

Linking People to Places: Evaluating the Methodology of Collecting Human-Use
Data From Conservation and Protection Officers for Coastal Marine Protected
Area Planning in Nova Scotia

By

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The undersigned hereby certify that they have read and recommend to Marine Affairs Program for acceptance a graduate research project titled "*Linking People to Places: Evaluating the Methodology of Collecting Human-Use Data From Conservation and Protection Officers for Coastal Marine Protected Area Planning in Nova Scotia*" by Katie Wagner in partial fulfillment of the requirements for the degree of Master of Marine Management.

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Abstract

Nova Scotia's coastal habitats and marine resources are vital to the province's economy, identity, and well-being. Increasing human populations and associated pressures, however, are threatening these resources. A key solution to mitigating these pressures is the development of marine protected area (MPA) networks. A major constraint to Canada's proposed national MPA network is the lack of designated coastal MPAs in Nova Scotia. The inclusion of human-use data is a key component of MPA design, and failure to consider these human dimensions can compromise the success of an MPA. The paucity of human-use data for coastal Nova Scotia was the impetus for a new pilot project undertaken by the Ocean and Coastal Management Division (OCMD) at Fisheries and Oceans Canada (DFO) Maritimes Region. The objective of the pilot project was to map and document information on the distribution and intensity of fisheries and other coastal activities. This report evaluated the methodology used in the pilot project for collecting human-use information from Conservation and Protection (C&P) officers through semi-structured interviews and participatory mapping exercises. The evaluation considered four elements: performance of the research team, research process, interview questions, and use of C&P officers as a source of human-use information. The evaluation demonstrated that the sampling methodology for collecting human-use data from C&P officers was useful to the process. Minor adjustments to the methodology are suggested and it is recommended that a diversity of informant groups be pursued in future efforts. The OCMD also should consider alternative methodologies of participatory mapping workshops or web-based programs to improve the efficiency of data collection, and mitigate issues of data sensitivity and verification. Continued collection of human-use data in the early phases of coastal MPA planning will contribute to the success of MPA establishment on Nova Scotia's coast and the proposed national network of MPAs.

Keywords: Marine Protected Areas (MPA) planning, marine resources, human-use data, participatory mapping, Ocean and Coastal Management Division (OCMD), Fisheries and Oceans Canada (DFO) Maritimes Region

List of Acronyms

AOI	Area of Interest
CHS	Canadian Hydrographic Service
CMN	Community Mapping Network (based in British Columbia)
CPANS	Coastal Protected Areas of Nova Scotia
CPAWS	Canadian Parks and Wilderness Society
CSC	Coastal Services Center
C&P	Conservation and Protection
DFO	Fisheries and Oceans Canada
EBSA	Ecologically and Biologically Significant Area
EEZ	Exclusive Economic Zone
ENGO	Environmental Non-Governmental Organization
ERG	Eastern Research Group, Inc.
ESSIM	Eastern Scotian Shelf Integrated Management
GIS	Global Information System
GPS	Global Positioning System
ICAN	International Coastal Atlas Network
IUCN	International Union for Conservation of Nature
IM	Integrated Management
LEK	Local Ecological Knowledge
MARFIS	Maritime Fisheries Information System
MPA	Marine Protected Area
MSP	Marine Spatial Planning
MOU	Memorandum of Understanding
NOAA	National Oceanic and Atmospheric Administration
NSDFA	Nova Scotia Department of Fisheries and Aquaculture
NSDNR	Nova Scotia Department of Natural Resources
NSDTCH	Nova Scotia Department of Tourism, Culture and Heritage
OCMD	Oceans and Coastal Management Division
PACP	Protected Areas and Conservation Planning
PON	Provincial Oceans Network

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Chapter 1: Introduction

1.1 Background to the Management Problem

Coastal environments around the world have been among the most heavily exploited areas by human communities due to their rich resources. This use, however, has resulted in the loss of marine biodiversity and the degradation of coastal and ocean habitats and is an increasing global concern (Post & Lundin, 1996; Gleason et al., 2006). The primary impacts have come from pollution, overexploitation of fish stocks and marine resources, and the destruction of sensitive habitats (Post & Lundin, 1996). As a result there is a critical need for stronger marine conservation efforts (Allison et al., 1998).

Marine protected areas (MPAs) have become a principal tool for the conservation of biodiversity and endangered species, and for the management of targeted marine resources in nearly all of the world's oceans (Agardy et al., 2003; Christie et al., 2003). The International Union for the Conservation of Nature (IUCN) defines an MPA as, "A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve long-term conservation of nature with associated ecosystems and cultural values" (Dudley, 2008, p. 8), and to be considered effective, an MPA must provide a level of protection to a marine habitat or species (IUCN, 2008). It is widely known that small and isolated MPAs cannot sufficiently support populations of organisms that are large enough to be self-sustaining, and thus the need for MPA networks has been recognized. A systematically designed network of MPAs can allow for connectivity and spatial links necessary to maintain important ecosystem processes (IUCN, 2008). The IUCN defines an MPA network as "a collection of individual MPAs or reserves operating cooperatively, synergistically, at various spatial scales, and with a range of protection levels that are designed to meet objectives that a single reserve cannot" (IUCN, 2008, p. 12).

To design an MPA or MPA network that addresses conservation goals and objectives, it is necessary to collect the best available ecological, human-use and socioeconomic data (UNEP, 2008). There is a wide recognition of the value that biophysical and ecological data serves in systematic protected area design (Ban et al.,

2009), yet social science research is often conducted too late in the design phase to be effectively incorporated into policies (Christie et al., 2003). MPAs are fundamentally situated within the context of the objectives of the local community (Charles & Wilson, 2009), and the success or failure of MPAs often rests on the socioeconomic considerations¹ (Davis, 2002). Human dimensions, including the social, economic, and institutional considerations, can be the driving forces behind the need for MPAs as well as the constraining or supporting factors to their implementation (De Young et al., 2008; Charles & Wilson, 2009). When the human dimensions of MPAs are ignored or marginalized there is an increased risk of prolonged and counterproductive user conflicts, procedural delays, legal challenges and ineffective outcomes for both the protected ecosystems and the human communities they support (Wahle, 2003). Prior to assessing the economic, social and political factors necessary to support an MPA, the human uses² of the geographic region must be assessed.

Human-use information³ pertains to the ways in which stakeholders use resources in the marine environment, including extractive uses such as harvesting of fish and invertebrates, and non-extractive uses such as boating and diving (Wahle, 2003). The documentation of human uses in the marine environment is critical for the planning, management, and evaluation of MPAs (Wahle, 2003; NOAA, 2005). Marine and coastal human-use information is necessary not only for assessing threats to marine resources, but also to understand the social, economic, and cultural connections between user groups and marine resources, which may indicate the potential impacts of management measures on coastal human communities (NOAA, 2005). The types and intensities of human uses, and the concerns among user groups for continued access and participation in the activity

¹ The success or failure of an MPA or MPA network also rests on stakeholder engagement and the level to which the local community is involved throughout the process of establishment (Gubbay, 1995). While the author acknowledges the necessity of stakeholder engagement, the types of stakeholders, methods for their engagement, and the phases and levels to which they should be involved are beyond the scope of this paper and will not be discussed.

² In 2003, the United States National Marine Protected Areas Center identified human “use patterns” as one of six priority themes for social science research that may strengthen the planning, management, and evaluation of MPAs (Wahle, 2003).

³ The term “information” is used synonymously with the term “data” throughout the report.

must therefore be carefully considered in the siting of MPAs (NOAA, 2005).

Unfortunately, information on human uses is often limited, difficult to collect, and the knowledge of use patterns is often held by only a small number of individuals within marine sectors that regularly observe the coastal and marine environment and the activities occurring there (Wahle & D'Iorio, 2010).

1.2 The Management Problem

Over the past decade, Canada has made both domestic and international commitments to establish a national network of MPAs by 2012. The country is in the stages of finalizing the *National Framework for Canada's Network of Marine Protected Areas*, which will provide a strategic direction for the design of a national MPA network and will combine a number of bioregional networks. The coast of Nova Scotia is no exception to the global trends of coastal exploitation. Ever-increasing populations, developments, and anthropogenic pressures are negatively affecting the coast's species, habitats and ecosystems (as cited in Gromack, 2008). The province of Nova Scotia is highly dependent on its coastal and ocean resources, and coastal communities have long histories of fishing and marine transportation embedded within their cultural ties to the coast (Gromack et al., 2010). There is a need to protect the important coastal and marine ecosystems on which Nova Scotians depend. Currently only one federal MPA⁴, the Gully, has been designated 200 kilometers off the coast of Nova Scotia and there are very few protected areas on the province's Atlantic coast. The lack of coastal MPAs in Nova Scotia represents a major gap in the proposed national MPA network (Gromack et al., 2010).

Although there have been some efforts to identify ecologically and biologically significant areas on the province's Atlantic coast, there has been little work done on the collection of human-use information. Unexpectedly, there are more fine scale data sets on the biophysical, socioeconomical, and human-use characteristics in offshore regions of the province (Aimee Gromack, personal communication, March 9, 2011). A primary

⁴ In June 2011, St Anns Bank was officially announced as an area of interest (AOI) for an MPA from three candidate areas, including Misaine Bank/Eastern Shoal and Middle Bank. It will take some time, however, before St Anns Bank is officially designated as an MPA.

problem facing systematic conservation planning on Nova Scotia's Atlantic coast are the numerous data gaps, specifically fine scale data regarding spatial human-use characteristics of coastal communities (Gromack et al., 2010).

1.3 Purpose, Scope, and Methodology

A current constraint to the proposed national network of MPAs is the lack of coastal MPAs in Nova Scotia, and a paucity of human-use data in important coastal regions is the principal reason for a new pilot project undertaken by the Ocean and Coastal Management Division (OCMD) at Fisheries and Oceans Canada (DFO) Maritimes Region. The objective of the project, *Mapping Human Uses in the Coastal Zone of Nova Scotia: Pilot Study to Capture Expert Knowledge from C&P Officers* (hereafter referred to as the pilot project), was to map and document information regarding the distribution of coastal fishing activities (commercial and recreation) and areas of fishing importance at scales for which this information is not currently available, and to obtain any other information that may be relevant for coastal and ocean management. The pilot project focused on the collection of detailed information on coastal fishing location and levels of fish harvesting due to the fact that it is a major coastal industry for which information is sparse or collected in a way that is not suitable for MPA planning. This information was collected through semi-structured interviews, including participatory mapping exercises, with Conservation and Protection officers (C&P officers) within the Conservation and Protection Branch of DFO. C&P officers carry out enforcement activities in support of Canada's *Fisheries Act* and conduct regular patrols on the sea, land, and in the air, and therefore have a wealth of information and knowledge about fishing activities along the coast. The duties of C&P officers are further discussed in Chapter 2.

This report evaluates the pilot project's methodology for collecting human-use data from C&P officers for coastal MPA planning in Nova Scotia. This is done using a review of academic and grey literature⁵ that pertains to the collection of human-use data

⁵ Grey literature is defined as "document types produced on all levels of government, academics, business, and organization in electronic and print formats not controlled by commercial publishing" (as cited by University of British Columbia Library, 2011).

in coastal and ocean environments. The evaluation considers four elements of the pilot project: the performance of the research team, the research process, the interview questions, and the C&P officers as a source of information. To inform and support the evaluation of the pilot project methodology, the professional perspectives of marine managers and academics from the United States (US) were sought out through informal phone conversations and email exchanges for the purpose of identifying the best practices for the collection of coastal human-use data. Specialists from the US were approached due to the fact that the newly established US National Ocean Policy has granted state and federal agencies an opportunity to plan and adaptively manage the nation's marine and coastal zones through coastal and marine spatial planning (MSP) efforts (ERG, 2010), thus allowing for the advancement of methodologies for coastal human-use data collection. The purpose of this report is to determine the feasibility of continuing the collection of human-use data from C&P officers, and how the methodology can be improved for future human-use mapping initiatives of the OCMD. By considering other North American initiatives, this report will also inform the OCMD of alternative or additional methodologies that may be considered for the collection of human-use information for coastal MPA planning in Nova Scotia.

Chapter 2: Literature Review

2.1 Legal Framework for MPAs

This section provides a summary of the various authorities and legislation associated with MPA establishment in Canada and Nova Scotia. As the pilot project being evaluated in this report was an initiative of DFO, the department's ocean management and marine conservation policy and legislation are emphasized. Jurisdictional issues associated with the coast, cooperation between federal and provincial departments, and outreach initiatives for coastal MPA establishment in Nova Scotia are also briefly addressed.

2.1.1 Federal Authorities and Legislation

In Canada there are three federal departments with the authority to establish MPAs. Parks Canada can establish National Marine Conservation Areas under the *National Marine Conservation Areas Act*⁶. Environment Canada can establish National and Marine Wildlife Areas under the *Canada Wildlife Act*⁷. Fisheries and Oceans Canada can establish Oceans Act MPAs under the *Oceans Act*⁸. In many cases, the three federal departments will seek cooperation from other federal departments such as the Department of National Defense, Transport Canada, Natural Resources Canada, Indian and Northern Affairs, and Foreign Affairs Canada (DFO, 2005). While Parks Canada and Environment Canada have the authority and respective mandates to establish MPAs, DFO is the lead federal department responsible for the development and administration of multiple marine conservation legislative initiatives that are outlined below.

Operating within the Fisheries Management branch of DFO is the Conservation and Protection Division. C&P is the enforcement arm of DFO and facilitates with public compliance of the *Fisheries Act*⁹ and other regulations in support of the conservation and sustainable use of Canadian fisheries resources, the protection of species at risk, as well as fish, habitats and oceans. The goal of the program is to:

⁶ *Canada National Marine Conservation Areas Act*, S.C. 2002, c. 18

⁷ *Canada Wildlife Act*, R.S., 1985, c. W-9, s. 1; 1994, c. 23, s. 2(F)

⁸ *Oceans Act*, S.C. 1996, c. 31

⁹ *Fisheries Act*, R.S.C., 1985, c. F-14

...promote compliance and deter non-compliance with legislation and departmental management measures related to: International Fisheries, Commercial Fisheries, Recreational Fisheries, Aquaculture Management, Oceans Management, Species at Risk, and Maritime Security (DFO, 2009).

The C&P division plays a key role in fisheries management in Canada. C&P officers (i.e., fishery officers) are federal employees, who work within the C&P division and are trained to enforce the *Fisheries Act* and other supporting legislation and regulations; protect fish, marine resources, and habitats through patrols in the land, sea, and air; participate in public education and awareness regarding fishery resources and habitat protection; and conduct major case investigations (DFO, 2008a). The specific roles of the C&P officers interviewed for the pilot project are discussed in Chapter 3.

During the past decade, and at the national level, DFO has developed a policy and legislative framework to provide guidance and direction for ocean management and the development of MPAs and MPA networks (DFO, 2008b). In 1997, Canada's *Oceans Act* came into force, thus establishing Canada as the first country to put forth a comprehensive legislation for ocean management (DFO, 2008b). The Act provided a framework for ocean management initiatives and called for the establishment of a national system of MPAs operating within the concept of integrated management (IM; DFO, 2008b). Building on the *Oceans Act*, Canada's *Ocean Strategy* was developed in 2002 for the purpose of defining the visions, principles, and policy objectives for future ocean management plans, and it also called for the development of a strategy for a national MPA network (DFO, 2008b). Following the *Ocean Strategy*, Canada's *Oceans Action Plan* was finalized in 2005 to advance the pillars of the *Oceans Act* through the provision of a framework for the coordination and management of ocean activities that will contribute to the sustainable development of the oceans (DFO, 2008b). In 2005, the *Federal Marine Protected Areas Strategy* was developed to address the need for a cooperative and collaborative approach to the development of federal network of MPAs in Canada. The strategy also served to clarify the responsibilities of federal departments and agencies with mandates to establish MPAs (DFO, 2008b).

