadian Community Monitoring Network pilot program that environmental information intended to inform decision making at the community level should be:

- Targeted and relevant to problems and players;
- Accessible and understandable to the audience;
- Integrated;
- Usable (in its form and context); and
- Timely.

To be effective, the delivery and communication of monitoring information should also:

- Suggest a course of action;
- Allow decision-makers to weigh consequences; and
- Make those involved feel they are in control of the problem (Pollock et al. 2003b).

These recommendations suggest that monitoring information is most applicable to decision making if multiple players agree on what problems are relevant, usable and timely, and if results can be linked to clearly defined courses of action, as well as consequences for inaction.

In addition to contributing scientific information to decision making processes, citizen monitoring was said to be able to address information needs through the provision of local knowledge (Smailes 2003a). Interviewees in Comox Valley and Hamilton asserted that citizen participation in environmental initiatives has the potential to provide richer and more detailed information to decision making than expert research alone (Harvey, Lukasik 2003, Smailes 2003a). With respect to qualitative information, one Comox Valley coordinator stated that local knowledge is currently undervalued to the point where the ecological history of watersheds is “a big gap in our information” (Smailes 2003a). This interviewee went on to say that long-term residents can apply their knowledge of a geographic area in order to provide a “big picture” perspective to help direct studies; by ignoring this, external scientists or consultants can miss major pieces of important information (Smailes 2003a). A government representative in Hamilton concurred that “non-expert evaluation and analysis” is important for balanced decision making (Harvey 2003).

If citizen groups use quantitative methods to collect the same types of information as conventional researchers, then adopting a local focus allows them to notice details that government might not otherwise consider (Smailes 2003b, Lukasik 2003). As one Hamilton coordinator said, “That’s what we keep trying to say to government: look, you guys can’t be everywhere all the time, so there’s real power in having an army of citizens out there looking for problems...” (Lukasik 2003). This suggests that citizen groups can fill gaps in both the nature and level of detail of monitoring information by focusing on local conditions that are accessible and familiar to participants.

In addition to these benefits, citizen group coordinators identified some dangers associated with working more closely with governments to define information needs and design monitoring programs. Among these, some feared that citizen groups can lose their role as independent “watchdogs” if they conform too closely to information needs that are defined by governments, which can be tied to a specific political agenda (Sorger 2003). In particular, where enforcement of environmental laws is a goal of monitoring, monitoring groups may not wish to align their information priorities with those of

government or industrial authorities who may be responsible for pollution. For example, citizen groups in Hamilton at times have exposed environmental problems that would not seem to be in the City of Hamilton's interest to reveal. It is unlikely that the municipality would consider the identification of its own environmental transgressions – and the consequent need to correct them – to be an “information need.” This is consistent with observations in the literature that power holders may resist shifts in the distribution of knowledge or power (for example, the acquisition of public knowledge through citizen monitoring), particularly if the knowledge gained through such exercises reflects badly on the authorities themselves (Au et al. 2000; Bliss et al. 2001). These experiences add a cautionary note to attempts to integrate the agendas of multiple stakeholders in program design. This topic is discussed further in the following section.

6.1.2 Strategies for aligning information needs

This section discusses strategies for reducing the gaps in information needs between citizen groups and governments through collaboration, the use of existing decision making frameworks, and institutionalization.

Collaboration

Interviewees from all cases agreed that having a common vision that all partners hold helps partnerships to function (Pinho, Harvey, Black 2003). Examples of common visions that helped to advance and guide monitoring partnerships in the case studies include clean water in Baynes Sound (Pinho 2003), sustainability in Hamilton through Vision 2020 (Harvey 2003), and watershed health in Muskoka (Black 2003). As well, the City of Hamilton's Vision 2020 coordinator cited the value of partnerships themselves as part of the initiative's guiding vision, which recognizes that citizens, government and business all have roles and responsibilities regarding the pursuit of sustainability (Harvey 2003).

Several interviewees agreed that if the information needs of multiple groups are to be aligned, this can best be accomplished if the groups and agencies that are involved form partnerships and meet with each other from the earliest stages of program development (Hatfield, Crawford 2003). As an example, farm stewardship programs in Comox Valley

were said to work best where the farmers and stewardship groups worked together to design the project so that it provided information needed by both groups (Hatfield 2003). Another type of partnership employed in Comox Valley involved the Regional District hiring the Project Watershed Society to collect a specific set of mapping information. A government representative cited this as the best example of a connection that was made between government information needs and citizen efforts (Mewett 2003).

Existing frameworks

As an alternative to multi-stakeholder partnerships that collaboratively determine the structure and goals of monitoring programs, the case studies provide examples of matching between citizen monitoring programs and existing policy or legal frameworks. The Hamilton Naturalists' Club achieved this with their sensitive areas inventory work by fitting their findings into protection measures that were already within the City of Hamilton's Official Plan (McHattie 2003). Efforts to integrate citizen monitoring into Hamilton's Vision 2020 represent a similar attempt to make sustainability indicators locally meaningful by linking monitoring findings to a municipal policy mechanism that is already developed (Lukasik 2003). The Comox Valley Project Watershed Society provides a third example of a citizen group making use of an existing decision making framework. Project Watershed's initial goal was to provide information for land use planning and best management (Chamberlain 2003). The group identified the Sensitive Habitat Atlas at the Regional District level as a tool for achieving these goals that needed more extensive and detailed information, and set out to provide that information (Chamberlain 2003). In other words, the group matched its goals to an existing information need.

Institutionalization

Institutionalization is a third strategy for melding citizen and government information priorities, which involves taking a program that was initiated outside of government and creating a framework to sustain it within government institutions. This approach has been applied in Hamilton through the sensitive areas inventories conducted by the Hamilton Naturalists' Club. As described in section 4.2.1, in its early stages, citizens provided the

initiative for most aspects of the program, including fundraising and coordination. Over time, the City of Hamilton has adopted the program to some extent by taking on duties related to program management and fundraising (McHattie 2003). This has contributed to the longevity of the program by shifting some of the burden of responsibility from volunteers to paid staff at the municipal level:

- “When I say institutionalized, some alarm bells go off there too, in the sense that you don’t want it to be bureaucratized and lost within the system, but that’s not happening, because we’re keeping our finger on it. But if it had been left to us, it might have just dropped, because we only had so much energy...” (McHattie 2003)

This comment acknowledges that while institutionalization has proven to be important for the continuity of this program, there are potentially negative consequences to giving governments more power over citizen-initiated programs. Taking this further, not all types of programs would benefit from institutionalization. One such example is Environment Hamilton’s water quality monitoring program:

- “The water quality sampling, at least with the current political regime, cannot become institutionalized, because it is by its very nature confrontational. Because the City are the ones who are polluting, and they’re not cleaning up, so we have to keep calling them on it...” (McHattie 2003)

In this case, the government body that has the jurisdiction to institutionalize the program is also the offender, thus creating a conflict of interest.

The Millard/Piercy Watershed Stewards have tried to institutionalize recommendations from their Watershed Management Plan by encouraging municipal and regional governments to translate them into official bylaws (Smailes 2003a). The Muskoka Watershed Council also appears to be pursuing institutionalization of citizen-informed monitoring through the development of its Watershed Report Card, a work still in progress. These processes follow the same pattern as the Hamilton work in that the initiative and/or initial guidance for a program came from the grassroots, while over time the program and its outcomes achieve greater longevity by being integrated into new government mechanisms.

