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Integrated ocean management - Fisheries, oil, gas and seabed mining

by

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ABSTRACT

This report explores the principles and application of integrated ocean management (IOM) concepts from a policy perspective through the use of four case studies: Norway, Namibia, Angola and Indonesia. This report is very timely in light of the recent inclusion of IOM, both in the exclusive economic zone (EEZ) and areas beyond national jurisdiction (ABNJ), in the discussions of the marine sector.

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EXECUTIVE SUMMARY

Oceans cover around 70 percent of the earth, hold 97 percent of the earth's water, produce more than half of the atmosphere's oxygen, and sequester large quantities of carbon. This report looks at the policy interactions between the fishery, oil and gas, and seabed-mining sectors through a policy review of four case study countries – Norway, Namibia, Angola and Indonesia. Through the case studies, challenges and lessons are identified on the development and implementation of ocean management.

The case studies presented demonstrate both the successes and challenges a country faces when developing an integrated ocean management (IOM) policy. The historical and cultural contexts play a role in how governments are able to create and implement policies. In Norway, the Government is able to draft, pass and enforce laws in a relatively short time, whereas in Indonesia, the planning and coordination process may take much longer. Namibia's cultural heritage has given the country strong governance, which it has used to create vibrant ocean industries. And yet, countries are not trapped by their histories; for example, despite Angola's devastating past, it remains committed to the Benguela Current Commission (BCC) and thus the responsible use of their oceans.

The relative power of each marine industry in each case seems may have some bearing on the resulting marine management plans. In Norway, the fishing industry is quite powerful because of the long history, and the management plans aim to maintain the health of the fish stocks and ecosystems. However, in Indonesia, fisheries have relatively less power, and thus do not have a strong voice in policy-making. It is important for each country to consider the relative power of each industry during the stakeholder consultation process while moving towards equal representation.

1. INTRODUCTION

Oceans cover around 70 percent of the earth, hold 97 percent of the earth's water, produce more than half of the atmosphere's oxygen, and sequester large quantities of carbon; and more than half of the world's population lives in coastal zones. Were it a country, the ocean economy would rank as the seventh largest economy in the world, with a GDP of US$2.5 trillion. The oceans are essential to life, and have long been considered an unlimited resource. However, over the past several decades, it has been observed that the ocean resources are limited. Fish stocks have been overexploited, with some stocks collapsing (e.g. Canadian cod); garbage islands and microplastics threaten the health of the ocean ecosystems; and changing chemistry as a result of climate change impacts life in the seas. Despite the harm that mankind has caused, the seas contain unknown riches in terms of aquatic life, metals, rare earth minerals and potential scientific discoveries. With land-based resources becoming more difficult to find and extract, attention is turned to the rich deposits in the oceans.

The global shift to ocean extraction of petroleum, gas and other minerals has highlighted the need for IOM,[1] i.e. how to maximize benefits while minimizing negative impacts. IOM is crucial when looking at the interactions between and importance of the major marine sectors (fishing, aquaculture, petroleum extraction, and mining). Its importance is highlighted by the shift towards "blue growth", i.e. increasing economic growth through marine industries. Many international organizations and governments have created blue growth policies towards increasing economic independence. FAO's Blue Growth Initiative is focused on food security, fisheries management and ecosystem services. Offshore petroleum and seabed mining both impact the health and operations of the marine environment, and thus can impact food security worldwide. The issue of IOM is an important component of FAO's Blue Growth Initiative as well as the global movement towards economic growth through the ocean economy (FAO, 2014). This report discusses the issues of IOM through four case studies focused on the interaction between fisheries, petroleum and seabed mining.

Fisheries and aquaculture have a long history and are crucial to food security worldwide. With the ongoing efforts of the international community to promote sustainable, responsible fisheries, this resource can be potentially renewable in perpetuity. However, the ongoing productivity of the world's fish stocks is also impacted by other important marine sectors. There have been many studies on the impacts of offshore petroleum operations (from exploration to exploitation) on fish and marine mammals (see Appendix 3 for more details). With the emergence of deep sea or seabed mining as an upcoming industry, many scientists and organizations are now focusing on studying the impacts of these operations on the environment and marine ecosystems (see Appendix 4 for more details).

[1] For the purposes of this paper, the term "integrated ocean management" (IOM) is used, whereas in other projects, the term used is "ecosystem-based management" (EBM). At the writing of this paper, FAO had not identified a preferred term; hence these two terms are used interchangeably.

Offshore petroleum activities started in 1896, with the first marine well drilled in California. Since then, the offshore petroleum industry has spread throughout the world, and technologies have become increasingly developed. Petroleum is a highly valuable non-renewable resource; the impacts of offshore extraction on fisheries and the marine environment can be devastating (oil spills), or relatively localized and benign (ongoing operations). The petroleum industry is highly lucrative, and high oil prices have made offshore reserves economical in recent years. As the industry has developed, the regulations and standards to which companies are subject have become increasingly strict, yet the level of regulations and enforcement vary around the world.

Although seabed minerals and metals were discovered in the 1870s, the prohibitive costs of extraction and development of these resources for many years kept the industry at bay. In 1994, the UN Convention of the Law of the Sea (UNCLOS) created the International Seabed Authority (ISA) to regulate seabed mining in the areas beyond national jurisdiction (ABNJ). Although the ISA jurisdiction is limited to the ABNJ, the codes of conduct developed by ISA for seabed mining will link to domestic policies of member nations and therefore have some relevance to IOM. With the rise in metal prices and the increased demand from the developing world, there has been a move towards seabed mining. The offshore oil and gas industry has paved the way for offshore resource extraction, both in policy and technological development. These mineral and metal resources in the sea are potentially highly lucrative and non-renewable; however, the impacts of seabed mining operations are not well known. Regulations for seabed mining are beginning to emerge, with the ISA leading the development. With the petroleum industry regulations, the level of governance is likely to vary across the globe.

Individual marine sectors have increasingly become managed over time. Fisheries management is based on effort (gear, zoning, etc.) and output restrictions (ITQs, transferable rights, etc.). The offshore oil and gas sector is managed through licensing, discharge allowances and impact assessments, although to a lesser extent in developing nations. Seabed mining is a new sector with minimal regulations at present; however, through the ISA, national policies are being formed. Although the above are all great strides towards minimizing the tragedy of the commons, there has been no account taken of the interactions between the sectors and only to a small extent of the impact of the industries on the environment.

This report explores the ideas of IOM from through the use of four case studies. The case study countries were chosen based on geographic diversity and the existence of competing marine industries. When the research began, the null hypothesis was that culture and development level would play a major role in the stage of ocean management. For example, in Namibia and Angola, it was expected that there would be little interest and effort in moving towards IOM. However, these two countries have made great progress towards not only national integrated management, but also regional management. Further, it was expected that the offshore resource extraction industries (oil, gas and mining) would have a fatal impact on local fish stocks. It was found that, although there are impacts from offshore operations, the full extent of the impacts is not yet known, and the impacts to date seem to be relatively minor.

This report first presents a brief literature review on the work being carried out in IOM of marine industries. Next, the methodology of the report is discussed, and the case studies are presented. The lessons that can be learned from each case study are presented, followed by conclusions and the way forward. The appendices present some of the management tools that governments can use to plan the spaces, the concept of Large Marine Ecosystems (LMEs), and the impacts of oil, gas and seabed mining on the environment and fisheries.

2. LITERATURE REVIEW

Within the ocean management sphere, much work has already been carried out, but most of it on a sector-by-sector basis. Fisheries, oil and gas and seabed mining have been dealt with separately in policy and regulations. However, with the emergence of the ecosystem-based management (EBM), policy-makers started looking at the marine ecosystems not only within one sector, but on a broader scale (Hoagland and Ticco, 2001). This shift gave rise to multi-use Marine Protected Areas (MPAs) to manage sensitive ecosystems across sectors. Further development of these concepts led to marine spatial planning (MSP), systematic conservation planning (SCP) and adaptive management to manage ocean spaces across different sectors (Ban *et al.,* 2014), which are described in Appendix 1. Ban *et al.* (2013) call for using three tools together (MSP, SCP and adaptive management) to achieve a well-balanced integrated marine plan. In the European Union (EU), there has been a shift towards joint management of ocean spaces across sectors (van Leeuwen *et al*., 2014).

The issue of ocean management can be well described by the tragedy of the commons, which is the problem of open access and unregulated resource management (Hardin, 1968). In his seminal work on the topic, Hardin described the problems that occur when *open-access public goods* are unregulated and how selfish motives can lead to the destruction of the public goods. The tragedy of the commons is commonly used to describe the issues of managing environmental spaces and natural resources. Libecap (2011) frames the tragedy of the commons around resource and environmental overexploitation problems. He suggests property rights and markets as a solution to the problem and as a means to force the exploiters of the resources to internalize the user costs through ownership. Fisheries have long suffered from the tragedy of the commons; overfishing has been a large issue due to a lack of a regulating body overseeing the health of the fish stocks. In fisheries throughout the world, regulatory bodies have been established and now use Libecap's solution of property rights to manage the problems through quotas (ITQs) and fishing rights.

In her book *Governing the commons: the evolution of institutions for collective action*, Ostrom describes design principles for governing the commons (i.e. marine spaces) for the benefit of society (Ostrom, 1990). Fleischman *et al.* (2014) found that five of the Ostrom's design principles seem to be facilitators in the success of large-scale common pool resource (CPR) management, namely boundaries, monitoring, sanctions, fit to conditions, and conflict resolution mechanisms when governing large-scale social-ecological systems, i.e. exclusive economic zones (EEZs) of each country. In IOM, MPAs, MSP and zoning are used to define the ocean industries in space and time across a state's EEZ. These tools are used to bring together the different marine industries and together formulate a management plan that benefits all sectors.

Large-scale, socio-ecological systems have been managed for over 100 years in American public lands and forests. Work on managing this common area resource started in the 1800s to foster cooperation among industries in these multi-use spaces. The United States of America was highly successful in creating integrated management plans that benefit society at large and the forest industries. However, ocean management is relatively new; it began between the 1940s and 1980s. Although there are many differences in the context of the forests and the ocean, there are also sufficient similarities for lessons to be drawn

(Gopnik, 2015). Gopnik's research shows that in both the forests and the oceans, management must be focused on balancing goals and necessary trade-offs. All levels of government and stakeholders must work together to ensure that the trade-offs being made are acceptable. These are valuable lessons for the ocean management community.