Each of the aforementioned legislation and policy frameworks contributed to the drafting of the *National Framework for Canada's Network of MPAs* in 2010 (DFO,

2010c). The framework serves an important step towards meeting Canada's domestic and international commitments to establish a national network of MPAs by 2012, as it will combine the existing and future protected areas of the three aforementioned federal departments, as well as provincial and territorial designations. The national network will be comprised of 13 smaller networks, each within the spatially defined bioregions (Figure 1) that extend from the high water mark to the boundary of Canada's Exclusive Economic Zone (EEZ), as well as the Great Lakes (DFO, 2010b). The 13 bioregions have been biogeographically divided based on ecological attributes of the marine environment. The 13 smaller MPA networks will share a common foundation, including: vision, goals, principles, design and eligibility criteria, and approach to management, thus contributing to the success of the national network (DFO, 2010b).

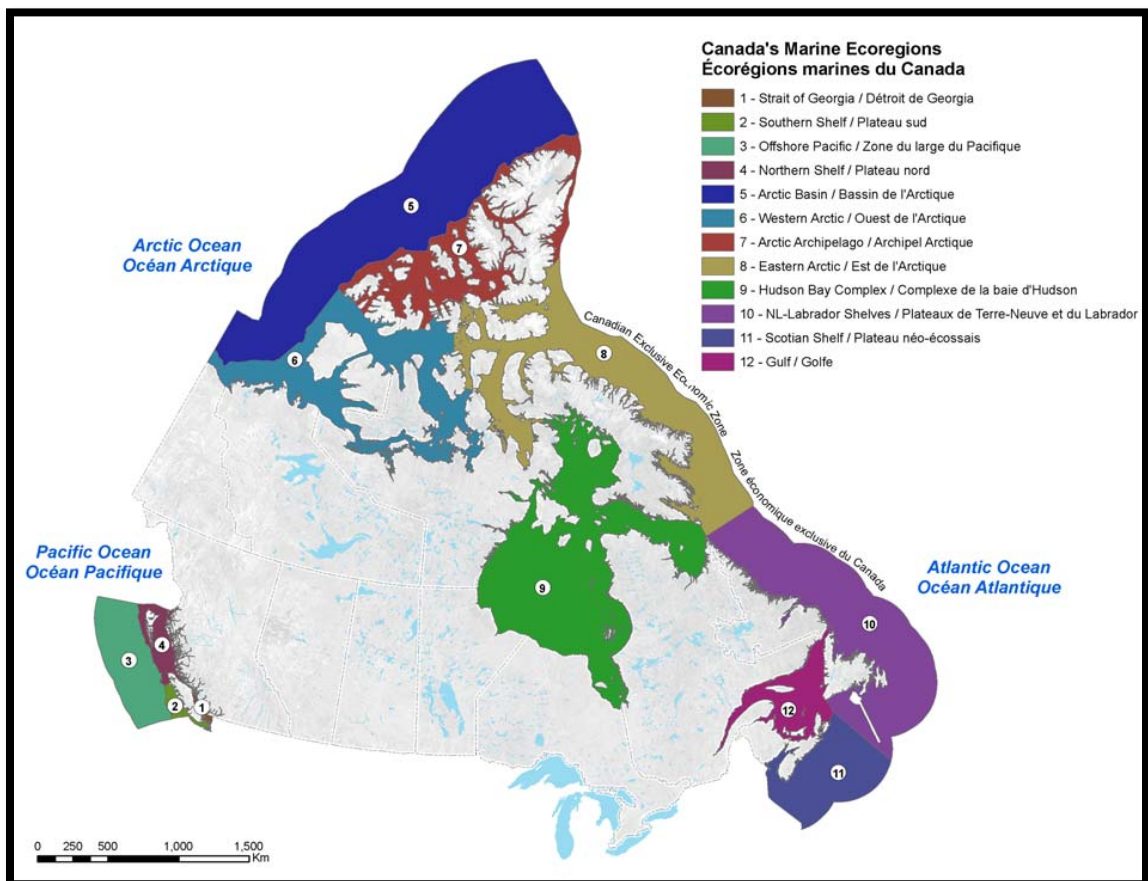


Figure 1: Bioregions for Canada's national network of MPAs (DFO, 2011).

The national framework was released for public review and comments from December 2010 through February 2011, which marked the final step in the consultation process that began in the summer of 2009 (DFO, 2011). The consultation process included feedback from government agencies, industry stakeholders, aboriginal groups, non-governmental organizations, academics and other parties with interest in MPA network planning (DFO, 2011). Generally, the feedback from the above parties expressed recognition of the importance of MPA network planning, however there have been concerns regarding timelines, funding, the need to adopt international MPA guidelines, and the level at which communities will be involved (DFO, 2011). Currently, the framework is being finalized with an expected approval of the final version by federal-provincial-territorial government agencies by the fall of 2011 (DFO, 2011). Until the final draft of the framework is released, Canada cannot substantially advance in MPA network planning (Aimee Gromack, personal communication, March 9, 2011).

2.1.2 Provincial Authorities and Legislation

Nova Scotia has several programs for provincial protected areas. The Nova Scotia Department of Natural Resources (NSDNR) administers protected areas such as Wildlife Management Areas, Provincial Parks, Park Reserves, Game Sanctuaries, and Protected Beaches (Gromack et al., 2010). Some of these protected areas extend into the marine environment for the purpose of protecting intertidal areas and to limit access to sensitive areas (Gromack et al., 2010). The Nova Scotia Department of Environment has the authority to designate Wilderness Areas and Nature Reserves, and while some of these areas are located on the coast, none of them include marine waters (Gromack et al., 2010). The Nova Scotia Department of Tourism, Culture and Heritage (NSDTCH) designates protected sites that are of historical, archaeological, and palaeontological significance (Gromack et al., 2010). The Nova Scotia Department of Fisheries and Aquaculture (NSDFA) does not have a mandate to designate protected areas, however, the department is a key player in Nova Scotia's marine conservation efforts, as the Department has passed the *Fisheries and Coastal Resources Act*¹⁰ for the purpose of encouraging and promoting programs to sustain and improve fisheries. The department

¹⁰ *Fisheries and Coastal Resources Act*, S.N.S 1996, c. 25, s. 1.

also leads the initiative to implement a provincial coastal management strategy that is discussed below. It is important to note that while there are provincial protected areas on coastal lands, they do not extend beyond the intertidal zone or water-covered land, and marine limits are not specified (Gromack et al., 2010).

Building upon the provincial protected area programs, the provincial government has recently recognized the need to sustainably manage Nova Scotia's 7,459 kilometer-long coastline. The province formed the Provincial Ocean Network (PON) in 2002 that is chaired by the NSDFA (Government of Nova Scotia, 2009a). The PON is an interdepartmental body consisting of twelve provincial departments and agencies¹¹. The PON is responsible for coordinating the management of the coasts and oceans within the provincial government, and to provide advice and expertise in carrying out the province's *Coastal Management Framework* that outlines how the government will work to address priority coastal management issues (Government of Nova Scotia, 2009b). The main priority under the framework is to develop and implement the *Sustainable Coastal Development Strategy* (Government of Nova Scotia, 2009a). The strategy will determine the course of action to ensure that the health of coastal regions and resources are maintained and enhanced for future generations (Government of Nova Scotia, 2009b). While the framework does not specifically call for the designation of MPAs, there is still much potential to incorporate MPAs within the framework to provide protection spanning from land to sea (Gromack, 2008).

2.1.3 Jurisdictional Issues, Federal-Provincial Cooperation, and Outreach Initiatives

In Nova Scotia, there are complex jurisdictional issues involved with designating coastal MPAs, some of which may include both terrestrial and marine components. These issues are far more complicated than when establishing protected areas on land or even offshore, where exclusive federal jurisdiction is designated to the limit of the EEZ. In the

¹¹ The provincial departments and agencies within the PON include: Aboriginal Affairs; Economic Development; Energy; Environment; Fisheries and Aquaculture; GeoNOVA; Intergovernmental Affairs; Natural Resources; Service Nova Scotia, and Municipal Relations; Tourism, Culture, Heritage; Transportation and Infrastructure Renewal, and the Emergency Management Office (Government of Nova Scotia, 2009a).

nearshore marine environment, a legal debate exists with regard to the geographical boundaries of the jurisdictions of the federal and provincial government, as demonstrated by the many pieces of provincial legislation and the vagueness of the *Oceans Act* (Gromack, 2008). Through the interpretation of the *Oceans Act*, it is generally recognized that provincial jurisdiction ends and federal jurisdiction begins at the low-water mark. This, however, is not clearly stated in the Act, but rather that, "...in any area of the sea not within a province, the seabed and subsoil below the internal waters of Canada and the territorial sea of Canada are vested in Her Majesty in right of Canada" (*Oceans Act*, s. 8(1)).

In Nova Scotia, the provincial jurisdiction over the marine environment has not been clearly defined, and the *Oceans Act* does not apply to areas above the low water mark. The vague jurisdictional limits have pushed DFO, the most active federal department in MPA designation in Nova Scotia, to focus conservation efforts in offshore areas (Gromack, 2008). Coastal MPAs may be ineffective if they are established without adjacent terrestrial protection because species, habitats and ecosystems are affected by land-based activities. As stated by Duval et al. (2004), "fragmentation of jurisdictional authority significantly impacts the ability to institute effective protection" (p. 321), and therefore the cooperation between federal and provincial governments is imperative¹² (Gromack, 2008).

The aforementioned PON allows for much horizontal collaboration among provincial departments, as well as some vertical collaboration between provincial and federal departments. Early in 2011 a memorandum of understanding (MOU) was signed between the province and the government of Canada (Government of Nova Scotia, 2011). The MOU focuses on: "implementing Nova Scotia's future coastal strategy; integrating coastal and oceans management and planning; managing and sharing information relevant to coastal management and planning; and developing a network to advance coastal research in Nova Scotia" (Government of Nova Scotia, 2011, para. 9). Prior to the signing of the MOU, vertical collaboration was particularly weak and the protection of

¹² It is outside the scope of this report to suggest means to address issues of jurisdictional and cooperation between the federal and provincial governments, however, a thorough discussion is provided in Gromack (2008).

the marine environment was a low priority on the agenda of the provincial government (Gromack, 2008). The MOU is the first high-level agreement across the governments that will allow the bridging of knowledge, the designation of departmental roles and responsibilities, and the development of a formal process for collaboration for coastal management (Gromack, 2008). Despite the establishment of the PON and the signing of the MOU, there are still many challenges and opportunities for horizontal and vertical collaboration across government sectors and levels. A recent study (Gromack, 2008) has demonstrated there is a growing political interest in increasing federal-provincial collaboration to support and facilitate the designations of coastal MPAs in Nova Scotia. This political will may be increased further with the help of Environmental Non-Governmental Organizations (ENGOS).

In Nova Scotia, there are several ENGOS (e.g., Nova Scotia Nature Trust, Nature Conservancy of Canada, Ducks Unlimited, etc.) concerned with marine and coastal conservation, however their role has been minimal with regard to the designation of coastal MPAs (Gromack, 2008). The main ENGOS that have had some involvement in offshore MPA projects are the World Wildlife Fund, the Ecology Action Center, and the Canadian Parks and Wilderness Society (CPAWS). Only CPAWS, however, has been involved in coastal MPA initiatives. CPAWS has been lobbying and working with Parks Canada since 2008 to establish a National Marine Conservation Area in the Bay of Fundy, yet the project remains in preliminary stages. ENGOS have played key roles in the designations of MPAs throughout the Maritimes (e.g., Musquash Estuary, New Brunswick; and Basin Head, Prince Edward Island). In Nova Scotia, however, they have not been actively lobbying DFO to designate coastal MPAs (as cited by Gromack, 2008). They have been known to actively lobby for the protection of terrestrial areas, but have generally not lobbied for the protection of the marine environment (as cited by Gromack, 2008). It may be important for ENGOS to advocate and support the federal and provincial departments concerned with the designation of coastal MPAs (Gromack, 2008).

2.2 Human-Use Information in Systematic Conservation Planning

Many of the most challenging decisions in coastal and marine management are associated with the relationships between people and the environment (NOAA, 2009).

MPAs are the “product of social institutions...and their purpose is to manage the behaviour of people in their use of coastal and marine resources” (Pomeroy et al., 2006, p.149). In order to change human behaviour, however, the “drivers” of human behaviour must be understood, which has often been neglected in MPA establishment (Pomeroy et al., 2006). As mentioned in Chapter 1, the MPA design process is often considered from a purely biological perspective and social science research is often implemented too late in the planning phase to be incorporated into policies (Christie et al., 2003). Neglecting the human dimension aspects of MPAs can result in poor understanding of contentious social issues, unintended negative consequences, missed opportunities for reallocation of resources, and an incomplete scientific record” (Christie et al., 2003, p. 22). As identified in Pomeroy et al. (2006), social science information¹³, including knowledge of use patterns and various uses of the marine environment, can positively contribute to MPA management.

MPAs that are planned without integrating social sciences into the design and evaluation process often fall short of biological and social goals (Christie et al., 2003). It has also been stated that the failure of MPA planners to address the human dimensions of MPAs “is perhaps the greatest single impediment to their broader and effective use in marine conservation today” (Wahle, 2003, p. 5). Despite these trends, the significance of collecting and incorporating social science data into MPAs is now recognized in the MPA literature. While it is acknowledged that there is a wide range of social science data that can and should be collected at various spatial and temporal scales (Wahle, 2003) for MPAs and MPA network planning, this report will primarily focus on the methods of collecting human-use data and supporting information about fishing activity in coastal regions.

¹³ Pomeroy et al. (2006) presented a list of social science information that had been culminated from further reputable resources including: “1) Public attitudes, perceptions, beliefs and values. 2) Use patterns, uses of the marine environment, users of the environment, and relationships between different user groups. 3) Value of MPA and the resources. 4) Impacts of the MPA on the stakeholders and the community. 5) Relationships between submerged cultural resources and the local populations. 6) Existence of difference in opinion between users and the government. 7) Socioeconomic trends or demographic characteristics. 8) Informal/traditional marine governance systems 9) Social capital” (p. 152).

2.2.1 Spatial Aspects of Human-Use Data

Within the coastal and marine environment there are often conflicting demands and pressures between the need for economic development the need to protect sensitive ecosystems and habitats. The interactions among various activities and resource users are complex due to their overlapping or competing rights, restrictions, and responsibilities (Rajabifard et al., 2005). It has been recognized that the information necessary to balance the interactions and competing interests of the marine environment has an inherent spatial dimension (Rajabifard et al., 2005). For example, fisheries management strategies are often area-based; coastal and offshore developments are assessed by spatial human displacement and level of access to place-based resources; and MPAs are areas defined by geographic coordinates (Pomeroy et al., 2006; St. Martin & Hall-Arber, 2008). As a result, “the marine environment is rapidly becoming a collection of habitats, natural processes, multi-stakeholder practices, and use rights that are tied to places” (St. Martin & Hall-Arber, 2008, p. 779).

