

Integrated Ocean management

Making local global: the role of monitoring in reaching national and international commitments

By

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List of Abbreviations

CBD	Convention on Biological Diversity
CITES	Convention on Trade in Endangered Species of Wild Animals
CMS	Conservation of Migratory Species
CMSP	Coastal and Marine Spatial Planning
DFO	Department of Fisheries and Oceanography
ESSIM	Eastern Scotian Shelf Integrated Management
GOM	Gulf of Maine
GoMOOS	Gulf of Maine Ocean Observing System
IUCN	International Union for Conservation of Nature
MPA	Marine Protected Areas
NOAA	National Oceanic and Atmospheric Administration
UNCLOS	United Nations Convention on the Law of the Sea
USA	United States of America

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1. Introduction

1.1. The Management Problem

Today, there are many countries that have their own ocean management plans either at a national and/or regional level that aim to meet various national/international commitments or targets (United Nations, 2008). Those that are signatory to international treaties such as the Law of the Sea or the Convention on Biological Diversity should be using them as a guidelines to direct their national or regional efforts and programs. This can ensure that they are meeting the international standards and targets. Where traditional management may have failed before to prevent environmental and ecological loss or degradation, new forms of management can allow for a more successful approach to conservation. Such a method is an integrated structure that can be multi-species, cross sectorial and more comprehensive (Knoi, 2010). Many countries have formally adopted integrated management as the new approach to ocean management, involving in-depth science, interested stakeholders, and the co-management of multiple industries that have affects on one another or the environment. Included within integrated management is the ability to understand and measure the level of success of different policies or action plans.

The monitoring process can allow managers to create indicators that can be used to determine the effectiveness and efficiency of a developed policy and make changes where needed (Day, 2008). The use of proper ecosystem indicators within monitoring can ensure that the policy is being implemented to meet its goals and that it remains adaptive and up to date. However connecting regional ocean management plans to the larger scale can be difficult without proper indicators or proper structure. Ideally the goals and objectives of a regional plan should either coordinate or be a means for the country to meet its national programs and/or international commitments. However, the links between the regional and national are sometimes unclear, or missing altogether, making it harder for decision makers to a) reach these national and international commitments and

b) measure the success that these regional management action plans or policies are having.

This paper will examine Canada's progress in linking a regional plan to its national and international commitments. It will use Norway and the United States of America (USA) as two case studies to demonstrate potential successful elements that could be used within the Canadian context. Thus, the purpose of this paper is to provide recommendations to appropriate decision-makers in Canada to help improve the link through monitoring between a regional plan on the Atlantic coast to Canada's national acts, programs, and international commitments.

1.2 Research Questions, Objectives and Thesis Format

The Canadian context for this project will focus on the Eastern Scotian Shelf. The research objective is to identify the overall ecological vision for the Scotian Shelf Area in terms of goals and objectives from various government issued documents and scientific papers, and to examine how they could be linked to Canada's national and international commitments. Due to the scope of the project, only the ecological component will be reviewed within policies, laws, and national/international commitments for Canada and all case studies. The research questions are designed to try to identify, compare and contrast with the two other case studies, and to provide information regarding the ecological goals and objectives for the given area. The three key research questions are:

1. What are the ecological goals and objectives for the Scotian shelf area?
2. What are Canada's national and international commitments, laws and policies?
3. How can the identified goals and objectives for the Scotian Shelf relate/link back to Canada national and international commitment with the monitoring structure that Canada has?
 - a. Why or why not?
 - b. What are the Gaps?
 - c. What are the Recommendations?

By using a case study from the USA and a case study from Norway, the objective is to highlight successful methods that have been used in other countries to link the two together.

This paper is divided into eight sections: introduction, literature review, Canadian context, case studies, results/analysis, discussion/recommendation and summary/recommendations/conclusion. The first section provides a brief background on two major international treaties, a definition of integrated management and the management problem is outlined. The second section provides a more in depth view of integrated management, the traditional approach of linking management needs to national and international commitments, the role of monitoring and identified successful elements within the literature. Section three presents that Canadian context, and will be presented in the same manner as the two case studies. Section four first introduces the methodology for choosing the case studies and then presents the USA and Norway case studies. Section five shows the formal analysis of the case studies and the framework that was used. It also briefly discusses limitations of the study. In the sixth section, a discussion of the results will be presented and recommendations will be made. Finally, section seven will be a summary of the USA, Norway and Canada, recommendations and conclusion of the paper and its findings.

2. Literature Review

2.1. Integrated Management

Integrated ocean management is an emerging approach to management. It differs from the traditional approach as it is no longer single species or industry specific. Instead, this approach attempts to address the difficult problems of managing overlapping jurisdictions, competing coastal and ocean uses and vulnerable environments (Cicin-Sain *et al.*, 1994). Historically, navigation and fisheries primarily dominated the uses of the ocean and thus a sector-by-sector approach was used for management. Where the demands of our ocean have increased with increased population, exploration and other

ocean uses are becoming prominent (Hilborn & Hilborn, 2012). Presently, all of these activities combined are capable of affecting one another and are doing so with increasing frequency (Ban *et al.*, 2010). Integrated management also allows for multi-level government control. Where activities may be controlled or managed at different jurisdictional levels, the actual use may affect all the zones and thus require the involvement of more than one level of government (Cicin-Sain *et al.*, 1994). Lastly, integrated management attempts to understand the complexity of the ocean's ecosystems and processes as dynamic entities that have no real boundaries separating one area from another.

Integrated management seeks to manage for both the effects that humans and human related activities have on the ocean environment, and *vice versa*. It is a two-way process that includes biotic and abiotic factors. Thus those involved with integrated management are not only the decision makers and the government officials, but also various stakeholders and the environment (Ottersen *et al.*, 2011). These stakeholders include the industries directly involved, potential affected industries, the scientific community, the indigenous community and indirect users (such as the general public) who have a right to know how the use of the ocean resources affect them. Since integrated management has a social component, the social groups are necessary and are an integral part in the decision making process of any management plan (Cicin-Sain *et al.*, 1994).

As the uses for the ocean increase, the potential for conflict also increases. Typical areas of conflict includes competition for ocean and or coastal space, adverse effects on one another and/or adverse effects on ecosystems (Cicin-Sain *et al.*, 1994). As well, conflict can occur between the various governmental agencies that are in charge of the various ocean programs. These conflicts can come from having different objectives and confusion of who legally manages which industry, sector or area. By using integrated management, ideally, these conflicts can be minimized through a discourse of communication and the alignment of different objectives.

2.2. The Need for Monitoring

Monitoring, in the broadest sense, is defined as the routine measurement of chosen indicators to understand the condition and trends of the various components of an ecosystem (Bisbal, 2001). It is an important part of any policy as it allows for two parts. First, it allows for a community or government to monitor the changing state and resiliency of the relevant coastal and marine systems. This includes both the biophysical components as well as the human dimensions (Kearney *et al.*, 2007). Second, it also allows managers to assess the extent to which said policy is working in practice at the various levels (local or national). To be able to properly monitor ocean and coastal policies, objectives and goals need to be clearly defined so developing and utilizing appropriate indicators can be used to track changes over time.

There are three categories that indicators can be used for: social, ecological and governance. The ecological and social indicators can only be judged as a matter of outcomes and impacts. These ecological outcomes and or impacts could include the monitoring of improved water quality, fish stocks, and habitat loss. Social indicators could include both the monitoring of increased public access to beaches and increased/decreased employment.

Ocean management policies are implemented but the monitoring and evaluation aspects are sometimes lacking, inhibiting the plan from reaching its full potential of being both effective and efficient. Proper and accurate monitoring is an essential pre-cursor to evaluation. The evaluation of these indicators subsequently allows them to be analysed to determine the progress towards the key goals and objectives of an ocean management policy. The use of proper ecosystem indicators in monitoring can ensure that the policy is being implement to meet is original goals and objectives. It also allows for the plan to remain adaptive and up to date provided that a review of the information is in a timely manner.

In the operational phase there are many different management tools that can be used to implement the action plan or policy. This can include, but are not limited to, zonation, marine protected areas, special area planning, easements, developments, mitigation and restoration and the issuance of coastal permits. Along with these various management tools, monitoring will be an integral part of the overseeing the success of the action plan or policy (Cicin-Sain & *et al.*, 1994). From the monitoring program information will be gathered that will be analyzed to make the necessary changes.

2.2. National and International Commitments

Many countries have adopted various national and international commitments to protect and conserve the marine ecosystems through various ways. For example, from the Convention on Biological Diversity (CBD), a goal to conserve 10% of the world's oceans by 2012 was agreed upon by participating countries. The world failed in reaching this target, however reaching these targets may mean nothing at all. In some cases, if the goal is just to reach a target, the conservation reason may just be lost. For example, in the case of marine protected areas, larger and larger MPAs are being announced all over the world. However, how protected are these areas? In some areas where enforcement of no-take areas is severely lacking, the MPA may not really be successful in protecting what it was intended to protect in the first place. Thus although it may help the country reach its target on paper, it may not be any more protected then it was before it became a designated area (Agardi, 2003).