The concept of blue growth was first introduced at the United Nations Conference on Sustainable Development (UNCSD) (or Rio+20). In 2000, however, Smith (2000) was already writing about the industrialization of the oceans, a similar concept to blue growth. Smith describes maritime industrialization over the past several centuries, focusing on the enormous investment in fishing, whaling and trade, standardization of production for transportation and post-harvest fishing activities, and in the development of technologies such as fish drift nets. Throughout the paper Smith describes many of the aspects that are considered in blue growth with a few important exceptions. The focus of blue growth is not only growth of marine industries and incomes, but is also linked to conservation and sustainability (FAO, 2014).

The European Commission and FAO have recently launched Blue Growth programmes, which will assist member nations in developing sustainable marine industries. FAO focuses on developing nations and sees the potential of Blue Growth to help countries increase their economic development (FAO, 2015).

3. METHODOLOGY

This report presents research on IOM, focusing on petroleum, seabed mining and fisheries through four case studies. Research was conducted through document scans, semi-structured interviews and webinars, and by comparing cases to develop explanations and draw lessons. The methodology followed is based on the work of Yin (2003) from his book on case study research. A multiple-case study structure is used in this report, with assumed theoretical replication for the cases, i.e. each case is predicted to have contrasting results for anticipated reasons. Specifically, it is predicted that countries with lower levels of development and income will have fewer integrated marine policies and lower governance of ocean spaces in general.

The in-depth document review carried out for the study included a wide variety of sources and topics, including varied fields of management, science, economics and biology. Documents covered included peer-reviewed journal articles, legislation, policies, inter-governmental organization reports and key websites. Further, 15 webinars conducted by experts were reviewed on topics of management tools and methods, technological methods and impacts from petroleum and seabed mining.

The interviews conducted were semi-structured and in the form of guided conversations, with prepared questions varying depending on the expertise of the interviewee. The interviewees were identified through research for subject matter experts and are from varied backgrounds (i.e. policy, science, government, academia, etc.) to provide a holistic understanding of the complexities of IOM and the case study countries. Twenty-five interviews were conducted for the case studies, throughout which notes were taken, which were fed into the information described below. Early in the research, findings were presented at the Bergen Economics of Energy and Environmental Research (BEEER) Conference, which led to valuable inputs and feedback from peers coming from a variety of fields.

The purpose of the case studies is to understand the ocean policies and management mechanisms in place, identify some of the challenges for each country to create and implement IOM policies, and identify any differences between countries at different levels of development and in different geographic regions. Throughout the research, a picture of the current activities in the country as well as the cultural and historical contexts of each case has been drawn. The interviews with different stakeholders and the document review helped to develop the contextual features of each case and create a robust case presentation.

4. CASE STUDIES

Norway, Namibia, Angola and Indonesia were chosen as case studies because each has conflicting marine industries, are at different stages of economic and social development, and are from different geographical areas. Angola and Namibia were chosen despite the proximity to each other in order to compare the differences of two African nations at different stages of social development.

Each case discusses the historical, cultural and developmental context, the current policies and management mechanisms in place for IOM, and how the policies evolved. The information is then synthesized into a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis. Finally, any lessons or strengths are identified and discussed for applicability to other countries. As a result of these cases, lessons were drawn to help inform the understanding of IOM.

The cultural and social context is given through the Hofstede cultural dimensions, the Human Development Index (HDI), the Gini coefficient, and the Worldwide Governance Indicators (WGI). Other indicators such as GDP, life expectancy, literacy, coastal length and the percentage of GDP in the marine industries are included to better inform the contextual aspects of each case.

Geert Hofstede is a widely respected social psychologist who created a model to describe and compare countries along five dimensions: high versus low power distance (hierarchy versus decentralized power); individualism versus collectivism (degree of societal independence); feminine versus masculine (motivated by enjoyment versus winning); high or low uncertainty avoidance (degree to which uncertainty is considered threatening and institutions are built to minimize uncertainty); and long versus short-term orientation (level of links to past and dealing with change) (The Hofstede Centre, n.d.).

The HDI is a composite measure developed by the United Nations on an annual basis. It takes into account life expectancy, education and income indices to describe the level of human development in a nation. HDI ranges from 0 to 1; 1 represents high development, and 0, low development (UNDP, 2014).

The Gini coefficient describes the income distribution of a country and is used as a measure of inequality. The measure looks at the statistical dispersion of income, through both distribution and frequency at different income levels. The ratio varies between 0, representing perfect equality, to 100, representing perfect inequality (The World Bank, 2015).

The WGI were developed by the World Bank and are a collection of individual governance indicators for 215 economies over the 1996–2013 period (Kaufmann, Kraay and Mastruzzi, 2014). The WGI describe each country in terms of six dimensions of governance: Voice and Accountability; Political Stability and Absence of Violence; Government Effectiveness; Regulatory Quality; Rule of Law; and Control of Corruption. All the measures are given on a scale of 0 to 100, where 0 is very poor and 100 is perfect governance. For the purposes of this report, three measures are considered: rule of law, government effectiveness and regulatory quality. These three measures were chosen to describe the ability of the government to draft, pass and enforce laws and regulations.

A SWOT analysis is performed for each country to synthesize the information and to identify strengths and challenges. Although the SWOT tool is not traditionally used at the country level, it is often used to assess specific areas of national policy, regions within a country and for specific cases. In his work, Paliwal (2006) used a SWOT analysis to examine the evolution of environmental impact assessment (EIA) practices in India. Similarly, Terrados *et al.* (2007) used a regional SWOT to help create an energy plan and assess the impact of strategic planning tools on renewables development.

Finally, the lessons learned for each case are discussed by examining the policies and movement towards IOM, within the contextual backdrop. The lessons are considered in contrast to the other cases presented and summarized in the concluding remarks. Moreover, strengths or policies are discussed in the context of applicability to other countries.

4.1. NORWAY

Norway has a long fishing tradition, and Norwegians have a strong relationship with the ocean. Much of the population lives in small towns along the vast coastline, only able to reach the main cities via the well-organized ferry network. As western Norway is modernizing, more bridges and tunnels are being built along the coast to connect the towns by roads, minimizing the need for ferries.

Currently, oil accounts for 23 percent of the Norwegian GDP; however, with oil reserves declining, the country is looking to the future beyond oil (EIA, 2014). Before oil, Norway was a relatively poor country among its Nordic neighbours. Due to the discovery and extraction of petroleum, Norway has risen to one of the richest countries in the world, with one of the highest standards of living. Norway is looking to its renewable energy, fisheries and service industries to carry forward the future economy. Due to forward-looking policies and the cultural importance of fisheries, Norway has been very careful to protect the marine environment from the impacts of marine industry.

Described by Geert Hofstede in his theory of cultural dimensions, Norway is an egalitarian state that values pursing individual interests, with a preference for minimal societal change (The Hofstede Centre, n.d.). These aspects of Norwegian culture facilitate the implementation and success of the ocean governance policies.

Table 1. Norwegian statistics

Population	5 147 792[1]
GDP (2014)	US$339.5 billion
Per capital income (2014)	US$65 900
Coast line length	>83 000 km
Large Marine Ecosystems (**LMEs)**	Barent Sea, Norwegian Sea, North Sea
Fisheries/aquaculture (2012)	0.7 % of GDP
Oil (2012)	23 % of GDP[2]
Life expectancy (2014)	81.6 years (79.63 male; 83.69 female)[1]
Gini (2008)	25.9[1]
HDI (2014)	0.944[3] (1)

Sources: [1]CIA (2015); [2]EIA (2014); [3] UNDP (2014).

Table 1 shows a high Gini coefficient for Norway, representing a high level of equality across the nation in terms of income distribution; according to the 2015 ratios, it has the second best score after Sweden, among 154 countries (CIA, 2015). Similarly, Norway has a high level of human development, with the highest score in 2014 (UNDP, 2014). Its cultural context as described through these figures presents a politically, socially and economically stable country. This is confirmed by the high life expectancy and equality between men and women (CIA, 2015).

All of the considered in these case studies describe Norway as having a strong ranking in rule of law (100), effective governance (98) and high regulatory quality (95) (Kaufmann, Kraay and Mastruzzi, 2014). These three indicators together describe a stable, strong government that is able to draft, pass and enforce policies. In IOM, the strong governance is reflected in the strong ocean management plans and effective enforcement.

4.1.1. Marine industries

The two most important marine industries in Norway are fisheries and petroleum. Fisheries are a part of the cultural heritage of Norway; throughout its history, the people of Norway have survived on fish and the fishing industry. The petroleum industry, although relatively new in comparison to the fishing industry, has been established for 40 years in Norway. Both industries have become highly developed through mutual consideration, due to the strong position of the Government, the income from the petroleum industry and the power of the fishing industry. Further, both industries are highly technologically advanced, and many of the world innovations in both industries came from Norway.

Oil was discovered on the Norwegian continental shelf in the late 1960s and had a radical impact on the lives of all Norwegians (EIA, 2014). With the extraction and export of oil, the country created more jobs, substantially raised the standard of living, and introduced significantly more activity and industry based on its oceans. Not only were oil platforms introduced to the marine environment, but also a multitude of supply and export ships.

4.1.2. Policies and regulations

Long before the existence of the integrated ocean policies in Norway, the fisheries and petroleum industries were subject to regulation. Indeed, fisheries have been little impacted by the new integrated policies because most of their operations fall outside the current IOM policies.

Fisheries governance in Norway is now highly sophisticated, with real time data from ships and catches being monitored 24 hours a day, 7 days a week at the Fisheries Monitoring Centre (FMC) located in the Fisheries Directorate offices in Bergen. FMC analyses the location and catch data in order to ensure regulatory compliance. These data may also be to close fishing zones with too much bycatch. The Norwegian system relies on scientific studies to create the total allowable catch (TAC) and individual transferable quotas (ITQs).