This “spatial turn” in the assessment and management of marine resources has led to the need for spatially explicit data that represent the human dimensions of the marine environment (St. Martin & Hall-Arber, 2008). The spatial representations of coastal issues, mainly maps, have become a critical tool for coastal resource managers (NOAA, 2009). The use of maps allows for a clear understanding about a variety of coastal issues, including the way people make use of coastal resources for livelihood and recreational purposes (NOAA, 2009). Similar to other social science data, generally “...the social landscape of the marine environment is undocumented and remains a missing layer in decision-making. As a result, the resource areas upon which stakeholders and communities are dependent are neither mapped nor integrated into planning processes” (St. Martin & Hall-Arber, 2008, p.779). There is a “cartographic silence” within the current mappings of the marine environment, and therefore, the communities that are dependent upon marine and coastal resources and space are generally not included in decision-making (St. Martin & Hall-Arber, 2008).

This cartographic silence and resulting exclusion of human communities that depend on coastal resources can lead to the failure of MPA establishment altogether. For example, in 2001, proposed sites for MPAs in the coastal waters of California were not

accepted in part due to the failure of marine planners to incorporate fine scale information and use patterns of commercial and recreational fish harvesters (Bernstein, 2004). Had this information been collected and incorporated, the sites of the proposed MPAs could have been better planned to minimize economic impacts while still addressing the conservation goals (Bernstein, 2004). Thus, the success of an inshore MPA or MPA network relies on the incorporation of spatial human-use data of coastal resource users, specifically coastal fish harvesters.

2.2.2 The Need to Document and Map the Social Landscape of Coastal Fishing Communities

Small-scale fish harvesters are often the primary stakeholders of conservation efforts in coastal waters (Weeks et al., 2010). MPAs can have potential costs and benefits for individual fish harvesters, their households, and the broader fishing community (Pomeroy et al., 2006). Fish harvesters could lose customary access to fishing areas due to the establishment of an MPA, and some fishermen can be forced out of the industry should they not have the means to fish elsewhere. The costs of an MPA are often concentrated, while the benefits are often diffused across various coastal and marine-based industries. Therefore, the fishing community will have a strong concern in how costs and benefits are redistributed with the establishment of a coastal MPA and its associated management measures (Pomeroy et al., 2006).

Similar to the *collection* of biophysical data for MPA planning, biophysical data are also mapped in greater detail and incorporated into MPA planning more frequently than human-use data, and the “social landscape” of fisheries and fishing communities is largely undocumented (St. Martin & Hall-Arber, 2008, p. 780). Fishing communities worldwide are not homogenous and each has unique ecological and social characteristics that can influence MPA design and implementation (Pomeroy et al., 2006). Although each community is different, it has been recognized that citizens in coastal communities generally face increasing levels of insecurity from poverty and a high dependence upon natural resources (Pomeroy et al., 2006). These trends are often due to declining resources, increasing coastal populations, limited alternative livelihoods, limited access to land, political and economic marginalization, unsustainable resource-use, and

competition and conflicts over space and resource use (Pomeroy et al., 2006). It is necessary for MPA design and implementation to consider and understand the diversity of coastal residents and communities, especially in relation to their livelihoods (Pomeroy et al., 2006). As stated by St. Martin & Hall-Arber (2008), “Linking port-based communities to the locations at-sea that they utilize, know, and depend upon is fundamental to community-level participation and cooperation relative to ecosystem and area-based approaches to marine resource management” (p. 780). The incorporation of the dynamic and diverse social landscape of the coastal region requires methodologies and data collection efforts that document the “at-sea” locations, interests, and dependencies of communities and stakeholder groups (St. Martin & Hall-Arber, 2008), especially that of coastal fish harvesters.

2.2.3 Methods of Human-Use Data Collection

Coastal residents participate in various activities in the marine environment. Humans have always relied on both renewable and non-renewable resources provided by the ocean, however with the recent adoption of ecosystem-based management, humans and their needs are considered a fundamental part of coastal ecosystems (ERG, 2010). Little spatial information exists on human activities in coastal and marine zones relative to environmental information, and approaches to collection and mapping human-use data vary across the range of human uses (ERG, 2010). The methodology for collecting human-use data is often influenced by the policy and management context of the activity, and the level of regulation associated with the activity (ERG, 2010). For example, data regarding highly regulated activities such as military and industrial uses can be collected from official documentation systems. In comparison, human-use data for non-consumptive and least regulated activities (i.e., most tourism and recreational uses) must often be collected through various surveys and workshops (ERG, 2010).

The United States has recently implemented a National Ocean Policy, which has prompted efforts to better incorporate spatial data on human uses into coastal and marine spatial planning initiatives due to the fact that existing data are inadequate. The Coastal Service Center (CSC) of the National Oceanic and Atmospheric Administration (NOAA) contracted the Eastern Research Group, Inc. (ERG) to research and synthesize commonly

used methods and approaches for mapping human-use information in the coastal and marine environment. The ERG performed an extensive literature review of the human-use data collection methods and approaches that had been documented in peer-reviewed articles and reports between 1990 and 2010. The study divided human activities into three broad categories (with acknowledgement that a significant overlap exists among uses): non-consumptive, military and industrial, and consumptive. For the purpose and scope of this report, the methods of collecting and mapping consumptive human uses, specifically commercial and recreational fishing are reviewed, as they were the primary focus of DFO's pilot project¹⁴.

There are various ways to collect human-use data on commercial and recreational fishing, however the review by ERG (2010) demonstrated that trends of preferred approaches exist for data collection. Below are general approaches for collecting human-use data for commercial and recreational fisheries. An emphasis has been placed on the data collection method of participatory mapping due to the fact that a variation of this method was employed for DFO's pilot project under evaluation in this report.

- **Use of existing data for mapping and analysis**

Existing fisheries data from federal logbooks, forms, Vessel Monitoring Systems, and information from databases can all be mapped and analyzed.

- **Participatory mapping**

Representatives and selected stakeholders from the fishing industry can attend workshops or meetings to participate and assist in the development of representative mapping layers. When employing this methodology, categories of fishing are often divided into specific categories that are relevant to the area of interest (ERG, 2010). The information represented on the maps often goes beyond physical boundaries. Nearly

¹⁴ It should be noted that the pilot project also involved the collection of non-consumptive uses including aquaculture, tourism operations, and recreational activities specific to the study areas. However, as non-consumptive uses were not the primary focus of the pilot project, and the methodologies for their collection are very similar to those of consumptive uses, the methods of collecting non-consumptive human uses are not reviewed in this report.

everything that is valued by the participant can be expressed in a spatial format, including social, cultural, and economic features (NOAA, 2009). Because participatory mapping is a time-consuming method that requires significant planning for data collection, it should not be used in every decision-making process. Participatory mapping¹⁵ should however be used in initial data collection phases when additional information is necessary to better inform other stakeholder engagement processes (NOAA, 2009). Participatory mapping can also facilitate in the validation and ground-truthing¹⁶ of previously collected data with elements of uncertainty (NOAA, 2009).

Participatory mapping of consumptive uses can be conducted with various forms of technologies, and there are many challenges to its collection, analysis, and presentation. Paper maps, including nautical charts and aerial photos, are a simple way to obtain spatial information that can be digitized at a later date. Combinations of Geographic Information System (GIS) tablets, Global Positioning System (GPS) devices, and custom-made mapping software or web-based programs, can also be employed as an interactive means for the collection of spatial information (NOAA, 2009). As a result of marine resource management becoming increasingly focused on spatial issues, advancing geo-technologies of GIS and associated analytical methods are advancing assessments and decision support for marine planners (St. Martin & Hall-Arber, 2008). The challenges of participatory mapping include the dynamics associated with working with people of varying interests, education, and culture. Some coastal stakeholders may be apprehensive to provide proprietary information associated with their livelihood (or potentially illegal activity), creating challenges for collection, management, and display of the data. Issues of accuracy as a result of bias, cooperation, scale and resolution, and the use of technology may affect the quality of the data (ERG, 2010). Participatory mapping is an effective methodology that could be employed to map various human uses of coastal regions, and an extensive review of this method can be found in a document produced by the NOAA Coastal Services Center entitled, *Stakeholder engagement strategies for participatory mapping* (NOAA, 2009).

¹⁵ The term “participatory mapping” is used synonymously with “human-use mapping” throughout the report.

¹⁶ The process of ground-truthing involves collecting first-hand information at a specific location for the purpose of verifying information that was first gathered at a distance.

- **Interviews**

Interviews can be used to obtain information directly from stakeholders. To avoid the concerns of participants of sharing information in a large group setting or through a survey, interviews are often conducted in a one-on-one fashion or in a small group. Interviews enable researchers to elicit answers to predetermined and modifiable questions from individuals who hold extensive knowledge that may not be available in a written or published format (CDFG, 2008; Weeks et al., 2010). Interviews often include participatory mapping exercises to obtain spatial human-use data to accompany descriptive information (Hall & Close, 2007).

- **Intercept, fixed-point, and aerial field surveys**

Surveys of coastal and marine human uses can be conducted in the field by researchers. Intercept surveys allow researchers to be stationed in one place (e.g., popular fishing areas such wharves and beaches) for the purpose of interacting with and asking questions of those performing the activity. Fixed-point or fixed-area surveys allow researchers to observe the activities from a single location, and they are often responsible for covering a specific geographic region. Lastly, aerial surveys can be done with the use of video or photography to capture human-use activity over a specified time period.

- **Paper, phone, or online surveys**

Common questionnaire-based surveys can be done through the mail, over the phone, or through online survey programs and software to randomly sample representatives to characterize the activities of the broader population.

While the above methodologies have been identified as the most common means of data collection for consumptive uses, they can be slightly altered for the collection of non-consumptive and industrial uses of the coastal environment. A complete review of additional methodologies and variations of the above methodologies for the mapping of other human uses can be found in the aforementioned report, *A review and summary of human use mapping in the marine and coastal zone* (ERG, 2010).

Each of the above data collection methodologies involves interacting with people who live, work in, or are knowledgeable about the study area. Information collected from people familiar with place-based activities is known as local ecological knowledge (LEK). Many residents of coastal areas have a long tradition of using local marine resources, and often knowledge is passed down to generations usually without ever having been documented (O'Brian et al., 1998). LEK pertains to personal, shared and inherited experiences. While the term "ecological" is used to describe the knowledge, the information provided is much broader (St. Martin et al., 2007). The individuals providing LEK are often part of a web, relations, or networks that include the biophysical environment as well as management regulations, kinship ties, peer pressure, and social support mechanisms (Murray et al., 2006). Essentially, LEK is a social-ecological product (St. Martin et al., 2007). The use of LEK in MPA planning can be beneficial for MPA management due to participatory processes early on in the development, and studies have demonstrated it is an optimal method to collect fine scale human-use and socioeconomic data (Scholz et al., 2004).

2.2.4 Notable North American Human-Use Mapping Initiatives

Efforts to map human uses of coastal and marine environments have been increasing throughout North American states and provinces. This trend is likely due to the international commitments to the establishment of MPA networks, the sustainable use and development of coastal spaces and resources, and the growth of marine spatial planning initiatives. While there are numerous coastal human-use mapping initiatives currently underway, an example from British Columbia, Canada, and large scale, high profile examples from the US are briefly reviewed below.

In British Columbia (BC), the Community Mapping Network (CMN), a not-for-profit organization was established seven years ago in response to the "growing interest from communities and stewardship groups to take a more direct role in environmental planning and management" (CMN, n.d., p.1). The network is a partnership of numerous groups and agencies, including the BC Conservation Foundation, DFO, Environment Canada, and the BC Ministry of Water, Land and Air Protection, each of which have played a role in the direction, governance, and funding of mapping initiatives. The

objective of the CMN is to promote the planning of sustainable communities, through the mapping of sensitive habitats and taking inventory of their attributes, for the purpose of conserving fisheries, wildlife and aquatic habitat resources throughout the province (CMN, n.d.). The network created a website and a user-friendly mapping system that allows for the integration of data from many sources for various mapping projects.

A significant project of the CMN is the *Pacific Coastal Resource Atlas for British Columbia* (PCRA, n.d.). The CMN website allows for the amalgamation of coastal resource data in an atlas through a single web-based system. The system incorporates information from the Fisheries Information Summary System (BC Ministry of Environment, n.d.), and the Coastal Resource Information System (GeoBC, n.d.). The above databases include spatial information on biophysical features, distribution of species and habitats, fisheries information, and coastal human uses, some of which was collected through interviews with DFO fisheries staff (Booth et al., 2005). Authorized users¹⁷ may also upload LEK, digital data sets, or transcribe hard-copy data sets onto maps and nautical charts within the atlas. While CMN acknowledges that data may be inconsistent, vary in accuracy, and require ground-truthing, the organization maintains that “suspected presence” of a habitat, species, or activity is more beneficial than having no information at all (CMN, n.d.). While the CMN of BC was profiled here, it should be noted that similar web-based, participatory coastal mapping projects are taking place in Washington State, Oregon, New York, Maryland, Texas, as well as Ohio and Wisconsin bordering the Great Lakes.

The *California Ocean Uses Atlas Project* is a joint initiative between NOAA’s MPA Center and the Marine Conservation Biology Institute. The purpose of the project is to map the non-consumptive, fishing, and industrial and military uses from the shoreline to the boundary of the EEZ (Wahle et al., 2010). To collect the data, regional experts attended participatory GIS workshops throughout the state. The participants¹⁸ represented local, state, and federal agencies, community organizations, tribes, and ENGOS.

¹⁷ Individuals may become authorized by requesting an account on the organization’s website.

¹⁸ Specifically, the participants were members of the US Coast Guard and Navy, marine scientists, park managers, harbour masters, recreational and commercial fishermen, boat operators and captains, lifeguards, and others.

Participants were selected for their spatial knowledge of how the coast and ocean is used and for their experience working in or around marine-based industries. At the workshops, interactive, digital whiteboards or tablets were used and participants drew the locations and spatial extent of the coastal or ocean use for which they were most knowledgeable. The main goal of the workshop was to collect three layers of spatial information for each use, including “the general use footprint of the activity, dominant use areas, and potential future use areas” (Wahle et al., 2010, p. 1).

The group setting of the workshops allowed for the refinement of use patterns through discussions and deliberations, to reach a collective understanding. The project has produced various data layers and maps of individual uses and sectors, which may be employed for evaluating and prioritizing various ocean management scenarios (Wahle et al., 2010). The data collected in the workshops “provides a baseline for current patterns of human-use in the marine environment and offers spatial resources to address a variety of existing and future coastal and marine management issues” (Wahle et al., 2010, p. 4). NOAA’s MPA Center has made the maps and GIS data available on their website, and has also formatted the maps into an Interactive Mapping Tool, where users may compare and contrast data layers at various scales. Methodological insights have been gained through the *California Ocean Uses Atlas Project* and are available in a report produced by NOAA’s MPA Center entitled, *Mapping Human Uses of the Ocean: Informing marine spatial planning through participatory GIS* (Wahle & D’Iorio, 2010). The methodological insights have proved useful in subsequent human-use mapping projects conducted with the same participatory GIS workshop approach, including the *New Hampshire and Southern Maine Ocean Uses Atlas Project* and the *Hawai’i Coastal Use Mapping Project*.

Large scale and web-based or digitized human-use mapping initiatives have developed significantly in recent years and are now taking place in numerous countries. The resulting coastal web-based atlases are very valuable to coastal decisions makers, scientists, and the public, as they allow for real-time changes to the quality and availability of data to inform policies and decisions regarding coastal and marine management issues (Wright et al., 2009). In 2007, the International Coastal Atlas Network (ICAN), hosted by Oregon State University, was established by 30

organizations representing approximately twelve nations. The mission of the network is to, “share experiences and to find common solutions to coastal web atlas development while ensuring maximum relevance and added value for the end user” (Wright, 2010, para. 1). ICAN defines coastal web atlases as "...collections of digital maps and datasets with supplementary tables, illustrations, and information that systematically illustrate the coast, oftentimes with cartographic and decision support tools, all of which are accessible via the Internet" (Wright, 2010, para. 1). The establishment of ICAN demonstrates the growing acknowledgement of the importance of human-use mapping for informing policy and decision-making processes for conservation and protected areas management. It should be noted that despite the fact that Canada has the longest coastline in the world, BC is the only Canadian province to initiate large-scale human-use mapping efforts and to hold a membership in ICAN.

