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Marine regional planning measures to improve the sustainability of the Seaflower MPA in the Colombian Caribbean Sea/

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MARINE REGIONAL PLANNING MEASURES TO IMPROVE THE SUSTAINABILITY OF THE SEAFLOWER MPA IN THE COLOMBIAN CARIBBEAN SEA

By

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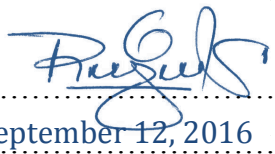
DECLARATION

I certify that all the material in this dissertation that is not my own work have been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

(Signature): 

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ABSTRACT

Title of Dissertation: **Marine regional planning measures to improve the Sustainability of the Seaflower MPA in the Colombian Caribbean Sea**

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The dissertation is an analytical review of the available literature on marine protected areas (MPAs), and a proposal for some governance, and spatial management mechanisms in the Colombian Caribbean Sea, particularly in the Seaflower MPA.

The Seaflower MPA is facing several challenges regarding political issues of boundary disputes and also adverse impacts on the marine environment from the increase in shipping activities. This is largely due to the expansion of the Panama Canal and the possible Nicaragua Canal, which is predicted to increase the maritime traffic of international shipping to almost double that of today. In addition, the increase in seabed activities such as oil and gas exploitation is also a threat to the ecosystems within it.

This research describes the Colombian framework of MPAs, and it also shows the issues that the Seaflower MPA faces today. The aim is to propose and to recommend clear governance and management measures based on the ecosystem-based approach to establishing a transboundary agreement maintaining the integrity of the MPA and giving regional relevance for the protection of the unique ecosystems. Furthermore, to address the issues of negative impacts from shipping, some protective measures are recommended to protect the ecosystems and safe navigation, guaranteeing long-term sustainable development.

Keywords: MPAs, EBM, Colombia, The Seaflower MPA, boundary issues, ship-source impacts, governance, Transboundary agreement, PSSAs, Protective measures, sustainable development.

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LIST OF ABBREVIATIONS

AFS	Antifouling Convention
AIS	Automatic Identification System
ANH	National Agency of Hydrocarbons
APMs	Associated Protected Measures
BR	Biosphere Reserve
BWMC	Ballast Water Management Convention
CARs	Regional Autonomous Corporations
CBD	Convention on Biological Diversity
CCO	Colombian Ocean Commission
CEP	Caribbean Environment Programme
CLME	Caribbean Large Marine Ecosystem project
CMS	Convention on Migratory Species of Wild Animals
CO_2	Carbonic Dioxide
CORALINA	Regional Corporation for the San Andres Archipelago
DIMAR	General Maritime Directorate
EMB	Ecosystem-Based Management
EEZ	Economic Exclusive Zone
EU	European Union
FAO	Fisheries and Agriculture Organization
GDP	Gross Domestic Product
GEF-LME	Global Environment Facility-Large Marine Ecosystems Project
GHG	Green House Gas Emmissions
HSC Code	High-Speed Craft Code
Hz	Hertz (Frequency Unit)
Ibero-MAB	Ibero-American MAB Network
ICJ	International Court of Justice

ICM	Integrated Coastal Management
ICZM	Integrated Coastal Zone Management
IMO	International Maritime Organization
INVEMAR	Marine Research Institute and Coastal "Jose Benito Vives de Andreis"
IOC	Intergovernmental Oceanographic Commission
IUCN	International Union for Conservation and Nature
IUU	Illegal, unreported and unregulated
IWC	International Whaling Commission
KMI	Korean Maritime Institute
LCVs	Large Commercial Vessels
LMEs	Large Marine Ecosystems
MAB	UNESCO Man & Biosphere Programme
MADS	Ministry of environment and Sustainable Development
MARPOL 73/78	International Convention for the Prevention of Pollution from Ships
MDGs	Millennium Development Goals
MEAs	Multilateral Environmental Agreements
MPAs	Marine Protected Areas
MSP	Marine Spatial Planning
NGOs	Non-Governmental Organizations
NWG	National Working Group
PCG	Panama-Colombia Gyre
PSMM	Pelagos Sanctuary Marine Mammals
PSSA	Particularly Sensitive Area
PSU	Practical Salinity Units
Rio+20	United Nations Conference on Sustainable Development
RUNAP	Unique Registry of Protected Areas

SAMP	Subsystem of Marine Protected Areas
SAP	Strategic Action Plan
SDGs	Sustainable Development Goals
SINA	National Environmental System
SP	Special Areas
SPAW	Specially Protected Areas and Wildlife Protocol
SPNN	National Natural Parks System
TBMPAs	Transboundary Marine Protected Areas
TBPP	Transboundary Protected Peace Park
TSS	Traffic Separation Scheme
UAC	Environmental Coastal Units
UNCED	United Nations Conference on Environment and Development
UNCLOS	United Nations Convention on the Law of the Sea
UNCTAD	United Nations Conference on Trade and Development
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational Scientific and Cultural
UNSD	United Nation Sustainable Development Division
VTS	Vessel Traffic Services
WCMC	World Conservation Monitoring Centre
WCPA	World Commission on Protected Areas
WCR	Wider Caribbean region
WHC	World Heritage Convention
WNBR	World Network of Biosphere Reserves

INTRODUCTION

In recent times, oceans have become more industrialized, facing several issues that generate conflict between economic and environmental protection values. For instance, the increase in shipping activities is causing issues such as increases in marine invasive species, as well as of CO_2 emissions and underwater noise (IMO, 2012), which are causing massive losses of native ecosystems. Furthermore, drilling activities related to the exploitation of the seabed around the world are becoming increasingly common (ISA, 2008) as new technologies are developed in the industry.

Furthermore, transnational threats such as illegal fishing, piracy, drug smuggling, slavery and illegal migration are also contributing as stressors of the marine environment (Patrick & Storm, 2013). These transnational threats are contributing in some manner to marine pollution and consequently causing degradation of the marine environment (Van Tatenhove, 2013). Additionally, climate change effects are now more evident, degrading ecosystems such as coral reefs, causing migration of fish, and creating an imbalance in habitats (Harrould-Kolieb & Herr, 2012).

The reason these issues persist is that there is still a lack of compliance by states with the international framework and awareness from all stakeholders with the sustainable development of the marine environment; there are also weaknesses in the existing local framework, and enforcement measures. However, many people from the scientific community and environmental institutions (EU, 2015) have raised their voices in concern, to take actions to tackle the issues and manage the oceans effectively (Jones, 2014; Kelleher G. , 2015).

Therefore, the United Nations, through its specialized agencies, is making efforts to address these problems (UNSD, 2015). They have called for the participation of all responsible actors, i.e., member states, Non-Governmental Organizations (NGOs), the shipping industry, communities, and academia, to adopt the strongest measures in a cooperative manner to ensure the sustainable development of ecosystems for our future generations. Nevertheless, it must still be a requirement that the protection of biodiversity has a strong relevance at all levels of society.

As a result, several initiatives in marine governance have been put into play. At the end of the 20th century, the United Nations upgraded and updated the Convention on the Law of the Sea (UNCLOS) as a necessity to improve governance and protection of the environment (Jones, 2014). Operational activities in marine spatial planning (MSP) have emerged as a solution to address those problems through an enormous process of analysis to manage at both spatial and temporal levels, the distribution of human activities in the oceans (Vallega, 2001; 2002).

Furthermore, the improvement of cooperation mechanisms in the political process contributes to reaching environmental, social, and economic goals from coastal state jurisdictions including the exclusive economic zone (EEZ), especially in regional seas (Vallega, 2001; Osherenko, 2006; Van Tatenhove, 2013; Ehler, 2014). In addition, some states have assumed the leadership and started to approach conceptions of marine governance, focusing on marine and coastal protection, through the concept of Marine Protected Areas (MPAs).

Today, MPAs have been put into place as a suitable solution for protection of marine habitats and as an effective measure in marine spatial planning (Jones, 2014). It is considered an effective solution to counteract transnational threats and environmental problems caused by multiple marine activities (Kelleher, Bleakley, & Wells, 1995).

This is where environmental institutions such as the Non-governmental International Union for Conservation of Nature (IUCN) and United Nations Environment Programme (UNEP) are playing an important role developing initiatives for improvement and guiding countries in the designation of these areas to facilitate and support the management process (Van Tatenhove, 2013; Jones, 2014; Wright, 2014; Marine Conservation Institute, 2015). They have also increased the level of protection to restrict some human activities as a mechanism to ensure the long-term conservation of ecosystems (Jones & Qiu W, 2011; Van Tatenhove, 2013; Jones, 2014).

Likewise, The International Maritime Organization (IMO) is doing its part in the protection of the environment from impacts of shipping activities through the establishment Particularly Sensitive Sea Areas (PSSAs) (IMO, 2006). It has been an effective solution in foreseeing the conservation of marine habitats through the establishment of exclusion zones or limiting specific shipping activities. This includes maritime navigation in high-risk traffic areas to tackling the degradation of marine habitats from the adverse effects of it. However, MPAs require strong enforcement, monitoring, and control measures, especially in developing countries, to succeed in the governance process.

For instance, the Seaflower MPA in the Colombian Caribbean Sea, as one of the biggest protected areas in the Wider Caribbean Region (WCR), is facing many issues as a consequence of inadequacy of governance at national level (Taylor, Baine, Killmer, & Howard, 2013) as well as a lack of regional agreements and cooperation mechanisms between neighboring countries. Likewise, illegal fishing and overfishing are issues faced by the MPA. Furthermore, the increase in maritime traffic by the extension of the Panama Canal, and the possible further increase by the Nicaragua Canal contribute to the degradation of the ecosystems within the MPA. The consequences may an increase in invasive species from ballast water exchange, oil

pollution, and adverse wave making and underwater noise produced by propellers as an effect of maritime traffic. Moreover, an increase in seabed explorations might cause damage and pollution as well.

Therefore, The Seaflower MPA requires improvement of governance strategies at national and regional levels. Additionally, further special sensitive areas could be established as a measure against environmental threats around coral reef areas in the key islands.

This dissertation will address these concerns through the development of four chapters. Chapter one will show an analytical review of the existing literature on MPAs, starting with governance at the global level, down to the regional basis to analyze the current situation in the Caribbean Sea. Chapter two will show the current framework of Colombian MPAs focusing on the Caribbean area. Chapter three will discuss the real conditions of the Seaflower MPA, and their existing and future issues associated, mainly, with shipping activities. In addition, political issues, such as boundary disputes, that are threatening the integrity and the conservation objectives within the MPA will be highlighted. Chapter four will approach possible solutions to address the problems based on the analysis of some specific areas worldwide, taking into account best practices and spatial planning measures adopted therein. Finally, the paper concludes by proposing and recommending which of these actions can be taken to improve governance in the Seaflower MPA.

CHAPTER I: MARINE PROTECTED AREAS GOVERNANCE

1.1 Background

Approximately two-thirds of the world's surface is covered by water. Oceans, including the seabed and coastal areas, contain rich and diverse environments, fauna and flora, corresponding to 80% of Earth's biosphere, some of which are key ecosystems for life on Earth (Plata, 2009). Nevertheless, these ecosystems are being threatened by anthropogenic activities causing significant degradation (Jones & Qiu W, 2011). Therefore, to ensure the heritage for future generations, they should be protected, preserved and managed appropriately. In that sense, MPAs have become a suitable solution for the protection of marine/coastal ecosystems (Jones, 2014).

MPAs have undergone a gradual evolution from theory to practice. Thus, today 2.3% of the total global sea area is enclosed by MPAs (IUCN; UNEP-WCMC, 2013). However, the number of MPAs is quite low, compared with the 12.7% of land areas protected, and recent studies have shown a continuous degradation of the ocean biota. The adoption of measures to protect sensitive ecosystems such as coral reefs, mangroves, and fish stocks is a real step towards guaranteeing the integrity and preservation of these areas. It is, therefore, necessary to move towards a stronger MPA governance system that is also sufficiently attractive to stakeholders in order to connect the concerns of society and the scientific community to improve, in both management and governance, the state and balance of the oceans (Jones, 2014).

1.1.1 Definitions

When discussing MPA governance, it is important to acknowledge some definitions surrounding this broad subject. Van Tatenhove (2013, p. 298) makes an extensive review of the existing literature and defines ocean governance as *"... the rules of collective decision-making where there is a plurality of actors or organizations and where no formal control system can dictate the terms of the relationship between them*". Besides this, the concept encompasses a set of official rules involving formal and informal institutions and a negotiation process between them, which function at different levels to ensure effective integrated management. This concept leads to a policy-making process, sharing administration roles through many governing entities during a temporary period while the stabilization and organization of marine policy occurs.

To ensure effective ocean governance it is necessary to establish management strategies based on an ecosystem approach. Ecosystem-Based Management (EBM), have been defined since mid-1970s as "*a conceptual framework incorporating human activities undertaken at sustainable levels as an accepted element of ecosystem functioning*". Nevertheless, in 1992 the concept took strong place for international environmental organizations and was defined as "*a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way*" (UNEP, 2014a, p. 20).

Conversely, it is important to formally define the concept of protected areas, since it is considered an umbrella term for protecting marine environments based on EBM. Since 1994, the International Union for Conservation of Nature (IUCN) developed the first definition of protected areas. Then, in 2008 the IUCN World Commission on Protected Areas (WCPA), created a stronger definition, updating this concept. "*A protected area is a clearly defined geographical space recognized, dedicated and*

managed, through legal and other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values" (Dudley, 2008 as cited by Lausche (2011, p. 12)).

Both concepts, governance, and protected areas, involve a systematic process of setting rules within a particular zone, (i.e. marine) to exclude or limit commercial purposes and tackle degradation of oceanic ecosystems. This is managed by legal measures (policies) and also by formal agreements with the participation of all the intervening stakeholders through effective strategies to ensure the long-term preservation of the environment (Osherenko, 2006; Patrick & Storm, 2013).

As a result, IUCN-WCPA established a formal definition for MPAs: "*any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment*" (Lausche, 2011, p. 14).

1.1.2 History of MPAs

The concept of MPAs dates back thousands of years to the Polynesians. They, through a traditional management system, protected some coral reef areas considered sacred and untouchable. Similar traditions were shared by other cultures worldwide by way of some logical approaches, based on religious and ancestral traditions. They were effective in preserving and revitalizing fish populations in fishing communities around coral reefs (Johannes, 1978 as cited by Jones (2014)). From that perspective, MPAs have had quite a long and slow history, much more spiritual and religious than managerial.

The first country that used the concept of an MPA as a management approach was Australia when, in 1879, it created the Royal National Park in New South Wales. This MPA was composed mainly of land, following by estuaries and an open shoreline. After that, the United States started to lead in the field and in 1903 established the first MPA on Pelican Island. In 1913, an MPA system at Cabrillo National Monument in California was established. Subsequently, in 1935, a complete environmental MPA was put in place in Fort Jefferson, a subtidal area, to protect the Dry Tortugas coral reef (Jones, 2014; Tripp, 2014).

Nevertheless, in the following years, the development of MPAs was slow. However, the necessity to improve management methods and protection of marine ecosystems did take place, which is why, between the mid-1950s and early 1960s, there were several developments. In 1962, marine and coastal protection was discussed during the first World Conference on Nationals Parks, representing a significant formal step, toward adopting and developing the MPA concept globally (Jones & Qiu W, 2011). During the 1970s concern about environmental protection grew due to increasing technical capability in the exploitation of marine resources. On that basis, several conventions such as the Ramsar Convention (1971) and the World Heritage Convention (1972) were developed in the following years. Simultaneously, the United Nations Council created the UNEP as the first body in charge of monitoring and reviewing environmental issues at an international level. After the establishment of UNEP, there was a considerable advance in the development of MPAs, from 118 in the 1970s to 718 between the mid-1980s and early 1990s (Kelleher & Kenchington, 1992).

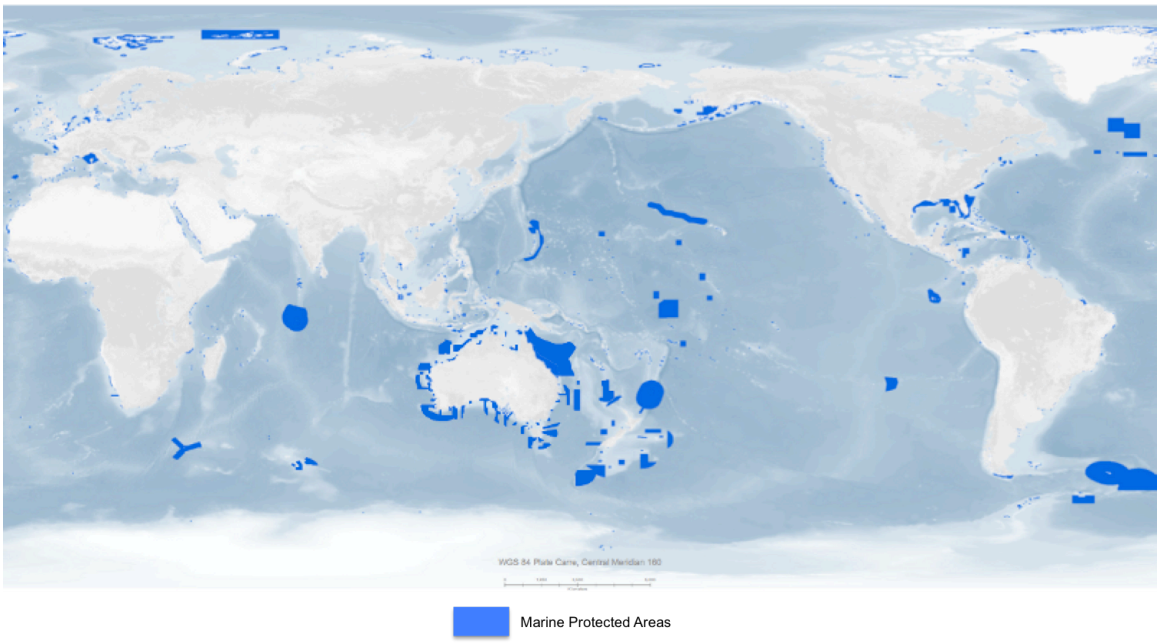
The designation of MPAs worldwide has grown exponentially, and by 2012, the number had increased to 10,000 representing approximately 2% (Figure 1) of the oceans' area (Jones, 2014). According to the Marine Conservation Institute (2015),

2.8% of ocean areas are under protection by 13,674 MPAs. This number is still is very low compared with the 15.4% of protected areas inland.

Nevertheless, MPAs coverage has grown because of awareness of the steady degradation that is being suffered by marine ecosystems such as coral reefs. This is especially true in tropical areas due to the increase in sea temperature as a consequence of climate change (Jackson, Donovan, Cramer, & Lam, 2014). Therefore, MPAs are considered an effective solution for the protection of those habitats that have been depleted due to unreasonable exploitation and impacts from anthropogenic activities (Jones & Qiu W, 2011). Nonetheless, MPAs effectiveness cannot be measured only by their designation; it is necessary to ensure effective protection measures.

Thus, MPA categories with different protection levels have been developed as a management approach, and enforcement solutions for achieving its conservation goals (Jones, 2014). In addition, marine governance has been strengthened to effectively address the measures taken in these particular areas, such as reaching the global Sustainable Development Goals (SDGs) by 2020 of increasing the number of MPAs to 10% within the oceans (UNSD, 2015).

Figure 1. The World Database on MPAs



Source: IUCN; UNEP-WCMC **(2013)**

1.2 WORLDWIDE MARINE GOVERNANCE

The exploitation of oceans through new technologies started taking place in the 1980s when the oceans became more industrialized, and transnational threats increased (Van Tatenhove, 2013) at the same time as shipping activities were increasing (Jones, 2014). Therefore, the impacts of pollution on the oceans are high, and marine ecosystems continue to suffer deterioration due to shortcomings of regulation, legislation and enforcement (Fanning, et al., 2007) worldwide. Thus, broader conceptions relating to governance have started to be developed rigorously (Vallega, 2001).

The following sections will describe the international instruments that have been implemented to support the establishment of MPAs to date.

1.2.1 United Nations Convention on the Law of the Sea (UNCLOS 1982)

UNCLOS is the Umbrella convention of all international treaties developed since the mid-twentieth century (Vallega, 2001) and several changes were made up to the last update in 1982. As the mother of the international binding regulations, it deals broadly with all matters related to oceans including closed and semi-closed seas (Vallega, 2002). Furthermore, through these essential principles, it gives provisions to states regarding the rights and duties in the development of policies under EEZ jurisdiction, and on the high seas (Umana, 2002; Jones, 2014). Nonetheless, the interest of this analysis is to discuss the framework related to the conservation and management of marine resources focusing on MPAs under national jurisdiction.

UNCLOS part XII contains provisions related to the protection and conservation of the marine environment through sustainable development (UNCLOS, 1982). Furthermore, in other sections of the Convention, it establishes the duty of states to cooperate in relation to environmental matters (Van Tatenhove, 2013; Wright, 2014). Cooperation is the most important principle enforcing the convention because it is the appropriate mechanism wherein coastal states are accountable to undertake measures to deal with all transnational threats that are affecting and degrading the marine environment today. Besides it is necessary to work together with specialized organizations (Umana, 2002; Jones, 2014) to address the issues efficiently.

Furthermore, UNCLOS gives broader provisions in Articles 194 and 211 regarding environmental protection and preservation of ecosystems through the establishment of special areas (UNCLOS, 1982). For instance, it establishes general rules under which states can act concerning their sovereign rights and perform mechanisms such as the creation of MPAs (Vallega, 2001; Umana, 2002; Jones & Qiu W, 2011).

Moreover, taking into account UNCLOS, several UN specialized organizations started to develop a mechanism in matters concerning the protection of marine ecosystems. The main goal is to fill the interpretation gaps that the umbrella convention has, adapting to the challenges of the 21st century (Vallega, 2001).

In this regard, The IMO is addressing some mechanisms to protect the environment, through the establishment of special areas such as PSSAs (IMO, 2006) that are being affected by shipping activities (Van Tatenhove, 2013; Wright, 2014). The aim is to protect and preserve rare or fragile ecosystems in the long-term (UNEP, 2012; Jones, 2014). In this respect, States have demonstrated their concern to enhance the MPA approach, since 1992, in the global conference on environment and development.

1.2.2 United Nations Conference on Environment and Development (UNCED) – Agenda 21 (1992)

Agenda 21 is the result of the first steps that the UN undertook to reach the goals and priorities regarding sustainable development of the environment for the twenty-first century. This agenda was adopted during the Earth Summit (UNCED) in Rio de Janeiro, Brazil in 1992 with the participation of over 170 member states (UNSD, 2015).

The scope of the agenda was based on the provisions made by UNCLOS. Thus, the agenda is a non-binding action plan formed of four sections, wherein section II encourages the states to undertake measures to protect fragile environments, conservation of biodiversity, and control of pollution among others (UNSD, 2015). It was voluntarily implemented by UN member states and executed at the national level but also on a global scale. This plan agreed to keep an efficient development through a permanent follow-up and the establishment of international partnerships (Lausche, 2011; UNSD, 2015).

The global alliance was developed with the aim of balancing and integrating environment and development as one concept to address several issues regarding the effects of anthropogenic activities such as climate change that can only be solved at the highest level of cooperation. To strengthen cooperation efforts, Chapter 2 of the agenda addressed these concerns by way of sub-regional, regional and international organizations stepping up sustainable development in developing countries to succeed in the long-term (UNCED, 1992; Lausche, 2011). However, its successful implementation has to be a responsibility of governments at a national scale through the execution of strategic action plans and policies within their territories.

Moreover, as was mentioned, section II leads with matters concerning conservation and management of resources for development. Specifically, Chapter 17 put emphasis on "*protection of the oceans, all kind of seas, including enclosed, semi-enclosed seas, and coastal areas and the protection of rational use and development of their living resources*" (UNCED, 1992, p. 168; Umana, 2002, p. 34).
As the concern is mainly related to sustainable use and conservation of marine living resources, it places emphasis on national jurisdictions, and their obligations and rights regarding preservation and rational use of their resources. Chapter 17 also sets rules concerning the sustainable development of fisheries and the management of related activities (UNCED, 1992). Therefore, it obligates coastal states to undertake measures to enforce preservation and restoration of their threatened ecosystems such as coral reefs, mangroves, and seagrass beds. Put simply, it encourages states to develop mechanisms to protect areas minimizing adverse impacts on the marine environment. This is when MPAs play a major role in doing so (Umana, 2002; Lausche, 2011).