Other issues that have been identified are the convenience in selecting a single rule-of-thumb figure for all situations. Will this hold the same meaning in each situation given the array of unique and variable biology of specific targets and distinct ecological characteristics for populations, communities and ecosystems? Scientific uncertainty also plays a large role in the determining the usefulness of creating targets. Although increased monitoring and research is slowly decreasing the knowledge gap for some areas, it is sometimes hard to create a target where it is uncertain what the important threshold value is for sustaining or exploiting an ecosystem.

Targets can be positive and can provide a goal for all to achieve to. It can create a framework for various management plans and policies. With different approaches being used such as adaptive management, targets can be moved, and feedback loops created between science and policy. With integrated management, where multiple ocean uses are addressed, the different sets of objectives demanded by a wide variety of stakeholders are more likely to ensure that user conflict is avoided, so targets will not be inhibiting each other.

There are two national commitments that are known world-wide. The Law of the Sea treaty that resulted from the third UNCLOS conference (1973-1982) became ratified in 1994. This treaty defines the responsibility of the nation's use of the world's oceans and establishes guidelines for business, the environment and the management of marine natural resources (UNCLOS, 2011). Besides the European Union, there are currently 165 other signatory states. This treaty addressed issues such as the exclusive economic zone (EEZ), continental shelf jurisdiction, deep seabed mining, protection of the marine environment and scientific research (UNCLOS 2011).

Later in the 20th century, the issue of biodiversity loss and its implications also became an international concern. Thus, in 1992 at the Earth Summit in Rio de Janeiro, an important legally binding agreement was created addressing the biodiversity problem. This was the Convention on Biological Diversity (CBD) that came into force in 1993. This was the first time in international law that the conservation of biological diversity was a common concern for human kind and considered an integral part of the development process (IUCN, 1994). This treaty set out to inform decision makers to ensure that the use of natural resources was conducted in a sustainable way. The CBD and UNCLOS are both treaties that are legally binding and provide guidelines for countries that are signatory to follow in terms of their own national laws, codes of conduct and action plans surrounding the ocean at either a national, regional or local level.

3. Canadian Context

Canada is truly an ocean nation possessing the largest coastline in the world. Bordered by three oceans, the livelihood and culture of Canada is strongly influenced by its marine resources. Although traditional fishing practices and transportation are still key players within the ocean industry, other emerging uses such as oil and gas exploration and development, aquaculture and increased commercial fishing are increasing the potential threats to marine life and habitats (OECS, 2012). To manage these demands and ensure sustainability of its ocean's and resources, Canada was the first to implement comprehensive ocean management legislation: the Oceans Act. With the oceans act, a more holistic approach was outlined for managing ocean resources. It introduced the need for collaboration among all ocean users, new management tools and a more holistic concept of the marine ecosystem as compared to previous single-species approaches. Within Canada, the Ocean's Act is founded upon three main principles; 1) sustainable development, 2) integrated management and 3) the precautionary approach. With over 7.1 million square kilometres of ocean to manage, the federal, provincial and territorial governments all play an important role. In Canada, the Minister of Fisheries and Oceans Canada, on behalf of the government of Canada, is in charge of leading the implementation of integrated management (DFOa, 2013). The purpose for integrated management within Canada is to be able to provide information for decision makers responsible for ocean-based activities. This method also allows for the management of activities that will sustain a healthy marine environment and provide consideration of other ocean uses (DFOb, 2013). The aim is to ensure that the decision making process is more effective in the long term, not conflicting with other ocean users and are built upon a single common knowledge base. By taking into consideration the needs of both the ecosystem and the needs of Canadian citizens, it is hoped that the cumulative effects of human activities within a defined ocean space can be limited (DFOc, 2013).

For Canada, integrated management has three major components: ecosystem and social and economic considerations. The ecosystem consideration is an ecosystem-based approach within integrated management. The biggest change that the ecosystem-based

approach brings is its view on managing ocean activities. Instead of focusing on the impact of the targeted resources (such as a single fishery) it looks at the impact on the whole environment. By looking at the whole environment, ecosystem objectives need to be set, and different ecosystem components such as productivity, fish stocks, key species and sensitive habitats are monitored to ensure long term sustainability and maintain the health of Canada's oceans (DFOc, 2013). The long-term goal for Canada is to be using an integrated-management approach for all of Canada's marine waters.

Prompted by the Oceans Act, the Department of Fisheries and Oceans Canada initiated a pilot project on the Eastern Scotian Shelf that would be the first integrated management process and plan for its kind in Canada.

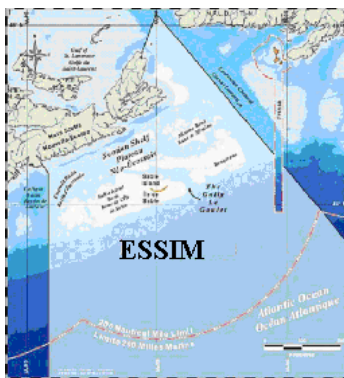


Figure 1: The area that ESSIM covers off of Nova Scotia. Image from <http://www.dfo-mpo.gc.ca/oceans/publications/essim-giepne-eng.asp>

The Eastern Scotian Shelf Integrated Management (ESSIM) initiative is for an area of about 120,000 km² (figure 1). The Eastern Scotian Shelf is an important ecosystem that provides high biological diversity, productivity and critical living and non-living resources. Ocean activities such as fisheries, offshore oil and gas, shipping, maritime defence, recreation and tourism, offshore mineral development and marine conservation all affect the Scotian Shelf ecosystem (Rutherford et al., 2005). The ecosystem services that this area provides have ecological, social and economic values that are both important for Nova Scotia and Canada. This pilot project came to an end as of last year (2011) and an evaluation of the ESSIM initiative was published in spring of 2013. Although this integrated management plan has concluded and DFO has since then proposed a new Maritimes Regional Marine plan for the Scotian Shelf and its surrounding area. Thus the ecological objectives and goals that were determined for the Scotian Shelf are still relevant even with the termination of the ESSIM project. It is most likely that many of the ecological objectives and goals will be carried forward as the new Maritimes Regional Marine Plan progresses through its various stages.

The Oceans Act is DFO's lead agency for providing leadership and programs for ocean use, IM and planning and marine protected areas (MPAs). In 2002, the ministers of Fisheries and Oceans released Canada's Ocean Strategy, a national management plan for Canada's estuaries, coastal and marine ecosystems and Canadian waters (Foster et al., 2005). It had one over arching goal to ensure healthy, safe and prosperous oceans for the benefit of current and future generations of Canadians by using principles of sustainable development, integrated management and a precautionary approach. Canada had taken a 'learning-by-doing' approach to integrated management, and thus, the ESSIM was also a learning process for the successful elements of planning, implementation, monitoring and evaluation.

Table 1. Links between ESSIM objectives and related National Acts and international commitments: The objectives are taken from the ESSIM strategic Plan available from the DFO website (DFO, 2006; p40).

ESSIM Objectives	Related National Objectives	National Acts	International commitments
1. "Diversity of benthic, demersal and pelagic community types is conserved"	-	Ocean's Act	UNCLOS UNFA CBD
2. "Incidental mortality of all species is within acceptable levels"	-	-	CBD
3. "At risk species protected and/or recovered"	Prevent extinction of human threatened species and improve their conservation status	Species at Risk Act	CBD
4. "Invasive species introductions are prevented and distribution is reduces"	Prevent and control the introduction of alien species into the marine environment	-	UNCLOS CBD
5. "Genetic integrity is conserved"	-	-	CBD
6. "Primary productive and secondary	-	Ocean's Act, Canada National Marine Conservation Areas	-

productivity are healthy”		Act, Canada Wildlife Act	
7. “Trophic structure is healthy”	-	-	-
8. “Biomass and productivity of harvested and other species are healthy”	-	Oceans Act	-
9. “Physical characteristics of ocean bottom and water column support resident biota”	Protect and preserve rare or fragile ecosystems (including deep-water vulnerable marine ecosystems, coral reefs, cold coral)	-	UNCLOS
10. “Harmful noise levels are reduced to protect resident and migratory species and populations”	-	-	-
11. “Waste and debris are reduced”	Regulation of wastes in coastal and marine waters Prevent the harmful alteration, disruption or destruction of habitat	Fisheries Act, Canadian Environmental Protection Act	UNCLOS
12. “Chemical characteristics of ocean bottom and water column support resident biota”	-	Oceans Act	UNCLOS
13. “Atmospheric pollution from ocean activities are reduced”	By 2020, bring down levels of pollution, including from excess nutrients, to levels not detrimental to ecosystem function and biodiversity	Oceans Act	CBD
14. “Habitat integrity is conserved”	-	Oceans Act	UNCLOS CBD

Since there is currently no official plan in place for this particular region, a current overarching monitoring plan is lacking. The findings from the case studies should provide

insight of the monitoring elements that Canada should include for the Maritimes Regional Marine plan to ensure successful and relevant links between regional objectives and national acts and international commitments. It is important to note however, that ESSIM was an objective based approach, and thus monitoring, performance evaluation and reporting is an integral component. The objective of monitoring and reporting effective and timely was outlined with three strategies. Although the ESSIM initiative was lacking on a framework for monitoring, a system was still developed independently of the ESSIM document. There are environmental monitoring programs present within the Scotian shelf, the most comprehensive being the Atlantic Zone Monitoring Program that collects a variety of environmental data. There are other monitoring programs for fish and marine mammals populations. Thus a main component that may be lacking is a monitoring program that ties all of the different ones together to provide results to appropriate and interested parties. Monitoring for the Scotian shelf will help measure the success of integrated management and can adjust programs accordingly. It could also show how the various programs contribute to Canada's national acts and international commitments.