Norway has many straddling fish stocks, shared with Russian Federation, United Kingdom, Europe, Iceland, Faroe Islands, Denmark and others. Despite the vast cultural and regulatory differences, Norway and Russian Federation have jointly managed their shared stocks since the 1950s. The approach is based on scientific research and a common desire to maintain the health of the stocks. In its cooperation with Europe, Norway has also been successful, although the cooperation has been more difficult.

The petroleum sector has also been subject to regulations since oil was discovered in the late 1960s. The Ministry of Petroleum and Energy has oversight over the petroleum operations. It aims to develop the industry for the good of all Norwegian citizens, through the Norwegian Oil Fund, and the responsible use of marine space. The process of licensing for exploration or drilling involves an application that is reviewed by this Ministry, the Ministry of Fisheries, Ministry of Climate and Environment and marine research institutes. Through the process, the rights to the petroleum transfer from the State to the extracting company in order to help align the company and government interests. The Government captures the resource rents through high taxes on the sector and uses the money for the good of the country through the Norwegian Oil Fund.

IOM policies in Norway were created in response to climate change, pollution and, importantly, the petroleum industry's wish to expand into the north and near coast regions (Olsen, 2013). These conditions led to the 1997 meeting of the Norwegian North Sea ministers that called for an ecosystem approach to management of the seas. This was followed by the Johannesburg Declaration 2002, which called for similar ecosystem-based management reforms to be implemented by 2010 (Olsen, 2013).

The process of creating and implementing the ecosystem-based management systems began in 2001 with the Barent Sea plan, as a response the pressure that the oil and gas industry was placing to gain access to northern drill sites. The Barent Sea plan was in effect by 2006, with a five-year revision process. The Norwegian Sea plan was in place by 2009 and the North Sea plan, by 2013. All of the plans have a five-year revision policy to ensure that the management of the ecosystems remains updated with changing information and pressures (Olsen, 2013).

Norway created three ocean policies, one for each of the Large Marine Ecosystems (LMEs) (see Appendix 2) of the country, with the aim to sustainably use and maintain the health of the ecosystems. The plans were very carefully developed with an iterative ecosystem-based approach, based on the geographic-based methods (Ottersen *et al*., 2011). The management plans were developed in three steps using a MSP framework (Olsen, 2013). The first step focused on developing status reports of the environment, marine resources, valuable marine areas, relevant socio-economic aspects and economic activities. These EIA reports were created in order to understand the current state of the ocean and each industry, as well as the needs and impact of each industry (Olsen, 2013).

The second step conducted the following four more targeted, intensive environmental impact assessments (EIAs) for each of the three major marine industries in Norway – fisheries, petroleum-related activities, maritime transport, and external pressures considered the most likely to have an impact on the marine ecosystems (Olsen, 2013). This step also involved consultation with the public and final reports to ensure that all stakeholders were considered. These studies were then used to identify particularly vulnerable areas, coordinate environmental monitoring, and determine environmental threshold levels for action based on the current state of the ocean (Olsen, 2013).

In the third step, the results from all the EIAs were considered together to identify the goals of the management policy, the cumulative effects on the ocean, the areas of conflicts between sectors, and the areas that need more research (ibid). This step also involved a stakeholder conference where the plan was presented to the stakeholders for comment. Together these EIAs were used to create ocean zoning that represented marine ecosystem areas that are particularly vulnerable to the impacts of marine industry. Indicators were developed to test the health of the ocean on a going-forward basis, with the current condition as the base line (ibid.). A mapping process created zones or MPAs covering the vulnerable areas that excluded marine industry activities and areas that were open to activities but still subject to licensing.

The governance system in place in Norway is a hybrid top-down approach because it is led by the Government, but the process involves strong vertical and horizontal integration across sectors and stakeholders. All important zoning decisions are made at the government level to ensure minimal industry biases (ibid.).

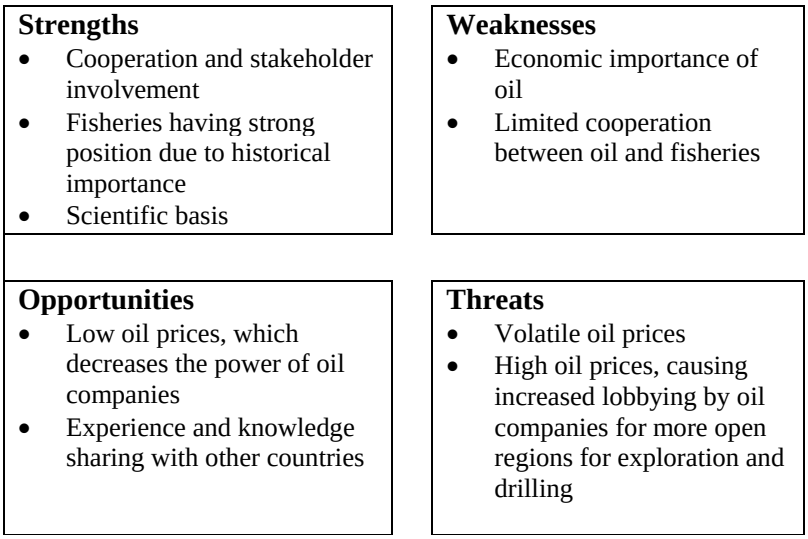
The zoning mechanisms in the Norwegian policies allow for the identification and protection of valuable areas, i.e. moving shipping lanes further offshore to maintain the health of the coastal environment and an area-based management framework for oil and gas activities in order to ensure minimal disruption to marine ecosystems. In the North Sea, the Petroleum Management Framework (2006–2011) was developed to give specific area instruction as to where petroleum activities were allowed. There are zones with no petroleum activities: for example, in Lofoten Islands in the Barent Sea, where there are areas with no new petroleum activity permitted (allowing for previous or ongoing operations to continue) and seasonal closure for drilling activities (closure between March and August in some regions) to ensure the safety of the surrounding ecosystems.

In 2011, the Barents Sea plan was revised to allow for more petroleum activities closer to shore; prior to the revision, annual reports were prepared and new studies conducted. Some areas that were previously closed to oil activities were opened as a result of the knowledge gained through the annual scientific reports (ibid). The Marine Resources Act that governs the oceans was designed to allow for revisions in IOM plans, minimizing the need to change legislation. The revisions are passed through Government as soft law, which is then enforced through the existing legislation. The revision of the plans allows for incorporation of new and ongoing research with a goal to ensure ecosystem safety (Olsen, 2013).

4.1.3. SWOT analysis

Figure 1 provides a SWOT analysis of the IOM and the strength of the system on a going-forward basis. The strengths and weaknesses highlight the current situation, and the opportunities and threats focus on the future strength of the IOM policies. The Norwegian IOM is very strong, but there are major threats and weaknesses related to oil prices, and thus the power of the oil industry. The main opportunities lie in the decreasing power of oil companies due to low oil prices, thus limiting the expansion of regions opened for drilling and the potential to help other countries around the world achieve the same sort of IOM successes that Norway has enjoyed by sharing experiences and knowledge.

Figure 1. Norwegian SWOT



The main weakness in the Norwegian system is the limited cooperation between the oil and fisheries sectors. This is likely caused by the uneven power of influence between the two sectors: in most nations, the industry with the highest GDP contribution will be the industry with the most power in policy-making, but in Norway, the fisheries have a great deal of power in the process due to the long history and employment it provides. This imbalance, nevertheless, does not greatly hinder the drafting, passing and enforcement of the integrated management plans, or Ocean Policies, and thus is not considered to be caused by a gap in policy or enforcement.

The Government of Norway recognizes the above issues and has created a special forum for the fisheries and petroleum ministers and sectors to discuss them and build understanding and cooperation. Although the industries are able to further their discussions through this forum, there are still conflicts between the two sectors.

4.1.4. Lessons learned

The main lesson to be learned from the Norwegian experience is related to the policy development process. The process is based in scientific knowledge, but is not burdened by it; it takes time to gather information, but then, marine boundaries can be established. The Norwegian Government also conducts ongoing research to allow for modifications to the zoning. The Norwegian approach is precautionary, but action-focused. This is a good model for other countries when developing an IOM process, but it may not be feasible for all of them to carry out the same level of scientific research. Countries unable to carry out a high level of scientific research could use a combination of scientific study and local knowledge to develop plans. The ongoing research could then adapt the plans as more knowledge becomes available (Ottersen *et al*., 2011).

The Norwegian Agency for Development Cooperation (Norad), which offers assistance to developing countries that are developing oil resources, has a programme called Oil for Development (OfD). This programme provides assistance to developing nations to develop resources sustainably as well as robust governance and polices for the oil industry and the country. Norway is putting efforts into helping other countries use oil incomes to develop them and their institutions

Another lesson that can be drawn from the Norwegian experience is stakeholder involvement and vertical and horizontal integration. The Norwegian system not only consults every marine sector to obtain input, but also creates a forum for discussion among sectors. This allows to obtain the best information from every sector to inform the IOM plan, and allows for discussion between parties on the conflicts. This process brings the best industry knowledge to light and increases the buy-in of the plan for the sectors. When sectors voice their opinions, feel that they are listened to and discuss the issues, they will be much more likely to accept and follow the IOM plan that is developed.

4.2. NAMIBIA

Namibia gained independence in 1990 after being ruled first by Germany and then South Africa. Before independence, Namibia's plentiful natural resources were exploited with little regard to the environmental and ecosystem impacts. Diamond mining activities have been ongoing for more than 100 years, and have drastically changed the landscape and

coastline in the south of the country. Some of the areas that were exploited early on are only now being reclaimed by the seas (OECD, 2008).

Since independence, the country has had two successful democratic government transitions and enjoys a high level of governmental, economic and social stability. Namibia is one of the only countries to address conservation and protection of natural resources in its Constitution:

> *Article 95: The State shall actively promote and maintain the welfare of the people by adopting, inter alia, policies aimed at the following: maintenance of ecosystems, essential ecological processes, and biological diversity of Namibia, and utilization of living natural resources on a sustainable basis for the benefit of all Namibians, both present and future.*

Further, the Constitution provide a process to enforce the conservation of the natural environment. In Article 91, the ombudsman is responsible for investigating complaints:

> *Concerning the overutilization of living natural resources, the irrational exploitation of non-renewable resources, the degradation and destruction of ecosystems, and failure to protect the beauty and character of Namibia.*

Namibia has demonstrated its commitment to conservation by proclaiming almost 14 percent of its land as national parks. Much of the coastline of Namibia is covered by national parks, and there are plans to make the entire coastline, with the exception of large towns, one continuous protected area (NACOMA, 2009). Namibia's desert coast lies along the Benguela current, one of the most productive LMEs in the world.