Despite that, UNCED has led different approaches for marine and coastal development, focusing more on high-level management integration. It has been

working on specific environment-based management programs in coastal states and small islands jurisdictions (including EEZ) and high seas (Umana, 2002). The aim is to "*integrate management and sustainable development; marine environmental protection; sustainable use, and conservation of marine resources addressing critical uncertainties within marine ecosystems like climate change, strengthening regional and international cooperation and coordination*" (UNCED, 1992, p. 168).

Thanks to the commitment and contribution of member states supplying information related to the status of marine habitats and ecosystems, UNCED developed the World Ocean Assessment. This review provides analysis, evaluating the sustainability of oceans on how they have been managed at both global and regional levels (UNEP, 2014b). Nevertheless, these efforts for the protection of particular ecosystems are being supported by a convention related to protecting biodiversity and ecosystems.

1.2.3 Convention on Biological Diversity (CBD)

The CBD is the result of environmental organizations commitment on biological sustainable development. In 1988, a UNEP initiative started the development of the Convention, which was adopted at the UNCED (the Rio Earth Summit), in 1992 and entered into force in 1993, with the participation of 196 member states (CBD, 2016). The aim is to provide a globally binding framework based on an EBM, concerning the sustainable use of the components of biodiversity, based upon the conservation of biotas and cooperation through the interchange of equal benefits from genetic resources (Kelleher, Bleakley, & Wells, 1995). Nevertheless, this cannot be done without enforcement at the national level; likewise, the development of agreeable measures such as the Strategic Action Plan (SAP) and domestic programs, which cover the objectives of the Convention (Kelleher, Bleakley, & Wells, 1995; Umana, 2002).

In that sense, the Convention imposes some obligations. Article 6 gives tools and provisions for governments regarding the integration of those strategies under national jurisdictions. Article 8 refers to *in-situ* conservation measures and gives provisions through the establishment of the protected areas system, enforced by domestic legislation, to preserve ecosystems against threats such as invasive and alien species, and degradation of those biotas by human activities (CBD, 1992). Finally, the adoption of these actions shall be taken through the involvement of local stakeholder communities to ensure the equitable allotment of benefits resulting from them (Umana, 2002; Lausche, 2011; CBD, 2016).

As compromises of the Convention, parties agreed to develop a regular meeting to review the SAP to manage and address governance. Therefore, in 1995 the Jakarta Mandate on Coastal and Marine Biodiversity was issued (Umana, 2002). It identifies five activities that parties shall implement under the scope of the convention referring to marine habitats. The activities are, integrated coastal management (ICM); sustainable use of coasts and marine living resources; implementing feasible mariculture; preventing invasion of alien species; and creating MPAs (Lausche, 2011).

Likewise, in 2004 at its seventh meeting, a program to work on protected areas was adopted through decision VII/28 (CBD, 2016). The program is led by an *Ad-hoc* working group. The main objective is to look into cooperation options for the formulation of marine protected areas beyond national jurisdictions using UNCLOS as a basis. Moreover, it undertakes to identify mechanisms to finance small islands and developing countries taking into account Article 20 of the CBD (CBD, 1992). On the other hand, the group has to contribute to the development of instruments to identify, designate, and implement the management process on national and regional protected areas in ecological networks involving the local community and stakeholders (Lausche, 2011).

Finally, the Secretariat of the CBD recently updated its SAP for the period from 2011 to 2020, focusing on 16 goals and specific targets (Jones, 2014; CBD, 2016). They are: to restore approximately 15% of degraded areas by implementing conservation activities through proper and efficient MPA designations, effectively managed in a global network, making a special effort in reducing stressors on coral reefs areas mainly related to fishing activities (Lausche, 2011; Jones, 2014).

1.2.4 Code of Conduct for Responsible Fisheries (FAO)

The code of conduct was an initiative of the Fisheries and Agriculture Organization (FAO) as a contribution to reach the objectives of the UNCED Agenda 21. The main purpose is to assist, especially, developing countries in the conservation, responsible management and development of all fisheries within its jurisdictions (FAO, 1995).

In addition, the code has one particular objective related to promoting "*the protection of living aquatic resources and their environments in coastal and marine areas*"(Art 2) (FAO, 1995, p. 2). Thus, the general principle of the code is to establish that all marine ecosystems and fishery habitats in a critical situation of depletion, degradation and pollution due to anthropogenic activities, should be protected and rehabilitated through a stronger mechanism. In this regard, MPAs are the mechanism that can deal with these issues through effective MSP implementation.

The above mentioned has a close relationship with the efforts made by other UN organizations as part of the strategy to create biosphere networks as a measure to cope with vast areas for conservation of biodiversity and ecosystems through sustainable development.

1.2.5 UNESCO Man and Biosphere Programme

United Nations, Scientific and Cultural Organization (UNESCO) established the Man and Biosphere (MAB) Program in the early 1970s. It is an Intergovernmental Scientific Programme with the objective of improving the affinity of the environment with people on a systematic basis (Umana, 2002; Lausche, 2011; UNESCO, 2015).

The program encompasses the designation of Biosphere Reserves (UNESCO, 2015) which by definition are "*areas comprising terrestrial, marine and coastal ecosystems which are internationally recognized for promoting and demonstrating a balanced relationship between people and nature*" (Kelleher, 1999 cited by Umana (2002, p. 35)).

National governments nominate areas that become biosphere reserves, but remain their sovereign jurisdiction. Nevertheless, the international status is recognized according to the Statutory Framework of the World Network of Biosphere Reserves (WNBR) (UNESCO, 2014). The aim is to promote solutions for the conservation of ecosystems with sustainable use. Therefore, the purpose of these areas, as a scientific basis, is preventing and monitoring through management, all changes attributable to interactions between humans and ecological habitats (UNESCO, 2015).

Additionally, three principal aims have to be achieved by biosphere reserves. The first is to contribute to the conservation of landscapes, ecosystems, species and genetic variation. The second is to reinforce scientific research, monitoring, training and education through consistent ecological practices in surrounding areas. The third is to allow sustainable socio-cultural and environmental development in the part of the reserve named the "*transition area*" (UNESCO, 2015).

The MAB program has a strong connection with the Convention on World Heritage (WHC) due to the relevance of conservation for future generations. In some areas, this is through a cultural awareness such as the Great Barrier Reef in Australia, which has invaluable importance for humanity (Kelleher, Bleakley, & Wells, 1995). Today, the program manages a dynamic and interactive WNBR, which is mainly terrestrial but with an increasing number of maritime reserves. It is achieving a shareholder dialogue through the harmonious integration of people and environment with the objectives of reducing poverty, sharing knowledge, and respecting traditional beliefs to improve national welfare, besides facing the impacts of climate change using interdisciplinary research and innovate combinations for sustainable development (Umana, 2002; Lausche, 2011; UNESCO, 2015).

In that way, action plans have been developed to achieve the objectives of the program. Since 1995, the Seville Strategy suggests some solutions to reach sustainable development goals for the twenty-first century (UNEP, 2012). Likewise, as a result of the suggestions proposed in the Seville Strategy, the Madrid Action Plan was adopted in 2008. This plan joins the MAB and the WNBR in proposing an agenda to achieve their goals by 2013. Recently, this agenda was updated to continue reaching the goals for the following decade, until 2015, especially in the increase in MPAs (UNESCO, 2015).

Therefore, the MAB program supports countries in education and capacity building. This is achieved by strengthening activities through many programs and partnerships as a platform for cooperation and training in topics related to biosphere reserves (Kelleher, Bleakley, & Wells, 1995). In consequence, today there are over 600 biosphere reserves in 119 countries. The Caribbean Sea is part of the Ibero-American MAB Network (IberoMAB), which encompass 120 biosphere reserves under the jurisdiction of 21 countries (UNESCO, 2015). Colombia is one of these with three

biosphere reserves including the Seaflower Biosphere Reserve, the largest MPA in the Caribbean Sea (Taylor, Baine, Killmer, & Howard, 2013).

Furthermore, as part of the initiatives on environmental protection, the IMO sets provisions for the establishment of special areas threatened and degraded by the effects of shipping activities and ship-source pollution.

1.2.6 Special Areas (SP) and PSSAs under MARPOL 73/78

Since 1959, IMO as part of the UN system in charge of matters related to shipping and maritime safety, has assumed responsibility concerning pollution prevention, and its associated issues with the aim of mitigating the impacts on the environment as a consequence of maritime activities. There are over fifty binding agreements adopted by IMO to regulate shipping worldwide, out of which 21 encompass environmental concerns (IMO, 2016).

The role of IMO in achieving the protection of the marine environment through the concept of MPAs is, without any doubt, crucial. That is why, since 1991, IMO has under the MARPOL 73/78, by the Resolution A 720 (17), adopted and updated guidelines for Designation of Special Areas and Identification of Particularly Sensitive Sea Areas (PSSAs) (Blanco-Bazán, 1996; IMO, 2006). The aim is to avoid the discharge of polluted liquids and waste into the sea (Umana, 2002). In that sense, the Pollution Convention in Annex I, II, IV, and V defines some sea areas as "Special Areas" for scientific reasons concerning their natural conditions, which are vulnerable to stressors of maritime activities such as sea traffic (IMO, 2016). Therefore, a binding mechanism with a higher level of protection to preserve and to protect those environments from sea pollution is necessary.

Recently, IMO through Resolution MEPC.200 (62) (IMO, 2016) updated and established new requirements for the designation of Special Areas. The success of those provisions takes effect by the commitment of the coastal states to notify and to improve adequate reception facilities (MARPOL Annex IV) on the borders of those special areas. The resolution entered into force on January 1, 2013.

The criteria for the designation of both PSSAs and special areas are not mutually exclusive since both points can be identified as parts of one another (Umana, 2002; IMO, 2016), and are developed taking into consideration provisions made by UNCLOS. The most up-to-date guidelines for the designation of PSSAs were adopted by Resolution A.982 (24) on December 1, 2005 (IMO, 2006). The management practices for enclosed and semi-enclosed seas apply this concept in an accurate manner (Plata, 2009; IMO, 2016).

The document sets the criteria that coastal states must fulfil to obtain the designation from IMO. The information required from the area to be designated, at least, should meet one of the three criteria. These include: *ecological criteria* (rarity or uniqueness), the importance of biodiversity in the ecosystem, its vulnerability and degradation by ocean phenomena and/or anthropogenic activities; *socio-economic and cultural value* (tourism), and *scientific and educational* or historical value (IMO, 2006). There are additional associated protective measures that states can undertake to manage maritime activities and guarantee the safety of navigation within the PSSA, such as traffic separation schemes (routing), and vessel traffic services (VTS).

Moreover, the guidelines enforce the strict application of MARPOL provisions related to ships discharges (equipment on board) to avoid oil pollution and invasive species. Likewise, the guidelines determine provisions to supply information regarding the Automatic Identification System (AIS) from ships. Additionally, states have to provide

hydrography and marine weather information (IMO, 2016). The above mentioned is valuable in the risk assessment plan that coastal states must have to execute a proper management and governance inside the PSSA (Umana, 2002; IMO, 2003; IMO, 2006).

Although, the effectiveness of PSSAs concept has not been truly proved due to different interpretation and application of the concept by states (Roberts J. , 2007). Nonetheless, the IMO aims to continue increasing the number of these particular areas and, for instance, increase the development of systems (e.g. VTS, AIS) through the e-navigation concept to minimize the impact on the environment by shipping activities (Umana, 2002). Therefore, to date, IMO has designated fourteen PSSAs around the world. Colombia is one of the states that has one under its jurisdiction with Malpelo Island (Pacific Ocean) (Plata, 2009; IMO, 2016).

Nevertheless, IMO has aligned its efforts to protect the marine environment according to the provisions made by the CBD (1992), and its current SAP with the objective to work together to reach the goal of protection of marine ecosystems (UNEP, 2016). There, regional environmental bodies start to play an important role in managing all the anthropogenic activities, including shipping-related ones, within regional sea areas.

1.2.7 UNEP Regional Seas Programme

It is established that UNCLOS provides the scope to cooperate between coastal states at the regional level by way of multilateral agreements. This is based on relevant proof of how effective governance in regional seas, both closed and semi-enclosed can be (Vallega, 2001). For instance, in 1974, UNEP established the first political approach to deal with those particular sea areas (Lausche, 2011). Therefore, the first concern was the Mediterranean Sea, creating the Mediterranean Action Plan with the main aim of conceiving *"... the causes of environmental degradation and encompassing a*

comprehensive approach to combating environmental troubles through the management of marine and coastal areas" (Vallega, 2002, p. 734).

In 1984, after ten years of the program having been established the lessons learned were shared, and the UNEP encouraged a generation of policy frameworks by launching ten more Action Plans enveloping 140 coastal states (UNEP, 2012). The Caribbean Environment Programme (CEP) was the second having been established in 1981 (UNEP, 2014a). It is considered a postmodern approach for the regionalization of ocean governance because it provides the essential legal framework for conservation, including rules for the establishment of MPAs (Vallega, 2002; Lausche, 2011; Jones, 2014).

Today, the UNEP's Regional Seas Programme leads 18 successful Multilateral Environmental Agreements (MEAs). The scope is based on cooperation and solidarity among states, improving Integrated Coastal Zone Management (ICZM) and MSP, and reducing land-based pollution. Additionally, it protects valuable ecosystems promoting the creation of MPA networks to tackle the impacts of ocean acidification and climate change on coral reefs, moving forward a green economy approach (Lausche, 2011; UNEP, 2014b).

The Regional Seas Programme is not independent of all previous worldwide governance mechanisms because, being part of UN specialized agencies, it has a strong link with other conventions, programs, and strategies developed to work in the protection and sustainable development of the oceans as a whole. For that reason UN is making significant efforts to determine new goals for the next decade, especially in the sea, adding their objectives at the sustainable development agenda (Umana, 2002; UNEP, 2014a).

1.2.8 New 2030 Agenda for Sustainable Development – SD Goals

The new 2030 Agenda is the update of all previous agendas (e.g. Rio+20) and the masterpiece of the UN action plans. The global aim for the next fifteen years is to work for the prosperity of people and planet eradicating poverty through sustainable development (UNSD, 2015). The Agenda pursues the Millennium Development Goals that encompass 17 goals and identify 169 associated targets approved by Resolution A/70/L.1, during the 70th session of UN General Assembly on October 21, 2015, and put into operation on January 1, 2016 (UNSD, 2015). The goals of sustainable development are integrated and indivisible, balancing three dimensions; economic, social, and environmental. These are developed through the cooperation of all countries and global partnerships through a collective consciousness for the well-being of current and future generations (Kaurobi, Espey, & Durand-Delacre, 2016). All the above is framed within international law provisions; for instance, countries agreed to enforce them at all levels, regional, sub-regional and national (UNSD, 2015)

This dissertation will focus mainly on the goals related to sustainable management of oceans and seas preserving and restoring ecosystems and biodiversity that suffer adverse impacts from climate change and anthropogenic activities.

In that sense, according to UNSD (2015), a specific goal is part of the discussion:
Goal 14. "*Conserve and sustainably use the oceans, seas and marine resources for sustainable development*". The targets that should be reached during the next fifteen years concern:

1. Reducing of all kinds of marine pollution;
2. Increasing sustainable management of existing MPAs;
3. Reducing the impacts of ocean acidification through scientific cooperation;
4. Regulating all kinds of fisheries activities, effectively restoring fish stocks through science-based management;

5. Increasing protection and conservation of coasts and marine areas through science advice by 10%;
6. Prohibiting irregular fishery subsidies, especially in developing and less developed countries;
7. Increasing the economic benefits from the sustainable exploitation of marine resources in Small Island Developing States (SIDS), and least developed countries.

All of the above will be achieved through enhancing the international binding regime for the conservation and sustainable use of oceans, increasing scientific knowledge capacity and, cooperating with scientific organizations for the wellbeing of developing countries.

The way forward to develop this important strategy is through a global solidarity partnership where all the stakeholders, governments, and communities are involved. Regarding sustainable ocean development, the aim is to tackle the degradation of ecosystems reducing the harmful impacts produced by all kinds of industrial activities. To achieve these, it is necessary that coastal states work hard on the designation of MPAs with the strongest governance strategy possible until 10% of the oceans are protected effectively (Jones, 2014; Wright, 2014). The agenda is very optimistic, but it is not impossible to accomplish.

Thus, it is necessary to continue working, focusing the regional level, and strengthening governance to achieve these global goals.

1.3 REGIONAL MARINE GOVERNANCE IN THE CARIBBEAN SEA

As discussed, on a worldwide basis, several regulations have been created in matters concerning conservation and restoration of the environment through sustainable development, in particular for the establishment of MPAs under national jurisdictions

(Fanning, et al., 2007). To address environmental concerns on a regional basis, in 1974, the UN system created a regional program, as a response to UNCLOS part XII. The main purpose is to work together for the proper management and development of closed and semi-enclosed seas encompassing binding and non-binding agreements, i.e. Regional Seas Conventions and Action Plan (RSCAPs) (Lausche, 2011; UNEP, 2014a; UNEP, 2014b).

Referring to regional governance, it is necessary to define the concept of Regional Seas. The definition suggested by UNEP through the Regional Seas Programme is "*conceived as a portion of the ocean within which the ecosystem merited protection, and also within which the development of coastal and islands states would benefit from the international cooperation*" (Vallega, 2002, p. 727). Besides, it is important to take into consideration that ecosystems do not respect political borders. Therefore, it is necessary to consider that the nature of ecosystems is transboundary, i.e. across political boundaries. For instance, today regional governance based on the EBM Approach is taking place (Vallega, 2002; UNEP, 2014a).

When discussing accomplishment of the EBM Approach through the concept of sustainable development, it is important to consider the link between both environments; marine and terrestrial, taking into account natural changes and ecological variation in the long-term perspective (UNEP, 2014a). In that sense, to better manage those regional seas, UNEP created the concept of Large Marine Ecosystems (LMEs). They are defined as "*discrete marine areas (typically about 200,000 km2) identified by ecological criteria (bathymetry, hydrography, productivity and trophic relationship) adjacent to the continents in coastal waters*" (Sherman & Hempel, 2008 as cited by UNEP (2014a, p. 25)). Under this concept, today, there exist 64 LMEs, which are designated and monitored by Global Environment Facility –LME Project (GEF-LMEs); one of the biggest is the Caribbean Sea (UNEP, 2014a).

The UN system recognizes the Caribbean Sea as one of the most unique and complex areas of the world. Its extension is over 2.5 million km^2 ("The Caribbean Sea", 2015). It is geographically and politically diverse as it embraces 44 States and territories with over 100 maritime boundaries (UNEP, 2012; UNEP, 2014a; CEP, 2015). For that reason, to manage this vast area, several initiatives have been developed.

Kelleher, Bleakley, & Wells (1995), listed several initiatives and institutions that work in the Wider Caribbean for the protection of marine environment. However, many of them focusing on fisheries. There are only two biggest environmental protection programs concerning the whole area that today will be discussed. The first one is the Caribbean Environment Programme (CEP), and the other is Caribbean Large Marine Environment project (CLME).

1.3.1 United Nations Environment Programme - Caribbean Environment Programme – (UNEP-CEP)

The CEP was the second UNEP program established in 1982 with all its institutional components (Convention, Action Plan, Funds, and Coordination Unit), building one of the most valuable programs of the UN system. In addition to this, the CEP is recognized by the countries in the region for its high commitment to the development of environmental management initiatives (UNEP, 2014b).

The UNEP's main goal is to reduce and tackle the degradation of environments by marine pollution (UNEP, 2014b). In that sense, the Caribbean is considered the second most complex marine route worldwide. This is a consequence of the traffic through the Panama Canal, and the increase of seaborne trade in many nearby ports in the area due to its economic attractiveness. These factors are threatening the surrounding ecosystems by ship-source pollution, including the issue of invasive species (Patrick &

Storm, 2013). Likewise, tourism and fisheries are the main activities in the zone and are sources of marine pollution. Furthermore, the Caribbean faces several political conflicts and presents diverse economies in terms of development, with significant influence of developed countries exerting colonial powers, and hosting many different languages (Patrick & Storm, 2013; Van Tatenhove, 2013; UNEP, 2014b).

To address all the above issues and challenges, in 1982, countries unanimously decided to work for the adoption of a cooperative and integrated approach through a convention for the protection and sustainable development of the Caribbean region (UNEP, 2012).

1.3.1.1 Convention for the Protection and Development of the Marine Environment in the WCR and its Protocols.

The Wider Caribbean Action Plan was the first step taken by CEP and countries to start to develop a binding agreement. As a result and through the commitment of the countries involved, it was possible to move forward to the adoption of the Convention for the Wider Caribbean, which was agreed in Cartagena de Indias, Colombia in 1983 (hereafter, the Cartagena Convention). This regional treaty entered into force in 1986. To date, 25 States have ratified it (Lausche, 2011; UNEP, 2012).

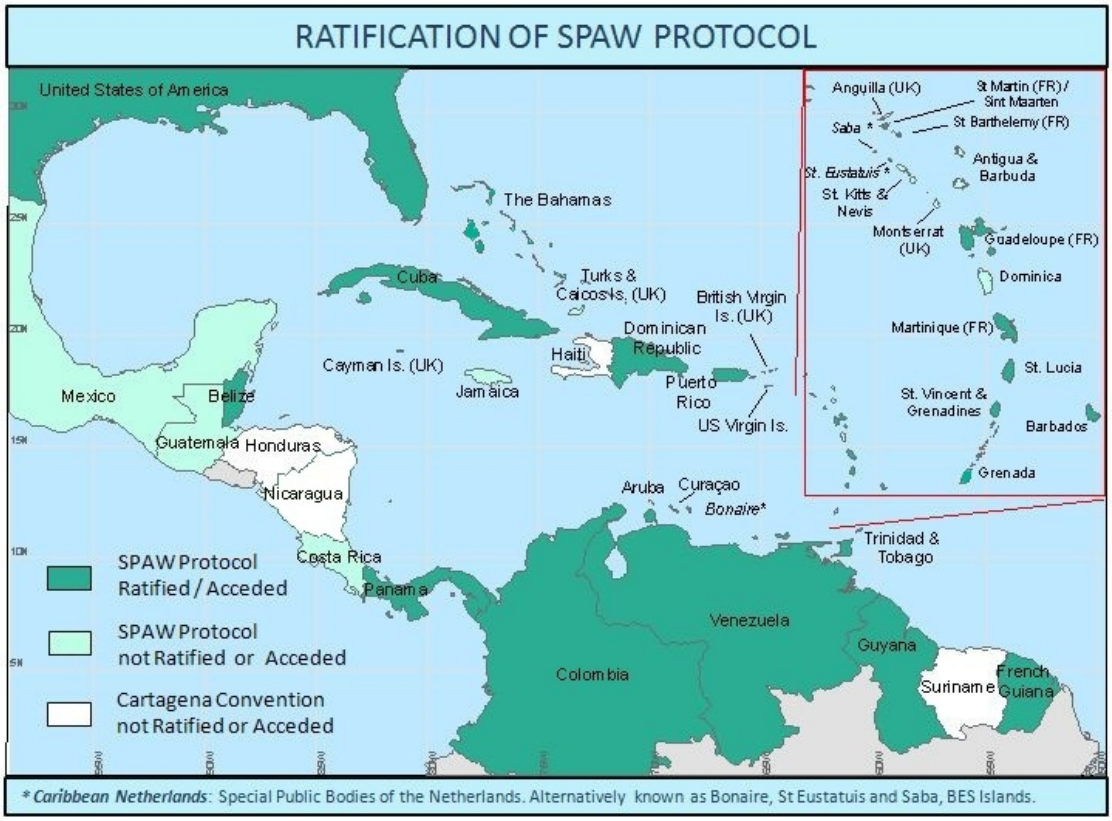
The Cartagena Convention is the current binding regional environmental agreement serving as an essential reference for both managers and policy-makers when protection measures and management development of coastal and marine resources are in place, either individually or jointly. Nevertheless, due to developing economies surrounding the area, many issues are facing the Caribbean region. For that reason, one of the main targets is the establishment of MPAs as a mechanism to ensure the conservation of biodiversity, reduction of pollution, education, and capacity building. For instance, it

is necessary to apply regional ocean governance based on the effective EBM approach to ensure sustainability in the WCR (UNEP, 2012).