In order for institutionalization to benefit a citizen monitoring program without sacrificing it to political interests, it appears that mutually trusting relationships with government agencies are needed. The following section discusses the theme of partnerships between citizen groups, government agencies, and other stakeholders.

6.2 Partnerships

While the examples discussed above raise questions about power and autonomy in determining the agenda for local monitoring work, they also suggest that in many cases, a joint determination of monitoring agendas is possible. The following sections discuss some benefits of strong partnerships between citizen groups, governments and other stakeholders, as well as some obstacles that appear to impede their formation and functioning.

6.2.1 Benefits of partnerships

Interviewees identified partnerships between many different groups as important for citizen monitoring, including NGOs, governments, businesses, community members, academics, and Conservation Authorities (Pinho, Craig 2003). This research suggests that strong partnerships can contribute to beneficial features of citizen monitoring programs such as increased perceived legitimacy, strategic direction, and communication between unlikely allies.

Citizen group coordinators stated that partnerships with government agencies, consultants and academics helped to build legitimacy for citizen monitoring efforts (Pinho, Logan, McHattie 2003). In Comox Valley, one coordinator described the political response to citizen findings from the Baynes Sound stormwater monitoring initiative by saying that at first, city engineering staff ignored evidence of deficiencies in the sewer system for several months because of a dismissive attitude towards the abilities of volunteer monitors (Pinho 2003). The fact that the Baynes Sound Round Table involved a supportive elected political representative helped to give legitimacy and eventual recognition to its citizen monitoring component (Pinho 2003). In Muskoka, professional consultants (Gartner Lee Limited) developed the Muskoka Lakes Association's water

quality monitoring program, contributing to its perceived technical legitimacy from the perspective of decision makers (Logan 2003).

These comments are supported by literature contending that the legitimacy of citizen groups is advanced through strategic partnerships. Lukasik (1993) writes: “securing some form of technical support also appears to increase a group’s credibility. Affiliation with a university or research institution is a wise step for a volunteer monitoring group to take as part of a partnership-promoting strategy” (Lukasik 1993: 220) Accordingly, a coordinator in Hamilton saw the involvement of professor George Sorger at McMaster University as boosting the credibility of local water quality monitoring efforts (McHattie 2003).

It is worth noting that the terms of these examples of case study partnerships were quite different. The Baynes Sound Round Table involved an existing political process; the water quality monitoring program in Hamilton was initiated by non-government actors (citizen groups and academics); and the Muskoka Lakes Association affiliation with Gartner Lee Limited took the form of a paid, consultant-client relationship.

Another benefit of partnerships identified in the Comox Valley case study is that when partners come from varied affiliations, they can bring resources and knowledge to the partnership that are useful for providing organizational stability and strategic direction to citizen monitoring groups. One coordinator asserted that multisector round tables (when successful) can provide “strategic friends” in the form of bureaucrats who can advise the group on how to access funding and shape its message for decision makers (Pinho 2003). This was the case for Baynes Sound, where good working relationships (“people liked working together”) helped the round table to reach its goals (Pinho 2003).

Finally, interviewees indicated that partnerships can open lines of communication between citizen groups and government agencies, with positive outcomes for policy directions (Chamberlain, Hilliar 2003). Project Watershed’s coordinator described a collaborative regional planning process that allowed dialogue to occur and allegiances to form between people from different government departments who normally “push paper”

and do not have opportunities to talk to each other, in a forum where “community eyes” watched (Chamberlain 2003). This arrangement was said to “build capacity at the local planning level; [those involved] get to know what is important, and how to identify what is important.” (Chamberlain 2003)

6.2.2 Obstacles to building partnerships

Interviewees identified several factors that inhibit the formation of productive and mutually trusting partnerships between governments and citizen monitoring groups. Among these, lack of staff time and available resources for monitoring programs were seen to stand in the way of effective partnership building (Harvey, McHattie 2003). As well, partnerships were said to flounder if partners demonstrated an unequal level of commitment to a program (McHattie, Sorger 2003) or if citizen group coordinators moved on to other initiatives when funding for their work ran out (McHattie 2003).

In the context of international relations, Noam Chomsky has observed that “true cooperation can only be for common goals and between equals” (Chomsky 2003). While the topic and scale of analysis are quite different, interviewees’ comments suggest that this interpretation of cooperation, with its implications for goal setting and power sharing, is also relevant to partnerships between citizen monitoring groups and governments. Some barriers to setting common goals, particularly where pollution and legal infractions are involved, have been discussed in section 6.1.2. This section now turns to a discussion of how discrepancies in power and trust have apparently affected the success of case study partnerships.

Interviewees described lack of trust concerning each other’s motives and agendas as an obstacle to building strong partnerships (see also sections 5.1 - Political will and 5.3 - Reputation). Along these lines, a citizen group coordinator in Comox Valley expressed the view that in a time of cutbacks to environmental programs, “...government would like to know how they can get more for free out of people” in the form of volunteer labour (Pinho 2003). This suggests that if the partners do not feel that they are working toward common priorities, then it is possible for those involved to perceive the

partnership as a manipulative one. These concerns were echoed by one Hamilton citizen group coordinator, who stated that too close a relationship with government can lead to exploitation of citizen groups (Lukasik 2003).

One interviewee in Muskoka stated that a sense of ownership of results, together with a lack of trust in governments on the part of citizen groups, can create a reluctance on the part of citizen groups to share their data:

- "...depending on the personalities, and it's all a matter of personalities, often times you can get an ownership issue: 'My data. I'm not too sure I want to give you that data and share that data.' ...To give that away is a bit of a leap of faith, and I think, everybody loves each other dearly, but you know that upper-tier region [of government] is still over there, is still Big Brother." (Brouse 2003)

Like the previous comments, this statement supports the idea that citizen groups can remain sceptical of government motives, and refrain from engaging in full partnerships as a result. A Hamilton coordinator observed that while many citizen volunteers harbour doubts and questions about government motives, "It's a minority, I would say, that are that suspicious of government that they wouldn't want to have anything to do with them" (Lukasik 2003). Another coordinator spoke to citizen monitors' awareness of power imbalances and the need to address these in order for partnerships to be constructive:

- "We were told by the granting agency for the province, "we don't fund activists," you know. And that, in turn, requires a change in attitude of government towards the public. We're not the enemy. And if you look at us as the enemy, then we can't cooperate. If you look at us as partners, and not just words, partners, real partners – which means when something's wrong, you try to correct it – then, yeah, then we can work together." (Sorger 2003)

These remarks illustrate the caution with which some citizen groups approach partnerships, as well as the importance of establishing "common goals between equals."

6.3 Best roles

Interviewees offered their perspectives on the best roles for various partners involved in citizen environmental monitoring. This section discusses their comments about volunteers, citizen groups, and governments in terms of their strengths, weaknesses, optimal roles or activities, and dangers. These are summarized in Table 6.1.

6.3.1 Volunteers

Interviewees identified one strong characteristic of volunteers as their knowledge of local ecological history (Smailes 2003a). Citizens have contributed qualitative, local knowledge to case study monitoring and mapping initiatives through Project Watershed's mapping program, where volunteers provide narrative information about streams and watersheds, as well as through Project Watershed's landowner contact program (Chamberlain 2003). As well, volunteers can bring valuable expertise or political clout to monitoring programs, particularly retired persons with relevant career experience. This has been the case in Muskoka and Comox Valley (Brouse, Pinho 2003).