One of Namibia's biggest industries is tourism, specifically eco-tourism. The vast and varied landscape together with the diversity of animals in the country have allowed Namibia to attract over one million visitors per year (ibid.). This has aligned the interests of the tourism industry with the conservation mandated in the Constitution, making enforcement easier. Additionally, the country has been able to raise substantial funding from around the world to support conservation efforts.

As described by the Hofstede dimension, Namibia exhibits a high degree of power distance (hierarchical power structures); is a collectivist, group-centric society; is a masculine society (i.e. members are driven by competition more than desire for cooperation; exhibits no preference for uncertainty avoidance; and like Norway, has a shorter-term orientation (i.e. a preference for tradition and suspicious of societal change) (The Hofstede Centre, n.d.).

Table 2. Namibian statistics

Population	2 198 406[1]
GDP (2014)	US$23.59 billion
Per capital income (2014)	US$10 800
Coast line length	1 517 km
Large Marine Ecosystems (LMEs)	Benguela Current
Fisheries/aquaculture (2007)	7.44% of GDP[2]
Mining (2008)	13 % of GDP[3]
Life expectancy (2014)	51.85 years[4] (52.22 male; 51.46 female)
Literacy rate (2014)	76.5% (74.3% male; 78.4% female)
Gini (2010)	61.3 (151st)
HDI (2014)	0.624 (127th)[5]

Sources: [1] CIA (2015); [2] FAO (2007); [3] OECD (2008); [4] CIA (2015); [5] UNDP (2014).

Table 2 shows that in the HDI, Namibia ranks in the medium human development level, at 127 of the 187 countries (UNDP, 2014). Since independence, Namibia has been making strides to improve its development level and the lives of its citizens. However, according to the Gini coefficient, the country is ranked 151 out of 154 countries, demonstrating its extreme income inequality (CIA, 2015). These three measures show Namibia as a nation plagued with inequality, striving towards development. These efforts can be seen in the growing equality between male and female education, literacy and life expectancy. Development is a long process, but as can be seen through these variables, Namibia is making great progress.

With respect to the WGI governance measures, Namibia scores very well on most of the indicators; however, there has been a downward trend in all indicators since 2003. Nevertheless, Namibia continues to score higher in all categories than the sub-Saharan African average, and almost on par with the European and Central Asia average. This demonstrates the German and South African influences on the Namibian economy, resulting in strong effective governance (60), rule of law (60) and regulatory quality (58) (Kaufmann, Kraay and Mastruzzi, 2014). If the downward trend continues, it will create problems in the future for the Government and its ability to govern the environment and people.

4.2.1. Marine industries

Namibia's coastline ranges from the vast Namib Desert to harsh lichen planes and rocky shores. These areas were not traditionally inhabited, and only more recently have seaside cities sprung up. This unique history and geography had limited the artisanal marine fishery sector. Before independence, Namibia's unique and highly productive fisheries sector was terminally overfished.

After independence, Namibia had the unique opportunity to eliminate the old fisheries laws and industry, revoking all foreign permits and starting anew. The country decided to create a Namibian fishing industry, allowing foreign involvement only through joint-ventures with Namibian companies (FAO, 2002). This aimed to ensure knowledge transfer to the local industry and to build up a vibrant on- and offshore fisheries industry.

Namibia's fisheries policy has been effective in rebuilding previously exhausted stocks and creating local Namibian industry. The fishing industry now faces issues of infrastructure and technology deficiencies; not all boats have cooling facilities on board, and the post-harvest industry is still underdeveloped.

The Namibia's onshore diamond mining sector is well developed with activities dating back over 100 years. Offshore diamond mining is a more recent development, which began in 1908 (Namdeb, 2015). The most recent marine mining to be considered in Namibia is deep seabed mining for Seafloor Massive Sulphide (SMS). This industry has yet to begin operations because the environmental and fishery ministries successfully managed to obtain a 18-month stay in order to study the impacts of deep sea mining. Deep sea mining is an emerging industry on the global stage, hence the impacts of these activities are yet not known. Namibia recognizes the unique and productive marine ecosystem, and is hesitant to allow industries that may be very harmful to operate without prior impact studies.

4.2.2. Policies and regulations

Namibia has the Marine Resources Act 2000, which aims to "provide for the conservation of the marine ecosystem and the responsible utilization, conservation, protection and promotion of marine resources on a sustainable basis; for that purpose to provide for the exercise of control over marine resources; and to provide for matters connected therewith" (Government of Namibia, 2000). The Act sets out provisions for the implementation and enforcement of fisheries management using the economic-based methods. The Act describes the quota and tariff systems in place in Namibia, and the structures in place to enforce them. The Act also describes two funds that have been created financed by fisheries' fees and levees: the Marine Resource Fund, which is used to fund research, development, training and education related to marine resources by any institution approved by the Ministry; and the Fisheries Observer Fund, which is earmarked for the activities of the Ministry. Thus, Namibia is using the captured resource rents for the benefit of the sector (Government of Namibia, 2000).

Fisheries management in Namibia uses mainly output restrictions such as ITQs, but in some regions, there are effort restrictions to minimize the impact on the environment and bycatch. The country is developing its fishery policy. Namibia recognizes the issue of spatial management for its ocean spaces, and as a part of the process for the fishery policy, there will be multiple stakeholder consultations from different government ministries, industry players and communities. This is a major step towards integrating ocean management.

The Ministry of Mines and Energy (MME) oversees energy and mining activities. Namibia is rich in natural resources and has many different mining operations throughout the country, from uranium to zinc. Since the beginning of the last century, there has also been a vibrant diamond mining industry along the southern coast of the country. Large sea walls were built up to allow the dredging of the coast to recover the diamonds. Now these reserves are dwindling, and offshore mining for diamonds is growing. The MME has many policies in place for the mining and petroleum sectors, such as the Diamond Act (1999). The Diamond Act created the Diamond Board, regulatory bodies and duties.

The Act specifically refers to offshore (or marine) diamond mining operations, and delineates the actions necessary to receive a permit to carry out operations.

Namibia has also been prospecting for oil and gas through extensive seismic surveys and some exploratory drilling carried out throughout its waters. There have been some sites identified along the coast for both oil and gas reserves. These activities are regulated through Petroleum (Exploration and Production) Amendment Act (1993), the Petroleum Laws Amendment Act (1998), the Model Petroleum Agreement (1998) and the Petroleum Products and Energy Amendment Act (2000). The Acts set out the legislative framework for the petroleum industry and describe exploration and production licences, tax regimes and regulations.

Since independence in 1990, Namibia has spearheaded local action towards marine sustainability efforts in the South East African region. In 1995, Namibia initiated the establishment of the South East Atlantic Fisheries Organization (SEAFO), with Angola and South Africa as signatories (SEAFO). Also, in 1995, these three countries created the Benguela Current Commission (BCC) to facilitate the cross-country management of the shared resources in the Benguela current (BCC, 2013). Although each nation has its own marine policies, the establishment of these two inter-governmental bodies demonstrates the commitment to jointly manage all of the shared marine resources and recognizes that the actions of each nation impact the other two as well as the health of the LME.

BCC aims to "promote a coordinated regional approach to the long-term conservation, protection, rehabilitation, enhancement and sustainable use of the Benguela Current Large Marine Ecosystem, to provide economic, environmental and social benefits" (2014). The Benguela Current Convention was developed by the BCC as a guideline for conduct in the shared LME and is based on the principles of polluter pays, precaution, protection of biodiversity, cooperation, collaboration and sovereign equality and prevention, mitigation and avoidance of pollution (BCC, 2014). The first actions required by the Convention are to collect information on the state of the ecosystem and the impact of various activities on the current. This information is used to help strengthen policies in each of the member countries for the protection and sustainable use of the Benguela Current's resources.

The SEAFO Convention (2001) covers the high seas of the southeast Atlantic region. Angola, South Africa, Namibia, Norway, Japan, the European Union and the Republic of Korea are all contracting parties to the Convention, which is committed to cooperative conservation and the sustainable use of ocean resources. SEAFO has successfully been able to close some areas to trawling, and is working towards sustainable fisheries in the region.

4.2.3. SWOT analysis

The SWOT analysis of the Namibian potential for IOM is presented in Figure 2. The figure shows that governance and culture are conducive to creating and implementing an IOM policy; however, the lack of cooperation between the ministries limit this potential.

Figure 2. Namibia SWOT

Strengths	**Weaknesses**
• Strong rule of law for the region • Conservation focus • Limited artisanal fishing	• Lack of cooperation between sectors and ministries
Opportunities	**Threats**
• Support of South East Atlantic Fisheries Organisation (SEAFO) to develop an Integrated Ocean Management (IOM) policy and bring the sectors together	• Increased bureaucracy and inefficiencies in national Government • High income inequality • Economic importance of mining

The main threats to creating an IOM policy are the low level of development in the country, the increasing bureaucracy and the economic importance of the mining sector. However, the Government recognizes these problems and is working towards co-operation between sectors. Further, through the BCC, Namibia has the opportunity to receive support in setting up IOM with stakeholder consultation, and a forum through which ministries can communicate. The BCC has enormous potential to help Namibia develop a balanced IOM that will help the state develop.

The main challenge to creating an integrated marine policy is the lack of communication and cooperation between the different marine sectors. The hierarchical power structures as described by Hofstede tend to increase bureaucracy and exacerbate the cross-ministry communication issues. More recently, however, due to pressure from industry on the Ministry of Fisheries and Marine Resources and support from the BCC, there has been some discussion of environmental impacts. As a result, Namibia was successful in creating a moratorium on deep seabed mining in order to conduct EIAs. This example shows the power of the BCC in supporting the country to achieve its conservation goals. Further, the BCC is able to sidestep governmental bureaucracy to create a plan that is then presented to the Government for approval. The country is also starting to address the multi-use ocean spaces across different sectors. The Government recognizes the overlap of activities and management plans, and is beginning to address it.