4. Case Studies

4.1 Selection of Case Studies

There were three components that were used to choose two case studies. This included crucial requirements, special considerations and positive factors. There were four case studies that were considered, but due to the scope of the project, ultimately two were chosen:

1. The Gulf of Maine region within the United States
2. The Barents Sea within Norway

The crucial requirements for the case studies included being in the North Atlantic Ocean, possessing an integrated management plan and outlined ecological objectives. Since both the case studies are being analyzed for the Canadian context, it was decided that both should be within the North Atlantic Ocean for relatively consistent ecosystems. Since the

original management plan for the ESSIM was considered by Canada's definition of an integrated ocean management plan, the other areas must also have an integrated ocean plan. This will allow for a more appropriate comparison as the same methodology and practices are being applied to manage the natural resources. Finally, as this project is focusing on ecological objectives and goals, the integrated management plan needs to have a section that outlines their ecological objectives for the given area. The Gulf of Maine, the Barents Sea – Lofoten Area and the Scotian Shelf have similar ecological objectives, and thus the approach to monitoring these objectives can be compared.

There were three factors that were thought as special considerations: geographical diversity, scale diversity, and national and/or international commitments. Due to only having two case studies, geographical diversity and scale diversity representation is considered poor. Therefore, USA's Gulf of Maine region was chosen as it is in on the same shelf system as the eastern Scotian Shelf. Norway was chosen based on its readily available integrated management and providing a more arctic example still within the North Atlantic Ocean. The Eastern Scotian Shelf is geographically the smallest area at 120, 000 km², followed by the Gulf of Maine at 179, 008km² and the Barents Sea – Lofoten Area at 1, 405, 000 km². This difference in size can provide a better understanding how integrated management might change in terms of the size of the area being managed.

Finally, there were two features that were considered a positive attribute for both the USA and Norway's integrated management plans. Both the Gulf of Maine Region and the Barents Sea – Lofoten area management plans have undergone internal evaluation and have been updated. This allows for understanding of the various elements that are considered to be working and successful and those that are failing or not improving. The second positive feature is the monitoring strategies and indicators that are present for both the areas. This, along with the evaluation and assessments of the plans, provide insight to the components that allow for successful implementation.

Table 2: Summary of the crucial factors, special considerations and positive features that were used to ensure that the Gulf of Maine Area and the Barents Sea – Lofoten Area were appropriate case studies for this project.

Case Study	<u>Crucial Factors</u>			<u>Special Considerations</u>			<u>Positive Features</u>	
	Must be in the North Atlantic Ocean	Integrated management plan publicly available	Chosen plans must have outlined ecological objectives	Geographical diversity	Scale diversity	National and/or international commitments	Evaluation/assessments of current plan	Accompanied monitoring plans
USA	Along the same shelf system as the Eastern Scotian shelf	The Gulf of Maine has both management polices and action plans	There are ecological goals and objectives outlined	Although along the same shelf system, can provide relevant context	179,008 km ² – aprox. 50 thousand km larger	Although USA is not signatory to either UNLOS or CBD, has equivalent national programs	The Gulf of Main ocean management strategies, policies and action plans have been updated with published evaluations	There are outlined monitoring strategies and indicators that are suggested
Norway	In the North Atlantic Ocean	There management plan is considered an integrated approach by definition	There are ecological goals and objectives outlined	Provides an example in the more arctic region of the North Atlantic Region	1,405,000 km ²	Yes, signatory to both conventions	one assessment has been completed – with a revised and updated version of the ocean management policy published and publicly available	Yes, within the ocean management strategy, monitoring is discussed.

4.3 Presentation of Case Studies

The presentation of the case studies will be presented with four key headings:

1. Introduction
2. Ecological Objectives
3. National/international commitments
4. Monitoring strategies and frameworks

4.4 United States of America: The Gulf of Maine

4.4.1. Introduction

In USA, the ocean related economy provides more jobs and more economic output than the farming sector (Marine Policy, 2012). Currently there are 23 different federal agencies that oversee and manage over 140 different and sometimes conflicting national laws regarding marine resources. These numbers do not include the state or local laws (Marine Policy, 2012). Thus, before the implementation of new ocean policies within the USA, ocean related activities tended to be managed and regulated on a sector-by-sector, case-by-case basis without much regard for trade-offs, interactions and/or cumulative impacts on other sectors or the environment. In 2010 however, USA realized the real need for a more integrated and collaborative approach, and for the first-time, created a national ocean policy. This was a result of an executive order issued by President Barack Obama in which decreed federal agencies to implement coastal and marine special planning (CMSP) to the nation over the next five years (Marine Policy, 2012). The CMSP is considered a proactive integrates systems approach for the current and future uses of the ocean. With this program (CMSP), it recognizes that the integration of science, ecosystem-based adaptive management and transparent planning involving stakeholders, regional ocean partners and indigenous groups all need to be included (Whitehouse, 2011).

USA has also implemented a national coastal zone plan which also uses an integrated approach. This is a voluntary federal-state partnership that was created through the Coastal Zone Management Act to protect, restore and responsibly develop USA's national coastal communities and resources (NOAA, 2011). Of the 35 eligible states, 33 are currently a participant in this program. This program aims to integrate and address issues such as climate change, oil and gas, public access to the ocean, habitat protection and water quality. Although this program is technically for the coastal area, there is understanding that due to the dynamic nature of the ocean, ultimately all of USA waters within the EEZ can be affected and thus need to be addressed when managing the various activities.

The National Oceanic and Atmospheric Administration (NOAA) is the main governing body for the waters surrounding USA. This organization works at a national level with national programs. NOAA has divided the USA waters into different regions, including the Northeast Shelf System. This shelf system is then sub-divided into 5 other areas, including the Gulf of Maine, Georges Bank, Southern New England, Mid-Atlantic Bight and the South Atlantic Bight.

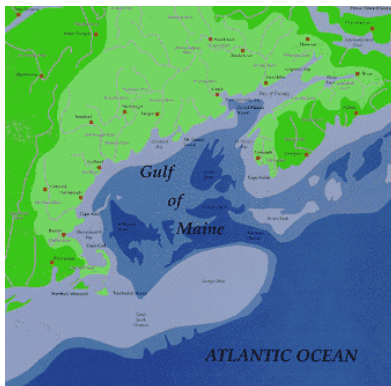


Figure 2: The Gulf of Maine.
Image from
<http://www.gulfofmaine.org/knowledgebase/aboutthegulf/asebesidethesea.php>

The Gulf of Maine is an important ecosystem and with its extremely nutrient rich water, it is considered to be one of the most productive marine mammal waters in North America (Gulf of Maine Council, 2012). The Gulf of Maine is bordered by the states of Maine, New Hampshire and Massachusetts and the provinces of New Brunswick and Nova Scotia. The Gulf of Maine Council, which includes members from the three states and the two provinces was created in 1989 to oversee collaborative integrated management. Despite the obvious ecological connections that the animals have within the bay, management has been historically single species. Thus the Gulf of Maine Council has been working for over 20 years creating action plans to address the most

current and pressing issues. The committees that are associated with the Gulf of Maine council are responsible for implementing the plans and strategies that help reach the outlined goals and objectives within the most recent action plan.

4.4.2. Ecological Objectives

Of the three goals, the first two are ecologically relevant. Within this action plan, the goals are considered to be long-term goals which contribute to the overall vision for the Gulf of Maine. The following ecological goals are sourced from the Action Plan 2012-2017 distributed by the Gulf of Maine Council on the Marine Environment (Gulf of Main Council, 2012: p. 2).