Following the adoption of the convention in 1983, two legal instruments were subsequently adopted. The first one was the Protocol concerning Cooperation in Combating Oil Spills in the Wider Caribbean Region (Oil Spills Protocol). This protocol and the convention itself were convened simultaneously. The second is the Protocol Concerning Specially Protected Areas and Wildlife (SPAW Protocol), which was adopted in the early 1990s and entered into force in 2000. The latter was the third program driven by UNEP with the aim of preserving and improving the marine ecosystem in the region (Lausche, 2011; UNEP, 2012; CEP, 2015).
Today, the SPAW Protocol has been ratified by only 16 states (UNEP, 2014a) (Figure 2), including Colombia. The aim is "*to take necessary measures to protect, preserve and manage, in a sustainable way, zones that require protection to safeguard their particular value and that threaten or endanger species of flora and fauna*" (Art. 3) (UNEP, 2012, p. 40).

To date, nine coastal states in the wider Caribbean encompass over 31 MPAs under the SPAW protocol and the CEP. The marine area covered is approximately 100,000 km^2 corresponding to only 4% of the all-regional sea (CEP, 2015).

Figure 2 SPAW Protocol Ratification Status 2012



Source: CEP (2015)

Although the number of MPAs is relatively small, in 2014, the Caribbean Regional Programme (CRP), under the umbrella of the SPAW Protocol, established the Caribbean Challenge Project (CEP, 2015). The objective is to enlarge regional MPAs up to 20% by 2020 through a sustainable governance mechanism based on cooperation between countries for the protection of the ecosystem in the larger Caribbean (UNEP, 2014a).

Colombia is the depository country for the Convention and one of the first to ratify it. Therefore, it is making efforts to fulfil the agreement. Currently, around nine percent of its maritime jurisdiction is protected through MPAs (PNNC-RUNAP, 2016); one of

the largest in the region is the Seaflower MPA (Howard, 2006; CEP, 2015).

1.3.1.2 The Caribbean Large Marine Ecosystem (CLME) Project

The CLME is a strategy developed by the UNEP in cooperation with the Global Environment Fund (GEF) for the protection of ecosystems in closed and semi-enclosed seas and in particular areas around the world which, according to their oceanographic patterns and biodiversity, create special habitats. The Wider Caribbean Region is one of the LMEs (Fanning, et al., 2007; UNEP, 2014a; Vousden, 2016). The CLME is a comprehensive regional governance approach that addresses the objective of the RSP for the protection of the environment through the creation of MPAs underpinning management initiatives such as the EBM approach (Fanning, et al., 2007; Vousden, 2016).

CHAPTER 2: COLOMBIA'S CARIBBEAN COAST MPAs

2.1 Background

Colombia is the fifth-largest and most biologically diverse State in Latin America (Toro, Requena, & Zamorano, 2009; "US Commerce Office", 2011; OECD, 2014; Alonso, et al., 2015). Due to its strategic position, it shares waters in both the Caribbean and the Pacific oceans, corresponding to approximately 45% of the national territory (Minambiente, 2012). The Caribbean coast is the largest area, with approximately six thousand square kilometers and 1,300 kilometers of coastline (CCO, 2014; "Cancilleria Colombia", 2016). Its waters and coastal areas embody rich coral reefs, seagrass beds, mangroves, estuaries and coastal lagoons (The World Bank, 2006; "US Commerce Office", 2011; Minambiente, 2016).

Thus, the economy is based on ecosystem services, which have grown considerably in recent years, especially coastal and marine (Nolet, Vosmer, De Brujin, & Braly-Cartillier, 2014). Therefore, it represents 40% of the national GDP (OHI, 2015), of which commercial fishing, and small-scale artisanal fishing represent only 0.36% (Ramirez, 2016). Nevertheless, fishing is the core livelihood for coastal and islander communities. For instance, efficient management mechanisms and frameworks are necessary to protect its marine richness from anthropogenic activities. On this basis, Colombia has established coastal and marine conservation priorities (Alonso, F., Diaz, Segura, Castillo, & Anthony, 2007), through the establishment of MPAs to overcome the threats that are causing marine degradation (Ramirez, 2016).

2.2 National Governance and Framework on MPAs

Colombia's environmental framework is considered one of the most comprehensive and the oldest in Latin America (Cajiao, et al., 2006; "US Commerce Office", 2011). All the principles and provisions for the protection and management of the natural resources and biodiversity are in the National Constitution of 1991 (Art 8, 63, 80, 102) (Minambiente, 2011; OECD, 2014). Colombia has also adopted and implemented international conventions and programs (Minambiente, 2011).

To guarantee the protection of the nation's natural patrimony, the government, has created several institutions since 1968. The Ministry of Environment (MADS) is in charge of managing and developing policies in matters concerning the protection of areas where natural resources are threatened and require special care (Cajiao, et al., 2006). To do so, more specifically, the National System of Natural Parks (SPNN), was created in 1974, and several pieces of legislation were adopted, taking into account the model used by the United States (Minambiente, 2012).

Likewise, extensive changes have occurred with the preparation and ratification of the CBD (Minambiente, 2011). Thus, in MPA governance, in 1993, it created the National system of Protected Areas (SINA), and the subsystem of Marine Protected Areas (SAMP). Furthermore, the government decentralized some management functions creating the Regional Autonomous Corporations (CARs) in charge of the administration and management of natural resources at regional level (OECD, 2014).

On the other hand, the governance structure implemented in the legislation for the conservation and protection of MPAs is based on the adoption of international instruments (Table 1). In addition, it considers the IUCN categories and classification (Table 2) (Lausche, 2011; Al-Abdulrazzak & Trombulak, 2011), including the restricted protection and multiple-use categories. In general, the country manages

eleven national categories that correspond to four IUCN categories (Minambiente, 2012, pp. 9-10).

Table 1 International and Regional MPA's mechanisms adopted by Colombia.

Instrument	Signed	Related (National Law)
UNCLOS, 1982	December 10, 1982	Not Ratified yet
AGENDA 21, 1997	New York, 1997	CONPES 3164, 2002
CBD, 1992	Rio de Janeiro, 1992	Law 165 of 1994
FAO Code of Conduct, 1995	------	Resolution 121. March 21, 1995
UNESCO MAB Convention Concerning the Protection of the World Cultural and Natural Heritage	Paris, 1972	Law 45 of 1983
MARPOL 73/78		Law 12, January 9, 1981
UNEP	1976	
SDGs Agenda, 2015	New York, 2015	Decree 280, February 2015
Cartagena Convention, 1983	Cartagena, 1983	Law 56, December 23, 1987
SPAW Protocol, 1990	Kingston, 1990	Law 356, January 21, 1997

Source: Minambiente (2011)

Table 2. IUCN PA's Classification and Categories

IUCN Category	Scope of Application	Main MPA Objective
I	(Strict Nature/Wilderness area) PA managed for science or wilderness protection	Restore Ecosystems; enhance MPA Network/MSP; Cultural value of set-aside areas; Management tourism/recreation its impacts; cultural symbolic value
II	(National Park) PA managed for ecosystem protection and recreation	Restore ecosystems; enhance MPA Network/MSP; control the impacts of tourism/recreation
III	(National Monument) PA managed for conservation of specific natural features	Promote research and education
IV	(Habitat/Species Management Area) PA for conservation based on management intervention	Protect rare and vulnerable habitats and species
V	(Protected Landscape/Seascape) PA managed for conservation and recreation	Maintain traditional uses; cultural values of set-aside areas
VI	(Managed Resource PA) PA managed for the sustainable use of natural ecosystems	Restore fish stocks; maintain traditional uses

Source: Lausche (2011); Jones (2014)

Nevertheless, reviews of the earlier legislation identified a few deficiencies. For instance, in 2010, the government clarified definitions of protected areas and their categories. It also established coordination mechanisms and defined the criteria, procedures and responsible actors for designation, administration, and management of the MPAs (Minambiente, 2011). As a result, it created the Unique Registry of Protected Areas (RUNAP) to consolidate the inventory of PAs based on the type of governance, classified in public and private law, at the national and local level, based on the IUCN categories and objectives. Furthermore, the legislature is working on developing a law to include communitarian and stakeholder governance in the protected area system (Minambiente, 2012).

This governance approach has been implemented in Colombia since 2001, and it is being developed in the national bio-cultural regions, including the Caribbean (De Pourcq, Thomas, Arts, Vranckx, Leon-Sicard, & Van Damme, 2015). There was an innovative mechanism executed by the MADS to ensure management and conservation of biodiversity within PAs in the territory.

The relevance of this approach is the involvement of ethnic communities near the PAs, which have the awareness to conserve the environment due to the benefits of the sustainable development of these areas. Thus, it recognizes that the state is not the only actor in the governance process (Ramirez, 2016). Nevertheless, the system does not have enough information about the effectiveness of the management objectives on MPAs, and the information available is related mainly to fisheries (Minambiente, 2012).

According to RUNAP, Colombia has protected approximately nine percent of its total marine area (7,854,381.83 ha) (Figure 3) (PNNC-RUNAP, 2016). Likewise, national MPAs are classified into six categories (Table 3).

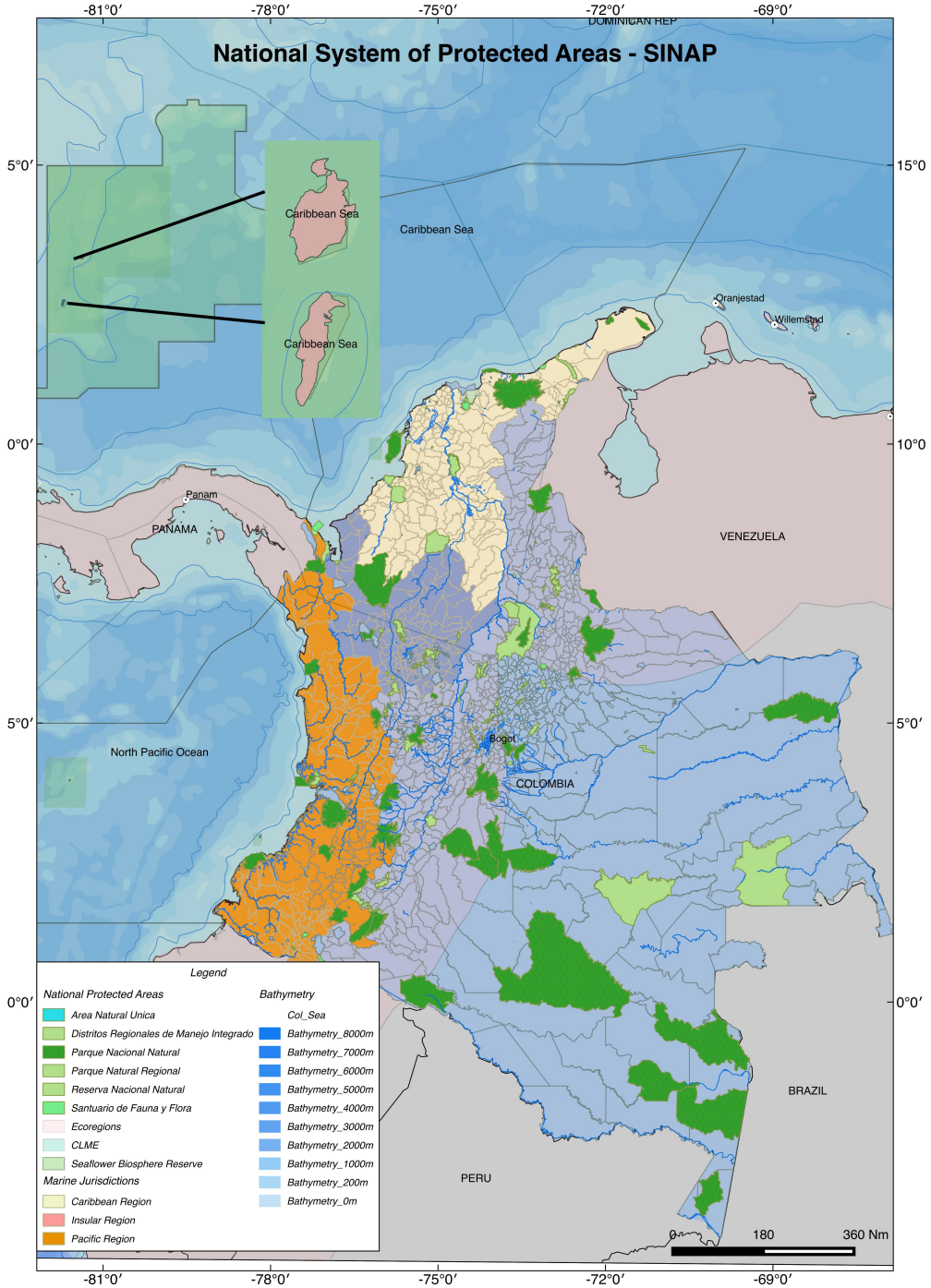
Table 3. Information of National MPAs - SINAP Categories

SINAP Category	IUCN Category	Admin Entity	Total area (ha)	Total terrestrial area (ha)	Total maritime area (ha)
National District of integrated management Seaflower Biosphere Reserve	I IV VI	MADS-PNN	6,501,800.00	6,000.00	6,495,800.00
Park Via	III	PNN	56,200.00	27,315.47	28,884.53
Regional Natural Park	II	PNN - CARs	405,195.30	405,156.40	38.90
Regional District of Integrated Management	VI	MADS - CARs	4,129,038.10	4,124,013.10	5,025.00
National Natural Park	II	PNN - CARs	11,049,941.71	10,699,432.31	350,509.40
Sanctuary of Fauna and Flora	III	PNN	1,048,629.26	74,505.26	974,124.00
TOTAL			23,190,804.37	15,336,422.54	**7,854,381.83**

Source: PNNC-RUNAP (2016)

On the other hand, geographically the marine jurisdiction of Colombia is divided into the following regions: Tropical Atlantic and East Tropical Pacific, within which three provinces are found, two in the Caribbean and one in the Pacific. The Caribbean provinces are the Caribbean Sea province and the province of the Archipelago of San Andres, Providencia and Santa Catalina (Figure 3) (CORALINA-INVEMAR; Gómez-López, D. I.; Segura-Quintero, C.; Sierra-Correa, P. C.; Garay-Tinoco, J., 2012; INVEMAR, 2016).

Figure 3. Colombia's National Protected Areas



Source: The Author – Software QGIS

2.3 Coastal and Marine MPAs in the Caribbean Coast of Colombia

The Colombian Caribbean Sea is located in the northern part of South America. The Caribbean coast extends 1,932 km, with a marine jurisdiction of 532,154 km^2 (CCO, 2014); the portion of submerged coastal zone is 7,673 km^2 (INVEMAR, 2016). This includes the extension of the continental margin in the insular area of San Andres and Providencia (Figure 4).

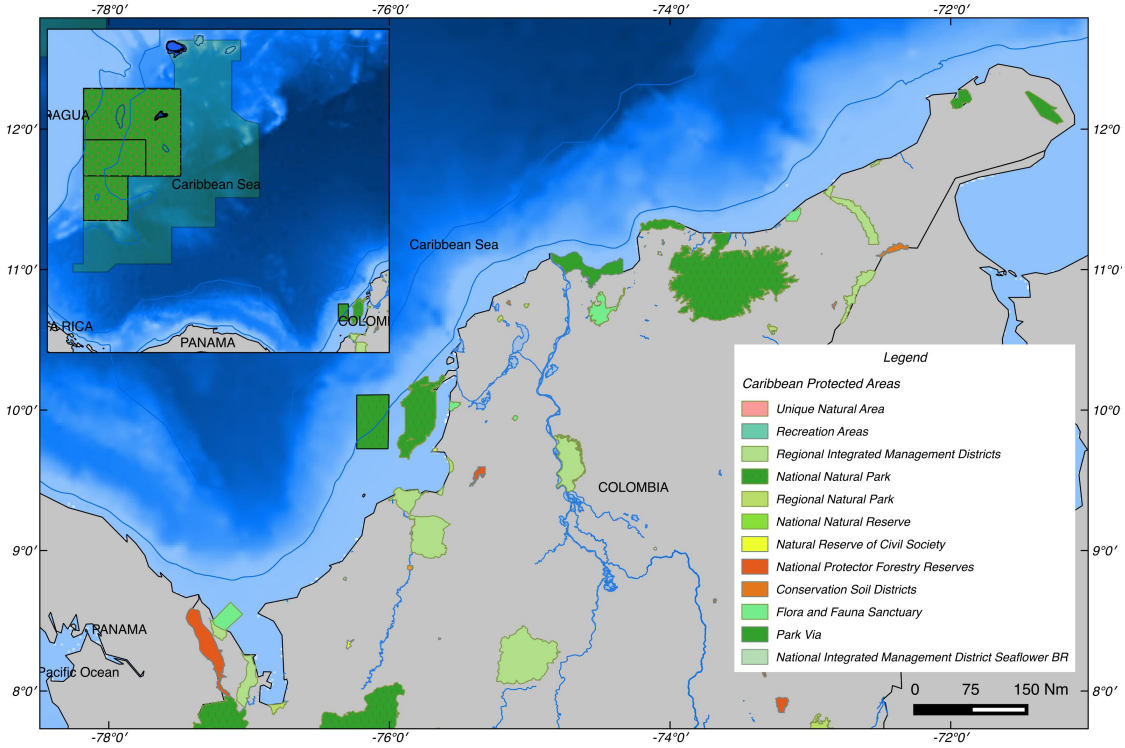
The governors of eight continental departments, one insular department, twelve environmental authorities and nine harbor masters, in charge of environmental management, complicate the governance in the region. This system deals with 84% of the total coastal population of the country (INVEMAR, 2016). Likewise, these authorities manage six Environmental Coastal Units (UAC), and the Caribbean Oceanic Environmental Unit defined by the MADS through Decree Law 1120 in 2013 (Minambiente, 2015; Alonso, et al., 2015; INVEMAR, 2016).

As the country has embraced its extensive biodiversity, the Caribbean coast underpins vast ecosystems of coral reefs, seagrass beds, mangrove forests, coastal lagoons and estuaries, which cover a total of 561,235 ha (Alonso, et al., 2015). The coral reefs are the biggest area (over 52% of total) followed by coastal lagoons and estuaries. Over six thousand marine species in the Caribbean have been recorded. However, only 16% of these marine ecosystems are included under 23 MPAs (Figure 3) (INVEMAR, 2016; PNNC-RUNAP, 2016).

The biggest Colombian Caribbean MPA is the Seaflower MPA located in the insular area of San Andres and Providencia. It encompasses the largest ecosystem of coral reefs (INVEMAR, 2016) in addition to seagrass beds, and mangroves. All of the above are the habitats of several vertebrate marine species, molluscs, and migratory species

(CORALINA-INVEMAR; Gómez- López, D. I.; Segura-Quintero, C.; Sierra-Correa, P. C.; Garay-Tinoco, J., 2012)

Figure 4. MPAs in the Colombian Caribbean Region



Source: The Author – Software QGIS

CHAPTER 3. Case Study: THE SEAFLOWER MPA

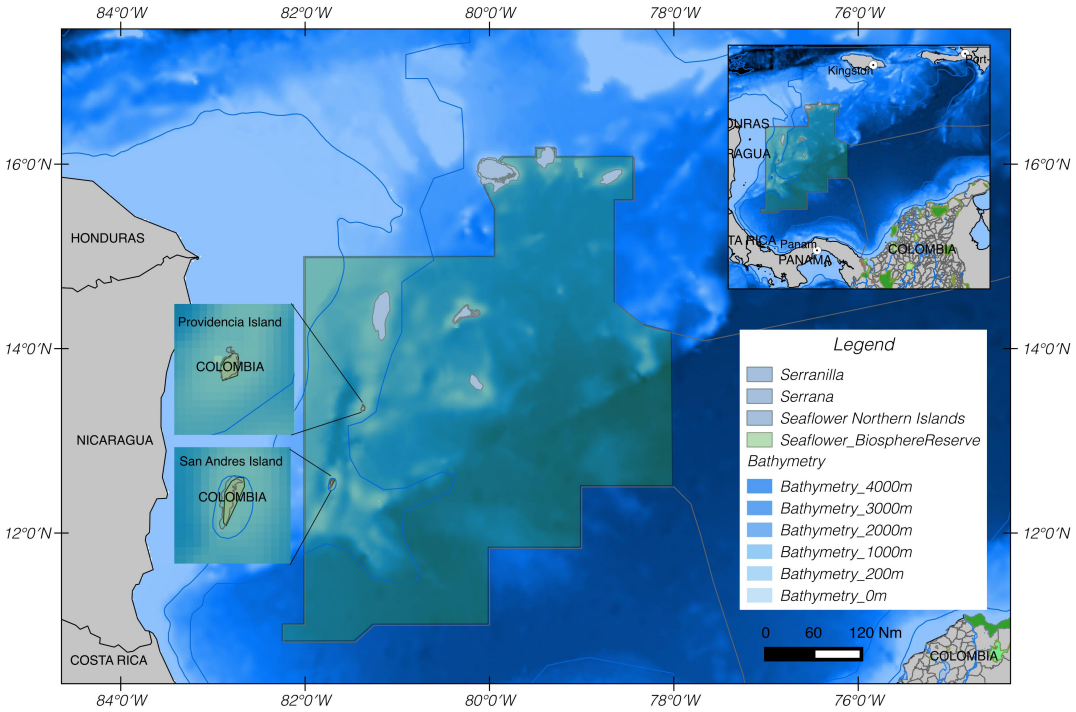
3.1 Background

Colombia's constitutional mandate considers the preservation and conservation of its unique ecosystems and areas of ecological importance, and is respectful of the obligations prescribed in the international environmental treaties to which it is party (Minambiente, 2011). The government, in 1998, proposed the designation of the archipelago of San Andres, Providencia, and Santa Catalina, and the surrounded marine area, as a biosphere reserve (Figure 5) to be known as the Seaflower Biosphere Reserve (Minambiente, 2005). Later in 2000, UNESCO included it within the MAB World Biosphere Network (Howard, 2006).

Moreover, in January 2005, the MADS through Resolution 107, declared an MPA, within the biosphere reserve (Minambiente, 2005), the largest in the Caribbean Sea, and the first of its category in Colombia (Howard, 2006; UNEP, 2010; CORALINA-INVEMAR; Gómez- López, D. I.; Segura-Quintero, C.; Sierra-Correa, P. C.; Garay-Tinoco, J., 2012; Taylor, Baine, Killmer, & Howard, 2013).

The Archipelago's Regional Environmental Corporation – CORALINA is the administrative and environmental management authority, which determined the internal management division and zoning of the MPA through accords 021 and 025, respectively (Coralina, 2005). Furthermore, in 2014, through Resolution 0977, the MADS gave the Category of Integrated Management District "Seaflower MPA" (MADS, 2014) to including within the RUNAP.

