MARINE PROTECTED AREAS SUSTAINABILITY: ISSUES OF COMPLEXITY AND STEWARDSHIP

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Marine Protected Areas Sustainability: Issues of Complexity and Stewardship

by

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Abstract

The success rate for MPA implementation both in Canada and globally is low. Tools such as 'How is Your MPA Doing?' exist that do assess MPAs, but neglect to assess them long term. This thesis examines MPAs from the point of view of sustainability through the use of various tools, and highlights the issues of complexity and stewardship as factors influencing this sustainability. Specifically, stewardship is a term often linked with MPAs and other environmental initiatives, but rarely defined with any depth or operationalized. This thesis proposes to begin understanding the concept of stewardship through literature review and community dialogue, using the case study of the Eastport Peninsula MPA, in Eastport, Newfoundland, Canada. A set of questions were developed from this dialogue that can begin to assess stewardship in the Eastport region.

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Chapter 1 Introduction

1.1. Introduction

Rapid population growth, uncontrolled coastal development and intensified resource exploitation have placed pressures on marine ecosystems, unforeseen by conventional approaches to resource management (Salomon *et al.*, 2002; Arkema *et al.*, 2006). The associated consumptive and non-consumptive demands are believed to be driving factors behind anthropogenic induced changes currently affecting the health of many ecosystems, including fisheries, mangroves, estuaries and coral reefs (Defeo *et al.*, 2009). Some studies suggest that losses in biodiversity and species richness (Peters and Hawkins 2009), over-harvesting and habitat alteration are positively correlated with human population increase (see, for example, Evans *et al.,* 2006). The complex and dynamic social and economic systems of multiple, but often incompatible, uses, add to the management challenges (Bastien-Daigle *et al.*, 2008), requiring instead 'governance' mechanisms to deal with, and to help make decisions about hard choices and trade-offs (Chuenpagdee *et al.*, 2005).

Several people have argued that conventional ocean and coastal resource management, focusing separately on sectors such as fishing, tourism and coastal development, is inadequate for addressing marine issues (see for instance, Pikitch *et al.*, 2004; Arkema *et al.*, 2006; Crowder and Norse, 2008; Curtin and Prellezo, 2010; Tallis *et al.*, 2010). Challenges posed by the cumulative effects of these activities on the marine ecosystem require an integrated rather than individual, sectoral approach to address (WECD, 1987; O'Boyle and Jamieson, 2006). In the

marine and fisheries realm, this need has resulted in the adoption of an ecosystem-based management (EBM), which is seen as a holistic way of better understanding the complexity and interactions of the ecosystems (Pikitch *et al.*, 2004; Arkema *et al.*, 2006), and is used to replace sectoral-based management (Babcock and Pikitch, 2004).

Many tools can aid in EBM. Prominent among them are marine protected areas (MPAs). An MPA is a place-based tool defined as "an area of intertidal or sub-tidal terrain together with its overlying waters and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part of or all of the enclosed environment" (Kelleher, 1999, p. xviii). They have a variety of specific purposes including biodiversity conservation, fisheries management, and habitat restoration (Christie and White, 2007) and have been known to increase size, biomass, and density of fishes where they are employed (Ban *et al.*, 2009). MPAs come in different shapes and forms, and offer different level of protection to species, habitats and marine ecosystems. The International Union for the Conservation of Nature (IUCN) differentiates MPAs into six categories of protection, including strict nature reserves and wilderness areas (categories Ia and Ib), national parks (category II), national monuments or features (category III), habitat/species management areas (category IV), protected landscapes/seascapes (category V), and protected areas with sustainable use of natural resources (category VI) (Dudley, 2008). The purpose of this classification system is to provide a common understanding of MPAs, both between and within countries. All six categories share some objectives, including, but not limited to, conserving the "composition, structure, function and evolutionary potential of biodiversity" (Dudley, 2008, pp. 12), and contributing to regional conservation strategies. They differ in level of protection and allowable human use. For example,

MPAs of category Ia offer the highest protection, allowing minimum human use or visitation (Dudley, 2008). Category II MPAs, on the other hand, combine protection with some degree of recreational use (Dudley, 2008). The different levels of protection implies incompatibility in some cases, for instance, between category VI MPAs and category Ia, as the former allow for the sustainable use of natural resources (Dudley, 2008).

As of 2008 it was estimated that there were 5,045 MPAs globally (Spalding *et al.*, 2008), which, according to Wood *et al.* (2008), offer protection to only about 1.6% of the world's marine area under national jurisdiction. Further, only 10-15% of these MPAs are effectively managed (White *et al.*, 2002). Nevertheless, their establishment continues to expand globally, partly because of the commitment made at the Convention on Biological Diversity in 2006 to protect and conserve at least 10% of the world's marine and coastal regions (Spalding *et al.*, 2008).

Many challenges impede the successful implementation and sustainability of MPAs, including ineffective size (Rioja-Nieto and Sheppard, 2008), lack of comprehensive knowledge about the ecosystems, limited funding (Barr and Mourato, 2009), lack of community support and weak institutional capacity (Jameson *et al.*, 2002). There is also the challenge of dealing with multiple stakeholder groups, some of which ignore resource restrictions placed upon them by the MPA (Stamieszkin *et al.*, 2009). Responsibility is also often split up among various stakeholders, thus creating management complications due to the overlapping objectives and jurisdiction (Mangi and Austen, 2008). Many MPAs indeed fail to meet prescribed objectives, and often exist in name only as 'paper parks' (Depondt and Green 2006).

Despite the difficulties in implementation and warnings against using MPAs as one of the universal tools to address marine and oceans related issues (see Degnbol *et al.*, 2006), establishing MPAs still tops the priority list of many governments, intergovernmental and environmental organizations. Accordingly, emphasis has been placed on the efficient design of MPAs, appropriate process of establishment, and optimal mechanisms for implementation. Once they are established, an emphasis is shifted to monitoring success and assessing effectiveness, using tools such as 'How is Your MPA Doing' (Pomeroy *et al.*, 2004), among others.

The focus on design, planning and implementation are arguably important steps in the creation of a successful MPA. However, it does not guarantee the long-term sustainability, which is a critical aspect in the discussion about EBM. Marine ecosystems are complex and dynamic (Karkkainen, 2002), composed of many parts, both biotic and abiotic, which interact with and influence each other (Jorgensen, 1990). Thus, the problems associated with management and governance of marine ecosystems is considered 'wicked', meaning there is no easy solution, but rather a managed situation in which the solution changes over time (Jentoft and Chuenpagdee 2009). For this reason, authors like Brady and Waldo (2009) suggest that MPAs should only be used as part of an integration of tools along with others, such as property rights and community-based management.

As suggested by Chuenpagdee and Jentoft (2007), the 'step zero,' or the stage when the idea is originally conceived and communicated, is very crucial for successful implementation of any management regime. Some researchers have suggested further that the real question about MPAs is not whether they are effective but rather whether they *can be* effective (Jameson *et al.* 2002).

Others submit that the limited success in MPA implementation is due to the generally assumed position by the MPA proponents about what they are for, as opposed to a careful deliberation about what they may mean to different stakeholders (Jentoft *et al.* 2011).

1.2. Research Objectives and Approaches

This thesis builds on the above observations about the relatively low success rate in the MPA implementation and the call for broadening perspective in understanding and sustaining MPAs. Specifically, it examines two concepts - complexity and stewardship - which may play key roles in MPA sustainability. Firstly, it hypothesizes that the insufficient understanding about the complexity and interactions between natural, social and governing systems associated with the MPAs may limit their performance, and thus the ability to sustain them. Secondly, it proposes that MPA sustainability may be fostered by linking it with a related but broader concept of stewardship.

While the terms complexity and stewardship seem intuitive and are commonly referred to in the discourse about MPAs and EBM, they are often not properly investigated. One possible reason is the lack of tools and frameworks that can aid in this understanding. The thesis aims to address this gap by conducting the following research. First, it explores what can be learned from an existing and most commonly used management tool, 'How's Your MPA Doing,' and what a governance tool like 'governability assessment framework' can add to the understanding of ecosystem complexity. A visualization tool, 'Coastal Transects Analysis Model' (CTAM), is also employed to demonstrate how currently available technology can be used to enhance

communication and public participation in resource management. The second aspect of this thesis is to examine the concept of stewardship using a simple approach that comprises keyword search and focused group discussion in defining what the term means and in discussing its significance. The study was conducted in Eastport Peninsula in eastern Newfoundland, where an MPA was established in 2005 to provide protection to lobsters and their habitat.

Two theoretical frameworks inform this research. The first component of the thesis draws from the interactive governance theory (Kooiman *et al.*, 2005), which considers complexity as a key system property that gives rise to difficulties in governance, limiting thus the ability of the governing actors in implementing and sustaining their effort. The approach taken in studying stewardship aligns well with participatory action research (Kindon *et al.*, 2008), which suggests that involvement of local community in defining the issues and in finding solutions is an important element for long-term sustainability of any management initiative.

1.3. Thesis Organization

Chapter 2 provides a literature review about EBM, MPAs and sustainability, as well as the two key concepts addressed in the thesis, complexity and stewardship. This is followed by Chapter 3, which describes the study area and the Eastport MPA. In Chapter 4, the 'How is Your MPA Doing' tool is employed to assess Eastport MPA, and the results are discussed in the context of sustainability. Chapter 5 utilizes the governability assessment framework in examining complexity and other system properties associated with the Eastport MPA, and discusses how they may foster or inhibit its sustainability. Next, an illustration of CTAM is presented in

Chapter 6, along with discussion about its potential use in communication about complexity. Chapter 7 describes an approach taken in this study to examine the concept of stewardship. The final chapter (Chapter 8) summarizes key findings and implications from this research.

Chapter 2 Literature Review

2.1. Ecosystem-based management (EBM)

The EBM approach reconciles biological diversity, conservation, and socio-economic needs (Crowder and Norse, 2008). It attempts to broaden the scope of resource management such that ecological, environmental, and human factors are considered (Curtin and Prellezo, 2010). According to scientific consensus, released by the Communication Partnership for Science and the Sea in 2005, EBM is defined as "an integrated approach to management that considers the entire ecosystem, including humans. The goal of EBM is to maintain an ecosystem in a healthy, productive, and resilient condition so that it can provide the services humans want and need. Ecosystem-based management differs from current approaches that usually focus on a single species, sector, activity, or concern; it considers the cumulative impacts of different sectors" (McLeod *et al.*, 2005, pp. 1). An early definition of EBM identified five specific goals: maintenance of viable populations, of ecosystem representation, and of ecological process, protecting the evolutionary potential of species and ecosystems, and accommodating human use (Grumbine, 1994). Others, like Cogan *et al.* (2009), add other elements to EBM considerations such as interconnectedness within and among systems, the importance of interactions between species and services, and integration of ecological, social, economic, and institutional perspectives, with recognition of their dependence upon each other. Recently, the EBM approach attempts to capture whole-ecosystem complexity in order to understand human impacts (Kaufman and Borrett, 2010). Citizen participation is another new component of EBM, as it is

believed by many that stakeholders should partner in addressing issues, identifying opportunities, and finding solutions (Angulo-Valdes and Hatcher, 2010).

Elements of the EBM concept originated among scientists in the 1930's and 1940's (Grumbine, 1994). In 1932, for example, the Ecological Society of America's Committee for the Study of Plant and Animal Communities advised that a U.S. nature sanctuary system should protect whole ecosystems rather than just a single species, and should include a wide range of ecosystem types in order to manage the fluctuations or natural disturbances (Grumbine, 1994). Aldo Leopold is also attributed with the development of some of the core concepts of EBM (Grumbine, 1994), specifically in *A Sand County Almanac* published in 1949. Although Leopold did not use the term "ecosystem-based management", he did study many interdisciplinary principles in ecology, socioeconomics, and human interest in natural resource management that were later included in the concept (Szaro *et al.*, 1998), and advocated understanding the interconnectedness of landscapes and managing through a bio-centric ethic (Yaffee, 1998).

The early discussion leading to the present-day concept of EBM was in the context of land management (Arkema *et al.*, 2006). It was not until the Earth Summit of 1992 in Rio de Janeiro, however, that the commitment to protecting and developing ocean resources occurred (Arkema *et al.*, 2006). Other ocean policy initiatives since then have emphasized the importance of sustainability and progressing towards EBM goals.

Many tools can aid in EBM, including protection measures such as MPAs. It has been suggested, for instance, that extensive MPA networks would help protect fisheries ecosystems (Lubchenco

et al., 2003; Roberts *et al.*, 2005). As described on the EBM Tools Network (http://www.smartgrowthtools.org/ebmtools), which will be later discussed, other categories of EBM tools include decision support tools; modeling and analysis tools; data collection, modeling, and process tools; stakeholder engagement and outreach tools; conceptual modeling tools; visualization tools; project management tools; and monitoring and assessment tools (EBM Tools Network, 2010). The availability of these tools should help facilitate EBM implementation. Studies show, however, that implementation of the EBM concept is difficult, in part due to the belief that it is complicated and has prohibitive information requirements (Tallis *et al.*, 2010). This belief is not entirely untrue as EBM is a complex entity, comprising a variety of interconnected concepts, various approaches, and issues that must be interpreted, synthesized, and communicated to a variety of interested parties, including stakeholders, scientists, and policy makers (Cogan *et al.*, 2009). EBM is seen by some as too broad for any practical implementation and there is also the issue of political and administrative bottlenecks, which restrict implementation (Cogan *et al.*, 2009). Additionally, there is no overwhelming evidence to suggest that even long-term use of an EBM strategy would lead to improvements in ecosystems (Tallis *et al.*, 2010). Another challenge, and one related to governance, is that EBM is overlaid on existing policies and practices, yet often demands the reform of the same (Christie *et al.*, 2009). Because of the lack of evidence, arguments in support of EBM are typically based upon principles instead of proof.

2.2. Marine Protected Areas (MPAs)

As earlier mentioned, MPAs are areas where human activity has been restricted in some way (Pitcher and Lam, 2010). They are strong candidates for marine conservation (Salomon, 2002), and they fulfill EBM goals by conserving marine biodiversity, maintaining productivity, re-establishing ecosystem integrity, enhancing the size and productivity of harvested fish or invertebrate populations, and adding to economic and social welfare (Villa *et al.*, 2001; Hooker and Gerber, 2004). The implementation and order of importance of these goals, however, may depend upon societal and economic pressures in a region (Hooker and Gerber, 2004). As noted by Jentoft *et al.*, (2007), these goals are not static, but can shift with interactions between stakeholders, and composition changes between stakeholder groups.

The level of protection offered by MPAs varies, ranging from no-take reserves closed to fishing (Pitcher and Lam, 2010), to those that allow fishing yet restrict activities such as drilling for oil or gas (Lubchenco *et al.*, 2003). Recent global estimates have the number of MPAs worldwide at 5,045, but covering less than 1% of the world's oceans (Spalding *et al.*, 2008). A group of international marine scientists have called for an increase of MPA coverage to 20% by the year 2020, while the Fifth World Parks Conference has a goal of 20-30% coverage by 2012 (Pajaro *et al.*, 2010). With such a low current coverage, it will be difficult to achieve the goals proposed by these recent meetings.

