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Increasing Citizen Participation In Sustainability-Centred Environmental Assessment Follow-Up

Lessons from Citizen Monitoring, Traditional Ecological Knowledge, And Sustainable livelihood initiatives

**prepared by
Carol Hunsberger, Robert Gibson and Susan Wismer with case studies by Carol Hunsberger, Tyler Shaw and Thalia Santisteban**

**for the
Research and Development Monograph Series, 2003**

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Executive summary

Conventional arguments for increasing citizen participation in environmental decision-making activities hold that public involvement produces a locally relevant and relatively inexpensive body of information, heightened public awareness of and capacity to engage in issues of local concern, and decisions that are stronger and more acceptable. Similarly, conventional arguments for sustainability gains hold that significant decision making processes including environmental assessments should integrate short- and long-term perspectives, human and biophysical considerations, and local as well as broader knowledge. These levels of integration should occur within a framework of social equity, cultural integrity, and empowered political participation. Taken together, these arguments suggest that increased citizen participation in follow-up activities such as monitoring could help to improve the quality and local relevance of environmental assessment, while at the same time advancing the process towards sustainability goals.

The purpose of this report is to provide recommendations for strengthening environmental assessment follow-up through increased citizen participation in ways that are consistent with principles of sustainability. To this end, the report discusses the arguments raised above in relation to experiences from the areas of citizen environmental monitoring, traditional ecological knowledge, and sustainable livelihood analysis. Insights and lessons on related themes are gained through a detailed examination of three case studies: citizen environmental monitoring in Comox Valley, British Columbia; community-based monitoring in Lutsel K'e, Northwest Territories; and community lobster fisheries management in Eastport Peninsula, Newfoundland. Conclusions are presented as sets of recommendations for each of the report's target user groups: environmental assessment practitioners and project proponents, community groups, and designers of environmental assessment legislation.

The main findings are that community involvement in determining the purpose, scope and priorities of follow-up activities helps to produce results that are locally meaningful. Adopting a broad temporal, geographic and topical scope through ongoing monitoring and compliance assurance activities, watershed-based analysis, and integration of social and ecological variables leads to several benefits. Follow-up programs with these characteristics are able to track cumulative effects of multiple projects, assess changes in local quality of life, and respond to detected changes with adaptive design and management strategies. In particular, environmental assessment follow-up in many cases could benefit from adopting a focus that is broader than the effects of a single project.

Strong partnerships between and among citizen groups, government agencies and project proponents are vital to the development of follow-up strategies that engage the public meaningfully and promote protection of valued natural and social features. Some suggestions are provided on ways to coordinate and fund community environmental assessment follow-up activities involving citizen participants, government agencies, and project proponents.

This report offers new insight into public participation by examining three significant case studies,

discussing the pros and cons of different approaches, and giving recommendations for strengthening public participation in environmental assessment follow-up. As a result, the report makes a unique contribution to ongoing efforts to improve environmental assessment processes in Canada.

1. Introduction and rationale

1.1 Public participation in environmental assessment

Public participation is widely recognized as a crucial part of environmental decision making. Several international agreements, including the 2002 World Summit on Sustainable Development Implementation (Paragraph 119), the 1998 Aarhus Convention, and the 1992 Rio Declaration on Environment and Development (Principle 10), emphasize the importance of opportunities for citizens[1] 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).

A commonly cited avenue for public participation in environmental decisions involves commenting on proposals while they are undergoing environmental assessments. However, citizens can also play direct roles in the full cycle of decision making from monitoring existing conditions, through objective setting and planning for new initiatives, to monitoring results and follow-up. This report explores initiatives that involve citizens as agenda setters, resource managers, and information providers about ecological changes and local quality of life. Programs that encourage citizens to assume an active role in knowledge creation and environmental decision making are consistent with the precedent set by Beanlands and Duinker (1983) for citizen involvement in ecosystem-based assessment. Using 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 and desirable two-way exchange of knowledge between citizens and decision makers becomes possible (de Neufville 1985).

In addition to fostering decisions that are well founded and more locally acceptable, public involvement in environmental undertakings provides many further benefits, according to various analysts. The main supplementary benefits include increased public education and heightened awareness of local issues (O'Rourke & Macey 2003); capacity building, which may in turn lead to stewardship programs, enhanced partnerships or greater political participation in other areas (Bliss et al. 2001); and, in the case of monitoring activities, more data collected at a lower cost than conventional research (Au et al. 2000).

1.2 Monitoring and environmental assessment follow-up

Monitoring is a form of research or compliance assurance that involves taking repeated measurements of the same parameters in order to detect changes in those parameters over time. This process is a necessary part of environmental assessment follow-up, making it possible to assess whether predicted effects match actual effects and whether expressed commitments match actual behaviour. Effects monitoring provides mechanisms for evaluating the accuracy of predictions and provides a basis for enforcing regulations, and implementing corrective actions where environmental effects are found to exceed acceptable levels. Compliance monitoring is undertaken to ensure that project proponents meet all formal conditions and terms of agreement associated with their environmental assessment approvals.

While monitoring does not constitute the entirety of environmental assessment follow-up, it is a major prerequisite for useful applications of follow-up programs. In order to be meaningful, monitoring needs to be integrated into planning and decision-making mechanisms for adapting management or operating procedures when negative effects are detected.

Until 2003, the *Canadian Environmental Assessment Act* did not require project proponents or regulators to conduct follow-up monitoring. The Act now requires responsible authorities to design and ensure implementation of follow-up programs for developments approved through comprehensive study, mediation or review processes (CEAA 2003, s.38(2)). This increased emphasis means that monitoring programs may have to be designed and implemented where none existed before, without the benefit of additional financial resources. Community involvement can be appealing for those seeking to satisfy these requirements while minimizing the costs of follow-up activities.

1.3 Sustainability-centred environmental assessment

Canada is committed to promoting sustainability through various policy mechanisms, including the *Canadian Environmental Assessment Act*. This means adopting an integrated approach to environmental assessment that goes beyond biophysical considerations.

Numerous definitions of sustainability exist.[2] Generally, a sustainable society will be based on 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 assessment 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.

Processes as well as outcomes are important in considering how citizen involvement in environmental assessment follow-up can contribute to progress towards sustainability (Bliss et al. 2001). A major goal of monitoring is to protect environmental integrity by gathering information that can be used to make informed decisions about managing or protecting land and resources. The means by which this information is gathered and shared should also be consistent with principles of democracy and public participation in governance, as well as social and political equity. Ultimately, the application of citizen-collected data by decision makers also depends on the adoption of a precautionary approach.[3]

1.4 Purpose and objectives of the report

This report provides recommendations for strengthening citizen participation in environmental assessment consistent with the principles of sustainability identified above. Lessons from experiences from citizen monitoring, traditional ecological knowledge, and sustainable livelihoods are applied to the monitoring component of environmental assessment. Three case studies (Comox Valley, BC; Lutsel K'e, NWT; and Eastport, NF) illustrate major themes and challenges. Conclusions include recommendations for environmental assessment practitioners, in addition to considerations for policy and academic actors.

2. Review of current practice

2.1 Citizen participation in Canadian environmental assessment processes

In Canada, public participation is written into environmental assessment legislation in all provincial and federal jurisdictions (Sinclair and Diduck 2001: 126-7). This is an indication that the spirit of the legislation, at least, recognizes the importance of citizen involvement at some stages of the process. However, project proponents have been left chiefly responsible for designing and carrying out public involvement schemes. Regulatory standards for best practices do not exist (Sinclair and Diduck 2001).

Involving the public in environmental assessments has most frequently meant providing public notification about developments that are subject to assessment processes and providing an opportunity for citizens to submit comments. Public hearings in which citizens may participate are required only for assessments that are sent to review panels (Boyd 2003). In environmental assessment law, citizen involvement tends to be required only at late (operational) stages of project planning and development, rather than at earlier stages when alternatives to the project under review might be considered more seriously (Sinclair and Diduck 2001). Three other identified obstacles to citizen participation in environmental assessment are that citizens may receive less assistance from government agencies than do project proponents; that plain-language information on environmental assessment is not available in all jurisdictions; feedback to participants is not always provided (Sinclair and Diduck 2001); and, as in Alberta, that citizens may have to prove they are directly affected by a proposed development before they are allowed to participate (Boyd 2003).

Some of the recent amendments to the *Canadian Environmental Assessment Act* were intended to provide greater opportunities for public input in the screening and comprehensive study processes (CEAA 2003). While these changes could lead to an enhanced public role in some aspects of the approval process, they do not yet require direct citizen input into determining the purpose, scope or priorities of local undertakings, or of contributing knowledge to the follow-up

stage of project development. The identification of benefits and challenges of an active role for citizens throughout the environmental assessment process is a major focus of this report.

2.2 Citizen monitoring in Canada

Community-based monitoring refers to a range of activities through which concerned citizens gather and record systematic observations about ecological 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. Recently, some groups have begun to monitor a broader set of concerns in order to gauge changes in sustainability practices (Bliss et al. 2001) or quality of life (e.g. in Muskoka, Ontario[4]).

The number of active citizen monitoring groups in Canada has grown dramatically since the early 1990's. Over the same time period, governments have generally reduced their own participation in environmental monitoring activities (Savan et al. 2003). Citizen monitoring groups often struggle to secure adequate funding for their activities.

Citizen monitoring represents a form of public participation in environmental affairs. While some citizen monitoring groups focus their efforts on educational goals or local problem identification, others seek to apply their monitoring results to conservation, regulatory, policy, or even legal initiatives (Savan et al. 2003). In order to achieve these desired outcomes, citizen groups have employed a range of strategies.

Monitoring groups choose between science-based and qualitative approaches. In general, observational monitoring is used to flag problems for follow-up investigation by another body, while science-based monitoring is intended to produce assessments that can stand on their own. Standardizing methods for gathering, analyzing and reporting data increases the comparability of results across communities and regions. 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 citizen monitoring across Canada.

Citizen monitoring groups determine the scope of their activities based on local priorities. These may point to crisis-based or long-term monitoring. Crisis-based (or "hot spot") monitoring focuses attention on specific areas where a problem is suspected, often with the result of identifying point sources of pollution. This type of investigation is more likely to lead to enforcement of regulations and specific actions to correct violations (e.g. in Hamilton, Ontario[5]). By contrast, long-term ecological monitoring seeks to identify general trends over time, with the interpretation of results usually linked to non-point sources of pollution or cumulative effects of many activities. Long-term monitoring results are more often linked to planning or policy changes that respond to broad trends.

2.3 Traditional ecological knowledge and decision making

Traditional ecological knowledge (TEK) is based on indigenous peoples' experiences and beliefs about interactions between all types of beings and their surroundings, which have been passed on from generation to generation (Ho 2003). Although the long-term view and broad perspective associated with this type of knowledge give it a richness that is often missing from conventional,

science-based research and monitoring, TEK has frequently been discounted as a matter of opinion. This was demonstrated for example in past environmental assessment processes involving the Lutsel K'e First Nation (Shaw 2004 [Appendix B, "Integrating local and conventional knowledge"]).

Traditional ecological knowledge has recently assumed a more prominent role in environmental decision-making initiatives led by Canadian governments. For example, the Government of the Northwest Territories has introduced legislation requiring that TEK be fully and equally considered in environmental research or decisions affecting aboriginal communities. With specific reference to environmental assessment, the *Mackenzie Valley Resource Management Act* requires that TEK be included in environmental impact assessments in one region of Canada's north (see Appendix B for further details).

Federally, the amended *Canadian Environmental Assessment Act* (s.16.1) allows consideration of local and aboriginal traditional knowledge in environmental assessment processes; however, such consideration is not firmly required. Further, incorporating these types of knowledge into environmental assessments is seen as a means of increasing public participation, rather than of improving the calibre of environmental assessment (CEAA 2003).

Traditional ecological knowledge is important from a sustainability perspective because, in addition to providing valuable information about relationships between human and non-human activities, it fosters cultural integrity. Valuing TEK helps to sustain a worldview that is distinct from, though often also complementary to, scientific ways of understanding the world.

2.4 Sustainable livelihood initiatives

Sustainable livelihood concepts present an inclusive model for integrating social and ecological considerations. Sustainable livelihoods focus on planning by community members and analysis of individual, household, and community assets, activities, and access to resources.

Livelihood analysis provides one framework for examining relationships between social and ecological well being and evaluating scenario choices based on these relationships at the community level (Wismer 2000). Three mutually supportive sets of social activities form the basis for quality of life as determined by livelihood analysis: traded work, subsistence, and community support. Traded work consists of "jobs," meaning any activities that generate financial income or barter transactions. Subsistence activities are those that provide support to family or community members through the provision of goods or services, including child care, gardening, and activities that maintain a home. Community support consists of "volunteer work" including political, cultural, resource management, and religious activities (Wismer 2000).

Sustainable livelihoods are achieved by balancing activities in these three areas while working towards equity and dignity, and avoiding or correcting environmental damage. Sustainable livelihoods are therefore "economically viable, socially just and environmentally wise." The availability of ecological resources, both in abundance and accessibility, is important to all three livelihood areas. Biophysical changes that diminish the pool of available resources, as well as social decisions that restrict who is able to access them, can thus have major adverse effects on the stability and sustainability of livelihoods. For this reason, social and ecological considerations in livelihood analysis are closely intertwined (Wismer 2000).

Sustainable livelihood analysis and related programs have been applied in many parts of the

developing world (UNDP 1999). In Canada, community members have been involved in developing and evaluating strategies for sustainable livelihoods[6] Livelihood analysis is highly relevant to discussions of community participation in ecological and social assessment and resource management, and can provide ideas for strengthening citizen participation in environmental assessment follow-up.

3. Case studies

The three case studies included here were chosen to provide lessons for environmental assessment follow-up from experience in the areas of citizen monitoring, traditional ecological knowledge, and sustainable livelihoods. These cases are described in detail in Appendices A, B and C. This section presents the process by which case studies were chosen, including an explanation of its relevance to citizen participation in environmental assessment follow-up. Information was gathered through primary, interview-based research in Comox Valley, and secondary research of existing publications for Lutsel K'e and Eastport.

3.1 Criteria and methodology for selection of cases

Potential cases were identified through literature surveys, Internet searches, and contact by e-mail or telephone. Out of ten possible cases that were identified, three were selected based on how closely they matched the following criteria:

- practical experience in the application of citizen monitoring and ecosystem approaches;
- initiatives that demonstrate particular integration of human and ecological concerns;
- representation of environmental assessment-related experience at different levels of government (federal, provincial, territorial, aboriginal, regional/municipal);
- regional diversity; and
- working examples from three fields of experience (citizen monitoring, traditional ecological knowledge, and sustainable livelihoods)..

The three cases evaluated here - Comox Valley, Lutsel K'e, and Eastport Peninsula - collectively meet these criteria.

3.2 Citizen monitoring in Comox Valley, BC (Appendix A)

Citizen monitoring initiatives in Comox Valley, British Columbia, have informed environmental planning and management decisions in numerous ways. For example, through a process of public engagement and partnership with four levels of government, the Millard/Piercy Watershed Stewards developed a watershed management plan in 2001 that is based on information collected by volunteers. Also in the Comox Valley, water quality testing by volunteers identified a problem with sewage cross-connections that threatened shellfish production in Baynes Sound. The City of Courtenay and Town of Comox subsequently conducted their own investigations and made substantial financial investments to correct these infrastructure problems. Finally, mapping work by Project Watershed, a non-profit organization that originally based its work on volunteer efforts and now employs professional technicians, has provided information used to address zoning and development permit issues through a Sensitive Habitat Atlas used at the Regional District level.

These citizen monitoring and mapping efforts represent a clear example of the intentions and impacts of citizen science in the Comox Valley. The Comox Valley experience is instructive for the extent of its public engagement in, and commitment to, a coherent but broad set of local environmental considerations. Several conclusions from the Comox Valley initiatives are relevant to environmental assessment follow-up. These are grouped into two categories: the factors that facilitate, and those that impede, application of citizen monitoring outcomes in decision-making processes.

The credibility and usability of science-based citizen monitoring results in Comox Valley were positively affected by

- using approved protocols,
- forming active partnerships with governments at early stages of program development,
- establishing a reputation for accuracy and volunteer training over time,
- having a paid coordinator to oversee volunteer monitors, and
- establishing a clear purpose before designing a monitoring program.

Barriers or ongoing challenges to citizen monitoring in Comox Valley include

- government perceptions that citizen groups are biased towards conservation objectives,
- citizen perceptions that governments are biased towards economic development objectives,
- securing stable, long-term funding for monitoring and mapping initiatives,
- maintaining communication between government and non-government partners, and
- implementing recommendations based on citizen monitoring that is conducted at a watershed level when more than one political jurisdiction has authority within that watershed.

3.3 Traditional ecological knowledge in Lutsel K'e, NWT (Appendix B)

Mineral development in Canada's north has raised many issues of concern to First Nations communities whose traditional territories are potentially affected by resulting ecological change. In the Slave Geological Province, the proposed opening of the first diamond mine in the traditional territory of the Lutsel K'e First Nation sparked a desire to address environmental concerns. In 2002, the Nihat'ni monitoring program was launched to collect information on indicators that "describe fundamental aspects of the community's way of life and how it is changing" (LKDFN 2002, i). The program is designed so that community members gather and validate information in culturally meaningful ways, largely through the use of traditional ecological knowledge (TEK). One early success of the Nihat'ni program was the use of community monitoring results to negotiate measures for lessening the impact of mining roads on caribou herds.

The Lutsel K'e case illustrates several themes of importance to environmental assessment. First, the Nihat'ni program relies on TEK as its principal form of information, and evaluates the significance of monitoring results within the cultural context of TEK. Participants in the program gather information while engaged in traditional land use activities. For example, hunters make observations about fat deposits, bone marrow and fetal development in harvested caribou. Discussions among local elders and comparisons with historical observations lead to conclusions about caribou health. Rather than considering TEK as a form of public participation or a supplement to conventional scientific studies, the Lutsel K'e program is designed to collect and interpret information in a way that is locally determined and locally meaningful. Second, the program fully integrates social and biophysical considerations, with its indicators contributing to an overall understanding of quality of life. In an early stage of program development, it emerged that community members "could not meaningfully separate social effects from other cultural, economic, spiritual and environmental issues" (Shaw 2004). Finally, the Nihat'ni program addresses cumulative effects, with a scope that is geographically based on landscapes (due to the large traditional territory of the Lutsel K'e First Nation) and temporally long-term.

Four features of the Nihat'ni program are especially important in encouraging citizen involvement in environmental assessment follow-up:

- the use of tools including a searchable digital database, maps, and supportive multimedia;
- the use of locally selected indicator species that were chosen to match local expertise and priorities;
- data interpretation within a First Nations cultural context before the release of data for non-local use; and
- cultural benefits from considering traditional ecological knowledge within its own cultural context and worldview.