Chapter 3: Coastal MPA Planning Initiatives in Nova Scotia

3.1 Overview of DFO Maritimes Region Efforts

DFO is committed both nationally and internationally to develop networks of MPAs and to support and oversee the implementation of Canada's *Oceans Act* (Horsman et al., 2011). The Maritimes Region of DFO is one of the largest and most diverse of the department's six administrative regions across Canada (DFO, 2010a). It is comprised of portions of Nova Scotia and New Brunswick, from the northern tip of Cape Breton, Nova Scotia, to the border of New Brunswick and Maine (Figure 2). The boundaries of the Maritimes Region align closely with the geographically defined Scotian Shelf Bioregion (Figure 1), one of the 13 bioregions that will collectively create Canada's national network of MPAs (DFO, 2010b).

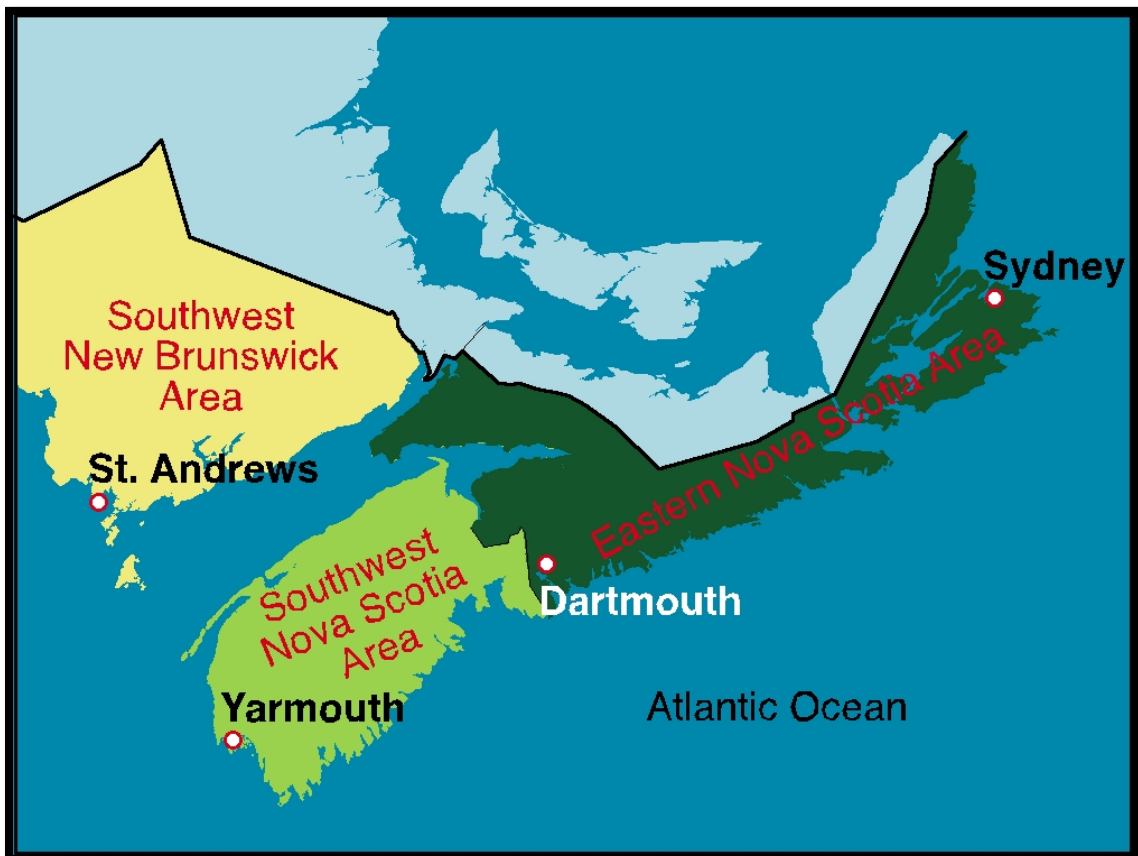


Figure 2: Jurisdictional boundaries of DFO Maritimes Region (DFO, 2010a).

The OCMD at the DFO Regional Headquarters in Dartmouth, Nova Scotia assumes the role of implementing and managing MPAs designated under Canada's

Oceans Act. The division is also responsible for “coordinating initiatives that will provide for improved management of Canada’s oceans through integrated management with various sectors of ocean users and regulators” (Horsman et al., 2011, p. 3). There are three draft planning areas being considered by DFO Maritimes Region for use in MPA network planning in the Scotian Shelf bioregion: The Atlantic coast of Nova Scotia, the Offshore Scotian Shelf, and the Bay of Fundy (Figure 3). While there have been IM (e.g., Eastern Scotian Shelf Integrated Management (ESSIM) plan) and MPA (e.g., The Gully) initiatives in the offshore area of the bioregion, and some initiatives to collect ecological data in the Bay of Fundy (e.g., Graham et al., 2002), the Atlantic coast of the province will require planning and management at a different scale, and the consideration of different stakeholders (Horsman et al., 2011).

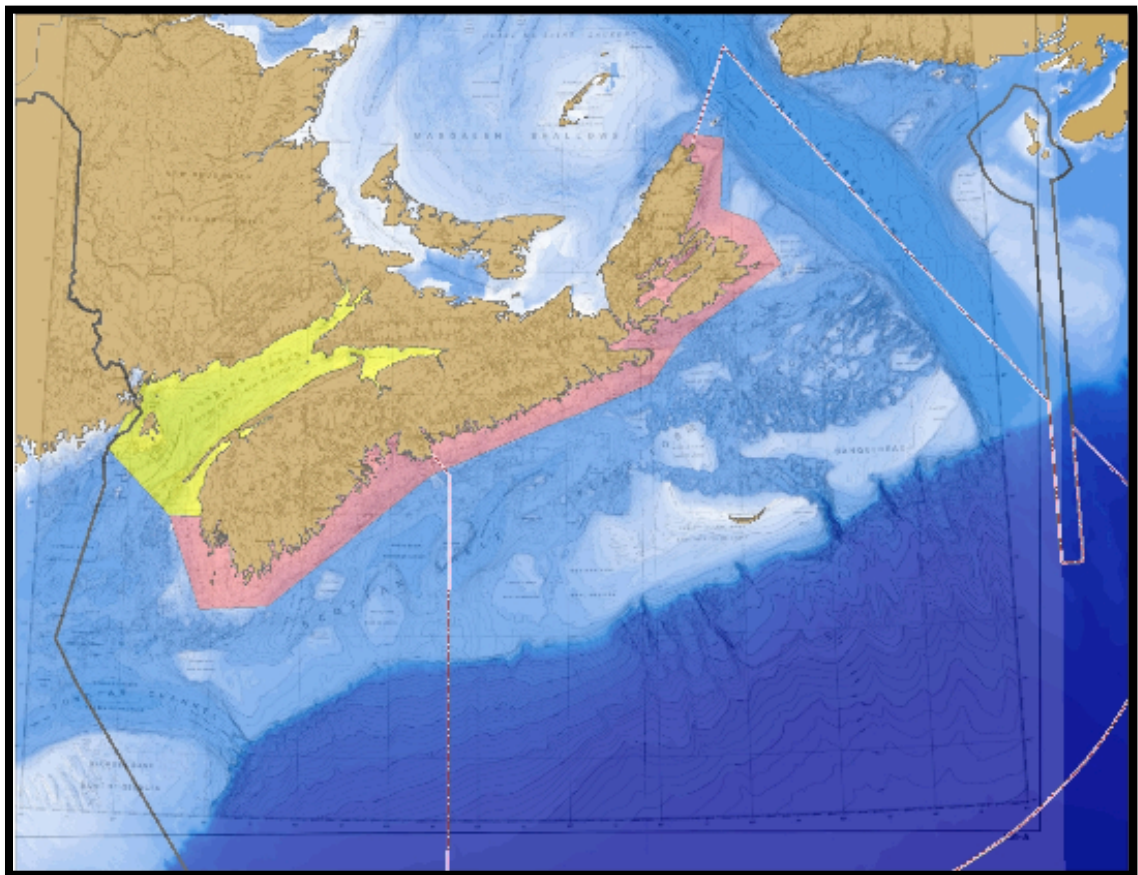


Figure 3: Draft planning areas being considered by DFO Maritimes Region for use in MPA network planning in the Scotian Shelf bioregion. The Atlantic coast of Nova Scotia (pink shading); the Offshore Scotian Shelf, including ESSIM (blue/pink outline); and the Bay of Fundy (yellow shading). Unpublished image created and use permitted by DFO.

The coast is unique in regards to its land-water interface and includes a number of habitat and community types (including human communities) that are not present in the offshore area. Planning and management of coastal areas are complicated by the intense human presence and the interactions of various jurisdictional authorities. Generally, the Nova Scotian coast is data deficient, and there are inconsistencies in approaches used for coastal ecological studies, in comparison to the abundant data sets from trawl surveys conducted in the offshore waters (Gromack et al., 2010). The low resolution of ecological and biological data prevents the coastal region from being included in the analyses of offshore regions for MPA planning (Horsman et al., 2011). Furthermore, the deficiency and poor resolution of coastal data complicate coastal MPA planning initiatives. Recent efforts of DFO Maritimes Region, however, have been undertaken to identify inshore areas of ecological significance for the purpose of identifying areas that may require management attention or potentially an MPA. These efforts are reviewed below.

3.2 The Identification of Ecologically and Biologically Significant Areas

In Nova Scotia, few studies have been done to identify coastal areas of ecological significance. In recent years there has been an effort to identify Ecologically and Biologically Significant Areas (EBSAs) for the purpose of raising awareness of areas that may require management attention and potentially to identify MPAs (Gromack et al., 2010). It is possible to identify EBSAs in a number of ways. The areas can be ecologically significant due to structural properties and/or the functions they serve (Doherty & Horsman, 2007) and selection criteria have included: uniqueness, aggregation and fitness consequence, naturalness, and resilience (Clarke & Jamieson, 2006). In 2006, a workshop was held to identify EBSAs along the Atlantic coast of Nova Scotia. Participants from the epistemic community and ENGOs proposed and mapped 47 inshore EBSAs (Figure 4), which were selected for reasons such as high productivity, a large presence of seabirds, and areas of importance for spawning¹⁹ (Doherty & Horsman, 2007).

¹⁹ The proposed EBSAs have not yet been peer-reviewed by the *Canadian Science Advisory Secretariat*, and they are not granted legal status (Doherty & Horsman, 2007).

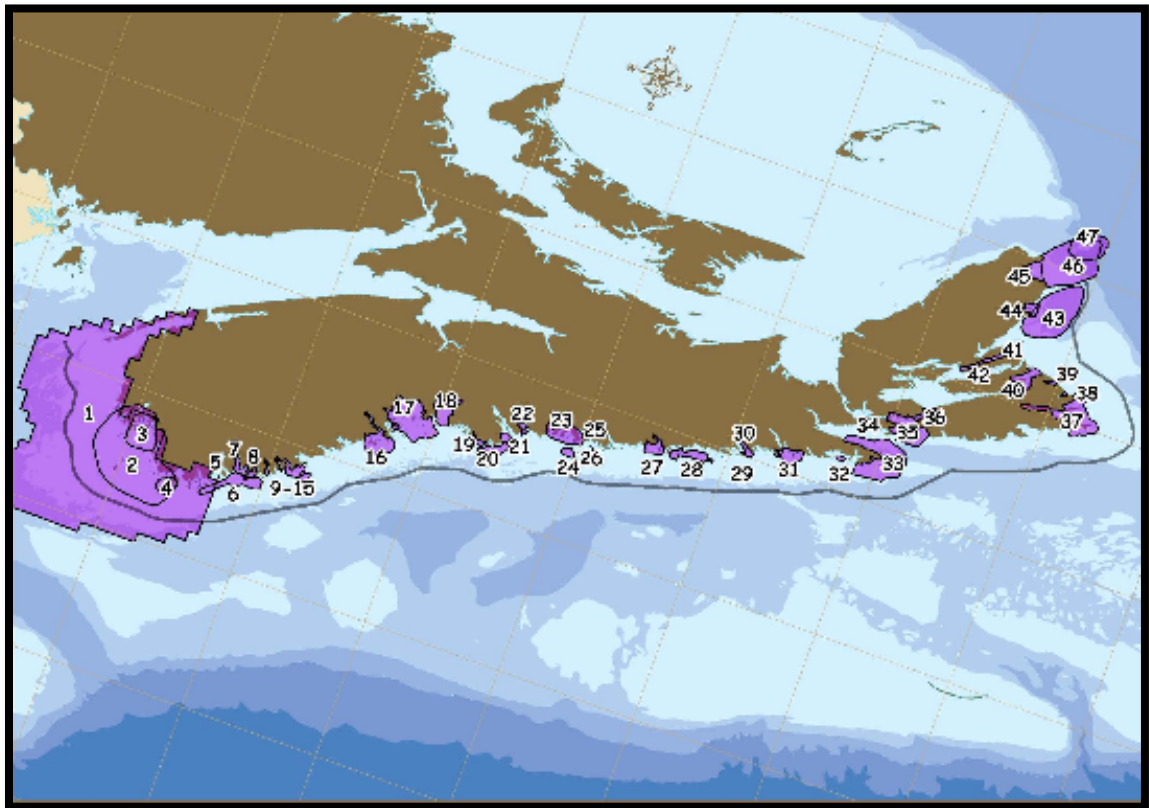


Figure 4: The 47 inshore EBSAs proposed by scientific experts in 2006 (Doherty & Horsman, 2007).

In 2010, an effort by Gromack et al. (2010) was undertaken to reduce the number of proposed inshore EBSAs to a more manageable number for assessment. The purpose of this effort was to facilitate the advancement of DFO’s MPA program, the protected area programs of other federal and provincial departments, and coastal management initiatives through the identification and presentation of ecological and human-use information on areas that require further assessment as potential priority areas for coastal conservation (Gromack et al., 2010). The areas may one day contribute to the bioregional network of MPA and therefore Canada’s national network of MPAs.

To reduce the number of EBSAs, the areas were categorized into Types: I, II, and III, based on the extent to which they met four main criteria²⁰:

²⁰ The methodology of how the sites were ranked will not be reviewed here and details are available in Gromack et al. (2010).

- 1) If they met the *Oceans Act* criteria of designating MPAs (as listed under Section 35 (1) in the *Oceans Act*).
- 2) The number of times they were identified by scientific experts in the 2006 EBSA workshop.
- 3) How many primary EBSA criteria they meet (uniqueness, aggregation, and fitness consequences).
- 4) Whether they were predominantly intertidal (due to the fact that *Oceans Act* MPAs cannot be designated above the low-water mark).