Within the past few decades there has been growing interest in evaluating the performance of MPAs (Pomeroy *et al.*, 2004). The Parties to the Convention on Biological Diversity (CBD)

committed to adopting and implementing frameworks to be used in the monitoring, evaluation, and reporting of MPAs by 2010 (Pajaro *et al.*, 2010). Managers can assess their progress in achieving objectives through of the use of indicators, developed to provide information for stakeholders and show progress towards an MPA's desired goals (Pajora *et al.*, 2010).

In the past, specific indicators for MPA evaluation have been focused on the natural system, the MPA itself, and the species within it. In Kenya, for example, MPAs have existed since the 1960's and the assessments have shown that there is a higher abundance of coral reef fish inside the MPAs compared to outside (Muthiga, 2009). Studies in that country have been undertaken on biodiversity and community structure of coral reefs, which are dominant inside the MPAs.

Stakeholder roles in successful MPAs have been stressed (Himes, 2007), as stakeholder input is considered critical in developing MPA goals and objectives, and to the overall management of the MPA (Pomeroy *et al.*, 2004). An understanding of the environmental and societal values that stakeholders hold is necessary to determine a community's expectations and aspirations for their MPA. Not all areas are suitable for 'co-management' style MPAs. A case study in San Felipe, Yucatán, México, for example, described participatory research, where a variety of methods including GIS mapping, surveys, interviews, and a community workshop were used, as a process leading to co-management of a small MPA in the area called *Actam Chuleb* (Chuenpagdee *et al.*, 2004). The study found that while there were differences between community members and government officials about the ecological and socio-economic importance of coastal resources, they shared an interest in protecting habitats and managing coastal resources. This, along with good leadership, community cohesion, and the early engagement of stakeholders in the

discussion about the MPA, implies that the area may have some potential for co-management (Chuenpagdee *et al.*, 2004).

Specifically, community involvement and participation in resource management has been linked to the long-term success of MPAs (Pollnac *et al.*, 2001; Martinez, 2008). This involvement can lead to a sense of ownership for an MPA which increases its chances of being supported and sustained (Launio *et al.*, 2009). Engagement of the community is a crucial step for MPA sustainability as social factors are highlighted by many authors as a core determinant of MPA success (Morin Dalton, 2001; Mascia, 2003; Kessler, 2004; Drew, 2005). Many of the sustainable MPAs located in the Philippines, for example, are community initiated and currently continue to be managed by the community (Launio *et al.*, 2009). Community involvement does not guarantee the success or sustainability of MPA, however. Each of the MPAs in the Philippines, despite all involving the community, had a variety of factors that led to their success (Launino *et al.*, 2009). For instance, the attitude of stakeholders adjacent to MPAs towards these areas is an important consideration. As discussed by Mangi and Austen (2008), unless stakeholders' attitudes about the MPA and its regulations are positive, it is not likely that rules and regulations of the MPAs will be enforced, and that the MPAs will fulfil their promises.

2.3. Complexity

Ecosystems are complex and dynamic, meaning that they do not always gravitate towards an equilibrium state (Karkkainen, 2002). They are increasingly seen as the result of large numbers of interacting forces (Clark and Gelfand, 2006), related to the composition of many mutually

interdependent parts that interact in multiple and complicated ways (Karkkainen, 2002). Different system components, both biotic and abiotic, may interact and influence each other directly and indirectly (Jorgensen, 1990), creating thus chaotic, incompletely known, and constantly changing ecosystems (Wells, 2003). Some scientists consider that complexity is more behavioural than structural, and that simple systems can display complex behaviour (Earn and Rohani, 1999; Cadenasso *et al.*, 2006).

Our knowledge of ecosystem complexity has increased dramatically since the 1970s (Arkema *et al.*, 2006), but it is far from complete (Karkkainen, 2002). Even with an understanding of the individual components of an ecosystem, there will often be some uncertainty in predicting the impact of certain inputs or management adjustments (Karkkainen. 2002). This is particularly true of marine ecosystems which exist in internally consistent dynamic states (Daskalov *et al.*, 2007). These ecosystems have a high level of ecosystem complexity, with a high level of biodiversity and varied habitats (Borja *et al.*, 2008). Even after more than a hundred years of study, marine ecosystems are only partially understood and few changes are predictable (Berkes, 2003; Wells, 2003).

Despite the complexity and scientific uncertainty, Ludwig *et al.* (1993) argue that conservation efforts should not be impeded, and that an adaptive approach should be taken. This proposition recognizes that conventional fisheries science is often unable to predict complex issues such as ecosystem regime shifts (large changes in oceanic conditions) and recovery (Daskalov *et al.*, 2007). One approach to deal with these issues is to build partnerships between managers and resource users (Berkes, 2003), fostering thus the exchange of knowledge and co-learning. Both

adaptive and precautionary approaches are required for EBM (Pikitch *et al.*, 2004), as well as for MPAs.

2.4. Sustainability

Linked with EBM is the concept of sustainability, proposed as a method of stopping global degradation (Bastien-Daigle *et al.*, 2008). Sustainability is also a word of which exact interpretation has been debated (Ciegis, 2009). It was defined by the Brundtland Commission (WECD, 1987) as development that meets the needs of the current generation without compromising the needs of future generations. It placed an emphasis on fair distribution of resources among the present generation, and between present and future generations, as well as on development that finds a balance between economic, social, and environmental dimensions (Ciegis, 2009). Later definitions attempted to expand upon this. In 1992, for example, the Rio de Janeiro declaration on Environment and Development defined it as a long-term process aimed at satisfying humanity's needs at present and in the future via rational usage and replenishment of natural resources, while allowing for replenishing of the Earth for future generations (Rio Declaration on Environment and Development, 1992). It has been argued that a commonality among definitions was a lack of inclusion of all aspects of the concept (Ciegis, 2009). Nevertheless, the Brundtland definition is the most widely utilized and thought to be most inclusive definition for sustainability (Ciegis, 2009). Sustainability in a variety of circumstances, such as tourism and water use, has also been described as a "lofty goal" (Taylor, 2005; Olsen and Fenhann, 2006). Combined with the intangible definitions of the term, this implies that the goal of sustainability cannot always be reached, or put in practice.

In addition to EBM, integrated management (IM) has been described as helpful in achieving sustainability. IM, in particular, has been proposed as a collaborative governance model to help achieve sustainable development (Bastien-Daigle *et al.*, 2008). It has been difficult, however, for Canada to move from a conceptual definition of the IM into a practical implementation, and the inclusion of IM plans into Canada's *Sustainable Development Strategy* has been slow (DFO, 2005).

2.5. Stewardship

Traditional management considers humans at the peak of a trophic pyramid, drawing resources from the base (Bundy *et al.*, 2008). Sustainability and sustainable development concept considers human needs first, although it places the emphasis on future generations rather than the current one (Worrell and Appleby, 2000). Several authors have argued that the homocentric focus in resource management and development paradigm partly explains the poor performance of MPAs and other environmental initiatives ((Bundy *et al.*, 2008; Jentoft *et al.* 2010). A holistic view recognizing linkages between people and environment is required.

Stewardship is a concept that resemblances this alternative perspective. The focus on 'stewardship' stems from the global movement towards sustainability, especially since the 1992 United Nations Conference on Sustainable Development. The agenda for the environment was created to move economic policies toward reducing the impact on the environment and also to encourage the promotion of both the individual and the community (Scipioni *et al.*, 2009).

Stewardship is a term that is increasingly used by a variety of agencies, including resource industries, government, and community activists to describe their own resource use philosophy (Schlag and Fast, 2005).

Stewardship has been identified as important in an MPA context in Canada. For example, one of the guiding principles for MPA implementation, and in the strategic framework, is stewardship (DFO, 2005). Specifically, this involves engaging Canadians in the development and support of MPAs, combined with increasing the awareness and understanding of the public with regard to ocean conservation issues. Stewardship has been identified as a crucial component in the implementation and long-term health of MPAs. Nevertheless, how it could be used in the context of MPAs is never addressed.

In the United States, the Commission on Ocean Policy has stated; "Ecosystem-based management can provide many benefits over the current structure. The coordination of efforts within a specific geographic area allows agencies to reduce duplication and maximize limited resources. It also provides an opportunity for addressing conflicts among management entities with different mandates. Less obvious, but equally important, ecosystem-based management may engender a greater sense of *stewardship* among government agencies, private interests, and the public by promoting identification and connection with a specific area" (U.S. Commission on Ocean Policy, p. 64, emphasis added). Although the statement is about EBM, stewardship is identified here as crucial.

Chapter 3: Eastport Case Study

3.1. General Description

The Eastport peninsula is approximately 655 km^2 (Bull, 1999), and bordered by the Atlantic Ocean and Terra Nova National Park (Figure 3.1). It is a narrow peninsula extending out into the center of Bonavista Bay, on the eastern part of Newfoundland, Canada (DFO, 2007). The area is known for its many coves and beaches (Bull, 1999) and is surrounded by a number of small islands. It consists of seven communities, including Sandringham, Eastport, St. Chad's, Happy Adventure, Salvage, Burnside, and Sandy Cove, with a total population of approximately 1500 in 2006. Fishing has always been the primary economic activity of communities like Salvage and Happy Adventure, with roughly 40 inshore fishers, and two fish plants that provide seasonal employment to the local population.

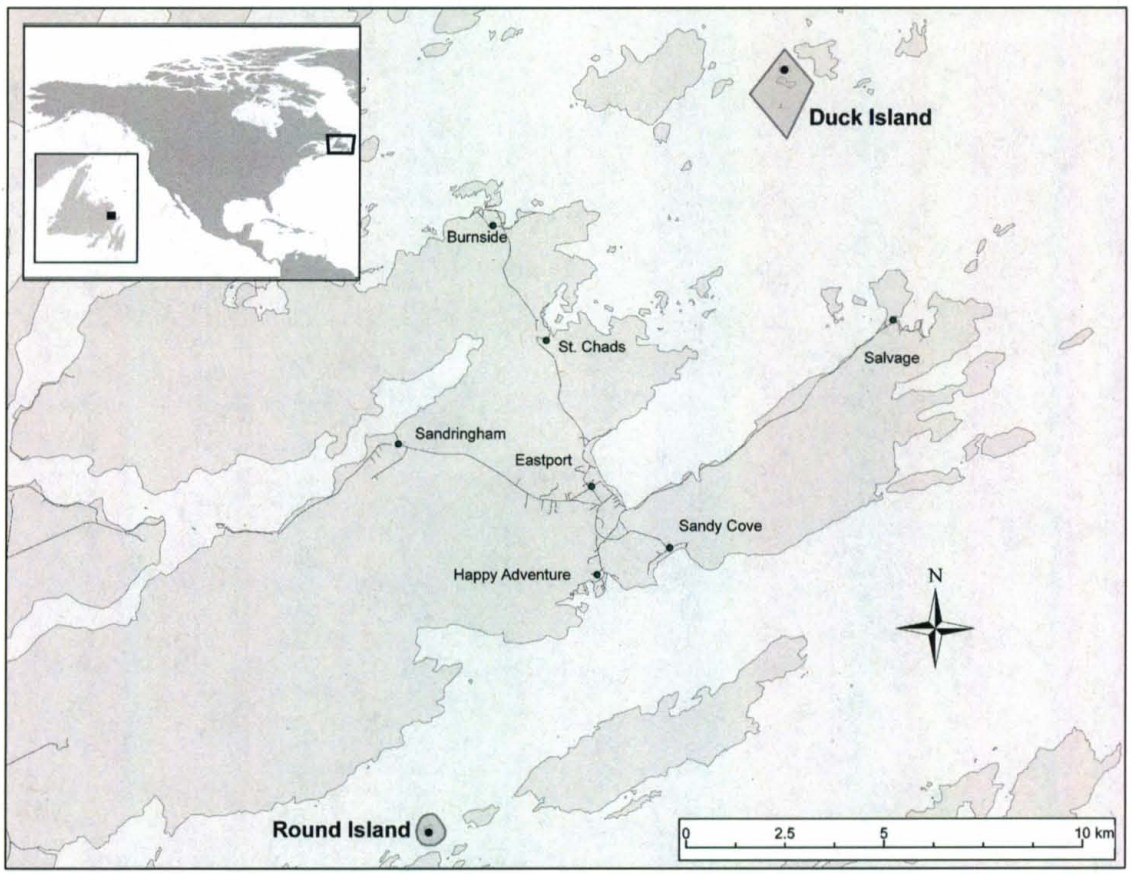


Figure 3.1: The seven communities of the Eastport Peninsula and Duck and Round Islands MPA (Modified from Canadian digital elevation data from Geobase 2007)

With the collapse of the groundfish fishery near the end of the twentieth century, fishers in Eastport were forced to increase efforts towards other species. One of these species was American lobster (*Homarus americanus*) (Davis *et al*, 2006), which also began to decline after a few years of more intense fishing pressure. Concerned by the trend, fishers of the peninsula formed the Eastport Peninsula Lobster Protection Committee (EPLPC) in 1995 (Power and Mercer, 2000). The goal of the EPLPC was to ensure the conservation and protection of lobster stocks in the area (Rowe and Feltham, 2000).

Building upon this successful community-based conservation initiative, the EPLPC submitted a proposal to create a small MPA around two local islands in 1999 (Power and Mercer, 2000). The protected area is 2.1 km^2 in size and its specific management boundaries include both Duck and Round Island (see Figure 3.1.). Both islands are located in Lobster Fishing Area 5 (DFO, 2007). Duck and Round Islands were declared an Area of Interest (AOI) in 2000, before being officially designated as an MPA in 2005.

3.2. Eastport MPA

As mentioned above, the formation of the EPLPC was driven by declining lobster abundance. This decline coincided with an initiative from Parks Canada with regard to Marine Conservation Areas (Blundon, 1999). Information about this initiative was presented to the EPLPC, and was influential in their eventual desire to implement an MPA. The publication of a report in 1995 by the Fisheries Resource Conservation Council (FRCC) on the state of Canadian lobster stocks was another driving factor. The FRCC also recommended that local stakeholders and management work together to develop a program specific to their region (DFO, 2007).

The impetus of the MPA was in large part due to the concern of Eastport fishers over outside fishers (those not from the Eastport Peninsula) fishing in their local waters. The EPLPC wished to exclude those from outside the peninsula from fishing their waters in order to protect livelihoods and keep the benefits of the EPLPC conservation work localized. The meetings to decide the MPA boundary were conducted with fishers both from the peninsula and from outside the region who fished in Lobster Fishing Area 5. DFO supported the lobster fishers of Eastport

and enabled the creation of this boundary zone in 1997, in addition to the creation of two closed areas around the future MPA sites of Duck and Round Islands. This occurred three years before the Islands became an AOI, and was considered a necessary 'step zero' before the MPA designation.

A Steering Committee was initially formed in 2002 to assess the suitability of the AOI as an MPA. The first meeting took place in March, 2002, co-chaired by DFO and the EPLPC. The Steering Committee also changed with the eventual designation of the MPA; it now acts in an advisory role for management of the MPA and Steering Committee members continue to meet 3-4 times per year (DFO, 2007). It currently consists of co-chairs from DFO and the EPLPC, and representatives from fisheries, tourism, Eastport municipalities, harbour authorities, and the government.

A management plan was published in 2007 for Eastport by DFO and the Eastport MPA Steering Committee. The plan was created with input from stakeholder groups and incorporated collected scientific data and background information (DFO, 2007). The plan outlined a number of regulatory and non-regulatory objectives, with associated short and long term goals.