Goal 1: Restored and Conserved Habitats: habitats in the ocean and along the coast, including the rivers that flow to the Gulf, are healthy, productive and resilient, they support rich aquatic life and vibrant sustainable ocean economy.

Goal 2: Environmental and Human Health: Environmental conditions support the health of people and the ecosystem.

Within the Gulf of Maine Action Plan, outcomes are considered to be measureable changes which will overall, contribute to reaching the long term goals. Where the long-term goals can take up to decades to achieve, these outcomes are meant to be met at the end of the action plan in 2017. The following six outcomes are selected based on the ecological relevancy and can be found in the Gulf of Maine Action Plan 2012-2017 (Gulf of Main Council, 2012). Page numbers are indicated after each outcome.

1. “Water quality protection: Coastal decision-makers receive up-to-date, accurate, relevant information needed to improve and protect marine water quality for current and future generations” (p. 4).

2. “Habitat restoration: habitat restoration practitioners and community based organizations receive information, funding, and technical assistance for restoring degraded coastal ecosystems and habitats” (p. 4).
3. Habitat Conservation: Coastal decision-makers have the data and information required to conserve coastal and marine habitats in a time of intensifying human uses and changing climate (p. 4).
4. “Environmental Monitoring: Scientists and coastal decision-makers have access to data for assessing environmental conditions in the ocean and along the coast” (p 5).
5. “Environmental indicators and Reporting: Managers receive understandable, useful, reliable information about environmental conditions and trends in the region” (p. 5)
6. “Climate adaptation; decision-makers receive up-to-date information about the impacts of a changing climate on coastal and ocean areas and approaches for adapting these impacts” (p. 6).

4.4.3 National/International Commitments

USA is not currently signatory to either the CBD or the UNCLOS treaties. Although the states were in support of the first Convention of the Law of the Sea in 1956, the changes made in the third convention were not aligned with USA goals or objectives (Burke, 1982). USA felt in particular, that the changes made to the guidelines for deep-sea mining and ocean exploration would restrict USA’s navy, as well as possible restrictions if water was ever to be found in outer space (Borgerson, 2009). In regards to the convention on biological diversity, USA has instead come up with their own national programs and its own equivalent acts regarding ocean use, environmental practices, biodiversity, habitat protection and conservation.

In 1972, the Coastal Zone Management Act was introduced in USA. This program is at a national level, in which states can choose to participate. The federal government provides

funding to the participating states and works with them to ensure protection of the coastal zone through different implemented measures (NOAA, 2012).

Endangered Species Act created in 1972 aims to protect and conserve endangered and threatened species of fish, wildlife and plants in the United States. With this act, is also the protection of the endangered or threatened species habitat (ESA, 2013).

Marine Mammal Protection Act: This act seeks particular protection for all marine mammals within the marine environment. This protection includes protection from sonar activities and underwater explosives. This act is the main instrument for the conservation of the mammals (NOAA Fisheries, 2013) .

4.4.4. Monitoring

The Gulf of Maine Council has implemented extensive ecological monitoring programs that they recognize are mandatory for habitat restoration and conservation to ensure and measure success. They understand that pre-restoration monitoring is necessary to establish a baseline of the site's conditions that can be used in the planning project goals, objectives and performance indicators. The post-monitoring allows for accurate assessments of change from the baseline data and documents any subsequent ecological changes at the various sites. The project and strategic actions can be reduced or increased depending if performance targets are met. Ideally if the targets are met, then the project has been a success. A key point that the Gulf of Maine council indicates is that monitoring of similar non-impacted sites should be monitored over the same time frame to be able to distinguish if the success is related to the project or due to other causes. Thus, the monitoring from different projects in the same habitat can be analyzed together to evaluate the effectiveness of specific restoration techniques and strategies (Gulf of Maine Council, 2012b).

There are over 50 different national, regional and national monitoring programs within the Gulf of Maine that monitor features from water quality, to biodiversity, to specific

target fisheries to contaminants. The entire list of these programs are summarized within the Marine Monitoring Programs in the Gulf: an Inventory, prepared by Heather Chandler of the Marine State Planning Office and the Gulf of Maine Council.

Two very important monitoring programs are the Gulfwatch program and the Gulf of Maine Ocean Observing System. The Gulfwatch is a contaminant monitoring program that was first established in 1991. This chemical-contaminants monitoring program is organized and operated by the Gulf of Maine Council. In particular, the Gulfwatch program measures contaminants in blue mussels to assess they types of contaminates within the Gulf of Maine waters. Samples of the waters happen every one to three years (Gulf of Maine, 2013). This program also aimed to establish a baseline reference for future monitoring efforts on trace chemicals. To help facilitate this baseline knowledge, there is a total of 71 sites, with sampling sites in all five of the jurisdictions around the Gulf of Maine. The Gulf of Maine council has a unique challenge in managing this shared resources and recognizes the problems arising from collaboration and communication between USA and Canada.

The Gulf of Maine Ocean Observing System (GoMOOS) program was established in 2001. This program aims to provide real time information on currents, temperature and other oceanographic parameters for the waters with in the Gulf of Maine. Since its employment in May 2001, observations of the different parameters are posted on an hourly basis. The information collected is posted to the internet and is made free available to any interested individual or party.

4.5. Norway: The Barents Sea –Lofoten Area

4.5.1. Introduction

Norway has three seas that border its coastline, the Norwegian Sea, the Barents Sea and the North Sea. In 2002, the Norwegian parliament developed a framework that all future oceans policy of the country would follow. It was in this layout that integrated ocean

management was introduced (Hoel & Olsen, 2012). The first policy to be operational was the Integrated Management of the Barents Sea that was adopted in 2006, and went under review 6 years later in 2012. It is the goal of the Norwegian government to eventually have all of its water being managed under an integrated management approach (Cochrane, 2007). Thus, the Norwegian Sea Integrated Management Plan was implemented in 2009, and currently, the integrated management plan for the North Sea is still in the works. Norway has invested interest in integrated management as a means to successfully manage their world-class fisheries. As one of the world's most important fishing areas, the Barents Sea offers North-east Arctic Cod and haddock, capelin, and herring and others. Due to the economical significance for Norway, the marine issues are at the forefront the Norwegian government (Norwegian Ministry of the Environment, 2012).

The Norwegian approach to integrated management may be considered more technical than that of USA or Canada. Although Norway understands that the integrated approach implies that different types of uses of the ocean environment have to be reconciled in order to achieve sustainable use of the oceans, the decisions made for the waters in Norway will have to be made that favour certain interests at the expense of others (Norwegian Ministry of the Environment, 2012). Thus the methodology for this is the ordering of priorities, selection of criteria and collection of data to asses against them so the optimal choice can be derived (BEPOMAR, 2009). This method has given Norway the push to increase the knowledge base of the oceans ecosystems and has allowed Norway to be more adaptive in the face of climate change and address cumulative effects more carefully.



Figure 2: The Barents Sea. Image from http://www.timeslive.co.za/incoming/2012/01/09/barents_sea_map.png/ALTERNATE S/crop_630x400/Barents_Sea_map.png

The Barents Sea Integrated Management Plan was updated in 2012 due to the expansion of knowledge about the ecosystem, ecological goods and services and other resources that provide economic value. The most important changes that were identified included affects of the environment with climate change, benthic communities, Sea birds, effects of seismic activities and mapping of petroleum resources. The updated goals and objectives within the new plan aim to address these issues.

4.5.2 Ecological Goals and Objectives

The Norwegian Government states a variety of different national goals that pertain to Barents Sea – Lofoten area. Below are the selected three that have an ecological context. These goals apply within the management of this area and therefore, also have related monitoring programs. The following three goals can be found in the Update of Integrated Management Plan for the marine Environment of the Barents Sea – Lofoten Area. (Norwegian Ministry of the Environment, 2011). Page numbers are indicated after each outcome.

1. “Management of the Barents Sea – Lofoten area will promote sustainable use of the area and its resources to the benefit of the region and the country in general” (p. 130).
2. “The management regime will ensure that activities in the are do not threaten the natural resource base and thus jeopardise opportunities for future value creation” (p. 130).
3. “Living marine resources will be managed sustainably through the ecosystem approach” (p. 131).

Norway divides their objectives into three overarching headings: biodiversity, pollution and safe seafood. Within these three headings are targets for specific area that would all contribute to the larger objectives. The following objectives and targets can be found in

the Update of Integrated Management Plan for the marine Environment of the Barents Sea – Lofoten Area. (Norwegian Ministry of the Environment, 2011). Page numbers are indicated after each outcome.