Findings of the Nihat'ni program also indicate areas needing improvement:

- Policy and legislation measures that are designed to integrate TEK into environmental assessment and monitoring are not currently accompanied by a means of doing so

effectively. An appropriate and practical framework for incorporating TEK into environmental assessment processes should be developed.

- The dominance of conventional scientific knowledge in environmental assessment hampers the empowerment of TEK holders. This dominance is reinforced through non-local research funding that requires results to be presented in ways that satisfy conventional scientific criteria.

3.4 Lobster management in Eastport Peninsula, Newfoundland (Appendix C)

Since 1992, the lobster fishery in Newfoundland has faced increased pressure due to fishers' loss of revenue from the closure of the cod fishery. In response to new concerns about over-harvesting of the lobster fishery, in 1995 a community program was launched in Eastport, Newfoundland to protect and enhance the local lobster fishery. Fishers agreed to a system that restricted their harvesting to traditional fishing areas in exchange for an agreement that outside fishers would not have access to these areas. A program of releasing egg-bearing female lobsters and notching their tails so that they could continue to be identified and released was introduced. Together with an agreement to release undersize lobsters, this has helped to restore the lobster population. As well, two areas (Round Island and Duck Island) have been declared marine protected areas and closed to all lobster fishing, with the result that after three fishing seasons, lobster size was significantly greater inside the two closed areas than outside them. As well, lobster density and proportion of egg-bearing females were significantly greater in one of the closed areas than in surrounding habitat open to harvesting (Rowe 2001).

Sustainable livelihood approaches are relevant here because of the direct relationships between fishers' access to lobster as a resource, the community's economic stability, and the protection of the lobster stocks. Community involvement is a key feature of the development and implementation of the Eastport lobster fishery's protection measures, with community members actively involved in education programs about the fishery, such as involving students from a local school in analyzing monitoring data. Citizens also help to apply the conservation plan through a system of peer enforcement. Scientific methods have been introduced into the local knowledge base in order to enhance benefits from both quantitative and qualitative information gathered by local people.

Conclusions from the Eastport Peninsula program that are encouraging for citizen participation in environmental assessment follow-up include the following:

- Economic incentives helped to motivate community members to follow the new restricted harvesting guidelines. For example, undersized lobsters can increase in value by 50 percent through growth if left for a single extra year.
- Maps and monitoring protocols were important tools used for monitoring lobster stocks.
- Local knowledge about relationships between marine species, oceanography and human activities has been applied as a useful complement to scientific research.
- Community-based fisheries management ensures that fishing families participate in decision making about resource use, thus helping to preserve their own livelihoods.

- A long-term perspective on resource management with attention to social as well as biophysical features is important to the well being of resource dependent communities.

Two aspects of the Eastport program point to possibilities for improvement:

- Anticipatory monitoring of lobster stocks in the no-take zones (i.e. before they were closed to harvesting) would have allowed for more meaningful interpretation of lobster stock assessments conducted after their closure.
- Adequate funding is necessary to ensure the success of community-based conservation initiatives. This could come, at least in part, from local users.

4. Discussion of case study themes

Common patterns emerging from analysis of the case studies have important implications for public participation in environmental assessment follow-up (see Table 1). In all case study communities, "citizen scientists" collecting information for the purpose of informing local policies or practices have faced challenges to their credibility and rigour. At the same time, the cases offer encouraging examples of situations in which local knowledge has been successfully integrated with more conventional research conducted by outside experts in science.

The theme of integration is also apparent in the scope of citizen monitoring and assessment activities across the cases. All set broad boundaries around their activities in time frames, geographic reach, and topics for investigation, thus allowing for more effective inclusion of cumulative effects and social-biophysical interactions. Power relations between citizen participants and conventional decision makers are key factors in determining the potential for meaningful participation in environmental monitoring and knowledge creation. Above and beyond their locally stated aims, monitoring and assessment activities in the case communities contribute to broader societal goals as expressed in the sustainability principles guiding this research (see section 1.3), as evidenced in a range of positive outcomes including enhancement of stewardship (Comox Valley), citizenship (Eastport), and cultural integrity (Lutsel K'e).

4.1 Credibility of citizen-collected information

Each of the case studies illustrates challenges related to the perceived credibility of participation

of citizen scientists in environmental assessment and management. In Comox Valley, both government and citizen interviewees suggested that efforts to establish legitimacy through the use of scientific methods, volunteer training and quality assurance/quality control measures have been undermined to some extent by government suspicions that individual volunteers or citizen groups are susceptible to bias, or are trying to advance an agenda that privileges conservation over development and/or immediate economic gains.

In response, citizen groups in Comox Valley have attempted to increase the usability of their data by adapting and following recognized protocols. At times, however, citizens in all case communities still face the assumption that information gathered and presented by local people represents "special interest" rather than public interest. On the other side of things, citizens involved in this type of work reported to us that they harbour their own suspicions that their governments favour economic growth and urban expansion over the protection of habitat and resources, thereby acting on "special interests" of another kind (Hunsberger 2004).

The Lutsel K'e case details a situation in which local assessments of ecosystem trends face an even deeper stigma: the idea that research conducted through a culturally based system of knowledge entirely lacks rigour and replicability, and is therefore subordinate to scientific knowledge (see Appendix B). This view is especially damaging given that environmental assessments tend to be dominated by the drive for information collected using conventional scientific methods. Although there is growing recognition of traditional ecological knowledge as an important way of understanding environmental change, equal recognition for TEK and outside expertise is still a long way off (Shaw 2004).

In Eastport, efforts to protect and regenerate the lobster fishery through local knowledge, cooperation and peer enforcement represent a departure from conventional fisheries management, which relies heavily on expert-led assessment and largely discounts community involvement (see Appendix C). Only recently has fishers' understanding of ecological relationships been recognized as an important element of stock assessment. Previously such traditional knowledge was totally excluded from management models. The community fisheries management scheme currently used for lobster in Eastport represents an innovative and successful approach to integrating information contributed by local harvesters and fisheries scientists (Santisteban 2004).

Barriers to the acceptance of environmental knowledge gathered by citizens can thus include differences in worldviews, doubts about the scientific validity of local knowledge or monitoring results, and suspicion that those citizens who engage in environmental monitoring or assessment activities are pursuing a particular agenda related to ecological preservation. This last argument is of particular interest to this research, given that project proponents have an economic interest in maximizing the scale of their projects and minimizing their spending on environmental protection measures, and have traditionally been the ones charged with nearly all of the responsibility for evaluating and reporting the environmental effects of their activities. Inevitably, their perspective will be affected by their priority interests. This research suggests that citizens trying to promote public interest, local livelihoods, or cultural traditions through their participation in environmental assessment activities, however they interpret these concepts, can only help to diversify the perspectives and values guiding the process, achieving a richer research product and a base for better decisions.

4.2 Integrating local and conventional knowledge

The three case studies illustrate different forms of reluctance to accept local knowledge or

monitoring results as a legitimate basis for environmental regulations or management decisions. However, they also offer some encouraging signs that local knowledge can be integrated meaningfully with conventional, expert-led scientific research findings. This section focuses on positive steps in this regard that emerged from the case studies, and strategies have apparently facilitated these successes.

In Comox Valley, citizens have made both quantitative and qualitative contributions to the environmental knowledge base. Citizen science has accounted for the bulk of local knowledge contributions, with some anecdotal information also serving to complement monitoring and mapping data. This approach represents an attempt to gain scientific legitimacy through the use of protocols, while still valuing narratives for their ability to offer nuance and richness of understanding. While both citizen monitoring coordinators and decision makers in Comox Valley have expressed some discomfort with the other's perceived agenda, these groups have been able to work together successfully. From this case, it appears that fostering strong working partnerships between citizen groups and government agencies from the earliest stages of program design and implementation is key to overcoming potential conflict or suspicion. In Comox Valley, such partnerships achieved success through advisory bodies that included both citizen participants and technical advisors, such as the round table guiding the Baynes Sound Stewardship Action Group, and the advisory committee for the Millard/Piercy Watershed Management Plan.

In Lutsel K'e, integrating local and conventional forms of knowledge has been less a process of meshing local and scientific perspectives than one of respecting and encouraging local definitions regarding what constitutes value and significance. Rather than following an imposed scientific system of inquiry, participants in the Nihat'ni monitoring program gather information while they are engaged in traditional land use activities. Results are interpreted within a traditional ecological knowledge framework before they are released for non-local use, though use of advanced GIS techniques is also involved. In an attempt to lessen the gaps in understanding between TEK holders and scientists, non-local researchers are invited to learn about TEK from local researchers, and to confer with them on matters of data interpretation that may be outside the scope of local experience, such as effects from large-scale mining operations (Shaw 2004).

In Eastport, scientific methods have been integrated into the local knowledge base, as opposed to trying to fit local knowledge into an existing scientific framework. As a result, community members have provided both quantitative and qualitative information to a body of knowledge that is used to determine local fisheries management practices.

4.3 Scope

The three cases discussed here exhibit a scope of inquiry that is broader than that of conventional monitoring and assessment activities on three levels. These initiatives tend to be temporally long-term, spatially based on relatively large geographic units, and topically diverse, integrating social and biophysical parameters.

Temporal scope

The case studies all illustrate a life-cycle approach to monitoring with the goals of both establishing pre-development conditions and measuring the long-term effects of development. The Comox Valley and Lutsel K'e initiatives in particular show a commitment to anticipatory monitoring. Gathering baseline information before development is undertaken allows for

comparisons to be made and trends to be established as projects proceed. In addition to making it possible to evaluate the effects of development and establish causal relationships, this type of monitoring can also help to reveal whether further development is appropriate. For example, by comparing the proportion of land covered by impervious surfaces in the watershed with known thresholds for maintaining viable salmon habitat, citizen monitoring initiatives in Comox Valley have provided an argument for placing a cap on future urban development in order to protect this valued resource.

As well, all cases involve ongoing monitoring with an eye towards detecting cumulative effects. The Nihat'ni monitoring program relies on knowledge that has been accumulated over many generations in order to detect and interpret trends in ecological relationships. This long-term view is helpful in determining the significance of observed changes within the context of historical fluctuations.

The Eastport example connects ongoing monitoring to iterative policy formation through adaptive management. New local guidelines for fisheries practice are largely determined by improvements or declines in the lobster population as detected by monitoring. An understanding of cause-and-effect relationships between changes in fisheries practices and changes in the viability of the lobster population is being established through long-term, ongoing monitoring.

A temporal scope for monitoring activities that is both anticipatory and long-term can therefore provide many benefits. Among these are opportunities to prioritize scenario choices before development occurs, to detect cumulative effects of multiple stresses over time, to interpret the significance of changes within a historical context, and to adapt management strategies based on monitoring outcomes.

Geographic scope

All cases use watersheds, landscapes, or traditional territories as their units of analysis. In this way, it becomes possible to track the cumulative effects of multiple, separate ecosystem stresses that are distributed in space. However, adopting an approach to problem detection and solving that is based on geographic, rather than political, boundaries can present challenges of its own.

In Comox Valley, citizen monitoring has been conducted on a watershed basis. This has allowed for more effective and comprehensive efforts to protect natural features than a piecemeal program based on only one municipality would allow. While the benefits of watershed-level activities are many, difficulties related to inter-jurisdictional division of responsibilities can also be seen through two examples in Comox Valley. First, where watershed-based monitoring through the Baynes Sound Stewardship Action Group revealed the need for sewer infrastructure corrections, the City of Courtenay and the Town of Comox needed to go through separate processes to purchase equipment and approve the repairs, even though the two municipalities are side by side and their effluent flows into the same water body. Second, the Millard/Piercy Watershed Management Plan has made policy and planning recommendations that apply to both the City of Courtenay and the Regional District of Comox-Strathcona. In order to turn these recommendations into reality, two different administrative bodies need to go through the necessary processes of debate and approval to amend their official documents.

In Lutsel K'e and Eastport, the geographic scope for monitoring activities is based on a combination of ecologically and socially recognized boundaries. The Nihat'ni monitoring program encompasses the traditional territory for Lutsel K'e, an area large enough to be considered landscape scale. In Eastport, areas for protection and management of the lobster fishery are

based on ecological considerations (areas of high-quality lobster habitat) and traditional rights to fishing grounds. In both of these cases, management strategies can be applied to areas that make sense in both human and ecosystem terms.

Topical scope

Integration of human and biophysical variables is a central feature of sustainability-based environmental assessment. The cases examined here all include attempts to consider social and ecological well being through local monitoring and knowledge creation. The connections between these considerations may be direct, as in the case of economic reliance on a particular resource, or indirect, as in a multi-variable measure of ecosystem health or quality of life.

When it comes to shellfish in Baynes Sound, lobster in Eastport, and caribou in Lutsel K'e, people's livelihoods are intimately linked to the protection of a particular ecosystem component. When that natural feature is threatened by pollution, over-harvesting or land use change, people stand to lose their principal means of meeting their material needs. Citizen groups that have initiated monitoring or assessment efforts in these communities have understandably focused their attention on tracking changes related to these valued ecosystem components, as well as the ecological conditions on which they depend.

Links between human and biophysical factors can be seen another way through holistic approaches that measure progress towards a goal such as overall quality of life. The Lutsel K'e initiative illustrates a deeper dependence on ecosystem integrity for maintaining not just material, but also cultural needs. By refusing to separate ecological and social well being, communities that choose to follow a holistic approach in their monitoring programs find ways of acknowledging relationships between human and non-human systems that may be overlooked in narrower environmental assessments.

4.4 Power

Through citizen monitoring efforts in Comox Valley, citizens are empowered to the extent that they have pushed local governments to enforce or modify existing bylaws. They have also worked collaboratively with government actors, gaining enough confidence over time to assign them specific tasks related to watershed protection. However, the existing programs have not led to any significant shifts in the allocation of power. Politicians are still the ones who make decisions, informed though they may be by citizen-led monitoring results and planning recommendations.

Power issues are paramount in Lutsel K'e. Intercultural conflict over land, resources and political self-determination since the time of European contact has made local people reluctant to trust non-locals on issues of governance or industrial development. The marginalization of First Nations cultures and ways of knowing has continued through research projects that draw their conclusions based only on determinations of significance that are drawn from conventional science. The Nihat'ni program is significant in that it relies on the autonomous legitimacy of cultural values and traditional practices in order to assign meaning to the program's monitoring results and associated recommendations.

Community resource management in Eastport empowers fishers through a system of rights and responsibilities. Attaching a sense of ownership - and stewardship - to fishing areas by restricting access to only a designated few harvesters provides an incentive to protect the resource,

allowing the lobster population to grow and mature for future harvests. In addition to giving citizens effective authority to manage their own resources, the Eastport example also shows the fishing community being empowered by their knowledge of ecological changes in the area. Decisions made at local level about future management strategies are based on local evaluations of the success or failure of past initiatives. While external agencies are still very much involved in the Eastport program, the relative importance of local knowledge, opinions and participation has increased dramatically since the shift to community management of the fishery began.

4.5 Contributions to society

One conclusion of this research is that citizen involvement in local monitoring and assessment initiatives helps to build an enhanced social and ecological knowledge base, and it can also contribute to broader societal goals such as cultural preservation, stewardship programs, and a sustainability ethic. Interviewees in Comox Valley suggested that hands-on experience through environmental monitoring, assessment or management activities can enable people to realize and value their relationships with natural spaces and processes, as well as to consider how they situate themselves within their social and political surroundings.

In Comox Valley, citizen involvement in monitoring programs led to a landowner contact program and subsequent project-level successes in improving agricultural practices. As well, educational programs on water quality concerns that were articulated through citizen monitoring have resulted in increased public awareness of key issues and individual actions for change. Efforts such as these have also fostered an environmental ethic in a resource-rich area, based on people's understanding of their connection to natural features and their enjoyment of related aesthetic and recreational opportunities.

In addition to assessing changes in local quality of life, the Nihat'ni monitoring program contributes to First Nations' cultural preservation. The program is set up to value information gathered while people are involved in traditional practices and land uses in Lutsel K'e, thus providing an incentive to continue these activities. The program also contributes to the passing of traditional knowledge, and respect for that knowledge, from elders to younger members of the community. Finally, it leads to political empowerment through increased community influence over the benefits and mitigation measures of local industrial development.

Broad societal goals have also been approached through community fisheries management on the Eastport Peninsula. Cooperative relationships have been established between fishers and scientists, with local involvement contributing to greater public understanding and acceptance of conservation strategies. Educational initiatives connecting ecosystem and livelihood considerations have promoted a stewardship role among Eastport lobster fishers. As well, by protecting and nurturing lobster stocks, the community works to secure the longevity of a local culture that is tied to fishing as not just an economic strategy, but also a way of life.

Table 1: Summary of case study activities and themes

	Comox Valley, BC	Lutsel K'e, NWT	Eastport, NF

Type of initiative	• Citizen monitoring • Citizen science	• Community monitoring • Traditional ecological knowledge (TEK)	• Community resource management • Sustainable livelihoods
Valued features	• Shellfish production • Salmon habitat • Watershed health	• Overall quality of life • Traditional values, practices, knowledge	• Lobster fishery
Threats to valued features	• Water pollution • Increased urban development	• Mineral development • Dominance of scientific worldview	• Over-harvesting
Tools for protection	• Monitoring, mapping • Watershed planning • Regulatory measures • Infrastructure corrections	• Monitoring, mapping • Local interpretation, application of results • EA agreements for industrial practices	• Research, monitoring • Marine protected areas • Harvesting restrictions • Peer enforcement
Temporal scope	• Anticipatory, ongoing	• Ongoing, cumulative	• Ongoing
Geographic scope	• Watershed	• Landscape (traditional territory)	• Traditional harvesting areas
Topical scope	• Biophysical, with some economic elements	• Holistic: overall quality of life	• Biophysical, livelihood changes inseparable

Credibility issues	• Credibility increases with protocols, partnerships, training • Decreases with perceived agenda/bias • Largely scientific approaches	• TEK increasingly considered in EA • Scepticism re. scientific "value" of TEK (different worldview) • Data interpretation is culture-specific	• Community involvement, knowledge previously excluded from fisheries management • More inclusive approaches now sought
Integration of local, conventional knowledge	• Citizens make quantitative, qualitative contributions • Must choose purpose, protocols to meet goals, information needs	• Barrier: TEK stigmatized as "opinion" • Response: locals train interested non-locals in TEK methods, interpretation	• Scientific methods introduced into local knowledge base • Fishers contribute quantitative and qualitative information
Power	• Citizens empowered to push local governments to enforce or modify existing bylaws • No major power shifts	• Historically, TEK marginalized by non-local program guidance • Nihat'ni program based on local significance of TEK	• Fishers empowered to manage resource • Knowledge as power • Decisions based on local determinations of success or failure

Benefits to society	• Stewardship projects • Relationship building • Environmental ethic • Fosters citizenship that includes environmental citizenship	• Cultural interests, worldview, local land uses protected • Informs non-aboriginal settings - local knowledge in EA	• Stewardship ethic • Cooperation between harvesters and scientists • Local involvement increases acceptance of conservation strategies

5. Recommendations for environmental assessment practitioners

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5.1 Agenda

It is important for community members to play a role in determining the purpose, scope, and priorities of environmental assessment follow-up activities. As noted in the Comox Valley case, setting the agenda for environmental decisions can enhance government and citizen perceptions that they are working towards a common, mutually acceptable goal if the process involves collaboration between citizen groups, governments, academics and industrial representatives. What emerges from this research is a sense of the importance of the context and unique characteristics of each place where developments with potential effects on the environment are proposed. Because the community-defined priorities and strategies varied greatly from place to place, a "one size fits all" approach to citizen involvement clearly would not have led to acceptable results in Comox Valley, Lutsel K'e and the Eastport Peninsula. Broadening this insight gained from the case studies to a wider range of communities, it would be undesirable to apply a national or provincial strategy for meeting local needs through environmental assessment processes when the valued ecosystem and social features in each community are place-specific.