Relationship building was identified as an area of weakness for volunteers, with roles such as landowner contact being better left to a coordinator or staff person (Pinho 2003). This is related to difficulties in establishing continuous volunteer involvement. Seasonal and long-term fluctuations tend to occur with respect to volunteer interest in and commitment to monitoring initiatives (Hatfield 2003), therefore, short-term volunteers are not well placed to build and maintain long-term relationships with program partners.

Best roles and activities that were identified for individual citizens included hands-on work, which volunteers tend to prefer over planning and brainstorming-type exercises (Hatfield 2003). In terms of data collection, interviewees described the most appropriate activities for citizens as "gathering data on bulk" (Pinho 2003), or collecting samples that do not require sophisticated instruments or extensive training (Ellefson 2003). In other words, interviewees indicated that volunteers are best suited for taking samples or making observations that are simple, reproducible, measurable and numerical (Pinho 2003).

Table 6.1: Strengths, weakness, best roles and dangers of citizen monitoring actor groups

Actor	Strengths	Weaknesses	Best roles	Dangers
Volunteers	<ul style="list-style-type: none"> Local knowledge (ecological history) Can bring expertise, political clout 	<ul style="list-style-type: none"> Relationship building Seasonal and long-term fluctuations in interest, involvement 	<ul style="list-style-type: none"> Perform hands-on work Gather reproducible, measurable data that does not require sophisticated instruments or training Conduct mapping, biophysical and ecological monitoring Identify points of interest 	<ul style="list-style-type: none"> Can't rely entirely on volunteers –some investment in paid labour is needed Volunteers may be “co-opted” into doing tasks that paid staff should be doing Paid coordinator is essential
Citizens' groups	<ul style="list-style-type: none"> On leading edge of local issues Citizens have passion, initiative to start programs, recruit partners Work with established, compatible groups 	<ul style="list-style-type: none"> Might not see broader picture Not enough communication between groups Limited power, funding Slow to learn what is possible 	<ul style="list-style-type: none"> Identify monitoring needs; potentially secure resources Coordinator: facilitate communication between partners, follow up to ensure they perform designated tasks Focus on problem solving Pressure governments to enforce environmental laws 	<ul style="list-style-type: none"> Early plans may be vague, delegate too much or too little responsibility to partners Later iterations more directive, less participatory Little power: groups dismissed, undervalued
Governments	<ul style="list-style-type: none"> May appreciate “bigger picture” Power: can make changes based on program outcomes Buy-in important for success 	<ul style="list-style-type: none"> Reactive, not proactive Regulatory, not problem-solving Agency mandates too narrow to address complex problems 	<ul style="list-style-type: none"> Provide monitoring protocols Support community organizations through pilots, long-term vision Officials navigate bureaucracy, enable cooperation Municipalities should take lead on local monitoring, with provincial support 	<ul style="list-style-type: none"> Can't rely entirely on governments – agencies with power to enforce regulations may not do so Governments have power to overlook information that does not support political goals

Interviewees stated that volunteers can perform a wide range of physical, chemical and biological/ecological monitoring activities including mapping, fish counts and flow monitoring (Millard/Piercy Stewards), water chemistry and microbiology (Hamilton, Baynes Sound, Muskoka) and wildlife counts (Muskoka). Volunteers can also be adept at applying local knowledge by showing others where points of interest are in mapping or monitoring projects (Ellefson 2003). One Muskoka interviewee summed up the potential for volunteers to contribute certain kinds of data by saying, “If it’s kept simple, and if the information you’re collecting doesn’t have to be pinpoint accurate, then for broad information, citizen monitoring should be a thing of the future” (Mann 2003).

Dangers that interviewees associated with volunteer-based programs included the risk of volunteers being “co-opted” into performing tasks that should be the responsibility of paid staff, municipal or otherwise (Lukasik 2003). Several interviewees voiced the concern that it is not feasible to rely entirely on volunteers; instead, there needs to be NGO or government staff time devoted to monitoring (McHattie 2003), a “base level of service” (Lukasik 2003), or an “investment from the community” of which a paid, staff coordinator is an essential part (Craig 2003).

It should be noted that while volunteers may appropriately gather many types of information, it is not possible for citizen monitoring activities to meet all types of information needs. Technically sophisticated activities that require expensive equipment, such as ground water monitoring, may be beyond the reach of citizen monitoring programs, while privacy issues may make it unadvisable for citizens to check up on their neighbours’ compliance with environmental regulations (e.g. septic system maintenance or farming practices). Finally, it may be difficult for citizen monitoring activities to contribute to decision making in communities where economic viability is closely linked to a single industry, since it is likely that criticism of such an industry would receive a politically unfavourable response. These represent a few of the situations in which the applicability of citizen monitoring may be particularly limited, and monitoring of any kind may not occur as a result. In such cases, monitoring by municipal or provincial governments may be more appropriate.

6.3.2 Citizen groups

Strengths that interviewees associated with citizen groups included their local focus, passion, initiative, and opportunities for collaboration with one another. One interviewee stated that citizen groups are usually on the leading edge of community issues because they tend to be well connected with what is going on at a local level: “For citizens’ groups, they’re usually on the ground, so they know often what’s happening [and] what’s going to happen... just because they’re closer to the action” (Smailes 2003a). On the theme of initiative, a Hamilton coordinator stated, “Traditionally it’s the citizens that need to initiate things, because they’ve had the most passion for things, and that’s why it works or why it doesn’t work” (McHattie 2003). A coordinator in Comox Valley provided further support for this idea: “At the provincial level, we kind of don’t figure on the radar screen. So then, if we want to save our area, we have to do it ourselves” (Smailes 2003a). Following this spirit, the Millard/Piercy Stewards initiated the development of their Watershed Management Plan and convinced government partners to “come on board” (Smailes 2003b). Finally, opportunities for collaboration between like-minded organizations were seen as a way to multiply the strengths of citizen organizations. Interviewees considered it helpful to draw in existing and well-established groups with compatible mandates, such as the Project Watershed Society in the case of water quality monitoring in Baynes Sound (Pinho 2003).

In terms of weaknesses, interviewees articulated that at times, citizen groups “might not see the broader picture...” (Smailes 2003a) and end up with an overly specific geographic or issue-based focus as a result. As well, collaboration between non-profits was reported to be up and down (Chamberlain 2003), with not enough communication taking place between groups that work separately (Doyle 2003). On the matter of working together with conventional power holders such as government agencies, one Comox Valley coordinator stated that at first, “[as a young NGO], you’re not sure what you can ask people to do... often it’s a question of confidence” to build assertiveness over time (Smailes 2003a).

Interviewees saw a role for citizen groups in identifying what needs to be monitored and potentially securing the resources to do it (Smailes 2003b). As well, interviewees noted that citizen groups would do well to focus on local problem solving, which is “a critical role for outside-of-government agencies” (Hilliari 2003). The presence of a paid citizen group coordinator was said to be critical for facilitating communication between groups that are working together on developing or implementing a plan, as well as for following up with government partners to make sure that they perform their designated tasks (Smailes 2003a).