The classification of the sites was then adjusted based on whether they were identified as priority areas for conservation by provincial and federal departments, or if they had been mentioned as having ecological significance in other governmental reports (Gromack et al., 2010). Furthermore, in 2008 a brainstorming session was held at the Bedford Institute of Oceanography (DFO Maritimes Region's headquarters) to identify the sites of interest to federal and provincial government departments, including Parks Canada, Environment Canada, DFO, NSDNR, Nova Scotia Environment, the NSDTCH, and the NSDFA²¹ (Gromack et al. 2010). This meeting marked the first time that federal and provincial protected area planners and managers came together to specifically discuss the conservation of *coastal* areas in Nova Scotia. This meeting was the final step in narrowing the classification of the 47 previously identified EBSAs down to 20 (Figure 5). Type I sites are designated as a high priority from an *Oceans Act* perspective, and Type II sites may be of high priority for other federal and provincial departments. While Type III sites are considered to be biologically and ecologically significant, they were excluded from further assessment in the study by Gromack et al. (2010).

²¹ The group of governmental departments has been recently named the Coastal Protected Areas of Nova Scotia (CPANS) Working Group. CPANS will likely play a role in the future implementation of the national network of MPAs (Gromack et al., 2010).



Figure 5: Type I and Type II EBSAs as identified by Gromack et al., (2010). Boundaries are not fixed and correspond with EBSA boundaries (Gromack et al. 2010).

To further assess the 20 Type I and II EBSAs, information that is relevant to MPA and conservation planning was collected from various sources. This information was collected from government reports, government and non-government websites and databases, peer-reviewed literature, unpublished data from DFO scientists, and personal communication with scientists and other DFO staff (Gromack et al., 2010). Information from the above sources was compiled into Site Profiles for each of the 20 EBSAs. The Site Profiles provided information on:

- Location and population of the area within the EBSA boundary (as identified in the 2006 EBSA workshop).
- Physical features and habitat types (where available), as well as oceanographic descriptions of bathymetry, tidal to freshwater ratios, tidal ranges and inlet flushing times.

- Important ecological attributes including information on spawning and nursing grounds, presence of endangered species, level of biodiversity and productivity, and birds (as they are recognized as ecological and environmental indicators).
- Human-use information in regards to coastal development (residential, commercial, and industrial); commercial fishing; aquaculture; marine plant harvesting; and tourism, recreation, and culture. Commercial fish landings were qualified as high, medium, and low in relation to other areas in the Maritimes Region. The landings are estimates, and while they may represent the general importance of the area for each fishery relative to other areas in the region, they do not indicate the importance of each fishery to individual fish harvesters.
- Current protection, research, and conservation initiatives and the availability of information from each site.

Upon completion of the site profiles, Gromack et al. (2010) identified that it is necessary for a framework for coastal conservation areas planning and implementation to be established for the purpose of outlining a process to further evaluate the 20 EBSAs. Such a framework will require input from stakeholders and should reflect the mandates of federal and provincial departments and align with international guidelines for MPAs and MPA networks.

While this framework is being developed, the numerous data gaps identified by Gromack et al. (2010), which varied among the 20 sites, must be addressed. While many of the data gaps pertain to ecological factors, there are various research initiatives underway to address such gaps. There are also gaps pertaining to the “linkages between human activities and ecological impacts” and socioeconomic information (Gromack et al., 2010, p. 197). Furthermore, in many regions, LEK is outdated and inconsistent. It would be ideal to have fine scale data for the Atlantic coast of the province, however this would require unavailable time and resources that would delay management action for important ecological areas in need of protection and conservation (Gromack et al., 2010). To advance the efforts of creating site profiles for the 20 selected EBSAs, it is more appropriate to fill the data gaps of particular areas. As identified by Gromack et al. (2010) an immediate next step to advance this effort is to collect fine scale, socioeconomic information for each of the 20 sites, which has led to the pilot project: *Mapping Human*

Uses in the Coastal Zone of Nova Scotia: Pilot Study to Capture Expert Knowledge from C&P Officers.

In the May and June of 2011, the author interned in the Protected Areas and Conservation and Planning (PACP) section of the OCMD of DFO, and assisted with the development and administration of the division's pilot project. The background, materials, and methods of the pilot project are presented below. Where the pilot project is the division's first attempt at using a standardized methodology for collecting human-use information from C&P officers, the methodology of the project is evaluated and recommendations for improvement are provided in Chapter 4.

3.3 Mapping Human Uses in the Coastal Zone of Nova Scotia: Pilot Study to Capture Expert Knowledge from C&P Officers

As previously mentioned, information on Nova Scotia's coastal human uses and fishing activities is not readily available at fine spatial scales. Some information on fishery landings is held within the Maritime Fisheries Information System (MARFIS) database. MARFIS contains information on fishing activity, associated retained catches, effort, quota, licensing, and fishing trip information (Heather Breeze, personal communication, August 4, 2011), and is amalgamated from hail-out reports²² and logbook data from the Dockside Monitoring Program (DFO, 2006). The database has proved useful for offshore fisheries management, as landings are consistently reported at a scale that is appropriate for offshore management measures. The database also allows for the C&P division to target enforcement efforts (DFO, n.d.). The information within MARFIS is useful for select coastal fisheries, however, other coastal fisheries report on a larger regional scale and thus do not have the detail necessary for coastal MPA planning (Heather Breeze, personal communication, August 4, 2011).

The lack of fine scale data and the inconsistencies in coastal fishery reporting present a major challenge for MPA planning. For example, lobster landings are reported by large scale, geographic units called Lobster Fishing Areas (as well as Statistical

²² Hail-out (i.e., departure from port) reports include information on the vessel identification number, fish harvester license number, time of departure, estimated date of landing, and the species and areas to be fished (DFO, n.d.).

Districts and smaller scale grid squares). In comparison, the harvesting of marine plants is reported by geographic units known as Marine Plant Harvesting Districts (Sharp et al., 2008), some of which span large portions of the provinces coastline. Other species (e.g., soft-shell clam, oysters, sand and blood worm, periwinkles, quahog, eel, green crab, and other exploratory fisheries) are also inconsistently reported at large scales that are not suitable for coastal MPA planning. In addition to scale and consistency issues of coastal fisheries information, the exact location of recreational fishing and tourism activities, and the specific status of aquaculture lease sites are not readily available, thus presenting a further challenge for coastal MPA planning.

Although past efforts have been undertaken to collect and map human-use and fisheries information in areas of the Maritimes Region, much of the coastal information was either excluded or not easily interpretable for coastal conservation initiatives. In 2005, *The Scotian Shelf: An Atlas of Human Activities* (Breeze & Horsman, 2005) was prepared by the ESSIM Planning Office to represent the extent of human activities occurring on the Scotian Shelf. However, many of the activities occurring on the coast were left unmapped. While there is a long-term commitment to build upon this initiative for IM of the coastal zone and inshore areas (DFO, 2007), this has yet to be undertaken. Other efforts in the Maritimes Region have involved the collection of LEK for coastal resources mapping (e.g., Rutherford et al., 1995; O'Brian et al, 1998), however the results cannot be easily interpreted for use in MPA planning due to inconsistent and uncertain methods applied in different coastal regions and issues with data portrayal (Aimee Gromack, personal communication, April 21, 2011).

The inconsistencies and deficiencies in human-use and coastal fishery data for Nova Scotia's Atlantic coast justify the socioeconomic data gaps, including the lack of quantitative information, in the profiles of the coastal EBSAs presented in Gromack et al. (2010). To address the data gaps, the OCMD pursued a human-use mapping pilot project to build on the information presented in Gromack et al. (2010). Ultimately, the pilot project will contribute to the advancement of DFO's MPA and IM programs by providing information that may help to advance MSP, determine management requirements for specific sites while minimizing socioeconomic impacts, and inform boundaries of future MPAs (Aimee Gromack, personal communication, April 28, 2011).

The OCMD recognizes that the collection of LEK from coastal community members and stakeholders is an effective method to obtain fine scale information on human uses, however, there is much potential for it to be a lengthy process for which resources are unavailable at this time. An alternative to the collection of LEK is the collection of “expert”²³ knowledge from fisheries enforcement officers in the C&P division of DFO. In 2008, informal conversations with C&P officers proved to be very effective for gathering information on coastal fishing activities, as the officers possess a wealth of knowledge regarding the various activities within their jurisdiction (Aimee Gromack, personal communication, April 5, 2011). The pilot project was designed in the hope that interviews²⁴ with C&P officers would serve as “a practical, cost-effective means of collecting information needed to understand and portray human uses along the coast of Nova Scotia” (Aimee Gromack, personal communication, April 21, 2011). The pilot project’s objectives, deliverables, and potential challenges, materials, and methods for study site selection and interviews are presented below.

3.3.1 Objectives, Deliverables, and Potential Challenges of the Pilot Project

The pilot project’s three objectives were to:

- 1) Map the distribution of coastal fishing activities and areas of fishing importance at scales for which this information is not currently available.
- 2) Obtain and record other information provided by C&P that may be relevant for coastal and ocean management.
- 3) Evaluate the utility of this methodology for collecting and mapping coastal fisheries information for coastal and ocean management (the focus of this report).

²³ The term “expert” has been selected by the OCMD to describe the knowledge of C&P officers because their knowledge is derived from extended amounts of time spent living and working in the coastal study areas.

²⁴ It is important to note that the interviews with C&P officers included participatory mapping exercises for the collection of spatial data. For simplicity, the term “interview” will be used to describe all aspects of the meetings with C&P officers where a fixed list of questions was asked and responses were both documented and mapped.

The planned deliverables of the pilot project are:

- 1) A report documenting the methodology, results, challenges, and recommendations for future efforts.
- 2) Digitized and hard copy of maps and associated information.

The potential challenges of the pilot project, as identified by the OCMD were:

- 1) Scheduling conflicts
- 2) Time constraints to answer all of the interview questions
- 3) Staff with lack of experience
- 4) Unwillingness of C&P officers to answer some questions
- 5) Unwillingness of C&P officers to provide very detailed information

3.3.2 Selection of Study Sites and Project Approval

The OCMD selected five study sites²⁵ for the pilot project (Figure 6):

- Port Joli and surrounding areas (Port Mouton and Port L'Herbert)
- Lobster Bay
- Musquodoboit Harbour and surrounding areas (Chezzetcook Harbour, Petpeswick Harbour, and Jeddore Harbour)
- Mira Bay and Scatarie Island
- The Bras D'Or Lakes

Subsequently, the C&P detachment²⁶ with jurisdiction over each study site was identified. Type I EBSAs (as identified in Gromack et al., 2010) were targeted, for they are of higher priority from an *Oceans Act* perspective, and members from the OCMD selected Type I EBSAs that were the most practical from the perspective of the MPA and IM programs (Aimee Gromack, personal communication, July 27, 2011). The OCMD also wanted to sample the project's methodology at sites that would allow for an adequate representation of the geographical range of Nova Scotia's Atlantic coast bioregional draft

²⁵ It should also be noted that the Eastern Shore Islands were also selected as a study site of interest, however C&P officers were unavailable for interviews during the pilot project study period.

²⁶ To protect the identity of the C&P officers, the names/locations of the detachments will not be included in this report.

planning area; therefore the study site locations are dispersed from the northern tip to the southern tip of the province. The area of focus (i.e., study area) for each study site was selected based on the geographic boundaries of the EBSA but included the entire area of the Canadian Hydrographic Service (CHS) nautical charts (explained in section 3.3.3) used to map the responses to interview questions. Explanations for each selected study site are provided in Table 1 of Appendix A, and further details of the study sites are available in Gromack et al. (2010).

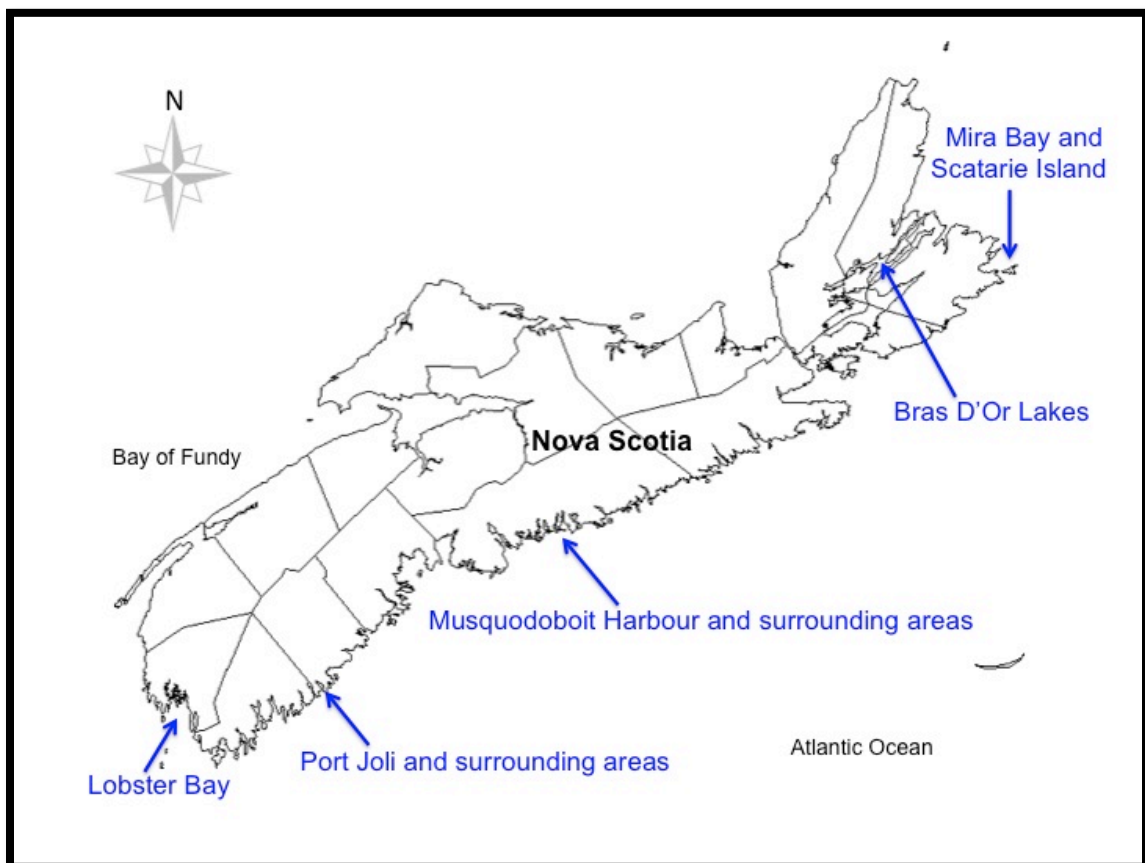


Figure 6: Approximate locations of the five selected study sites for the pilot project. Adapted from GeoNova, 2003.

Following the selection of study sites, the OCMD sought out project approval from the appropriate authorities. The C&P division reviewed and approved the concept of the pilot project. Following the approval of the project, C&P officers from each detachment that would be most knowledgeable about the fishing activities in the study area were recommended for interviews. The recommended C&P officers were contacted and interview dates were arranged for the months of May and early June. Prior to the

interviews, the interview methodology (explained in section 3.3.4) was established, reviewed, and finalized by OCMD employees with assistance from the author.

3.3.3 Pilot Project Materials

The following materials were prepared for each interview:

- **Set of interview questions**

Aimee Gromack, the project leader, and employee of the PACP section of the OCMD, created the set of interview questions (Appendix B) with some assistance from the author. The questions were modeled after the question-set used in a joint project between DFO and the Fishermen and Scientists Research Society which began in 2005, entitled *Local Ecological Knowledge (LEK) Survey of Inshore Commercial Fish Harvesters on the Scotian Shelf* (Bundy & King, 2005). The interview questions were then reviewed, edited, and finalized in a meeting of the OCMD. It was also decided that the questions would not be sent to the C&P officers prior to the interviews, to avoid premeditated answers or second hand information.