4.2.4. Lessons learned

Since independence in 1990, Namibia has successfully created a strong regulatory framework for the marine environment. The focus on conservation, sustainability and cross-border cooperation has led to a comprehensive regional governance plan. One of the reasons for the success of the policies is the strong and stable political, economic and social structures in the country.

However, the results of the multi-country cooperative efforts in the Benguela Current region remain to be seen. The level of enforcement will depend heavily on the buy-in of all member nations. This may, however, create significant challenges in managing the resources across three different nations at different stages of economic, social and political development.

The main lesson to be learned from Namibia is the important role that regional fisheries and management bodies can play in supporting good IOM. Namibia has been greatly supported by the BCC in the creation of its IOM policies. Regional bodies can play an important role in supporting the developing of IOM policies, especially in the developing world where policy development can be hampered by bureaucracy.

4.3. ANGOLA

For 50 years, Angola was a colony of Portugal. Before independence, it was considered the bread basket of southern Africa, supplying large quantities of bananas, coffee and other goods to the region. After it gained independence in 1975, the country was thrust into a bloody civil war between the two main resistance movements that lasted until 2002. Nearly three decades of civil war have left the fertile fields littered with landmines and destroyed them, which has led to dependence on food imports from South Africa and Portugal (OECD, 2007).

Angola currently has an authoritarian regime, with party elections, but no presidential elections. The legal system is loosely based on the Portuguese system, but is weak and ineffectual. Since the 1990s, Angola has been one of the fastest growing countries in the world, with GDP growing in excess of 10 percent in the first decade of the 2000s due to the discovery of offshore oil. And yet, the people in Angola remain among the poorest in the world (ibid.). Oil represents 50 percent of the country's GDP, and fisheries only represent 1.7 percent of the annual GDP.

According to the Hofstede dimensions, Angola has similar scores, but to a more extreme degree, to those of Namibia for all categories. Angola has a very strong hierarchical structure (high power distance); is a very collective society; has short-term orientation and an even stronger connection to traditions. The only dimension on which Angola differs from Namibia is the feminine vs. masculine, or the motivation dimension; Namibia is more masculine, i.e. people are motivated by competition, whereas Angola is considered feminine, with motivation arising from enjoying employment (The Hofstede Centre, n.d.). This may be an important difference in the success of the policies in the two countries and accentuated by the Portuguese culture and decades of civil war.

Table 3. Angola statistics

Population	19 088 106[1]
GDP (2014)	US$175.5 billion
Per capital income (2014)	US$8 200
Coast line length	1 600 km
Large Marine Ecosystems (LMEs)	Benguela Current
Fisheries/aquaculture (2012)	1.7% of GDP[2]
Oil (2012)	50% of GDP
Life expectancy (2014)	55.29 Years (54.16 male; 56.47 female)
Literacy rate (2014)	70.6 percent (82.5% male, 59.1% female)
Gini (2000)	58.6 (148)
HDI (2014)	0.526 (149)[3]

Sources: [1] CIA (2015); [2] FAO (2014); [3]UNDP (2014).

Table 3 shows the poor human development in Angola, ranking among the lowest development rates in the world. The HDI of Angola is ranked 149 out of 187 countries (UNDP, 2014). The Gini ratio places Angola at 148 out of the 154 countries, demonstrating the high level of inequality (CIA, 2015). The low ranking of these two indices is further confirmed by the low life expectancy and the inequality in literacy rates between men and women. In all the measures presented in Table 3, Angola has a low level of social and economic development. The cultural context described identifies some of the key issues in policy development and implementation.

The WGI give further proof of the situation in the country and demonstrate the poor governance environment. All three indicators considered ranking well below the sub-Saharan African averages; there have been only very minor gains in each of the indicators over the past ten years. The poor rule of law (9), government effectiveness (11) and regulatory quality (15) show the low rate of development, and the inability of the Government to govern (Kaufmann, Kraay and Mastruzzi, 2014).

4.3.1. Marine industries

The most important industries in Angola are its oil and onshore mining, followed by fisheries, at 1.7 percent of the GDP in 2012 (FAO, 2014). The oil industry started onshore in 1955 and has grown very quickly. With the inclusion of deep-water offshore oil fields and ultra-deep-water fields, Angola has become the second largest oil exporter in sub-Saharan Africa after Nigeria (OECD, 2007). One of the challenges in the industry is the transparency of oil incomes, which currently does not trickle down to the population.

The fishing industry has been and continues to be important to the Angolan economy. The country has created a legal structure that allows industrial fisheries to only be carried out by Angolan vessels either leased to or in joint venture with Angolan companies (FAO, 2014b). The industry has been characterized by overfishing for some time, which, together with changes in hydrological conditions, have impacted the stock levels of fish. It is estimated that most of the Angolan fish stocks are overfished, specifically horse mackerel, a staple of the Angolan diet. By contrast, small pelagic species, such as sardinellas, are underutilized (ibid).

The bulk of the production from the fisheries industry is for domestic consumption, in part due to the limited technology. The main challenges facing fisheries and small-scale fisheries are high post-harvest losses, unhygienic processing methods, low quality of fish products in local markets, and difficulty in selling high-value fish in sophisticated markets (FAO, 2014). These challenges are caused by lack of technology in port and vessel facilities, lack of cold storage on board vessels, and lack of education about safe fish handling and good fishing practices (FAO, 2014). These issues are compounded by the lack of port and transportation infrastructure in the country, making it difficult to get high quality products from ports to rural communities or exported.

4.3.2. Policies and regulations

In 2010, the Angolan Ministry of Fisheries was created, together with two national directorates for fisheries management, infrastructure and development institutes. These institutional bodies form the framework for managing the industry. The legal framework is based on the Fisheries Law (2004) and later regulations (FAO, 2014). The main tools used to govern the fishery industry are based on effort restrictions, licensing, closed seasons, gear restrictions and zoning, with some output restrictions in the form of TAC.

The Fisheries Administration Commission (CAP) was created in 1990 to facilitate the involvement of the private sector and local communities in the legislative and management process (FAO, 2014). The establishment of the CAP is an important effort to include stakeholders in decision-making, which allows for more robust decision- making and increases the buy-in of these stakeholders to the regulations. Angola is moving towards geographical-based methods in the fishery sector and is currently introducing MPAs (FAO, 2014).

The Angolan Fishery policy aims to give strategic direction to the industry and reach social goals of food security, increase export earnings, alleviate poverty and minimize unemployment. Generally, these aims are achieved by: increasing responsible fisheries management; developing the level of activity and capacity of institutions, communities and aquaculture; improving the management and surveillance systems; increasing the use of technology and facilities to reduce waste; and increasing funding and support to the industry (FAO, 2014).

Angolan energy policies are striving to “Angolanize” the industry and now require 70 percent local content for all oil and gas companies (EIA, 2014). However, this threshold has rarely been met. Due to the lucrative nature of the oil and gas industry, it seems that there is no overarching marine policy. The Ministry of Energy and Water is responsible for managing the oil and gas sector in Angola. The Nation Energy Policy is

responsible for the regulations within the sector, and promotes a shift towards renewable energy sources for domestic consumption.

Together with Namibia, Angola is member of the BCC, a signatory of the Benguela Current Convention and SEAFO. These policies are discussed in detail in the Namibian case study. All of these multilateral commitments are based on the principles of polluter pays, precaution and pollution prevention. They all align well with Angola's national policies, and as a result, should enhance, rather than impede the enforcement and development of the national marine policies.

4.3.3. SWOT analysis

Figure 3 presents the SWOT Analysis for Angola. The main weaknesses and threats lie in the cultural and governance context described earlier. The weak rule of law, low level of development, bureaucracies and economic importance of oil all hinder the ability of the Government to develop and then enforce an IOM policy. However, with the support of BCC and SEAFO, Angola may be able to develop an IOM policy and begin to enforce it. One important difference between the Angolan and Namibian experiences in ocean management is the artisanal fishery sector. Unlike Angola, Namibia has historically had few coastal settlements and artisanal fisheries due to the inhospitable coastline. The southern coastline is characterized by the Namib desert, and the northern coastline has equally inhospitable conditions. By contrast, in Angola, there has always been a vibrant community of artisanal fishers, and consequently, there are more complications in policy development and enforcement, and catch documentation.

Figure 3. Angola SWOT

Strengths	**Weaknesses**
• Resource-rich country • Committed to Benguela Current Commission (BCC) and South East Atlantic Fisheries Organisation (SEAFO)	• Lack of cooperation between sectors and ministries • Weak rule of law and low development • Large artisanal fishery sector
Opportunities	**Threats**
• Support of South East Atlantic Fisheries Organisation (SEAFO) and Bengula Current Commission (BCC) to bring expertise in developing Marine Protected Areas (MPA) and policies	• Bureaucracy and inefficiencies in national Government • Economic importance of oil and gas

The weaknesses and threats discussed are as a result of the historical and cultural context. The weak rule of law and inefficiencies were likely due to the more than three decades of civil war. In contrast to Namibia, which did not have the same struggles, Angola is much further behind in some areas. It is also interesting to observe the different influences of colonization on each nation, Portuguese colonization in Angola, and German colonization in Namibia. The strong hierarchical structure in the country, together with the inequality, further slow the process towards an IOM.

4.3.4. Lessons learned

One of the major challenges in managing the ocean resources is the low level of development in Angola and the relatively opaque political situation. As seen in the previous two case studies, a strong government and stable social context are conducive to development and enforcement of marine policies.

The lesson that can be drawn from the Angolan experience is the impact of historical and cultural context on the development of IOM. Nevertheless, Angola has shown strong commitment to BCC and SEAFO. The country is now developing MPAs with the support of BCC as a first step towards ocean management. The role of BCC in Angola seems to be even stronger than for Namibia, which is another good lesson for nations who have internal struggles. Regional management bodies can offer support to developing countries in designing IOM at different stages.