Keeping in mind the importance of unique community values and characteristics, it is possible to make some general recommendations based on this research:

- *The agenda for environmental assessment generally should integrate monitoring into all stages of the process, from anticipating effects to post-project compliance and effects monitoring.*
- *Follow-up activities should include monitoring that can be connected to adaptive design and management (i.e. actions to ensure flexibility and to identify and correct unanticipated or excessive effects).*
- *The scope should be based on ongoing time frames, ecological units (e.g. watersheds), and an integrated view of human and ecological considerations.*
- *Priorities should be designated according to locally valued ecosystem features.*
- *Provisions for project-specific environmental assessment follow-up monitoring should be integrated into the broader agendas of citizen-based monitoring of watersheds, landscapes or other areas in which the cumulative effects of multiple activities can be recognized and addressed.*

5.2 Tools

Several already available tools exist that can help to promote the success of public participation in environmental assessment follow-up activities, including monitoring. This section discusses tools that facilitate monitoring and interpretation of results at the community level. A second type of tools, those that facilitate the application of findings, will be examined in section 5.4.

Various tools can facilitate monitoring and interpretation activities that involve community members using both science-and non-science-based strategies. These can be applied to the stages of obtaining, sharing, comparing and keeping track of information.

As demonstrated through the work of the Millard/Piercy Watershed Stewards and Project Watershed Society in Comox Valley (Appendix A), volunteer efforts to collect reliable information are greatly aided by the use of protocols developed by recognized agencies or organizations. Standardization is important for increasing the respectability, applicability and comparability of protocols, but it is also important to realize that protocols may need to be adapted to suit local conditions and priorities. Several government agencies have taken up the challenge of preparing standardized and relatively simple protocols that cover a wide range of chemical and ecological monitoring parameters[7] . Governments have also provided valuable training and technical advice to citizen groups, particularly through round tables or advisory committees as seen in Comox Valley (Appendix A) and Eastport (Appendix C). Thresholds and indices developed through academic or government research can assist with interpreting and determining the significance of monitoring results. Such guidance has been crucial to ongoing evaluation and modification of community lobster management initiatives in Eastport (Appendix C).

For monitoring activities that follow a non-scientific approach (e.g. using traditional or local ecological knowledge), the participating community should develop criteria for determining significance that are consistent with cultural values and practices. Recognition for local and culturally appropriate definitions of significance is an important feature of the Nihat'ni community monitoring program in Lutsel K'e in that it leads to recommendations based on monitoring outcomes that are consistent with local values and a non-Western worldview (Appendix B).

Both science- and non-science-based information gathering can benefit from maps that have been ground tested for accuracy. In some instances, citizen mapping initiatives have proven to be equal or superior in quality to those performed by external experts. For example, on Galiano Island, British Columbia, local citizens found many inaccuracies within a land-use classification exercise that had been produced by scientists and air photo interpreters who did not conduct any field visits to any of the sites under study. (Holden 2000: 293). In this case, community knowledge served as an important check on government-collected and interpreted data.

Community monitoring activities conducted within a traditional ecological knowledge framework can be enriched through the inclusion of multimedia such as photographs, audio and video footage. In Lutsel K'e, these supplementary materials have helped to communicate to non-local stakeholders the context in which the information was collected (Shaw 2004 OR Appendix B, "Tools"). In a non-aboriginal setting where differences in worldviews between the citizen participants and other stakeholders are less significant, narrative information about local land use history can still be a valuable supplement to monitoring data, as shown through Project Watershed's mapping work in Comox Valley (Appendix A).

Finally, much improved data storage and communication are made possible through searchable digital databases. User-friendly databases have revealed relationships between natural features and human activities and supported the development of community atlases in Comox Valley (Appendix A) and Lutsel K'e (Appendix B). Online information clearinghouses, if well coordinated and managed, can make monitoring information widely, though not universally, accessible.

Recommendations about tools derived from this research can be summarized as follows:

- *Provincial and federal government agencies should continue to develop standardized protocols that include thresholds and indices for data interpretation on a range of parameters that are broadly relevant to assessing and monitoring community environmental health.*
- *In recognition of the unique nature of each community, increased provisions should be made for adapting protocols to meet local needs.*
- *Where standardized or adapted methods for interpreting monitoring results are considered by the community to be culturally inappropriate, communities should develop locally and culturally acceptable criteria for determining significance in monitoring. Resources and opportunities for this are needed.*
- *Maps on a scale that is useful for discussions about community-level land uses and effects should be generated by government agencies and ground tested for accuracy by citizens.*
- *Community monitoring data should be compiled into searchable digital databases. Where desired, these should include supporting multimedia and narrative information about the area.*

5.3 Resources

Long-term, stable funding is critical to the success of environmental assessment follow-up

activities. As discussed in section 3.2, NGO and government representatives in Comox Valley stressed the importance of having a paid coordinator to facilitate volunteer involvement in monitoring activities. Organizations that initiate community monitoring or research programs face the challenge of securing ongoing funding, often from government grants or foundation sources. As program coordinators in Comox Valley observed, these available funds tend to be short-term and directed at new projects that are small enough to completed within one or two years. Unfortunately, monitoring programs are multi-year, ongoing initiatives that produce the same kind of deliverable year after year. Their need for longer-term funding is unavoidable (Pollock et al. 2003).

While funding for community monitoring programs is often ephemeral, it can also come with concerns that funding organizations attach certain expectations to their support. This is of particular concern in First Nations communities such as Lutsel K'e, where the scientific methods and evaluation criteria of research programs led by non-locals have at times conflicted with aboriginal worldviews and undermined the value of locally meaningful ecological knowledge. If aboriginal organizations had adequate funding from sources without these expectations, it would be possible to run these programs without facing pressure to conform to non-local research agendas. Given that financial allocations are value-based, neutral funding may be as difficult to come by as neutral information. Intervenor funding offers one possible avenue for strengthening community monitoring programs that are culturally appropriate in First Nations communities.

For non-aboriginal settings, several funding models for citizen monitoring and management activities are suggested through the case studies. These include restructuring the local tax base, soliciting voluntary contributions, charging project proponents for a portion of community monitoring efforts, and (as in the case of the lobster fishery) moving to a user-pay system. A particularly ambitious idea, also discussed in section 5.3, is to establish a system for funding community-based monitoring and stewardship centres across the country, funded through multiple levels of government and coordinated through partnerships among local organizations.

This idea raises a fundamental question about the most appropriate funding model for environmental assessment follow-up: should follow-up activities be funded on a project-by-project basis, or should a system be developed that supports geographically and temporally broader monitoring initiatives? It is argued here that the benefits of broadening the scope of follow-up activities outweigh the logistical challenges associated with doing so. As discussed in section 4.3, our research suggests that locally directed environmental assessment follow-up activities with the latitude to set their own boundaries will be better able to examine the cumulative and interactive effects of many developments on ecosystem health and quality of life than follow-up programs limited to examining only one development at a time.

Recommendations about resources derived from this research are summarized as follows:

- *Long-term, stable funding is important to the success of environmental research and monitoring initiatives involving citizens in order to support consistent activities and a paid program coordinator.*
- *Funding for such programs should come without expectations that citizen monitoring efforts will be consistent with a non-local agenda, particularly in First Nations communities.*
- *Intervenor funding should be examined as a potential source of funds for environmental assessment-related community monitoring programs that are consistent with local values and culture.*

- *Other funding models should be considered, including a combination of local tax reallocation and support from project proponents.*

5.4 Application of findings

Monitoring efforts in locally informed environmental assessment follow-up activities are of limited value without effective tools for decision makers and practitioners to act on the findings. Some such tools are provided through the terms and conditions of the approvals of assessed projects, but other important options are also generally available.

The programs detailed in the case studies demonstrate some measure of success at incorporating citizen-collected information into planning, management, regulatory, enforcement, and evaluation mechanisms at the local level. Planning applications include preparation of watershed management planning documents and policies to protect sensitive areas. Resource management mechanisms include fisheries closures and changes to local harvesting strategies. Regulatory measures include use of development permit systems and restrictions on resource extraction activities. Enforcement applications include peer enforcement systems for local management schemes, as well as round tables where citizens report their findings to multi-stakeholder groups that include both polluters and regulators. Local information can also be used to evaluate the outcomes of changes in any of these areas.

In order for monitoring findings to be applied successfully, results must be reported in a timely fashion. Matching the time frames of locally conducted research with decision making schedules has proven to be a challenge to date. This has been the case in Comox Valley, where official plans have not yet been updated to include recommendations from the Millard/Piercy Watershed Management Plan (see Appendix A).

A recommendation about applying findings derived from this research is:

- *Environmental assessment practitioners, citizen groups and decision makers should be aware of and, make appropriate use of planning, resource management, regulatory, and enforcement mechanisms based on locally informed environmental assessment follow-up activities.*

5.5 Roles and tasks

This section presents the above recommendations in terms of roles and tasks for particular target users of this report: Non-government ("citizen") organizations, government agencies, and project proponents. Recommended roles and tasks for these groups are summarized in Table 2.

Non-government organizations and citizen participants are currently the driving force behind many community environmental monitoring and management activities. In all three case studies, citizen groups and community members have assumed responsibility for training volunteers, gathering data, interpreting results, and producing management plans. Apparent successes at managing these activities can be observed through the Comox Valley, Lutsel K'e, and Eastport experiences (see Appendices A, B and C). If stable funding and productive, mutually trusting relationships between citizen groups, governments and project proponents can be established,

then environmental assessment follow-up will be stronger for involving citizens in these roles.

Governments at multiple levels can help to strengthen citizen involvement in environmental assessment follow-up by developing protocols and analysis tools (including thresholds and indices) that are adaptable to meet local needs. Government coordination, housing and sharing of citizen-collected data would also be tremendously beneficial to community monitoring, assessment and management activities, at regional, provincial or federal levels.

Project proponents have a role in ensuring that environmental assessment follow-up is sufficient to detect adverse environmental effects stemming from their activities, and a responsibility to adapt their practices to mitigate these effects (and enhance positive effects). Proponents work to maintain open, honest and responsive relationships with citizens and governments so that follow-up activities can be connected to adaptive design and management.

Table 2: Recommendations for practitioner target groups

Recommendation	**Target user**	**Report section**
The agenda for environmental assessment generally should integrate monitoring into all stages of the process, from anticipating effects to post-project compliance and effects monitoring.	All	5.1 Agenda
Follow-up activities should include monitoring that can be connected to adaptive design and management (i. e. actions to ensure flexibility and to identify and correct unanticipated or excessive effects).	Proponents	5.1 Agenda
The scope of follow-up activities should be based on long-term time frames, ecological units (e.g. watersheds), and an integrated view of human and ecological considerations.	All	5.1 Agenda
Priorities should be designated according to locally valued ecosystem features.	Citizen groups	5.1 Agenda

Provisions for project-specific environmental assessment follow-up monitoring should beintegrated into the broader agendas of citizen-based monitoring of watersheds, landscapes orother areas in which the cumulative effects ofmultiple activities can be recognized and addressed.	Federal, provincial, and territorial governments, proponents	5.1 Agenda
Standardized protocols should continue to be developed that include thresholds and indices for data interpretation on a range of parameters that are broadly relevant to assessing and monitoring community environmental health.	Governments	5.2 Tools
In recognition of the unique nature of each community, increased provisions should be made for adapting protocols to meet local needs.	All	5.2 Tools
Where standardized or adapted methods for interpreting monitoring results are considered by the community to be culturally inappropriate, resources and opportunities should be provided for the community to develop locally and culturally acceptable criteria for determining significance in monitoring.	Citizen groups, governments (intervenor funding?)	5.2 Tools
Maps on a scale that is useful for discussions about community-level land uses and effects should be generated.	Governments	5.2 Tools
Government-generated maps should be ground tested for accuracy.	Citizen groups	5.2 Tools
Community monitoring data should be compiled into searchable digital databases. Where desired, these should include supporting multimedia and narrative information about the area.	Citizen groups, governments	5.2 Tools

Long-term, stable funding is important to the success of environmental research and monitoring initiatives involving citizens in order to support consistent activities and a paid program coordinator.	Governments and other partners	5.3 Resources
Funding for such programs should come without expectations that citizen monitoring efforts will be consistent with a non-local agenda, particularly in First Nations communities.	Governments and other partners	5.3 Resources
Intervenor funding should be examined as a potential source of funds for environmental assessment-related community monitoring programs that are consistent with local values and culture.	Governments	5.3 Resources
Other funding models should be including a combination, including a combination of local tax reallocation and support from project proponents.	Governments, proponents	5.3 Resources
Environmental assessment practitioners, citizen groups and decision makers should be aware of and, where appropriate, implement planning, resource management, regulatory, and enforcement mechanisms based on locally informed environmental assessment follow-up activities.	Citizen groups, gouvernments, proponents	5.4 Application of findings

6. Policy and academic conclusions

In light of recent legal amendments to strengthen the follow-up component of environmental assessments, this research proposes two framework recommendations for those who create consultation processes, each of which encompasses a suite of policy and academic considerations. These are intended to guide future decisions about environmental assessment follow-up at the policy level, and are summarized in Table 3. This section discusses these framework recommendations, and introduces recommended areas for further research.

6.1 Framework recommendations

The first framework recommendation is that in order for environmental assessment processes to follow principles of sustainability more closely, it is important for follow-up activities to integrate short- and long-term perspectives, social and biophysical parameters, and local and conventional knowledge more effectively.

This means that monitoring should be treated as an anticipatory as well as a follow-up activity. Providing an understanding of pre-development baseline conditions allows for meaningful comparisons to be made between predicted and actual effects, and for causal relationships to be established. This in turn fosters adaptive design and management strategies, which can mitigate unanticipated negative effects by changing the way that a project operates in response to monitoring information (see section 4.3, "Temporal scope").

Human as well as biophysical conditions should be considered part of sustainability-centred environmental assessment follow-up. Social considerations can be introduced to follow-up monitoring by determining local definitions of quality of life and designing follow-up activities to consider appropriate parameters (see section 4.3, "Topical scope").

Monitoring should focus on cumulative effects and be conducted on an ecosystem (e.g. watershed) basis, rather than just following jurisdictional boundaries or focusing on specific effects of individual projects. Accordingly, project environmental assessment follow-up monitoring should where feasible be integrated with strategic environmental assessment and planning follow-up monitoring (see sections 4.3, "Geographic scope").

Enhancement and application of local knowledge should be integrated with conventional (scientific) research, following precedents set in the case study communities (see section 4.2, "Integrating local and conventional knowledge).

The second framework recommendation is that a participatory public role in designing follow-up monitoring programs and contributing knowledge during their implementation stage could help to achieve these goals of enhanced integration.

Citizens have a particular interest and a useful role in determining the agenda of environmental assessment follow-up monitoring activities, especially as these relate to health, equity, livelihoods, and other social concerns (see section 4.5, "Contributions to society").

In order to minimize conflicts related to perceived bias or special interest on anyone's part, citizens, governments and project proponents should work together from the earliest stages of environmental assessment follow-up program development to foster mutually acceptable goals. Typically, citizens are included in environmental processes in an advisory role. We recommend that environmental assessment follow-up initiatives go beyond this, 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 (i.e. an advisory mandate) as well as authority (i.e. a decision-making mandate). (See the discussion of power in section 4.4, above.)

Table 3: Policy and academic recommendations

Recommendation	Report section
If environmental assessment processes are to follow principles of sustainability more closely, it is important for follow-up activities to integrate short- and long-term perspectives, social and biophysical parameters, and local and conventional knowledge more effectively.	Framework recommendation 1
Monitoring should be treated as an anticipatory as well as a follow-up activity.	4.3 Scope (temporal)
Human as well as biophysical conditions should be considered part of sustainability-centred environmental assessment follow-up.	4.3 Scope (topical)
Monitoring should focus on cumulative effects and be conducted on an ecosystem (e.g. watershed) basis, rather than following jurisdictional boundaries or focusing on specific effects of individual projects.	4.3 Scope (geographic)
Enhancement and application of local knowledge should be integrated with conventional (scientific) research, following precedents set in the case study communities.	4.2 Local knowledge
A participatory public role in designing follow-up monitoring programs and contributing knowledge during their implementation stage could help to achieve these goals of enhanced integration.	Framework recommendation 2
Citizens, governments and project proponents should work together from the earliest stages of environmental assessment follow-up program development to foster mutually acceptable goals.	4.4 Power
Citizens have a particular interest and a useful role in determining the agenda of environmental assessment follow-up monitoring activities, especially as these relate to health, equity, livelihoods, and other social concerns.	4.5 Contributions to society

6.2 Areas for future research

This research provides suggestions for strengthening environmental assessment follow-up through increased citizen participation consistent with principles of sustainability. Examining three case studies has enabled us to make progress towards this goal. We recognize that there are several related questions raised in this report that deserve to be explored through future research. These are discussed here.

First, the case studies that form the basis of this research provide insight mainly on citizen involvement in effects monitoring. Future research could be directed towards investigating difficulties related to citizen engagement in compliance monitoring. This presents particular challenges because compliance monitoring varies under different regimes with various enforcement mechanisms.

Second, more attention should be given to integrating multiple projects into watershed- or ecosystem-based monitoring. While our research demonstrates the importance of this integration, others could make further contributions by researching existing or new models for putting this into practice.

Third, more research is needed into funding for follow-up programs that involve citizens. As discussed above, tensions already exist with regard to keeping citizen groups alive through long-term funding. If stronger partnerships form between government and non-government organizations (especially involving funding arrangements), then questions arise related to accountability mechanisms for non-government, citizen organizations.