3.2.1. Regulatory Objectives

Two objectives are mandated in the management plan for the Eastport MPA. The plan specifies maintaining a viable lobster population as its first regulatory objective, to be monitored by study of larval drift and of lobster size, both inside and outside the closed areas (DFO, 2007). Larval drift is the time period of a lobsters' life when it is in larval stage and inhabiting the water

column rather than the ocean bottom. Studying larval drift provides scientists with a better understanding of lobster distribution, and why lobsters settle in a particular area. Next, by examining the size distributions of lobster inside and outside the closed area, it may be possible to determine whether the MPA contributes to larger lobsters, and consequently higher number of egg production (DFO, 2007).

The second regulatory objective is related to conservation and protection of endangered species. In particular, DFO put wolffish (*Anarchichas lupus*) under the Species-at-Risk Act (SARA) as a species of concern in June 2004 to provide protection to the species. Although there are no studies linking any specific cause to the species decline, it is believed that overfishing and habitat alteration have affected wolffish abundance (DFO, 2010). The northernmost limit of wolffish distribution is in the Arctic, specifically Davis Strait (DFO, 2010). The species is also found in the North Atlantic Ocean, off the coast of southern Newfoundland, southern Labrador, the Atlantic provinces, and to the west of Greenland. It can also be found around the Eastport Peninsula. Information packages about wolffish have been distributed to local fishers and the goal is to monitor wolffish bycatch outside the MPA boundaries. In the long run, DFO wishes to estimate wolffish populations inside and outside the closed areas (DFO, 2007).

3.2.2 Non-regulatory Objectives

Several non-regulatory conservation objectives are included in the management plan. They are: ensuring the participation of stakeholders in MPA management, increasing stewardship and awareness among the public for lobsters and other conservation measures, promoting scientific research to increase understanding of the MPA ecosystem, ensuring concentration of potential

economic benefits of the resource within the Eastport communities, and maintaining and enhancing the Eastport ecosystem.

According to the DFO (2007), stakeholder participation is achieved through continuing annual science briefing meetings, regional MPA science workshops, and public meetings. A long term goal is to establish a lobster interpretation centre in Eastport. Efforts to enhance stewardship and public awareness include development and maintenance of the Eastport MPA website, brochures and publication of the Coastal Current, a quarterly publication focusing on the Eastport and Gilbert Bay, Labrador MPAs, and organization of community events, and festivals (DFO, 2007)

The short term scientific research focus is on the development of collaborative agreements with Memorial University of Newfoundland (MUN) to provide scientific support for research related to the MPA, and the development of activity plans and approvals for the MPA regulations (DFO, 2007). Another short term goal is collaboration with the Newfoundland and Labrador Legacy Trust.

In addition to conservation and protection of marine ecosystem, potential economic benefits in the area, particularly from tourism, were expected with the establishment of the Eastport MPA. Long term goals include studies into eco-labeling and further investigations into the economic benefits of endeavours such as a lobster interpretation centre (DFO, 2007).

Short term goals include the initiation of a public awareness program about marine debris and an invitation to local fish plant managers to attend a Best Management Practices Workshop (DFO,

2007). Also included is the monitoring of fish plants for improper dumping and disposal. Long term goals include the investigation of alternative uses for fish offal in order to eliminate or at least reduce dumping at sea (DFO, 2007). They also include implementing best management practices to reduce fish effluent impact on marine ecosystems.

Chapter 4 MPA Assessment

4.1. How is Your MPA Doing?

Evaluation of MPA management effectiveness is useful as it can both ascertain if MPA objectives are being fulfilled, and illuminate the problems and challenges with the management system and processes (Pomeroy *et al.*, 2004). Identifying these challenges may then provide opportunities for improving management effectiveness in the future as this type of assessment can inform discussions on what conditions lead to an MPA successfully fulfilling its objectives. This type of evaluation could be especially crucial for many developing countries, which have to balance biodiversity conservation with resource extraction and poverty alleviation (Muthiga, 2009).

The handbook 'How is your MPA Doing?' (Pomeroy *et al.*, 2004) was developed to evaluate the effectiveness of MPA management. Development of the handbook started in 2000 when the World Wide Fund for Nature and The World Conservation Union World Commission on Protected Areas – Marine joined to create the *MPA Management Effectiveness Initiative*, whose goal was to design a methodology to evaluate the effectiveness of MPAs (Pomeroy *et al.*, 2005). After two years, a team of 37 experts from diverse backgrounds and knowledge in the governance, biophysical, and socioeconomic fields, had developed a number of indicators that could be used for evaluation of an MPA (Pomeroy *et al.*, 2005).

Initially, the group surveyed the goals and objectives of MPAs worldwide and discovered they fell into three categories; socio-economic, biophysical, and governance (Pomeroy *et al.*, 2005). They also surveyed all indicators used in assessing the marine environment and coastal communities, creating a master list of 130 indicators, which were then linked to the MPA goals and objectives they could measure. The group, with aid from two peer reviews, narrowed this list down to first 52, then 42 priority indicators (Pomeroy *et al.*, 2005). Most indicators fulfill more than one of the goals and a number of objectives are incorporated within each goal.

The guidebook was tested using 18 MPAs with a variety of characteristics and objectives (Pomeroy *et al.*, 2005). The majority of the MPAs were located in North America, Central America, and Southeast Asia. The managers of these MPAs volunteered to undertake a trial run of the assessment, and picked the indicators which most applied to their situation to be evaluated. The evaluation period lasted 8 months between 2002 and 2003, with many sites creating a multi-disciplinary team to undertake the assessment (Pomeroy *et al.*, 2005). The results from these evaluations allowed the guidebook to be further revised and improved.

The resulting guidebook is a document that describes how to evaluate MPA management effectiveness, which is defined as the "degree to which management actions are achieving the goals and objectives of a protected area" (Pomeroy *et al.*, 2004). An evaluation of the Eastport MPA using the guideline has never been conducted prior to this research; thus it was considered useful in providing some insight into what constitutes a successful MPA, and how this success could be sustained.

4.2. Methodology

The majority of the data was collected by informal discussions with key informants, literature review, and field observation. Field visits took place from June to August in 2008, and in August and September of 2009. The data for most indicators had been collected previously by scientists, fishers, and other residents of the peninsula. Following the examples of the 'How is Your MPA Doing?' case studies, some indicators were excluded from the assessment either because they did not apply, or because there was limited information. The selected indicators were chosen because they had a direct linkage with management objectives.

Informal discussions with fishers, fish plant managers, and the DFO Biologist for the Marine Protected Areas Program of Fisheries and Oceans Canada were conducted to collect information for biophysical indicators. Key literature sources for the chosen biophysical indicators included the Eastport MPA Technical Report for 2009 and scientific articles from Rowe (2001, 2002).

Key informants for socio-economic indicators were a variety of Eastport residents including fishers, bed and breakfast owners, Terra Nova Park workers, farmers, the MPA coordinator, and others. Additional information was also obtained from *The Eastport peninsula: A people of the sea and soil* (Hynes, 1999).

For governance indicators, key references were the Eastport MPA Management Plan (2007), a Masters' Thesis (Blundon, 1999) and peer-reviewed articles such as Davis *et al.* (2006), which provided information about the Eastport Peninsula Lobster Protection Committee (EPLPC) and

MPA Steering Committee. Informal discussions were also conducted, primarily with fishers and the Eastport MPA coordinator, to gain more insight about the governance indicators.

4.3. Results

4.3.1. Biophysical summary

Table 4.1 summarizes the biophysical characterization of the Eastport MPA, according to the 'How is your MPA Doing' indicators. Since the implementation of the EPLPC, both average size and abundance of lobsters in the Eastport area has increased significantly. Over a five year period (2004-2009), the number of lobsters sampled within the MPA was 2,530, while areas outside and adjacent to the MPA, where lobsters were commercially fished, the number was smaller at 1,548 (Janes, 2009). This increase has been attributed to the conservation and education efforts of the fishers. The differences in population size and structure inside versus outside the MPA are attributable to the protected nature of the two islands, which were no-take reserves even before the MPA was established. It is difficult to know how much of an additional impact the MPA formation has had on this trend. Recruitment success has also been positive, as evidenced by increasing lobster populations.

The MPA itself is small, and is fairly uniform in terms of habitat structure. Much of the water area is deep with rocky bottoms, while the areas around the two islands are shallow. There are a variety of species in the area; many of these are migratory. No populations in the area are threatened from the small-scale fishing effort, and the area experiences little impact due to the dearth of marine activity. Lobster is a primary commercial species for peninsula fishers, but it is

not the only one. Fishers in the area do not target one particular species, but on a variety of them. In terms of landed value, lobster has been among the top five species from 1998-2007 every year with the exceptions of 2000 and 2005 (Community Landings Report, 1998-2007). Other common species on these lists include snow crab (*Chionoecetes opilio*) and capelin (*Mallotus villosus*). The area also has little marine activity or traffic. Fish plant waste is dumped away from the MPA. On a whole, the MPA is not experiencing much impact from human activity.

Table 4.1: 'How is your MPA Doing?' biophysical assessment for the Eastport MPA

Indicators	Results	Sources
1. Focal species abundance	-significant increase in lobster abundance, 1997-2007 -abundance, life expectancy, size, number of eggs greater inside the MPA than outside	Rowe (2001, 2002), Janes (2009)
2. Focal species population structure	-increase in average size of lobsters in area as well as abundance of large lobsters (1997-2007) -male-female ratio was 651 to 638 in Round Island, and 755-486 outside	Janes (2009)
3. Habitat distribution and complexity	-rocky substrate, shallow area within MPA	Janes (2009), informal discussion
4. Composition and structure of community	-variety of plant life, animals passing through waters of the MPA -jellyfish, sea urchins, capelin and scallops -eelgrass, Irish moss, and species of kelp and rockweed	DFO (2007), informal discussion
5. Recruitment success within community	-recruitment successful due to increases in lobster abundance in and around the MPA -concern that lobster larvae are settling beyond Bonavista Bay headlands	DFO (2007), Janes (2009), informal discussion
6. Food web integrity	-there are no imbalances between trophic levels	Informal discussion, Janes (2009)
7. Type and level of fishing effort	-lobster is one of many important species commercially -small scale, inshore fishing, boats mostly 6-9 m in size	Catch and Effort -Community Landings Report (DFO, 1997-2007), Rowe and Feltham (2001), informal discussion
8. Water quality	-little activity/development in area -fish plant waste dumped away from the MPA	Informal discussion, observation
9. Area showing signs of recovery	-lobster populations have recovered -sustainable population for fishing purposes	Janes (2009)
10. Area under no or reduced human impact	-small amount of boating, small-scale fishing -low impact from human activity	Observation, informal discussion

4.3.2. Socio-economic summary

As summarized in Table 4.2, outside of fishing, not many activities impact marine resources in the area. People's perceptions of these resources are positive and the marine ecosystem is highly

valued. This belief stems from the education efforts of the EPLPC prior to the MPA implementation, and an appreciation and pride in the area in which they reside. This appreciation combined with education efforts also have led to an understanding of the human impacts on marine areas, specifically fishing impacts. Education has been a key component of the work of the EPLPC and now MPA. Fishers in the area have been educating other fishers, community members, and school children on issues of lobster biology, MPAs, and general marine conservation. Education is aided by the community-wide perception that the conservation efforts of the EPLPC and MPA have increased lobster abundance. The community can see that their work is having a tangible impact on the number of lobsters.

The quality of life for community members has not been drastically affected by the implementation of the MPA. Lobster is a supplemental species for fishers economically as none are dependent upon it for their livelihoods. The two islands were no-take areas before the MPA implementation. Basic services are provided in the peninsula's hub, the town of Eastport, and were pre-MPA as well.

Table 4.2: 'How is your MPA Doing?' socio-economic assessment for the Eastport MPA

Indicators	Results	Sources
1. Local marine resource use patterns	-fishing -educational boat tour for local students -sight-seeing tours (e.g. whale watching) in the past, currently discontinued	Informal discussion, observation
2. Local values and beliefs about marine resources	-marine resources highly valued within community	Informal discussion, observation
3. Level of understanding of human impacts on resources	-lack of understanding in mid 1990s -the education efforts of the fishers towards their peers and the community has aided understanding considerably	Literature review, informal discussion
4. Perceptions of seafood availability	-readily available -sold to two local fish plants, but extra remains for community members	Informal discussion

5. Perceptions of local resource harvest	-fishers feel lobster has increased in abundance -attributed to the work of the EPLPC and MPA	Informal discussion
6. Perceptions of non-market and non-use value	-post EPLPC and MPA a greater appreciation for the natural environment -aesthetics important, beach clean-ups a common activity	Informal discussion, observation
7. Material style of life	-relatively unchanged since MPA implementation	Informal discussion, observation
8. Quality of human health	-basic health services provided -clinic and pharmacy	Informal discussion, observation
9. Household income distribution by source	-income sources include fishing, tourism, service industry, and farming -also, some are employed by Terra Nova Park -much work is seasonal, fishers supplement through carpentry, other activities	Observation, informal discussion
10. Household occupational structure	-some fishers involve family in their fishing activities -many families have one provider engaged in full time employment and a second involved in seasonal work, such as at the Salvage fish plant	Observation, informal discussion
11. Community infrastructure and business	-all residents are provided basic goods and services -larger towns with more services close by (as in Glovertown)	Observation
12. Number and nature of markets	-fish processed at two local fish plants (Happy Adventure and Salvage) -most sold to buyers in the United States	Informal discussion
13. Stakeholder knowledge of natural history	-high degree of local knowledge -fishers' suggested MPA areas -knowledge of the lobster lacking pre-EPLPC but currently high	Literature review, informal discussion
14. Distribution of formal knowledge to community	-regular presentations made to school kids in area -newsletters, posters, also used as educational material for the whole community	Informal discussion
15. Percentage of stakeholder group in leadership positions	-fishers represented on the MPA Steering Committee which advises DFO in MPA decisions -also represented are fish harvesters, tourism sector, harbour authority, municipalities, fisheries board and government	DFO (2007), EPLPC (2008), informal discussion
16. Changes in conditions of ancestral and historical sites/features/monuments	-there are no historical sites in the area -human impacts are minimal	Informal discussion

4.3.3. Governance summary

Table 4.3 shows the assessment results for the Eastport MPA in terms of governance. There was initial suspicion towards DFO by many of the fishers on the peninsula when the idea was first

introduced. This suspicion stemmed from earlier interactions with DFO. The MPA is fulfilling many of its objectives, specifically the primary regulatory goal of maintaining a viable lobster population. Many of the non-regulatory goals have been implemented as well, such as the promotion of scientific research, ensuring participation, and increasing public awareness and stewardship. Some specific objectives have been less successful, however. For example, lack of government funding has made it difficult to complete larval drift studies for the last two years. Larval drift is an issue as lobster larvae spend time in the water column, and can drift out beyond the Eastport Lobster Management Area (ELMA). Fundraising may be an option in the future, however.