1. “Biodiversity: Management of the Barents Sea – Lofoten area will ensure that diversity at ecosystem, habitat, species and genetic levels, and the productivity of ecosystems are maintained. Human activity in the area will not damage the structure, functioning, productivity or dynamics of ecosystems” (p. 130).
 - a. “Valuable and vulnerable areas and habitats: Activities in particularly valuable and vulnerable areas will be conducted in such a way that the ecological functioning and biodiversity of such areas are not threatened. Damage to marine habitats that are considered to be threatened or vulnerable will be avoided. In marine habitats that are particularly important for the structure, functioning, productivity and dynamics of ecosystems, activities will be conducted in such a way that all ecological functions are maintained” (p 130).
 - b. “Species management: Species management: Naturally occurring species will exist in viable populations and genetic diversity will be maintained. Harvested species will be managed within safe biological limits so that their spawning stocks have good reproductive capacity. Species that are essential to the structure, functioning, productivity and dynamics of ecosystems will be managed in such a way that they are able to maintain their role as key species in the ecosystem concerned. Populations of endangered and vulnerable species and species for which Norway has a special responsibility will be maintained or restored to viable levels as soon as possible. Unintentional negative pressures on such species as a result of activity in the Barents Sea–Lofoten area will be reduced as much as possible by 2010. The introduction of alien organisms through human activity will be avoided” (p. 130).
2. “Prevent or limit pollution: Releases and inputs of pollutants to the Barents Sea–Lofoten area will not result in injury to health or damage the productivity of the

natural environment and its capacity for self-renewal. Activities in the area will not result in height levels of pollutants” (p. 131)

- a. “Hazardous substances and radioactive substances: environmental concentrations of hazardous and radioactive substances will not exceed the background levels for naturally occurring substances and will be close to zero for man-made synthetic substances. Releases and inputs of hazardous or radioactive substances from activity in the area will not cause these levels to be exceeded” (p. 131).
 - b. “Litter: Litter and other environmental damage caused by waste from activities in the Barents Sea-Lofoten area will be avoided” (p 131).
3. “Ensure that seafood is safe: Fish and other seafood will be safe and will be perceived as safe by consumers in the various markets” (p 132).

4.5.3. National/International Commitments

Within the updated integrated management plan, it outlines Norway’s *national* goals and targets for all its waters, including the Barents Sea – Lofoten Area. The following national commitments can be found in the Update of Integrated Management Plan for the marine Environment of the Barents Sea – Lofoten Area, page 29. (Norwegian Ministry of the Environment, 2011)

Norway’s national targets for living seas and coastal environments:

1. The structure, functioning, productivity and diversity of marine ecosystems will be maintained or restored and they will provide a basis for value creation through sustainable use of natural resources and ecosystem services
2. All coastal waters will have at least good ecological and chemical status or, if appropriate, good ecological potential, by 2021.
3. Management of all harvested stocks of fish, invertebrates and seaweeds will be ecosystem-based, and they will be harvested sustainably.

4. The extinction of threatened marine species will be halted and the status of declining species will be improved by 2020
5. The most seriously threatened habitat types will be classified as selected habitat types.
6. A representative selection of Norwegian nature in areas covered by the geographical scope of the Nature Diversity Act will be protected for future generations
7. The conservation value of marine protected areas will be maintained or restored.
8. By 2015, the cumulative effects of human activities on coral reefs and other vulnerable ecosystems that are affected by climate change or ocean acidification will be minimized, in order to maintain ecosystem functioning as fully as possible.
9. The most seriously threatened species will be classified as priority species
Substantial adverse impacts on biological or landscape diversity in connection with the import and release of alien organisms will be avoided. Eradication, containments or control measures will be initiated or implemented for particularly invasive alien organisms that are already established in the Norwegian environment.
10. Genetically modified organisms that are deliberately released, of the Gene Technology Act, will not have adverse impacts on biodiversity.
11. Norwegian inputs of nutrients and particulate matter to coastal waters that are affected by eutrophication or sediment deposition will be reduced to a level that ensures good chemical and ecological status by 2021.
12. Operational discharges will not result in damage to health or the environment, or result in a rise in background levels of oil or other environmentally hazardous substances in the long term.
13. A low level of risk of damage to health or the environment as a result of acute pollution will be maintained, and continuous efforts will be made to reduce the level of risk.
14. Municipal, county and regional planning will help to prevent undesirable building on the shoreline and ensure sustainable use of resources along the coast.

15. Transport and travel in Svalbard will not cause serious or permanent damage to the vegetation or disturb animal life. It will be possible to enjoy the natural environment undisturbed by motor traffic and noise even in areas that are easily accessible from the settlements.
16. The current extent of wilderness-like areas in Svalbard will be retained, biological and landscape diversity will be maintained virtually untouched by local human activity, and the value of protected areas as reference areas for research will be safeguarded.

One of Norway’s largest concerns for their country and the Barents Sea – Lofoten area is biological diversity. The set of objectives outlined for species management is a binding agreement that Norway has made a commitment to achieve. Norway has also signed a number of international agreements and conventions on species Management. Examples of the national and international agreements are outlined below.

Table 3: Norway’s National Goals as related to International Commitments. The 5 major national goals from Norway’s integrated management plan are linked to the international commitments and treaties that Norway have agreed to. The select national goals can be found in the Update of Integrated Management Plan for the marine Environment of the Barents Sea – Lofoten Area. (Norwegian Ministry of the Environment, 2011).

National	International
1. “Naturally occurring species will exist in viable populations and genetic diversity will be maintained’	Convention on Biological Diversity (CBD)
2. “Harvested species will be managed within safe biological limits so that their spawning stocks have good reproductive capacity.”	Convention on Trade in Endangered Species of Wild Animals (CITES)
3. “Species that are essential to the structure, functioning, productivity and dynamics of ecosystems will be managed in such a way that they are able to maintain their role as key species in the ecosystem concerned.”	Convention on the Conservation of Migratory Species of Wild Animals (CMS)
4. “Populations of endangered and	Agreement on North Atlantic Marine

vulnerable species and species for which Norway has a special responsibility will be maintained or restored to viable levels as soon as possible.”	Mammal Commission (NAMMCO)
5. “Unintentional negative pressures on such species as a result of activity in the Barents Sea–Lofoten area will be reduced as much as possible by 2010. The introduction of alien organisms through human activity will be avoided.”	United Nations Convention of the Law of the Sea (UNCLOS)

The objectives that are outlined above were the same for the first Integrated Management Plan, and an evaluation has been completed for reaching those targets. The updated management plan provides a detailed account of the targets that have been reached, and those that have been missed. For those that have been missed, there are actions and strategies that the government will take in order to try to reach these targets. Monitoring for the Barents Sea is extensive. The wealth of information that is being collected for the Barents Sea continues to grow as the knowledge gaps start to decrease. There are particular areas that need more research such as the affects of climate change, the level of resilience within the Barents Sea and the effect of cumulative impacts and domino effects. There is particular concern as the domino effect may increase the vulnerability of species and habitats. The Norwegian government understands the complex system with in the Barents Sea, and aims to understand where the most intense cumulative effects are taking place. This is done through research and monitoring.

4.5.4. Monitoring

The monitoring program within Barents Sea is a systematic program, and with the new updated management plan, the monitoring has expanded even more to ensure that targets that have not been met can be reached. The monitoring system is based on a set of indicators and reference values that have been created for each objective. There is a set threshold that have been created for action if needed. There are programs and initiatives set in place for continuous updating of knowledge and changes in the state of the environments. This allows researchers and authorities to make cross-sectoral assessments and implement necessary measures to improve the environment.

As indicated by the updated versions of the integrated management plan, the Barents Sea – Lofoten area has multiple monitoring programs for all the various activities identified within the plan. For example, activities related to fisheries and aquaculture are explained within the plan. Following the explanation are the corresponding monitoring programs and the current success that they are having in reaching the relevant objective or target. One of Norway's objectives was to reduce illegal fishing, and with an extensive satellite tracking system that was put in place in 2006, Norway has significantly decreased illegal fishing. This has allowed Norway to have a better control of their resources and keep the harvesting quota at a sustainable level.

With the updated version, new measures for the conservation and sustainable use of ecosystems were developed. Although the government in 2006, considered the state of the environment in the Barents Sea – Lofoten area to be generally good, increasing issues surrounding long term pollution, climate change and ocean acidification need to be carefully monitored. Thus the government has given priorities to ensure that the management measures will increase the resilience of the ecosystems and will be evaluated in the next revision of the plan set for 2020. Actual elements of the different monitoring programs will be further elaborated within the discussion section of this paper.