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Appendices

Appendix A - Case study of Citizen Environmental Monitoring in Comox Valley, British Columbia

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1. Introduction

Citizen environmental monitoring represents one way in which members of the public can demonstrate an interest in assessing local environmental conditions, often with the goal of protecting valued natural features. Participants in these programs volunteer their time, energy, and knowledge in order to collect information about the environment, and in many cases seek active partnerships with government or academic institutions in an effort to enhance their work. The proliferation of such citizen monitoring groups across Canada, particularly during a period of decline in government-led environmental monitoring and enforcement activities (Savan et al. 2003), shows widespread commitment to environmental monitoring and assessment at the community level. It is argued here that certain aspects of citizen environmental monitoring can inform, and possibly enrich, the follow-up stage of environmental assessment.

This case review examines a range of citizen environmental monitoring activities taking place in Comox Valley, British Columbia. Emergent themes and their relevance to EA will be discussed, including credibility issues, time frames, geographic scope, application of local knowledge, and integration of monitoring parameters.

Rationale for case selection

This case was selected because it illuminates several areas of interest to environmental assessment processes. First, Comox Valley citizen monitoring efforts have been built through a process of public participation. Citizen volunteers have been actively involved in collecting baseline information, and continue to be involved in ongoing monitoring to track any changes in

certain environmental parameters. Public meetings and events also helped to establish local stewardship initiatives, as well as to guide the direction of the Millard/Piercy Watershed Management Plan.

Second, the creation of the Millard/Piercy Watershed Management Plan involved cooperative partnerships between volunteers, non-profit groups, and four levels of government (municipal, regional, provincial, and federal). This joint effort produced a document that was based on protocols and parameters designed to meet the information needs of all participating groups and agencies. Investigating the successes and obstacles encountered in building these partnerships may illuminate possible parallels in an environmental assessment system that involves citizens, governments, and project proponents.

Third, there is a long and productive history of citizen monitoring efforts in the Comox Valley. From bacteriological water quality testing to GIS mapping, community volunteers have contributed information to support environmental protection measures in the Valley for nearly a decade. Tracing the interactions between various citizen groups over time provides an interesting perspective on one key focus of this study, establishing trust and credibility for volunteer monitoring efforts.

Fourth, unlike some specifically targeted citizen monitoring programs, the Millard/Piercy Stewards and Project Watershed both base their work on the geographic unit of the watershed. This scope lends itself to a holistic view of environmental considerations, allowing for investigation into both specific and cumulative effects.

Finally, this case was chosen for its potential to illustrate some (if limited) integration of human and ecological considerations. The work of citizen monitors in Comox Valley relates not only to parameters in the "natural environment," but also to issues of human health, economy, and urban development. Citizen monitoring efforts are designed to inform land use planning and strategies for development, to protect shellfish production, to improve agricultural practices, and to consider one especially important natural feature, salmon, in light of its role in the economy and identity of British Columbians.

Research methods

The majority of the information used to compile this case study was gathered through face-to-face, audiotaped interviews with government and NGO representatives. These interviews took place in Comox Valley in September 2003. These interview transcripts were supplemented by telephone interviews with additional government and academic contacts related to the case. Websites and documents produced by the environmental NGOs under study contributed further information.

2. The story

Comox Valley is located on the east coast of Vancouver Island, within the Regional District of Comox-Strathcona, approximately 100 km 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).

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.

Fig. 1: Comox Valley and surrounding areas

(adapted from Comox Valley Airport)

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 better stewardship practices. In their efforts to establish credibility, each group's work has proved to be complementary to the others. This discussion will focus on citizen involvement in three major initiatives in the Comox Valley: Comox Valley Project Watershed Society, the Baynes Sound Stewardship Action Group, and the Millard/Piercy Watershed Stewards.

Comox Valley Project Watershed Society

In 1992, the 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 year-long 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 (Hilliar 2003).

Another outcome of the pilot project was the formation of "Project Watershed" (Comox Valley Project Watershed Society). The group's mission is to "promote community stewardship of Comox Valley watersheds through education, information, and action". 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 ground-truthing of stream and wetland information is incorporated into a habitat atlas, which is shared among local governments and senior agencies (Hilliar 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: hand drawn lines on cadastral maps, compass and chain combined with Global Positioning Systems (GPS), culminating in high-end 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 Global Positioning System (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 formal planning regime, 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. 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, involving volunteers as assistants, 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).

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 percent of British Columbia's total shellfish yield (Comox Valley Economic Development Society, in Pinho 2001). Here, citizen monitoring 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 Environment Canada's Eco Action program, trained and oversaw approximately 40 volunteer monitors. These citizens collected water samples from 55 stormwater outfalls on a monthly basis, testing the water for temperature, pH, greases and 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 and human health (Pinho 2001). This suggested that raw sewage was entering local waterways through the stormwater system. Observational monitoring, where volunteer monitors 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 stormwater outfalls were a major cause of pollution. To investigate this possibility, the City of Courtenay conducted smoke testing, purchasing the equipment needed to do so. Following these tests, the City performed dye tests to pinpoint the locations where plumbing errors had incorrectly connected residential sewage pipes to municipal stormwater 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 (Pinho 2003).

Millard/Piercy Watershed Stewards

The Millard/Piercy Watershed Stewards have employed a broad range of strategies 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 doing restoration work (Smailes 2003a). The Stewards also arranged to have the watershed flown for air photos, and used this information to calculate the percentage of land

in the watershed covered by impervious surfaces (Smailes 2003a). 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 2003a).

From 1998-2001, The Millard/Piercy Watershed Stewards worked with four levels of government 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 (MPWS 2001). The resulting document outlines a strategy for achieving the vision, "to restore and protect the health of the Millard/Piercy Watershed" (MPWS 2001).

The plan appears to have had an impact on decision making. At the Regional District level, information from the Watershed Management Plan has been used to inform 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, the Millard/Piercy Stewards' work has been identified as contributing to British Columbia's stormwater management plan (Henigman 2003). At the municipal level, however, 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 2003b).

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

3. Major themes and considerations

Credibility of volunteer data

Can citizens collect information that is useful and reliable for monitoring environmental changes? Opinions differ on the value of data collected by volunteers in community-based monitoring programs. Some have suggested that "large-scale questions about environmental change can be answered only by combining the observations of citizen scientists across the continent" (Bonney 2001, 20). 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 and Reitsma 2001, 29), or on a spatial scale that would be beyond the feasible reach of expert researchers (Brown 2001, 33).

Of studies that have compared the accuracy of volunteer-collected data in relation to expert-collected monitoring data, 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, 199), or even on par with data collected by professionals (Heiman 1997, 296). Others have reported that volunteer data have a higher degree of variability than professional data and are therefore less reliable, especially where volunteers use different methods or equipment that might lead to a higher degree of estimation, or lower level of precision than that used by professionals (Nicholson et al 2002; Mayfield et al 2001).

The Comox Valley experience suggests that volunteers can collect useful monitoring information for some purposes, with several factors serving to increase the credibility of their data. Using approved protocols, forming active and early partnerships with government agencies, developing

a reputation for accuracy and high-level training, and identifying with a respected past history of citizen efforts in the area all positively affected government perceptions of data reliability. Both government and NGO representatives also identified the presence of a paid coordinator as a critical factor for producing worthwhile volunteer efforts.

Involving political figures in the process that guides a citizen monitoring program can also help to increase its legitimacy. While municipal officials were at first reluctant to accept the results of the Baynes Sound volunteer monitoring, the fact that political representatives were part of the Round Table helped to ensure that the results made their way into the local decision making arena (Pinho 2003). A politician who had championed the process worked to ensure that the City's engineering staff acted in response to the high coliform counts reported through the program (Pinho 2003). In this case, the politician's involvement was a factor in the municipality's decision to take the citizen-collected results seriously enough to act on them.

Some government representatives indicated that even if citizen-collected information did not follow established protocols and there were possible issues surrounding standards for data quality, they were still willing to accept it as preliminary if there was no other information available (Mewett 2003, Hatfield 2003). In such cases, even if governments have the desire to challenge volunteer data, they may not have the capacity or expertise needed to do their own monitoring.

Perceptions of bias

Both government and NGO representatives who have been involved with Comox Valley citizen monitoring programs expressed concern that bias on the part of the other could hamper the success of such initiatives. From a government perspective, those interviewed suggested that volunteer monitors might reflect an "ecological" agenda (Hatfield 2003), be reluctant to give up "ownership" of their work (Crawford 2003), lose sight of the "broader picture" (Milne 2003), or even misrepresent their findings in a manner that is "quite nefarious, as opposed to just sloppy record keeping" (Mewett 2003). One government interviewee related a story about a citizen group in another watershed that had apparently planted fish in a stream where fish had never before been found, so that the area would qualify for higher conservation measures (Mewett 2003). Suspicions like these, which are often accompanied by the assumption that governments or external consultants are capable of performing "unbiased" or "non-partisan" work, can undermine trust in both directions. Governments may dismiss citizen-led efforts as value-driven, while citizen groups may balk at the idea that government- or consultant-led science is value-free.

Is there evidence to suggest that governments are biased? Both government and NGO interviewees stated that governments in Comox Valley might ignore citizen monitoring data for a variety of political reasons. Governments were described as being "pushed" by pro-development interests (Crawford 2003), being "reactive" rather than proactive (Hilliar 2003), having "built-in inertia" (Mewett 2003, Milne 2003), and making excuses for not recognizing citizen data if "the council of the day" isn't "green" (Henigman 2003). One NGO coordinator stressed that it was important for the group not to rely on governments for support or expertise (Smailes 2003b). These statements correspond to literature that explains the non-use of information as a "partisan" scenario, where governments choose to use only data that support a position they have already developed (de Neufville 1985). It has also been argued that policy makers may use scientific information carefully in order to steer public debate in a particular direction (Irwin 1995).

For those interviewed in Comox Valley, the most widely acceptable solution to the problem of mutual suspicion seems to be to form active partnerships between governments and citizen groups at the early stages of program development. In this way, representatives from both areas

can see each other as allies, rather than as opponents who are pursuing separate - and not always explicit - agendas.

Integrating local and conventional knowledge

In Comox Valley, several different perspectives on the best possible contributions of citizen monitoring are represented. These range from seeing citizens as competent scientists, to seeing them as sources of qualitative knowledge that can supplement more technical research. In turn, these divergent views can each be linked to theories about types of knowledge and knowledge creation.

The Baynes Sound approach reflects the view that citizen efforts achieve their best results when volunteers collect bulk, quantitative data (Pinho 2003). This is consistent with a view of citizens as scientists, albeit ones with limited training and expertise. Several authors have discussed the suite of options available to citizen groups wishing to collect quantitative data, with a frequent recommendation that citizens perform monitoring at a lower-than-professional level of scientific rigour in order to provide a "warning" to regulatory agencies, rather than a detailed analysis of their own (Savan et al. 2003, Penrose and Call 1995).

By contrast, the Project Watershed approach is based on the belief that volunteers are best off performing non-technical tasks. When tasks, such as GPS mapping, demand a high degree of technical sophistication, data quality can suffer when volunteers act as primary data collectors (Ellefson 2003, Chamberlain 2003). Project Watershed sees its mapping work as being enhanced by the qualitative information its volunteers provide, with the end result that the organization can produce reports that are "narrative of the stream, not just data" (Chamberlain 2003). This is consistent with a view of citizens supplementing scientific knowledge with local knowledge. In the literature, local people's familiarity with a place has been described as a valuable check on "official" sources of information (Holden 2000), as well as a source of "broader and richer rationality" than that offered by traditional risk assessment experts (Tesh 1999). Stories and explanations have also been accorded an important role within efforts to persuade political actors to take action on quantitative research findings (de Neufville 1985).

Whether citizens are to collect quantitative or qualitative data, Comox Valley interviewees agreed on the importance of establishing a purpose for monitoring before choosing protocols and performing tests (Crawford 2003, Hilliar 2003, Hatfield 2003). From a citizen perspective, choosing what purposes the eventual data will serve is an important step that precedes other group decisions, such as the selection of indicators, use of protocols, and degree of training required (Savan et al. 2003). From a government perspective, monitoring efforts can have more meaningful impacts on decision making if they are linked to information needs (Mewett 2003, Hilliar 2003). Despite the partnerships between government and NGOs in Comox Valley, some interviewees still stated that there is not enough communication between these groups regarding what types of information each has an interest in acquiring.

Temporal scope: anticipatory monitoring and mapping

The Comox Valley citizen initiatives treat monitoring as an anticipatory, as well as a follow-up, activity. The Millard/Piercy Stewards have gathered information about low flows and impervious surfaces in the watershed with the aim of using their results to apply political pressure to lessen the impacts of future urban development (Smailes 2003b). This approach uses monitoring to establish a baseline set of current conditions, compares this baseline to known thresholds for certain impacts (e.g. the maximum percentage of impervious surfaces in the watershed that are

compatible with a viable salmon run), and tracks any change in conditions toward or away from those thresholds.

Project Watershed's work also acknowledges the importance of understanding current conditions before making decisions that will affect the future. While it is not strictly a monitoring project, the group's sensitive habitat mapping has been useful in establishing a reference that can be used to make choices about future land use scenarios and to track future changes. This type of work underscores a commitment on the part of non-profit groups in Comox Valley to determine baseline conditions in the local environment before development occurs, thereby allowing for planning that protects known and valued natural features.

Geographic scope: watershed-based initiatives

All of the citizen-based groups described here use the watershed as their unit of analysis and concern, as opposed to defining their activities along political boundaries. While Ontario has Conservation Authorities, which are mandated to conserve and enhance water resources and conservation areas on a watershed basis, British Columbia has no such authorities with jurisdictions based on natural, rather than political, divisions. The lack of overlap between the geographic scope of the issues being investigated in Comox Valley, and the jurisdictional scope of the political bodies with the power to respond to them, has presented a challenge for citizen and government actors alike.

The citizen groups discussed above have found themselves trying to integrate their results into the bylaws of more than one political body, either at the same level of jurisdiction (for BSSAG, the City of Courtenay and the Town of Comox), or at different levels (for the Millard/Piercy Stewards, the City of Courtenay and the Regional District of Comox-Strathcona). This can represent a time-consuming duplication of efforts. Meanwhile, municipal governments may encounter frustration when new residential developments occur just outside of municipal boundaries, and are not subject to municipal bylaws that are designed to protect watershed health (Crawford 2003).

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 controls, such as tree protection bylaws, that municipalities can use (Crawford 2003). This leaves any areas that fall outside of municipal boundaries unregulated with respect to these environmental concerns. The ability of provincial agencies to play a role is also limited, because under the *Local Government Act*, the province has handed over most of the authority for environmental review processes to local governments (Henigman 2003).

Although a watershed-based approach offers many benefits over monitoring that focuses on only a narrow geographic scope, it also creates difficulties in coordinating conservation measures at different political levels (Lopez and Dates 1998).

Topical scope: integrating human and ecological factors

The Millard/Piercy Stewards' coordinator admits that the group has a strong focus on ecological protection over and above social considerations, but recognizes that future development in the watershed is to some extent inevitable (Smailes 2003b). Considering this, the group aims to promote responsible development to the point where it is considering buying a property, developing it in an environmentally responsible way, and re-selling it (Smailes 2003b). The group's coordinator also sees the human and natural history of the watershed as a knowledge

set that could be strengthened in the organization's work, in that the people who, or whose ancestors, originally cleared the land could help to answer questions about present-day hydrology (Smailes 2003b).

The Baynes Sound citizen monitoring work has been closely tied to human health concerns, as well as to economic viability through the shellfish industry. This case brings into sharp relief the interconnectedness of water quality (one component of environmental health) and human well-being (both physical and economic). As well, BSSAG's landowner contact program, which focuses on changing agricultural practices to reduce water pollution, has relied on mutual understanding between farmers and those concerned with protecting water quality. Here again, livelihood and ecological considerations intersect.

Project Watershed informs development choices by building an inventory of natural features, thus allowing for valued ecosystem components to be protected. The mapping work conducted by this organization is intended to produce a reference tool that can be consulted when making decisions that involve any number of social, cultural, economic and ecological values.

None of these initiatives explicitly addresses equity considerations. In theory, improved water quality and watershed protection lead to health and other benefits that are shared among all members of the population. However, in the Comox Valley programs, there appear to be no explicit attempts to address the needs of traditionally marginalized groups in society. As well, it is difficult to determine how much of the community is actually represented in such "community-based" programs. Even strong and continued participation by 40 or 50 volunteers per program represents only a tiny fraction of the valley's population.

4. Conclusions

It is worth considering the extent to which lessons learned from citizen environmental monitoring programs might be transferable to the environmental assessment arena. To do this, conclusions will be organized into categories of consideration that are relevant to both monitoring and environmental assessment programs: agenda, tools, roles and tasks, resources, application of findings, and contributions to broader societal considerations. The discussion will then conclude with a final look at power, integration, and civility as themes of this work.

Agenda

The agenda of an undertaking will here be considered to include its purpose, scope, and priorities. In Comox Valley, the main purpose of citizen-based monitoring programs is environmental protection, with links to health and economic well-being. Salmon and shellfish are two natural features with substantial economic value that citizen groups and government agencies agree should be protected.

As discussed earlier, the scope of these monitoring activities includes temporal, geographic, and topical boundaries. On a temporal level, Comox Valley citizen programs treat monitoring and mapping as anticipatory, as well as follow-up, activities. On a spatial scale, the watershed is the primary unit of analysis. Topically, their main focus is on biophysical parameters, with some social implications related to economic and health values affected by water quality.

The priorities are to protect shellfish production through improving water quality in Baynes Sound, to ensure that the flows needed to sustain salmon in Millard/Piercy watershed are

maintained (largely through staving off certain kinds of urban development), to improve agricultural and septic practices that contribute to non-point source water pollution, and to produce high-quality maps to act as a reference when making land use decisions that could affect natural features.

The citizen groups involved in Comox Valley initiatives have largely determined their own agendas with some input from government partners. If citizen monitoring at a watershed level is to play a direct role in environmental assessment follow-up, this will have to be kept in mind. Who would determine the purpose, scope and priorities for environmental assessment-driven monitoring efforts in communities? Unless citizen groups are centrally involved in determining the agenda for these initiatives, it is possible that they may perceive environmental assessment-relevant monitoring as a threat to their autonomy and their broader agendas. Collaborative round tables and committees comprised of government, citizen, and at times industrial representatives, have worked well in Comox Valley so far. In the context of monitoring in support of environmental assessment, similar arrangements have the potential to continue to reduce suspicion about motives, and to increase buy-in across all sectors involved.

Tools

The major tools employed by citizen monitoring initiatives include protocols and maps.

A wide range of protocols have been developed for tracking changes in physical, chemical, biological, and ecological parameters in the environment. Lack of coordination has resulted in numerous different protocols being used for the same parameter by organizations across Canada. However, efforts to standardize these protocols are ongoing, notably through Environment Canada's Ecological Monitoring and Assessment Network (EMAN), the Canadian Nature Federation, the Department of Fisheries and Oceans, and some provincial bodies.