Dangers that interviewees associated with citizen groups included concerns about their ability to facilitate a process that places appropriate expectations on the partners involved, as well as to establish a position in which others value their work and take them seriously. Due to a lack of experience in these areas, the Millard/Piercy Watershed Management Plan delegated too many tasks to the Millard/Piercy Stewards themselves, and too few to specific individuals within government agencies (Smailes 2003a). The document was also described as too vague in terms of timelines (Smailes 2003a). Later iterations of the plan are likely to be more directive and less participatory, with stricter deadlines and more specific allocations of tasks – an arrangement that the Millard/Piercy Stewards’ coordinator said would be considered acceptable now that relationships between the partners are established (Smailes 2003a). Other authors have made the compatible observation that “while diverse stakeholders may easily develop goals and plans in partnership, the division of responsibility for implementation remains a significant challenge” in community-based monitoring (Pollock & Whitelaw 2003). Interviewees also spoke to the limited power of non-profit organizations to effect change, particularly where money is required to pursue legal action: “We don’t have any power. We don’t have money for lawyers” (Sorger 2003). Another danger is that governments tend to undervalue the work of environmental non-profits (Smailes 2003a), thus making it difficult for citizen groups to gain respect and a feeling of equal partnership.

6.3.3 Governments

Interviewees identified the strengths of government agencies and departments as their position of relative power and their potential to adopt a broad perspective. One interviewee said that governments appreciate the “bigger picture” better than local groups (Smailes 2003a) with respect to the complexities and many considerations that are involved in decision making. Several interviewees also spoke to the power of governments to enact changes (Smailes 2003b, Pinho, Sorger 2003), with the implication that government “buy-in” is important for the success of citizen monitoring activities (Smailes 2003b, Pinho 2003). If citizen groups are able to establish a reputation for reliable data collection, then governments can enable substantial positive actions based on their results (Smailes 2003b).

One weakness that government interviewees identified with government agencies was that they tend to be reactive rather than proactive (Mewett, Hilliar 2003), meaning that they are more effective at responding to identified problems than at anticipating or preventing them. Further, one federal government representative pointed out that government agencies are regulatory, not problem-solving organizations, and that their mandates are often too narrow to address complex problems adequately (Hilliar 2003). These remarks suggest that while governments may have a broad perspective on issues across several departments and jurisdictions, these separate branches of government may suffer individually from over-specialization and lack of coordination.

Best roles and activities that interviewees saw for governments include providing coordination, recognition and technical support to citizen monitoring groups. Specifically, case study respondents suggested that governments could best support citizen efforts by providing monitoring protocols (Hilliar 2003) and initiating provincial pilot projects, as was the case with Project Watershed’s mapping initiative (Chamberlain 2003). Evaluation of the Canadian Community Monitoring Network pilot echoes these views, stating that “the role of government as support agent rather than leader” was a positive feature of this program (Pollock et al. 2003b).

The benefits of having a supportive government official involved in citizen monitoring programs were recognized through the Baynes Sound storm water monitoring initiative, whose coordinator appreciated that a participating Member of Legislative Assembly was able to “cut out the bureaucratic red tape and b.s. of all these different jurisdictions and departments” (Pinho 2003), thus facilitating a process that involved several agencies and stakeholders. In terms of levels of government and their respective responsibilities, interviewees suggested that municipalities should take the lead on community-based monitoring (Craig 2003), while provincial agencies could offer important contributions in terms of coordination, data sharing and technical support (Mann 2003). One federal government employee stated that at the national level, governments should recognize community organizations and their place in Canadian society through a long-term vision (Hilliar 2003).

The dangers that interviewees associated with government participation in citizen monitoring activities are the flip side of one of its strengths: power. Citizen group coordinators maintained that it is important not to rely on governments (Smailes 2003b) for a variety of reasons, including that those who have the power to enforce environmental laws or to enact legislation preventing or mitigating future environmental damage may not choose to exercise this power. One interviewee stated that this occurred in Hamilton, where the provincial agency responsible for enforcing environmental regulations (the Ontario Ministry of the Environment) was not seen to be doing its job (McHattie 2003). Other concerns with the amount of power entrusted to elected officials, including political motives for dismissing citizen monitoring results, are discussed in section 5.1.

6.4 Ideal scenarios

When asked to describe their ideal scenarios for citizen monitoring, interviewees identified several existing programs and new ideas as desirable in terms of goals, partnerships, or organizational structures. This section presents the positive characteristics of these examples that interviewees identified and sorts them into themes. These themes, characteristics and example programs are summarized in Table 6.2.

One provincial interviewee in British Columbia identified the Millard/Piercy Watershed Stewards as a group that has formed exemplary partnerships, both by including affected government agencies from the early stages of program design and by working closely with the community to develop trust and understanding (Henigman 2003).

Several Comox Valley interviewees promoted the idea of a common home for non-profit groups in each community that have mandates related to stewardship (Ellefson, Chamberlain, Hilliar 2003, Smailes 2003b). While such a “stewardship centre” does not currently exist, interviewees identified the main potential benefit of such an arrangement as an increase in opportunities for collaboration between NGOs (Ellefson, Chamberlain 2003, Smailes 2003a). This would allow non-profits to partner and learn from one another (Ellefson 2003, Smailes 2003a), as well as to pool their resources to cover expenses such as rent, phones, and accounting (Ellefson, Chamberlain 2003). Having a single, highly visible office or resource centre could also facilitate greater volunteer recruitment (Chamberlain 2003). One government interviewee stated that a stewardship centre would provide organizational stability to non-profits because they would have a constant home even when short-term project funding came to an end (Hilliar 2003).

One Comox Valley interviewee described favourable aspects of American monitoring groups that are funded by the United States Environmental Protection Agency (US EPA), including their funding model, coordination, and opportunities for collaboration (Chamberlain 2003). In this system, a national advisory group of government agencies coordinates and oversees citizen monitoring groups, while bioregional organizations work to maintain volunteer efforts (Chamberlain 2003). Local monitoring groups have access to stable funding, while national conferences help to promote communication, mutual learning and celebration of successes between groups (Chamberlain 2003). This coordinator envisioned a strong role for Project Watershed as a bioregional organization if such a system were to be established in Canada (Chamberlain 2003).

One Hamilton coordinator’s ideal scenario for citizen monitoring was the system of partnership and responsive government found in the Town of Falmouth, Cape Cod

(Lukasik 2003). In this example, the Town funds water quality sampling work and citizen groups receive technical support from scientists in order to perform the monitoring. The Town implements environmental policies and management actions based on the citizen group's findings (Lukasik 1993). The interviewee described Falmouth as exhibiting a strong partnership between citizens and local government where the Town directly benefited from the partnership, knew it, and valued its relationship with citizen groups accordingly (Lukasik 2003). However, the interviewee cautioned that this was a unique scenario; a similar arrangement probably would not be viable in Hamilton because local governments would not be willing to build the same kind of partnership (Lukasik 2003).

The Hamilton Naturalists' Club shows a similar pattern of incorporating citizen results into institutional frameworks with local government responding to citizen group findings as a result (McHattie 2003). In this example, citizens initiated the idea for the program and completed the necessary start-up fundraising and work to launch it (McHattie 2003). The program became institutionalized over time in that the City now devotes staff to keeping the program running, checking on citizen monitoring activities, and analyzing results (McHattie 2003). One Hamilton coordinator saw this as an ideal direction for local water quality monitoring work to proceed (McHattie 2003). Another stated that a citizen program such as an environmental watch should ideally become "organic to the city government... without it being part of politics" (Sorger 2003).