5. Results/Analysis

5.1 Framework Analysis

All the objectives from the three countries were placed into an excel sheet, and were categorized based on what the objective was trying to achieve. Based on the categorization, four sections were created that encompassed all the objectives. From these four sections, the objectives were further summarized into short broader themes. For example, many objectives surrounding reducing pollution, and were specific to which

types of pollution were to be reduced. All of those were grouped together, and under habitat, was labelled “pollution reduction.” This was done until all the objectives were included under the broader themes within the four major sections:

1. Habitat
2. Conservation and Biodiversity
3. Water Quality
4. Climate Change

All three countries have objectives that related to the conservation of the marine habitat. Coupled with mapping technology, identifying key habitats is important. These habitats can act as nurseries for important species and maintain biodiversity in the area. It is estimated that over the past 50 years, humans have changed marine and terrestrial ecosystems, more rapidly and extensively than in any other comparable period in human history (Douvere, 2008). With these rapid changes to the marine environment and the increasing demands of ocean use, sustaining the original integrity of the ecosystem is being lost. Many of these objectives aim to restore or maintain the productivity and physical features of the marine habitats in various ways. This includes pollution reduction, habitat conservation and habitat conservation.

Conservation and biodiversity are key goals for many countries including Canada, USA and Norway. When Worm et al., (2006) stated that the “loss of marine biodiversity is increasingly impairing the ocean’s ability to produce seafood, resist disease, filter pollutants, maintain water quality and recover from perturbances such as over fishing and climate change,” it spurred international collective action to understand how to reverse this disturbing trend. The rate of extinction on earth has also increased 1,000 to 10,000 times the background rate, and has been caused almost entirely by humans and their activities. With the CBD, the conservation of species became a prominent goal in hopes to slow the extinctions and conserve biodiversity. Within this major heading, the broader themes were incidental mortality reduced, genetic integrity, invasive species, and at risk species protected and/or recovered.

Water quality in this case refers to the physical attributes of water, such as the turbidity, pH, temperature, and the amount of dissolved oxygen. Water quality is being monitored in the waters for all three countries. Water quality is monitored as changes can have adverse affects on different fish species or marine habitats. Contaminants are monitored for various reasons such as to ensure the seafood being extracted is safe for human consumption, that the levels are safe for sustaining fish stocks, or can be alerts for eutrophication which can have serious negative impacts. Water quality is carefully being monitored with in the Gulf of Maine, Scotian Shelf and the Barents Sea – Lofoten area and data is continuously being collected. Safe seafood and environmental monitoring were the two broader themes within this section.

Climate change has recently become an important topic within marine conservation. Where climate change had historically been driven by natural causes, today it is largely driven by human activities (Root & Schneider, 2006). The exact affects of climate change are unknown, but the need for countries to be well prepared is understood. There are many challenges with attempting to mangle for the climate change largely due to the uncertainty. This includes predicting patterns and its effects, conserving species and the severity of cumulative affects. Many of the objectives focus on increasing the decreasing the knowledge gaps surrounding climate change.

These four sections will have all the ecological objectives from Canada and the two case studies to be able to compare and contrast. The top row of the table includes the three countries. Within each cell, there will be a comment on how the monitoring of these objectives can contribute and link to the national/international commitments.

Table 4: Example of the Analysis Table. This table demonstrates the presentation of the analysis table for the three different countries and corresponding objectives.

Objectives		Countries					
		USA		Norway		Canada	
		Strategy/ Action	Monitoring	Strategy/ Action	Monitoring	Strategy/ Action	Monitoring
Habitat	Habitat Restoration						
	Habitat Conservation						
	Pollution reduction						
Biodiversity	At risk species protected						
	Invasive species						
	Genetic Integrity						
	Incidental mortality reduced						
Environmental Quality	Water Quality						
	Environmental Monitoring						
	Safe Seafood						

5.2 Results

USA's action plan is the shortest of the three integrated management plans analyzed. At 16 pages, it is brief and to the point. USA structures its plan with three goals, outcomes to reach that goal and the activities outlined by the Gulf of Maine council to be able to reach said objective. The Gulf of Maine Action Plan's goals do not include material explicitly surrounding biodiversity or invasive species and instead focuses more with environmental monitoring. The Gulf of Maine Strategic Regional Ocean Science Plan in 2009 does address the issue of biodiversity briefly, however action plans were not outlined. Unlike in the ESSIM Initiative or Norway's integrated Management Plan for the Barents Sea, biodiversity or invasive species does not seem to be a major concern. USA's action plan also differs from both its counterparts as it does not include a large background of the state of the ecosystem within the Gulf of Maine. This information can be found in other documents, thus keeping the actual action plan very easy to read and to understand. The flow of the USA's action plan is the most intuitive, with all the necessary information being presented right after each other. Instead of presenting a background and context first for the objective, the objective and goals and activities are outlined, with a small paragraph underneath explaining why this it is important. However, this action plan does not include any references to national or international commitments, and thus information regarding linking the regional or the national goals together needs to be conducted as external research.

Norway's integrated management plan is much more extensive with 151 pages. This document is essentially an all-inclusive document that provides information on the state of the ecosystem, the various activities within the Barents Sea and the current knowledge gaps that exist within the science. The document begins with an overview of the different organizations involved, the key acts that allow for implementation and the organization of all the various committees and their roles. The state of the ecosystem includes the most updated information available for the Barents Sea-Lofoten area and the different activities and their impacts within the region. The chapter outlining the various goals and objectives begins with the national commitments as concluded by the government for

both the Norwegian waters and those specific to the Barents Sea – Lofoten area. As this integrated management plan was an updated version of the 2006 plan, following the national objectives, the regional objectives are described and provide a brief account of progress towards them. Where applicable, the government outlines future programs to help achieve these objectives.

The Norwegian management plan is long, and finding information quickly on specific objectives is hard to find. Although there is clear linking between the regional and national goals and commitments, it is not as easy to understand. Where as the Gulf of Maine action plan 2012-2017 was not created at the national level, but by the regional Gulf of Maine council, the Norwegian Integrated Management Plan was conducted at the national level. This could explain why the national goals in the Norwegian plan are listed. The national government has control over the Barents Sea and does not have an equivalent council like the Gulf of Maine. As this Norwegian plan was an update of its precursor, some of the length of the document can be contributed to the fact that there is a chapter dedicated to the new programs and actions that the government will take to reach the uncompleted objectives. Although this documents provides an excellent summary for all the information regarding the Barents Sea, it is not as accessible for finding the objectives quickly. Unlike USA's plan for the Gulf of Maine, where any stakeholder or industry who reads it will understand what the objectives are and how it intended to reach them within the first few pages, Norwegian's plan calls for a much larger time commitment. For those who do not need a large background on the state of the ecosystem, USA's plan with its much simpler wording and content is accessible for all stakeholders such as scientists, decision makers and the general public. The Norwegian Integrated Management Plan although made available to the public lacks simplicity.

For Canada, when the ESSIM Initiative was still a pilot project, the document that outlined the plan (released to the public) was structured more like that of Norway. It provided a shorter background on the ecological state of the Eastern Scotian Shelf. A more detailed document on the ecological state of the Scotian shelf was released separately. This integrated management plan includes overall vision, goals and

objectives, and corresponding strategies to reach those objectives. The strategies are then furthered examined and possible issues that could arise are stated. This section of the integrated management plan demonstrates the possible challenges that there may be in reaching these various objectives and thus provides suggestions on how to overcome these obstacles.

Monitoring strategies for all three of the integrated management plans are harder to find. USA and Canada are very largely program driven. That is, that both aim to implement different programs that aim to reach the goals and objectives. For example, the Gulf of Maine council stated that between the period of 2007-2012. In total, 49 habitat restoration programs were established. Together, the project restored 335 salt marsh acres. However, the issue is that the overall habitat restoration objective did not have a numerical target, and thus although this is a tremendous effort, it is hard to say if the objective was reached. Unlike Norway, many of the objectives are coupled with threshold targets or numerical values. That is, objectives such as reducing invasive species to zero, or completing the mapping of the sea bed in the Barents Sea – Lofoten area by 2020 gives a measurable success. Therefore, even if the government says that they have mapped 80% of the sea bed, it is still clear that the objective has not been reached. If it was worded like that of USA, (mapping of the sea bed will continue), then it is unclear when the objective is reached.

Both the Gulf of Maine and the Eastern Scotian Shelf have many different monitoring programs, however, many of these were in place before the establishment of the integrated management plan. Therefore, some of the monitoring programs are not targeted for reaching overall objectives within the plan, but instead some of the information that is already being gathered for other purposes can be used. However, it appears that Norway has established many of their monitoring programs in connection with the establishment of their integrated management plan. Therefore, their monitoring programs seem to be directly linked to their objectives, and allows Norway to better observe their success in a more efficient approach. Norway also clearly states their

national commitments, which gives context for the regional ones. In this way, the monitoring is also being used to measure success of the regional and national objectives.