Figure 5 Seaflower Biosphere Reserve location



Source: The Author – Software QGIS

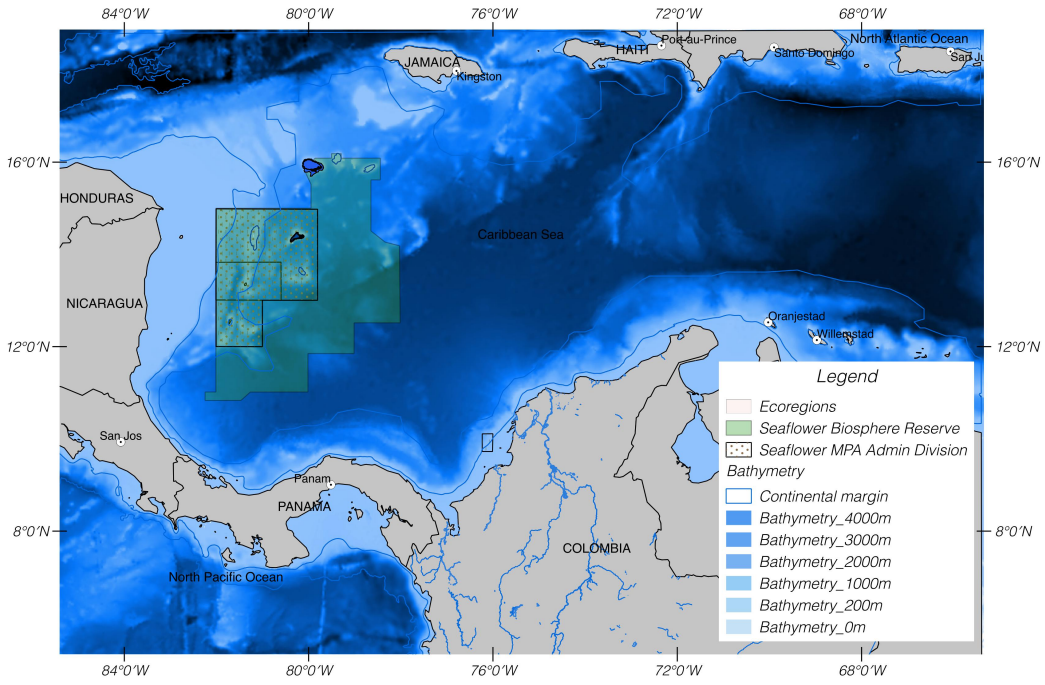
Despite the legal designations made by Colombia's environmental institutions and those accorded by international bodies to protect the ecosystems and to manage the activities within the area, it is still threatened and jeopardized by several issues, mainly shipping-related. Further, boundary disputes, with the neighbouring country Nicaragua, due to the judgment of the International Court of Justice (ICJ) might be damaging the integrity of the entire ecosystem within the biosphere reserve as well as the MPA (Gorricho, 2012; De Rivaz, 2013; CORALINA, 2014).

3.2 Geographical position

The Seaflower MPA is located in the south-western Caribbean region, surrounding the San Andres Archipelago (i.e. three small inhabited oceanic islands and eight unsettled

cays and atolls) (Figure 6). The origin of the formation of islands, cays, and atolls was caused by volcanic formations as a result of fracture zones associated with the Nicaragua Rise (Diaz, Diaz-Pulido, Garzon-Ferreira, Geister, Sanchez, & Zea, 1996). The largest island, San Andres is 800 km (480 NM) north-west of the Colombian continental territory (UNEP, 2010; Murillo & Ortiz, 2013). The MPA Area covers a maritime area of 65,000 sq.km, with only 1% of the terrestrial surface (650 sq.km.) (UNEP, 2010). The population of over 100,000 base their livelihood on artisanal fisheries and tourism (Howard, 2006). The MPA is part of the Caribbean coral reef hotspot, which is among the richest areas in marine species diversity, but also one of the most threatened (Howard, 2006). For instance, the area is considered to be of regional and national ecological significance.

Figure 6 The Seaflower MPA Location



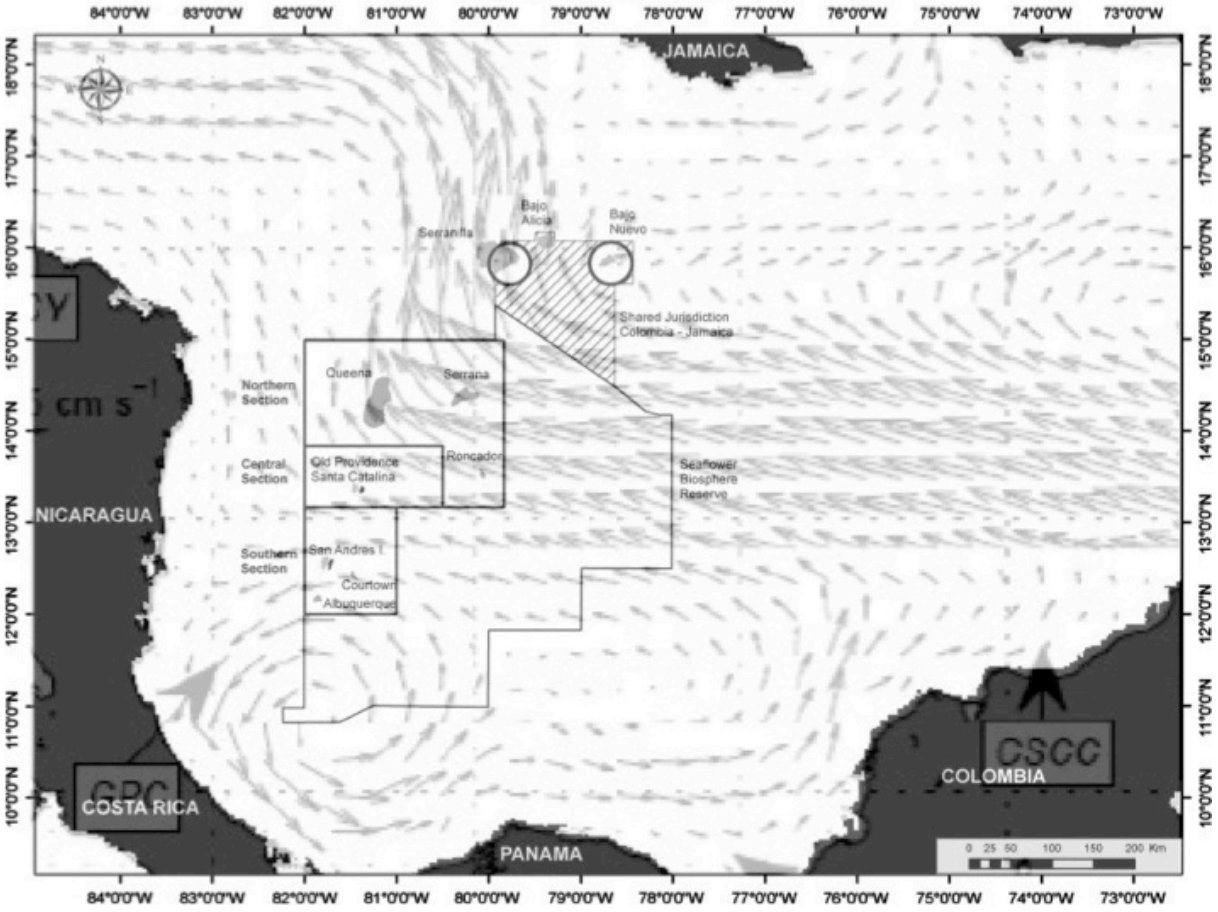
Source: The Author – Software QGIS

3.3 Oceanographic conditions

Due to its location within the Wider Caribbean Region, the archipelago has a continual east-to-west flow of currents from the Atlantic Ocean (Figure 7) which, considering the marked changes in bathymetry, divide the Caribbean current between the islands, forcing the stream to deviate to the south. The flow, which collides with the continent, recirculates in the area, forming the Colombia-Panama Gyre with an average velocity of 1m/s, which by the effect of winds, creates a long wave fetch (Andrade C. , 2000; CORALINA-INVEMAR; Gómez- López, D. I.; Segura-Quintero, C.; Sierra-Correa, P. C.; Garay-Tinoco, J., 2012).

The temperature in the water column fluctuates between 26 and 29.5ºC, and the horizontal distribution is influenced by wind stress, maintaining an average of 28ºC and reaching a value of 27ºC at 100 m depth (Andrade C. , 2000). Additionally, the patterns of salinity oscillate between 35.5 PSU (Practical Salinity Units) at the surface, reaching values close to 37 PSU at 150m depth. At the surface, the horizontal distribution of salinity is influenced by a zonal gradient from the south-west due to the intense seasonal rainfalls in the area. This stratifies the water column markedly. These factors produce optimal values of oxygen and turbidity, vital for coral life (CORALINA-INVEMAR; Gómez- López, D. I.; Segura-Quintero, C.; Sierra-Correa, P. C.; Garay-Tinoco, J., 2012). These particularly complex oceanographic conditions have contributed to the formation and evolution of a unique coral reef that serves as a habitat for diverse species of marine fauna and flora.

Figure 7 General Ocean Circulations in the Wider Caribbean Sea



Adaptation from: Taylor, Baine, Killmer, & Howard (2013); Ruiz-Ochoa (2011)

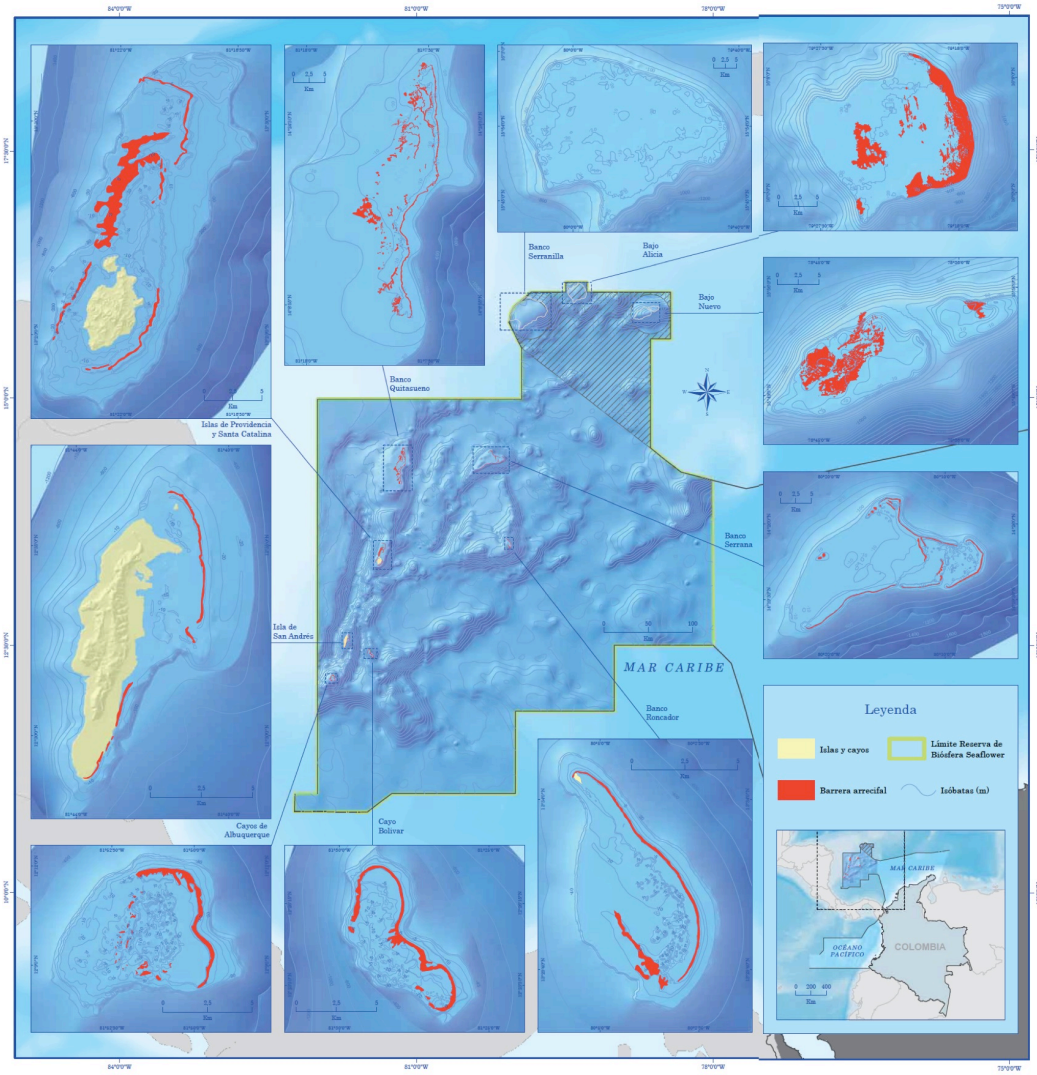
3.4 Marine Ecosystems

The Seaflower MPA is recognized as possessing one of the highest levels of marine biodiversity in the Caribbean region (Murillo & Ortiz, 2013). It representatively defines Colombia's six tropical marine ecosystems: coral reefs, seagrass beds, mangroves, rocky littorals, sandy beaches, and soft bottoms, which influence the high productivity of the area (Howard, 2006).

The coral reef is the key ecosystem for conservation in the MPA because as one of the largest in the Caribbean, it represents about 14% of the world's coral reefs (UNEP, 2005), the second in the western hemisphere, and most productive in the region (UNEP, 2010). The reef extension covers approximately 2,000 km^2 (Taylor, Baine, Killmer, & Howard, 2013), and is composed of two barrier reefs, five atolls, reef lagoons, and coral banks (Howard, 2006), which is 78% of the national total (Figure 8) (CORALINA-INVEMAR; Gómez- López, D. I.; Segura-Quintero, C.; Sierra-Correa, P. C.; Garay-Tinoco, J., 2012).

Seagrass beds extend 2,000 ha, covering over five percent of the archipelago extension, and they are found mainly in reef lagoons, providing habitat for fish, sea turtles, and invertebrates (Murillo & Ortiz, 2013). Mangroves, covering about 250 ha, are catalogued as one of the most productive ecosystems in the zone (UNEP, 2010), They provide refuge for a number of marine species, especially in the first larval stages, and also migratory species of birds (CORALINA-INVEMAR; Gómez- López, D. I.; Segura-Quintero, C.; Sierra-Correa, P. C.; Garay-Tinoco, J., 2012). The sections of the coastline comprised of sandy beaches are characterized by calcareous formations (Diaz, Diaz-Pulido, Garzon-Ferreira, Geister, Sanchez, & Zea, 1996). Together, they contribute to the control of erosion, stabilization of the sea bottom, and provide food, and oxygen for marine life. In addition, the beaches provide human and cultural values for islanders who base their economy on ecosystem services, mainly fisheries, for the provision of livelihood and recreational benefits.

Figure 8 Coral reef areas within Seaflower Biosphere Reserve



Source: CORALINA-INVEMAR; Gómez- López, D. I.; Segura-Quintero, C.; Sierra-Correa, P. C.; Garay-Tinoco, J. (2012)

3.5 MPA Objectives

Colombia set, through the National Law 99/93 (Alonso, et al., 2015), overall targets for the MPAs in the territory, based on the global IUCN objectives (Lausche, 2011; Speed & Levine, 2014; Jones, 2014). Moreover, the Seaflower MPA has defined its objectives with the participation of islander communities, and stakeholders based on the concept of community-based management (Howard, 2006; De Pourcq, Thomas, Arts, Vranckx, Leon-Sicard, & Van Damme, 2015) to ensure effective governance and protection of the ecosystems in the zone. Moreover, to succeed in achieving the activities within the MPA, five core objectives were defined (Coralina, 2005):

1. *Preservation, recovery, and long-term maintenance of species, biodiversity, ecosystems, and other natural values including special habitats;*
2. *Promotion of sound management practices to ensure long-term sustainable use of coastal and marine resources.*
3. *Equitable distribution of economic and social benefits to enhance local development.*
4. *Protection of rights concerning historical use.*
5. *Education to promote stewardship and community involvement in planning, and management*.

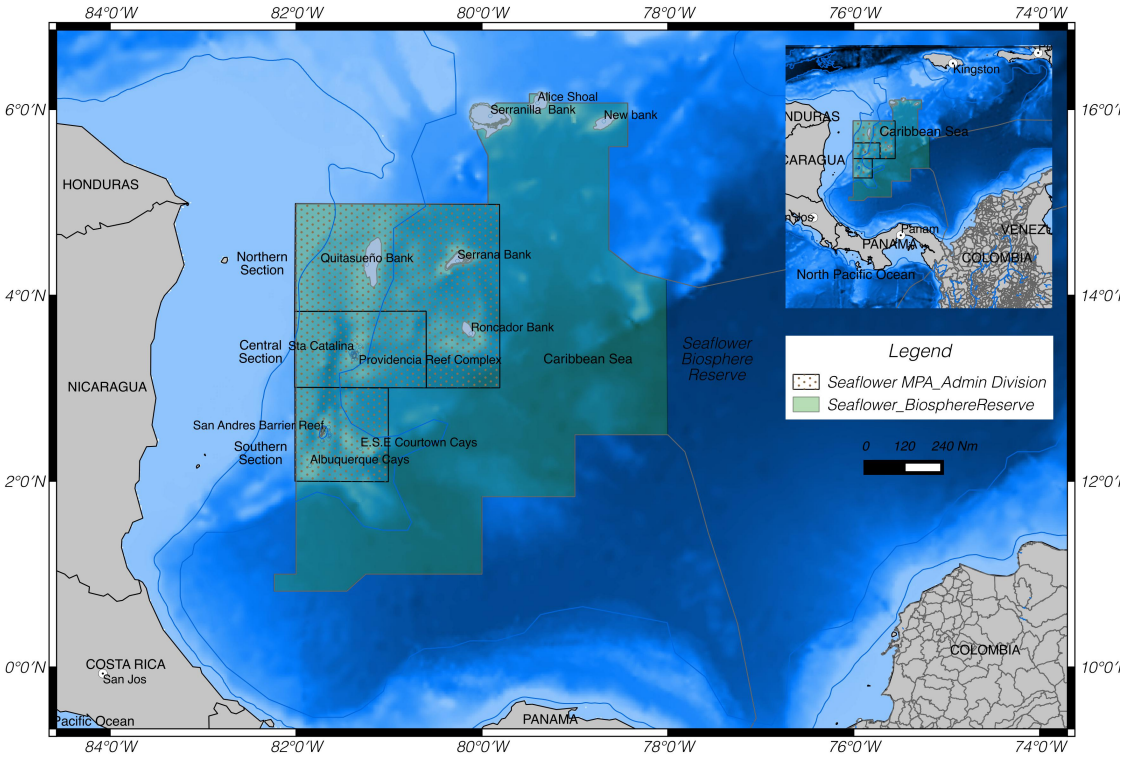
Based on these, and using the EBM approach (Fanning, et al., 2007; UNEP, 2014a), both the community and authorities designed the zones within the MPA to ensure the protection of ecologically relevant areas. The zoning criteria took into consideration the ecological criteria (Roberts, et al., 2003), seeking an easy demarcation based on representativeness and connectivity of key habitats, (i.e. coral reefs, seagrass beds, algal beds, and mangroves). Moreover, it seeks social-ecological resilience (Jones, 2014), absorbing and adapting to the changes to foster compliance to meet the MPA objectives (UNEP, 2010) effectively.

3.6 MPA Zoning

The MPA is divided into three administrative sections, established through Accords 021, and 025 (Coralina, 2005), seeking a better implementation of the biosphere reserve. Therefore, the areas are: Northern (37,522 km^2), Central (12,716 km^2), and Southern (14,780 km^2) (Figure 9). Moreover, within the administrative divisions, there are five zone types for *in-situ* conservation and sustainable use (Howard, 2006; Taylor, Baine, Killmer, & Howard, 2013):

1. No-entry (116 km^2), preservation zones restricted only for research and monitoring activities;
2. No-take (2,214 km^2), conservation zones that incorporate and allowing non-extractive uses;
3. Recovering and sustainable use of marine resources (2,015 km^2), allows traditional artisanal fishing activities, and artisanal sport fishing and all the activities allowed in the special use, no-entry and no-take zones;
4. Special use (68 km^2), shipping related, leisure, and waters sports;
5. General use (60,587 km^2), minimal restrictions apply, seeking and maintaining the MPA objectives to promote marine conservation.

Figure 9 The Seaflower MPA Administrative Division



Source: The Author – Software QGIS

3.7 Threats to the MPA in the region

Vallega (2002), UNEP (2005), Lopez & Krauss (2006), Fanning, et al. (2007), Biggs (2009), Morris (2012), and UNEP (2014a) have described the threats and issues concerning the marine ecosystems in the Caribbean region, and thus, they are not different for this MPA.

Likewise, Howard (2006), and Taylor, Baine, Killmer, & Howard (2013), described the drivers and conflicts within the MPA. Furthermore, since the establishment of Seaflower, the national government, by the hand of the archipelago's local authority, determined those and are stated in the legal documents (Minambiente, 2005; Coralina,

2005). Moreover, today, new challenges concerning shipping activities have emerged as a consequence of on-going and short-term developments in the region. In addition to IUU fisheries and boundary disputes that are affecting and threatening the link of the unique ecosystems within the Seaflower MPA, the following developments are of concern.

3.7.1 Increase in Maritime Traffic

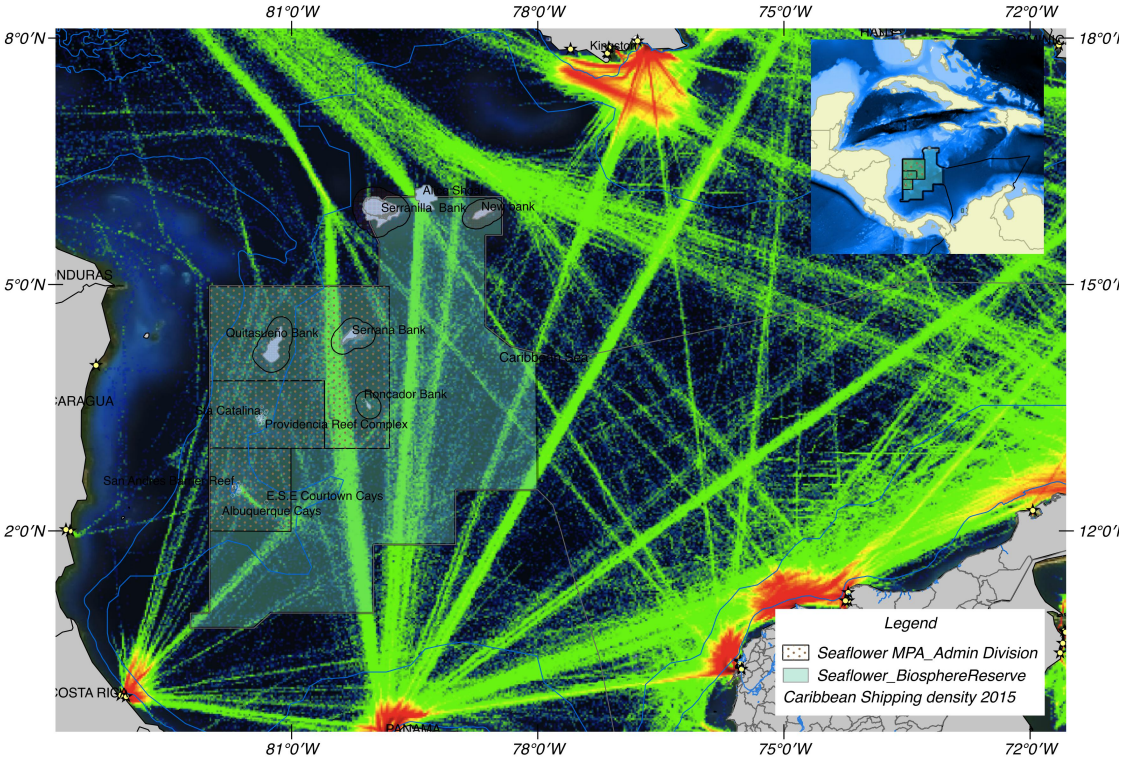
About 90% of global trade is moved by seagoing vessels (IMO, 2012), and keeping pace with global economic development, shipping has grown by 30% over a period of four to five years (AGCS, 2014), increasing routes and connectivity. For instance, according to UNCTAD (2015), Latin America and the Caribbean have the highest liner shipping connectivity with Panama. To date, 21 vessel operators connect with the US directly through the Panama Canal, which is the crossroad between east-west and north-south routes, followed by Mexico, Jamaica, and Colombia. Thus, the Panama Canal expansion will allow regional expansion of ports, and therefore, larger vessels transiting through the Caribbean. Likewise, the proposed Nicaragua Canal will be another development in the region that will bring more pressures and, thus, impacts on the Seaflower MPA ecosystems.