In Muskoka, an interviewee affiliated with the Muskoka Lakes Association (MLA) identified this organization as an ideal type of group in a seasonal community because of its high levels of local involvement, accountability, and funding (Logan 2003). This interviewee stated that people identify with the MLA as a membership-based institution in a situation where they are seasonal residents and may not identify with the local government (Logan 2003). As well, the organization has broad appeal because it serves as a social network with many different types of activities and events: "There's a good chance people will know what's going on [with monitoring] because they're a member [of the MLA], even though they might be a member for some totally unrelated reason" (Logan 2003). Because the organization's budget comes from membership fees, the MLA

has a stable funding base for monitoring activities, coupled with a sense of accountability to its members (Logan 2003). However, the MLA model is unique to a seasonal community, and may not be effective in urban settings (Logan 2003).

Table 6.2: Themes, characteristics and programs from ideal scenarios

Theme	Characteristic or type	Example
Agenda	<ul style="list-style-type: none"> • Citizen-led OR • Common vision with government 	<ul style="list-style-type: none"> • Hamilton Naturalists' Club, MLA • Muskoka
Rigour	<ul style="list-style-type: none"> • Technical support • Coordination (paid) • Protocols • Data sharing 	<ul style="list-style-type: none"> • Muskoka (ideal), • Town of Falmouth
Trust	<ul style="list-style-type: none"> • Trust of community • Trust between partners • Accountability to community 	<ul style="list-style-type: none"> • Millard/Piercy Stewards • Baynes Sound • MLA
Partnerships	<ul style="list-style-type: none"> • Close links between government and NGOs at early stages • Provincial or federal coordination 	<ul style="list-style-type: none"> • Millard/Piercy Stewards, Town of Falmouth • US EPA, Muskoka (ideal)
Institutional frameworks	<ul style="list-style-type: none"> • Programs institutionalized without becoming part of politics 	<ul style="list-style-type: none"> • Town of Falmouth, Hamilton Naturalists' Club
Organizational Stability	<ul style="list-style-type: none"> • Funding support from regional, provincial, or federal body • Opportunities for increased learning, pooling resources • Succession planning 	<ul style="list-style-type: none"> • US EPA • Stewardship Centres (ideal) • Muskoka (ideal)
Impact, Application	<ul style="list-style-type: none"> • Decision makers responsive to monitoring outcomes 	<ul style="list-style-type: none"> • Town of Falmouth, Hamilton Naturalists' Club

Other interviewees in Muskoka offered a set of ideal considerations for citizen monitoring rather than citing a particular example of a successful program. These ideal characteristics focused on rigour, coordination and organizational stability. In terms of rigour, one interviewee identified standardized protocols and data sharing using compatible data bases as important to the success of citizen monitoring initiatives, together with the recognition that all the associations that perform monitoring will work differently (Brouse 2003). In terms of coordination, another interviewee envisioned a system of citizen monitoring that would be provincially coordinated by a central

organization that does not perform monitoring itself, but helps community organizations to do so by providing kits, protocols and support to cottage associations, municipalities and government agencies (Mann 2003). This coordinating body would ideally gather community results and provide a central capacity for answering questions from participating groups (Mann 2003). In terms of organizational stability and continuity, succession planning was identified as an important component of community monitoring work (Brouse 2003).

6.5 Summary

This chapter has discussed issues affecting the application of citizen monitoring results to decision making processes, with particular emphasis on information needs and partnership arrangements. The research findings indicate that gaps exist between the information priorities of citizen groups and governments, and present three strategies for aligning these information needs more closely that were employed in the case examples: collaborating during the stage of monitoring program design and development, fitting monitoring programs into existing decision making frameworks, and institutionalizing monitoring programs and their outcomes. In terms of partnerships, benefits of strong working relationships between citizen groups, governments and other stakeholders include increased legitimacy and strategic direction for monitoring programs as well as enhanced communication between program partners. Obstacles to partnership formation include unequal levels of commitment and trust between the partners, as well as a general lack of funding and personnel time allocated to building and maintaining monitoring programs. In the areas of information needs and partnerships, questions arise with respect to the power and autonomy of citizen groups to develop, conduct, and gain recognition for monitoring programs that are based on local priorities, given that government staff and elected officials appear to hold considerably more influence and authority.

This chapter also presented best roles for various actor groups affiliated with citizen monitoring programs, together with interviewees' ideal scenarios related to the structure and functioning of citizen monitoring programs. Tables 6.1 summarizes the strengths, weaknesses, best roles and dangers associated with volunteers, citizen groups and

governments, while table 6.2 links themes, characteristics and examples of ideal monitoring scenarios.

7.0 CONCLUSIONS

This final chapter synthesizes the primary research covered in the body of the thesis, compares it to theory discussed in the literature review, and builds recommendations for practice for various actors and scales related to citizen monitoring programs. Section 7.1 discusses how the research findings address the original research questions. A summary of positive outcomes, enablers and obstacles derived from the case studies leads into a discussion of how the current distribution of political power may place systemic limitations on the ability of citizen monitoring groups to inform decision making. Section 7.2 provides considerations for various stakeholder groups involved in efforts to link citizen monitoring outcomes to decision making processes, including citizen groups, municipal governments, and agencies at the provincial and federal levels. Section 7.3 highlights novel and surprising contributions made by this research, together with questions to guide further investigations.

7.1 Research questions

This research sought to draw lessons from cases where information gathered by citizen monitoring groups was applied to decision making processes, and to identify factors that facilitated or impeded success in this regard. Reflecting on these objectives at the end of the research project, it is now possible to return to the research questions and assess the extent to which these can be answered. First, what kinds of “success” were actually achieved in the case studies, as opposed to goals that were oriented towards achieving future success? Second, which factors and strategies characterized successful or ideal citizen monitoring initiatives, and which served as obstacles to programs reaching their goals? Finally, what degree of influence did citizen monitoring groups achieve, and what limitations did they face with respect to making valued contributions to decision making outcomes or practices?

7.1.1 Kinds of success

In response to the first question, empirical evidence shows that citizen monitoring in the case study communities directly contributed to several forms of decision making and regulatory enforcement:

- Environmental law enforcement (Hamilton)
- Sewer infrastructure corrections (Comox Valley)
- Development of planning documents (Comox Valley)
- Protection of natural areas (Hamilton)

These examples represent ways of directly linking citizen monitoring to decision making that are consistent with the kinds of “success” that were envisioned at the beginning of the study. In addition to these cases where citizen monitoring directly influenced decision making and regulatory processes, interviewees also described how citizen monitoring efforts led to other, less measurable types of positive outcomes:

- Stewardship projects (Comox Valley)
- Community education and support (Comox Valley, Hamilton)
- Intangible pressure (“nudging”) on decision makers (Comox Valley, Hamilton)

One could argue that these impacts on the broader community and public opinion represent precursors to future influence on decision making processes, although further study would be needed to determine if this is the case. This line of reasoning would be consistent with the enlightenment perspective that research findings can have a “subtle influence on the understanding of policy makers” as described by de Neufville (1985), or the “agenda-setting” role for citizens described by Tesh (1999).

Where citizen monitoring programs that were studied were too young to have realized their objectives to date, future positive impacts on decision making were planned:

- Recommendations from plans informed by citizens may be integrated into bylaws (Comox Valley, Muskoka)

- Watershed Report Card will inform future development planning and decision making (Muskoka)
- Citizen data may be integrated into municipal sustainability reporting through Vision 2020 (Hamilton)
- Ecological monitoring will contribute to an understanding of long-term change (Muskoka)

These plans represent ideal scenarios for citizen monitoring that are at various stages of development.