Table 4.3: 'How is your MPA Doing?' governance assessment for the Eastport MPA

Indicators	Results	Sources
1. Level of resource conflict	-suspicion about DFO early, as they had full management and control of MPA -no suspicions currently, fishers are satisfied with the work of DFO -little conflict between fishers as the majority support the conservation efforts of the Steering Committee and MPA	Informal discussion
2.Existence of a decision-making and management body	-steering committee influential in guiding the operation of the MPA -three levels of participation -two co-chairs, nine voting members and seven ex-officio members	EPLPC (2008)
3. Existence and adaptation of a management plan	-management plan initiated in 2007, purpose was to "guide and inform management decisions for the Eastport MPAs over the next several years" (DFO, 2007) -short and long term objectives	DFO (2007)
4. Local understanding of MPA rules and regulations	-well understood by local community -fishers involved in designation of MPA	Informal discussion
5. Existence and adequacy of enabling legislation	-MPAs are created under the *Oceans Act* which provides a framework for ocean management	DFO (2007)
6. Availability and allocation of MPA administrative resources	-small MPA, doesn't require much funding -funding for the larval distribution program has been rescinded -fundraising is an option in the future	Informal discussion
7. Existence and application of scientific research and input	-the At-Sea monitoring program which includes v-notching and tagging -most work undertaken through volunteer fisher efforts -larval distribution studies have been	Janes (2009), informal discussion

	discontinued	
8. Existence and activity level of community organization (s)	-active partners of the MPA include Terra Nova Park, Coastal Connections and the communities of the peninsula	Informal discussion
9. Degree of interaction between managers and stakeholders	-bi-annual meetings between stakeholders and managers, arranged by the MPA coordinator	Informal discussion
10. Proportion of stakeholders trained in sustainable use	-workshops attended by fishers have focused on what makes MPAs successful	Informal discussion
11. Level of training provided to stakeholders in participation	-fishers have been trained in v-notching and lobster tagging -they have also been instructed on the use of log books to record sex and weight of lobsters, and when and where they were caught	Informal discussion, literature review
12. Level of stakeholder participation and satisfaction in management	-most fishers' satisfied -feel their concerns are given serious consideration/attention	Informal discussion
13. Level of stakeholder involvement in surveillance	-pre-MPA peer pressure was a common tactic for getting other fishers to comply -reporting individuals only when peer pressure and education efforts fail	Informal discussion
14. Clearly defined enforcement procedures	-procedures are clearly defined -up to $100,000 for convictions and $500,000 for indictable offenses	Informal discussion, DFO (2007)
15. Enforcement coverage	-patrolled by DFO during peak fishing times	Informal discussion
16. Information dissemination	-Committee meetings are frequent -quarterly newsletter (Coastal Current) highlighting Eastport and Gilbert Bay MPAs	Informal discussion, DFO (2007)

4.4. Discussion and Conclusion

According to the 'How is your MPA Doing' assessment, the Eastport MPA is doing relatively well. The success of this MPA may be due in part to the involvement of its communities. The MPA was initiated by fishers, who played an active role in its designation, and the formation of its goals and objectives. The fishing community remains invested in the management of the MPA currently, along with others in the community. Community participation has been linked to MPA success, both initially and long-term (Pollnac *et al.*, 2001; Martinez 2008). Additionally, the small size of the MPA and the low livelihood dependency on the lobster fishery have aided in its success.

However, there are issues that challenge the continued success of the MPA, which are not revealed in the assessment using the indicators suggested by the guidebook. Many residents are concerned, for example, that there are few young fishers in the area. Currently, there is one fisher under the age of forty on the peninsula. Questions raised by the local fishers are whether the MPA will continue to function as it has when all current fishers in leadership positions retire, and whether there will be anyone to take their place. The lack of young fishers and leadership void are two possible hurdles to the continued success of the MPA. Neither of these issues related to the future of the MPA showed up when applying the 'How is Your MPA Doing?' to assess its effectiveness.

In fact, an assessment such as this often does not address the sustainability of MPAs. It could be argued that success today predicts success in the future, but this is not always the case. The 'How is Your MPA Doing?' guidebook focuses heavily on the present day context, which gives a good indication of the current success of the MPA, but may not be sufficient for predicting its future. Even within MPAs that are currently successfully fulfilling their goals and objectives, there is concern about their future prospects. One issue is the lack of long-term financing, which is a major constraint to MPA sustainability (White *et al.*, 2005; Lowry *et al.*, 2009). In many examples, once external funding and support is withdrawn, the MPAs struggle to fulfill their goals (Pomeroy *et al.*, 2005). There is a need for the practical considerations of the cost of establishing and maintaining an MPA (Mcrea-Strub *et al.*, 2010), as conservation efforts cannot be implemented without charge. This is problematic among researchers as well, as many scientific articles focus on the biological benefits of protected areas, ignoring economic and social cost associated with their establishment (Naidoo *et al.*, 2006).

Another aspect that seems to receive insufficient consideration in 'How is Your MPA Doing?', is the level of community involvement both in the MPA and in the broader community. There are sections of the guide which assess stakeholder interaction with management and the number of stakeholders in leadership positions, yet the nature of this relationship and factors which may affect how they interact are missing. The relationship between management and stakeholders, for example, may be stressful, making management difficult. In Eastport, there was a local lobster scientist from DFO with whom many of the fishers had a positive relationship. Without this positive experience, it is possible that the bid to establish the MPA may have failed. Also missing from the guidebook is a consideration for community spirit, pride, and ownership for the area in which coastal people live. A community that has pride in its environment may be more likely to want to protect it. These attributes can be expressed in a number of ways; festivals, volunteer activities, and town clean-ups for example. The activities could suggest community management would be successful.

On the whole, the 'How is your MPA Doing' is a useful assessment tool that can provide the basic understanding about factors contributing to success and effectiveness of the MPA management. Its emphasis on 'management' and effectiveness makes other aspects considered important for long-term sustainability of MPAs, like leadership and prospect for future generations, less evident. The situation in the Eastport Peninsula and the MPA suggest that an evaluation that takes long-term considerations into account is needed, along with more in-depth diagnosis of the MPA characteristics, and surrounding communities.

Chapter 5 A Governability Assessment of the Eastport Peninsula Marine Protected Area

5.1. Interactive Governance Theory

Governance can be a difficult concept to define. The term originates from the Greek word *kubernáo*, which means "to pilot or steer" (Kjaer, 2000). Traditionally governance has been about government (Jentoft and Chuenpagdee, 2009), but recently it has been seen as something beyond management, and including more actors than government. Specifically, it is the process whereby sections of society influence and implement policies, and governing activities are carried out by the state as well as markets and public and private sectors (Kooiman *et al.* 2005; Ehler, 2003). In other words, it can involve government, universities, civic organizations, communities, the media, political parties, and private businesses (Jentoft and Chuenpagdee, 2009). The process of governance often involves partnerships or interactions between a number of these different groups, and in this way can be seen as more of a "bottom-up" approach than a traditional "top-down" (Jentoft and Chuenpagdee, 2009). Governance involves a mix of all governing efforts by various actors, at different levels (local, national, international), and in different governance modes and orders (Kooiman, 2003).

Interactive governance recognizes these relationships between agencies and at different levels. It is defined as "the whole of interactions taken to solve societal problems and to create societal opportunities, including the formulation and application of principles guiding those interactions and care for institutions that enable them" (Kooiman *et al.*, 2005, p.17). This approach places an emphasis on the inherent complexity in systems and allows for the characterization of systems

based upon all these interactions. It also considers ethical principles and social values as influential factors in governance and decision-making (Jentoft *et al.*, 2007). This consideration is accomplished by focusing on second-order (i.e., institutional building) and meta-order (i.e., principle setting) governance, rather than just first-order (i.e., problem solving) (Chuenpagdee, 2011). Interactive governance is similar to some other types of governance, such as adaptive and collaborative governance, in that it identifies how complex and uncertain the natural, social, and governance systems are (Chuenpagdee, 2011). It differs, however, in its emphasis on interactions between public and private sectors, or between the state, market, and civil society (Chuenpagdee, 2011). Interactive governance can thus be a much more proactive approach than some other governance models due to the focus on interactions.

Interactive governance utilizes a three system model, and recognizes that there are limits to how well systems can be governed, referred to as governability (Jentoft and Chuenpagdee, 2009). These include the governing system (GS) and system to be governed (SG), in addition to the governing interactions (GI) between the two (Chuenpagdee *et. al.*, 2008). The SG includes both natural and socio-economic components, in addition to the governing system itself which needs also to be governed. The GS are those agents involved in the governing and their actions. GI refers to interactions between the GS and SG. Interactive governance recognizes that these systems have various properties, i.e. they are diverse, complex, dynamic, and operate at multiple scales (Chuenpagdee *et. al.*, 2008). Diversity refers to structural variation in a system, and both spatial and organizational elements; complexity to relationships and linkages between elements; dynamics to change and variability over time; and scale to the size of interactions and boundaries both temporally and spatially (Jentoft *et al.*, 2007; Chuenpagdee and Jentoft, 2009).The

characteristics of SG, GS, and GI are what constitute governability, making the entire system more or less governable. Generally speaking, SGs that are highly diverse, complex, dynamic and large in spatial (or temporal) scale are likely low in governability. It is possible, however, that GS may be very competent or GIs very effective, which will then contribute to increasing governability (Chuenpagdee, 2011). Learning about what system characteristics foster or inhibit governability helps broadening possible options to improve the overall quality of governance.

Several frameworks can be used to examine system characteristics. This study employs the governability assessment framework, which considers MPAs as GS in one instance and SG in another (Jentoft *et al.*, 2007). The study is conducted under a proposition that an assessment of an MPA using this framework, focusing also on how it interacts with the socioeconomic and biophysical environment, can add to the discussion on MPA sustainability. The application of the framework to the Eastport MPA is an illustration of that.

5.2. Methodology

Following Chuenpagdee and Jentoft (2009), a series of questions were developed and asked to determine the system characteristics (see Appendix for details). The information for the governability assessment originated from a variety of sources such as scientific papers, books, observation, and informal discussions with key informants. The discussions took place between June 2008 and October 2009 on the Eastport Peninsula. Forty-one individuals were consulted, including fishers, town clerks, educators, plant managers, farmers, scientists, Terra Nova park

employees, and other peninsula residents. Discussions usually occurred in people's homes and ranged from half an hour to two hours in length.

As suggested by Chuenpagdee and Jentoft (2009), for diversity, the questions were related to the components of the natural, social and governing systems. How these components relate to each other determines system complexity. The governability assessment considers interaction among system components as factors giving rise to their dynamics. Finally, questions about management boundaries were posed to determine scale.

5.3. Results

5.3.1. System-to-be governed: Natural system

The waters around Eastport, including the area of the MPA itself, are home to a number of species including capelin (*Mallotus villosus*) and herring (*Clupea harengus*), which form the bulk of the biomass passing through the MPA (DFO, 2007). Also common to the area are marine plants such as Irish moss, and species of kelp and rockweed (*Ascophyllum nodosum*). Invertebrates are varied and include crab, squid, lobster, sea urchins, whelks, scallop, blue mussels (*Mytilus edulis*), and sea cucumber (DFO, 2007). The crucial species in the context of the MPA and EPLPC is the American lobster, heretofore referred to only as lobster, which are long-lived bottom dwelling marine organisms (Santisteban, 2003). Although the area is known for lobster (due to its economic importance), the natural system is rather diverse, requiring thus an EBM approach, not single species management.

Habitat preferences for lobster are areas less than 50 m in depth (Paille and Bourassa, 2009), and rocky substrates with algae. In the Northeast of Newfoundland, however, this can be less than 30 m. Lobsters use these rocky areas for shelter as they can hide under the rocks or in holes excavated by the lobster. The importance of these shelters is for protection against predators, waves and currents, and daylight (Paille and Bourassa, 2009). Lobsters are nocturnal, so they prefer the dark. These sheltered areas are especially important for juvenile lobsters that need protection from predators. DFO used fishers' local knowledge about lobster habitats to determine an appropriate site for the MPA, as both scientific knowledge and the extent of appropriate habitat in the area were limited. The importance of the presence of habitats for lobsters at different life stages enhances the system complexity, therefore calling for careful management considerations.

Dynamics is the most difficult system property to observe in the case of Eastport MPA, which could imply that the natural system has low dynamics. One possible indicator of the system dynamics is the significant increase in the abundance of lobster population in the period of ten years (1997-2007, with 2005 as the year when the MPA was officially designated) (Janes, 2009). With respect to scale, lobster is found primarily along the east coast of North America, specifically as far south as Cape Hatteras in the US, and North until the Strait of Belle Isle (Paille and Bourassa, 2009). Areas of highest abundance are the Gulf of Maine in the US and around Nova Scotia and the Gulf of St. Lawrence in Canada. It is also found on the eastern part of the island of Newfoundland as evidenced by the fishery near the Eastport peninsula. It is important to note migration patterns of lobsters at different life history stages, given how they may affect the governability of the MPA.

On a whole, and as summarized in Table 5.1, the natural system in the Eastport MPA is moderately diverse and with low to moderate complexity. The system is not highly dynamic but the migration pattern of the lobster raises some issues with respect to scale.

Table 5.1 Level of 'governability' of the Eastport MPA, according to the four key characteristics

System Properties	Natural SG	Social SG	Governing System	Governing interactions
Diversity	Moderate	Moderate	Moderate	High
Complexity	Low - Moderate	Low - Moderate	Moderate	High
Dynamics	Low	Moderate	Low	Moderate
Scale	Moderate	Low	Low	Low

5.3.2. System-to-be governed: Socio-economic system

Information about the socio-economic SG is largely covered in Chapter 4 in the assessment of the Eastport MPA using the 'How is Your MPA Doing' guidebook. In order to be consistent with the natural SG section, however, the characteristics of the socio-economic SG are presented below, in the context of its diversity, complexity, dynamics and scale.

The Eastport peninsula has a population of approximately 1,500 residents. There is a small number of farmers on the peninsula, but most employment is provided through fishing, tourism and the two fish plants located in Happy Adventure and Salvage. The fishery of the Eastport peninsula is small-scale, multi-species, using small boats with crew members who are often relatives. Fishing is seasonal, but still the primary occupation for those that undertake it. Many who do fish have part time jobs such as carpentry in the non-fishing season. There are approximately 40 fishers on the peninsula; most of them are over 40 years of age. As of 2001, there were 46 lobster licenses, but not all of them are operated. Multiple gears are used in the

fishery, including bottom gill nets, longlines, hook and line, and lobster pots. For the lobster specifically, most of the fishers use traditional lobster traps, which they carry in small, open boats of approximately 6-9 m in length (Rowe and Feltham, 2000). The traps are set at depths of 5-10 m for most, but can be 20 m in some cases (Santiseban, 2003).

There are a low number of fishers in the area, in part due to many fishers advising their children to explore other employment options. A common theme is to encourage these young people to enrol at a university or college. The difficulty of the profession and its economic instability are the two primary reasons for the potential discontinuity in the fishing occupation. Overall, the lobster fishery, though vital, is a supplementary income for most peninsula fishers (Murray *et al.*, 2005) who fish a variety of other species aside from lobster, such as pelagic fishes and crab. Tourism and recreation are other sources of employment (DFO, 2007). The peninsula has a number of scenic areas and there are two beaches around the community of Eastport. There are also numerous bed and breakfast establishments, souvenir shops, motels/resorts, and restaurants among the communities. Although operated seasonally, many of these businesses are owned by residents who live in the area year-round. Despite tourism development, out migration has been a problem in the area (DFO, 2007). The current population number is slightly reduced from the 2001 population of 1,595 (Davis et al., 2006), in spite of the influx of retired teachers, government workers and artists. This situation creates a moderate level of dynamics, but as indicated in Table 5.1, the overall socio-economic system of the Eastport MPA is generally low in terms of diversity, complexity, and scale.