Table 5 (below) summarizes all the objectives and the different strategies and related monitoring programs if applicable. All three countries have objectives that relate to habitat with some sort of monitoring plan. USA developed a regional framework while Norway has a national monitoring program. Both however, are monitoring the same sort of indicators and both identify the need for increase mapping of the sea bed. Canada also has a habitat and predictive monitoring system that is used for habitat restoration. In terms of habitat conservation, Norway and Canada are similar, and MPAs are the main programs. Where the Gulf of Maine is a smaller body, the use of MPA is not the main method, but instead they use the same regional base framework to continue to monitor. Table 5 demonstrates that all three plans have objectives surrounding pollution reduction. Like their habitat monitoring program, Norway is linked into their national monitoring program, where USA's Gulfwatch is just for the Gulf of Maine. However, from the 2013 evaluation of the ESSIM, no reports of assessing sources and/or impacts of waste and debris specific to the Scotian shelf was completed. There is however, the Atlantic Zone Monitoring Program that does detect different chemical properties of the water, but it is not specific to pollution.

In terms of biodiversity, table 5 shows that Norway has had a successful monitoring plan in place that has demonstrated that sea birds have actually been declining since the implementation of their integrated plan. Current changes have now been made to help reverse this trend. USA's management plan for the Gulf of Maine does not directly address biodiversity within the objectives. However, within the body of the text of the action plan, biodiversity is addressed, and other monitoring plans around the Gulf of Maine are there for that reason. This could be attributed to the fact that there is one overarching plan for the Barents Sea, where as the management of Gulf of Maine is through multiple jurisdictions and conducted through local and regional bodies. Other programs therefore, can address biodiversity. Canada does have many objectives regarding

biodiversity, and monitoring programs are linked to other departments within Canada such as Environment Canada. Where Norway has mentioned the risk of alien species, no monitoring plan was actually mentioned that would track new species, where as DFO and environment Canada have developed invasive species programs.

Water quality seems to be the largest concern for the Gulf of Maine, in which the Gulf watch program was created for the purpose. Norway's objectives regarding water quality are present; their national monitoring program has developed threshold values for immediate action. In the case of Canada, monitoring is dependent on the Atlantic Zone Monitoring Program. Climate change interestingly is not actually alluded to in any the healthy ecosystem objectives for the Eastern Scotian Shelf. USA and Norway both acknowledge the need for more information and both have different programs to help facilitate the gathering and sharing of information.

Table 5: Summary table of the Analysis. This table provides a summary of the strategies and corresponding monitoring programs for all three of the countries, USA, Norway and Canada. Blank cells indicate that there was no corresponding strategy or monitoring program for the particular objective.

Objectives		Countries					
		USA		Norway		Canada	
		Strategy/Action	Monitoring	Strategy/Action	Monitoring	Strategy/Action	Monitoring
Habitat	Habitat Restoration	<ul style="list-style-type: none"> - provide Gulf of Maine habitat restoration grants and technical assistance - facilitate the exchange of information - promote greater understanding 	<ul style="list-style-type: none"> - developed a regional base framework for science-based monitoring 	<ul style="list-style-type: none"> - since 2006, some of the targets have been reached for outlined objectives. For those that have not been reached, increased mapping of the seabed with a target of completing by 202 	<ul style="list-style-type: none"> National monitoring program 	<ul style="list-style-type: none"> - identify and quantify the impacts of physical factors on biota - manage human influences to address negative impacts on physical properties 	<ul style="list-style-type: none"> - habitat monitoring - predictive modelling
	Habitat Conservation	<ul style="list-style-type: none"> - region-wide exchange of information - increase seafloor mapping - use of ecosystem-based approaches for decision making - strengthen the links between US and Canada marine spatial planning efforts 	<ul style="list-style-type: none"> - developed a regional base framework for science-based monitoring 	<ul style="list-style-type: none"> - habitat conservation is conducted through Norway's marine protected areas and related programs. 	<ul style="list-style-type: none"> - related monitoring programs with the marine protected area programs 	<ul style="list-style-type: none"> - incorporate habitat consideration in the integrated conservation framework Identify and conserve rare, important and representative habitats -manage human influences to address negative impacts on habitats 	<ul style="list-style-type: none"> - bio-regional network of MPAs and related monitoring programs
	Pollution reduction	<ul style="list-style-type: none"> -facilitate the compilation, sharing, and management applications of data from aquatic monitoring programs in the region 	<ul style="list-style-type: none"> - Gulfwatch contaminants monitoring program 	<ul style="list-style-type: none"> - increase legislation regarding oil spills - develop further technology for mapping acute pollution -establish a national preparedness and response system 	<ul style="list-style-type: none"> - National monitoring program 	<ul style="list-style-type: none"> -assess sources and impacts of waste and debris, current measures, capabilities and infrastructure - develop and implement measures to limit inputs - eliminate the intentional discarding of garbage at sea 	<ul style="list-style-type: none"> - no reports of assessing sources and impacts of wastes and debris

Biodiversity	At risk species protected and/or	-	-	- reduced fishing pressure - Increased enforcement - determining TAC for various fisheries	- Monitoring plan clear for fisheries, unclear for other endangered animals.	- Implement recovery strategies under the Species at Risk Act - coordinate multi-species recovery planning where appropriate.	- Monitoring conducted through SARA
	invasive species	-	-	- uncertainty regarding the nature and level of risk associated with alien species within the Barents Sea	n/a	- assess source, vectors, extent and risks of invasion -develop plans to prevent introductions - establish a surveillance and monitoring system	National and regional aquatic invasive species programs have been established by Environment Canada and DFO
	Genetic Integrity	-	-	- same as above (up to cells, change around)	n/a	-improve knowledge of genetic integrity and identify priority species -develop measurement factors to conserve genetic integrity where required	no reports of relevant action -Main area of effort through SARA through protection of priority/vulnerable species
Incidental mortality reduced	-	-	- not mentioned	n/a	- quantify and identify acceptable levels - monitor the catch of non-commercial species -identify management steps -manage human activities where applicable	Bycatch programs Observers and dock-side monitoring Monitoring catch of non-commercial species	
Water Quality	Water Quality	- spread information about ways to improve and protect the region's marine and estuarine water quality	Gulfwatch contaminants monitoring program	- increase observation - strict rules for operational discharge	Environmental monitoring through the national environment program	- identify and quantify chemical factors on biota - manage human activities where applicable	- review of contaminants in Scotian Shelf. - Monitoring select chemical parameters

	Environmental Monitoring	facilitate the compilation, sharing, and management applications of data from aquatic monitoring programs in the region	Gulfwatch contaminants monitoring program	- increased sampling	thresholds developed for action	-chemical characteristics of ocean bottom and water column -harmful noise levels are monitored and aimed to be reduced	- developing acceptable sound levels. - measures still need to be developed to meet the acceptable sound levels - educational programs, infrastructure development, increased enforcing
	Safe Seafood	-	-	- reliable documentation - increased sampling to create baseline studies	- need for monitoring	- assess and review factors that influence primary and secondary productivity - develop management measures to address negative factors - ensure trophic structure is healthy	Atlantic Zone Monitoring Program
Climate change		- support region-wide exchange on climate change, promote the exchange of information, - receive up to date information for managers	- ongoing, up to date monitoring on the physical and chemical characteristics of the water - continued assessment of biological diversity - climate change network program	- decrease the knowledge gaps of the affects of ocean acidification and climate change	- Continuous monitoring	-	-

6. Discussion

All three of the countries have national and international commitments, along with national programs and Acts to create a legally binding method to reach these commitments. The largest problem arising however is how the various regional programs/management plans fit into the larger picture. In areas in particular where regional councils are in charge of the monitoring and implementation, the regional vision may not always align with the national vision, or the links unclear. In the case of Canada, there are various national Acts that have components like the objectives outlines for the Eastern Scotian Shelf, however the process of linking them together seemed intuitively backwards.

In researching the different acts and commitments, instead of having a list of the National Acts first, and then creating objectives that fit into them, Acts were fit to the objectives. Although there may be some objectives that are specific to the region without corresponding national acts, it may make it harder for it to be legally binding.

Due to the complexity that the integrated management approach possess from attempting to manage all the different ocean activities and resources, establishing a measurement system is challenging. Usually, the process that takes place instead is to measure performance through outcome-based results. This could include the number of laws or regulations adopted or the number of programs put in place. However, decision makers and managers should be careful, as this may not always be indicative of success. Instead, it is suggested that outcomes should be measured as a matter of outcomes and impacts. For example, success could be defined as improved water quality, decreased habitat loss, increased fish stocks, etc (Cicin-Sain *et al.*, 1994). For example, ESSIM has an objective of reducing wastes and debris. Regulations of dumping of wastes and debris in Canada's fishing zones were assessed to ensure that it complied with International Convention for the Prevention of Pollution from Ships (MARPOL). However, it was not mentioned in the evaluation if there was a clear indicator that the level of debris and waste had increased,

stayed the same or decreased. Therefore, although the review of regulations, or new educational programs may have been set in place, it does not describe whether reaching this objective was truly successful.