As noted earlier, government representatives in Comox Valley cited the use of approved protocols as one factor serving to increase their confidence in the quality of citizen-collected data. The Millard/Piercy Watershed Stewards used protocols developed by the Department of Fisheries and Oceans and the provincial Ministry of Water, Land, and Air Protection, modifying these data collection methods to suit their local objectives (Smailes 2003b). Project Watershed found that when the organization was formed, no suitable protocol existed for their particular type of mapping work. Over the past 10 years, the group has developed its own method and submitted this to the Resources Inventory Committee so that it can be vetted and eventually approved as a standard (Chamberlain 2003).

Maps are integral to the success of monitoring work. They define natural features of interest, facilitate replicability of results by allowing for repeated sampling of the same sites, and increase the possibility of linking causes to observed effects. Comox Valley non-profit groups have contributed to the development of map resources in the community through Project Watershed's GPS mapping work, as well as through the aerial photography and photogrammetry arranged by the Millard/Piercy Stewards.

Roles and tasks

Citizen monitoring programs involve many steps: training volunteers, gathering information, interpreting results, housing data, and communicating results to decision makers and the public. For a program to succeed, decisions must be made about who will be responsible for completing each stage - in other words, defining operational roles. But these decisions rest on more

fundamental assumptions about how the agenda will be set. Before a monitoring program can proceed, roles must be established for deciding on the purpose, scope, and priorities of the monitoring. These decisions may take the form of establishing an organizational structure, selecting parameters and indicators, and choosing protocols at a certain level of technical sophistication. Round tables and advisory committees, such as those guiding the Baynes Sound Stewardship Action Group and the Millard/Piercy Watershed Management Plan, offer collaborative models for approaching these decisions.

In Comox Valley, both government and NGO representatives cited paid volunteer coordination as an important success factor for monitoring efforts. In the programs discussed here, NGOs have taken on the role of coordinating volunteers, although government funding has sometimes supported these efforts. In some cases, these coordinators are individuals who have identified a need for a particular project, and taken the initiative to write the funding proposals needed to support it. For the most part, governments have largely provided the protocols used (though these have been adapted to meet local needs). Governments and NGOs have shared expertise used for training, data housing and interpretation.

Any discussion of delegating roles and tasks must take into account each group's perception of what the other should be doing. One NGO coordinator described a consequence of government cutbacks on citizen monitoring as, "government would like to know how they can get more for free out of people" (Pinho 2003). Perspectives like these reinforce the importance of aligning each group's agenda before monitoring work begins, and of developing clearer accords between government and NGO bodies on roles and expectations.

Resources

In Comox Valley, both government and NGO representatives identified consistent funding as critically important for the success of citizen monitoring initiatives. While involving volunteers does reduce monitoring costs (Smailes 2003b), and working as a non-profit enables NGOs to perform mapping more cheaply than private consultants (Chamberlain 2003), citizen organizations still need long-term funding in order to provide proper training, coordination, and organizational stability.

A recent study of community-based environmental monitoring initiatives across Canada found that coordinators were expected to perform too many different tasks to successfully secure long-term funding for their programs (Pollock et al 2003). Of interest, "funding duration was cited as more important than funding amount," since short-term funding allotments had proved to be unreliable and disruptive to smooth program functioning (Pollock et al 2003). A period of initial funding of 3-5 years was recommended in order to establish effective monitoring programs, with this financial support potentially coming from local, provincial or federal government, or industry (Pollock et al 2003).

When asked what an "ideal scenario" would be for organizing and sustaining citizen monitoring activities in Comox Valley, respondants offered several visions ranging from the Millard/Piercy Stewards' model of partnership (Henigman 2003), to the well-funded Environmental Protection Agency model in the United States (Chamberlain 2003).

Others envisioned a new system of community stewardship centres in Comox Valley and across Canada, where local non-profit groups with complementary mandates could have a common "home" (Hilliar 2003). NGO representatives thought that their organizations could benefit from this arrangement by sharing office resources, trading skills, having greater opportunities to

collaborate, and having a highly visible volunteer centre that could be easily recognized by the public (Ellefson 2003, Smailes 2003). Presumably, this would also allow for greater integration of external expertise into monitoring efforts, by having a single contact hub and simpler lines of communication. Suggestions for funding such a venture included drawing from the local tax base, individual donors, and creating a new, national government agency designed to coordinate and support local stewardship organizations.

Application of findings

Citizen monitoring and mapping results in Comox Valley have influenced land use planning, infrastructure corrections, stewardship programs, and regulatory mechanisms, including development permits. The power to implement recommendations generated through these activities has rested mainly with two groups: local governments (municipal and regional) through infrastructure corrections, bylaws and enforcement, and individuals through stewardship actions. Extension to include environmental assessment authorities would seem to be within the capabilities of the current approaches.

Contributions to broader society

In the realm of government decision making, citizen monitoring efforts in Comox Valley seem to have had greater influence when it comes to fixing direct pollution problems (e.g., the Baynes Sound infrastructure corrections) than they have in amending actual bylaws. From the comments of both NGO coordinators and government representatives, it appears that citizen monitoring has achieved even greater successes than these in the areas of public education and encouraging citizens to adopt an active stewardship role (Hatfield 2003). Positive relationships have been fostered between citizen monitoring groups and members of the agricultural community (Hatfield 2003, Pinho 2003). As well, it was suggested that the Millard/Piercy Stewards' work has made the City of Courtenay more sensitive to fisheries issues in the community, now that citizens are pressuring them to pay more attention to aquatic habitat and other concerns (Chamberlain 2003). One academic consultant summed up a general attitude shift by saying, "over time, [the Millard/ Piercy] group has nudged the town towards being a little more green" (Marsh 2003).

It could be argued that these exercises in citizen involvement play a role in rebuilding, or extending, the concept of civility to include both social and ecological components. Rather than seeing citizenship as a set of strictly political rights and responsibilities, programs such as those run by Project Watershed, BSSAG, and the Millard/Piercy Stewards promote a broader, more holistic interpretation of citizenship and civic responsibilities, one that includes environmental participation and the protection of shared resources. In Comox Valley, this means building on existing values centred on the natural features and aesthetic beauty that characterize the region, and encouraging citizens to choose actions that are consistent with these values.

Power

Citizens who participate in citizen monitoring initiatives may come to feel empowered by their knowledge of environmental conditions and their ability to push municipalities to comply with their legal responsibilities (e.g. to prevent bacterial pollution from discharging into waterways, or to enforce the buffer zones around creeks outlined in their bylaws). However, there is little evidence in this case study to suggest that citizen monitoring efforts in Comox Valley have produced any real redistribution of power. Citizen groups have exercised their ability to choose what parameters to investigate, and to a large extent, the methods they use in order to do so. However, with the exception of their stewardship projects, which rely on the compliance of

individual landowners, the means of turning their conclusions into policy actions has remained largely in the hands of local governments.

In the context of environmental assessment processes, it seems likely that mutual suspicion of bias on the part of project proponents and the public will exist, especially where industrial-scale resource extraction is involved, since this has often polarized "economic" and "ecological" interests in the past. In the Comox Valley case, the best way to allay these suspicions seems to have been to involve all potentially interested parties from the beginning, so that the monitoring programs are based on the parameters and standards specified by each agency concerned. Compromises may be made, but must be agreed on early in the process.

Integration

The Comox Valley citizen monitoring and mapping initiatives show some attention to integrating human and ecological considerations, with the desire and potential to strengthen these ties even more. As well, the anticipatory nature of the monitoring and mapping work fosters the integration of short and long term perspectives in forecasting and choosing among different overall future development scenarios. Finally, the watershed focus lends itself to a holistic view that integrates physical, chemical, biological, ecological and social considerations.

Stewardship/civility/culture

By advancing an ethic that fosters a sense of value with regard to ecosystems, as well as engagement in their protection and trust, citizen monitoring and stewardship programs help to build a society - even a culture - where respect for the natural world is so central as to become customary. Arguably, a culture that values stewardship and ecological integrity is essential to the success of voluntary compliance initiatives for governments and industries. By extension, this promotes corporate responsibility on the part of socio-assessment project proponents. In this way, in addition to any direct role that citizen monitoring programs may be able to play in environmental assessment processes, they also contribute to strengthening the basis for a sustainable society.

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Appendix B - A Case Study of Community-Based Monitoring using Traditional Ecological Knowledge in Lutsel K'e, NWT

prepared by Tyler Shaw, University of Waterloo

1. Introduction

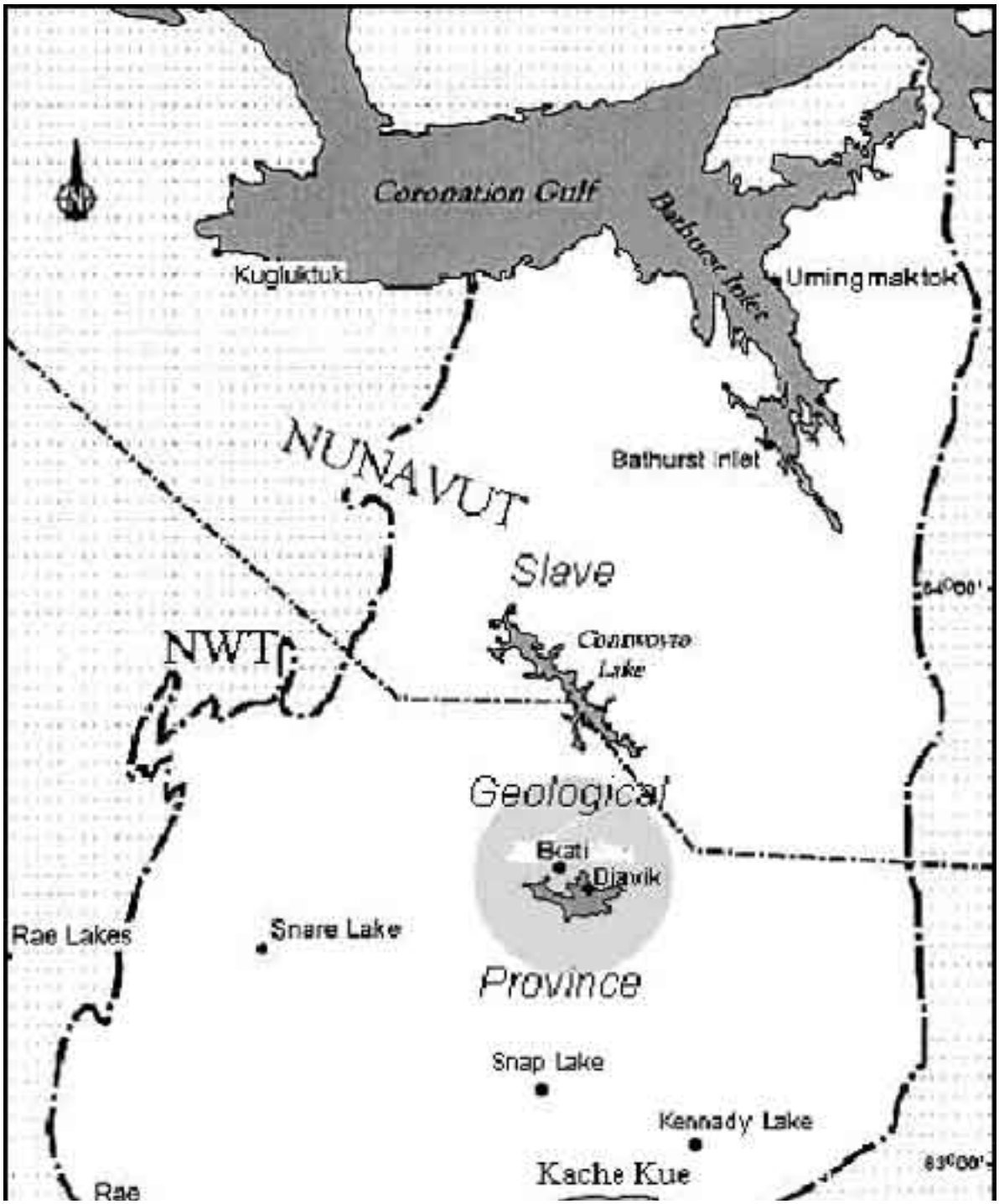
This case was selected because it raises many issues relevant to environmental assessment processes in Canada. Environmental monitoring and assessment activities in Lutsel K'e have explored the challenges associated with the explicit incorporation of traditional ecological knowledge (TEK) into environmental assessment; the integration of socio-cultural and biophysical factors; and the consideration of cumulative effects. This case is also notable because community-based monitoring efforts in Lutsel K'e figured prominently in two significant assessed projects (the Diavik and BHP diamond mines) which had relatively high public profiles and attracted attention from a wide variety of stakeholders, including government, industry and the research community (Stiff, 2001). This study of community-based monitoring in Lutsel K'e relies on secondary research.

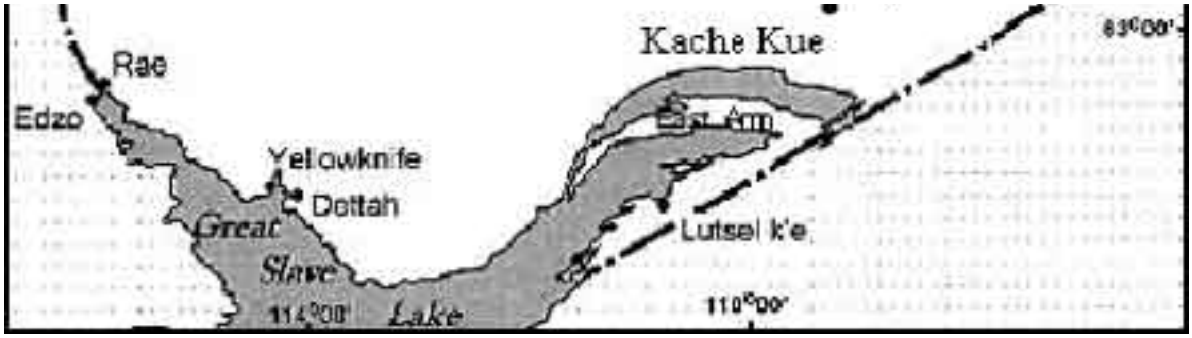
2. The story

Lutsel K'e: community history

The Lutsel K'e community is predominantly made up of Chipewyan people (called Denesoline in the local dialect), whose pre-contact territory included a broad strip from the shores of Hudson's Bay in the southeast to the Coppermine River watershed in the northwest (Hearne, 1934). Denesoline people traditionally moved in a yearly cycle, and in the northwestern section of their territory, one group summered on the shores of Great Slave Lake, and then moved to the northeastern barrenlands in search of caribou in the late fall and winter. As the fur trade spread into northwestern Canada, trading posts began to appear throughout the Northwest Territories. In 1925, a Hudson's Bay trading post was established on the eastern arm of Great Slave Lake, about 200 kilometres east of Yellowknife, near the southern boundary of the Slave Geological Province (see Figure 1). By the early 1950's, a variety of socio-political forces caused many Denesoline to settle around the trading post, which was eventually renamed Lutsel K'e (Bielawski, 2003; Vanstone, 1963).

Fig. 1 Lustel Ke and the Slave Geological Province





(source: Ellis, 2003, p.53)

The Nihat'ni Monitoring Program

The development of community-based monitoring in Lutsel K'e was sparked by a local desire to address environmental concerns associated with the opening of the first diamond mine in the SGP, within the traditional territory of the Lutsel K'e (Parlee, 1998). As mining development continued to expand, the community became determined to mitigate the impacts and realize the benefits of this development (LKDFN, 2002b). The Nihat'ni monitoring program was created in 2002 to help achieve these goals. To date, the program has successfully gathered baseline information for a number of indicators that "describe fundamental aspects of the community's way of life and how it is changing" (LKDFN, 2002b, p. i). Although the program has only been in operation for approximately one year, there are some early indications of success. For example, program findings have been used to successfully negotiate the implementation of mitigation measures in response to mining industry impacts (see section "Application of Findings" for details).

3. Major themes and considerations

Credibility of TEK

Noted traditional ecological knowledge (TEK) researcher Fikret Berkes describes TEK as "a cumulative body of knowledge, practice and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment" (Berkes, 1999, 8). Many researchers believe that TEK is a credible source of data for environmental assessment and monitoring efforts. TEK is widely recognized as a credible source of information for environmental decision making in general (Berkes et al, 2000; Corsiglia and Snively, 1997; Freeman, 1979) and environmental monitoring and assessment in particular (Riedlinger and Berkes, 2001; Ashford and Castleden, 2001). The typical view is that the credibility of TEK is a function of the intimate relationship that TEK practitioners build with their environment through their participation in traditional land use activities. The depth and breadth of TEK is enhanced by accumulated generations of application and ongoing cross-referencing with multiple local land users (Gunn et al., 1988).

Government acceptance of the credibility of northern-based TEK is demonstrated by the fact that it is now widely discussed in local, regional and provincial government-led land and resource management activities in the Northwest Territories (Duerden and Kuhn, 1998; Stevenson, 1996; Gunn et al, 1988). These discussions have produced a variety of specific agreements and pieces of legislation relevant to Lutsel K'e. For example, an environmental agreement made between the Federal Government, the BHP mining operation and affected aboriginal communities

spawned an Independent Monitoring Agency, which has a mandate to integrate TEK into BHP's environmental assessment efforts (Parlee, 1998). Similarly, the Mackenzie Valley Resource Management Act, which guides environmental assessments in the region where the BHP and Diavik mines operate, requires that TEK be included in analyses of environmental impacts (MVRMA, 1997). The Government of the Northwest Territories has also created legislation that requires full and equal consideration of TEK in environmental research and decision-making relevant to aboriginal communities (GNWT, 1993).

The credibility of TEK is also suggested by the fact that in many cases TEK-managed environments are associated with sound ecological integrity (Nakashima and Roue, 2002). In environmental assessment, the credibility of TEK is implied by support for its use in environmental monitoring efforts by many major international organizations, including the International Association for Impact Assessment, the United Nations Convention on Biological Diversity, and the Canadian International Development Agency (Roue and Nakashima, 2002).

Despite the widespread support for TEK in environmental monitoring, some scepticism about the scientific credibility of TEK persists. The basic contention is that TEK cannot be scientifically credible because it is anecdotal, non-replicable and non-universal (e.g. Howard and Widdowson, 1996). From this perspective, TEK is seen as a cultural construct and not true science. However, some argue that credibility criteria based on conventional science do not consider that, like TEK, conventional science is itself a cultural construct (Nakashima and Roue, 2002). To maintain that TEK is acceptable only insofar as it can meet the criteria of conventional science reflects an ethnocentric and culturally embedded point of view (Nakashima and Roue, 2002; Purcell and Onjoro, 2002; Berger, 1977). In other words, to insist that the cultural point of view inherent in conventional science is the ultimate lens through which environmental data should be gauged, suggests that conventional science is somehow universally valid, regardless of cultural context.