5.3.3. Governing system

The formation of the EPLPC was spurred by the collapse of the groundfish fishery in the early 1990s. This led to a greater fishing focus on lobsters that once were supplemental (Davis *et al.*, 2006). A decline was soon experienced in lobster populations much like the groundfish before it, and concern was raised among fishers in the area. The EPLPC was formed in 1995 to combat this decline through consultation with a lobster biologist from DFO (Power and Mercer, 2000).

The EPLPC has representatives from each of the seven peninsula communities and its primary goal is the conservation and protection of local lobster stocks (Rowe and Feltham, 2000). Early in the process, it was identified that the harvesting of undersized and juvenile lobster was one of the main threats to the fishery (Blundon, 1999). Most fishers were in favour of stopping this type of harvesting, and had made it their responsibility to educate fellow fishers about the impacts of such practices on the future of the lobster fishery.

Other measures were also introduced to aid in lobster conservation. One of the first measures implemented by the EPLPC was the formation of a v-notching program targeting berried females. V-notched lobsters were marked by a shallow notch on their tail (Power and Mercer, 2000), which allowed for the berried female to be identified and returned to the ocean when caught. The purpose of v-notching is the removal of breeding females from the fishery, which would then potentially increase the reproduction of the lobster.

Another measure was the creation of two no-take zones of about 2.1 km^2 in 1997 around Duck and Round Islands (Rowe and Feltham, 2000). These two areas were considered suitable habitat

for lobster, and yielded high catch rates in the past, as well as a good mix of mature and juvenile lobster (Blundon, 1999). The fishers were able to fish the area around these no take zones but not within them. The impetus for the zone creation was the need by Eastport fishers to protect their livelihoods by formally excluding 'outsiders' (those not from the peninsula) from fishing their nearby waters (Blundon, 1999). This was a formal exclusion that still exists today.

Control of the Eastport MPA is in the hands of DFO, but a Steering Committee located on the peninsula acts in an advisory role. The Committee was originally formed to steer the initial MPA screening (DFO, 2007), but is still influential in guiding the operation of the MPA today as collaboration, consultation and stakeholder participation are strongly advocated (DFO, 2007). The responsibilities of the Committee include the representation of stakeholders or constituents, providing advice to DFO about MPA management, and encouraging community involvement in management of the Eastport MPA (DFO, 2007).

The Steering Committee is structured so that it has three levels of member participation; stakeholders affected directly by the MPA are active members; those not affected by the MPA but who may be able to provide assistance or advice are ex-officio members; and interested persons or agencies (Eastport Marine Protected Areas, 2008). Representatives from DFO and the EPLPC co-chair the Committee. Other current board members are from a variety of sectors, including fishers, tourism, harbour authority, municipal, fisheries board and governmental (Eastport Marine Protected Areas, 2008). In total, in addition to the two co-chairs, there are nine voting members and seven ex-officio members. Among the nine voting members five are EPLPC

representatives, two are harbour authorities, one is a municipal representative (joint for all seven towns) and the last is from the Road to the Beaches Tourism Association.

DFO and the Steering Committee have a shared vision for the Eastport MPA. The development of regulations for the MPA, for example, was overseen by both parties. They also work collaboratively in determining non-regulatory objectives, and often in consultations with stakeholders, and with input from other governmental and non-governmental organizations (NGOs) (DFO, 2007). Examples of groups consulted include federal departments such as Environment Canada and Parks Canada; provincial departments such as Fisheries and Aquaculture, and Natural Resources; and NGOs such as the World Wildlife Fund. The regulations were released for public review on June 18, 2005.

The set-up of the governing system for the Eastport MPA is rather unique, with the original creation of the no take zones initiated and managed by local fishers. DFO came in at a later stage, and while they are responsible for the management of the MPA, the Steering Committee still have influence over the MPA governance. Having two governing bodies adds to the diversity and complexity of the governing system, as shown in Table 5.1.

5.3.4. Governing interactions

DFO's approach of the fishers here was an important milestone for the people of the peninsula, as distrust of government was common in the area due to previous negative interactions. According to the Eastport MPA coordinator, tensions existed due to the past handling of the provincial government with respect to the designation of Terra Nova Park in Eastport Peninsula.

Many in the area feel that they were not consulted on the decision to establish the park, which was a unilateral action with little announcement or discussion with local residents. Some of these decisions had direct impacts on several people, like those who had cabins, woodlots, and sawmills in areas that became the park, which they were no longer legally allowed to use.

In the case of the MPA, the positive interaction between DFO and fishers was facilitated by the friendship many fishers had with the now retired DFO biologist. As the level of trust between the fishers and DFO increased, fishers became more involved in research undertaken in the area (Murray *et al.*, 2005). They participated, for example, in the monitoring and tagging of lobster populations (Power and Mercer, 2000). They would carry log books when fishing and record the size and weight of the lobster, in addition to noting the location where the lobster was caught, and whether they were harvested or released. This work helped DFO greatly in monitoring the population of lobsters in the area.

The formation of the EPLPC illustrates that there has been much learning and adaptation on the part of the fishers of Eastport. Some within the profession realized that their methods of fishing were unsustainable, and thus had decided to change their fishing practices. Currently, it is the fishers who are educating others in the community about conservation, when originally there were a small number of fishers who believed in the EPLPC and its work. This learning and adaptation in the community, as well as high level of participation and representation in the MPA governance, are positive attributes of governing interactions.

Participation in management does not apply to the rest of the community, however, as most community members have limited interaction with the Committee, and thus the MPA. Involvement in the MPA from non-fishers is low, despite the exhibited sense of community by several members. It is difficult to gauge whether community members would become involved, but current participation and representation from non-fishers is minimal and collaboration is somewhat limited in the area. The lack of collaboration may not be an issue, as the MPA is small and does not have many stakeholders with varied interests. Moreover, residents seem to be quite proud of the MPA and of the work of the fishers. They have certainly benefited from education efforts from fishers about marine conservation issues.

As summarized in Table 5.1, the governing interactions are highly diverse with various forms being used between groups of stakeholders. They are also rather complex due to the history of negative interaction and the lack of participation by some groups. New users of the areas, such as tourists and resident artists, add to the dynamics of these interactions, although scale is less of an issue.

5.4. Discussion and Conclusion

The assessment summary in Table 5.1 shows that from the governability perspective, several characteristics of the Eastport MPA help foster governance while others impede it. The low to moderate level of dynamics and scale in the natural and social SG and the GS make it possible for the MPA to function and operate according to the stated objectives. On the other hands, the complexity in the natural SG and the GS pose significant challenges to governance. The

'success' of the Eastport MPA, as suggested by the effectiveness assessment using 'How is your MPA Doing' may be attributed to the high level of governing interactions among different stakeholder groups. Taken together, it is likely that the Eastport MPA is moderately governable, which implies that the possibility of sustaining this MPA in the future does exist.

The emphasis of the assessment on system properties is only the first step in understanding governability. According to Chuenpagdee (2011), other criteria such as the 'goodness of fit' between the instruments and the problem, the responsiveness of the governing mode, as well as the quality of interactions, all play a role in making the system more or less governable. While not directly illustrated in this chapter, it can be expected that the relatively good relationship between DFO and the Steering Committee, and the various forms of interactions between stakeholder groups, are likely to contribute to enhancing governability of the Eastport MPA. This is further supported by the observation of existing initiatives in Eastport, such as beach clean-ups, festivals, and volunteer activities, which indicate the importance that fishers, community members and the area residents place on the marine environment.

Chapter 6 The Coastal Transect Analysis Model

6.1 Introduction

The focus of this chapter is ecosystem complexity, as ecosystems have increasingly been seen as the product of huge numbers of interactions creating highly complex areas (Clark and Gefland, 2006). As illustrated in Chapter 5, one of the issues of MPA sustainability is that ecosystems, both natural and social components, are often very complex. The understanding and communication of this complexity, while problematic, is likely to contribute to enhancing governability and sustainability of the MPA.

Scientists have attempted to deal with the issue of system complexity through the use of models and tools which can provide stakeholders with some understanding of their environment. This chapter presents two types of widely employed tools to deal with ecosystem complexity, i.e., decision support and communication tools. While the former is useful in predicting the impacts of management decisions, the latter is considered important because it helps improve an understanding between stakeholders, scientists, and management. The Coastal Transect Analysis Model (CTAM) falls in the latter category and is presented here as an example of a simple tool, which can assist stakeholders in understanding their environment. Importantly, it can be used to facilitate dialogue between stakeholders and decision makers and encourage stakeholders' involvement in coastal management.

In the following, different decision support and communications tools are reviewed. Next, CTAM is described and illustrated using the Eastport case study. The advantages and disadvantages of CTAM are discussed at the end of the chapter.

6.2. Decision Support Tools

Decisions in an environmental context are usually multi-faceted, as they involve an array of stakeholders with varying goals and priorities (Linkov *et al.*, 2005). In the context of MPAs, Jentoft *et al.* (2010) suggest that these goals are often contested, especially because they are not explicitly discussed and evenly communicated to all stakeholders. The myriad of factors, such as those related to sociopolitical, economic, and environmental considerations, need to be accounted for in environmental decision-making. Careful deliberation among stakeholders about the different tradeoffs is required (Linkov *et al.*, 2005; Antunes *et al.*, 2006). Also crucial is consideration of values, or what should be honoured, protected, sustained, or developed.

An example of a tool that helps make decisions in complex scenarios is the multi-criteria analysis (MCA) (Antunes *et al.*, 2006). MCA is useful for supporting decision-making in an environmental context, and in scenarios where a variety of alternative paths are possible. Other multi-criteria tools include the multi-criteria decision analysis (MCDA) (Hanandeh and El-Zein, 2010), and the social multi-criteria evaluation (SMCE) (Garmendia *et al.*, 2010). MCDA has a number of advantages, including the ability to handle difficult decision structures, especially those with conflicting criteria influencing the decision, the ability to account for complex criteria, and to help structure the decision making process (Hanandeh and El-Zein, 2010).

SMCE is a tool that emphasizes transparency, and operates in a manner such that issues of ethical positions, assumptions, interests, and values are clear from the beginning of the participatory process (Garmendia *et al.*, 2010). Public participation is a necessary condition of this framework, which aligns well with the call for stakeholder participation at the early stage in the decision-making process (Antunes *et al.*, 2006). The SMCE involves combination of participatory methods, and includes socio-cultural context, and a cyclic and dynamic evaluation procedure. It is also recommended that an application of participatory approaches within the SMCE framework accounts for the influence of powerful stakeholders in discussion groups, as well as inclusion of non-organized groups (Garmendia *et al.*, 2010).

6.3. Communication Tools

The effectiveness of scientific research is arguably affected by the difficulty in communicating results to the stakeholders who are most able to use it (Liverman, 2008). Many examples exist where policy makers have ignored scientific advice. An example at a global scale is the issue of climate change. There is a widening gap between the people who make decisions and scientists (Liverman, 2008). Gaps even exist between scientists, due to increasing specialization. Ideally, communication tools are a way of bridging these gaps. Research can be done well and have clear implications for future policy, yet be meaningless if not communicated well to those affected.

There are a number of specific obstacles to communication in sciences. Problems common to all sciences include the use of complex and often technical language, presentation of results in

inaccessible media, inability to explain scientific uncertainty, and lack of training in communication skills (Liverman, 2008). Specific disciplines also have unique problems. Liverman (2008), for example, identified a number of issues applying specifically to environmental geosciences. There is less of a problem with communication to stakeholders in the field due to the familiarity of most (often in the mining or energy industry) with geosciences and of some of the technical terms and aspects (Liverman, 2008). On the other hand, there are issues such as communicating environmental risk, which is also a challenge in other science disciplines.

One category of communication tools are models. Models can be used to predict impacts and to enable scientists and policy makers to explore scenarios (Olsson and Anderson, 2007). Results from these models can then provide the basis for discussion. An advantage of models is their ability to deal with large amount of data and to produce manageable descriptions of complex interactions and processes, in addition to human impacts (Olsson and Anderson, 2007). Models may also aid in increasing both public participation and an understanding of the issues among stakeholders (Olsson and Anderson, 2007). However, models have a difficult balance in dealing with complex situations without becoming too bogged down with information (Hannah *et al.*, 2010).

Models may need to meet certain criteria to become useful for environmental management. Among them are user relevance and friendliness, awareness of the constraints of using models in dialogue and the ability to handle these constraints, transparency in dialogue, mutual respect in dialogue, a robust institutional network as a prerequisite, and time and effort (Olsson and Anderson, 2007). User relevance is an issue because oftentimes experts present data to a

scientific audience for which primary data is sufficient. Policy makers and the lay public may, however, need more information, or may require information be presented in another way for it to be of use (Olsson and Anderson, 2007). Cost is also an important consideration, which is not always included in scientific reports. Using models in dialogue can be constraining, as although they may inspire stakeholders to act, in some cases it may make groups feel singled out as being the cause of an environmental problem (Olsson and Anderson, 2007). Some studies have illustrated that transparency is crucial for model success, and that stakeholders should understand as much as possible the parameters and variables of the model. Experts should attempt to explain what the model is attempting to accomplish and how it will achieve these goals (Olsson and Anderson, 2007). In dialogue it is also imperative that there be respect and open communication between the modellers and the users of the model-derived data. Finally, putting time and effort into dialogue is also crucial in ensuring stakeholders both understand and accept information. A robust institutional network in the form of, for example, well functioning political institutions, can facilitate this dialogue (Olsson and Anderson, 2007). There are also factors that may influence a users' acceptance of a model or its results, including their own interests and the issues at stake, social, educational, and economic background, and trust in the institutions and ways of communicating (Olsson and Anderson, 2007).

Indicators are an example of a communication tool, designed to avoid complex terminology and illustrate change so that the results of actions can be shown (Liverman, 2008). An indicator is defined as a qualitative or quantitative measureable clue that can provide information about a larger whole (Nardo *et al.*, 2008; Hammond, 1995), and consists of a careful selection and monitoring of variables that indicate change in complex systems (Liverman, 2008). Indicators

are useful as they can simplify information and enhance understanding. The indicators used in monitoring environmental conditions are generally sustainability indicators (Pan and Kao, 2008), which attempt to measure a complex and dynamic environment (Singh *et al.*, 2008). Indicators are mainly of two types, individual and composite. Composite indicators are individual indicators synthesized into a single index (Nardo *et al.*, 2008).

The DPSIR (drivers-pressures-state-impacts-responses) framework has also been proposed as a tool for improving communication both between scientists, and between policy makers and stakeholders (Stuart *et al.*, 2008). Drivers, or driving forces, can be in economic, social, or environmental form and exert pressures on the environment. These pressures cause the state of the environment to change, and lead to impacts which then are responded to by society. These responses feed into driving forces as the framework is a loop (Stuart *et al.*, 2008). One of the strengths of the DPSIR framework is that it does a good job of illustrating direct relationships between society and the environment, allowing for these communication channels to be open. On the other hand, the model has been criticized as being too simple to capture system dynamics, among other complex aspects of system interrelations. Nonetheless, the framework has been commonly used in indicator development, assessments, model and system conceptualization, and research programme structuring (Stuart *et al.*, 2008).