3.7.1.1 The Panama Canal Expansion

The opening, on June 26, 2016, of the expanded new Panama Canal (The World Bank, 2016) will enable the transit of approximately 4,750 additional ships per year, handling over five percent of global goods, and about eight percent of all transshipments worldwide (Rodrigue & Ashar, 2015). Furthermore, over 72% of all regional Central and South American transshipments move through the south-western Caribbean area - wherein the Seaflower is located, a high amount of cargo, being containers and petroleum products the principal commodities moved through the area (AGCS, 2014).

Approximately 60 voyages per week (14,000 annually), to over 100 maritime routes (Figure 10), pass through the Caribbean Sea (US Department of Transportation, 2013; Webster, 2015). Thus, the risk of an incident occurring during transit through the routes in the Caribbean is much greater. Further, it will cause an increase of ship-source pollution such as CO_2, and GHG emissions (UNCTAD, 2015), which contribute to ocean acidification (Harrould-Kolieb & Herr, 2012; Hassellöv, Turner, Lauer, & Corbett, 2013), affecting the coral reefs in the Wider Caribbean area, and those within the Seaflower MPA.

Figure 10 Major shipping routes and Marine Traffic within the Caribbean Sea

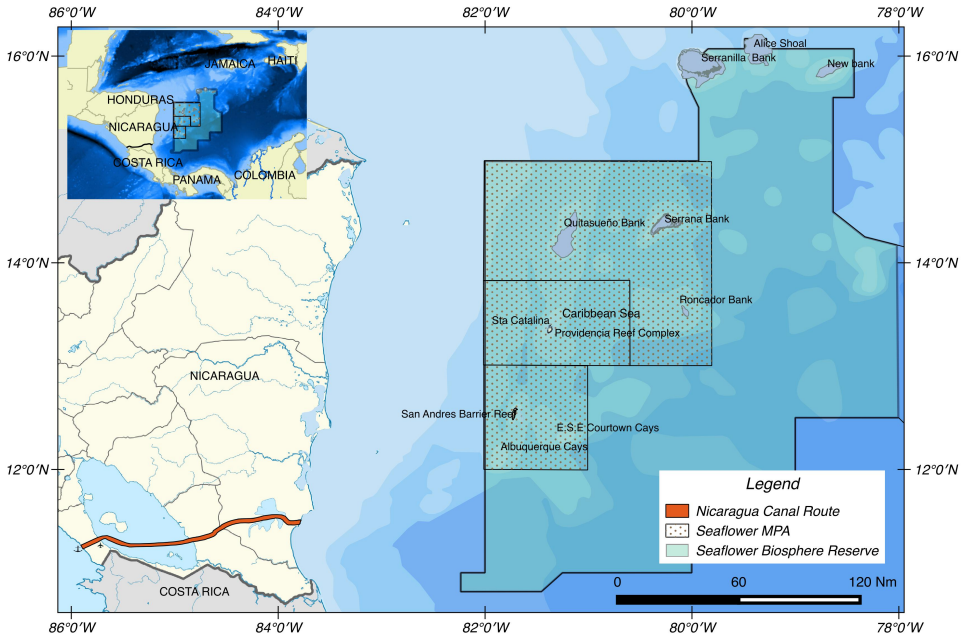


Source: The Author – Software QGIS

3.7.1.2 The Nicaragua Canal Construction

After several debates, the Nicaragua Canal (NC) seems set to become a reality. In 2013, the Nicaraguan government gave a concession to a Hong Kong Corporation (HKND) for the construction of the interoceanic canal including an oil pipeline, and two deep-water ports among other inland projects. This concession, since the beginning, has not taken account of the environmental impact assessment as part of the approval requirement; nevertheless, the government is continuing the development of this project despite the recommendations made by the scientific community (Huete-Pérez, et al., 2015; Yip & Wong, 2015). The development of this alternative route in the Caribbean will allow the transit of about 17% of the global fleet (AGCS, 2014). This means an increase in maritime traffic near the Seaflower MPA (Figure 11) due to its proximity to the Nicaraguan coast, over 100 km away (Howard, 2006).

Figure 11 Nicaragua Canal



Source: The Author – Software QGIS

The construction of the canal represents a significant and long-term negative implication for this hotspot of global biodiversity (Huete-Pérez, et al., 2015), changing oceanographic patterns especially in the following areas:

3.7.1.2.1 Physical properties of water

The opening of channels from continental zones may cause the exchange of fresh water, altering the equilibrium of sea temperature and salinity, and influencing changes in the water mass composition. These alterations can be markedly noted in specific regions, especially in semi-enclosed seas like the Caribbean Sea (Stewart, 2003; Osborne, Haley, Hathorne, Flögel, & Frank, 2014).

For instance, the behaviour of the water mass circulating the Seaflower MPA will depend on the climatology of the region (dry and rainy seasons), defining the long-term physical conditions, which determine the development of living organisms (Andrade C. , 2000). Therefore, changes in patterns of physical properties, and the water mass circulation will affect some of the marine organisms regarding their physiological processes, presence, and distribution.

Moreover, the opening process and further maintenance activities on the canal will impact the surrounding marine environment. The disposal of dredged materials along the coasts and estuaries on both sides the Caribbean and Pacific will contribute increasing sediments, affecting the turbidity, and quality of water due to dispersion caused by currents. The consequences for the area are, among others, damage to the coral reef and seagrass bed ecosystems (Huete-Pérez, et al., 2015) including those within the Seaflower MPA.

3.7.1.2.2 Water Mass Circulation

The opening of the NC might alter the hydrodynamics in the area, changing the patterns of adjacent water flows, especially on the surface taking into account the analysis of the currents by Molares et al., (2004). For instance, the south-western Caribbean has three predominant surface currents well described by Andrade (2000), Andrade, Barton, & Mooers (2003).

Moreover, the stream, which may change, is the Panama-Colombia Gyre (PCG), due to its cyclonic circulation in a southwesterly direction (Figure 7), might move the sediments produced from the NC, displacing all the suspended particles in the surrounding areas. It could alter the oceanographic regime, as well as cause degradation of the biota in the area, especially in the coral reef.

There are other shipping-related aspects associated with the Panama Canal expansion and Nicaragua Canal construction that could impact considerably, in the long-term, the ecosystems within the Seaflower MPA, and thus the whole biosphere reserve.

3.7.2 Other Shipping Related Environmental Issues

Today, it is well known that 12% of marine pollution is produced by ships (Romero, 2016), including sewage, waste, and invasive species, among others. Furthermore, there are other shipping-related concerns that may also affect the marine environment such as the impact of wave wakes, and underwater noise produced by the transit of vessels into the Caribbean Sea.

3.7.2.1 Invasive Species

The issue of invasive species is a hot topic for the international community, particularly the IMO. The IMO has developed binding and non-binding instruments, such as the 2001 Anti-fouling Convention (AFS), and guidelines to prevent invasive

species from ballast water (Tamelander, Riddering, Haag, & Matheickal, 2010). Furthermore, the Ballast Water Management Convention (BWMC) will soon enter into force, addressing the issue widely, seeking the reduction and control of invasive species from shipping. In addition, many other institutions are contributing to this issue (WWF, 2009) more broadly, advising and increasing awareness within communities due to the importance of conservation of biodiversity.

Therefore, due to the multiple negative impacts on the environment as described by Tamelander, Riddering, Haag, & Matheickal (2010), one of the major concerns is associated with the reduction of native biodiversity by predation or competition with indigenous species. Furthermore, impacts to the ecosystems mainly pertain to the changes of ecological cycles, owing to the diminution of oxygen, causing decomposition of nutrients, and also affecting water quality and impacting the health of coastal populations (WWF, 2009).

Consequently, According to Mooney (2005), the combined impact on these biota, in the short-term might be unappreciated. However, in the long-term, it will threaten the environment altering and changing the stability of ecosystems services, and then, the primary production will be affected, having repercussions on the economy of the region. This economic repercussion is concerning, mainly, with the reduction of fish stocks due to introduction of pest and pathogens.

Studies regarding invasive species in the Colombian Caribbean Sea have been conducted by Lopez & Krauss (2006). Moreover, the major issue concerning invasive species is the Lionfish (Mooney, 2005; Green & Côté, 2008; Morris, 2012), which due to its fast spread from the East Coast of US is causing severe damage to the environment of the coral reef areas in the Caribbean region. Therefore, ecosystems within the Seaflower MPA are not immune to these issues.

The permanent traffic passing, through the Panama Canal, and in the short-term, through the Nicaragua Canal, will increase the risk of invasive species by ballast water exchange and fouling during voyages into the zone.

3.7.2.2 Wave Wake by Ships

The increase in maritime traffic as a result of the Panama Canal expansion, and the Nicaragua Canal construction might cause more impacts to the marine environment within the zone as a consequence of ship wave generation.

To discuss wave wake impacts, it is necessary to define the concept of the high-speed vessel. According to MarCom (2003), The IMO developed the High-Speed Craft Code (HSC Code), establishing, and, therein, its definition. Thus, a High-speed vessel is one which can reach maximum speed, equal or superior to $3{,}7\ \nabla^{0{,}1667}(m/s)$, wherein $\nabla\ (m^3)$ is the displacement of the ship measured above the waterline.

Merchant vessels are embodied in the category of high-speed craft according to the interpretation of British Law (UK Legislation, 2004). Therefore, considering this, there are adverse effects of ships adding wake wave energy to coastal systems where they occur. For instance, the morphology and ecology in an area can be affected significantly by the transit of merchant vessels at slow steaming (Moon & Woo, 2014), and small, fast boats through or near to MPAs especially when the natural wave energy is very low (Bauer, Lorang, & Sherman, 2002).

Two dominant processes related to wave making have been identified as having negative impacts on the environment, associated with vessel traffic. Firstly, changes in the wave period due to the ship's speed; and secondly, wave transformation caused by the effect of bathymetry (MarCom, 2003). Thus, these two processes are relevant for

the MPA, due to the bathymetry and seasonal oceanographic patterns within, which are more sensitive to the effects of a vessel's wave wake, causing changes of wave height, celerity, and direction, affecting the normal physical and biological conditions of the ecosystems.

3.7.2.3 Underwater Noise by Shipping

International concern is rising regarding the impacts of noise pollution on the marine environment from anthropogenic activities, especially shipping. Furthermore, the safeguarding of MPAs from ship noise is an important topic due to the ecological richness, and the protection of threatened marine species of mammals and fish. That is why the International Whaling Commission (IWC), and IUCN has addressed and called for the adoption of measures to protect marine species and environments from ship noise pollution, especially in MPAs (Haren, 2007; Abdulla & Linden, 2008).

Additionally, the IMO developed through MEPC.1/Circ.833 on April 2014 (IMO, 2014) "*Guidelines for the reduction of underwater noise from commercial shipping to address adverse impacts on marine life*". These guidelines are establishing some measures that the maritime industry can adopt. These measures are related to technology, good maintenance practices, and selection of ship speed. The reduction of ship speed is a major factor that contributes to reducing cavitation of propellers reducing underwater noise. Furthermore, these guidelines advice countries to adopt measures such as rerouting as a mean to reduce adverse impacts on marine life especially in sensitive areas.

Commercial shipping is categorized as lower-level and chronic, which means that the constant perturbation also poses a threat for the long-term cumulative effect (Haren, 2007; McKenna, Ross, Wiggins, & Hildebrand, 2011). For instance, the increase in maritime traffic will increase noise levels interfering with species' ability to

communicate, but it also may affect natural reproductive and developmental functions due to generalized stress (Hildebrand J. , 2005).

According to Poleika, S., (2004) as cited by Haren, (2007), in 2004, a study conducted in the Santa Barbara Channel National Marine Sanctuary on the Pacific Coast of US, showed that noise generated by propellers from commercial shipping had the most significant impact on the sanctuary due to the proximity of the routes passing by.

Additionally, other studies related to underwater noise from ships, such as supertankers and container ships, show that these vessels emit the highest broad bands of low-frequency tones (long wave distance) between 5 and 500 Hz, due to the wave characteristics produced by their propeller cavitation (McKenna, Ross, Wiggins, & Hildebrand, 2011).

Furthermore, as a consequence of high displacement, and considering the physical property of water to absorb sound, it may stay resilient in the water for extended periods if maintaining constant low-frequency emissions. These are the primary sources of background noise in areas heavily transited by merchant ships. Thus, shipping is the principal source of background noise in oceans worldwide, doubling this value every decade, proportionally to the increasing of the size of vessels (Mazzuca, L., 2001, as cited by Haren, (2007)).

Specifically for the Caribbean, the increase in maritime traffic due to recent developments will result in denser shipping route areas that will threaten the surrounding marine environments by ship-source noise, causing degradation of the ecosystems in the area as well as in the Seaflower MPA.

3.7.3 Environmental Impacts from Seabed Activities

The seabed is a reservoir of natural resources such as oil, and gas, and while these resources remain in the seabed within the EEZ of a state, it has the rights to explore and exploit these resources in a sustainable way (Zeeniya, 2013). Moreover, these activities represent only the one percent of total marine pollution (Romero, 2016). Nevertheless, the impacts of this particular activity might be devastating in the long-term (Markussen, 1994; Morgan, Odunton, & Jones, 1999; Eastwood, Mills, Aldridge, Houghton, & Rogers, 2007).

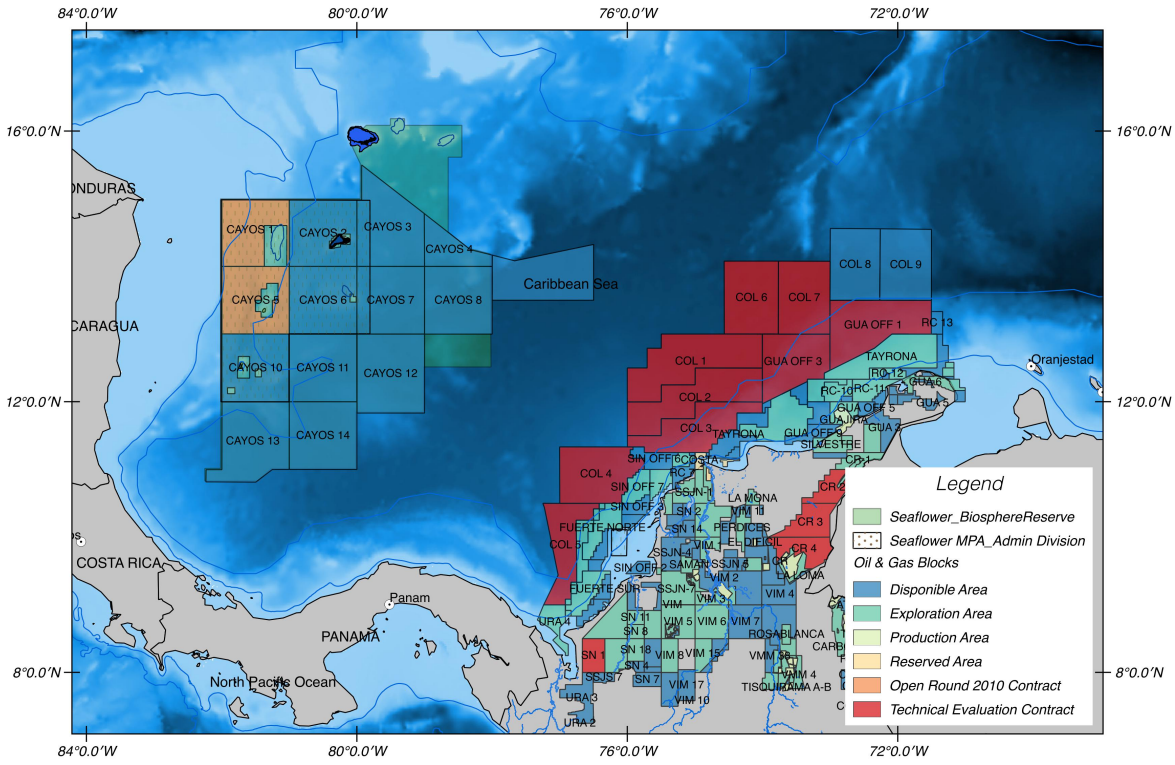
Therefore, at global level, UNCLOS (Part XII) gives provisions concerning protection and prevention of pollution from seabed activities (UNCLOS, 1982). Likewise, international institutions such as the Seabed Authority (ISA, 2008), and many others such as the IMO, are committed to addressing offshore activities regarding oil and gas exploration and exploitation (Lyons, 2011; EMSA, 2013) encouraging the states to take the effective measures.

In this regard, Colombia has stated in its national constitution, and enforced through several national laws, the protection of the marine environment, including regulations for the development of seabed activities (Minambiente, 2011; Minambiente, 2015).

The National Agency of Hydrocarbons (ANH) is the entity in charge of managing the development of these activities. For instance, they have conducted studies in the Caribbean Sea, and determined areas for exploration in the Nicaraguan platform (ANH, 2010), and the Cayos basin (Castillo L. & Vargas C., 2013). Thus, around thirteen prospective areas has been identified (Figure 12), with an extension of over 130,000 sq.km within these sectors. There is evidence of hydrocarbons reservoirs (ANH, 2010) due to the structural geology formed by calcareous and shell rocks from the coral reef from geological ages.

Despite its potential, these zones have not been drilled, especially since the majority of the areas are within the Seaflower Biosphere Reserve. Therefore, in 2011, Colombia's Government decided not to explore it (Garcia, 2012), as an example of the awareness of and commitment to the protection of the marine environment from the central level. However, again, the ecosystems within the MPA and the biosphere reserve are jeopardized by maritime disputes with the neighbouring country, Nicaragua. The reason is because it seems that one of Nicaragua's pretensions is to exploit oil resources in the seabed within the area (Gorricho, 2012).

Figure 12 Caribbean Colombian Oil and Gas exploitation blocks



Source: The Author – Software QGIS

3.7.4 Maritime Boundary Disputes

According to Sanín, and Ceballos (2013), Gorricho (2012), and Bekker (2013), Colombia and Nicaragua have been in maritime disputes since the 19th century, when they obtained sovereignty over their respective territories after being ruled by Spain since the colonial period. Moreover, in 1928, both states agreed to solve sovereignty rights differences over the San Andres Archipelago and the Nicaraguan Mosquito Coast with a bilateral treaty. It is agreed in the treaty that Nicaragua keep the Mosquito Coast, and Colombia the archipelago area. However, in 1972, Colombia and the US signed a treaty in which the US renounced its sovereignty claims over the north-western cays and atolls Quitasueño, Roncador, and Serrana. Nevertheless, at that time, Colombia was protesting against Nicaragua because, in 1969, it granted concessions for oil exploration in the Quitasueño area. Therefore, Nicaragua denounced the 1928 treaty, in 1980, and declared it null.

Consequently, in late 2001, Nicaragua instituted proceedings against Colombia at the International Court of Justice (ICJ), claiming rights to the islands and maritime waters (Bekker, 2013). Additionally, Nicaragua requested to the Seabed Authority an extension of their continental shelf with the pretension of granted in concession the area claimed for exploration and exploitation of oil and gas, jeopardizing the marine biodiversity, in particular, the coral reef areas. However, the ICJ refused the request due to insufficient data and information to do so (ICJ, 2012).

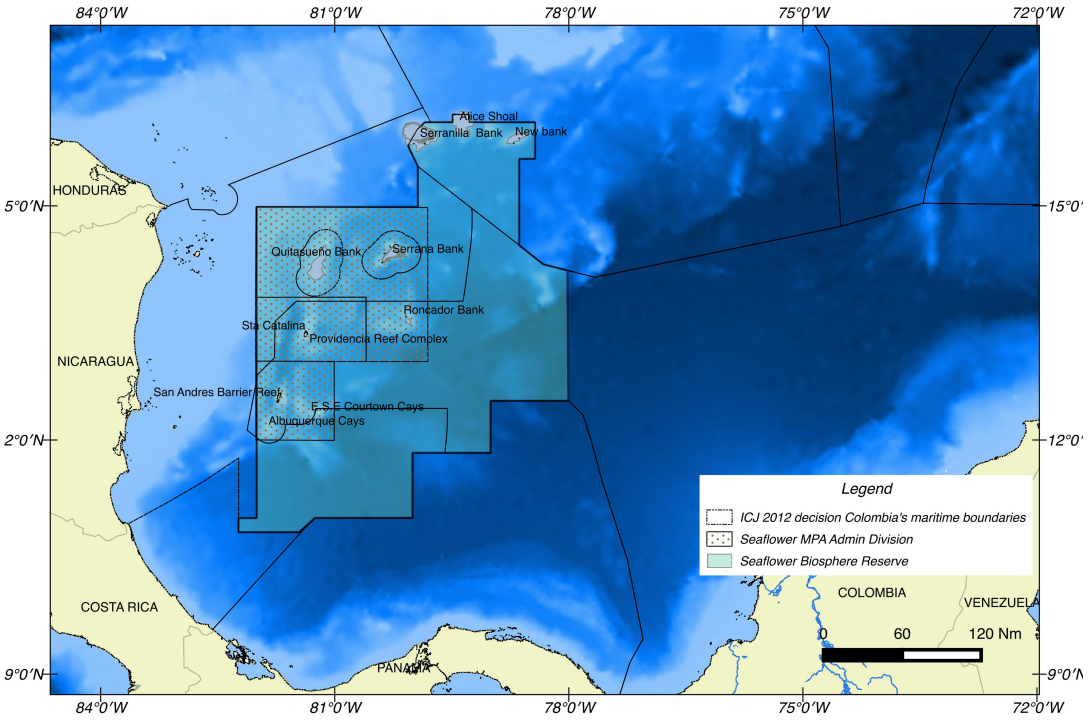
After eleven years, the ICJ ruled, based on customary law, that Colombia has the sovereignty over the islands in question. However, due to Colombia not being party to UNCLOS, Nicaragua was given rights to over 75,000 km^2 of sea (ICJ, 2012; Bekker, 2013) (Figure 13), surrounding the islands, which tremendously affected the historical values of native islanders from the archipelago, whose legal livelihoods depend mainly on fishing activities as the basis of their subsistence, followed by tourism. Besides,

drug trafficking is an emerging activity for the young population due to the proximity to Central America (Gorricho, 2012; Taylor, Baine, Killmer, & Howard, 2013; Otero, 2014-2015), which are affecting the economy of islanders because of the reduction of labour in fishing and tourism activities. Moreover, an increase in IUU fishing activities is also an issue as consequence of the judgment (CORALINA, 2014).

Furthermore, the ICJ decision is a disaster for the pristine marine ecosystems, dividing the integrity of the Seaflower MPA and the biosphere reserve declared by UNESCO in early 2000 (Howard, 2006), and backed by many international environmental organizations such as UNEP, and GEF (Gorricho, 2012). For instance, during the International Coordinating Council of the MAB program in 2014 (UNESCO, 2014), UNESCO appealed to both authorities, Colombia and Nicaragua, to continue respecting the protected areas of the Seaflower BR, encouraging them to establish a transboundary biosphere reserve.

After the 2012 judgment, Colombia presented objections to the ICJ, who in early 2016 reaffirmed its first judgment, giving rights to Nicaragua over the waters of the archipelago (ICJ, 2016). Colombia refused the judgment and said that it would seek bilateral agreements with Nicaragua, calling for diplomacy between the states to deal with the dispute (El Tiempo, 2016). In consequence, political constraints and economic interest are affecting and jeopardizing the protection of the marine ecosystems within the Seaflower Biosphere Reserve, and thus the MPA.

Figure 13 Seaflower MPA and Colombia's maritime boundary (ICJ Decision)



Source: The Author- Software QGIS

CHAPTER 4. APPROACHES TO ADDRESS THREATS TO THE SEAFLOWER MPA

As shown in Chapter 3, threats to the Seaflower MPA and the biosphere reserve are inherently transnational and are exacerbated by weak enforcement and ineffective implementation of regulations, and management instruments by authorities and administrators. Meanwhile, the effects of climate change continuing impacting negatively, plus the regional common environmental threats of overexploitation of fish stocks, and land-based pollution continuing causing degradation of the ecosystems.