7.1.2 Factors affecting success

A number of factors affecting the application of citizen monitoring outcomes to decision making have been identified through this study. Generally, these include political will, rigour, legitimacy, and partnerships with decision making officials and agencies. Major obstacles include suspicions between governments and citizen groups about each other's motives or political agendas, as well as difficulties in connecting monitoring results to established thresholds and clear courses of action for decision makers. Specifically, the success factors ("enablers") and obstacles derived from this research have been formulated into a set of recommendations for practice. These are summarized and compared with the recommendations of Pollock et al. (2003) for achieving influence through citizen monitoring in Table 7.1. Pollock et al's report evaluating the pilot year of the Canadian Community Monitoring Network (CCMN) was chosen for comparison because it is the most recent and comprehensive study to date on Canadian local environmental monitoring efforts involving citizens. The report is based on the experiences of twelve regional coordinators working to establish and implement community-based monitoring programs in thirty-one communities over a period of one year (Pollock et al. 2003b).

Table 7.1: Comparison of recommendations from primary research and Pollock et al. (2003b)

Theme	Primary research findings	Pollock et al. (2003)
Agenda	<ul style="list-style-type: none"> Define a citizen-led agenda through a public consultation process; or, Establish a common vision with interested partners through a round table structure. 	<ul style="list-style-type: none"> Make achieving influence a priority for CBM groups. Hold open forums for interested parties to discuss monitoring priorities under the direction of the CBM group or network, using trusted facilitators.
Rigour	<ul style="list-style-type: none"> A paid coordinator and technical support from experts are highly valuable. Standardized, yet adaptable protocols are important for high quality data; data sharing between groups allows for enhanced learning and comparisons. 	<ul style="list-style-type: none"> Use of standardized protocols allows for integration across and comparison between communities. Locally relevant protocols support progress toward sustainability by monitoring issues of specific community relevance.
Strategy	<ul style="list-style-type: none"> Match monitoring approach, indicator selection, and type of partnerships with desired applications for outcomes. 	<ul style="list-style-type: none"> Use existing (long-term) monitoring protocols where relevant to community needs; develop program further based on local problem identification.
Community relations	<ul style="list-style-type: none"> Build trust through public events; establish accountability through membership organizations. 	<ul style="list-style-type: none"> Focus on transforming public values by engaging people in monitoring and stewardship activities.
Partnerships	<ul style="list-style-type: none"> Build links between governments, businesses and NGOs at early stages if partnerships are seen as preferable to independent, “watchdog” status. 	<ul style="list-style-type: none"> Seek partnerships with government staff and politicians to influence policy development; build partnerships to work with and influence business.
Provincial, federal role	<ul style="list-style-type: none"> Provincial or federal government agencies should develop standardized monitoring protocols. Provincial or federal coordination of citizen monitoring activities is desirable. 	<ul style="list-style-type: none"> National coordination (possibly by a not-for-profit organization) is essential for sharing experiences, managing data, developing protocols, maintaining websites and building capacity.
Institutional frameworks	<ul style="list-style-type: none"> Institutionalize programs without letting them become part of politics. 	<ul style="list-style-type: none"> Developing institutionalized access to government structures is required.
Stability of organizations	<ul style="list-style-type: none"> Long-term funding support and succession planning are needed to sustain monitoring activities. Maximize opportunities for learning, collaborating, and pooling resources with other citizen groups. 	<ul style="list-style-type: none"> Sufficient funding and involvement of champions are important to monitoring programs. A “How-To” manual should be provided that makes CBM implementation accessible and practical.
Impact, Application	<ul style="list-style-type: none"> Decision makers should respond to monitoring outcomes. 	<ul style="list-style-type: none"> Build the capacity of decision makers and governance institutions.

The recommendations from the primary research findings and the Canadian Community Monitoring Network pilot evaluation are largely consistent. Regarding the agenda of local monitoring efforts, both recommend collaborative efforts led by citizen groups in order to determine program priorities. The CCMN evaluation makes the additional recommendations that trusted facilitators should help to guide the priority-setting process, and that achieving influence should be made an explicit priority for community-based monitoring programs (Pollock et al. 2003b).

In terms of rigour, both recommend the use of monitoring protocols that are standardized, yet flexible and locally relevant in order to promote high quality data. The primary research makes the additional recommendation that a paid coordinator and support from technical experts be enlisted in order to improve data quality. The primary research suggests that a monitoring strategy be chosen in order to support the desired applications for monitoring program outcomes. The CCMN pilot originally promoted the use of long-term monitoring through existing protocols that were developed by the Ecological Monitoring and Assessment Network, in part because these protocols were available and ready to use. Over the course of the year, participants in the CCMN initiative came to appreciate the importance of context-specific protocols that are relevant to local information needs (Pollock et al. 2003b).

Both the primary research and the CCMN evaluation emphasize the importance of engaging the broader community in stewardship activities and other events, as well as building partnerships between citizen groups, governments and businesses in order to foster collaboration. Both recommend a role for a national body (government or not-for-profit) to coordinate local monitoring efforts, with the primary data set indicating that provincial authorities might also be suited to this task. Both studies include institutionalization of monitoring programs as an important means of achieving influence, and see a need for enhanced collaboration and information sharing between local monitoring groups.

In terms of organizational stability and functioning, the primary research suggests that long-term funding and succession planning are essential to the continuity of monitoring programs, while the CCMN evaluation makes the specific recommendation that a “how-to” manual be developed in order to facilitate citizens in the delivery of monitoring activities. Finally, both sources include recommendations regarding the role of decision makers, with the primary research suggesting that decision makers should be more responsive to local monitoring outcomes, and the CCMN evaluation recommending that monitoring programs focus on building the capacity of decision makers and governance institutions (Pollock et al. 2003b).

One difference between the two sets of recommendations is that the CCMN evaluation espouses the view that a collaborative model for community-based monitoring is preferable for all parties involved, while the primary research findings suggest that some citizen groups that are engaged in monitoring may prefer to remain at arm’s length from governments in order to maintain “watchdog” status. This desire to remain independent from government is particularly relevant for groups that adopt a hot spot, or advocacy, approach to monitoring, which was de-emphasized in the CCMN pilot communities. This is perhaps because the CCMN pilot originally promoted the use of a long-term approach to monitoring based on existing EMAN protocols (one of the CCMN program partners), although the CCMN now places greater emphasis on designing monitoring programs based on local priorities (Whitelaw 2004).

An interesting outcome of the primary research is that several factors appear to serve as both beneficial outcomes and prerequisites of successful citizen monitoring programs, suggesting that progress and success can be achieved through an iterative process. For example, a group’s ability to secure stable funding, build relationships with the broader community, and gain the trust of decision makers all depend to some extent on its previous successes in the same areas.

7.1.3 Degrees of success, power, and limitations

The third research question asked what degree of impact citizen groups achieved in contributing to decision making and regulatory processes through monitoring programs. It is argued here that citizen monitoring groups were able to contribute their results to decision making processes only to the extent that they were able to either fit with or shift existing political agendas and priorities within their own communities. While citizen participants in the case study monitoring programs sought empowerment through knowledge of laws and regulations, political processes, and scientific research, their ability to inform decision making outcomes still depended heavily on decision makers' willingness to share their power, as well as their commitment to follow through on their mandated responsibilities. Their experiences suggest that participation in case study monitoring programs did not lead to significant "shifts in the locus of power" as envisioned by Bliss et al. (2001).