The final aspect of a communication tool is visualization, which is recognized nowadays as an effective method to communicate information (Chen *et al.*, 2005). Visualization can be an approximate to reality or abstract components from the real world, which are represented as needed. Abstract components are useful for understanding geo-phenomena, geo-objects, and the

spatial relationships between them (Chen *et al.*, 2005). Visualizations can also be in two dimensions (2D), such as on a traditional cartographic map. 2D visualizations can increase knowledge of patterns and distribution of geo-phenomena as well as their spatial relationships (Chen *et al.*, 2005). For many users, however, a level of interpretation is needed with 2D visualizations, which can be avoided with 3D system that provides more realistic views of the world (Chen *et al.*, 2005).

6.4. Coastal Transect Analysis Model (CTAM)

This thesis employs a CTAM as a communication tool about complexity of Eastport MPA. CTAM is a simple, online tool that can be used to aid stakeholders in understanding and describing their natural and human systems (Chuenpagdee *et al.*, 2010). It is descriptive, featuring an interactive interface, which allows users to enter data about their region and then compare it to other regions around the world. These user-defined data include physical descriptions, habitat types and resources, coastal activities including fishing, management approaches and tools, and issues and challenges facing the area (Chuenpagdee *et al.*, 2010). The final output of the model is a representation of the entered information as an 'image' of the area, consisting of a set of recognizable icons.

6.4.1. CTAM Background and Development

Similar to marine ecosystems, coastal zones are diverse, complex, and dynamic systems with processes that operate at various scales (Chuenpagdee *et al.* 2008). The relations between components in these ecosystems are difficult to understand, and approaches such as Integrated

Coastal Zone Management (ICZM) have been used to deal with this complexity (Chuenpagdee *et al.*, 2006). The goal of ICZM is to support the sustainable development of coastal waters and nearby lands (Kay *et al.*, 2006).

Different approaches and tools are used in combination to achieve this goal, including technical tools such as remote sensing, assessment tools, economic tools, community-based tools, and stakeholder engagement tools (Chuenpagdee *et al.*, 2006). Stakeholder involvement is recognized as a critical aspect of the ICZM process. Difficulties in implementation are often attributed to the diversity of background, professional experience, education, and world views stakeholders hold (Kay *et al.*, 2006). Stakeholder engagement tools help illuminate and integrate stakeholder experiences, opinions, and skills into the process (Kay *et al.*, 2006). Specific tool selection does require trade-offs, however (Chuenpagdee *et al.*, 2010). For instance, comprehensive and sophisticated tools may be needed to address complexity and uncertainty, but high data requirements may limit the amount of users. Less comprehensive and data intensive tools may be useful to a broader user group, but lack analytical power. CTAM belongs to the second category, although it is considered useful as a method of initiating discussions among stakeholders, and between stakeholders, scientists and government.

CTAM models can be developed by individuals or through a group exercise and participatory process (Chuenpagdee *et al.*, 2010). They enable stakeholders to learn about their coastal ecosystem, and when used in the decision making process, allows stakeholders to engage in coastal planning and promote a mediated engagement between stakeholders (Kay *et al.*, 2006). CTAM is based upon earlier work by Pauly and Lightfoot (1992), who introduced a method of

comparing coastal areas through cross-section analysis (Chuenpagdee *et al.*, 2006). The tool is divided into two phases. Phase I is a basic, descriptive model for general users, while Phase II is a more advanced model that asks for additional quantitative information about the coastal area.

In the model, the coast is divided into six 'transects,' from coastal upland, lowland, intertidal, inshore, offshore, to high seas. Data is entered into Phase I of CTAM over the course of six pages, each of which contains multiple data options. On each page, users will make choices about their area, which will then be interactively represented by icons at the middle of the page. On the first page, users describe the landward and seaward sections of their coast. This is followed by their coastal area's bottom type, and then by descriptions of habitats, fishing activities, and other activities and management measures. CTAM Phase II is set-up differently than Phase I. Rather than selecting their answers from multiple choices, users must input data, usually in the form of weighted percentages, dealing with habitats, fishery information like the number of boats and crew, catches, boat ownership, and crew origin.

At the end of the data entering at either phase, a figure will appear with all of the users entered data. The Phase I figure is 2D, while the Phase II figure has a bit of depth, resembling 2.5D representation. Unlike the static mode displayed in Phase I, some animation is enabled in Phase II to represent changes in the ecosystem with various activities and management options. For instance, impacts of some bottom-tending gears like trawls are shown as a reduction of school of fish in the sea. It is also possible to see flows of fish, income and job in coastal communities, with the size and directions of these flows represented by the thickness and arrow heads, respectively.

The created CTAM models are saved onto a database and can be viewed by other users, but are protected from modification by a password given to the original creator of the model. This password can be used to modify existing CTAM models, as they can be adjusted after the initial completion by the original users when, for instance, more information becomes available or when changes in the ecosystem occur.

6.4.2. CTAM Analysis of the Eastport Peninsula

CTAM models were developed for the Eastport peninsula to illustrate the complexity of the ecosystem in four communities. Based on the properties of the natural system assessed using the governability assessment framework (Chapter 5), a transect of 2km was chosen as an appropriate width for the four communities (Burnside/St. Chad's, Eastport, Salvage and Happy Adventure). All areas have similar habitat/resource characteristics, with rocky bottoms and steep slopes. There is also a shared lack of coastal characteristics such as a small upwelling. The main differences in these areas are the activities. Eastport does not have many fishers, but serves as a hub for the rest of the peninsula with many services located within it. Happy Adventure and Burnside/St. Chad's have ports and a ferry service. Happy Adventure also has a fish plant, a trait it shares with Salvage. All four communities have some degree of coastal tourism, with Salvage being voted by McLean's magazine in recent years as one of the ten most scenic communities in Canada.

Fisheries in Burnside/St. Chad's, Salvage, and Happy Adventure are small-scale and inshore. Common gears used in all communities include gill nets, hook and line, longline, and lobster

pots. Species fished are lobster, snow crab, capelin, herring, seal, cod, and mackerel. Salvage and Happy Adventure typically have the highest catch by landed weight. In 2007, for example, Salvage reported a landed weight of about 2,535 tonnes of various groundfish, pelagic fishes, crustaceans, and marine mammals. Happy Adventure and Burnside/St. Chad's reported approximately 1,867 and 811 tonnes, respectively.

For CTAM Phase II, similar flows were generated in all communities except Eastport due to the lack of a strong fishing presence. All crew are local and are often family members or friends. Some of the fish is sold locally, but the majority is exported to markets in the U.S.

The figures below are an illustration of the CTAM processes and results of Phase II, using the example of the community of Salvage. Figures 6.1 and 6.2 are included to show the type of data required for this phase of analysis.

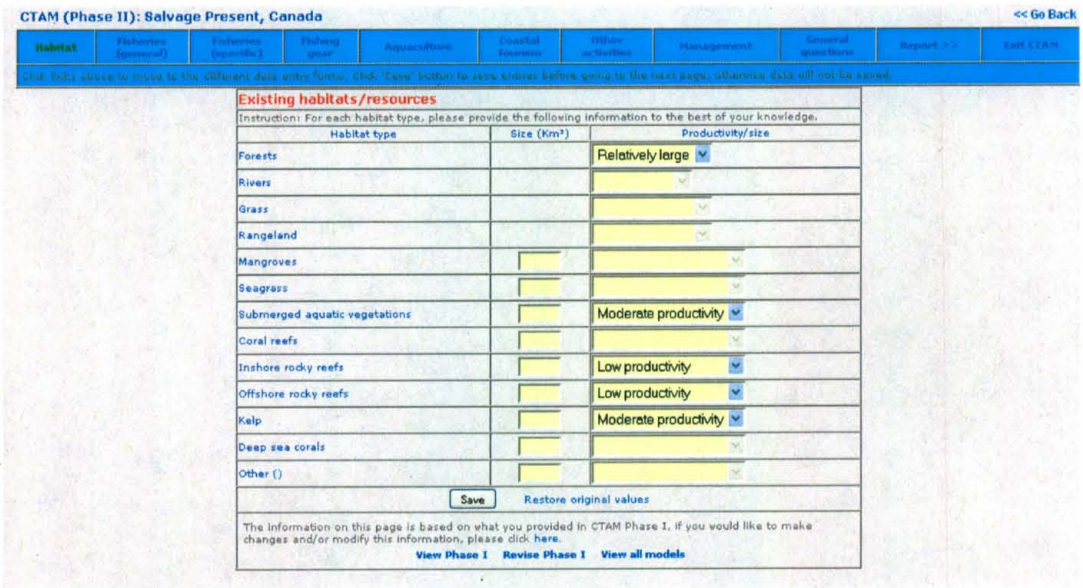
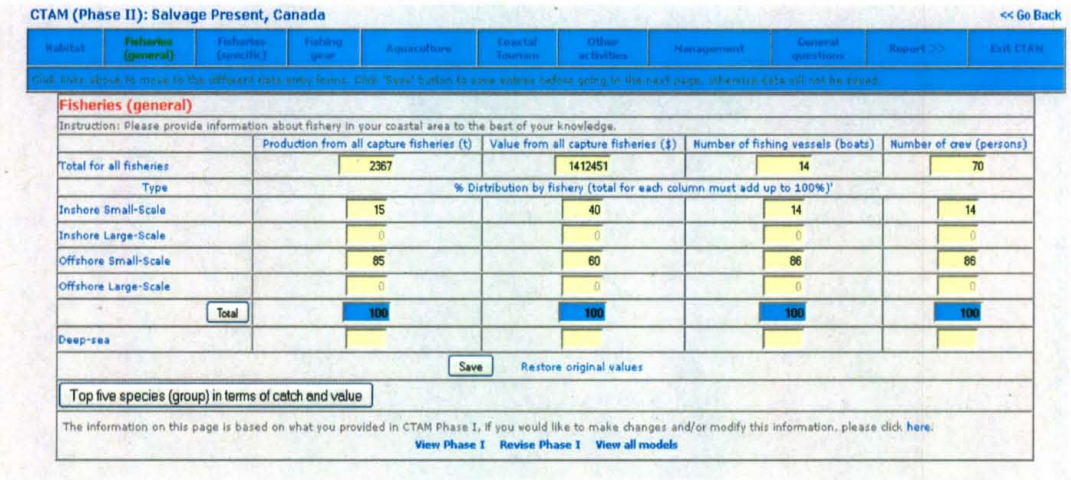


Figure 6.1: Existing habitats/resources of Salvage, Newfoundland.

The top of the screen shows several tabs, each of which contains one CTAM Phase II page. Information about existing habitats and resources is taken from the data input in Phase I. In other words, only those identified in Phase I will be 'enabled' for data about 'productivity/size' in Phase II (last column in Figure 6.1). As shown in this figure, the types of habitats and resources in Salvage area do not contribute to high level of productivity. This information will be factored in the analysis of impacts and flows at the later stage.


CTAM (Phase II): Salvage Present, Canada

<< Go Back

Habitat | Fisheries (general) | Fisheries (specific) | Fishing gear | Aquaculture | Coastal Tourism | Other activities | Management | General questions | Report >> | Exit CTAM

Fisheries (general)

Instruction: Please provide information about fishery in your coastal area to the best of your knowledge.

	Production from all capture fisheries (t)	Value from all capture fisheries ($)	Number of fishing vessels (boats)	Number of crew (persons)
Total for all fisheries	2367	1412451	14	70
Type	% Distribution by fishery (total for each column must add up to 100%)'			
Inshore Small-Scale	15	40	14	14
Inshore Large-Scale	0	0	0	0
Offshore Small-Scale	85	60	86	86
Offshore Large-Scale	0	0	0	0
Total	100	100	100	100
Deep-sea				

Save Restore original values

Top five species (group) in terms of catch and value

The information on this page is based on what you provided in CTAM Phase I. If you would like to make changes and/or modify this information, please click here.

View Phase I Revise Phase I View all models

Figure 6.2: Fishery type and production for Salvage

Figure 6.2 is related to the second tab (page) of Phase II. It illustrates the type of fishery occurring in Salvage, in addition to production. Similar to the above, for fishing activities indicated in Phase I, users will be asked to provide percent allocation of catch, values, number of fishing vessels and number of crew. In this example, there is no large-scale fishery in Salvage, thus the cells for these fisheries are shown as zero. Production and the number of fishers vary between the three communities. Salvage both has the highest production and value, in addition to

the largest number of fishers among the communities. Eastport differs from the others with minimal production and a low number of fishers.

Figure 6.3 is the resulting CTAM output for Salvage, generated from the data tables shown in the above figures. The green arrows indicate the flow of labour, which illustrate that in Salvage all fishers working in inshore and offshore are small-scale and local. Blue arrows show the flow of fish, and in this case, as in other communities, most of the fish is exported outside of Newfoundland. Finally, the yellow arrows indicate cash flow, which is concentrated towards fishers and fish plant workers in the communities.

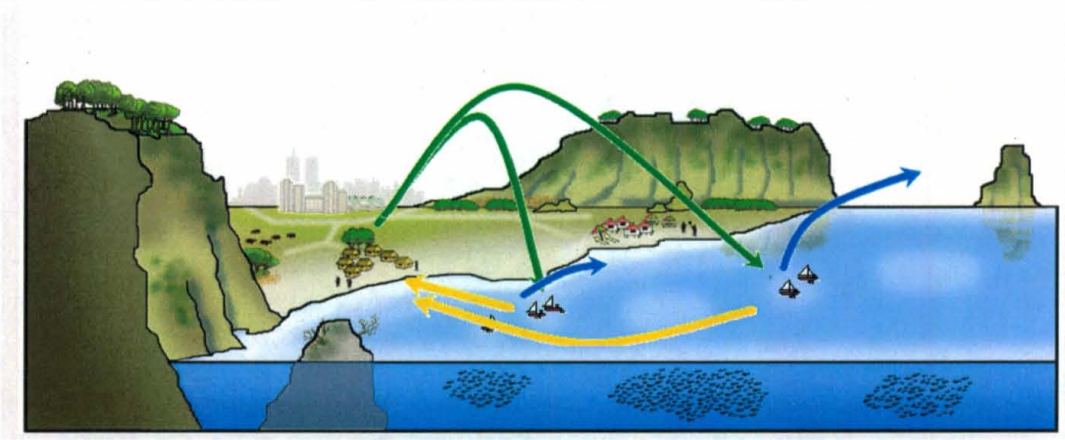


Figure 6.3: Interactions and flows in Salvage

6.5. Discussion and Conclusion

Complexity is a difficult aspect of ecosystems, and insufficient understanding of it implies the inability to develop informed and appropriate policies (Garmendia *et al.*, 2010). Coastal areas have long been affected by inappropriate management decisions, as well as by many solutions which neglect complex socio-ecological issues and the assortment of actors involved (Garmendia

et al., 2010). Ecosystem complexity not only adds to the difficulty in understanding the natural and social systems, but also creates complex governing systems, with several governmental resource management agencies dealing with the complexity (Ascher, 2001). Complexity can be approached in a couple of different ways, e.g. making jurisdictional adjustments so that they correspond to ecosystem boundaries, increasing the amount of coordination, and combining of multiple information sources (Ascher, 2001). Some managers, however, deal with this challenge by applying the same broad regulations to all scenarios, despite what may be needed for a particular area (Ascher, 2001). This traditional reductionist approach can only partially deal with ecosystem complexity arising from large numbers of components, interactions, and spatio-temporal dynamics (Borja *et al.*, 2008). In the past, there had been a rush towards solutions, and an oversimplification of issues such as ecosystem integrity (De Leo and Levin, 1997). It is believed, for instance, that only 6% of current environmental objectives center on ecosystem complexity (Arkema *et al.*, 2006).