In addition to this, while shipping remains on the surface, ship-source pollution will continue contributing to the degradation of marine and coastal biodiversity. Furthermore, as new technologies for seabed activities are being improved, marine pollution, of all kinds, is the top priority and the main challenge for the protection and conservation of marine biodiversity.

Nevertheless, political issues represent a significant threat to the protection of ecosystems and habitats within the Seaflower MPA that cannot be protected and sustainably managed if the integrity of Seaflower Biosphere Reserve is fragmented. Thus, recognizing the importance of marine biodiversity and its ecosystems, it is paramount to understand that oceans and their living species do not recognize political boundaries.

For instance, to address political constraints and shipping-related issues, some effective measures have to be taken at all levels. Although it is understood that solving political problems is a highly time-consuming process, whereas the shipping-related issues are possible to address by immediately taking the necessary actions to achieve the goals of protecting the marine environment.

4.1 Governance Initiatives

From the ocean governance, some measures at the regional level can be taken. Despite this, the governance framework in regional seas is not effective enough, in general, as was shown by the EU in the public consultation on international ocean governance conducted in 2015 (EU, 2015), and many other authors (Vallega, 2002; Wright, 2014) who agreed with it. For instance, there is the opportunity to enhance governance of MPAs, closing the existing gaps on national and regional framework, and management mechanism based on the combination of different theoretical governance perspectives expressed by Van-Tatenhove (2013) and Jones (2014), in which the states, market, and civil society are involved. There is an imperative to understand that the governance processes have to be developed in two ways, top-down and bottom-up. The involvement of all governments, and stakeholders surrounding the Seaflower is paramount, besides the integration of communities that receive benefits from ecosystem services through a participatory process (Van Tatenhove, 2013).

4.1.1 Regional agreements

At the governance level, it is paramount to enhance the existing links with UNEP-CEP through the WCR agreement (Cartagena Convention) especially in relation to the SPAW Protocol (UNEP, 2012) seeking international support to keep the unity of the MPA. To do so, Colombia as the depository country to the convention has to assume leadership among the neighboring countries to motivate them to ratify it, seeking the

commitment and awareness for the protection of the rich ecosystems that encompass the Seaflower BR. The aim for those countries who have not ratified the protocol yet, once they agree to comply with it, is to bind the actions of these states concerning the protection of the ecosystems surrounding the MPA.

It is vital to consider the ongoing regional process for the implementation of the SDGs, specifically on Goal 14.5 regarding conservation of at least ten percent of national MPAs (UNSD, 2015). The role of the regional environmental agreements is also fundamental (UNEP, 2016). To do so, it is paramount that the application of EBM approach (Fanning, et al., 2007; Van Tatenhove, 2013; Olsen, et al., 2013) be employed as a mechanism to strengthen governance in the Caribbean region (Mahon, et al., 2010).

Moreover, it is crucial that Colombia builds stronger partnerships between international environmental organizations such as the Intergovernmental Oceanographic Commission (IOC) and UNEP that have been working in the region for a long time. It might be a useful strategy to raise a voice to the international community, calling for the protection of the Seaflower BR, seeking support to create transboundary agreements, despite the boundary disputes that the country is facing.

4.1.1.1 Transboundary Marine Protected Areas (TBMPAs) - Conservation Agreements

As the regionalization of governance has received high acceptance in the last few years (Vallega, 2002), many organizations and states that share particular ecosystems are focusing on strengthening transboundary agreements.

Furthermore, since 1997 IUCN has taken leadership in developing the initiative to create the Global Transboundary Conservation Network defining different types of transboundary protected areas (IUCN-WCPA, 2011), with the mission of encouraging cross-border cooperation and peace-building among countries (MPA News, 2008). The main goal of this initiative is the protection of ecosystems and biodiversity, enhancing knowledge and capacity-building, and promoting cultural heritage and social values.

Additionally, there are some international treaties such as the Convention on Migratory Species of Wild Animals (CMS) that supports TBMPAs (Vasilijević, Zunckel, McKinney, Erg, Schoon, & Rosen-Michel, 2015). According to the latest inventory in 2007, there are 227 TBPAs in different categories around the world, where Colombia has four TBPAs, both inland, and marine, with the neighboring countries of Panama, Peru, Ecuador, Brazil and Venezuela (IUCN-WCPA, 2011).

Moreover, the international community firmly believes that LMEs and transboundary water systems are a good approach to achieving regional protection of marine ecosystems (Fanning, et al., 2007). Thus, GEF and the IOC, over a six year period (i.e. 2009 to 2015), developed the Transboundary Waters Assessment Programme (TWAP) (IOC-UNESCO; UNEP, 2016).

The report points out how anthropogenic activities are highly degrading the ecosystems within these LMEs including the CLME, in addition to the impacts of climate change. Furthermore, it is recognized that the option to address the issues and pressures on these ecosystems requires an integrative and multi-sectoral approach through the improvement of transboundary governance, seeking country-level engagement, and closing gaps in biodiversity arrangements.

To do so, the first step is to foster a scientific data revolution (CEPEI, 2015) developing a follow-up indicator framework, and monitoring associated systems through an innovative methodology. It is fundamental to consider an open governance process, based on co-management, which contributes to production, and collection of data as a mean of filling the gaps of information for a suitable decision-making process.

Taking the above into account, and based on the findings of the TWAP to improve governance, MPAs are an adequate mechanism to achieve ocean governance, particularly on the CLME, enhancing ecosystem resilience regarding an improvement on policy response (IOC-UNESCO; UNEP, 2016).

Moreover, one single country cannot protect all the ecosystems by itself. It is necessary to engage other nations and seek the establishment of transboundary agreements focusing on fisheries, biodiversity protection, and exchange of data and information (IOC-UNESCO; UNEP, 2016). The Seaflower RB might be the adequate scenario, seeking cross-cutting integration between the institutions in charge to manage the activities within the EEZ of each neighboring country to the Seaflower.

The Seaflower MPA is an ideal area to create a Transboundary Protected Peace Park (TBPP) (Gorricho, 2012) to promote peace and cooperation among countries (MPA News, 2008; IUCN-WCPA, 2011; Vasilijević, Zunckel, McKinney, Erg, Schoon, & Rosen-Michel, 2015). Some maritime disputes among countries have been solved through this effort. For example, in 1932, Canada and the US declared the Waterton Lakes an international peace park (Vasilijević, Zunckel, McKinney, Erg, Schoon, & Rosen-Michel, 2015), and other countries such as Ecuador and Peru have adopted the experiences learned (Gorricho, 2012). Nevertheless, it is vital for the intervention of

international environmental organizations to act as a neutral moderator for the well-being of the ecosystems within the CLME.

Furthermore, experiences learned from the effectiveness of transboundary agreements around the world are essential to support the initiatives that Colombia can undertake to address protection of the marine ecosystems and its habitats within the Seaflower BR, and therefore, for the MPA.

4.1.1.1.1 Case of analysis 1: The Gulf of Maine (Canada – US)

The Gulf of Maine has quite a similar history to the San Andres Archipelago. According to Vanderzaag (2010), in the 1960s and 1970s, the Gulf of Maine was an object of disputes between Canada and the US. The claim was for continental shelf rights in a fishing zone between borders (Georges Banks). After the ICJ judgment, both countries codified the adopted the decision through a bilateral treaty in 1981.

Several lessons were learned from this case; the most relevant being that countries demonstrate flexibility, showing an interest to agree on the disputes despite the economic interest (fishing) in the zone, but also recognizing the social and cultural values for the communities in the area. Another lesson is that, although the dispute was solved, both countries understood that while maritime boundary delimitation was the endpoint of political concerns, it was also the starting point for effective transboundary ocean governance, and long-term management cooperation of the marine environment.

Thus, from 1989 the bordering Canadian provinces and US states decided to adopt an informal agreement for the conservation of the marine environment, enhancing transboundary cooperation based on shared ecosystem goals and targets. To date, what started as an informal agreement has become a stronger binding instrument. This is

because, from the beginning, the main goal and the desire of local governors was to cooperate for the well-being of their communities and the long-term nature conservation of ecosystems (Hildebrand & Chircop, 2010; Hildebrand L. , 2016).

4.1.1.1.2 Case of analysis 2: The Red Sea Marine Peace Park (RSMPP)

After many years of political and religious conflicts between Israel and Jordan including maritime disputes in the Gulf of Aqaba, in 1994 both countries normalized political relations, and in 1999 agreed to solve their differences through the creation of the RSMPP. The importance of this case is to show how cooperation and good foreign relations can be built based on the conservation of the marine environment (Ormel, 2011). The Gulf of Aqaba is a semi-enclosed sea encompassing one of the largest coral reef ecosystems within the Red Sea; therefore, both countries have MPAs within the area, the Jordan's Aqaba Marine Park, and Israel's Coral Reef Reserve (MPA News, 2008). Each state funds this TBPP according to the targets in each particular MPA, and both promote tourism for the benefit of the communities surrounding the area, contributing to the growth of the regional economy. Moreover, the outcome of these actions resulted in protection and long-term sustainable development (MPA News, 2008), plus the improved management of the shared common natural resources that are being affected by the same stressors and anthropogenic activities.

4.1.1.1.3 Case of analysis 3: The Korean Peninsula

The both Korean countries, North and South, have faced political and military issues and boundary disputes in the Korean Peninsula. This resulted in two naval conflicts in a period of three years (1999-2002), which, thanks to the recognition of culture and economic values, were solved peacefully (KMI, 2007). Consequently, in 2005, initial actions to propose the creation of an MPP in the disputed areas between the South and North Korean governments started. With no response from the North, South Korea lead the actions, based on the goals for the MDGs to ensure sustainable and peaceful

development while taking into account the EBM, peace, and economic prosperity in the western Korean sea region. Moreover, political will, in this case, was the main problem (MPA News, 2008).

According to the report by the Korean Maritime Institute (KMI) (2007), as both governments could not agree through political channels to the creation of the MPP, the KMI proposed a set of recommendations to address the challenges in development, and to succeed in its creation. Firstly, countries have to give the leadership to the local communities, scientific organizations, and other stakeholders from both nations because between them it is possible to achieve a positive dialogue. Secondly, it points out that enhancing the partnerships with international and regional environmental organizations such as IUCN, UNESCO, UNEP and the GEF are paramount as moderators in the process and guarantors of the agreed.

Finally, the report encourages the countries to be patient in the schedule. Due to the construction of these processes, it is necessary to include social awareness, which is neither easy nor quick to achieve. To date, this initiative has not been fully implemented despite the significant efforts made by South Korea. Due to the unwillingness of North Korea (Mackelworth, 2016) to work for the efficient management and sustainable development of the area in question, it is still under discussion. Nevertheless, this initiative is an excellent example of how positive action can be undertaken in achieving transboundary marine environmental issues and peace building from one country that has the desire to cooperate.

4.1.1.1.4 Case of analysis 4: Pelagos Sanctuary Marine Mammals (PSMM)

The PSMM, the largest TBMPA in the Mediterranean Sea (3.5% of total Area) (Gabrié, et al., 2012), is a trilateral agreement between France, Italy, and Monaco for the protection of marine mammals, especially cetaceans (Grilo, 2010). This initiative

began in 1999 and entered into force in 2002 (Mackelworth, 2012), and is part of the Barcelona Convention, qualified as a Specially Protected Area of Mediterranean Importance (SPAMI) (Olsen, et al., 2013). It is a good example of how cross-border management is an efficient mechanism. The PSMM member states agreed that all management activities beyond the territorial sea must be co-managed. It is because all the coastal states in the Mediterranean Sea have not declared sovereignty over their EEZ. They only consider high seas to be beyond their territorial sea (Guerreiro da Silva, Fernandes e Castro-Ribeiro, Mocinho-Viras, & Grilo, 2012). Then, all the activities beyond its maritime jurisdiction (territorial sea) have to be managed by applying the agreement based on the EBM approach. However, the designation of a unique management body is threatening the effectiveness of the governance process (UNEP-MAP, 2012; Olsen, et al., 2013).

Nevertheless, this transboundary MPA has succeeded in effective management since its creation due to the willingness and commitment of the three states to protect the marine environment.

Finally, there are several other TBMPA regimes around the world such as the Coral Triangle TBMPA between six countries (White, et al., 2014). There are other TBMPAs in coastal and marine areas in East Africa (Guerreiro, Chircop, Grilo, Viras, Ribeiro, & Van der Elst, 2010; Grilo, Chircop, & Guerreiro, 2012). All of the above have succeeded in achieving cross-jurisdictional conservation.

The success of these TBMPAs has been based on the exercise of national sovereignty, and transnational coordination, thanks to the efficient management initiatives and mechanism implemented for the states that agreed to do so. They have been motivated by ecological concerns (Grilo, 2010) implementing EBM, but they have also given

significant value to the transboundary human and environmental interconnection (Jones, 2014).

Likewise, experiences learned from experts in MPAs (Jones, 2014; Kelleher G. , 2015) point out the importance of national and regional MPA networks, particularly in developing countries. Examples of these are well explained by UNEP-WCMC (2008) in the Report of the National and Regional MPA Network. The significance of creating such networks is that a single MPA is unlikely to succeed due to the transmission of the adverse effects of external anthropogenic activities into the MPA. This is because of the fast expansion of the economy in recent years, which is causing coastal and marine degradation. Moreover, managers frequently fail to reach the final goal of the MPA due to their, sometimes, preferring immediate recognition rather than long-term benefits (Kelleher G. , 2015).

Colombia, in the exercise of its sovereign rights and thinking about long-term management, carried out an analysis of the existing metadata in the Seaflower BR through the Colombian Ocean Commission (CCO) in 2013 (Murillo & Ortiz, 2013). The main goal, based on a science-based management approach, is to improve data and information in the area. Therefore, the government supported the initiative to create the Seaflower National Working Group (Seaflower NWG). This NWG is integrated by the MADS, CCO, DIMAR, Coralina, the academia (i.e. universities), and the INVEMAR. The objective is to incorporate marine research programs in their awareness to define the real state of marine knowledge within the biosphere reserve taking into account specific areas for research based on data gaps.

Furthermore, the report (Murillo & Ortiz, 2013, pp. 13-25) mentions that nineteen research areas were defined with a total of 187 projects developed to date by different sectors of the Seaflower NWG. The results of the data received point out a low

percentage of projects related to MPA management (5%), governance (4%), among others, while bathymetry is the highest value (21%) followed by biodiversity, and ecosystems. In addition, the majority of these have been developed mainly close to the main island San Andres (37%), followed by broader projects within the biosphere reserve and the archipelago, 18%, and 17% respectively. This means that the peripheral areas such as the north and south cays and atolls require more attention in monitoring and follow-up for data and information especially related to the state of the ecosystems. Therefore, it is paramount to reach a high percentage of developments regarding management and governance through the improvement of transboundary agreements and the implementation of MSP measures.

4.2 Spatial planning measures

As the governance process is the most meaningful solution to address the issues in the Seaflower MPA, simultaneously, other tools have to be considered to obtain effective management and conservation measures within the biosphere reserve. Moreover, transboundary agreements cannot be applied easily, and anthropogenic maritime activities, i.e. shipping, continues increasing rapidly; therefore other immediate actions are necessary.

Thus, spatial planning measures may contribute to management and conservation strategies (Olsen, et al., 2013). This tool is especially useful for the implementation of the EB management approach in the resolution of cross-border conflicts and inter-sectoral conflicts (Olsen, et al., 2013; Ehler, 2014), through the application of marine spatial management (MSM). Moreover, from the management point of view, EB-MSM is not independent of MPAs. These concepts are intrinsically linked, crosscutting and interrelating especially in multi-use MPAs wherein diverse purposes, ecological, social, cultural, and economic, apply (Olsen, et al., 2013).

The significance of this concept is well appreciated and widely understood across Europe (Jay, et al., 2016), but particularly in the Baltic Sea due to the narrow area that encompasses this regional sea, and the multiple activities, busy shipping routes among others, developed within. Therefore, in their awareness to manage this area effectively, a document was released called *Vision and Strategies around the Baltic Sea (VASAB)*, in which the general principles for MSP are established, cross-cutting with the environmental agreements. It is relevant to mention that this agreement is the first worldwide where the MSP concept was developed for a large transboundary co-operation area (EU, 2013). It also served as the basis for the 2014 EU Maritime Spatial Planning Directive (Jay, et al., 2016). Simultaneously, there are countries outside EU that also have developed MSP effectively such as Australia, Canada, and the US.

Thus, new routes for vessel traffic present challenges for managers, despite the strict governance in the shipping industry. Some conflicts and issues require proper zoning and delimitation so as not to interfere with each other, and in cases in which some of these overlap it does not cause any threats to the marine environment nor for safe navigation.

The regional developments in the Caribbean Sea such as the Panama Canal extension and the proposed Nicaragua Canal, will increase liner connectivity causing an increase of maritime traffic through the zone that, to a certain extent, crosses the Seaflower MPA.

Therefore, it is urgent to establish measures through the use of the MSP mechanism to protect the ecosystems, especially from shipping in the peripheral areas of the Seaflower BR. As it was mentioned in Chapter 3, within the MPA and the biosphere reserve there are unique ecosystems especially coral reefs that are suffering degradation, as a consequence of changes to the oceanographic conditions.

Additionally, the increase in maritime traffic in the area will create constant wave wake, as an effect of the marked variations in bathymetry, plus noise generated by propellers, contributing to the degradation of the ecosystems.

In consequence, to mitigate to some degree these impacts the most efficient solution is to make use of the IMO instruments to regulate maritime traffic and protect the ecosystems creating a TSS, and the establishment of a PSSA.

4.2.1 Traffic Separation Scheme (TSS)

Vessel traffic zones (VTZ) are defined as an approach to managing the traffic of large vessels within a particular area in order to boost protection of marine resources, physical and biological, and simultaneously allowing safe navigation and efficient vessel operation (Brown, 2001; Pietrzykowski & Magaj, 2016). This practice was implemented especially in passenger ships in the North Atlantic in 1898 and later on was adopted internationally for the importance of vessel safety in 1964, included within the 1960 SOLAS Convention (IMO, 2016). To begin with, the mechanism was adopted by coastal states in particularly busy areas of on-going vessels. In addition, due to the increase in collisions and maritime casualties, the states have been obliged to adopt regulatory measures. Thus, the IMO, as the international body responsible for regulation, has approved this mechanism, making it a mandatory observance for all ships. Therefore, in 1972, with the adoption of the collision regulations (COLREGs) TSS were included as the mandatory compliance (IMO, 2016).

Furthermore, the 1974 SOLAS Convention, in regulation V10, and V11 (IMO, 2003), defines the concept of ship's routing widely, encompassing protection of the marine environment as is stated in UNCLOS (Pietrzykowski & Magaj, 2016). Likewise, VTZ applies in principle to the following ship types: tankers, bulk carriers, and large

commercial vessels (LCVs) (Brown, 2001). In addition, any TSS scheme cannot function without a strong Vessel Traffic Service that controls and monitors the area where the TSS is demarked (IMO, 2003).

Based on international regulations, the measures in TSS are applicable to MPAs in every case, and coastal states have the right and duty to take effective preventive measures to protect their natural resources within their EEZ, including the exclusion, partially or wholly, of ships through MPAs (Spadi, 2000). The effectiveness of this tool has been measured and proved around the world. For example, the Baltic Sea as one of busiest shipping routes (EU, 2013; Pietrzykowski & Magaj, 2016), has shown the benefits of using routing schemes to safeguard the ships against collisions in busy areas and also protects the marine environment (Silber, et al., 2012). These assessments have also been conducted in MPAs, such as the Monterey Bay National Marine Sanctuary (Brown, 2001), and the Pelagos Sanctuary (Coomber, D'Incà, Rosso, Tepsich, Notarbartolo di Sciara, & Moulins, 2016).

The Caribbean Sea is also a busy area for shipping, which divides the maritime traffic into two broad categories, bulk, and containers (Briceño-Garmendia, Bofinger, Cubas, & Millan-Placci, 2015; UNCTAD, 2015). Nevertheless, according to Briceño-Garmendia, Bofinger, Cubas, & Millan-Placci (2015), the movement of containerized freight in the area is compounded by intercontinental and inter-island traffic that defines two types of routes: local routes and main roads. These, constitute a system of three different route networks within the Caribbean system, as follows:

- The actual island-to-island routes that bring all needed imports into the zone.
- The supply routes between main hubs for the Caribbean, and;
- The mainline routes passing through the region used for larger transshipment operations crossing the Panama Canal.

The routes above exclude passenger ships, which are increasing at the same rate as tourism grows. Moreover, three main gateway countries supply the Small Island States in the Caribbean: the US, Jamaica, and Trinidad (Briceño-Garmendia, Bofinger, Cubas, & Millan-Placci, 2015). Furthermore, almost all ports are connected through freight with Panama, where ten recognized carriers operates in the region (UNCTAD, 2015) Nevertheless, these carriers are different from those that connect with the US (US Department of Transportation, 2013; Rodrigue & Ashar, 2015) directly. Therefore, traffic becomes more dense, particularly, in the south-western Caribbean where the Seaflower MPA is located.

All the challenges mentioned above are causing negative impacts to the marine environment, including the MPA, as a consequence of the wave wake and underwater noise created by the transit of high-speed LCVs. Nevertheless, the most affected zone is in the northern part, where the cays and atolls Serrana, Quitasueño, and Roncador are located. The largest coral reefs in the entire Seaflower MPA are located there (CORALINA-INVEMAR; Gómez- López, D. I.; Segura-Quintero, C.; Sierra-Correa, P. C.; Garay-Tinoco, J., 2012) (Figure 8), and it is in these areas where vessels are observed navigating in proximity to the reefs. Additionally, other kinds of ship-source pollution like oil discharges, ballast water exchange, and CO_2 emissions are also impacting the MPA. Likewise, as was shown previously in the CCO report (Murillo & Ortiz, 2013), these areas are the least developed and least managed within the MPA. Additionally, the new Nicaragua Canal will force the transit of LCVs between the main islands of the archipelago (San Andres, and Providencia), creating new issues for the islanders, and managers in the management, and conservation of the ecosystems.

Therefore, the MPA is the proper scenario to develop the first TSS in Colombia, and the first in the southwestern Caribbean. As IMO routing guidelines mention

cooperation between states (IMO, 2003), it is an excellent opportunity to strengthen transboundary agreements regarding shipping with the neighboring countries that surround the Seaflower MPA and the biosphere reserve.

Furthermore, it has been proven that the restriction, in transit, of particular types of ships through protected areas is highly effective in the restoration and conservation of endangered species that have been extremely impacted by all kinds of ship-source pollution. Therefore, IMO established, as a preventive measure, an extensive list of adverse effects of navigation on the marine environment, and set up the concept of PSSAs (Spadi, 2000).

4.2.2 Particularly Sensitive Sea Areas (PSSAs)

The concept of PSSAs is defined by IMO in Resolution A.982 (24) as: "*an area that needs special protection through action by IMO because of its significance for recognized ecological, socio-economic or scientific reasons and because it may be vulnerable to damage by international shipping activities*" (IMO, 2006).

The criteria for an area to be selected by IMO as a PSSA must fulfill at least the following three elements (Roberts, Tsamenyi, Workman, & Johnson, 2005):

- The area proposed must embody one of the three criteria that mention the basic concept (i.e. ecological; social, cultural and economic; and scientific-educational);
- It must need special protection, i.e. be vulnerable enough to impacts by international shipping activities; and
- The area must allow IMO to take proper actions from their scope framework to provide protection from the vulnerability already identified.

The legal basis to do so is in UNCLOS chapter XII (UNCLOS, 1982) that gives the general scope to IMO, and to the states to take such actions, especially in rare and

fragile ecosystems. However, the designation of PSSAs by IMO is not legally binding at all because the concept was developed through a resolution, despite the legally binding convention, MARPOL 73/78, mentioning the designation of Special Areas. Therefore, PSSAs approach is covered under the legal concept of protective measures stated in MARPOL (Blanco-Bazán, 1996; Roberts, Tsamenyi, Workman, & Johnson, 2005). Nevertheless, for IMO to accede to declare a PSSA there have to be certain actions between international environmental organizations, coastal states and the IMO through co-operation mechanisms in the interest of being protected, and that the interrelated restrictive measures beyond IMO's competence do not affect further shipping activities (Blanco-Bazán, 1996).