Lingering inter-cultural uncertainties about the credibility of TEK may partly account for the fact that, despite the many policy and legislation initiatives that seek to incorporate TEK into environmental assessment and monitoring efforts in the NWT, there is no widely accepted framework for implementing this goal (Ellis, 2003). Part of the challenge to establishing such a framework is that environmental assessments based on conventional science are built upon one specific worldview, while TEK is built upon another, and these worldviews are not always compatible. For example, in the course of developing a framework for local cumulative effects assessment, community researchers in Lutsel K'e consulted with TEK experts in hopes of identifying thresholds of tolerance for industrial impacts. After extensive consultation, researchers discovered that:

> To establish thresholds of tolerance for the land was quite simply *not* the Denesoline way. The whole concept of thresholds is contrary to the Denesoline way of doing. Indeed, instead of asking "How much can the land tolerate?" the interview participants deemed it more appropriate to ask "How can we respect the land?" These questions represent two fundamentally different ways of looking at the relationship between the land and the people. Industrial culture seeks to determine to what extent they can modify natural systems before they collapse; the Denesoline seek to live in a respectful harmony with the land. (LKDFN, 2001a, p. 9)

Partly in an effort to address these differences in worldview, the Nihat'ni monitoring program was designed so that the credibility of TEK-based data could be evaluated and validated within the

cultural context in which it was generated. The program accomplishes this by gathering data based on local knowledge, accessed in a traditional manner (LKDFN, 2001a). Community researchers gather environmental observations made by experienced local land users in the course of their regular traditional land use activities. For example, as they have historically, hunters make observations regarding the health of harvested caribou by such factors as location and thickness of fat deposits, colour and consistency of bone marrow, or developmental stage of a fetus in relation to the time of year. Community researchers collect and amalgamate such observations, after which evaluations of data significance are made through discussions among elders and locally recognized experts. Evaluations are mare in light of collective historical environmental knowledge, and are informed by local values. Generations worth of baseline observations give land users a rich database with which to reference any notable changes. The relative credibility of data is determined partly by the length and frequency of a given land user's personal experience and area of expertise, as well as the context in which the data were collected. While this approach provides no guarantee that the data generated by the program are free of error, the hope is that ongoing cyclical iterations of the program will eventually expose any inaccuracies (Ellis, 2003).

Cumulative effects monitoring

The phrase "cumulative effects" is used to refer to the additive or interactive accumulation of human impacts in an ecosystem. When accumulated impacts interact, the results can be very significant at the ecosystem level, even though they appear to be acceptable at a local level (Kingsley, 1997). Categories of cumulative effects include spatial/temporal crowding, nibbling loss of habitat, and industrial growth that induces additional growth (CEAA, 1999). The discovery of diamonds in the Slave Geological Province created a major frontier for mineral development, which has the potential to create significant cumulative effects on surrounding ecosystems and the people who depend on them for their survival.

In the few years after diamonds were first discovered, prospectors laid claim to more than 50 million acres in the Slave Geological Province, an area roughly the size of Texas (CARC, 1995). This staking rush eventually expanded to be the largest in world history (Krajick, 2001; WKSS, 2001). Several large mines have already begun production in the Slave Geological Province. The Broken Hills Proprietary Inc. (BHP) mine, which opened in 1997, is expected to extract $12 billion in diamonds and create about 826 million tonnes of mining waste over a 25-year lifespan (BHP, 1995; CEAA, 1996). The subsequently approved Diavik mine is expected to generate $70 million in tax revenues alone, over a lifespan of approximately 20 years (INAC, 1999). Both of these mining operations are located within 100 kilometres of Lutsel K'e, in the northern section of the community's traditional territory. There are at least three other mining projects in the region in advanced stages of development, and another 25 exploration projects are in progress (GNWT, 1996; Ashbury, 1999). In order to service these mining activities, various infrastructure expansions have been completed or are underway. Notable among these is a 480-kilometre winter road, constructed every year from Tibbit to Contwoyto. According to a major mine operator, over eight thousand truckloads of supplies were carried on this road in 2001 alone (BHPB, 2001).

In the wake of environmental assessment reports generated by the BHP and Diavik projects, cumulative effects assessments were called for by affected communities such as Lutsel K'e, and NGOs such as the Canadian Arctic Resources Committee, the World Wildlife Fund and the Canadian Parks and Wilderness Society (Struzik, 1994). One of the key concerns raised was the potential cumulative effect of mining activity on the Barthurst caribou herd (Stiff, 2001). The caribou have profound socio-cultural value for the people of Lutsel K'e, as well as for other aboriginal communities in the NWT, and there is deep concern because the most active diamond

mining area is directly in the path of the herd's annual migration (Wismer, 1996). Other cumulative effects of concern to Lutsel K'e include potential disturbances to wildlife and wildlife habitat (and related health risks) caused by winter roads, exploration sites and work camps (LKDFN, 2001a).

From the beginning, the Nahat'ni monitoring program was designed to provide data relevant to the cumulative effects of industrial development. As noted in section 1 ("Credibility of TEK"), the program is based on local knowledge, accessed in a traditional manner. That is, primary data are gathered from land users as they engage in regular land use practices (LKDFN, 2001a). Monitoring activities are not attached to any particular development project or environmental issue. This means that, by design, the program's ongoing monitoring activities have a wide geographic and temporal scope. Data are gathered throughout the community's traditional territory, and could be used in an anticipatory or follow-up capacity, depending on the project under review or the given research goal.

Integration of social-cultural and ecological factors

For most community members in Lutsel K'e, life depends upon the land and its resources. Most families rely heavily on foods harvested from their traditional territory, while local history, traditions, creation legends, and the very foundation of the community's culture and identity are rooted in the surrounding land (Ellis, 2003). In a recent census, 74 percent of the community indicated that they regularly hunt and fish, and 37 percent indicated that they continue to trap (GNWT Bureau of Statistics, 2001). In Lutsel K'e, the close connection between social-cultural and ecological factors is simply a fact of everyday life.

The people of Lutsel K'e also see their world as an integrated whole. In the early stages of community-based monitoring efforts, large-scale community consultations were conducted in order to build an understanding of the potential *social* effects of development. As this research progressed, it became clear that community members could not meaningfully separate social effects from other cultural, economic, spiritual and ecological issues. During this stage of the program, it was decided that the upcoming community-based monitoring program should be concerned with nothing less than the integrity of the local "Dene way of life" (Parlee, 1998, p.88).

Several researchers have commented on the close integration of socio-cultural and ecological factors in aboriginal communities (Usher, 1992; Notzke, 1994). TEK itself illustrates how impacts on land can be manifested as cultural impacts. This is because TEK is transmitted and maintained by land-based practice, so impacts that affect the health and integrity of a community's traditional territory can also affect the community's ability to practice and transmit TEK (Roue and Nakashima, 2002).

Because socio-cultural and ecological realms are a closely integrated whole in aboriginal day-to-day life and outlook, environmental monitoring projects set up to address local concerns will likely be more effective if they are built upon a similarly integrated perspective. Several researchers argue that efforts to conduct integrated environmental monitoring in aboriginal communities are greatly assisted by the use of local TEK (Wismer, 1996; Sallenave, 1994; Berkes, 1988). This is partly because TEK provides valuable guidance for important locally specific socio-ecological monitoring concerns, such as the identification of valued ecosystem components (VECs). For example, in Lutsel K'e, TEK-holders identified a key VEC as the Bathurst caribou herd, which plays a crucial role in both the physical and cultural health of the community (Wismer, 1996).

The Nihat'ni monitoring program further builds upon the principle of using local TEK in monitoring

by relying on TEK and TEK-holders for both the structure and the operation of the program (see "Credibility of TEK" section). Moreover, because Nihat'ni is built around existing land practices, local knowledge and values, the implementation of the program also provides an effective means of ensuring the vitality and relevance of local traditional culture amid increasing industrial and cultural encroachment (LKDFN, 2001a).

Integrating local and conventional knowledge

Many northern aboriginal communities and organizations have strongly advocated for the meaningful consideration of TEK in environmental assessments concerning their traditional territories (WKSS, 1997). A large body of literature supports such calls for a greater role for TEK in environmental research.

Although there are many policy instruments in place to effect the incorporation of local TEK into environmental assessment and monitoring efforts relevant to Lutsel K'e, some barriers remain. Chief among these is the "scientization" process wherein only those aspects of TEK deemed compatible with conventional science are accepted for consideration, while the values, practices and knowledge relevant to TEK-holders are discarded (Duerden and Kuhn, 1998; Agrawal, 1995). The scientization process marginalizes local environmental analyses and brands local understandings as anecdotal and unreliable, because they do not appear to meet the Western scientific criteria of universality. As a result, local priorities are de-emphasized and environmental assessment and monitoring efforts may fail to meet the needs of local people. For example, traditional knowledge analyses given voice by Lutsel K'e elders during environmental assessment information meetings have, in the past, been rejected by technical consultants who maintain that elders' statements are individual opinions of an anecdotal nature, and therefore not valid information (Ellis, 2003).

The Nihat'ni program helps minimize the scientization effect by ensuring that most program duties, including monitoring and initial assessment, are performed by those versed in local traditional knowledge and practices. The program also employs measures to make the values and practices embodied by TEK more understandable to relevant non-local scientists/ stakeholders. For example, when willing, those unversed in local TEK and practice are trained by local experts. Also, when data collected through the program are prepared for conventional scientists (e.g. in the form of maps), indications of the cultural context from which the information was derived are included in multi-media supplements.

4. Conclusions

Agenda

In the initial phases of community-based monitoring efforts in Lutsel K'e, the overall purpose was to design a program that would increase the community's capacity to mitigate negative impacts and achieve the benefits of mineral development in the Slave Geological Province. The current phase of the Nihat'ni monitoring program approaches this broad goal with three specific priorities, which are to

i. foster traditional values, practices, and knowledge in environmental research and decision-making

increase local authority over industrial development within the community's traditional territory.

iii.

encourage youth to learn and respect traditional values, practices and knowledge (LKDFN, 2002a)

As discussed earlier, an additional concern is assessment and management of the cumulative effects of mineral development. Specific areas of focus here include adverse effects on wildlife and wildlife habitat brought on by roads, exploration sites and work camps (LKDFN, 2002a). Arguably, the ultimate long-term purpose of all monitoring activities in Lutsel K'e is the physical and cultural survival of the community. As one local elder explains in her own words,

> We're concerned about our land and the things that are growing on the land - fish, caribou, animals for trappers. We don't want this to be destroyed. We're really concerned about this….we don't want our land to be destroyed right in front of our eyes. There are some other places where we don't want a mine going on, even though there are minerals in the land. No development for our lands that we want to treasure for the future of our children (Alizette Abel in Ellis, 2003, p. 59).

Tools

Notable tools used by the Nihat'ni monitoring program include locally rationalized indicator species; a searchable digital database, maps, and supportive multimedia for data and maps. To explore the impacts of development in the Slave Geological Province, it was necessary to keep the number of indicators within the capacity of meaningful local observation. With this limitation in mind, indicator species were selected by local experts attending to local priorities. Indicators currently in use include plant and animal species with important subsistence value or species known to be susceptible to environmental perturbations. Indicators were further refined to species' qualities traditionally used in the course of regular land practice to monitor the health and integrity of populations in their respective habitats. The collection of indicator data was further organized into a schedule that reflects local seasonal land use. This was done so that observations could be gathered nearest to the times and places that land users are in closest interaction with a given species. This approach helps ensure that monitoring data are rich in detail and relevance (Ellis, 2003).

Once gathered, land user observations are then compiled in a searchable digital database so that information can be organized and communicated according to specific needs. For example, the database could be used to create map overlays that illustrate the relationships among wildlife distribution, local land use and industrial land use. The use of maps to build community-specific atlases of land values and activities is now a widespread practice in aboriginal communities (Aboriginal Mapping Network, 2004; Lydon, 2000; Tobias 2000). Lastly, supportive digital multimedia (e.g. audio, video, photos) are incorporated into the database so that maps and other data prepared for non-local stakeholders can be enriched with some indication of the cultural and ecological context from which monitoring data was derived. The goal here is to help overcome linguistic and conceptual differences between stakeholders (Ellis, 2003).

Roles and tasks

As outlined above, the first stage of the Nihat'ni monitoring stream begins with local land users making observations in the course of regular land use activities. Community researchers then compile these observations, subdividing data compilation efforts by gender in order to reflect gender-specific harvesting activities and areas of expertise. Amalgamated data is made available to elders and other local experts in interpretation workshops, to facilitate analysis and assessments of significance. When necessary, these workshops are also subdivided by gender. Reliance on elders for the interpretation of environmental observations reflects a long-standing traditional practice in the community.

As previously discussed, the roles and tasks of the program were designed so that TEK-based observations can be collected, aggregated and analyzed and interpreted within the cultural context that generated the data. Only after the results of the monitoring program have been locally prepared are they packaged for non-local use. One reason for this approach is to avoid the scenario where only those aspects of TEK that are amenable to outside experts and priorities are considered. From a local perspective, the selective use of TEK according to non-local criteria often diminishes TEK to a de-culturalized or "scientized" form (Ellis, 2003).

The reliance on individual land users for monitoring data could inadvertently introduce inaccurate observations into the Nihat'ni monitoring stream. The hope is that yearly iterations of the program will minimize this possibility. It is also possible that the analysis and interpretation of some observed environmental changes might go beyond the scope of local experience. Local experts are sensitive to the fact that some impacts may not be adequately explicable in terms of local TEK, especially in light of the fact that large-scale mining development and the related impacts are relatively novel phenomena in the region. In these cases, experts in conventional science are invited to confer with local experts to offer their interpretation of program findings (LKDFN, 2001a).

Specific decision-making roles among local leaders and government and industry vary, depending on the project under review and the regulatory agencies involved. In the case of land and water leasing, final authority remains with the Department of Indian and Northern Affairs, but provisions have been made for the consideration of local TEK-based findings. For example, Lutsel K'e is permitted to submit recommendations and comments, in writing and at public hearings, to the relevant land or water leasing board with respect to specific development proposals (Ellis, 2003).

Resources

Researchers have noted that human resource limitations in First Nations communities can be a barrier to local input and participation in environmental assessment activities (Wismer, 1996; CARC, 1996). This became an issue in Lutsel K'e when the sudden and extensive mining boom in the Slave Geological Province overwhelmed local authorities with related research and administrative obligations. One way that the Nihat'ni program helps address human resource shortages is by using existing local land use expertise as this is manifested in regular land use practice. This approach takes advantage of a rich source of data, without overtaxing the local labour pool. Using local experts also lowers the costs of conducting environmental monitoring, which have been recognized as a barrier to the implementation of community-based monitoring programs in the north (Gombay, 1995). The program does compensate land users for time spent in direct consultation with community researchers; however the land users are not compensated for time and effort spent collecting data. This portion of their services could be construed as a voluntary in-kind contribution to the program.

Funding for TEK-based research initiatives in Lutsel K'e have come from a variety of sources,

including land claim-related federal commitments to fund community participation in resource management, federal environmental capacity development programs and provincial programs aimed at assisting with the maintenance and transmission of TEK. Other funders include research foundations, NGOs and industry. A key issue is that the majority of TEK research funding comes from sources other than aboriginal organizations. These funders often have expectations with respect to research agenda and procedure that reflect conventional scientific approaches. As discussed in section on "Roles and Tasks", these expectations can marginalize local expertise and encourage the "scientization" of TEK (Ellis, 2003).

Application of findings

The Nihat'ni program is structured so that findings are shared among community members in the process of compiling data and through community interpretation workshops. In this way, findings are integrated into the collective community TEK base. This is an important aspect of the program as the local TEK base is the reference point from which future findings will be evaluated. The end products of program enter into local environmental governance via the Wildlife, Lands and Environment Committee (WLEC). Typically, program coordinators provide information to support specific projects undertaken by WLEC, however any significant findings are voluntarily reported. Community workshops are held by WLEC to determine the best response to findings, which could include administrative actions, or measures to focus data gathering on the issue in question.

Although the program has only been in operation for approximately one year, some preliminary outside application of findings have occurred.From the community's perspective, non-local uses of the end products of the program have been both promising and disappointing. In one encouraging case, local elders and community researchers were able to convince the BHP mine operators of the need to mitigate the adverse effects of mine roads on caribou, after the Nihat'ni program discovered a high incidence of caribou leg injuries near the roads and local elders determined that the jagged rock fragments used to construct the road were the cause (Ellis, 2003). In a less encouraging case, De Beers Canada prepared an Environmental Assessment Report that selectively quoted local land use experts' statements. De Beers chose to present quotes that discussed how small, disparate groups of caribou had used the region where De Beers proposed to set up a mining operation, while quotes which outlined the historic use the region by large portions of the Bathurst Caribou herd were not included in the report (LKDFN, 2001b).

Power

It has been recognized that power imbalances between TEK holders and conventional scientists often push TEK-holders to the margins in environmental assessment and monitoring activities (Sallenave, 1994; Berkes et al, 1991). One reason for this is that authority and expertise with regards to TEK are often co-opted by outside researchers. This is partly because TEK research is often funded by outside sources, a situation that has typically required that a non-local primary researcher manage research projects so that they conform to conventional scientific criteria and so that results are communicable and useful from the funders' perspective (Simpson, 2001). In this situation, the authority of non-local researchers is recognized, while the role of local TEK experts, especially in the analysis and synthesis of research results, can be limited.

Another reason why power imbalances persist is because of the dominance of conventional science in environmental research efforts. This dominance can create a dynamic wherein the empowerment of TEK holders occurs chiefly to the extent that they are able to conform to the

values and practices of conventional science. For example, when local people assist with TEK research, this is often done under the guidance of a non-local researcher operating within the boundaries of conventional scientific approaches. In this context, local people can become empowered with respect to TEK acquisition, but the relevance and applicability of their knowledge is still defined by a non-local value system (Ellis, 2003).

The Nihat'ni program helps address these power issues by adopting a program structure that inherently recognizes the value of TEK practitioners, while respecting locally validated traditional roles of power based on knowledge and experience. The program also helps empower developing TEK practitioners by providing program roles (e.g. community researcher) that allow TEK to be learned and appreciated in the context of local culture and practice (LKDFN, 2001a).

Culture

One of the overriding themes that emerges from the Lutsel K'e community's experiences with community-based monitoring is that traditional ecological knowledge is not simply data, but also a worldview, or culturally-based value system. As some of the issues explored in this study have shown, when TEK is absorbed by environmental assessment and monitoring processes as if it were mere data, key culturally specific aspects of TEK are often bypassed. The lessons learned in the development of the Nihat'ni program strongly suggest that the cultural aspects of TEK cannot be disregarded if aboriginal interests are to be meaningfully represented in environmental assessment and monitoring. The Nihat'ni program helps to ensure that the cultural aspects of TEK remain intact by adopting a program structure that supports the integrity of TEK and empowers TEK holders within their own cultural context.