The insufficient emphasis on complexity may be due to the lack of appropriate tools. Tools are either too sophisticated or too simple.. Yet, it is argued that simple tools like CTAM are useful in permitting stakeholders of varying backgrounds, in addition to managers and scientists, to collaborate on and discuss the impacts of various activities in their area (Chuenpagdee *et al.*, 2010). It fills the need for a user-friendly alternative to data intensive software that requires powerful computer system and modeling capabilities (Chuenpagdee *et al.*, 2006). The aim of CTAM is not for an in-depth analysis of the system, but it does allow for a basic analysis and comparison of different systems, which are crucial first steps in generating a common

understanding of the coastal area and initiating dialogue among stakeholders (Chuenpagdee *et al.*, 2010).

As a web-application, CTAM has advantages and disadvantages. It is open access and can be easily updated to accommodate system dynamics. Models can be created as often as required to capture the dynamics, and thus can be used to monitor changes. It is seen as a learning and communication tool more so than decision-support tool due to its lack of predictive capability. Yet, it enables stakeholders to explore simple policy and regulatory scenarios. Because the analysis is based on inputs from users, some validation and determination of data quality is required. This, and the fact that it is online database, implies high level of maintenance from the part of the software developer, which may be costly and time consuming. Finally, a stand-alone application (not web-based) may be necessary for coastal communities that have no access to internet.

Chapter 7 Stewardship for MPA Sustainability: A Community Perspective

7.1. Introduction

In response to the problems facing MPAs establishment and sustainability, various initiatives and research efforts have been implemented. One example of such an initiative is the 'How is your MPA Doing?' framework (Pomeroy *et al*, 2004), discussed in the previous chapter, which evaluates the effectiveness of MPAs. Although evaluated on four dimensions of sustainability, the framework does not put an emphasis on factors contributing to MPA sustainability. As argued by Christie *et al.* (2009), sustaining MPAs beyond the project lifetime is one of the key challenges faced by governments and organizations supporting the establishment of the MPAs.

The widespread use of the stewardship concept, as written in Chapter 2, suggests that it is an important aspect that may contribute to MPA sustainability. Yet, there is little research on practical application of this concept. One hypothesis is that this may be because the term stewardship is often used interchangeably with sustainability. Since sustainability is closely related with sustainable development, while stewardship is not, there is an argument for a careful examination of the stewardship concept, specifically in the context of MPAs.

In the following an argument is made as to why stewardship is important to MPA sustainability. Next, an overview of the existing uses of the term stewardship through a literature review is provided. Finally, it is illustrated how to elicit what stewardship means and how it can be related to environmental sustainability using the exercise conducted in Eastport.

7.2. Why Stewardship?

Stewardship is often presented in relation to the commonly-known concept of sustainability. An example is Canada's Oceans Strategy where stewardship has been used in the promotion of public awareness about sustainability of oceans and coasts (DFO, 2005). Under the Strategy, oceans stewardship entails "acting responsibly to conserve the oceans and their resources for present and future generations" (DFO, 2005). The document defines stewardship in the context of ensuring that resources are managed wisely and the oceans are protected for future generations. The involvement of citizens and participation in environmental initiatives are also stressed. While the term stewardship is introduced, the actual implementation of the Strategy draws more from sustainability. There is, however, a brief mention of how ocean stewardship can be promoted, namely through education, research, improved access to information, and on-ground activities (DFO, 2005).

Other examples of how stewardship concept is used are from business and environmental sectors. For instance, many organizations, including the World Business Council for Sustainable Development and the National Religious Partnership for the Environment, recognize that stewardship has value in helping to achieve sustainability (EPA, 2005). It has been acknowledged as significantly helpful in protecting both human and environmental health, and has been suggested as a possible solution to problems arising from globalization and exploitation. Organizations have also been developing methods of becoming 'greener' and the creation of a stewardship agenda has been recognized as a key step in sustainability (Anonymous, 2008). For example, under a stewardship agenda, Time Inc., a magazine publisher,

incorporated a zero waste policy in its kitchens whereby organic wastes are shipped for composting.

With an increase in public participation in environmental planning, monitoring and decision making in recent years, stewardship is also being linked with community-based management (Conrad and Daoust, 2007). Civic engagement has been proposed as a method of detailing the problems associated with environmental stewardship programs (Shandas and Messer, 2008). Community involvement has been positive in some cases with MPAs. Apo Island in the Philippines, for instance, is considered a "poster child" for successful community-based MPAs (Jameson *et al.*, 2002). The Apo Island MPA was established in 1985 and has since been operating primarily without external support (White and Vogt, 2000). Its purpose is conservation, in addition to protection from extraction and other dangerous activities. Although much of the literature on community involvement focuses on developing countries, Canada is no different. An example of a similar MPA success story in Canada is the Eastport MPA, which is a unique example in Canada of an MPA driven by efforts at the community level (Charles and Wilson, 2009). Prior to the MPA establishment, fishers were actively involved in conservation efforts on the peninsula, and, as previously described, they initiated MPA talks with DFO.

Both the Alpo Island MPA and the Eastport MPA exemplify successfully managed MPAs that feature community involvement. Lessons from these MPAs support the proposition that coastal issues cannot be resolved without stakeholders taking ownership and responsibility for environmental issues (Ellsworth *et al*, 1997). They are also evidence of how community involvement in the decision making process can be positively correlated with the future success

of an MPA (Pollnac, 2001). While there are also examples of successful top-down approaches to management, the success of MPAs can be improved with local stakeholder participation (Martinez, 2008).

Parallel to how stewardship is used in the context of sustainability, a similar trend exists in the fisheries context with the term subsistence. Schumann and Macinko (2007) employ literature research to produce a typology of definitions to determine what subsistence means. Their study shows that subsistence is related to sustaining livelihoods, sharing, social and cultural institutions, and a system of food production and distribution. They also distinguish between standard and colloquial use of the term. Based on their findings, they reinforce the proposition for the involvement of local communities in defining terms that may contain specific aspects that resonate well in certain contexts.

Stewardship may not be a solution for environmental problems and may not guarantee MPA success, yet many advantages can be gained from the concept, including the ideas of responsibility and awareness for the environment (Attfield, 1991). This contrasts with the classical way in which ecosystems are viewed, i.e., as a pyramid with humans at the top, drawing resources from the base as is our 'right' (Bundy *et al.*, 2008). A more broad view such as stewardship may be needed, one that recognizes the inherent and intrinsic value of nature and is not 'people centric' (Worrell and Appleby, 1999). In this sense, stewardship aligns well with the emerging 'interactive governance' perspective (Kooiman *et al*, 2005), which emphasizes, among other things, people's underlying motivations and cognitive processes as images, values, and principles (Kooiman and Jentoft, 2009).

7.2.1 Stewardship background

The word stewardship originates from the term 'sty-ward', referring to a person who looks after farm animals (Worrell and Appleby, 1999). As early as the patristic period (100-450 AD), stewardship, or the belief that people are entrusted to preserve the earth's beauty and fruitfulness, has been evident (Attfield, 1991). In a religious context, the term has Christian origins and appeared in the Old Testament of the Bible, which states that stewardship is a moral tradition in which 'wild creatures' are seen as valuable in and of themselves, and humans have an obligation to care for the earth (Attfield, 1991).

Additionally, stewardship has been suggested to have origins in some aboriginal groups (Worrell and Appleby, 1999), along with a history in philosophy (Worrell and Appleby, 1999), where it has been used in terms of responsible resource use. In North America the earliest practitioners of stewardship were aboriginal groups, many of whom continue to practice it today (EPA, 2005). Over the past few decades the term has been modernized and suggested as a possible way of describing an "environmental" or "land ethic", as well as an ethic that governs interactions and attitudes towards the environment (Worrell and Appleby, 1999). More recent definitions refer to stewardship as "the careful and responsible management of something entrusted to one's care" (EPA, 2005, p. 10). While there are several examples of how the term implies, the usage of the concept is context specific, and neither the precise definition nor details of what it means are given.

If it is not clearly defined or operationalized, what then is the utility of a term such as stewardship? Some people disagree that it is a worthwhile concept from an environmental perspective (Worrell and Appleby, 1999), even when clearly defined. They argue that the term conveys values based upon its religious origins which may be contentious. Specifically, if humans were to own the environment, or have control over it, it may lead to the conclusion that we can act in our own best interests rather than that of the environment (Worrell and Appleby, 1999). Further, we may act in a controlling manner, believing ourselves separate from the environment and the species in it (Worrell and Appleby, 1999). Most management philosophies infer some sort of control or ownership of the environment, however, so stewardship is not alone in being criticized for this. An example is management from a sustainability perspective. If it is agreed that people are going to be managing resources in some capacity, the problems of implied ownership, control, and power will likely be present regardless of the philosophy (Jentoft, 2007). Even sustainable management, for example, is human-centric and places emphasis on future generations (Worrell and Appleby, 1999).

7.3. Stewardship Literature Review

The identification of who uses the term stewardship, and in what context, was conducted through an extensive search and review of published journal articles and documents available on governmental and organizational web sites. Keywords used in the search engine were "steward," "stewardship," or "environmental stewardship", often used in combination with "environment," "coastal", and "marine," given the focus on MPAs. For each document using the term

stewardship, a record was made of whether or not a definition was provided. In all cases, keywords used to refer to stewardship, as well as the context of the word, were recorded.

The literature search netted over 250 documents from a variety of sources with diverse origins, ranging in date from 1978 to the present (Table 7.1). As the table shows, a very low percentage of the documents (a total of about 11%) define stewardship in any manner. Common words and phrases associated with the term include management, protection and conservation, participation, future generations, community, volunteerism, and public awareness. These keywords were either used in combination with the word stewardship or in the actual definition when given. In many journal articles, stewardship was often used in the context of community involvement and education, as well as in participatory decision-making. Future generations and long-term considerations were also discussed. For many governments and international organizations, stewardship was frequently referred to in the context of safeguarding or protecting the marine environment, or reaching sustainability goals. The key words, along with percentages of their appearance and the sources where they are found, are shown in Table 7.2. Key phrases include future generations, conservation and protection, volunteerism, education, management, collaboration and communication, participation, leadership, and community.

Table 7.1: Summary of stewardship search results

Source	Number of articles	Number that defined stewardship (% in brackets)	Main origins of sources
Journal Article	131	11 (7.6)	Ocean & Coastal Management, Environmental Management, Journal of Environmental Management, Marine Policy
Government Brochure/Document	43	7 (16.3)	Canadian, American, Australian government brochures and web sites
Government Research Report	26	4 (15.4)	NOAA Progress Report (US), Federal MPA Strategy (Canada)
Fisheries Organizations	23	2 (8.7)	Northwest Atlantic Fisheries Organization (NAFO), Food Fish and Allied Workers (FFAW), International Council for Exploration of the Sea (ICES)
NGOs	31	2 (6.5)	Australian Marine Conservation Society, Ocean Conservancy, Marine Conservation Society
Others [Books, Gray Literature]	11	4 (36.4)	
Totals	266	30 (11.3)	

In general, conservation and protection were common keywords, appearing in most documents. Accepted in all definitions of stewardship was that humans have a global responsibility to protect and conserve the environment. Present in fewer documents but still prominent was volunteerism. A study on volunteers engaged in environmental stewardship programmes found that helping the environment and learning were the primary initial motivations for volunteer activity (Ryan *et al*, 2001). Participants in the study also indicated an increase in their environmental concern over the course of the activity (Ryan *et al*, 2001). Another interesting key phrase is future generations, which is used to express concern about the impact that their activities have on future generations. In this context, generous intergenerational decision making can suggest a high level of

stewardship (Wade-Benzoni *et al.*, 2008). Any decisions made with an understanding of the effects on natural resource bases or global warming and a focus on long-term rather than short-term gain, for example, illustrates concern for future generations.

Table 7.2: Key word percentages and source

Source/Keyword	Journal Article	Gov. Brochure/ Document	Gov. Research Report	Fisheries Org.	NGOs	Others	% Present
Conservation and Protection	X	X	X	X	X	X	83.8
Community	X	X	X		X	X	58.6
Collaboration and Communication	X	X	X	X	X		53.2
Management	X	X	X	X	X	X	35.1
Participation	X	X			X		33.6
Future Generations	X	X					33.2
Education	X	X	X				31.7
Volunteerism	X						19.2
Leadership	X						10.6

Education has been used to specifically promote environmental stewardship and community involvement in management (Mow *et al*, 2007). It may also allow for the creation of moral citizens through the teaching of children about sustainability issues (Watson *et al*, 2009). Management is another common keyword associated with stewardship, especially in government documents and in the business community. The adoption of responsible environmental management practices in many firms, for example, reflects a consideration for environmental impacts in decision-making (Khanna *et al*, 2007).

Collaborative planning has emerged during the past decade as a prescriptive tool in environmental management (Selin *et al*, 2000). The essence of collaborative stewardship is

inclusion and interaction, and making joint decisions through consensus (Keough and Blahna, 2005). Additionally, these collaborations should not be limited by time, but be ongoing (Keough and Blahna, 2005). The terms communication and collaboration are combined in Table 7.2, as without good communication, collaboration becomes nearly impossible (Hermans *et al*, 2007). Leadership is also often highlighted in stewardship documents, typically in the context of community involvement. It is frequently of a voluntary nature, and arises from altruistic motives such as concern about others in a community (Bono *et al*, 2010). Finally, public participation in monitoring and other environmental initiatives has been increasing over the past few years (Conrad and Daoust, 2008). Community participation in environmental stewardship is stressed in Canada and internationally (Conrad and Daoust, 2008).

Stewardship can differ slightly depending upon the context used. Stewardship used in combination with education differs from the term associated with leadership. In some circumstances, stewardship is a principle by which to conduct a persons' life; in others, it is a goal with specific objectives. In an education context, for example, stewardship is often incorporated to influence beliefs, values, intentions, action skills and behaviours towards specific environmental activities (Siemer, 2001). The goal is to instil a sense of environmental responsibility and knowledge among students.

7.3.1. Stewardship Use Comparison

In addition to Canada and the United States, which have already been referred to, other countries also utilize the concept in their environmental policies and discussions. In all cases, there are differences in how the terms are used and incorporated. Canada and the US, for example, both

highlight it as important, yet the US is more active in defining it and attempting to implement it. Canada often defines it in combination with education and awareness, and the implementation is similar to sustainability. The US has stated difficulty in measuring or implementing the concept, but do attempt an in-depth definition, as provided earlier in this thesis. Australia's use of stewardship is similar to Canada's in that the concept is highlighted but not always defined or operationalized. The Environmental Stewardship Strategic Framework (2007), an environmental framework established for Australia, has outlined objectives and guiding principles for the Framework, but does not directly define what environmental stewardship means. The objective of the Framework is to "maintain and improve the condition and extent of targeted high value environmental assets on private land" (Environmental Stewardship Strategic Framework, 2007, p.6). It provides, however, some guiding principles, which include involving voluntary participation, using market-based approaches, and making payments for active environmental management among others (Environmental Stewardship Strategic Framework, 2007).