4.4. INDONESIA

Indonesia is the largest archipelago nation in the world, consisting in of over 17,000 islands (FAO, 2014a). Due to its strategic position between the Indian and the Pacific Ocean, Indonesia has long been a centre for trade. From the 1400s, the Dutch used Indonesia as a trading hub, eventually colonizing the nation until independence in 1949. Later, in the late 1990s, the country was one of the hardest hit by the Asian financial crisis (FAO, 2014).

The oceans have always been a very important part of Indonesian life, for transportation, food and the economy. The main marine industries in Indonesia are oil and gas, shipping, mining, fishing, aquaculture and tourism. Although most of the offshore oil has already been exploited, Indonesia is continuing to find natural gas reservoirs off its shores. In 2012, the fishing and aquaculture industries made up 3 percent of the national GDP and 21 percent of the agricultural sector (see Table 4).

In his inaugural speech, the new President Joko Widodo expressed his desire for his country to become a great ocean nation again. At the APEC CEO Summit on 10 November 2014 in Beijing, China, Widodo spoke about his desire to develop the fishing industry and transportation links, He stated that he wanted to put an end to illegal fishing in Indonesian waters and turn Indonesia back into the “world’s maritime axis”. In order to achieve this, considerable development mechanisms will be needed for small villages in order to modernize and connect them to the rest of the country. Widodo plans to usher in a marine policy, which will realize his vision for Indonesia.

The Indonesian culture, like many Asian cultures, has a high power distance, i.e. the culture relies on hierarchical structures and centralized power. Indonesia is also a collectivist society, which places value on the needs of the group over the individual. Unlike the rest of the region, the country has a low masculine score, i.e. the society is less motivated by competition than its neighbouring countries, but to a lesser degree than in European countries (The Hofstede Centre, n.d.).

Indonesia ranks high in the HDI (Table 4) and is considered to have medium human development (UNDP, 2014). This is also evident through the high life expectancy and literacy rates, which are on par with developed nations. The Gini index, however, demonstrates the fairly high level of income inequality, ranking 108 of the 154 countries measured. Indonesia has some large, well developed cities, as well as many small, underdeveloped fishing communities across the islands (CIA, 2015). Due to the distances between islands and the current poor transportation infrastructure, many small communities are unable to reach the large cities, either because of lack of infrastructure or the prohibitive cost of transportation.

Table 4. Indonesian statistics

Population	253 609 643[1]
GDP (2014)	US$2 554 billion
Per capital income (2014)	US$10 200
Coast line length	54 716 km
Large Marine Ecosystems (LMEs)	Sulu-Celebes Sea, Indonesian Sea, Bay of Bengal, South China Sea
Fisheries/aquaculture (2012)	2% of GDP[2]
Oil (2012)	5% of GDP
Life expectancy (2014)	72.17 years (69.59 male; 74.88 female)
Literacy rate (2014)	92.8 percent (95.6 male; 90.1 female)
Gini (2005)	34.0 (41st)
HDI (2014)	0.684[3] (108)

Sources: [1] CIA (2015); [2] Statistics Indonesia (2015); [3] UNDP (2014).

The WGI describe Indonesia as a fairly stable country in terms of government effectiveness (45), regulatory quality (46) and rule of law (36). Although the measures are not as high as for Namibia, they are slightly higher than the middle-income country average (Kaufmann, Kraay and Mastruzzi, 2014). According to these indicators, the country is at a medium development level, and each measure has increased over the past ten years, indicating that there is development.

President Widodo intends to increase development levels by addressing this transportation problem by improving the ferry infrastructure, allowing greater connection between islands of the nation. The cultural and social context described above demonstrates the challenges of development in such a wide spread country. Further, the context helps to inform the challenges in creating and implementing a policy for the country. Spread over three LMEs, with diverse cultures and disparity between areas, it may be prudent to follow the Norwegian example and develop a few local marine management policies to effectively address the regional differences in marine conditions.

4.4.1. Marine industries

The fishing and aquaculture industry provides a large portion of the local die and large export values, at approximately US$3.8 billion (FAO, 2014). Over 90 percent of the fishing industry is made up of artisanal fisheries and there are still many poor fishing communities that operate at a subsistence level. The lack of credit schemes available to the small communities, weak fisheries management and overfishing threaten the fishing industry.

The oil and gas industry has been an important part of the economy, although with rising domestic demand and falling production of oil, Indonesia is looking to other sources of energy. Increasing discoveries of offshore natural gas has stimulated greater investment in the industry. Indonesia also has a vibrant marine tin mining sector, mainly located on Bangka Island. This sector has been in operation since the 1700s, and has recently gained attention for the threat it poses to human health and the safety of the nearby ecosystems.

4.4.2. Policies and regulations

Currently, Indonesia has some limited local marine policies. The Indonesian Government has highly decentralized power, with local government bodies exercising a great deal of power over the marine environment but without the capacity to manage the spaces. President Widodo plans to usher in a country-wide marine policy that will cover the different marine environments and industries. At the ministerial level, Indonesia has a unique structure, whereby one minister has oversight responsibility for the ministries of all the marine industries. This structure gives Indonesia unique information and potential for cooperation among the marine industries.
There are some examples of marine policies at work in Indonesia. The Lombok Blue Economy project helped to build the capacity of local fishers, and create sustainable ocean management policies. This is one example of Indonesia's commitment to blue growth and its emphasis on the ocean as a key economic and environmental resource.

Since independence in 1945, the fisheries policies have undergone three cycles in Indonesia, with periods of decentralized and centralized power (Satria and Matsuda, 2004). From independence until 1966, there was a period consisting of decentralized power to five provincial management bodies, which was followed by the New Order period from 1966 to 1998 in which the central government reclaimed the administrative power from the provinces. However, the central government had a hard time enforcing the laws due to distance between the many islands and fishing areas. The most recent period has seen a shift back to decentralized fishery policies, with local governments and regional bodies responsible for different depths of oceans (ibid.). The first four nautical miles from shore are under local government jurisdiction; the next eight miles are under provincial jurisdiction; and the following 12 miles, is are under the central government jurisdiction.

The challenges in the most recent period have related mostly to the lack of communication and clarity over the powers granted to each level of government and the lack of human and technological capacity at those levels (ibid.). Indonesia must now make efforts to transfer the necessary skills and management competences to the local governments.

Indonesia created the National Energy Board in 2007 with a mandate to develop and enforce a national energy policy that would make Indonesia energy secure. Indonesia used to have high exports of petroleum, but the supply has decreased in recent years. It is now one of the largest exporters of coal in the region and has found large subsea reserves of natural gas.

Indonesia also mines for tin in the seabed at depths of 50 meters. This has been a dangerous industry both for the environment and the population. The Government has put further pressure on the industry by requiring that all mined ore be refined in the country, increasing the pressure on the environment from refining processes (Asmarini and Jensen, 2014).

In each of the LMEs that Indonesia spans, there have been efforts to foster cooperation between states to better manage the ecosystems and fishery resources. However, there are no regional bodies with the strength similar to the BCC. The Bay of Bengal has a regional body, Bay of Bengal Large Marine Ecosystem (BOBLME), yet Indonesia is not highly involved. Cooperation in this area of the world may be more difficult than in the BCC region because of the history in the area.

4.4.3. SWOT Analysis

One of the major challenges in Indonesia is the amount of time it takes to draft legislation. Indonesia has a relatively lengthy policy development process, with short-term policy projects spanning five to ten years (Suuronen, 2015). For this reason, it has been very hard for the country to create and implement an ocean management policy in the short term. However, since there has already been long consideration and discussions, the policy may soon be implemented.

Another challenge in creating an IOM policy is the lack of sophistication of the fishing communities, and the amount of time it takes to build capacity in these communities in order for them to be involved in the policy discussions. The Government therefore implemented the National Mid-Term Priority Framework (2010–2014) to help build capacity in the communities among other goals (FAO, 2014). Once the fishing industry has sufficient capacity and organization, the stakeholder consultation process can begin, followed by the creation and implementation of a marine policy.

The structure of decentralized power is another barrier to creating an integrated management plan. This type of power structure will require a longer process to coordinate all regulatory bodies and stakeholder associations. The local governmental bodies will bring valuable insights about local environments, but it may be difficult for them to have a larger, countrywide approach. However, this power structure also provides an opportunity for the central government to develop local technical and human capacity and benefit from local knowledge. This would not only contribute towards strengthening the ocean management policies, but also to develop the less developed regions of the State.

Figure 4. Indonesia SWOT

Strengths	Weaknesses
• High level of literacy and education institutions • Resource-rich country • Marine industry minister	• Economic importance of mining • Lack of cooperation between sectors and ministries • Bureaucracy and red tape in developing any projects
Opportunities	**Threats**
• Decentralized power structure • Involvement with regional Large Marine Ecosystem organizations • Relatively high rule of law and government effectiveness	• Increasing bureaucracy and inefficiencies in national Government • Decentralized power structure • Large artisanal fishery fleets (lack of organization)

The strengths and opportunities for Indonesia in creating an IOM policy are the generally high literacy and education, the resource-rich islands and the potential to obtain support from regional LME organizations. Indonesia has great potential to tap into its blue economy in order to further develop and grow its economy. The relatively strong governance indicators demonstrate a potential for the government to create and enforce policies and regulations. Further, the compartmentalization of the marine industry ministries into different sectors is a great opportunity for creating dialogue and cooperation between sectors.

4.4.4. Lessons learned

The lessons to be learned from the Indonesia experience are the potential of grouping marine ministries, although possibly, the hierarchical structure of a *super minister* may not be feasible in all countries; and a marine ministry board or meeting as a part of the regular ministerial duties might open the door to dialogue and cooperation. This would be highly applicable to most nations and would provide benefit to both developed and developing states.

Another lesson that can be learned is the information-gathering potential that comes through the decentralized power structure. Although in Indonesia this remains to be institutionalized, the ability of local governments and communities to provide information on the marine spaces is highly valuable. Stakeholder consultation has been highlighted in the other case studies as an important part of creating an IOM, but in developing nations, there are often issues with the time it takes to travel from one area to another. Using local governments to gather the information may allow to save time and costs during the consultation process.