Furthermore, according to Gjerde (2001), there are remarkable benefits with the designation of a PSSA. First, the area designated acquires international recognition of particular importance, which means that any further action to protect the marine environment has significant value. Second, safeguarding safe navigation, obliging sailors to take extra measures when navigating in proximity to the marked area; third, it lets coastal states take protective action to address different threats and risks associated with international shipping in the area. Additionally, the designated area must provide historical evidence of the risks and impacts (damage) caused by shipping, besides, vessel traffic characteristics, and relevant natural factors.

Moreover, to guarantee the effectiveness of the protective measures, coastal states may undertake enforcement measures through the adoption of Associated Protective Measures (APMs) within the PSSAs (Guan, 2010). The passage of these APMs will make PSSAs efficient in practice. Thus, IMO has approved certain measures regarding compulsory or recommended pilotage, mandatory ship reporting, avoidance areas, TSS, forbidding discharges, mandatory no-anchoring areas, deep water routes, and emission control areas (ECAs) (IMO, 2006). However, to ensure the efficiency of the

APMs from the lack of compliance by ship's masters, there enters into play a major role for countries, maritime administrations through coastal state and port state control. It is also possible to enhance these APMs in combination with the interaction of MPAs, and MSP (Guan, 2010).

To date, the IMO has designated fourteen PSSAs around the world (IMO, 2013), with Colombia having one, since 2005, in the tropical Pacific Ocean with the Malpelo Island, through Resolution 1589, October 26, 2005 (Cajiao, et al., 2006) (Figure 14). This area was designated with the aim of protecting the uniqueness of the marine fauna in the area (mainly sharks), and migratory species (whales and birds). In addition, in 2006, UNESCO declared this area as a fauna and flora sanctuary, and part of the culture heritage sites (UNESCO, 2016).

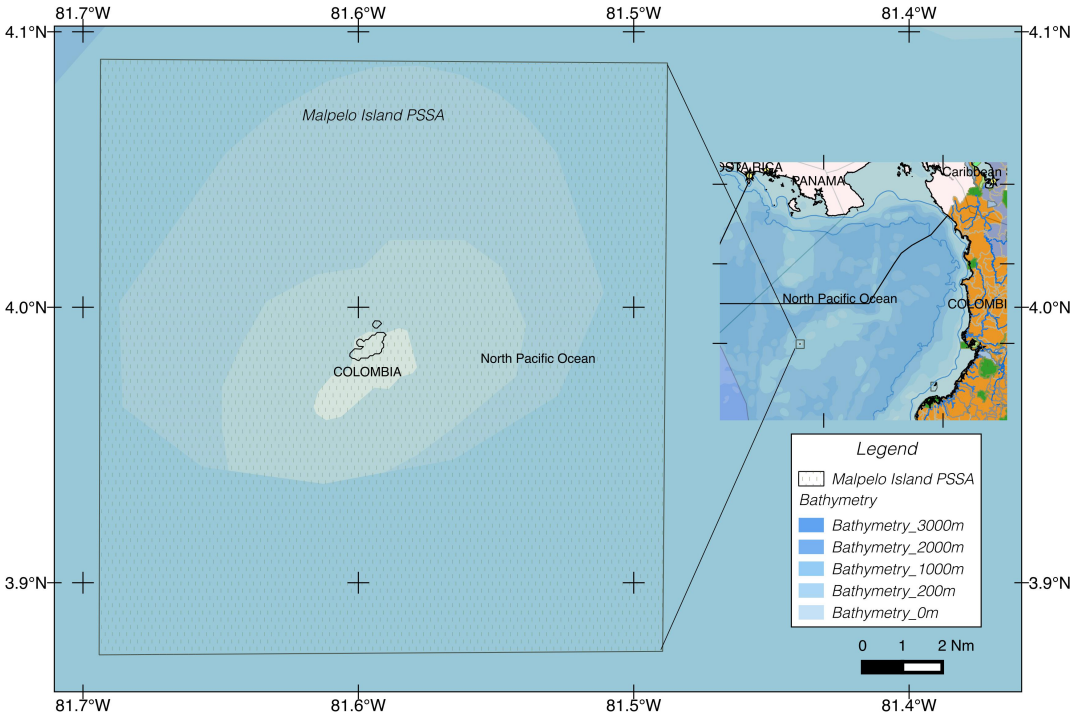
In accordance with all the above, the Seaflower MPA is again, the proper area to implement such measures for the protection of the marine environment, especially coral reef areas. The area meets the criteria established by the IMO guidelines for the designation of a PSSA (IMO, 2006).

For instance, analyzing ship tracks from international shipping through the major transited areas in the Caribbean, and that pass through Seaflower, and based on the information of the US Department of Transportation, the majority of international traffic consists of large containers and bulk (petroleum) ships (US Department of Transportation, 2013). The regional transshipment is also for containers and cruise ships (Webster, 2015). Thus, considering safe navigation, the northern part of the MPA, Serranilla, Quitasueño, Roncador, and Serrana, represents a high risk for ships due to the marked changes in bathymetry (Murillo & Ortiz, 2013).

Furthermore, the Seaflower MPA, as part of the biosphere reserve, counts on the recognition of international and regional environmental organizations, which provide

support and easy acceptance for the protection of the ecosystems in the areas mentioned above. Finally, considering that these are coral reef areas, it might be proper to adopt the APMs of a zone to be avoided, mandatory no anchoring, and TSS.

Figure 14 Malpelo Island PSSA



Source: The Author – Software QGIS

5 CONCLUSIONS AND RECOMMENDATIONS

Today, the world is facing the great challenge of developing and implementing the 2030 Agenda for Sustainable Development and its associated SDGs, which contain the path for the protection, conservation and sustainable use of oceans and coastal areas. In this regard, the international environmental organizations such as UNEP and the IMO, as the regulator of shipping activities, are performing well in the development of a comprehensive scope to establish protected areas to protect and conserve ecosystems and fragile habitats around the world. Nevertheless, it is the responsibility of states to establishing these, through a structured SAP and the development of proper policy mechanisms to enforce the correct management. The main goal has to be to conserve the ecosystems and habitats in the long-term, making the use of these in a sustainable way for the well-being of future generations.

Moreover, boundary disputes and political differences between states are of daily discussion due the desire of states to get more space to exploit natural marine resources. However, this is sometimes done without due care, with duties to the marine environment ignored. Therefore, actions have to be taken now seeking the commitment and the awareness of all stakeholders, national and regional, to ensure that biodiversity within a regional area maintains sustainable in the long-term. The use of marine areas in regional seas is increasing due to a rise in shipping activities, and these developments are occurring now mainly in developing countries. Thus, they need to adapt to these changes and be prepared to address the issues that emerge because of them.

For instance, in the Caribbean Sea, due to the expansion of the Panama Canal and the possible Nicaragua Canal, the surrounding countries have to take proactive and protective measures to preserve the marine environment within their EEZs as is stated in the umbrella convention, UNCLOS, and in the regional agreement, the Cartagena Convention. Furthermore, other binding applicable agreements such as the CBD and MARPOL also oblige the countries to undertake protective measures for the marine environment.

The subject of this dissertation, Colombia, has recently experienced an increase in its economy due to its strategic position and proximity to the Panama Canal. It has been obliged to move forward to develop more coastal and marine services, especially shipping facilities. Therefore, it is paramount to enhance and to improve the associated protective measures for the conservation of the ecosystems within its marine jurisdiction.

Furthermore, a maritime boundary dispute with the Republic of Nicaragua is threatening the integrity of the marine territory in the Caribbean Sea, specifically in the San Andres Archipelago affecting islander communities whose livelihoods are based on sea-usage. In addition, the archipelago as a unique ecosystem in the south-western Caribbean houses several species of fauna and flora in the WCR that Colombia has decided to protect through the establishment of the Seaflower Biosphere Reserve. It has established the adequate management mechanism to make the use of this natural wealth sustainable through the creation of the MPA within the vast area designated.

Thus, focusing on the improvement of the Seaflower MPA management, the following actions are proposed to address the issues and challenges that this important MPA is now facing.

5.1 Recommendations

Firstly, Colombia has to enhance political relationships with the neighbouring Republic of Nicaragua to solve the long-running maritime boundary dispute. The strategy that Colombia has to adopt is the social and EBM approach. It has to put environmental concerns first in order to agree that the Seaflower BR is the milestone for the protection of fish habitats and based on this maintains its integrity. To do so, it is recommended that dialogues putting in place the cultural values of islanders be supported, through a co-management strategy for the management of the MPA. Nevertheless, it is necessary to establish in the national legislation this mechanism to provide funds and support for the governance process.

Likewise, it is paramount to enforce this through a regional agreement. It is necessary for the neighbouring countries of Costa Rica, Nicaragua, and Honduras to ratify the SPAW Protocol as a mechanism to ensure the legal obligations for the protection of the Special Protected Areas with regional relevance such as the Seaflower Biosphere Reserve.

One approach for these countries for ratification could be the establishment of a transboundary agreement using the Seaflower BR to seek regional commitment for the protection of the ecosystems in the region. It is proper to use the IUCN marine transboundary protected area categories (Vasilijević, Zunckel, McKinney, Erg, Schoon, & Rosen-Michel, 2015).

To succeed in the establishment of the transboundary agreement, paramount is the participation of CCO as an advisory body in the negotiation process. Moreover, it is

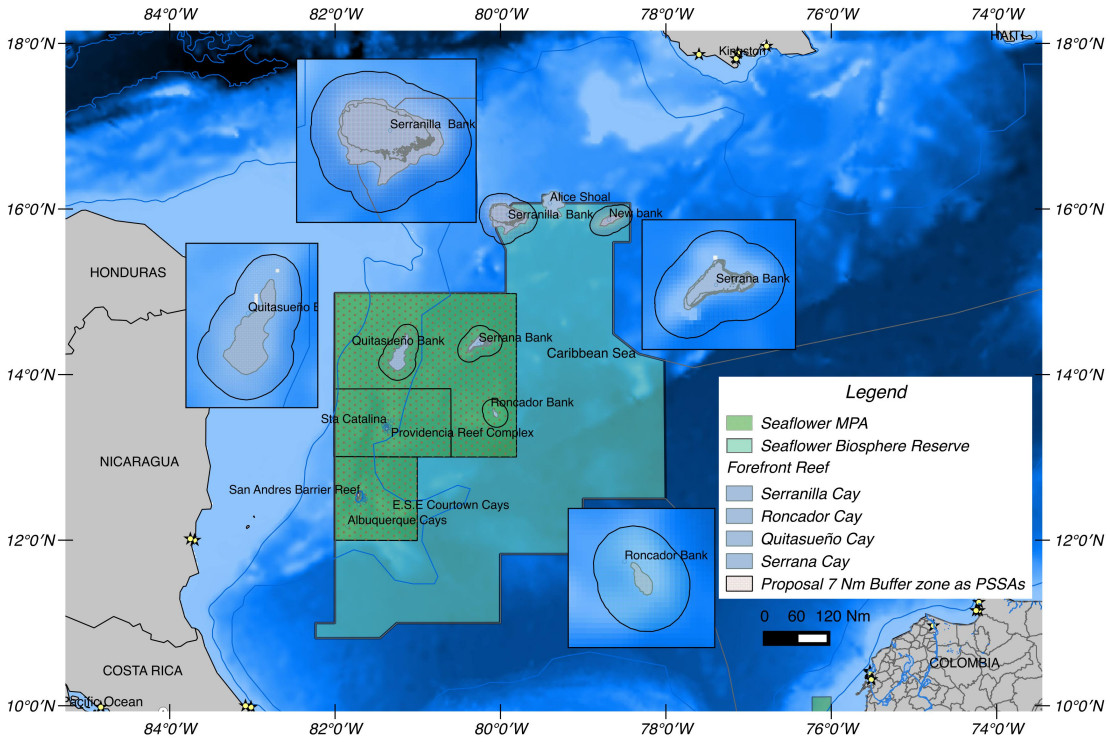
important to consider the support of the Seaflower NWG as a mean of expressing the awareness and the importance of the EBM for the adoption of the agreement

Parallel to this, some other actions must be taken by Colombia within its territorial sea in the archipelago MPA. As the expanded Panama Canal is increasing the maritime traffic in the zone, there are threats to the ecosystems, especially affecting coral reefs, marine mammals, and fish species. Thus, in the northern part of the MPA in the island cays and atolls of Serranilla, Serrana, Roncador, and Quitasueño (See figure 10), wherein the unspoiled coral reefs are located, the presence of higher density of maritime traffic for international shipping is a threat.

Therefore, the recommendation is, through DIMAR, to propose to the IMO, the creation of PSSAs in the islands cays mentioned above, establishing a buffer zone of 7 Nm (Figure 15), taking into consideration the experience and success in the conservation of the ecosystems from the PSSA in Malpelo Island. If the buffer created is close to the forefront reef, it will help to protect the coral from the wave wake and underwater noise from LCVs transiting the area.

Additionally, it is important to establish associated protective measures such as TSS, areas to be avoided, and no anchoring inside the buffer. The above is possible to do due to the MPA zoning in these small reef island cays being categorized mostly for general use. Thus, to allow sustainable fishing in the proximity of the reefs, it is necessary to allocate buoys to each island to facilitate small vessels belaying there during fishing trips.

Figure 15 Coral Reefs Buffer Zone as a PSSA within the Seaflower BR



Source: The Author- Software QGIS

Furthermore, on the enforcement side, and follow-up, it is important that in order to reach the efficiency of the recommended measures, it is necessary to enhance the archipelago's VTS station. To do so, as Serrana, Serranilla and Roncador islands cays are inhabited by marines from the Colombian Navy, as a mean to exert sovereignty in the area, it is recommended to install AIS repeaters there to increase monitoring coverage.

On the other hand, it is vital that the navy continue developing enforcement measures to tackle issues of IUU in the areas, as well as drug trafficking. Parallel to this, within the main archipelago islands, San Andres and Providencia, it is necessary to

implement social programs to involve the local young people in the management of the MPA based on co-management, to dissuade the population from involvement in illegal activities.

Finally, the integration of environmental education is paramount, although the high-level measures are still poorly structured. Nevertheless, a methodological path based on integrated environmental education in MPAs has been developed by Zorrilla-Pujana & Rossi (2014), and it will be useful to improve marine protected areas management including the Seaflower MPA.

5.2 Conclusion

The Caribbean Sea offers the proper scenario to establish the appropiate mechanisms to protect the Seaflower MPA. The new developments and challenges oblige Colombia and its neighbouring states to undertake immediate regional action.

It has been shown that Colombia's government has the commitment to improve the Seaflower MPA's management mechanisms through a science-based approach and institutional support; this is a significant step in the improvement of the MPA. However, the involvement of the entire stakeholder and islander community is paramount, applying co-management practices from the others inland continental MPAs.

Likewise, political will and effort from national governmental bodies are crucial for to succeed in the protection of the Seaflower's ecosystems. The creation of strong regional partnerships is also vital. By using the biosphere reserve as the milestone for transboundary conservation agreements based on EBM approach, sharing duties and

responsibilities between regional partners to ensure effectiveness, regional protection objectives can be achieved.

Finally, it is the proper time to request the IMO to create the PSSAs to ensure that shipping activities continue moving the highest freight in the region with safety navigation and in an environmentally sustainable way.

6 REFERENCE LIST

"Cancilleria Colombia". (2016). *Cancilleria*. Retrieved March 23, 2016 from Freshwaters and Oceans: http://www.cancilleria.gov.co/internacional/politica/ambiental/aguas-dulces-oceanos

"The Caribbean Sea". (2015). *The Columbia Encyclopedia*, 6th edition. Retrieved February 11, 2016 from Encyclopedia.com: http://www.encyclopedia.com/doc/1E1-Caribbea.html

"US Commerce Office". (2011). *Final Environmental Review. United States - Colombia Trade Promotion Agreement.* Retrieved April 19, 2016 from Office of the U.S. Trade Representative: https://ustr.gov/sites/default/files/uploads/Countries%20Regions/africa/agreements/pdfs/FTAs/columbia/COLOMBIA%20Final%20Environmental%20Review.pdf

Abdulla, A. P., & Linden, O. P. (2008). *Maritime traffic effects on biodiversity in the Mediterranean Sea: Review of impacts, priority areas and mitigation measures.* Retrieved August 07, 2016 from IUCN Centre for Mediterranean Cooperation: https://portals.iucn.org/library/efiles/edocs/2008-042-1.pdf

AGCS. (2014). *Panama Canal 100 Shipping safety and future risk.* Retrieved January 17, 2016 from Allianz Global Corporate & Specialty: http://www.agcs.allianz.com/assets/PDFs/risk%20bulletins/Panama-Canal-100_low-res.pdf

Al-Abdulrazzak, D., & Trombulak, S. (2011). Classifying levels of protection in Marine Protected Areas. *Marine Policy Journal* (36), 576-582.

Alonso, D. A., F., R. L., Diaz, J. M., Segura, C., Castillo, P., & Anthony, C. (2007). Chapter4: Coastal and Marine Conservation Priorities in Colombia. In A. Chatwin, *Priorities for Coastal and Marine Conservation in South America* (pp. 31-40). Arlington, Virginia, USA: The Nature Conservancy.

Alonso, D., Barbosa, H., Duque, M., Gil, I., Morales, M., Navarrete, S., et al. (2015). *Conceptualización del Subsistema de Áreas Marinas Protegidas en Colombia. Documento de Trabajo (Versión 1.0). Proyecto COL75241 Diseño e implementación de un Subsistema Nacional de Áreas Marinas Protegidas (SAMP) en Colombia.* Retrieved June 06, 2016 from INVEMAR:

http://www.invemar.org.co/documents/10182/14479/cartilla-conceptualizacion-final-web.pdf

Andrade, C. (2000). *Circulation and Variability of the Colombian Basin in the Caribbean Sea. PhD Thesis.* Menai Bridge, U.K.: University of Wales.

Andrade, C., Barton, E., & Mooers, C. (2003). Evidence for an Eastward Flow along the Central and South American Caribbean Coast. *Journal of Geophysical Research , 108* (C6-3185), 11.

ANH. (2010). *Los Cayos*. Retrieved July 14, 2016 from Open Round Colombia 2010: http://ronda2010.anh.gov.co/region.php?id=43&lang=

Bauer, B., Lorang, M., & Sherman, D. (2002). Estimating boat wake induced levee erosion using sediment suspension measurements. *Journal of Waterway Port Coastal and Ocean Engineering* (ASCE.128), 152-162.

Bekker, P. (2013, January 15). *The World Court Awards Sovereignty Over Several Islands in the Caribbean Sea to Colombia and Fixes a Single Maritime Boundary between Colombia and Nicaragua.* From The American Society of International Law: http://www.peacepalacelibrary.nl/ebooks/files/354062581.pdf

Biggs, C. (2009). *Indo-Pacific Red Lionfish: Pterois Volitans, Invasion of the Western Atlantic and Caribbean Oceans.* Retrieved August 23, 2015 from http://www.washington.edu: http://depts.washington.edu/oldenlab/wordpress/wp-content/uploads/2013/03/Pterois-Volitans_Biggs.pdf

Blanco-Bazán, A. (1996). *The IMO guidelines on Particular Sensitive Sea Areas (PSSAs). Their possible application to the protection of underwater cultural heritage.* Retrieved July 26, 2016 from Marine Policy : http://ac.els-cdn.com/0308597X9600019X/1-s2.0-0308597X9600019X-main.pdf?_tid=55d00398-5308-11e6-b136-00000aab0f6b&acdnat=1469520774_518c4fef85e319b6dce8d1757ed97bc0

Briceño-Garmendia, C., Bofinger, H. C., Cubas, D., & Millan-Placci, M. F. (2015, January). *Connectivity for Caribbean Countries: An Initial Assessment. Policy Research Working Paper.* Retrieved July 26, 2016 from World Bank Group: https://openknowledge.worldbank.org/handle/10986/21397

Brown, J. A. (2001). *A Review of Marine Zones in the Monterey Bay National Marine Sanctuary. Marine Sanctuaries Conservation Series MSD-01-2.* . Retrieved January 17, 2016 from U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Marine Sanctuaries Division: http://aquaticcommons.org/2352/1/Zones.pdf

Cajiao, M. V., Florez, M., Gonzalez, A., Hernandez, P., Martans, C., Porras, N., et al. (2006). *Manual de Legislacion Ambiental para los Paises del Corredor Marino de Conservacion del Pacifico Este Tropical.* San Jose, Costa Rica: Fundacion Mar Viva.

Castillo L., L. A., & Vargas C., G. (2013, December 2). *SEISMOSTRATIGRAPHY OF LOS CAYOS BASIN.* Retrieved July 14, 2016 from Boletin de Geologia [S.L]: http://revistas.uis.edu.co/index.php/revistaboletindegeologia/article/view/3738/4165

CBD. (1992). *Convention on Biological Diversity.* Rio de Janeiro, Brazil: UNEP.

CBD. (2016, January 1). *Convention on Biological Diversity*. Retrieved March 10, 2016 from CBD website: https://www.cbd.int

CCO. (2014, November). *Nationa Policy of the Oceans and Coastal Areas.* Retrieved March 29, 2016 from Comision Colombiana del Oceano: http://www.cco.gov.co/documentos/pdf/pnoec.pdf

CEP. (2015). *The Caribbean Environment Programme- about Cartagena Convention*. Retrieved February 11, 2016 from The Caribbean Environment Programme: http://www.cep.unep.org/

CEPEI. (2015, September). *Un zettabyte de motivos para hablar de datos y desarrollo.* Retrieved June 17, 2016 from Centro de Pensamiento Independiente-CEPEI: http://cepei.org/wp-content/uploads/2015/11/insumoevento17sept__1_.pdf

Coomber, F. G., D'Incà, M., Rosso, M., Tepsich, P., Notarbartolo di Sciara, G., & Moulins, A. (2016, April 16). *Description of the vessel traffic within the north Pelagos Sanctuary: Inputs for Marine Spatial Planning and management implications within an existing international Marine Protected Area* . Retrieved July 26, 2016 from Marine Policy Journal: http://ac.els-cdn.com/S0308597X16301853/1-s2.0-S0308597X16301853-main.pdf?_tid=25168920-5308-11e6-aad2-00000aab0f02&acdnat=1469520692_e90a59ba75f9ed8772d7f95729e47aec

Coralina. (2005). *Acuerdos 021 y 025 de 2005 Por medio del cual se delimita internamente el Área Marina Protegida de la Reserva de la Biosfera Seaflower y se dictan otras disposiciones.* Retrieved February 18, 2016 from Registro Unico Nacional de Areas Protegidas: http://runap.parquesnacionales.gov.co/reportes/generardocadminzip/aid/838

CORALINA. (2014, November 26). *Effects of the ruling of the International Court of Justice- ICJ of Hague in the Archipelago.* Retrieved July 7, 2016 from http://www.coralina.gov.co/coralina/categoria-noticia/1358-effects-of-the-ruling-of-the-international-court-of-justice-icj-of-hague-in-the-archipelago

CORALINA-INVEMAR; Gómez- López, D. I.; Segura-Quintero, C.; Sierra-Correa, P. C.; Garay-Tinoco, J. (2012). *Atlas de la Reserva de Biósfera Seaflower. Archipiélago de San Andrés, Providencia y Santa Catalina.* (Vol. 28). Santa Marta, Colombia: Instituto de Investigaciones Marinas y Costeras "José Benito Vives De Andréis" -INVEMAR- y Corporación para el Desarrollo Sostenible del Archipiélago de San Andrés, Providencia y Santa Catalina -CORALINA.

De Pourcq, K., Thomas, E., Arts, B., Vranckx, A., Leon-Sicard, T., & Van Damme, P. (2015). Conflict in Protected Areas: Who Says Co-Management Does Not Work? *PLoS ONE , 10* (12).