Contributions to broader society

Many of the issues raised in the Lutsel K'e experience with respect to community-based monitoring and TEK are echoed in non-aboriginal cases where local ecological knowledge (LEK) is under consideration. For example, fisheries researchers on the east coast have noted that the integration of LEK in environmental assessment and monitoring is hindered by the political dominance of mainstream science and the substantial alteration that LEK suffers under conventional research efforts (Gray, 2002). Given the similarity of the issues at hand, the lessons learned and approaches used in Lutsel K'e may be useful in such non-aboriginal contexts. For example, monitoring programs could be designed to allow LEK to be collected and evaluated within the context of local fishing practice and fisher priorities, before these data are incorporated into conventional scientific studies.

In other situations, the Nihat'ni program concept of using existing land practice as the basis for monitoring might also be applied. For example, in cases where the region being monitored is frequented by land users who have an intimate knowledge of the local ecology (e.g. non-aboriginal LEK-holders such as experienced hunters and anglers), this knowledge might be tapped into as a means of gathering detailed wildlife/ecological observations. While this approach might not generate sufficient monitoring data on its own, it could provide a useful additional perspective in a relatively efficient and cost-effective manner.

The Nihat'ni program also demonstrates how digital technology (e.g. searchable databases and multimedia) can be used to enrich locally collected data with important information with respect to ecological and cultural context. The program might also be useful in a broader context in that it demonstrates how environmental monitoring and assessments may serve local community needs better when local knowledge has a strong role in the proceedings.

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Appendix C - Case Study of Lobster Fisheries Management in Newfoundland: The Eastport Peninsula Lobster Conservation Initiative

prepared by Thalia Santisteban, University of Waterloo

1. Introduction

American lobsters (*Homarus americanus*) are a popular and valuable seafood harvested in the coastal waters of the northwest Atlantic, mainly by community-based, small-boat operators. As with all Canadian coastal fisheries today, the American lobster fishery is experiencing problems. Canada's Fisheries Resource Conservation Council[8] (FRCC) has raised concerns about the future of lobster stocks in Atlantic Canada (FRCC, 1995). Lobsters are long-lived, bottom-dwelling invertebrates in which female maturation occurs after several years of growth and egg

production increases exponentially with increasing size (Prudden, 1962; Aiken and Waddy, 1980; Ennis, 1981, in Rowe, 2001, 1337). In many areas, current exploitation rates are high; harvesters take up to 85 percent of the animals eligible for legal harvest each year and primarily immature animals are harvested (FRCC, 1995). This is a problem because intense harvesting results in extremely low levels of egg production and risks recruitment failure during periods when environmental or ecological conditions that influence survival to recruitment are unfavourable.

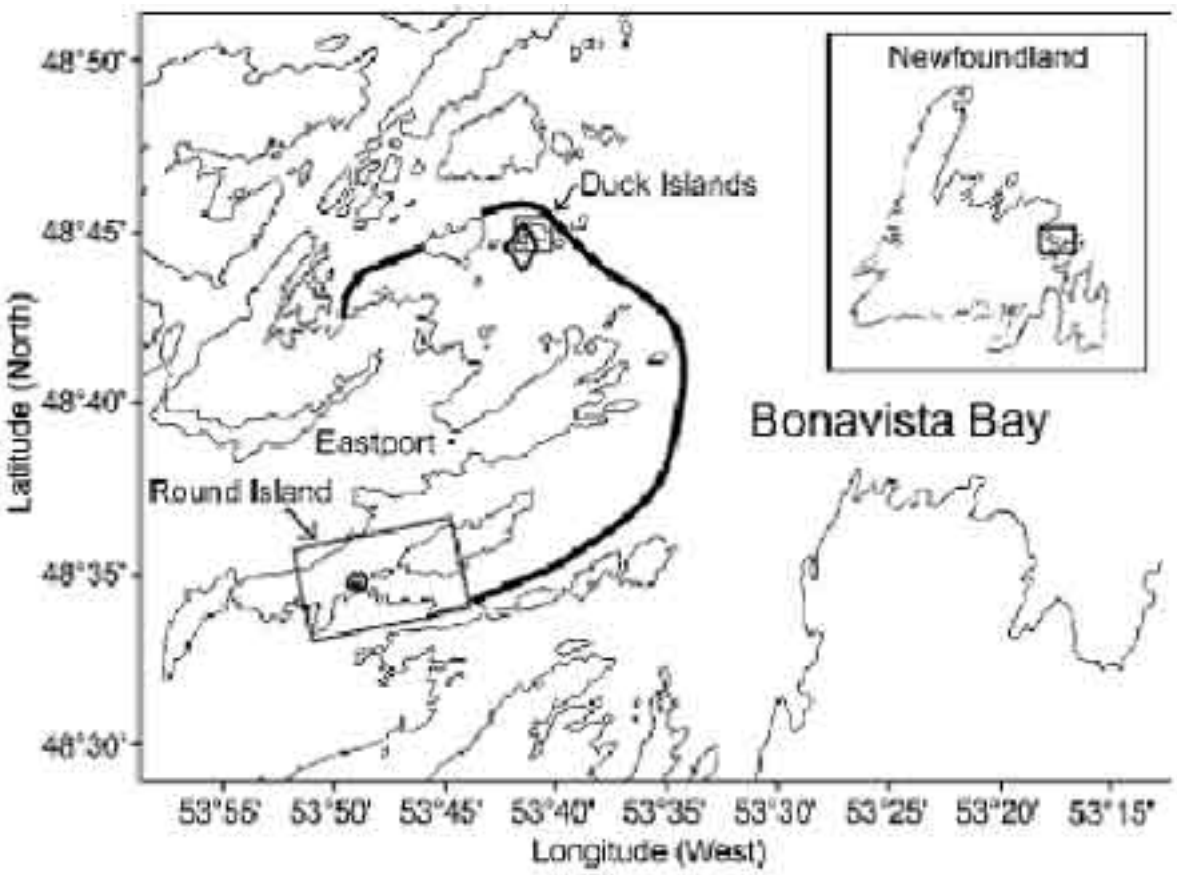
In its lobster conservation framework, the FRCC (1995) recommended that harvesters take measures to increase egg production, reduce exploitation rates, improve stock structure, and minimize waste. Some suggested measures for achieving these goals included reduction in harvesting effort, release of egg-bearing females, and establishment of areas protected from harvesting. Rather than prescribe specific measures to be implemented, the FRCC (1995) suggested several possible conservation strategies that might prove beneficial and recommended that local stakeholders and management officials work together in developing a program best suited to their particular region (Rowe and Feltham, 2000).

Around the Eastport Peninsula, in Bonavista Bay, Newfoundland (Fig. 1), the lobster harvesting season lasts about nine weeks, usually beginning in early May. Harvesters fish close to their home ports using small open boats and conventional wooden-lathed traps. Each harvester is permitted to set 200 traps, which are deployed in depths of less than 20 metres and checked every 1–2 days. Ovigerous females and lobsters less than 82.5 mm in carapace length are protected from exploitation. During 1997, in response to a decline in local lobster landings and the FRCC (1995) findings, Eastport Peninsula harvesters established two no-take reserves for lobster conservation, one at Round Island and one at Duck Islands (Fig. 1). The reserves encompassed a marine area of 2.1 square kilometres that surrounded three small islands and extended beyond the rocky substrate typically used by lobsters. Because local harvesters implemented and enforced the reserves, issues of illegal harvesting were avoided (Rowe and Feltham 2000).

To quantify movement and survival of adult lobsters between reserves and surrounding harvested areas at Round Island and Duck Islands, Rowe (2001, 1337) used a combination Global Positioning System (GPS) and Geographic Information System (GIS) to map lobster habitat within no-take reserves and surrounding areas subjected to harvesting. Lobster habitat was defined by local ecological knowledge of Eastport Peninsula lobster harvesters; shallow water areas (<20 m) with rocky substrate were typically deemed appropriate. The shoreline was considered to be the inner boundary of the habitat and the outer boundary was defined as the farthest distance from shore that harvesters could set a conventional trap during the harvesting season and expect to catch lobsters, usually where the near shore bottom sloped rapidly into deeper water. Geographic coordinates of the outer habitat boundary were determined from a boat operated at low speed and directed by local harvesters while position fixes were obtained every few seconds using the GPS. Habitat boundary co-ordinates were overlaid onto topographic maps of the region using the GIS (Rowe, 2001, 1337).

A detailed assessment of the lobster's habitat, movement patterns (emigration from, and immigration to no-take reserves), sampling, and how the proportion of lobsters harvested in the fishery was determined, can be found in Rowe's study (2001).

Figure 1. Eastport Peninsula Lobster Management Area (boundary shown by thick black line) with study site (box) and no-take reserve boundary (thin black line) at Round Island and Duck Islands.



(source: Rowe, 2001, p.1337)

Rationale for case selection

This case was selected because the diverse elements drawn into the creation of the marine conservation area illustrate a high degree of community involvement and considerable community monitoring efforts. Thus, the relationship between the fishers' livelihoods and the management of this particular resource (lobster) is worth a detailed analysis.

2. The story

The Eastport Peninsula Lobster Fishery

Newfoundland's lobster harvesters fish from small open boats (6-9 meters in length), close to their home ports (Rowe and Feltham, 2000). The province's lobster fishery has greatly increased in importance in recent years due to the collapse of groundfish stocks and closure of the cod fishery. In part due to this increased pressure, the lobster fishery shows symptoms of the problem identified by the Canadian Fisheries Resources Conservation Council (1995) –high exploitation rates and the high proportion of immature lobsters being harvested –and Newfoundland is an appropriate place for application of the conservation framework developed by the Council (FRCC 1995, in Rowe 2002; Gell and Roberts, 2002, 51).

The waters around the Eastport Peninsula in Bonavista Bay on the northeast coast offer some of Newfoundland's finest lobster habitat and the local fishery involves approximately 50 harvesters from seven small communities (Burnside, Eastport, Happy Adventure, Salvage, Sandringham,

Sandy Cove, and St. Chad's). The local lobster harvesting season is typically from early May until early July, and annual lobster landings ranged from 2,021 to 3,206 metric tonnes between 1978 and 1998 (Statistics Branch of Canada's Department of Fisheries and Oceans, u/d).

In 1994, Eastport area harvesters recognized that a serious decline in their lobster stocks had occurred over the preceding decade and that the rate of decline had accelerated due to increased harvesting directed towards the local lobster resource in response to groundfish fishery closures. Traditionally, lobster harvesting was a secondary fishery in this area; harvesters took lobsters for only the first few weeks of the season before changing to pursue groundfish. With the collapse of local groundfish stocks due to overfishing, a moratorium on commercial cod harvesting off the northeast coast of Newfoundland was announced in 1992. Since the moratorium, lobstering has become a more important source of income for many individuals (Hamilton and Haedrich, 1999). Previously inactive licences have been reactivated and active licences are being more fully used. Lobsters are now heavily harvested during the entire season. In addition, this fishery was characterized by such poor harvesting practices as the regular violation of trap limits and the retention of sublegal-sized and egg-bearing female lobsters. Lobster harvesters reported 1993 catch rates as being the worst in memory (Rowe and Feltham, 2000).

The Eastport Peninsula Lobster Protection Committee

On a local level, responding to FRCC recommendations, the Eastport Peninsula Lobster Protection Committee was established in 1995 to work on management techniques to promote a sustainable fishery. The committee was formed by local fishers and supported by the majority of lobster fishers in the area. One of their main roles was to reinforce the importance of complying with regulations on capture sizes, gear regulations and releasing egg-bearing females. In 1996 a voluntary program of marking and releasing egg-bearing females was introduced. Females with eggs were marked with a v-notch[9] in their tail and when caught again, even if not bearing eggs, they would be released to improve the opportunities for spawning individuals to continue to produce. There was good compliance with size and gear regulations amongst Eastport fishers and increases in landings resulted (Gell and Roberts, 2002, 51).

The Eastport Peninsula Lobster Protection Committee's main role was to design conservation management practices that would protect the lobster resource in their area. Specifically, the aims of the Committee were

- to conserve and enhance the lobster industry for themselves and future generations by encouraging responsible harvesting of the stocks;
- to learn and educate by using sound professional methods and practices in harvesting lobster;
- to provide vital information and statistics necessary to the management of lobster industry; and
- to demonstrate that professional fish harvesters can successfully harvest and manage the fishery to its fullest potential (Rowe and Feltham, 2000).

The Committee was fully supported by the vast majority of harvesters in the area and this support continues today. In 1995, the Committee held meetings to inform culpable individuals of

the potentially negative consequences of using illegal traps, excessive effort and the retention of egg-bearing or sub-legal lobsters. Although these practices often lead to increased catches in the short term, they ultimately reduced the number of breeders in the population and thereby jeopardized future harvesting success. By refraining from harvesting lobsters that are just below the minimum legal size and waiting an extra year, harvesters can increase their profits substantially because these individual lobsters can increase in mass (and thus value) by almost 50 percent through annual growth. This type of information was all the incentive that most harvesters needed to start working more responsibly and to obey the regulations (Rowe and Feltham, 2000).

In 1997, the Committee realized that more conservation measures were necessary, so they applied to the Department of Fisheries and Oceans to restrict lobster harvesting in the Eastport area to traditional users and to protect two areas of prime lobster habitat from all lobster harvesting (Rowe and Feltham, 2000).

In 1997 the Committee initiated protection of two areas of good lobster habitat within their fishing grounds, 2.1 km2 in total and supporting an estimated 1.5 percent of the lobsters in local fishing grounds. They also restricted lobster fishing to traditional users (about 50 licensed lobster fishers). In return, traditional users gave up the right to trap outside their area. There was also a buffer zone where fishers from Eastport and elsewhere could fish. Users were thus limited to fishing in their local area, assisting in the management of the resource. These two management decisions were the main impetus behind the establishment of the Eastport Peninsula Lobster Management Area, which incorporated the two closed areas (Rowe and Feltham 2000, in Gell and Roberts, 2002, 51).

In 1999, the Committee submitted a proposal asking the Department of Fisheries and Oceans to consider Round Island and Duck Islands under the Marine Protected Areas Program. After being reviewed, the proposal was accepted and as a result the Round Island and Duck Islands were officially identified as Areas of Interest or pilot projects on October 13, 2000. Building on their success, the Committee is now considering expanding their conservation and protection initiatives to include other species such as lumpfish (*Cyclopterus lumpus*) and sea urchins (*Strongylocentrotus droebachiensis*) (Power and Mercer, 22).

Restriction of Lobster harvesting to traditional users

The restriction of lobster harvesting in the Eastport area to traditional users was a pivotal point in the success of conservation efforts. Typically, lobster harvesters in Bonavista Bay have a licence that allows them to trap anywhere within this bay. However, Eastport harvesters gave up the right to trap outside of the area in which they traditionally took lobsters on the condition that harvesters outside of the area give up the right to trap around Eastport. This would make it easier to manage the lobster resource, because fewer people with restricted landing points would be involved. Exclusive access further increased the willingness and desire of harvesters to work towards conservation. Previously, a mentality existed among harvesters that if they did not take the sublegal-sized or egg-bearing lobsters or fish more traps than they were permitted, other harvesters would do so and reap the benefits. Now, individuals in the Eastport area refrain from these actions because they know that other harvesters will do so as well (Rowe and Feltham, 2000).

3. Major themes and considerations

Marine reserves

Fishery managers have long used fishery closures –areas temporarily closed to fishing for one or more species or to specific fishing gear –to help rebuild depleted stocks, reduce gear conflicts, protect vulnerable life stages of exploited species or protect sensitive habitats from damaging gear (Gell and Roberts, 2002, 6). Marine no-take reserves, areas closed to harvesting, are being increasingly used to conserve exploited populations and sustain fisheries. In the presence of intense harvesting pressure, no-take reserves may minimize over-exploitation by making part of the population inaccessible (Rowe, 2001, 1336).

According to Gell and Roberts (2002, 6), there is now strong evidence suggesting that with the support of local communities, marine reserves offer a highly effective management tool. People are the key factor in whether or not the reserves work. Without support and compliance from fishers no positive change can occur (Gell and Roberts, 2002, 19). Reserves offer many advantages over existing tools. They protect sensitive habitats from disturbance and damage by fishing gear such as trawls. Although closures to mobile fishing gear can achieve this, they lack the breadth of protection that reserves can afford. For example, reserves prevent by-catch mortality by preventing by-catch altogether. They eliminate ghost fishing by lost or discarded gear. They prevent impacts on populations by vessels high grading catches (discarding lower value species to load up with high value species). They foster the development of natural, extended age structures in populations, something that effort reduction alone cannot do (Gell and Roberts, 2002, 20).

Positive social effects of establishing marine reserves include increased environmental awareness and educational opportunities in local communities. Marine reserves often form a focus for conservation activities, which spread into more general practice. The initial consultation process of establishing a marine reserve often includes a strong educational element. Direct involvement of local communities in monitoring marine reserves can increase people's interest and enthusiasm for them. The Eastport lobster closures in Newfoundland involved local schools and other community members in collecting and analyzing lobster landings to assess the effectiveness of closed areas (Gell and Roberts, 2002, 20).

Marine reserves can also help generate alternative incomes for fishers. For example, one of the most effective ways of integrating local fishers' knowledge into the management of marine reserves is to employ them as park staff (Gell and Roberts, 2002, 21).

Power and control

In the absence of private ownership or collective management, individual fishers have no incentives to curtail fishing activities in response to declines in catches or increases in costs, because no property right or mutual agreement guarantees that fish not taken today will be available in larger quantity or at greater weight in the future (Acheson, 1987, 37). Quite often, the breakdown of a fishing boundary can result in conflict (territoriality issues). Since one's income is dependent on a specific area, one zealously maintains its boundaries (Acheson, 1987, 46). As pointed out by Acheson (1987, 46), the willingness to defend a boundary or invade another area depends on, first, the ability to form alliances, and, second, the existence of alternate income opportunities for the people involved.

Local knowledge can be understood as a system of power and thus can provide a basis for the empowerment of communities to undertake folk management (Ruddle, 1994, 195). Local groups are usually the least powerful among the different parties interested in conservation. Community-based conservation requires, therefore, that its advocates make more strenuous efforts to

channel greater authority and power toward local groups (Agrawal and Gibson, 1999, 641).

Community versus traditional management of the fisheries

The fisheries management institutionalized under the Law of the Sea Convention (1982) reflected a science-based management regime embedded in state bureaucracy and compatible with intensive utilization of ocean resources. This management model was committed to a simplistic image of marine ecosystems, and a faith in the human capacity to predict and control them (Holm, 1996, 178). Modern fisheries management was constructed as if the relation between fishing effort and stock size was direct, simple, and reversible. This radical simplification ignored most interactions among species within marine ecosystems (Holm, 1996, 184).