5. CONCLUSION

IOM has become increasingly important over the past decades. The increasing demands placed on the planet through population growth and technological development must be managed to ensure the future health of the planet. Oceans play a very important role in maintaining the health of the globe and in the world economy. The recent focus on blue growth and the blue economy must be matched with sustainable, cross-sector management plans for the oceans.

The case studies demonstrate both the successes and challenges a country faces when developing an IOM policy. The historical and cultural contexts play a role in how governments are able to create and implement policies. In Norway, the Government is able to draft, implement and enforce laws in a relatively short time, whereas in Indonesia, planning and coordination may take much longer. Namibia's cultural heritage has given the country strong governance abilities, which it has used to create vibrant ocean industries. And yet, countries are not always trapped by their histories; for example, despite Angola's devastating past, the country remains committed to the BCC and thus the responsible use of their oceans.

The relative power of each marine industry in each case may have some bearing on the marine management plans, such as in Norway, whose fishing industry is powerful because of its long history, and its management plans aim to maintain the health of the fish stocks and ecosystems. However, in Indonesia, fisheries have relatively less power, and thus do not have a strong voice in policy-making. It is important for each country to consider the relative power of each industry during the stakeholder consultation process while moving towards equal representation.

This report explores ideas of IOM from a policy perspective through the use of four case studies, Norway, Namibia, Angola and Indonesia. This report is very timely in light of the recent inclusion of IOM, both in the EEZ and ABNJ, in the public debates of the marine sector. The goal of opening up this topic for consideration and review has been accomplished within the given timeframe and resources available for research. It is hoped that this report will generate interest and discussion.

Further, studies focused on LMEs as management tools and how to use these regional bodies to support countries in developing IOM. Indeed, FAO is participating in some of this ongoing research through the EAF-Nansen Strengthening the Knowledge Base for and Implementing an Ecosystem Approach to Marine Fisheries in Developing Countries project, which is beginning to shift focus from exploration to regional fisheries and ocean management. Through the Nansen project, FAO has the opportunity to contribute to the growing body of knowledge on ocean ecosystems and support regional management bodies to help foster Blue Growth around the world. Further research with even greater depth, including practical applications would be very beneficial to the development of the Blue Growth Initiative.

6. REFERENCES

Asmarini, W. & Jensen, F. 2014. Refile - Update 3 - Indonesia's mining ministry looks to ease mineral export ban. *Reuters*.

Ban, N.C., Bodtker, K.M., Nicolson, D., Robb, C.K., Royle, K. & Short, C. 2013. Setting the stage for marine spatial planning: Ecological and social data collation and analyses in Canada's Pacific waters. Marine Policy, Volume 39, May 2013, pp. 11–20, http://dx.doi.org/10.1016/j.marpol.2012.10.017

Ban, N.C., Maxwell, S.M., Dunn, D.C., Hobday, A.J., Bax, N. J., Ardron, J.A. & Gjerde. 2014. Better integration of sectoral planning and management approaches for the interlinked ecology of the open oceans. *Marine Policy*, pp. 127–136.

Benguela Current Commission (BCC). 2013. *About section of the Commission's website*. www.benguelacc.org/index.php/en

——. 2014. Strategic Cation Program 2015–2019. Swakopmund, Namibia.

Central Intelligence Agency (CIA). 2015. *World Factbook* [online]. www.cia.gov/library/publications/the-world-factbook/

Curtin, R. & Prellezo, R. 2010. Understanding marine ecosystem based management: A literature review. *Marine Policy*, 821–830.

Edwards, S. F., Link, J. S. & Rountree, B. P. 2004. Portfolio management of wild fish stocks. *Ecological Economics*, pp. 317–329.

Energy Information Administration (EIA). 2014. *Norway Analysis.* [online]. www. eia.gov

FAO. 2002. Information on fisheries management in the Republic of Namibia. Rome. www.fao.org/fi/oldsite/FCP/en/NAM/BODY.HTM

FAO. 2007. *FAO Fisheries Country Profile – Namibia*. ftp://ftp.fao.org/FI/DOCUMENT/fcp/en/FI_CP_NA.pdf

FAO. 2014a. Blue growth – unlocking the potential of the seas and oceans. [online]. Rome. www.fao.org/zhc/detail-events/en/c/233765/

FAO. 2014b. Fishery and Aquaculture Country Profiles – Angola. [online]. Rome. www.fao.org/fishery/facp/AGO/en

FAO. 2014c. FAO fisheries and Aquaculture Department. The Republic of Angola. www.fao.org/fishery/facp/AGO/en

FAO. 2015. *Asia and the Pacific's Blue Growth Initiative* [online]. Rome. www.fao.org/asiapacific/perspectives/blue-growth/en/

Fleischman, F., Ban, N., Evans, L., Epstein, G., Garcia-López, G. & Villamayor-Tomas, S. 2014. Governing large-scale social-ecological systems: Lessons from five cases. *International Journal of the Commons.*

Gneezy, U. & List, J. 2013. The why axis: hidden motivation and the undiscovered economics of everyday life. Public Affairs.

Gopnik, M. 2015. From the Forest to the Sea - Public Lands Management and Marine Spatial Planning. New York: Routledge.

Government of Namibia. 2000. *Marine Resources Act 2000.* Windhoek, Namibia.

Halpern, B.S., White, C., Lester, S.E., Costello, C. & Gains, S.D. 2011. Using portfolio theory to assess tradeoffs between return from natural capital and social equity across space. *Biological Conservation*, pp. 1499–1507.

Hardin, G. 1968. The tragedy of the commons. *Science Magazine*, pp. 1243–1248.

Hoagland, P. & Ticco, P. 2001. Marine policy overview. *Encyclopedia of Ocean Sciences*, pp. 664–671.

Kaufmann, D., Kraay, A. & Mastruzzi, M. 2014. The Worldwide Governance Indicators [online]. http://info.worldbank.org/governance/wgi/index.aspx#home

Knol, M. 2011. Mapping ocean governance: from ecological values to policy instrumentation. *Journal of Environmental Planning and Management*, pp. 979–995.

Libecap, G.D. 2009. The tragedy of the commons: property rights and markets as solutions to resource and environmental problems. *Journal of the Australian Agricultrual and Resource Economics Society*, pp. 129–144.

Namdeb. 2015. History. Windhoek. www.namdeb.com/about_namdeb_history.php

Organisation for Economic Co-operation and Development (OECD). 2007. *African Economic Outlook. Angola*. Paris.

Organisation for Economic Co-operation and Development (OECD). 2008. *African Economic Outlook. Namibia*. Paris

Olsen, E. 2013. *Combining sustainable use and biodiversity protection in MSP – The Norwegian integrated management plans*, p. 20. Sweden, IMR.

Ostrom, E. 1990. Governing the commons: the evolution of institutions for collective actions. Cambridge, Cambridge University Press.

Ottersen, G., Olsen, E., van der Meeren, G. I., Dommasnes, A. & Loeng, H. 2011. The Norwegian plan for integrated ecosystem-based management of the marine environment in the Norwegian Sea. Marine Policy, pp. 389–398.

Paliwal, R. 2006. EIA practice in India and its evaluation using SWOT analysis. *Environmental Impact Assessment Review*, Vol. 26, Issue 5, July 2006, pp. 492-510. http://dx.doi.org/10.1016/j.eiar.2006.01.004.

Pressey, C.R. 2000. Systematic conservation planning. *Nature*, pp. 243–253.

NACOMA. 2009. *The Namib Desert Coast* [Video]. Namibian Coast Conservation and Management.

Protect Planet Ocean. 2010. *Why are oceans important?* [online] www.protectplanetocean.org/collections/introduction/introbox/oceans/introduction-item.html

Satria, A. & Matsuda, Y. 2004. Decentralization of fisheries management in Indonesia. *Marine Policy*, pp. 437–450.

Smith, H. 2000. The industrialisation of the world ocean. *Ocean & Coastal Management*, pp. 11–28.

Statistics Indonesia. 2015. [online]. www.bps.go.id/linkTabelStatis/view/id/1200

Suuronen, P. 2015. Conservation of young fish by management of trawl selectivity.

Terrados, J., Almonacid, G. & Hontoria, L. 2007. Regional energy planning through SWOT analysis and strategic planning tools: Impact on renewables development. Renewable and Sustainable Energy Reviews, Vol. 11, Issue 6, August 2007, pp. 1275–1287. http://dx.doi.org/10.1016/j.rser.2005.08.003

The Economist. 2015. Indonesia's marine policy – For the new administration, the path to prosperity is a watery one. [Cited 3 January 2015]. Asian edition.

The Hofstede Centre. n.d. *National culture* [online, cited 20 April 2015]. http://geert-hofstede.com/national-culture.html

The World Bank. 2015. *GINI index* (*World Bank estimate*). [Online]. http://data.worldbank.org/indicator/SI.POV.GINI

UNDP. 2014. *Human development report 2014 – Sustaining human progress*. New York, USA.

United Nations Educational, Scientific and Cultural Organization (UNESCO). Intergovernmental Oceanographic Commission. 2014. *Management procedures and policies leading to the sustainability of coastal and ocean environment and resources*. [online]. www.unesco.org/new/en/rio-20/saving-our-ocean/statement-iocs-contribution/

van Leeuwen, J., Raakjaer, J., van Hoof, L., van Tatenhove, J., Long, R. & Ounanian, K. 2014. Implementing the Marine Strategy Framework Directive: A policy perspective on regulatory, institutional and stakeholder impediments to effective implementation. *Marine Policy*, pp. 325–330.

Yin, R. 2003. *Case study research: design and methods*. Thousand Oaks: SAGE Publications Inc.

APPENDIX 1

MARINE POLICY DEVELOPMENT METHODS

There are many methods that countries use to build and implement marine policies. These range from licensing and ITQs to Marine Protected Areas (MPAs). The methods stem from two general backgrounds: geographic-based and economic-based. Most countries use a mix of these methods to arrive at an ocean or marine policy. Each of these methods is discussed below.[2]

Geographic-based methods

Geographic-based methods are based on mapping ocean and coastal areas to identify valuable and vulnerable areas for each of the marine industries. These maps are then used to create zones to protect vulnerable ecosystems, and occasionally zones for each of the industries to operate within. This process generally begins by identifying the most delicate ecosystems through environmental impact assessments (EIAs), e.g. spawning grounds, and identifying the location of stationary resources, e.g. oil and gas fields. After identifying these areas, different tools, such as zoning, reserves and MPAs can be used to accommodate the different marine industries.