Interviewees from all case studies made it clear that the political orientation of local authorities had a strong influence on the degree to which citizen monitoring results were applied to decision making scenarios. In Comox Valley and Hamilton, support and cooperation from individual government representatives were offset by the perception that local governments were pursuing an agenda that favoured economic development over environmental protection objectives. In contrast, interviewees saw Muskoka's local governments, businesses and the public as pursuing compatible objectives related to the protection and enhancement of environmental features, largely because the community's economic viability and overall quality of life were perceived to rely on characteristics such as clean air, clean water, quiet, the presence of wildlife, and aesthetic beauty. Different community characteristics – in this case, economies founded on agriculture and resource extraction, heavy industry, and recreation in Comox Valley, Hamilton, and Muskoka respectively – promoted different politically favoured courses of action on environmental matters, and consequently different responses to citizen monitoring activities.

With respect to policy and planning processes, citizen monitoring groups were largely restricted to a position of influence (an advisory mandate) rather than authority (a decision making mandate). This was especially true where citizen groups adopted a long-term approach to monitoring. Where citizen monitoring efforts were targeted at enforcing existing regulations using a “hot spot” strategy, more direct and immediate results were attained (e.g. Baynes Sound sewer corrections, orders against City of Hamilton) than in cases where a long-term monitoring strategy was employed. Where monitoring efforts focused on suspected environmental violations, citizen groups were able to use their data as evidence to trigger existing regulatory mechanisms, as opposed to feeding it into the development of new policy or regulatory mechanisms.

7.2 Considerations for different scales

Research findings are discussed here as they relate to several units of analysis. This section presents recommended and practices questions for consideration at the levels of individuals and community groups, municipal governments, provincial or national coordinating bodies, and broader frameworks related to citizen monitoring.

7.2.1 Individuals and citizen monitoring groups

Because of the unique geographic, demographic and political characteristics in each community, interviewees were clear in stating that general strategies for citizen monitoring and participation in governance would not necessarily work across different sets of local circumstances. As a result, the recommendations in this section are posed as a set of questions for citizen monitoring groups to consider in each community, rather than as a prescriptive list of answers.

- What is our clear purpose for monitoring (a question to answer or problem to solve)?
- Who are our logical partners or allies?
- Are there existing regulatory or decision making frameworks or processes that are relevant to this purpose?
- What monitoring strategy and indicators will allow us to fulfill this purpose?

- Do monitoring protocols exist for these indicators? If so, can and should we adapt them to meet local needs?
- How can we build community awareness and support for our activities?
- How can we work collaboratively with other community groups to help meet our basic organizational needs?

While the answers to these questions will vary from group to group and location to location, the process of defining a purpose for a monitoring program, identifying partners, information frameworks and protocols, designing a program that addresses local needs, building community trust, and sharing resources with other community groups reflects the characteristics that interviewees associated with successful and ideal citizen monitoring programs.

7.2.2 Municipalities

In order to minimize conflicts related to any group or agency's perceived bias or special interest, citizens, governments and citizen groups should work together from the earliest stages of monitoring program development to foster mutually acceptable goals. Typically, citizens are included in environmental processes in an advisory role. This research recommends that monitoring initiatives go beyond this level, involving citizens in actual decision making processes including agenda setting. The partnerships guiding community involvement in environmental initiatives should therefore be based on power sharing that enables citizens to play a role in terms of influence as well as authority.

The case studies provide examples of partnerships between citizen monitoring groups and municipal governments that range from independent (and mutually suspicious) to integrated (and generally trusting). A clear theme of this research is that mutually beneficial partnerships can only be achieved if all parties involved agree on a set of compatible priorities, remain committed to fulfilling their mandates, and are equally committed to applying the outcomes of monitoring work.

7.2.3 Provincial and national roles

The results of this study support the observation that “a nationally ‘consistent’ approach to community-based monitoring will need to be flexible and adaptable, consisting of multiple tools including monitoring protocols and information management techniques” (Pollock et al. 2003b). While interviewees were clear in stating that the same approach to monitoring would not work in all communities, they recognized several ways in which provincial or federal agencies could (and in many instances, did) assist citizen monitoring groups in performing locally useful work.

This research suggests that provincial and federal authorities can play several key roles in facilitating the production of citizen environmental monitoring outcomes that are applicable to decision making. Further, government agencies at these levels have an apparent interest in supporting citizen monitoring efforts for their contributions to sustainability objectives, including public participation in decision making and enhancement of environmental knowledge. Suggested roles for provincial and federal bodies include:

- Continue to develop and provide standardized monitoring protocols for a wide range of indicators.
- Provide tools to assist with data management and interpretation.
- Manage a centralized website that allows for data sharing and comparison between citizen monitoring groups in different communities.
- Facilitate communication and sharing of stories between citizen monitoring groups across communities and regions (possibly through the same website).
- Encourage citizen monitoring initiatives through provincial pilot programs.

Most of these activities have already been attempted or carried out by provincial or federal government agencies at one time or another (for example, the CCMN pilot program, Stewardship Canada website and EMAN/CNF monitoring protocols). What has yet to be seen is a long-term commitment to filling these roles. Pollock et al. (2003) point out that while national-level coordination is necessary for the continued success of citizen

monitoring efforts, the necessary functions for overseeing a national network could be performed by a non-profit or charitable organization just as well as a government agency. If this were the case, then one challenge to overcome would be establishing the legitimacy of the overseeing organization in the eyes of decision makers at all levels.

7.2.4 Macro-level analysis

This study has implications for broader discussions about citizen science and political frameworks. The results of this research suggest that where citizen monitoring results fail to inform decision making processes, it is not citizens' scientific abilities that decision makers doubt so much as it is their motives. Collaborative agenda setting and power sharing arrangements thus appear to have as much potential to affect the application of citizen monitoring findings as much as scientific tools such as standardized protocols and quality control measures. This position is consistent with Backstrand's argument that "the science-politics interface needs to be reframed to include the triangular interaction between scientific experts, policy makers and citizens. The citizen is not just the recipient of policy but an actor in the science-policy nexus" (Backstrand 2003: 25).

The lessons learned from efforts to apply citizen monitoring results to decision making scenarios can also potentially inform citizen participation initiatives in other areas of environmental research and management. For example, citizen involvement in the agenda setting and information gathering stages of monitoring is potentially applicable to federal and provincial environmental assessment processes (Hunsberger et al. 2004). As well, discussions about the public role that Francis (1991) envisions with respect to monitoring and managing ecological areas (such as Biosphere Reserves or Areas of Natural and Scientific Interest) can benefit from the insights presented here about volunteer data quality, organizational stability, and the benefits and limitations of various types of partnerships.

7.3 Taking stock; looking ahead

This section summarizes unique and surprising findings of the study, and proposes some questions to guide future research in the field.

7.3.1 Contributions of the research

One of the major insights that this research offers is the importance of linking citizen-led environmental research and action goals to a particular monitoring strategy. While it may seem obvious that research design is a critical element in determining the kinds of outcomes that are possible from citizen monitoring initiatives, interviewees described several scenarios where monitoring programs had either faltered or were predicted to do so because the indicators or sampling protocols that were chosen could not be connected to established ecological thresholds or decision points. In other words, the case studies revealed questions and challenges associated with interpreting and applying the results of citizen monitoring programs. While monitoring data can nearly always shed light on the question of “what is happening?,” not every program is equally equipped to address the follow-up questions of “what does it mean?” and “what should be done?.”