In the UK, stewardship is often used in the context of agriculture. The agri-environmental movement in the UK began in the mid-1980s, and has implemented a number of schemes since that time (Hodge and Reader, 2010). These schemes are mechanisms by which those involved in land management can be given incentive to manage their land in a particular manner. The purpose of these schemes in the UK context was to contribute to introduced or continued agricultural production practices, providing an adequate income for farmers, and following requirements to conserve natural habitat (Hodge and Reader, 2010). The first scheme incorporating the term stewardship was the 'Countryside Stewardship Scheme' in 1992 (Dobbs and Pretty, 2008). Its purpose was to "protect and enhance valued landscapes and habitats, and

improve the public enjoyment of the countryside" (Dobbs and Pretty, 2008, p.766). In 2005, an 'Environmental Stewardship' scheme was implemented, comprising of an Entry Level, and a Higher Level Stewardship (Hodge and Reader, 2010). Environmental stewardship is, however, not defined in any of these cases. The UK is, in effect, the opposite case of the US, as they implement but do not define the concept of stewardship.

7.3.2. Measuring Stewardship

Given the lack of proper definition about what stewardship means, measuring it is unavoidably difficult (EPA, 2005). Some efforts exist, however, like in the US where some agricultural scientists have sought to measure stewardship through a 'Stewardship Index,' which considers factors that are most relevant to stewardship. The index includes 15 proposed metrics under the broad themes of people (human resources and community involvement), planet (air quality, biodiversity and ecosystems, energy use, greenhouse gas emissions, nutrients, packaging, pesticides, water quality and water use), and profit (green procurement, fair price and incentives) (McIntyre, 2010).

There are few evaluation frameworks for stewardship. One example is a study by Clark and Maeer (2008), which focused on stewardship in the context of the Heritage Lottery Fund (HLF). The HLF is a UK organization that distributes funds to heritage projects in the country. Here, heritage is defined as anything we value, have inherited or want to pass on to future generations. It may include cultural (museums and historic buildings) or natural (landscapes and biodiversity), in addition to intangible aspects like language (Clark and Maeer, 2008). There are various programmes offered under the HLF that groups can apply to receive funding, and an

evaluation framework has been developed to assess their benefit and impact (Clark and Maeer, 2008). The framework considers three dimensions, i.e., intrinsic values, which include stewardship, instrumental benefits, and institutional values (Clark and Maeer, 2008). In this case, stewardship is defined in the context of conservation or heritage management, which entails looking after or managing a heritage. The measuring of stewardship involves identifying what HLF has done for the heritage and how well this goal has been achieved. The three aspects of stewardship evaluated under this framework include heritage inputs and outputs, conservation quality, and public perceptions of stewardship (Clark and Maeer, 2008).

Overall, stewardship is a problematic word to evaluate. Rather than attempting to measure it, it may be more appropriate to start with understanding what the term means. The following is an example of an exercise about how to define stewardship and what it may mean to local communities

7.4. Community's perspective on stewardship: Eastport dialogue

The 'Eastport Dialogue on Stewardship' was a small exercise conducted to illustrate an initial step in obtaining the communities perspectives on what stewardship meant and how it related to what was going on in the area, including the MPA. The invitation to participate in the dialogue was a printed announcement posted in public places in the communities, as well as verbally through the existing networks. The dialogue took place at the Beaches Heritage Centre, in the town of Eastport, from 4-6 pm on September 30, 2010. The dialogue was attended by eight people, including area residents, staffs of the Beaches Heritage Centre, a national park officer,

and the MPA community coordinator, from the peninsula towns of Happy Adventure and Eastport, as well as residents of the nearby community of Glovertown.

Through a facilitated roundtable process, participants were first asked to provide any keywords that came to their mind, which represented what stewardship meant to them. These keywords were written on a flipchart as they were suggested, for the general discussion that followed. Next, the participants were asked to discuss and make a short list of listed keywords that they felt were more relevant to their areas. Following this, they were instructed to indicate, for each selected keyword, what questions could be best used to capture and assess the stewardship level of a community. These questions were later used to form the basis to develop 'stewardship indicators' for the area.

About 40 keywords were listed in the first round of deliberation. Seven keywords were selected by consensus among participants as the most relevant in the second round (Table 7.3). The questions identified by the participants of the dialogue that best captured stewardship keywords in the context of Eastport are also shown in Table 7.3.

Table 7.3: Keywords associated with stewardship in Eastport and assessment questions. Note that these keywords are listed as they were discussed, and not by any prioritized order.

Questions	Associated keywords
1) What percentage of the community members are engaged in volunteerism? What proportion are under 50? 2) How many volunteer organizations are there in the community? What types of organizations?	Volunteerism
3) Are there special discounts for seniors to attend events (e.g. half-price ticket for people over 60 to see a show)?	Respect for elderly
4) Are the leaders in the community experienced and educated?	Leadership
5) Does the town have a K-12 school?	Future Generations
6) What is the recreation/activity level of the community? (Represented by number of trails, tennis/basketball courts, all terrain vehicle presence, etc.)	Recreation/Outdoor experience
7) Is there evidence of town planning? Is the town generally clean/tidy?	Tidiness/Order
8) Does the town host regular festivals/community gatherings that celebrate the culture and heritage of the area?	Community spirit

The dialogue also contained an open discussion about the two concepts, sustainability and stewardship. After the deliberation about stewardship as described above, the group was asked to discuss the differences between stewardship and sustainability, and which of the two terms they perceived as most needed. They all agreed that there were differences between the two terms, and highlighted the importance of sustainability from an economic standpoint. Although sustainability was considered important, the group believed a person or community could not truly be sustainable without first having a high level of stewardship. This sense of stewardship would then lead to communities acting sustainably. A linkage between the two terms was identified by the group, with stewardship emphasized as being the broader of the two terms.

7.5. Discussion and Conclusion

Table 7.1 illustrates that stewardship is often not defined in depth in the literature. One hypothesis is that an assumption may have been made about the general familiarity of the word, which is then though to be well understood and need no clarification (Worrell and Appleby, 1999). Vagueness exists, even when the definition is attempted. Given the complexity of the term suggested by the many keywords associated with it, shown both in the literature search and in the community dialogue, it is not surprising that many find the stewardship concept difficult to understand and operationalize. The issue then may not be with the lack of definition, but rather that the term is too broad and too vague to succinctly define, let alone to be used in any applied sense.

The concepts of stewardship and sustainability can be linked to the poverty alleviation and conservation debate. Historically, any kind of development or poverty alleviation was seen in contrast to conservation goals (Larsen, 2006). Over the past 50 years, however, arguments for whether conservation and poverty alleviation are mutually exclusive or supportive have been debated in the development and conservation communities (Halverson and Mcneill, 2008). Recently there has been an increase in the use and promotion of "equitable conservation" and pro-poor approaches which take into consideration conservation with the needs of people (Larsen, 2006). Some conservationists have shifted their goals to include people with a conservation-based community (CBC) movement (Torri and Herrmann, 2010).

Communities have been affected negatively by conservation efforts in the past. Examples include the formation of protected areas such as parks or nature reserves that border economically poor communities (Torri and Herrmann, 2010). There are many costs for the communities in these areas including restricted access to resources, increased threat from wildlife to people and property, and reduced social, political, and environmental autonomy. Protected area formation can often have the effect of exacerbating poverty (Adams *et al*, 2004). It was these sorts of issues highlighting the lack of social justice in many conservation efforts that lead to the formation of the CBC (Torri and Herrmann, 2010). Conservation versus poverty is no longer viewed as a zero-sum game. Local communities once seen as threats to conservation and biodiversity are now seen as stewards, and as part of a larger solution to environmental issues (Torri and Herrmann, 2010).

In the same way poverty alleviation may aid or even allow for conservation, stewardship can lead to sustainability, similar to what the Eastport group concluded. Incorporated in stewardship is the idea of taking care of both a community and environment, and in the absence of this, it can be argued, sustainability goals are difficult to achieve. Stewardship recognizes the links between ensuring a community's needs are met and protecting the environment.

Environmental ethics also support the concept of stewardship. Inherent within the ethic is concern for the environment regardless of its value to humans (Bourdeau, 2004; Abedi-Sarvestani and Shahvali, 2008). Environmental ethics places moral standing upon non-human parts of the environment, including plants, animals, and ecosystems (York, 2009). This is similar

to the many definitions of stewardship which emphasize recognition of the value of the environment, regardless of its benefit to humans.

The small number of participants presented both limitations and strengths in the study. Some stakeholder groups, like fishers, were absent in the dialogue and thus their perspectives were not represented. The results may have been more representative if participants with more diverse backgrounds were included. More dialogues should be organized to broaden the scope. It can be argued, however, that it may be easier to reach a consensus of opinion in small studies, especially if there are many like-minded individuals (Kajanus *et al*, 2004), and if all attendees of the dialogue were knowledgeable and concerned about environmental issues. Like-minded environmentally conscious individuals could better be able to pinpoint particular strengths and weaknesses from an environmental perspective in their community. .

The dialogue as a method to define and operationalize stewardship aligns with the idea of participatory approach and CBC. Such an approach offers not only the local and practical meanings of the word, but also an opening for reflection about what Kooiman and Jentoft (2009) term 'meta-order' elements, such as values, norms, and principles. They submit that an explicit discussion about what these are and how they influence people's behaviour can help facilitate governance tasks, especially when dealing with hard choices, for example, between development and conservation. Communities that have a set of values and principles that align well with stewardship are likely to forego short-term gains for the long-term benefits from conservation activities and programs. A public deliberation as conducted in this study is part of the

deliberative methods that are gaining recognition as appropriate approaches to understand values of resources and ecosystems (Vatn, 2009).

There is value in the concept of stewardship, as evidenced by its inclusion in scientific journals, government documents, and research reports. Our study shows that an effort to gain an in-depth understanding of the concept is warranted, as a way towards implementation. The Eastport dialogue was a small first step in this direction.

Chapter 8 Conclusion

Although it could be argued that MPAs are a powerful tool in combating the over-exploitation of marine ecosystems and resources, blind faith in these measures is unadvisable as many MPAs are poorly planned and the consequences of their establishments are not thought out (Agardy *et al.*, 2011). This is true of the larger and recognized MPAs as well. The Great Barrier Reef, for example, is too small to maintain stocks of marine mammals, sharks, and turtles, as they are all migratory species that transition across the Reef's boundaries (Berkes *et al.*, 2006). As suggested by Agardy *et al.*, (2011), the shortcomings of MPAs are numerous due to factors such as mismatch of MPA scale to issue and context, inappropriate planning or management process and failure to protect surrounding ecosystems. In some instances, MPAs cause damaging displacement and other unintended consequences, and create illusions of protection (Agardy *et al.*, 2011). Even if MPAs are perfectly designed and implemented, questions arise about their sustainability, especially after the initial funding ends and when stakeholders' interests start to wane (Christie *et al.*, 2009).

The Eastport MPA examined in this thesis is an example of sustainability challenges, despite its many positive features. For instance, it is of an appropriate scale for the species of interest (*Homarus americanus*), which is mostly sedentary with limited range as an adult. The ecosystem surrounding the MPA has not been degraded as there is little activity in the area, and there has been no displacement or other damaging consequence. Further, the MPA management plan was carefully created and fishers involved in the MPA management recognize that their continued vigilance and work is needed in protecting the lobster stocks.

As shown by the results of the governability assessment, many of the current concerns about the future of the Eastport MPA can be attributed to a lack of understanding about the environment caused by its complexity. Ecosystem complexity is one of the reasons, along with the many management objectives and uncertainty in predicting impacts, creating difficulty for management (Pikitch *et al.*, 2004). The more explicit this complexity is to stakeholders, the easier it will be to reconcile their differences. Additionally, a key characteristic of inappropriate planning or management may be communication problems. Because of these, a tool like CTAM is useful in both simplifying and providing a visualization of a users' environment, in addition to providing a basis for communication between scientists, management, and stakeholders. However, CTAM is neither the only tool nor the solution to all communication issues. Rather, it is a reasonable tool to help initiate some understanding about ecosystem complexity, and initiate communication and public participation.

Two tools were used to assess the MPA from a sustainability perspective; 'How is Your MPA Doing?' (Pomeroy *et al.*, 2004) assessed sustainability from a management viewpoint, and the interactive governance framework assessed it from a governability perspective. 'How is Your MPA Doing?' is a tool that assesses MPAs using the three pillars of sustainability; biophysical, socioeconomic, and governance. The guidebook focuses on the current management effectiveness and provides a summary of potential strengths and weaknesses of a current MPA. The governability assessment framework, on the other hand, can be used to gauge sustainability, as well as to help with the understanding of complexity, as previously indicated. Its main difference from the 'How is Your MPA Doing?' guidebook is a long-term view. In comparison,

the governability assessment framework reveals several aspects of the MPA not discussed in 'How is your MPA Doing.' The latter is, however, easier to use because of the ready-made check-list or indicators that it provides.

Stewardship is the final concept introduced in this thesis as a lens to enhance the understanding about MPA sustainability. Various scientists, governments, and environmental organizations recognize that an attachment or identification with an area is an important consideration for environmental protection and conservation, and for the sustainability of environmental initiatives such as MPAs. Stewardship in the context of this thesis is examined through a participatory approach to recognize its context specificity. The community dialogue acknowledges the different perspectives that are likely to exist, depending on the community and environmental initiative where it is utilized. We argue that using stewardship as a lens to govern the MPA may lead, not only to its sustainability, but also to other benefits to the community.

Important here is the idea of connectedness and the way in which each of the tools builds upon the other. CTAM allows for an understanding of the environment by all stakeholders, and a basis for communication which can only aid in the process of management initiatives such as MPAs. The 'How is Your MPA Doing?' guidebook provides an assessment of how the MPA is currently functioning, and is based upon an understanding of the environment that can be obtained through a tool such as CTAM. The interactive governance framework can then build upon the base of 'How is Your MPA Doing?' by examining the long-term sustainability of the MPA and identifying issues that may not have been apparent using the guidebook. Such examination leads to the exploration of the stewardship concept, and the use of community

dialogue to help provide some understanding about what it means and how relevant it is to sustainability, especially in the context of MPA. With respect to Eastport MPA, stewardship is referred to by words such as volunteerism, leadership, and future generations, and can be captured by asking simple questions that are not necessarily related to environment. This suggests a concept like stewardship can be used to bridge what communities and local resource users consider important with what scientists and policy makers see as necessary. The dialogue would suggest stewardship to be the foundation upon which sustainability occurs. Therefore, sustainability cannot be achieved in the absence of stewardship.

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Appendix

System Properties	**Natural System (SG)**	**Socioeconomic System (SG)**	**Governing System (GS)**	**Interactive Attributes**	**Governing Interactions (GI)**
Diversity	Biodiversity; habitats	Fisher/ community organization; specialization of fishing	Institutions and roles; objectives	*Representation/ Participation*	Level of community and fisher involvement in the Steering Committee
Complexity	Interactions: species-habitat, between species	Tourism; fishing gear use; fishers occupational diversity	Hierarchy of Steering Committee; relationship between fishers and management in committee	*Information/ Communication*	Communication strategies/ effectiveness
Dynamics	Changes in lobster abundance, and size; recruitment	Changes in fishing patterns	EPLPC; earlier conservation work	*Learning/ Adaptation*	Adaptation of fishing methods based upon earlier experiences
Scale	Boundaries; lobster range	Terra nova park; social and economic boundaries	MPA boundary	*Appreciation/ Collaboration*	Amount of collaboration