- **List of “species of interest”**

The MARFIS database was accessed to identify the species for which coastal harvesting information is not available, or not available at scales appropriate for MPA planning. The selected species of interest (Table 2 in Appendix A) were listed in order of priority (based on commercial importance) and used to guide interview questions.

- **Canadian Hydrographic Service nautical charts**

Paper copies of CHS charts were obtained for each study site (Table 3 in Appendix A), because the C&P officers use them regularly on patrols. In cases where the CHS charts were not at the appropriate scale for mapping purposes, a member of the OCMD created coastal maps using data from the Nova Scotia Topographic Database and various mapping software (Jennifer Hackett, personal communication, August 15, 2011). A digital mapping tablet was available for the

project, however, due to the lack of operational knowledge by the research team and strict project timelines, paper CHS charts were selected for simplicity.

- **Aquaculture site maps and reference sheets**

Aquaculture site maps and reference sheets were prepared for each study site. The NSDFA website provides an “Aquaculture Site Mapping” tool that allows the public to view where aquaculture is happening in the province (NSDFA, 2011). Maps showing the locations of aquaculture sites within each study area were printed at the appropriate scales to allow for the C&P officers to identify the sites. Aquaculture site reference sheets were also prepared and provided the: site number, species that is farmed, water body in which the site is located, name of license holder, number of hectares, and CHS chart of where the site is located.

3.3.4 Interview Methodology

Prior to each interview, the C&P officers were emailed a summary of the pilot project, as well as a brief questionnaire regarding their position, years of experience, and daily activities (Section 1a of Appendix B). The interviews were held at the C&P detachment associated with the study site. Each interview was conducted by an interviewer (Aimee Gromack), accompanied by a note-taker (Katie Wagner) and a facilitator (Katie Hastings, another Marine Affairs intern at DFO), hereafter referred to as the research team. These positions were kept consistent throughout all of the interviews, with the exception of the last two interviews where the facilitator was unable to attend.

Semi-structured interviews were conducted with one to three C&P officers at each detachment, depending on availability. The interviewer asked the fixed set of questions, for which answers could be given with room for expansion on certain topics. The questions pertaining to specific fisheries were asked in the order of the “species of interest” list, should there not have been sufficient time to address each species.

The locations of coastal fishing activities (and other coastal activities addressed in the interview questions) were hand-drawn in various colours by the C&P officers (and/or the interviewer when necessary) on CHS charts or coastal maps. The facilitator assisted with the colour coding and legend making while the questions were being asked. The

aquaculture site maps and reference sheets were used for the question that pertained to aquaculture activity in the study area.

Each interview was digitally recorded (audio only) with the permission of the C&P officers for the purpose of ensuring accuracy of the transcripts. The note-taker documented the responses to each question using a word processing program on a laptop computer. Each interview lasted approximately two hours, allowing sufficient time for every question to be answered and mapped.

In total, eight C&P officers were interviewed. Their responsibilities involve: regular inland and coastal patrols of fisheries, educating the public about rules and regulations of fisheries, supervising other officers, maintaining budgets and relations with marine industries, and commanding special investigations. The officers' experience at their detachment ranged from five to 23 years, with an average of 13 years. Every officer previously held a position at another C&P detachment, with experience ranging from one to 13 years, with an average of nine years. Nearly all of the officers are originally from the area where their respective detachment is located. In cases where the officer was not from the area, they had lived there for longer than a decade. The time the officers spend on the water conducting patrols varies with seasons, and times varied from zero to 16 days per month.

Currently, the project leader is working to finalize the written transcripts of each interview with the use of the audio recordings. Once the transcripts are finalized and the maps are digitized, they will be provided back to the C&P officers for approval of the information and any necessary changes will be made. At this time, all of the results of the pilot project (both documented and mapped) are confidential and may only be used for DFO internal purposes. Therefore, these results are not included in the evaluation of the pilot project, discussed below in Chapter 4.

Chapter 4: Evaluation of Pilot Project, Discussion of Data Issues, and Recommendations

4.1 Evaluation of Pilot Project

This chapter evaluates the pilot project's methodology of collecting human-use information from Conservation and Protection officers. The evaluation will ideally contribute to the success of the OCMD's future human-use mapping initiatives. The author's first-hand observations and perceptions of the C&P interviews will provide background to the evaluation, discussion of data issues, as well as recommendations for improvement. The evaluation will consider four elements of the pilot project:

- 1) The performance of the research team
- 2) The research process
- 3) The interview questions
- 4) C&P officers as a source of information

To inform and support the evaluation of the pilot project, the perspectives of professionals who specialize in various aspects of human-use mapping initiatives in the US were consulted informally for information about US experiences. The methodological research processes and data priorities for the collection of human-use data, as recommended by attendees of a human-use mapping national workshop, will be used as a standard by which to evaluate the research process and interview questions of the pilot project. Details about how the specialists were selected and approached, and the national workshop are described below.

The human-use mapping initiatives taking place in the US are more advanced and outnumber the few Canadian initiatives. In 2005, NOAA's MPA Center hosted a workshop, entitled *Mapping Human Activity in the Marine Environment: GIS Tools and Participatory Mapping* (hereafter referred to as the National Human-Use Mapping Workshop) in an effort to "design criteria for a practical participatory method or a suite of methods to collect spatial data on human-use patterns to inform local and regional MPA planning processes" (NOAA, 2005, p. 1). The attendees of the workshop, who hold

positions as leaders of MPA human dimensions programs, social scientists, anthropologists, and MPA coordinators, were approached by the author for information about the conference and human-use mapping methodologies. Academics and members of the epistemic community who have authored peer-reviewed literature on coastal and marine human-use mapping approaches were also approached. The “snowball” sampling method was employed, where the approached individuals were asked to provide the contacts of other individuals who might be willing to contribute (Scholz et al., 2004).

In total, 14 specialists were approached, and informal conversations or exchanges of emails were conducted with seven individuals (Table 4 in Appendix A). The author did not ask the specialists a fixed set of questions, however the conversations were geared towards gathering information on the experiences of the specialists, past and present human-use mapping initiatives taking place around the US, the specialists’ perspectives on the pilot project methodology, including the benefits or drawbacks to interviewing C&P officers, and any suggestions or recommendations they may have for methodological improvements and the future use of the information collected from the officers. Consent forms were not given, as the specialists were providing their professional perspectives of the pilot project and not their personal opinions. Transcripts of the conversations were not created, but the sections of this report for which they are referenced were sent to each specialist to verify the accuracy and to provide any necessary changes.

4.1.1 First-Hand Observations and Perceptions of the C&P Officer Interviews

Where the C&P officers were interviewed in a group setting, the author’s observations and perceptions of the interviews (including the process of participatory mapping) will be made at the level of C&P detachments. Observations and perceptions of the individual officers will not be provided, due to the fact that the officers employed within the same detachment had very similar interview styles and levels of knowledge of the study area. To protect the identity of the officers and the integrity of each detachment, the names of individual officers and detachments will not be provided. The purpose of this section is not to determine the detachment that was most successful at providing the

coastal fisheries and human-use information, but rather to demonstrate the various ways in which information was provided.

Generally, the interviews and associated participatory mapping exercises achieved the pilot project's main objective: to map the distribution of coastal fishing activities and intensities at scales that are not currently available. There was sufficient time at each interview for the officers to verbally and cartographically respond to the questions pertaining to the coastal fisheries of each "species of interest", and for the interviewer to ask every question²⁷ in the fixed question set. Although the fine scale data of coastal fishing and human uses in each study area was documented and mapped, the author's perceptions of the officers' certainty of knowledge, willingness to answer and map certain questions, and familiarity with charts and maps, varied among the detachments.

It became evident throughout the study period that the perceived degree of the officers' certainty in their verbal and cartographic responses to the interview questions varied across the detachments. Some detachments were able to thoroughly answer all of the questions without hesitation or perceived difficulty, while others appeared to have some hesitation or difficulty answering particular questions. It appeared however, that the officers' certainty in their verbal and cartographic responses was related to the amount of time they are able to spend patrolling the coastal waters of their jurisdiction. The officers of one detachment generally spend more time on the water in comparison to the other detachments. It was these officers who were able to provide more specific information in regards to the number of fish harvesters per fishery or geographic area (often referring to them by name), as well as the level of intensities and boundaries of certain coastal fisheries or human uses taking place within the study area.

The perceived level of the officers' willingness to draw symbols and boundaries on the CHS charts or coastal maps also varied among detachments. These differences, however, did not appear to be related to the amount of time the officers are able to spend patrolling the study areas. The perceived level of the officers' familiarity with the CHS charts or coastal maps, representing the study area and the officers' jurisdiction, also

²⁷ After the first interview, the research team removed questions pertaining to the locations of cetaceans and seabirds that were originally in the fixed question set, for it was decided they were not pertinent to the objectives of the pilot project.

varied among detachments. This difference appeared to be related to the amount of time the officers are able to spend on the water, however it was unclear whether this affected their willingness to draw on the chart. The officers who seemed most familiar with the charts would often point out locations on the charts to support verbal answers, yet had to be reminded to document the location with a marker. When necessary, the interviewer or facilitator would mark a boundary, symbol or label on the chart, with the approval and confirmation of the officers.

It was valuable to note that the perceived level of the officers' conservation interest and/or awareness also varied among detachments. While the interview questions were not designed to gauge their level of conservation awareness, some of the officers' conservation concerns were evident in how they responded to questions. The conservation concerns of the officers are valuable to the OCMD, for the information may support the observed degradation of certain species and habitats in some of the study sites, and may help to link the human activity to observed ecological impacts. Their conservation concerns may also inform the OCMD of conservation issues in certain study areas of which the division was not previously aware.

4.1.2 Performance of Pilot Project Research Team

The performance of the research team was a critical component of the pilot project. The successful collection and documentation of the knowledge of the C&P officers heavily relied upon advance preparation and planning by the research team. The research team successfully prepared all of the project materials, conducted the interviews and associated participatory mapping exercises in a professional manner, and recorded all collected information in an organized fashion. Furthermore, by keeping the positions as interviewer, note-taker, and facilitator consistent throughout the project, each team member became more comfortable in their position and performance of their specific duties.

The significance of the facilitator's position became evident when the team member was unable to participate in the last two C&P interviews. In the absence of the facilitator the interviewer and/or note-taker were tasked with colour coding, legend making, and ensuring the clarity of the officers' cartographic responses, and focus was

removed from their primary positions. The facilitator thus greatly contributed to the successful administration of the project.

The research team's ability to record the audio of the interviews was critical to the documentation of the information provided by the officers. The importance of audio recordings became evident to the author while finalizing the transcripts of two interviews²⁸. The audio recordings made it possible to verify the written information documented by the note-taker, and in some cases the explanations for the boundaries and symbols drawn on the CHS charts. When collecting coastal human-use information, audio recordings are often necessary as there is a "finite amount of time that people are willing to be interviewed", and there is the potential for pertinent information to be lost (NOAA CSC employees, personal communication, June 29, 2011).

4.1.3 Pilot Project Research Process

The research process of the pilot project is evaluated, for it determined the type of coastal human-use information that was collected, how it would be collected, and from whom it would be collected. At the 2005 National Human-Use Mapping Workshop, the participants agreed upon the "key steps" of research processes that should be completed when documenting coastal and marine human uses for MPA planning (NOAA, 2005). The recommended key steps are used as a standard to evaluate the general research process of the pilot project, and are shown in Table 1.

²⁸ The finalization of the C&P interview transcripts was included in the author's duties as an intern in the OCMD.

Table 1: Evaluation of pilot project research process

“Key steps” of the research process identified by workshop participants	Did the research process of the pilot project complete the key step?
<i>Define the boundaries of the study area</i>	Yes. The geographic boundaries of the pilot project were defined through the selection of the study sites. Within each study site, the study areas were defined by the EBSA boundaries but included the entire area of the CHS chart.
<i>Identify and prioritize the use types within the study area</i>	Yes. The priority of the pilot project was to map the distribution of coastal fishing activities and areas of fishing importance. The majority of the interview questions pertained to coastal fisheries and were asked of species in order of priority, based on commercial importance. Questions pertaining to other human uses were also asked in order of priority, based on the data needs of the OCMD.
<i>Collect secondary data on priority use types</i>	Yes. While this step was not performed in the pilot project, it was accomplished by Gromack et al. (2010), where various sources were used to identify coastal human uses within the 20 EBSAs.
<i>Design a sampling strategy</i>	Yes. The C&P officers were identified as the individuals with knowledge of the coastal human uses to be included in the research process.
<i>Determine data collection methods</i>	Yes. Semi-structured interviews and participatory mapping of coastal human uses on paper CHS charts were selected as the methods for data collection.

The research process used in the pilot project accomplished each of the recommended key steps that should be completed when documenting coastal and marine human uses for MPA planning, according to the 2005 workshop. While the pilot project did not include the collection of secondary data on the priority use types, this step was previously completed by Gromack et al. (2010), which ultimately led to the pilot project. It is evident, from the above evaluation and the perspectives obtained from specialists through informal conversations that the research team took a “good approach” to the methodological process of the pilot project (NOAA CSC employees, personal communication, June 29, 2011; Mimi D’Iorio, personal communication, June 30, 2011). Nevertheless, there are issues associated with selecting C&P officers as the sole source from which coastal human-use information was collected, which are evaluated and further discussed in section 4.1.5.

4.1.4 Pilot Project Interview Questions

The fixed set of questions used in the C&P interviews is evaluated for it was the component of the pilot project through which the research team interacted with the C&P officers, and ultimately guided the collection of human-use information. At the 2005 National Human-Use Mapping Workshop, the participants generated a list of priority research questions that are essential for the collection of coastal and marine human-use information (NOAA, 2005). The list of priority research questions also informs the socioeconomic dimensions of the spatial patterns that may be considered and later incorporated into MPA planning. The list of priority research questions will be used as a standard to evaluate the fixed set of questions used in the C&P interviews, shown in Table 2.

Table 2: Evaluation of pilot project interview questions

Priority research questions identified by workshop participants	Did the fixed set of questions used in the C&P interviews include the priority research question?
<i>Who are they and what are they doing?</i>	<i>Yes.</i> Where the main objective of the pilot project was to map the distribution of coastal fishing activities and areas of fishing importance, the questions inherently addressed the user group (fish harvesters) and their activity (fishing). Where questions addressed other coastal human uses, the members of the user group were characterized by their participation in the activity.
<i>Where do they go in space and time?</i>	<i>Yes.</i> The participatory mapping approach used in the interviews allowed for the collection of the spatial patterns of human uses. Short-term temporal patterns were collected from questions that addressed the length of daily fishing trips, as well as seasons of fisheries and other coastal activities.
<i>How much do they go?</i>	<i>Partially.</i> Interview questions that addressed the number of individuals performing the activity and the locations where the activity is most “intense” were geared at determining the intensity and of fishing and other coastal activities. A measure or quantitative scale was not included in the interview questions or responses.
<i>Where do they come from?</i>	<i>Yes.</i> Interview questions addressed the locations of the home ports and ports of landings of fish harvesters. The officers often included the point of origin of individuals performing recreational activities as well.
<i>Why do they go there?</i>	<i>Yes.</i> The officers were asked <i>why</i> they selected the locations that are subject to intense fishing or recreational activities. Their responses often included the ecological or biophysical conditions of the area, thus indicating the users’ perception of resource abundance or quality of habitat for the activity.
<i>What are the costs, values, or significance of the activities?</i>	<i>No.</i> Interview questions did not address the costs, values, or significance of the activities.
<i>What do they know?</i>	<i>Yes.</i> The semi-structured interviews allowed for the officers to share much of their experience-based and place-based knowledge. The officers’ responses to the interview questions indicated their range of knowledge.