The Canadian Community Monitoring Network pilot project represented an attempt to create a national network of community groups performing ecological monitoring, with considerable energy dedicated to assessing and evaluating the process. While this undertaking encouraged community groups to try to link their results with local and regional decision making processes, it is not clear that the applicability of monitoring findings was identified as an important consideration at the outset of the pilot. Community groups were encouraged to use existing, standardized monitoring protocols developed by EMAN and to adapt them to local conditions where appropriate, but this approach did not provide guidance for groups that may have wished to design their programs to resolve specific environmental crises through hot spot monitoring and existing regulatory mechanisms. Although it came to recognize and embrace other strategies over the course of the pilot year, the CCMN program was therefore originally intended for one type of monitoring strategy (long-term), rather than a diversity of strategies through which local groups might have pursued a wider range of goals.

Another research finding worth restating here is the mutually reinforcing relationship between factors affecting organizational stability and factors affecting citizen monitoring

“success.” Elements of an organization’s longevity such as adequate funding, a committed volunteer base, support from the community, and mutually trusting relationships with government or business partners appear to be interrelated to such an extent that it may seem to a young organization that each characteristic is needed before the others can advance. Interviewees’ comments about the need for new funding models for citizen monitoring programs, as well as ideal scenarios for collaboration and resource sharing between community groups, offer starting points for overcoming this potential obstacle.

A surprising finding of this study was the extent to which each case study citizen group’s legitimacy from a government perspective rested on decision makers’ perceptions about the group’s agenda and priorities. This was particularly true in Comox Valley and Hamilton. Given the sparse treatment of this subject in the literature (see Stokes & Havas 1990 as an exception), I had expected to find more of a focus on data quality than on motivations, priorities and issues of concern. In other words, if citizen groups were able to establish a reputation as “good scientists,” then I anticipated that their work would be more or less accepted by decision makers. Instead, the research revealed a more complicated set of considerations for establishing credibility that included receiving technical guidance from scientists, collaborating and holding a common vision with decision makers, and working to build support from the community at large.

7.3.2 Areas for further investigation

This study raises several questions that could be explored through further research. First, as mentioned in section 3.5, this study included government representatives such as planners and community liaison staff, but not elected officials such as municipal councillors. Since this research indicated that municipal councillors hold much of the power to apply or overlook information collected by citizens, the findings would have been enriched by the inclusion of interviews with elected government representatives. One question, then, for future research is: *How do elected decision makers (as opposed to government staff) perceive citizen environmental monitoring groups in terms of their*

capacity to contribute knowledge to decision making, or to perform other roles related to agenda setting?

A second question to guide future investigations pertains to accountability mechanisms for non-government organizations. This research has suggested some means by which citizen groups can boost their legitimacy from the standpoint of governments and the broader public. These include data quality assurance and quality control measures such as using standardized protocols, working with technical experts, and checking the accuracy of information collected by volunteers; forming partnerships with governments and other stakeholders early in the process of designing and implementing a monitoring program; establishing community support through public education and stewardship events; and securing longevity through consistent group leadership and by continuing to attract funding over time. Even so, the roles assumed by citizen monitoring groups in the case examples have been mainly advisory in character. It has been argued here that citizen groups could perform a broader range of activities with respect to agenda setting and decision making. If decision makers (primarily municipal councillors) were prepared to share their decision making power with citizen groups (and/or provide funding for these groups) more than they currently do, then it is easy to imagine that concerns would be raised regarding the legitimacy of citizen groups as political actors. This is, in effect, a second question for future research: *If partnerships between government agencies and citizen monitoring groups are to be strengthened, then how can the accountability of each partner be assessed or ensured?*

This research has barely begun to examine the existing and possible power sharing arrangements between citizen groups and governments, let alone other stakeholder groups such as business organizations. Some interviewees indicated that as long as local politicians maintain their current level of decision making authority and (economic development-oriented) set of priorities, citizen monitoring programs will not realize their full potential for informing local decisions, even if criteria relating to data quality and legitimacy are met. This perspective suggests the possibility of alternate governance arrangements that would grant citizen groups and members of the public a greater role in

defining local priorities, policies and strategies. The importance of this theme was underestimated at the outset of the study; as a result, future investigations of citizen environmental monitoring could focus attention on the possibilities presented by more participatory governance mechanisms and structures, including both theoretical and practical models. This leads to a third, broad question for further research: *How can and should decision making power be distributed and shared between government and citizen group partners?* Based on the lessons learned in this study, it seems likely that the responses to this question would vary in communities with different political and social characteristics.

Finally, this study identified political will and public support for citizen monitoring groups as important factors affecting the use of citizen-collected data in decision making. Further research could focus on broader strategies for citizen-based organizations seeking to influence decision making by making an effort to address political priorities or public opinion. These strategies could include use of the media and other forms of public education to promote awareness and public mobilization as an indirect route to political influence. Other relevant political strategies could include finding a balance between conflict and collaboration with governments and the private sector, as well as coalition building with socially-focused organizations. Taken together, these ideas produce a final question for further research: *In addition to environmental monitoring activities, what political or educational strategies can assist citizen monitoring groups in influencing decision making?*

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Appendix A: Sample Interview Questions

Non-government: Muskoka Watershed Council

Background

1. Can you briefly describe your own role within the Muskoka Watershed Council and/or local decision making?
2. What are the Watershed Council's goals for citizen environmental monitoring?
3. Does the Watershed Council try to integrate human and environmental considerations? (If so, how? What happens if these goals conflict?)

Success factors and obstacles

4. What successes has the Watershed Council experienced with respect to citizen monitoring? (What factors contributed to, or facilitated, these successes?)
5. What failures or shortcomings has the Watershed Council experienced with respect to citizen monitoring? (What factors contributed to, or enhanced, these shortcomings?)
6. Has the work of the Watershed Council affected the outcome of any local decisions so far through citizen monitoring? (If so, how? If not, what is the potential for the Watershed Council to influence decision making through citizen monitoring?)

Data quality and legitimacy

7. In your experience, do decision makers regard information that is collected by citizen volunteers as a suitable basis for land use or other decisions?
8. What has helped or hindered efforts for local citizen monitoring initiatives to gain legitimacy in the eyes of decision makers?

Reflection

9. What do you see as an "ideal scenario" for citizen monitoring that is useful for informing decision making at the local level? (If this involves partnership, who should pay for the monitoring, decide which indicators to monitor, etc?)
10. What would need to change in order to make that ideal a reality?

Government: City of Hamilton (Vision 2020)

Background

1. Can you tell me a little about the history of Vision 2020 and your work here?

Specific

2. How do you see citizen monitoring being incorporated into Vision 2020? (How would this be coordinated?)
3. How does Vision 2020 attempt to integrate human and environmental factors? (What happens when these goals conflict?)
4. Has Vision 2020 affected the outcome of any decisions at the City level so far? (If so, how? If not, what is the potential for Vision 2020 to influence decision making?)

General

5. Can you think of other cases where CBM activities have played a role in decision making at the City?
6. What impedes the use of volunteer-collected environmental data by the City?
7. What facilitates the use of volunteer-collected environmental data by the City?
8. Do the types of monitoring currently performed by local groups meet the City's information needs?
9. How do you feel about the quality of information collected by volunteers as a basis for land use or other decisions? (Is citizen monitoring a useful complement to government monitoring?)

Reflection

10. What do you see as an "ideal scenario" for citizen monitoring that is useful for informing decision-making at the municipal level? (If this involves partnership, who should pay for monitoring, decide which indicators to monitor, etc?)