Conventional fisheries management has focused mainly on raising incomes by increasing the efficiency of fishing effort. At the same time, the threat of depletion of the resource due to over-fishing has tended to be approached utilizing conventional top-down fisheries management policies, informed by equilibrium-based stock assessment methods. Other top-down instruments include output controls, set out to regulate the catch directly through devices such as total allowable catches and limits on permissible by-catch proportions in single species fisheries. These management policies have shown to be insufficiently responsive to trends and shocks (Allison and Ellis, 2001, 382; Wilson et al, 1994, 291).

Against this simplistic rational model, sociologists and anthropologists have proposed a more complex and realistic image of fishers as responsible social persons who often act rationally with regard to their own interests, but are also bound by their membership in a community (Holm, 1996, 184).

Alternative management measures, which include protection of spawning and nursery areas, limited access, closed seasons and size limits, have successfully sustained fisheries and are often based on local or indigenous knowledge. DeWalt (1994, 125) has pointed out the strengths of local knowledge. Local people have three comparative advantages. They are very savvy about their local environment and have accumulated a significant amount of experience concerning those factors that affect their existence. Many of them have a keen awareness of the interconnectedness of species and other ecological factors. And they have become very ingenious at making do with the natural and mechanical resources at their disposal.

Until recently, fishers' ecological knowledge had been largely neglected by social and natural scientists (Neis, 1997, 243). The ecological knowledge of fishers includes awareness of the relationships between season, winds, tides, water temperature, presence of other species, and location and "catchability" of fish (Neis, 1997, 250).

It has taken a succession of stock crises to make fisheries scientists confront their neglect of ecological relationships such as those among species, between stocks and oceanography, and between catches and human and marine ecology in stock assessment models. Analysts maintain that is precisely these relationships that provide the framework for traditional ecological knowledge (Neis, 1997, 251).

Ultimately, it is important to view indigenous knowledge systems and scientific knowledge as complementary sources of wisdom. Both those who use and develop indigenous knowledge systems and those who develop and apply scientific knowledge are constrained by the way in which they have been trained to think and the contexts in which they live. The key is to provide both knowledge systems with more opportunities in which they can inform and stimulate one

another (DeWalt, 1994, 127).

The poor conservation outcomes that followed decades of intrusive resource management strategies and planned development have forced policy makers and scholars to reconsider the role of community in resource use and conservation (Agrawal and Gibson, 199, 629).

Sustainable livelihoods

Ensuring and maintaining sustainable livelihoods is an especially important objective in this case. In coastal Newfoundland the environment is viewed as a source of livelihood and sustenance; furthermore, humans are thought to be an integral part of natural systems (Macnab, 1996, 112).

The livelihoods approach centres on the links between individual or household assets, the activities in which households can engage with a given asset profile, and the mediating processes that govern access to assets and to alternative activities (Allison and Ellis, 2001, 378). A livelihood comprises the assets (natural, physical, human, financial and social capital), the activities, and the access to these (mediated by institutions and social relations) that together determine the living gained by the individual or household (Allison and Ellis, 2001, 379).

The application of the livelihoods approach suggests that many of the precepts underlying conventional fisheries management may be wrong and can result in inappropriate or unnecessary policy (Allison and Ellis, 2001, 386).

Integrating harvesters' local knowledge with fisheries science

From the early stages of the Committee's work, the need for the collection and dissemination of quantitative biological information was apparent. Scientific research conducted in the Eastport area in previous years and the FRCC report in 1995 provided the Committee with the information needed to address the problem of poor harvesting practices, but local data were required to asses the effectiveness of local conservation measures. Without such quantitative data, the value of various conservation tools would be difficult to demonstrate both to harvesters and to scientists (Rowe and Feltham, 2000).

In 1997, with the establishment of the Eastport Peninsula Lobster Management Area and the two no-take lobster reserves therein, the Committee engaged in a partnership with the Department of Fisheries and Oceans, Memorial University of Newfoundland, and Parks Canada. Together, these partners drew on their very different knowledge bases to identify questions relevant to lobster conservation in the Eastport area, formulate hypotheses, decide how best to test them, collect the necessary data, and interpret the results. Instead of trying to insert harvesters' knowledge into fisheries science and management, the Committee decided to take a different approach: integrating scientific methodology into their local ecological knowledge base. As a result, the group has been able to gather scientifically rigorous data (quantitative in nature and collected using standardized techniques) and has benefited from local knowledge (typically qualitative in nature) particularly during the planning and interpretive stages (Rowe and Feltham, 2000).

As a result, the Department of Fisheries and Oceans "has used this success in Eastport as an example for other groups interested in similar initiatives, not only from a scientific or technical perspective, but to illustrate the importance of community support and resource stewardship, transparent consultations, and information exchange" (Power and Mercer, no date, 22).

Community involvement

Not only has the Committee designed and implemented a conservation plan to improve management of their resource, but they have also taken an active role in enforcement and education. For example, harvesters on the Eastport Peninsula have established a system of peer enforcement. Unlike the previous system in which harvesters reported infractions directly to the appropriate government regulatory agency, information on suspicious activity is now conveyed to the Committee. A group warning is issued to the perpetrator and the local fisheries officers are informed of the violation in case legal actions are required. Within the partnership, the Department of Fisheries and Oceans responds to the Committee's concerns through enhanced surveillance of problem areas and routine monitoring of the traps to ensure that they are registered to licensed individuals (Rowe and Feltham, 2000).

The harvesters involved have undertaken these initiatives so that they, their community, and future generations can earn a reasonable portion of their living from harvesting lobsters. The Committee has taken measures to educate both harvesters and non-harvesters about the importance of lobster conservation and some individuals now interested in the project do not actually harvest lobsters themselves. In many cases, family members of licensed harvesters have become actively involved in managing data collected during the commercial harvest season. In addition, the local school has supported the harvesters by taking on management and analysis of the lobster fishery monitoring data as a class project. The students' work provides the Committee with information on stock status and gives the young people and opportunity to learn more about the fishery and fisheries management. The involvement of the school has made this a truly community-based project and serves to strengthen the link between the local fishery and the future (Rowe and Feltham, 2000).

Mapping and monitoring results

Biological evidence for the effectiveness of closed areas is growing. In a study of lobster populations between 1997 and 1999, Rowe (2001, 2002, in Gell and Roberts, 2002, 51) found a low frequency of lobster emigration from closed areas, offering increased survival to protected lobsters. Over 90 percent of tagged lobsters were recaptured in the same area they had been tagged in. In a study of lobster populations inside and outside closed areas, in one of the two areas (Round Island) lobster density, sizes of individuals, and proportion of egg-bearing females were significantly greater than in adjacent fishery areas. Lobsters were significantly larger inside the other closed area (Duck Island), but there was no significant difference from fishing grounds in density or proportion of egg-bearing females. These studies were undertaken only three fishing seasons after the reserves were established.

Fishing pressure outside closed areas was intense with mortality estimated at nearly 72 percent of lobsters of harvestable size and condition (Rowe 2001). Rowe concluded that closures were already demonstrating the potential to benefit local fisheries, even after just 2-4 years of protection. Larger lobsters and more egg-bearing females in the closed areas will increase egg production. Only a very small proportion of lobsters within the wider management area are currently protected, but at present egg production is thought to be at such low levels that even this small number of lobsters producing significantly more eggs could have a positive effect on future numbers of lobsters in the area. Egg production is estimated to have increased (Ennis 2000) and closed areas are thought to have contributed 7.1 percent of total annual egg production.

Eastport lobster fishers have reported improved landings over the management period, whereas

in the rest of Newfoundland fishers have seen a serious decline in their landings. In the Eastport Peninsula Lobster Management Area lobster populations appear to be recovering in response to the package of management techniques introduced, the most important being the two closed areas and the marking and returning of egg-bearing females. The success of the program has prompted other communities in Newfoundland to consider similar initiatives. It has also prompted the Eastport community to consider totally closing the lobster closure areas to fishing, establishing them as marine reserves to protect other species as well (Gell and Roberts, 2002, 51).

Rowe's conclusions (2002, 174) could have been stronger if the study had begun several years before the reserves were established, in order to quantify pre-existing differences between the selected reserve and nearby control areas. Without data at sites inside and outside of reserves prior to reserve implementation, the author could not conclude with certainty that differences between them were due to protection from harvesting within reserves. However, because the proportion of ovigerous female lobsters and lobster size was observed to increase over time within reserves and remain stable outside, it is reasonable to believe that these differences were attributable to the protection of lobsters within reserves from harvesting effects.

Although the Bonavista Bay no-take reserves are still young, these results suggest that they offer increased survival to lobsters within them and thereby have the potential to provide direct benefits to local lobster populations and the fishery. This could happen in two ways: through elevated egg production by individuals within the reserves or by movement of juvenile or adult lobsters from reserves to harvested areas (Rowe, 2002, 174).

Community-based natural resource management

A community-based approach to fisheries management appears to satisfy several desirable goals. In addition to the direct resource protection gains, it places decision making at a level that should ensure that local knowledge of the resource is brought into play and it ensures participation by fishing families themselves in decision-making processes (Allison and Ellis, 2001, 384).

Several key considerations related to the successes of the program and possible future improvements can be summarized as follows:

- Lobster fishers themselves initiated management measures, including closed areas.
- Loss of fishing grounds was divided evenly amongst the fishers so nobody was hit too badly.
- Lobsters in closed areas are increasing in abundance, living longer, growing larger and producing more eggs than those in fishing grounds, potentially helping contribute to improvement of local stocks and supporting fisheries through increased recruitment and spillover.
- Although the reserves work, they are very small (in this case protecting an estimated 1.5 percent of the population) and more will be needed to fulfil their full potential to boost fisheries. Fishers are now interested in having a larger no-take area. (Gell and Roberts, 2002, 52)

4. Conclusions

Conclusions in the following categories are relevant to both monitoring and environmental assessment programs.

Agenda

Fishers' preoccupation about declining lobster catches gave rise, in 1995, to the creation of the Eastport Peninsula Lobster Protection Committee, which aimed to implement conservation and protection measures that would promote a sustainable lobster fishery. The priority of this community-based monitoring program was to regenerate the fishery by implementing a program of v-notching egg carrying females. The Committee also proposed closing two critical areas of lobster habitat to all fisheries. The goal of the project was to sustain and enhance the local lobster fishery for commercial harvesters in the area, promoting egg production in local populations and increasing recruitment (Power and Mercer, 22). Efforts were made to minimize adverse effects on fishers displaced as a result of the closed areas.

The scope of the associated monitoring activities was originally determined by historical and geographical considerations. Because fishers from the Eastport Peninsula created a management area in which they agreed to restrict to their lobster harvest, specific geographical boundaries were established to recognize traditional fishing areas. Fishers from surrounding communities who did not have an historical claim to this area agreed not to fish within the boundary (Power and Mercer, 22). The time frame of the undertaking was designed to monitor and manage the lobster population so as to maintain long-term viability. Finally, the livelihood connections between the lobster population, community assets, and access to this shared resource highlight the need to consider social as well as biophysical parameters through the management program.

Although the fishers have primarily determined the agenda in this case (through the Eastport Peninsula Lobster Protection Committee they selected their own permanent no-take areas), Department of Fisheries and Oceans staff and other partners (such as the Memorial University of Newfoundland) have worked closely with the Committee to monitor and evaluate these conservation and protection initiatives (Power and Mercer, 22).

Tools

For the particular case of the Eastport lobster initiative, the most important tools used for monitoring and management activities include special designated area protocols (Marine Protected Areas, Areas of Interest, Department of Fisheries and Oceans protocols) and maps.

"Marine protected areas are increasingly recognized by scientists, resource managers and fishermen as an effective method to protect species and the habitats on which they depend" (WWF, 3). They are important conservation tools for protecting fisheries and biodiversity and for maintaining healthy ecosystems. On Canada's Pacific coast several Areas of Interest (AOIs) have been identified for Marine Protected Area designation under the *Oceans Act*. In Atlantic Canada six Areas of Interest (candidate Marine Protected Areas) have been named.[10] Eastport was named an Area of Interest in 2000. Even though Eastport is still in the Area of Interest stage, interim management measures have started to pay off as catches are improving in the local lobster fishery (WWF, 5).

Maps have been useful to establish the limits of the conservation zone (geographic boundaries), to detect lobster patterns and rates of growth, for example. Also, a Global Positioning System (GPS) and a Geographical Information System (GIS) were used to map lobster's movement and survival between reserves and surrounding harvested areas.

Roles and tasks

This community monitoring program involved the participation of different actors: local community members and fishers (grouped in the Eastport Peninsula Lobster Protection Committee), scientists (represented by the Department of Fisheries and Oceans), researchers (from the Memorial University of Newfoundland), and other partners such as Parks Canada.

The Committee, for example, was responsible for reinforcing the importance of complying with regulations on lobster catches (capture sizes, gear regulations, release of egg-bearing females, etc.), for designing conservation management practices to protect lobsters, and for improving public education and promoting community discussion (Protected Areas Association of Newfoundland and Labrador, n/d, 4).

The Department of Fisheries and Oceans, as the lead federal authority in oceans related issues, has supported and assisted the Eastport Committee by identifying questions relevant to lobster conservation, formulating hypotheses, and deciding how best to test them, collecting the necessary data, and interpreting the results. It also provides surveillance of problem areas and monitors lobster traps to ensure that they are registered to licensed individuals (Rowe and Feltham, 2000).

Resources

It is not entirely clear what percentage of funds for the lobster conservation area come from the government, the community and other organizations. Support from the Memorial University of Newfoundland and the Department of Fisheries and Oceans has been in place from the early stages of the initiative, notably through research and the implementation of monitoring programs.

Nevertheless, effective institutionalization of community-based conservation requires that local groups have access to adequate funds for implementing the rules they create. The sources for these funds should also be local, raised through the contributions of users rather than allocated by central governments. Over time, this would mean that government agencies not just cede their authority to make rules about conservation, but also that community groups demand control over the resources themselves (Agrawal and Gibson, 1999, 641).

Application of findings

The Eastport lobster conservation initiative has modified the way in which fishers access marine resources such as lobster. Setting up no-take areas and implementing monitoring activities has promoted the protection and development of this particular resource.

The introduction of regulatory mechanisms such as the ones described earlier (closing of specific areas, no egg-bearing female fishing, etc.) has led to new, more efficient, management regimes supported by cooperation among local resource users, government agencies, and researchers.

It is also clear that community involvement in the process is key to preserve the livelihoods of the people that depend directly on the fisheries.

Contributions to broader society

According to the Committee, there are many things that can be learned from this experience (Rowe and Feltham, 2000):

- Conservation measures initiated from the grassroots are widely accepted and thus are more effective.
- The key to effective enforcement and compliance with conservation measures is an effective local education program and acceptance by stakeholders of a serious stewardship role.
- Both harvesters' local knowledge and fisheries science can make important contributions to fisheries knowledge and management.
- Harvesters and scientists can work co-operatively for effective management and betterment of a resource.

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1 The term "citizen" is used here and throughout the report as a means of referring to the community or local public, and is not related to citizenship status.

2 "Sustainable development" was most famously defined by the World Commission on Environment and Development's 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." Various definitions and models have subsequently been developed to illustrate the relationships between social, economic, and environmental components of sustainability.

3 The 1990 Bergen Declaration explains the precautionary principle as follows: "Environmental measures 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" (United Nations Environmental Commission for Europe 1990). Applied to decision making, this principle means that where uncertainty exists, available information should be considered in order to devise a course of action that minimizes the possibility of environmental harm.

4 Efforts are underway in Muskoka, Ontario to develop a community monitoring program that supports the protection of valued social and natural features as identified through a public consultation process. The resulting indicators of watershed health guiding this program include employment levels, rates of involvement in stewardship programs, and the prevalence of "green" school and business practices, in addition to many aspects of the biophysical environment (Muskoka Watershed Council 2003). For details, see the website of the Muskoka Watershed Council: http://www.muskokaheritage.org/watershed.

5 Citizen monitoring in Hamilton, Ontario has identified several specific instances of water pollution in Red Hill Creek. After further investigation by provincial authorities, the Ontario Ministry of the Environment has written orders against the City of Hamilton requiring that the municipality correct these problems. For details, see the website of Environment Hamilton: http://www.environmenthamilton.org.

6 Woolwich, Ontario is one of approximately 1000 "Healthy Communities" worldwide, as designated by the World Health Organization. In 1999, community members produced a report exploring social and economic equity, environmental quality, and citizen participation in policy formation in Woolwich (Woolwich Healthy Communities 1999).

7 The Ecological Monitoring and Assessment Network, Department of Fisheries and Oceans, Ontario Benthos Biomonitoring Network, British Columbia Ministry of Water, Land and Air

Protection, and Ontario Conservation Authorities are just some of the government agencies and quasi-governmental organizations working to develop standardized protocols for environmental monitoring programs suitable for citizen use.

8 The *Fisheries Resource Conservation Council* (FRCC) was created in 1993 to form a partnership between scientific and academic expertise, and all sectors of the fishing industry. Together, Council members make public recommendations to the Federal Minister of Fisheries and Oceans on such issues as total allowable catches (TACs) and other conservation measures for the Atlantic fishery. The Council is responsible for advising the Minister on Canada's position with respect to straddling and transboundary stocks under the jurisdiction of international bodies such as the Northwest Atlantic Fisheries Organization (NAFO). The Council also provides advice in the areas of scientific research and assessment priorities. The Council consists of 15 members from the "science" and "industry" fields, appointed by the Federal Minister of Fisheries and Oceans. Members are chosen on merit and standing in the community, and not as representatives of organizations, areas or interests: "science" members are drawn from government departments, universities or international posts, and are of a mix of diverse disciplines, including fisheries management and economics; and "industry" members are knowledgeable of fishing and the fishing industry, and understand the operational and economic impacts of conservation decisions. Members appointed from the Department of Fisheries and Oceans serve *ex officio*. The four Atlantic Provinces, Quebec, and Nunavut may each nominate a delegate to the Council. The Council is supported by a small Secretariat located in Ottawa. The Secretariat provides administrative support for the functioning of the Council; offers technical science and fisheries management support; organizes Council meetings; records decisions of the Council; undertakes a professional communications function for the Council, providing a central point for communications to and from the Council; and undertakes other matters as required (Available on line at: http://www.frcc.ca/eindex.htm).

9 A 'V-notch' is punched out of the tail of female lobsters. This notch persists through successive moulting so that females can always be identified and returned to the sea (Power and Mercer, 20).

10 "While the Eastport Peninsula lobster harvesters have not formally established an MPA, their techniques to conserve the lobster resource are very much like an MPA. Their initiatives show how a community can address conservation issues in a positive, productive way, and help ensure a healthy future for themselves" (Protected Areas Association of Newfoundland and Labrador, 6).