The majority of the priority research questions were included in the fixed set of questions used in the C&P interviews. Furthermore, the specialists indicated that the fixed set of questions used in the C&P interviews was thorough in regard to the targeted information and objectives of the pilot project (NOAA CSC employees, personal

communication, June 29, 2011). Despite this positive feedback, the question set used in the pilot project interviews could be adjusted to better address the intensity of the coastal human uses (*How much to do they go?*), and their socioeconomic dimensions (*What are the costs, values, or significance of the activities?*).

The intensity at which a coastal human-use is occurring “is a core dimension of mapping spatial patterns that is necessary for conducting numerous analyses such as threat and impact assessments” (NOAA, 2005, p. 6). The main objective of the pilot project was to document and map the distribution of coastal fishing activities and areas of fishing *importance*. A weakness in the interview question set used in the pilot project was the fact that questions pertaining to the intensity of a human-use were not quantified. Dr. Chris Ellis, a social scientist of the Human Dimensions Program at NOAA’s Coastal Services Center, who specializes in survey design for human-use data collection, reviewed the pilot project question set. It was suggested that definitions for the words “most” and “intense” used in relation to fishing harvesters and activities, respectfully, be defined for standardization of the information provided by the C&P officers (Chris Ellis, personal communication, July 12, 2011).

In conservation planning, it is both useful and difficult to assign a value to an important area or resource (Mimi D’Iorio, personal communication, June 30, 2011). An exercise known as “100 pennies” has been used in US human-use mapping initiatives to simply quantify the importance of geographic areas (Mimi D’Iorio, personal communication, June 30, 2011; Scholz et al., 2010). The exercise requires the individual partaking in a participatory mapping exercise to distribute 100 pennies over geographic areas of ecological or economic importance that may be in need of protection. The total number of pennies the individual places on the area quantitatively indicates the importance of the area. While many approaches can be taken to assign value to areas and resources, human-use information can be controversial to quantify. When considering systems of meaning, and people’s perceptions and knowledge, the drive to collect and analyze quantitative data attempts to reduce something that is ultimately irreducible (Bryan Oles, personal communication, July 15, 2011). While the pilot project did not attempt to quantify the intensities of human uses, or the importance of areas or resources

within or across study sites, the qualitative measures provided by the C&P officers will surely be useful for the MPA planning efforts of the OCMD.

The collection of information pertaining to the costs, values and significance of coastal human uses can be methodologically complex and assessed from various perspectives (NOAA, 2005). Given the timeline of the pilot project, it was not possible for the research team to attempt the collection of the costs, values, and significance of the coastal fisheries or other coastal human uses. As the coastal MPA planning efforts of the OCMD progress, however, the division will tie various socioeconomic figures to the human uses within the study sites or selected AOIs. As mentioned in Chapter 1, this aspect is an invaluable component of MPA planning and establishment, and until socioeconomics are incorporated, the information provided by C&P officers will remain human-use data (Mimi D'Iorio, personal communication, June 30, 2011).

4.1.5 C&P Officers as a Source of Information

The C&P officers are evaluated generally as an informant group, not as individuals or separate detachments, as they were the sole source of information of coastal human-use information. While various stakeholder or informant groups²⁹ can participate in interviews and participatory mapping exercises, one approach is to “conduct interviews with experts knowledgeable about stakeholders” (Pomeroy & Douvere, 2008, p. 819). In the case of the pilot project, the experts are the C&P officers and fish harvesters are the predominant stakeholders on which information is being collected. The method of collecting human-use data from C&P officers (known as fishery officers in other North American regions) has been used in US initiatives, such as the Ocean Uses Atlas Projects in California and Hawaii, explained above in Chapter 2. The planners of the Ocean Use Atlas Projects make an effort to have fishery officers in attendance at every workshop (Mimi D'Iorio, personal communication, June 30, 2011).

The knowledge of informants who participate in interviews and participatory mapping exercises will vary according to their position and experience (NOAA, 2005). Essentially, the type and extent of knowledge provided by the C&P officers differs from

²⁹ In this report, an informant group is defined as a group of individuals who hold the same professional position or place in the coastal community.

the type and extent of knowledge that would be provided by coastal fish harvesters, tourism operators, or community members. As demonstrated by the C&P interviews, the type and extent of knowledge can also vary *within* an informant group. When researchers and MPA planners rely on informants for human-use data, they are attempting to understand the informants' perception of the area and what they think about a place (Bryan Oles, personal communication, July 15, 2011). This understanding may be complicated by the potential of informants to hold biases in regards to areas and human uses occurring there. It is not uncommon for individuals who hold positions as C&P or fishery officers to have previously held a position as a commercial fish harvester, which was the case of some C&P officers interviewed in the pilot project. This diverse background may influence their perspective of the area or human uses occurring there³⁰ (Bryan Oles, personal communication, July 15, 2011). It should also be mentioned, however, that policy-makers and marine managers “inevitably have to consider the agenda of their governance institution, which can bias their interpretation” of the view or information provided by informants³¹ (Vella et al., 2008, p. 212).

In human-use mapping initiatives, it is important to obtain a diversity of perspectives (Bryan Oles, personal communication, July 15, 2011). The C&P officers interviewed in the pilot project recognized the importance of this, as each detachment had recommended that the research team interview or have an informal conversation with fish harvesters who had been fishing within the study areas for multiple decades. There is the potential for conflicts to arise within coastal communities should other informant groups realize that human-use data for MPA planning was only collected from one informant group that may be biased or have a potential conflict of interest (Bryan Oles, personal communication, July 15, 2011). Therefore the layer of human-use information provided by the C&P officers is just one of many information layers that should be collected from other informant groups. As mentioned in Chapter 2, some informant groups or coastal stakeholders may be apprehensive to provide proprietary information. Relevant literature

³⁰ It is important to note that any informant group, not just that of C&P officers, providing human-use information may have some type of bias.

³¹ While this may be the case, the author is in no way implying that the OCMD or research team was biased in the interpretation of the information provided by the C&P officers.

has demonstrated that fish harvesters often have concerns about revealing the location or information about specific fishing areas (Scholz et al., 2004). By interviewing C&P officers, the research team was able to avoid the various complexities associated with interviewing fish harvesters (Bryan Oles, personal communication, July 15, 2011). Despite this, the interviews with C&P officers should serve as a starting point in coastal human-use mapping initiatives, and the documented information should be ground-truthed and verified by coastal fish harvesters and other sectors of focus in the C&P interviews (Bryan Oles, personal communication, July 15, 2011).

4.2 Issues of Data Sensitivity, Verification, and Incorporation into MPA Planning

As coastal MPA planning efforts of the OCMD progress and the pilot project results are assessed and analyzed, the division may encounter issues of data sensitivity, the need for verification, and challenges to its incorporation.

The documented and mapped information provided by the C&P officers is sensitive, for it is proprietary information and may pertain to the livelihood of coastal fish harvesters and individuals from other marine sectors. While the data is confidential and at this time may only be used internally by DFO, there are limitations for how it may be cartographically displayed by the department. While the author could not access a written policy regarding the display of proprietary information, it is understood that there are limitations of the detail to which written and spatial coastal fisheries information can be published or cartographically displayed. Issues of data sensitivity have also been encountered in US human-use mapping initiatives (NOAA CSC employees, personal communication, June 29, 2011). To overcome issues of data sensitivity, it has been common practice to aggregate data sets prior to being published or cartographically displayed, so as to protect the identity of specific fisheries or individual fishing grounds (Scholz et al., 2004; Klein et al., 2008). Aggregating human-use information collected in numerous interviews or workshops may also ensure data confidentiality, as it portrays the perspectives of many individuals from various sectors (Scholz et al., 2010). The OCMD is aware of the issues of data sensitivity associated with the pilot project, and the data will

be sufficiently aggregated should it be published or cartographically displayed in internal reports.

It is important for the OCMD to verify the human-use information provided by the C&P officers (Madeleine Hall-Arber, personal communication, July 12, 2011). As briefly mentioned above, the information provided by the officers is just one of many layers of human-use data that should be incorporated in coastal MPA planning for the province. It is necessary for the OCMD to collect human-use information from the coastal sectors (such as commercial and recreational fish harvesters, tourism operators or recreationalists, representatives from aquaculture operations, and others) and verify or compare it to the human-use information provided by the C&P officers³². The OCMD is aware of the necessity to ensure the accuracy of the human-use data prior to its incorporation into coastal MPA planning. At this time, it is unclear if or how issues of data sensitivity may influence the extent to which the data may be verified by other informant groups.

Currently, the OCMD is determining how to best display the information collected from the pilot project, and incorporate it into coastal MPA and MPA network planning in Nova Scotia. In human-use mapping efforts, it is beneficial to “have a clear sense of how the data will be used and visualized” as it will help to ensure the right data are collected (NOAA, 2009, p. 13). Furthermore, “knowing the long-term use of the maps and data will help to define how the project should collect and store the information” (NOAA, 2009, p. 13). Ideally, the OCMD would have planned how the human-use data would be displayed and incorporated into MPA planning efforts prior to its collection. Fine scale human-use information is necessary to inform fine scale socioeconomic considerations and assessments of areas for MPA planning (EBM Tools Network, 2011). Generally, marine planners are seeking guidance on how to use socioeconomic data (Ban & Klein, 2009). The incorporation of fine scale socioeconomic data into marine conservation planning may help to avoid the costly conservation mistakes that have been known to occur when coarser scale data is used (Richardson et al., 2006; Ban & Klein 2009). It is outside the scope of this report to suggest the type of socioeconomic data that

³² Regardless of the informant group selected as the source of information for the pilot project, the information would need to be verified with other stakeholders.

should be linked to the human-use data and incorporated³³ into MPA planning and design, yet the information collected in the pilot project will surely inform the socioeconomic assessments of the study sites should one be pursued in the future as an AOI.

4.3 Recommendations for Future OCMD Human-Use Mapping Initiatives

The purpose of pilot projects is to conduct a preliminary study on a small scale to assess the feasibility of its continuation or to identify ways in which the methodology or project design can be improved. The pilot project was successful insofar that the objectives to document and map the distribution of coastal fishing activities and areas of fishing importance, and to obtain and record other information that may be relevant for coastal and ocean management, were sufficiently achieved. The collection of coastal human-use information from C&P officers is a feasible and cost effective method for this type of data collection. The C&P interviews are an excellent starting point for coastal human-use mapping initiatives in Nova Scotia. The interviews have provided the OCMD with a strong foundation of fine scale human-use information, and a catalog of significant informant or stakeholder groups for five coastal areas. It is necessary to collect human-use information from other informant groups to verify and build upon the foundation of coastal human-use information provided by C&P officers. While it is feasible for the OCMD to continue the collection of coastal human-use information from C&P officers, there are ways in which the methodology may be improved. The following recommendations address the areas for improvement in the methodology that are alluded to in the evaluation, and the issues of displaying, analyzing and incorporating the data that are discussed above.

Considering the performance of the research team, the absence of the facilitator resulted in added duties and responsibility of interviewer and note-taker. It is recommended that a facilitator be present at future interviews of this magnitude to assist with project administration and documentation of data. This recommendation will require

³³ Preliminary suggestions for how the human-use data may be incorporated into coastal MPA planning efforts include, quantitatively ranking the human uses, and overlaying the locations of coastal human uses with the locations of ecologically sensitive features (Aimee Gromack, personal communication, July 14, 2011).

very little effort or funding of the OCMD. Should large scale, province wide coastal human-use mapping efforts be pursued in the future, interdisciplinary research teams consisting of social scientists that specialize in interviewing techniques, and natural scientists that specialize in areas of coastal and fisheries ecology, should be assembled because together they may provide a highly informed position throughout interviews with various informant groups (St. Martin et al., 2007). This recommendation will require significant effort and likely national funding.

To address the issue of determining how the data will be incorporated into MPA planning (discussed in section 4.2), prior to future interviews the research team should develop a thorough strategy for how the human information will be analyzed and used for MPA planning. This low-effort, low-cost improvement will mitigate or reduce the difficulty of determining how the data will be used *following* its collection.

With regard to the pilot project interview question set, the questions and responses pertaining to the intensity of a coastal human-use or were not quantified. The suggestion from Dr. Chris Ellis is acknowledged and it is recommended that terms such as “most” and “intense” in interview questions should be quantitatively defined (e.g., 50% or more). To quantify the responses to interview questions, the interviewees could be asked to select a standardized, quantitative score for the intensity of the activity, use of an area, and level of importance of an area. This improvement could be accomplished by using a “100 pennies” method or similar approaches found in the MPA literature.

Where the pilot project interview questions did not address the costs, values, or significance of the activities, it is recommended that the OCMD determine the type of socioeconomic costs and values, associated with the spatial human-use data that should be incorporated into coastal MPA and MPA network planning. The type of socioeconomic data will determine the design of future interview questions and potentially alter the methodology of data collection. While the above recommendations will require significant effort, neither will require much funding.

Considering the fact that the C&P officers were the sole source of information for the pilot project and the necessity to obtain a diversity of perspectives, it is recommended that coastal human-use information be collected from other informant groups. The involvement of additional informant groups will address the concerns of the public,

expressed in the consultation of the draft *National Framework for Canada's Network of MPAs*, to involve coastal communities in the planning of MPAs. These additional perspectives could be obtained using interviews with other informant groups, workshops, and web-based programs, each of which would require significant effort and funding. The details of workshops and web-based program are further discussed below, as they can also address issues of data sensitivity and the need for data verification.

As discussed in section 4.2, there are issues of sensitivity and the need for verification of the data that were collected in the pilot project. To prevent or mitigate the issues, the OCMD may consider alternative methodologies for human-use data collection, such as participatory mapping workshops or a web-based program. A site-specific workshop where informants from various sectors come together to verbally and cartographically respond to questions of coastal human-use would allow for the data to be amalgamated on site, thus mitigating issues of data sensitivity that may be encountered with the future use of the data. Workshops would also allow the data to be verified with other informants on site, which may lessen the extent to which the data needs to be verified in the future or prevent further verification altogether. The various coastal human uses that were discussed throughout the C&P interviews will facilitate the identification of the informants that should be present as such a workshop. Although participatory mapping workshops would serve as an efficient method to simultaneously collect, aggregate, and verify human-use data from various marine sectors; they would require more planning and financial consideration by the OCMD.

DFO may also want to consider the establishment of a website or web-based coastal atlas program where individuals can upload human-use information from various sources. This type of program could be modeled after British Columbia's web-based Community Mapping Network and/or similar programs from US initiatives. The program could be linked to internal DFO databases to maximize the amalgamation of available coastal data. Human-use information collected in interviews or participatory mapping workshops could also be integrated into the program. The web-based program could be established and maintained in partnership with associated federal departments, the PON, CPANS, and ENGOS to enhance the cooperation, collaboration, and support that is necessary for the establishment of Nova Scotian coastal MPAs. Although the various

perspectives of human uses and data layers uploaded to the program would also allow for data verification, the data would still require ground-truthing. It should also be noted that despite the inevitable data aggregation that would occur within such a program, there are would likely be many issues of data sensitivity and ownership. A web-based program would be an efficient method to collect and verify human-use data that could evolve with technological advancements, however such an initiative would require extensive planning and funding. Lastly, should such a web-based program be pursued, the department/partnership should consider a membership in ICAN so as to ensure the latest development strategies and best practices.