Norway has a very explicit monitoring campaign for its various objectives and has set indicators and thresholds to be able to measure success. Therefore, in its updated version, when discussing its success to reaching various objectives, it has very clear statements of whether there has been improvement. For example, the objectives surrounding increasing various fish stocks has had a positive affect on fisheries such as cod and herring, however, the data from monitoring bird populations shows that Norwegian's bird populations are not improving despite various management measures in the past six years. Thus, the updated plan suggests other ways that Norway can help increase bird stocks, and suggest on going monitor should indicate whether the new activities will be successful.

USA also has quantifiable numbers through its various monitoring programs. The Council's well developed Gulfwatch Program, which was established in 1991, monitors contamination of coastal waters at sites around the Gulf of Maine, and provides that data and findings to resource managers to facilitate pollution control within a regional context. Like Canada and Norway, there are regional frameworks and other programs set in place, but coupled with monitoring, they have addressed the issues of increasing capacity for proactive and adaptive management depending on the results of various indicators.

Key to all three of the integrated management plans is the use of scientific knowledge. All sites underwent an ecosystem analysis where the "state of the ecosystem" was presented as either a separate document (USA and Canada) or imbedded within (Norway). However, in many cases, the objectives them selves do not state that it should be, or is, based on scientific knowledge. A review done by Akemia & et al. (2006) showed that often times, this is the case. Although the management plans emphasize the importance of science-based decision, many of the objectives that were analyzed lacked a scientific basis, especially for ecological objectives. The scientific gap regarding

ecosystem complexities and patterns of temporal variation is decreasing, but the greatest obstacle in predicting and communicating how natural systems respond to human intervention, especially in the face of climate change. USA and Norway all have objectives regarding climate change, however all three, especially Norway, discuss the research needs and knowledge gaps that still exist around how the environment will respond with increasing changes due to climate change. Although the ESSIM did address sustainability, specific issues pertaining to climate change was not present.

In 2007, DFO released a technical report on developing a national consistent approach to conservation objectives. This was directed for Canada's Large Ocean Management Areas (LOMAs). There were five areas that were identified, all of which integrated management plans were being developed for. For each area, ecological and conservation objectives were independently created (Charles, et al, 2007). At the national workshop for creating a consistent approach, it was discussed how to take the independent list and create a master set of conservation objectives. This type of discussion has many positive features such as the discussion of the type of language and wording that should be used when presenting the objectives. In the many different documents that DFO puts out, the use and definition of decision, goals, objectives, strategies and actions are sometime changed. This can make it hard for linking national objectives to regional ones, if the definition of "objective" differs. Although the ESSIM document clearly states how they define a vision, goal and or objective, it does differ from other documents that may not provide a clear definition. As a nation, for such plans and strategies, creating a common language for different sets of objectives, such as ecological or conservation, can allow for easier linking between documents.

Where Norway presents its national relevant national objectives within the Integrated Management Plan for the Barents Sea – Lofoten Area, the wording and use of goal, objective and strategies is consistent with all government issued documents. Thus, this allows for the reading of many different documents without having to check the definition of each time. USA's plan of action goes one step further then both Norway or Canada by providing a diagram that shows the relationship between all three. In this

context “goal” is the highest level, then outcome then the activities. This provides a visual ladder that helps in understanding the method of achieving the various outcomes, goals and overall vision.

Where the management for the Eastern Scotian shelf is broadening into a bioregional plan, in which most of the Scotian shelf, including the Bay of Fundy in being included, it is possible to continue to use many of the monitoring systems already in place for future references. For example, although an MPA, The Gully has its own monitoring plan, and monitors for different conservation objectives such as populations of various species, contaminants and genetic diversity (DFO, 2010). In many places, such as seabirds, they also monitor outside the Gully, and can be used as indicators for the states of these animals for the Scotian Shelf. If monitoring were to follow more of the same style as USA, then the advantages include sharing the responsibility between many different organizations for monitoring. However, the challenges that arise is ensuring that there are no gaps in the monitoring, and that the same areas are not being monitored unnecessarily, where the repeated effort could instead be put placed in another area. Alternatively, the monitoring style can be more like that of Norway, where one particular body (in the case of Norway it is conducted nationally) implement all of their own monitoring plans, and then delegates the roles to certain departments. In this case, the challenge can be ensuring that the government has the capacity to take this large responsibility. However, Norway does seem to be more advance with their monitoring plan, largely due to the fact that their monitoring plans are largely implemented to track changes and success with their objectives.

7. Summary, Recommendations and Conclusion

7.1 Summary

The Gulf of Maine Council oversees the Gulf of Maine management plan. The current action plan for 2012-2017 focuses on environmental/water quality and habitat restoration/conservation. Climate change is also addressed, but at a lesser extent. There

are numerous monitoring programs within the Gulf of Maine outside of the Gulf of Maine Council jurisdiction, which provides a wealth of information. The objectives that have been created for the Gulf of Maine are not directly linked to USA's national objectives, however, many are parallel in the terms of what they are trying to achieve.

Norway's integrated management plan for the Barents Sea is the most clear in terms of stating the national conservation objectives and how the Barents Sea objectives line up. With the national monitoring plan, where applicable, all the objectives have a related monitoring program with threshold values for management action. This plan therefore seems to be the most efficient with its monitoring programs as it is all directly related. The Barents Sea –Lofoten Area was the only management plan to address all four of the main subheadings (habitat, biodiversity, water quality and climate change).

The objectives and goals from the ESSIM initiative were mostly concerned with habitat restoration/conservation and biodiversity. The pilot project that was set in place seemed to be in the middle based on the monitoring approach. Although the ESSIM was considered to be an overarching plan for that area with ideally its own monitoring plan (like the Barents Sea – Lofoten Area) it is more like the Gulf of Maine with its many different programs by different departments and organizations. With the current plans underway for the bioregional area, DFO has the chance to ensure that they create monitoring programs that effectively reflect the level of success with reaching the various objectives.

The methodology of for this study presents some of its own limitations. As only two case studies were chosen, the comparative analysis was simpler than a larger study. Although this paper was able to consolidate the information, future research can use a more scientific approach with multi-criteria selection for the different case studies. When analyzing the case studies, a more hierarchical network and relation models can be created to show the level of success for each country, and their strengths and weaknesses.

7.2 Recommendations

Recommendations are provided below with an explanation for each. It is not in any particular order.

Include and be consistent with wording regarding goals and objectives, and clearly define the hierarchy and relationship between the terms

As there are many documents being released by many different departments within DFO as well as by different agencies, it would be beneficial to be consistent at least within the departments. That way, goals and objectives, visions and targets, can be compared between documents, as they are at the same hierarchical level.

Include within the integrated management plan the national commitments for Canada, and demonstrate how the regional objectives relate

As DFO is a national department for Canada providing the relative national commitments would be beneficial. This can establish from the beginning the link between how the regional programs contribute to Canada overall, and can show where the gaps exist for different conservation efforts.

Ensure that when defining success, it is through measured outcomes and impacts

Success can not be defined only on the number of laws or programs implemented, but on actual measurable changes. By creating more threshold numbers for various indicators, then evaluating the success of these objectives can be more useful.

When creating monitoring plans, ensure that the data is available to a variety of stakeholders and industries including those that are not in charge of making decisions

Since it is an integrated approach, it is important that information sharing is taking place. That way, all can understand the changes that are taking place, and those in charge can manage for both direct and indirect effects. This will also enable those being affected by the new management plans/policies to have a better understanding of why they need to take place.

Ensure that monitoring plans are adaptive

Since there is currently a lot of uncertainty in the face of climate change, ensuring that plans are adaptable and up to date is necessary. Continuous evaluation is needed, with new and updated information to be able to make the best possible management decisions.

7.3 Conclusions

Integrated management is still a new approach and due to its complexity constant updating and/or review is needed. Where integrated management can include an ecosystem-based approach, some argue that it truly has not reached an operational phase yet. Where Norway and USA both seem to be successfully implementing parts of an integrated management plan, Canada still needs to improve, especially in areas such as monitoring. Implementation is not easy, and unlike the widely accepted management tools and strategies to achieve the goals and outcomes for the traditional management approach, there is still no single accepted methodology to implement integrated and ecosystem based management. Where conceptual ideas are all agreed upon such as the including of multi stake-holders, scientific based research and monitoring, making it operational is still necessary. This could be due to managing the complexities that are inherent to ecosystems. Therefore, collaboration between multiple stakeholder and industries are necessary for integrated management to be successful.

With the new bioregional plan, Canada has the chance to use an integrated management approach as mandated by the Ocean's Act to achieve its various goals and objectives for the given area. By linking these goals and objectives to the national commitments from the get go, Canada also has a chance to better understand how all of their regional programs are contributing to Canada's overall ecological vision.

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