Within the geographic-based methods there are different kinds of mapping processes that put emphasis on different goals. Systematic conservation planning (SCP), for example, places a high value on ecosystem and environmental health by first identifying the weak ecosystems and areas important for biodiversity and then building policies to protect these areas. Marine spatial planning (MSP), by contrast, places greater emphasis stakeholder involvement and an IOM approaches (Ban et al, 2014).

SCP is focused on maintaining biodiversity and protecting vulnerable ecosystems. It requires the use and identification of measures of biodiversity and ecosystem health throughout the planning process to ensure that the goals of the plan are met, and that the areas selected for new reserves will be effective. After establishing marine reserves, SCP continues to use key features of the environment to ensure the ongoing health of the ecosystem through adaptive management (Pressey, 2000).

MSP takes into account the spatial and temporal distribution of marine industries in order to maximize economic, environmental, and social welfare (UNESCO, 2014). The features of an MSP plan are an interlinking system of policies, plans and regulations ensuring that all stakeholder views are taken into account and the marine environment usage is maximized. MSP must have many objectives and be spatially focused, and address the interdependence and interrelationships of the industries and the environment.

[2] Another interesting aspect of ocean policy is the application of simple game theory to the policy process which not only as applies to the strategic decisions between stakeholder interests, but also to the uncertainty of the impact on the environment for all activities. This section will be added later.

Both SCP and MSP develop plans and policies that protect vulnerable or valuable ecosystems by using marine reserves, MPAs, seasonal closures or through ocean zoning (Curtin and Prellezo, 2010). Marine reserves, although a type of MPA, are the most extreme of the three tools discussed and are akin to nature reserves on land. These reserves generally prohibit all economic activities within the bounds. MPA, by contrast, will often allow for limited exploration or use of the area, within strict guidelines. Seasonal closures are used for all industries, minimizing the impact of human activities on certain ecosystems at biologically important times. For example, in Norway, oil and gas exploration using seismic surveys is not given licences during spawning seasons. Finally, ocean zoning is used to separate various marine activities as a way to control the impact of each industry on the others, and on the environment. Under these policies, industries must seek permission or permits to carry out activities; fisheries must have licences and catch permits, and oil and gas must have permits for the marine blocks in which they wish to work.

Mapping methods of ocean management are very useful, and can incorporate different industry views and serve different goals (i.e. fishing community empowerment, environmental protection). However, mapping can also be highly susceptible to biases. Knol (2011) points out that maps not only reflect reality, but also can be used to create and implement policy. MSP can be subject to manipulation without strict governance; stakeholder groups may exaggerate marine weaknesses to protect areas or interfere with oil or mining operations (ibid.).

Economic-based methods

The economic-based management methods are based on aligning the motivations for all sectors with the goals of the policies (Libecap, 2009). Without incentives, private actor motivations are profit-driven and short-term. Oil companies make efforts to extract as much oil as possible with minimal wastage, but with little regard to the environment. Shipping firms will take the shortest route possible to economize on fuel costs. Fishing companies try to extract the greatest catches of fish, leading to overfishing. The fishing industry in many countries has now consented to constraining catches in the short term to ensure that the fish stocks remain stable, thereby ensuring profits in the future. However, even this change in motivation, i.e. shifting from profit now to ongoing but lower year-to-year profit, requires some external input from marine scientists and governments.

Aligning motivations can be accomplished in two ways, either through financial incentives and disincentives, or through the distribution of property rights. Financial incentives in the case of maintaining healthy marine environments can take the form of tax breaks or access to funding for companies that lower pollution levels or clean polluted areas. Financial disincentives take the form of tax on pollution/polluters, fines levied, and licensing fees for use of areas (Halpern *et al*., 2011). But these financial methods rely heavily on the transparency and integrity of the government, and on the culture. Further, creating fines that will incentivize effectively is difficult; if the fine is too low, it can act as an incentive rather than disincentive to pollute because it may be cheaper for the company to pay the fine than to comply with regulations (Gneezy and List, 2013).

Property rights can be distributed through zoning or tradable zoning rights. Within fisheries, the distribution of property rights takes the form of tradable harvesting rights (individual transferable quotas, or ITQs) (Edwards, Link and Rountree, 2004). Although in this system the total limit of fish that can be caught is set, the rights are auctioned to the industry, and then are tradable between industry players. Similarly, property rights could be issued for the maintenance of ecosystem health and would take the form of tradable pollution permits; again, the overall level of pollution is set by the regulator (i.e. number of permits), but the permits can be traded among market players. Property rights are a highly effective way to align the motivations of private players with the sustainability goals because it forces them to internalize the social benefits and costs.

To successfully implement a property rights system, there must be a strong government and culture; if both are weak, then the permits will essentially be useless. Policy-makers must consider how best to capture the resource rents, i.e. through licensing fees, cost of ITQs, etc. (Libecap, 2009). It is important for the regulators to capture resource rents in order to improve the industry and to compensate impacted communities.

Another economic-based management method is the portfolio approach, which entails maximizing overall profits from the marine industry by weighing the risks and rewards of each industry over the long term. In this approach, the regulator must weigh and make trade-offs in the marine industry portfolio to minimize the negative externalities of each industry and create the highest profit portfolio (Halpern *et al*., 2011). According to this approach, regulators must ensure that all stakeholders concerns are heard and that accurate information about the impacts and revenues of each industry are consulted.

The portfolio approach requires the regulator to have a deal of information in order to be able to create the portfolio of industry activities. A proxy for extensive environmental impact assessment (EIA) studies that are often used in mapping methods is the local knowledge of the marine environment and impacts of different industries; however, any bias in these communities must be known and managed (Knol, 2011).

The economic-based methods can be highly effective; however, the reliance on robust information can lead to extended planning phases when trying to build policy. When possible, local knowledge can be used to accelerate the creation of policies with built-in revision periods to assess how well the policies are working and make adjustments as necessary. This can also give the regulators more time to gather information on the environment.

APPENDIX 2

LARGE MARINE ECOSYSTEM MANAGEMENT

The concept of the Large Marine Ecosystems (LMEs) was developed in the 1980s and has been widely embraced by the world. The United Nations Environment Programme (UNEP) describes LMEs as:

> *regions of ocean encompassing coastal areas from river basins and estuaries to the seaward boundaries of continental shelves and the outer margins of the major current systems. These areas of the ocean are characterized by distinct bathymetry, hydrography, productivity and trophic interaction. They provide a flexible approach to ecosystem-based management by identifying driving forces of ecosystem change, within the framework of sustainable development. LMEs are located within Regional Seas areas.*

There has been a move towards creating regional bodies that help countries to manage shared LMEs. For example, the Benguela Current is jointly managed by Angola, Namibia and South Africa through the BCC. There are many LME organizations that are assisting member countries through scientific and information gathering, policy and management support and facilitating their cooperation.

This move was an important step in recognizing the fragility and interconnectedness of the oceans. This recognition and trend towards LME management will help move the world towards sustainable ocean management. Just as in the fishing industry, there is an ongoing still from managing individual stocks, to examining the interactions between stocks and ecosystems under the Ecosystem Approach to Fisheries (EAF).

It is also important for nations to consider oceans from an LME perspective when creating policies and laws because each LME has its own characteristics. Norway, for example, has three LMEs and three integrated ocean management (IOM) plans to ensure that the unique characteristics of each LME are considered in the management of resources.

APPENDIX 3

IMPACT OF PETROLEUM ON FISH

The full impacts of offshore oil and gas operations are not yet known. However, below is a short list of the known or suspected impacts.

Offshore oil operations affect the environment in different ways:[3]

- **Surveying for oil – seismic surveys**
  - Temporary displacement of marine life due to loud noises.
  - Temporary displacement can have a major impact if seismic surveys are carried out in spawning grounds during spawning season.

- **Location of petroleum platform**
  - Permanent or temporary displacement of marine life from areas around platform; potentially a major impact if platform is located near or in spawning grounds.

- **Ongoing operations**
  - Displacement, avoidance, change of navigation patterns for marine life around the platforms.
  - Constant water discharge from platform creates local impacts.
  - Level of impact depends on type and concentration of chemicals/pollutants in water. Potential small oil spill near platform has local impacts, can cause displacement and have negative developmental effects on larva, eggs and juveniles.

- **Oil spills/blowouts**
  - Oil spilled that comes into contact with fish larva, eggs and juveniles can have fatal or non-fatal impacts. Oil spills have negative impacts on marine life habitat, ecosystems and ecosystem services.
  - The use of dispersants to help oil break down has a more negative impact on the environment locally, but minimizes the impact at further distances.
    - Since dispersants are highly toxic, they can have a more negative impact than an oil spill if not mixed with oil.
  - The impact on larva and eggs also depends on the temperature of the water; higher temperatures result in more active larvae, and therefore more impact. Further, at higher temperatures, more of the oil will evaporate from the sea surface and there may also be a faster microbial degradation of the oil components.

[3] Impacts listed are sourced from academic articles and expert interviews.

APPENDIX 4

IMPACT OF SEABED MINING

Although not a new concept, deep seabed mining is a new and untested industry. There have been some seabed mining operations over the last several decades, i.e. diamonds in Namibia and tin in Indonesia. However, there has been limited deep seabed mining, and thus the impacts of operations are not yet known.

Research is now being conducted to determine what the impacts of mining activities will be and their severity. Despite these studies, the full impacts will likely only be learned over time as the industry matures. The main expected impacts from seabed mining are:[4]

- changes in the seabed landscape by removing nodules from the sea floor, changing sea mounts or thermal geysers;
- changes in the habitat for marine life;
- sediment plumes, which will cause a reduction of oxygen and light in the water column and an introduction of metals into the water column.
- a disruption in the seafloor and a redistribution of sediments, causing some Benthic ecosystems and creatures to be buried;
- very slow ecosystem recovery from the changes to the seafloor and displacement of marine life.

[4] Impacts listed are sourced from expert interviews.