Chapter 5: Conclusion

Nova Scotia's coastal habitats and resources have played a fundamental role in making the province what it is today. However, the ever-increasing populations, developments and anthropogenic pressures on the province's coast are threatening habitats, species, ecosystems, and ecological services on which coastal communities depend. The exploitive coastal activities have led to the need for stronger marine conservation efforts and MPAs are a management tool that if implemented properly, can conserve habitats, species, and marine biodiversity. The unclear jurisdictional boundaries of the coast has pushed DFO Maritimes Region to focus previous conservation efforts in offshore areas, and coastal MPAs will require cooperation between federal and provincial departments and the outreach initiatives of ENGOs.

MPAs that are planned without the consideration of human dimensions will likely fall short of the intended conservation goals and objectives. The significance of collecting and incorporating ecological data into MPA planning frequently overshadows that of social science data, and human-use information often remains a missing layer in MPA decision-making processes. The collection of human-use information contributes to the understanding of the social, economic, and cultural connections between user groups and marine resources or habitats, and thus indicates the potential impact or success of an MPA. When designing MPAs, human-use information should be collected for consumptive activities, including commercial and recreational fishing; non-consumptive activities, including recreational activities, tourism operations, and current conservation initiatives; and industrial activities, including military operations, aquaculture, and coastal developments. This report demonstrates the importance of collecting and quantifying the distribution and intensity of the coastal fishing industry from multiple informant groups.

To facilitate the advancement of DFO's MPA program, the OCMD has undertaken efforts to identify and profile coastal areas of ecological significance. The department is not currently committed to indentifying or advancing a particular site (Gromack et al., 2010), and therefore the recently administered pilot project, *Mapping Human Uses in the Coastal Zone of Nova Scotia: Pilot Study to Capture Expert*

Knowledge from C&P Officers, has demonstrated the department's recognition of the importance of collecting and incorporating human-use data in the early stages of MPA planning. The collection of human-use data through interviews and participatory mapping exercises allowed the OCMD to gain detailed, fine scale information that is otherwise limited, unavailable, or not useful for coastal MPA planning.

The general success of the pilot project and the evaluation of its methodology demonstrate the feasibility of collecting human-use data from C&P officers. Adjustments to the methodology can contribute to the success of the OCMD's future human-use mapping initiatives. The methodology of the pilot project is ideal in the initial data collection phases of the OCMD for coastal MPA planning, for the methodology allows for the identification of site-specific conservation issues and primary informant groups that should be involved in future human-use mapping efforts. While it is practical for the OCMD to continue interviewing C&P officers at other sites or EBSAs, it is imperative that a diversity of informant groups be pursued in the future, particularly if the OCMD commits to identifying a coastal AOI. Furthermore, where small-scale fish harvesters are one of the primary stakeholder groups of marine conservation efforts in coastal waters, it is critical for their perspectives and knowledge to be collected and incorporated. Alternative methodologies such as participatory mapping workshops or web-based programs may allow for the efficient collection of human-use information from various stakeholders, facilitate vertical and horizontal cooperation of government departments, and mitigate issues of data sensitivity and verification.

By collecting human-use information in the early phases of coastal MPA planning, the OCMD is reducing the risk of procedural delays, legal challenges, and conflicts forming among user groups should one of the sites be designated as an MPA in the future. The attempt to identify and spatially depict the relationships between people and the marine and coastal resources on which they depend lifts the cartographic silence and fills a missing data layer in coastal MPA planning. Linking people to places in the early phases of coastal MPA planning in Nova Scotia will contribute to the success of Canada's national network of MPAs and marine conservation efforts worldwide.

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Appendix A: Tables

Table 1: Reasoning for study site selection

<p><u>Port Joli and surrounding areas (Port Mouton and Port L’Herbert):</u></p> <p>The Port Joli study site (a Type I EBSA) was selected primarily due to the various ecological research initiatives in the area, indicating a high level of interest (and potentially ecological importance) of the site. The collection of human-use and socioeconomic information will complement the available ecological data and may inform conservation initiatives in the area. The site was also identified by the members of CPANS as an area with one of the highest levels of interest for conservation (Gromack et al., 2010). Furthermore, the previous informal conversations with C&P officers, mentioned in Chapter 3, took place at the detachment with jurisdiction over Port Joli. The OCMD wanted to build on the knowledge that was provided in the conversations using a standardized methodology (Aimee Gromack, personal communication, July 27, 2011). It should also be noted that Port L’Herbert, which is included in the Port Joli study area, is ranked as a Type II EBSA in Gromack et al. (2010).</p>
<p><u>Lobster Bay:</u></p> <p>The Lobster Bay study site (a Type I EBSA) was selected for its ecological significance and its very unique habitat that supports one of the most productive lobster grounds in the province. The site is the location of one of the most intense coastal fisheries in the province and there are many other coastal human uses in the region for which data is lacking. The Lobster Bay study site provides an ideal contrast to the other study sites where the commercial fishing activity is not as intense (Aimee Gromack, personal communication, July 27, 2011). Similar to the Port Joli study site, Lobster Bay was also identified by the members of CPANS as an area with one of the highest levels of interest for conservation (Gromack et al., 2010).</p>
<p><u>Musquodoboit Harbour and surrounding areas (Chezzetcook Harbour, Petpeswick Harbour, and Jeddore Harbour):</u></p> <p>Initially, the C&P detachment with jurisdiction over Musquodoboit Harbour and surrounding areas was selected (due to its close proximity to the DFO Maritimes Region headquarters, the Bedford Institute of Oceanography located in Dartmouth, NS) for the purpose of testing the pilot project methodology prior to conducting interviews at other study sites. Due to scheduling conflicts, however, the interview was moved to a later date (therefore the methodology was not tested with C&P officers prior to the other interviews) and Musquodoboit Harbour was selected as the study site. Although Musquodoboit Harbour is primarily intertidal, and an MPA designated under the <i>Oceans Act</i> cannot be in an intertidal area, the site is ecologically significant and much of the area is managed for conservation by the Nova Scotia Department of Natural Resources (Aimee Gromack, personal communication, July 27, 2011). It should also be noted that Chezzetcook and Jeddore Harbour, which are included in the Musquodoboit Harbour study area, were selected as a Type II EBSAs in Gromack et al. (2010).</p>
<p><u>Mira Bay and Scatarie Island:</u></p> <p>The Mira Bay and Scatarie Island study site (a Type I EBSA) was selected primarily due to its close proximity to St Anns Bank, being the only candidate Area of Interest (AOI) for an <i>Oceans Act</i> MPA that is located near the coast. St Anns Bank was officially announced as an AOI from three candidate areas (including Misaine Bank/Eastern Shoal and Middle Bank) after the pilot project study period.</p>
<p><u>The Bras D’Or Lakes</u></p> <p>The Bras D’Or Lakes (a Type I EBSA) was selected due to its unique ecosystem created by limited exchange with waters of the Scotian Shelf. It was also selected due to existing marine management efforts, and the cooperative research programs between the Mi’kmaq First Nations, universities, and government science agencies, including DFO (Gromack et al., 2010).</p>

Table 2: Species of interest in order of priority, based on commercial importance

Species of interest in order of priority	
1) Lobster (<i>Homarus americanus</i>)	10) Irish moss (<i>Chondrus crispus</i>)
2) Soft-shell clam (<i>Mya arenaria</i>)	11) Kelp (<i>various species</i>)
3) Periwinkles (<i>Littorina sp.</i>)	12) Other marine plants
4) Quahog (<i>Mercenaria mercenaria</i>)	13) Sea urchin (<i>Ascophyllum nodosum</i>)
5) Oysters (<i>rassostrea virginica</i>)	14) Groundfish (e.g. cod, haddock, Pollock, flounder, halibut)
6) Sand worm (<i>Alitta virens</i>) and/or Blood worm (<i>Glycera dibranchiata</i>)	15) Mackerel (<i>Scomber scombrus</i>)
7) Eel (<i>Anguilla Rostrata</i>)	16) Gaspereau (<i>Alosa pseudoharengus</i>)
8) Green crab (<i>Carcinus maenas</i>)	16) Other bait or exploratory fisheries?
9) Rockweed (<i>Ascophyllum nodosum, etc.</i>)	17) Other species harvested in the study area

Table 3: CHS charts used to document responses to interview questions at each study site

Study Area of Interest	Chart or Map
Provincial chart (<i>used to map the jurisdiction of each detachment</i>)	CHS 801-A
Port Joli and surrounding areas (Port L'Herbert and Port Mouton)	Coastal map created by OCMD
Lobster Bay	CHS 4244, CHS 4242
Musquodoboit Harbour and surrounding areas (Chezzetcook Harbour, Petpeswick Harbour, and Jeddore Harbour).	Coastal map created by OCMD
Mira Bay and Scatarie Island	CHS 4375
Bras D'Or Lakes	CHS 4277, CHS 4278, CHS 4279

Table 4: Names, positions, and date and type of contact of specialists who provided professional perspectives of the pilot project

Name	Position	Type of contact	Date of contact
Tricia Ryan*	Human Dimensions Program Coordinator NOAA Coastal Services Center	Phone	June 29, 2011
Chrissa Waite*	Coastal Management Specialist NOAA Coastal Services Center	Phone	June 29, 2011
Danielle Bamford*	Project Management Professional The Baldwin Group On site at NOAA Coastal Services Center	Phone	June 29, 2011
Mimi D'Iorio	GIS/Database Manager NOAA National MPA Center	Phone	June 30, 2011
Bryan Oles	Social Scientist/Program Manager I.M. Systems Group	Phone	July 15, 2011
Chris Ellis	Social Scientist Human Dimensions Program NOAA Coastal Services Center	Email	July 13, 2011
Madeleine Hall-Arber	Anthropologist Center for Marine Social Sciences MIT Sea Grant College Program	Email	July 12, 2011
* The perspectives of these individuals were expressed in a conference call, whereby the author could not continuously determine the identity of the speaker. The individuals are therefore cited within the text collectively as "NOAA CSC employees".			

Appendix B: Pilot Project Interview Questions

Mapping Human Uses in the Coastal Zone of Nova Scotia: Pilot Study to Capture Expert Knowledge from C&P Officers

Interview Questions for Conservation and Protection Officers

Interview location: _____

Interviewer: _____ Recorder: _____ Facilitator: _____

Interviewees: 1) _____ 2) _____
3) _____

Interview date and start time: _____

CHS Charts #: _____

OCMD study area of interest (e.g. Port Joli and surrounding area)³⁴: _____

You were sent the project description ahead of time. Do you have any further questions about the project?

Do you mind if we record the interview with a tape recorder? It will allow us to make sure we didn't miss anything in the transcription.

Yes or No. Comments: _____

TABLE OF CONTENTS

Section 1: About the interviewees

Section 2: About location and intensity of fishing activities

Section 3: About location and intensity of other human uses

Section 4: Additional questions (if time permits)

³⁴ We are aiming to obtain information for the whole CHS chart in most cases; however, the CHS charts are not all at the same scale. In situations where the CHS chart is at too large a scale, other maps may be used so that more detailed information can be recorded.

Section 1a: Questions about the interviewees

Each of the C&P officers were sent, and responded to the following nine questions via email prior to the interview. Their answers were clarified at the interview if necessary.

1. What is the official title of your position?
2. What are your general/day-to-day responsibilities?
3. Are you responsible for enforcement of specific fisheries or for all fisheries that occur in the area?
4. How many years of experience do you have working as an officer with this detachment?
5. Have you worked in other detachments previously? Yes or No
If so, where and for how many years?
Name of previous detachment(s): _____
Number of years: _____
6. Have you held previous positions in related sectors/departments/branches that contribute to your knowledge of the area or industry?
7. Are you originally from the area? Yes or No
 - a. If no, how long have you lived in the area?
8. How much time do you spend on the water?
Hours per day: _____ Days per week: _____
 - a. Does the time you spend on the water change over the course of the year?
9. Were you involved in earlier projects to map ecological and human-use information?
 - a. If yes, what projects were you involved in and when?

Section 1b: Questions about jurisdiction

Thank you for responding to the questions we sent by email. Following with the theme of those questions, we would like to ask you some questions about your area of jurisdiction.

1. Can you identify on the map (or describe generally) your detachment's area of jurisdiction? (*use chart 801-A*)
2. Do you know some parts of the area better than others? If so, please indicate and show on the map.

Section 2: Questions about location and intensity of commercial fishing activities (*questions to be asked for each fishery following the order of “species of interest” list)

Now we would like to ask you questions regarding the locations and intensities of fishing activities. You will be asked to illustrate answers to the questions using the charts/maps provided, based on your personal observations on the job.

3. Does [species] fishing occur in the study area? Yes or No. *(If no, proceed to next species on list)*
 - a) How does the fishery generally operate? (e.g. How many days per year? What time of the day does fishing occur? How long is a typical fishing trip?)
 - b) During which months of the season does **most** fishing occur?
 - c) How many harvesters/vessels are **active** in the study area?
4. Can you draw on the map (or show me on the map) the locations where [species] fishing occurs?
 - a) How many harvesters/vessels utilize each area? *(write # harvesters in each area on map).*
 - b) What type of gear is used? *(If needed, ask for clarification on how the fish are caught. Write gear types for each area on map).*
 - c) Where are the homeports of the majority of the fish harvesters?
 - d) Is the port of landing used by the majority of fish harvesters the same as the homeport? If not, what other port of landings are used? How many harvesters use those other homeports?
5. Which of the areas that you've identified on the map are the most intense? *(use hatch marks or clear symbology to identify most intense areas).*
 - a) Why would you describe this area as a location of intense [species] fishing?
 - b) How many harvesters/vessels utilize this area?

Section 3: About location and intensity of other human uses

Now we would like to ask you questions regarding the locations and intensities of other human uses. You will be asked to illustrate answers to the questions using the maps provided based on your personal observations on the job.

6. What are the main recreational fisheries and where do they occur? *(use a dotted line on map - - - -)*
 - a) Which species are targeted?
 - b) During which months of the year do these fisheries occur?
7. Do Aboriginal/First Nations food, social and ceremonial (FSC) fisheries take place? If so, where?
 - a) Which species are targeted?
 - b) During which months of the year do they occur?
8. Can you please identify whether the aquaculture leases shown on the map are
 - Active (**A**) (in operation),
 - Non-active (**N-A**) (have never been active) OR
 - Defunct (**D**) (were active at one point but are not currently active)
9. What other recreational activities occur in the area and where do they occur (for example, recreational boating, scuba diving, etc.?)
 - a) During which months of the year do these activities occur?
10. Are there any activities going on in this area that we have missed? If so, could you please indicate on the map where they are occurring.

Section 4: Additional questions (if time permits)

Finally, we would like to ask you some closing questions regarding further species sited in your jurisdiction and some feedback regarding future studies of this nature.

11. Can you tell us about changes in the fishing industry over time? (e.g. are there fewer vessels fishing now? Longer/shorter fishing trips? Same people fishing more species? Etc.)
12. Can you tell us about any specific issues raised by local fish harvesters, such as conflicts over access to space or concerns about other activities in the area?

13. Do you have any recommendations for working with the community to obtain LEK on areas of importance to them or to discuss other coastal management initiatives?
14. What can you tell us about the level of compliance for any of the fisheries we discussed? Are there specific areas where infractions have occurred?

Section 5: Closing questions

15. Do you have any questions comments or suggestions regarding today's interview?
19. Do you have any concerns about the use of the results?

Thank you for your time. Transcripts will be sent to you for verification. Upon completion of the research portion of this pilot study [likely by Fall 2011] the results will be sent to you for further discussion.

Please note:

Time interview completed _____

How many maps: _____

How many sections completed: _____

How many sheets of notes: _____

Are the maps and sheets of notes numbered and labeled with location?