De Rivaz, C. (2013, September 5). *Colombia government lays out measures to protect Caribbean islands from Nicaraguan expansion.* Retrieved July 7, 2016 from Colombia reports.com: http://colombiareports.com/colombia-govt-lays-measures-protect-islands-nicaraguan-expansion/

Diaz, J., Diaz-Pulido, G., Garzon-Ferreira, J., Geister, B., Sanchez, J., & Zea, S. (1996). I. Complejos arrecifales oceánicos. In *Atlas de los arrecifes coralinos del Caribe Colombiano. (Atlas of Caribbean Colombian Coral Reef)Atlas de los arrecifes coralinos del Caribe Colombiano. (Atlas of Caribbean Colombian Coral Reef)* (Vol. Special Publication Series No 2, p. 83). Santa Marta, Colombia: Instituto de Investigaciones Marinas y Costeras "José Benito Vives de Andreis"- INVEMAR.

Eastwood, P. D., Mills, C. M., Aldridge, J. N., Houghton, C. A., & Rogers, S. I. (2007). Human activities in UK offshore waters: an assessment of direct, physical pressure on the seabed. *ICES Journal of Marine Science* (64), 453-463.

Ehler, C. (2014). *A Guide to Evaluating Marine Spatial Plans* (Vol. 70). Paris, France: UNESCO.

El Tiempo. (2016, March 17). *Colombia respeta el derecho, pero exige también respeto al derecho*. Retrieved July 15, 2016 from El tiempo.com: http://www.eltiempo.com/politica/justicia/reaccion-de-santos-tras-decision-de-corte-de-la-haya/16539485

EMSA. (2013, Nov 14). *Action Plan for response to Marine Pollution from Oil and Gas Installations.* Retrieved June 01, 2016 from European Maritime Safety Agency: http://www.emsa.europa.eu/news-a-press-centre/external-news/download/2585/1961/23.html

EU. (2013, January 5). *European Seas and Territorial Development, Opportunities and Risks (ESaTDOR). ANNEX 10 to the Scientific Report Governance Case Studies: Baltic Sea* . Retrieved January 16, 2016 from European Observation Network Territorial Development and Cohesion: http://www.espon.eu/export/sites/default/Documents/Projects/AppliedResearch/ESaTDOR/FR_160413/20130417_annexes/ESaTDOR_FR_Annex_10_Baltic_CS.pdf

EU. (2015). *International Ocean Governance Public consultation* . Retrieved February 8, 2016 from European Commission_ Maritime Affairs and Fisheries: http://ec.europa.eu/dgs/maritimeaffairs_fisheries/consultations/ocean-governance/index_en.htm

Fanning, L., Mahon, R., McConney, P., Angulo, J., Burrows, F., Chakalall, B., et al. (2007). A Large Marine Ecosystem Governance Framework. *Marine Policy , 31* (Issue 34), 434-443.

FAO. (1995). *FAO Code of Conduct for Responsible Fisheries.* Retrieved June 04, 2016 from FAO- Fisheries and Aquaculture Department: http://www.fao.org/docrep/005/v9878e/v9878e00.htm#PRE

Gabrié, C., Lagabrielle, E., Bissery, C., Crochelet, E., Meola, B., Webster, C., et al. (2012). *The Status of Marine Protected Areas in the Mediterranean Sea.* Retrieved November 18, 2015 from MedPAN & RAC/SPA: http://www.medpan.org/documents/10180/0/The+Status+of+Marine+Protected+Areas+in+the+Mediterranean+Sea+2012/069bb5c4-ce3f-4046-82cf-f72dbae29328

Garcia, P. (2012, May 2). *How Change Happens: Defeating Oil Exploration in the San Andres Archipelago*. Retrieved July 14, 2016 from From Poverty to Power. How active citizens and effective States can change the World: https://oxfamblogs.org/fp2p/how-change-happens-defeating-oil-exploration-in-the-san-andres-archipelago/

Gjerde, K. M. (2001). Protecting Particularly Sensitive Sea Areas From Shipping: A Review of IMO's New PSSA Guidelines. In H. Thiel, & J. A. Koslow, *Managing Risks to Biodiversity and the Environment on the High Sea, Including Tools Such as Marine Protected Areas - Scientific Requirements and Legal Aspects* - (pp. 123-131). Boon, Germany.

Gorricho, J. (2012, November 28). *Global Pacebuilding II: High time for environmental diplomacy in the Caribbean.* Retrieved July 7, 2016 from Governance and Development: http://www.governanceanddevelopment.com/2012/11/global-peacebuilding-ii-high-time-for.html

Green, S. J., & Côté, I. M. (2008). *Abundance of Invasive Lionfish (Pterois volitans) on Bahamian Coral Reef.* Gulf and Caribbean Fisheries Institute, Department of Biological Sciences, Simon Fraser University. Guadaloupe: Gulf and Caribbean Fisheries Institute.

Grilo, C. (2010, April). *The Impact of Maritime Boundaries on Cooperation in the Creation of Transboundary Marine Protected Areas: Insights from Three Cases.* Retrieved January 16, 2016 from researchgate.net/ Ocean Yearbook: https://www.researchgate.net/publication/52005839

Grilo, C., Chircop, A., & Guerreiro, J. (2012, August 12). *Prospects for Transboundary Marine Protected Areas in East Africa.* Retrieved April 08, 2016 from Ocean Development & International Law: http://dx.doi.org/10.1080/00908320.2012.672297

Guan, S. (2010, June 16). *Enforcement of Associated Protected Measures in Particularly Sensitive Sea Areas.* Retrieved January 17, 2016 from aquatic commons/ School of Marine Science and Policy. : http://aquaticcommons.org/3907/1/Guan_papers.pdf

Guerreiro da Silva, J. Â., Fernandes e Castro-Ribeiro, R. C., Mocinho-Viras, A. d., & Grilo, C. B. (2012). *Transboundary MPAs: a challenge for the twenty-first century.* Retrieved April 08, 2016 from Management of Environmental

Quality: An International Journal: http://dx.doi.org/10.1108/14777831211232191

Guerreiro, J., Chircop, A., Grilo, C., Viras, A., Ribeiro, R., & Van der Elst, R. (2010, January 14). *Establishing a transboundary network of marine protected areas: Diplomatic and management options for the east African context* . Retrieved January 16, 2016 from Marine Policy Journal: http://ac.els-cdn.com/S0308597X10000151/1-s2.0-S0308597X10000151-main.pdf?_tid=fa71a232-bc57-11e5-be90-00000aacb35e&acdnat=1452952355_6d46e6fd6b4fdab069390164125974d0

Haren, A. M. (2007). *Reducing Noise Pollution from Commercial Shipping in the Channel Islands National Marine Sanctuary: A Case Study in Marine Protected Area Management of Underwater Noise.* Retrieved September 29, 2015 from Journal of International Wildlife Law and Policy: http://www.tandfonline.com/doi/pdf/10.1080/13880290701347432

Harrould-Kolieb, E. R., & Herr, D. (2012, January). *Ocean acidification and climate change: synergies and challenges of addressing both under the UNFCCC.* Retrieved October 22, 2015 from Climate Policy Journal: http://dx.doi.org/10.1080/14693062.2012.620788

Hassellöv, I.-M., Turner, D. R., Lauer, A., & Corbett, J. J. (2013, June 6). *Shipping contributes to ocean acidification.* Retrieved November 22, 2015 from Geophysical research letters: http://onlinelibrary.wiley.com/doi/10.1002/grl.50521/epdf

Hildebrand, J. (2005). Impacts of Anthropogenic Sound. (T. J. Press, Ed.) *Marine Mammal Research: Conservation beyond Crisis* , 101-124.

Hildebrand, L. (2016, March). Non-traditional Coastal and Ocean Partnerships. *WMU 201 Marine and Coastal Environmental Issues* , 50. Malmo, Skane, Sweden: WMU.

Hildebrand, L., & Chircop, A. (2010). *A GULF UNITED: CANADA-U.S. TRANSBOUNDARY MARINE ECOSYSTEM-BASED GOVERNANCE IN THE GULF OF MAINE.* Retrieved July 22, 2016 from Ocean and Coastal Law Journal : http://heinonline.org/HOL/Page?handle=hein.journals/occoa15&collection=journals&index=&id=343

Howard, M. W. (2006, June). *Evaluation Report Seaflower Biosphere Reserve Implementation: The First Five Years 2000 – 2005.* Retrieved November 2, 2015 from UNESCO: http://www.unesco.org/csi/smis/siv/Caribbean/San_actEnvEd_Seaflower2000-2005%20.pdf

Huete-Pérez, J. A., Alvarez, P. J., Schnoor, J. L., Rittmann, B. E., Clayton, A., Acosta, M. L., et al. (2015, March 2). *Scientists Raise Alarms about Fast Tracking of Transoceanic Canal through Nicaragua.* Retrieved January 17, 2016 from Environmental Science & Technology: http://pubs.acs.org/doi/pdf/10.1021/acs.est.5b00215

ICJ. (2012). *Territorial and Maritime Dispute (Nicaragua v. Colombia), Judgment, I.C.J. Reports.* Retrieved July 14, 2016 from International Court of Justice: http://www.icj-cij.org/docket/files/124/17164.pdf

ICJ. (2016). *Cases, Judgments, Advisory opinions and Orders by chronological order/ (Nicaragua v. Colombia)*. Retrieved July 15, 2016 from International Court of Justice: http://www.icj-cij.org/docket/index.php?p1=3&p2=5

IMO. (2014, April 14). Guidelines for the reduction of underwater noise from commercial shipping to address adverse impacts on marine life. *Circular Letter 66 session MEPC committee* . London, UK: IMO.

IMO. (2012, March 5). *International Shipping Facts and Figures – Information Resources on Trade, Safety, Security, Environment.* Retrieved July 10, 2016 from IMO-Knowledge Centre section: Ships and Shipping- Facts and Figures: http://www.imo.org/en/KnowledgeCentre/ShipsAndShippingFactsAndFigures/TheRoleandImportanceofInternationalShipping/Documents/International%20Shipping%20-%20Facts%20and%20Figures.pdf

IMO. (2003, January 6). *MSC/Circ. 1060. GUIDANCE NOTE ON THE PREPARATION OF PROPOSALS ON SHIPS. ROUTEING SYSTEMS AND SHIP REPORTING SYSTEMS FOR SUBMISSION TO THE SUB-COMMITTEE ON SAFETY OF NAVIGATION.* Retrieved July 26, 2016 from imo.org: http://www.imo.org/en/OurWork/Safety/Navigation/Pages/ShipsRouteing.aspx

IMO. (2016, January). *Our work- Marine Environment*. Retrieved March 11, 2016 from International Maritime Organization: http://www.imo.org/en/OurWork/Environment/Pages/Default.aspx

IMO. (2013). *Particular Sensitive Areas Website*. Retrieved July 27, 2016 from imo.org/pssa: http://pssa.imo.org/#/pssas

IMO. (2006, February 6). *Resolution A.982(24). REVISED GUIDELINES FOR THE IDENTIFICATION AND DESIGNATION OF PARTICULARLY SENSITIVE SEA AREAS.* Retrieved March 16, 2016 from imo.org/environment/PSSAs: http://www.imo.org/en/OurWork/Environment/PSSAs/Documents/A24-Res.982.pdf

IMO. (2016). *Ships' routeing*. Retrieved July 26, 2016 from imo.org: http://www.imo.org/en/OurWork/Safety/Navigation/Pages/ShipsRouteing.aspx

INVEMAR. (2016). *Informe del estado de los ambientes y recursos marinos y costeros en Colombia: Año 2015.* Retrieved June 06, 2016 from INVEMAR/ Publicaciones: http://www.invemar.org.co/documents/10182/14479/ier_2015_baja.pdf/f225fda1-eb06-44ad-9d60-535909e85cc6

IOC-UNESCO; UNEP. (2016, July 13). *Large Marine Ecosystems: Status and Trends, Summary for Policy Makers.* Retrieved July 20, 2016 from United Nations Environment Programme (UNEP): http://www.geftwap.org/publications/lmes-spm

ISA. (2008, March). *Protection of the Seabed Environment.* Retrieved July 13, 2016 from International Seabed Authority: https://www.isa.org.jm/files/documents/EN/Brochures/ENG4.pdf

IUCN; UNEP-WCMC. (2013). *The World Database on Protected Areas (WDPA)*. (UNEP-WCMC, Producer) Retrieved February 23, 2016 from Protect Planet Ocean: http://www.protectplanetocean.org

IUCN-WCPA. (2011). *UNEP-WCMC Transboundary Protected Areas Inventory-2007*. Retrieved July 22, 2016 from Global Transboundary Conservation Network: http://www.tbpa.net/page.php?ndx=78

Jackson, J., Donovan, M., Cramer, K., & Lam, V. (2014). Status and Trends of Caribbean Coral Reefs: 1970-2012. Gland, Switzerland.

Jay, S., Alves, F. L., O'Mahony, C., Gomez, M., Rooney, A., Almodovar, M., et al. (2016). *Transboundary dimensions of marine spatial planning: Fostering*

inter-jurisdictional relations and governance . Retrieved January 16, 2016 from Marine Policy Journal: http://ac.els-cdn.com/S0308597X15003954/1-s2.0-S0308597X15003954-main.pdf?_tid=e07fc708-bc59-11e5-b2d0-00000aab0f6b&acdnat=1452953171_4d76cf6dc70ebd5a12836c31a4c1a827

Jones, P. J. (2014). *Governing Marine Protected Areas: Resilience through Diversity.* New York: Taylor and Francis.

Jones, P. J., & Qiu W, D. S. (2011). *Governing Marine Protected Areas - Getting the Balance Right.* United Nations Environment Programme. Nairobi - Kenya: UNON.

Kaurobi, E. d., Espey, J., & Durand-Delacre, D. (2016, February 15). *Indicators and a Monitoring Framework for FfD: Proposals for Follow-up and Review of the Addis Ababa Action Agenda of the Third International Conference on Financing for Development* . Retrieved June 17, 2016 from United Nations Sustainable Development Solutions Network: http://unsdsn.org/wp-content/uploads/2016/03/Final-FfD-Follow-up-and-review-paper.pdf

Kelleher, G. (2015). *The importance of regional networks of Marine Protected Areas (MPAs) and how to achieve them.* Retrieved May 5, 2016 from IUCN: http://cmsdata.iucn.org/downloads/gkelleher_the_importance_of_regional_networks_of_marine_protected_areas__mpas__finala.pdf

Kelleher, G., & Kenchington, R. (1992). *Guidelines for Establishing Marine Protected Areas. A Marine Conservation and Development Report* (Vol. VII). Gland, Switzerland: IUCN.

Kelleher, G., Bleakley, C., & Wells, S. (1995). *A global Representative System of Marine Protected Areas* (Vol. II). Canberra, ACT, Australia: Great Barrier Reef Marine Park Authority.

KMI. (2007). *Towards Establishing the Marine Peace Park in the Western Transboundary Coastal Area of the Korean Peninsula.* Retrieved July 24, 2016 from The University of Washington: http://depts.washington.edu/mpanews/mppkorea.pdf

Lausche, B. (2011). *Guidelines for Protected Areas Legislation* (Vol. XXVI). Gland, Switzerland: IUCN.

Lopez, V., & Krauss, U. (2006). *National and Regional Capacities and Experiences on Marine Invasive Species, Including Ballast Waters, Management Programmes in the Wider Caribbean Region - a Compilation of Current Information.* United Nations Environment Programme. Trinidad & Tobago: CAB International Caribbean and Latin America Regional Centre (CLARC).

Lyons, Y. (2011). *Offshore oil and gas in the SCS and the protection of the marine environment.* Retrieved June 01, 2016 from Centre of International Law: http://cil.nus.edu.sg/wp/wp-content/uploads/2010/10/OG_SCS_CIL-Part206oct2011-1.pdf

Mackelworth, P. (2016). *Marine Transboundary Conservation and Protected Areas* (Vol. 1). New York: Taylor and Francis Group.

Mackelworth, P. (2012, March 2). *Peace parks and transboundary initiatives: implications for marine conservation and spatial planning.* Retrieved January 16, 2016 from Wiley Online Library - Conservation Letters : http://onlinelibrary.wiley.com/doi/10.1111/j.1755-263X.2012.00223.x/epdf

MADS. (2014, June 24). *Resolucion 0977 (Junio 24 de 2014) Por medio del cual se adiciona la resolucion 107 del 27 de enero de 2005, con el fin de asignar una categoria de area protegida al "Area Marina Protegida de la Reserva de Biosfera Seaflower".* Retrieved February 18, 2016 from RUNAP - UAESPNN - Ministerio de Ambiente y Desarrollo Sostenible: http://runap.parquesnacionales.gov.co/reportes/generardocadminzip/aid/838

Mahon, R., McConney, P., Parsram, K., Simmons, B., Didier, M., Fanning, L., et al. (2010). *Ocean governance in the Wider Caribbean Region: Communication and coordination mechanisms by which states interact with regional organisations and projects.* Retrieved March 18, 2016 from Academic Council on the United Nations System- ACUNS: http://acuns.org/wp-content/uploads/2012/05/Mahon_2010_Ocean_governance_in_the_Wider_Caribbean_CTR_40.pdf

MarCom. (2003). *Guidelines for Managing Wake Wash from High-speed Vessels.* Retrieved July 11, 2016 from PIANC- International Navigation Association: http://www.pianc.us/workinggroups/docs_wg/marcom-wg41.pdf

Marine Conservation Institute. (2015, December 1). *MPAtlas*. Retrieved February 22, 2016 from MPAtlas. Seattle, WA: http://www.mpatlas.org

Markussen, J. M. (1994). Deep Seabed Mining and the Environment: Consequences, Perceptions, and Regulations. (H. O. (eds.), Ed.) *Green Globe Yearbook of International Co-operation on Environment and Development* , 31-39.

McKenna, M. F., Ross, D., Wiggins, S. M., & Hildebrand, J. A. (2011, November 4). *Underwater radiated noise from modern commercial ships.* Retrieved July 12, 2016 from Acoustical Society of America: http://cetus.ucsd.edu/Publications/Publications/PAPERS/McKennaJASA2012.pdf

Minambiente. (2012, March 30). *Action Plan for the Implementation of the work program on Protected Areas under the Convention on Biological Diversity.* Retrieved April 6, 2016 from cbd.int: https://www.cbd.int/doc/world/co/co-nbsap-powpa-es.pdf

Minambiente. (2016). *Asuntos Marinos y Costeros y Recursos Acuaticos*. Retrieved March 29, 2016 from Ministerio de Ambiente y Desarrollo Sostenible: https://www.minambiente.gov.co/index.php/ambientes-y-desarrollos-sostenibles/asuntos-marinos-y-costeros-y-recursos-acuaticos

Minambiente. (2015, May 26). *Decree number 1075 of May 26 to 2015.* Retrieved March 17, 2016 from Ministerio de Medio Ambiente y Desarrollo Sostenible: https://www.minambiente.gov.co/images/normativa/app/decretos/4e-DECRETO%201076%20DE%202015%20MINAMBIENTE%20EXPIDE%20DECRETO%20%C3%9ANICO%20REGLAM.%20SECTOR%20AMBIENTE%20Y%20DESARROLLO%20SOSTENIBLE.pdf

Minambiente. (2011). *National Policy for the Integral Management of Biodiversity and its Ecosystemic services (NPIMBES)*. Retrieved April 10, 2016 from cbd.int: https://www.cbd.int/doc/world/co/co-nbsap-v2-en.pdf

Minambiente. (2005, January 27). *Resolución número 107 (27 de Enero de 2005) Por el cual se declara un área marina protegida y se dictan otras disposiciones.* Retrieved November 22, 2015 from Ministerio de Medio Ambiente y Desarrollo Sostenible: http://www.coralina.gov.co/coralina/rendiciondecuentas/monitoreo-plan-accion/normatividad-1/normatividad-por-temas/areas-protegidas/238-resolucion-107-de-2005-por-la-cual-se-declara-un-area-marina-protegida

Molares, R. B., Vanegas, T. J., Bustamante, J. V., & Andrade, C. A. (2004). Aspectos ocenograficos de las aguas sobre la depresion Providencia. *Scientific bulletin-CIOH* (22), 11-25.

Moon, D. S.-H., & Woo, J. K. (2014, August 1). *The impact of port operations on efficient ship operation from both economic and environmental perspectives.* Retrieved October 22, 2015 from Journal of Maritime Policy & Management: http://dx.doi.org/10.1080/03088839.2014.931607

Mooney, H. A. (2005). Invasive Alien Species: The Nature of the Problem. In H. A. Mooney, R. N. Mack, J. A. McNeely, L. E. Neville, P. J. Schei, & J. K. Waage, *Invasive Alien Species: A New Synthesis* (Vol. Scope 63, p. 357). Washington, USA: Island Press.

Morgan, C. L., Odunton, N. A., & Jones, A. T. (1999). *Synthesis of Environmental Impact of Deep Seabed Mining* . Retrieved July 14, 2016 from MArine Georesources & Geotechnology: http://dx.doi.org/10.1080/106411999273666

Morris, J. J. (2012). *Invasive Lionfish: A Guide to Control and Management. Gulf and Caribbean Fisheries Institute Special Publication* (Vol. 1). Marathon, Florida, USA.

MPA News. (2008, April). *Marine Peace Parks: Establishing Transboundary MPAs to Improve International Relations and Conservation.* Retrieved July 22, 2016 from Unversity of Washington: http://depts.washington.edu/mpanews/MPA95.pdf

Murillo, I., & Ortiz, R. (2013). *Analisis de los metadatos sobre proyectos de investigación científica marina desarrollada en el area de la reserva de biosfera Seaflower.* Secretaria Ejecutiva de la Comision Colombiana del Océano- Area Asuntos Marinos y Costeros, Bogotá D.C.

Nolet, G., Vosmer, W., De Brujin, M., & Braly-Cartillier, I. (2014). *Managing environmental and social risk: a roadmap for national development banks in Latin America and the Caribbean.* Retrieved April 24, 2016 from Inter-American Development Bank: https://publications.iadb.org/bitstream/handle/11319/6437/CMF%20MON%20Managing%20Environmental%20and%20Social%20Risks.pdf?sequence=1

OECD. (2014). *OECD Environmental Performance Review: Colombia.* Retrieved April 21, 2016 from oecd.org: https://www.oecd.org/env/country-reviews/ColombiaEPR_AssessmentRecommendations.pdf

OHI. (2015, October 15). *Colombia Makes Strides on Developing its First Ocean Health Index Independent Assessment*. Retrieved March 20, 2016 from News-Ocean Health Index: http://www.oceanhealthindex.org/news/colombia-makes-strides-developing-independent-assessment

Olsen, E., Johnson, D., Weaver, P., Go.i, R., Ribeiro, M., Rabaut, M., et al. (2013). *Achieving Ecologically Coherent MPA Networks in Europe: Science Needs and Priorities. Marine Board Position Paper 18.* (K. Larkin, & N. McDonough, Eds.) Retrieved November 18, 2015 from European Marine Board: http://www.marineboard.eu/file/23/download?token=hUK5AcVY

Ormel, E. (2011, June 28). *Marine Peace Parks effective peace-building instruments? A Marine Peace Park contribution to paving the road towards comprehensive neighbourly relations between Jordan and Israel* . Retrieved July 24, 2016 from Academia. edu: https://www.academia.edu/4360681/Marine_Peace_Parks_effective_peace-building_instruments

Osborne, A. H., Haley, B. A., Hathorne, E. C., Flögel, S., & Frank, M. (2014). Neodymium isotopes and concentrations in Caribbean seawater: Tracing water mass mixing and continental input in a semi-enclosed ocean basin. *Earth and Planetary Science Letters , 406*, 174-186.

Osherenko, G. (2006). New discourses on ocean governance: Understanding property rights and the public trust. *Journal of Environmental Law and Litigation , 21* (2), 317-381.

Otero, M. (2014-2015). Problems in the Caribbean: The Absence of Finality to the Territorial Dispute in Nicaragua v. Colombia Will Have Negative Impacts in the Region. *University of Toledo Law Review , 46* (3), 617-680.

Patrick, S., & Storm, B. (2013, January 02). *Council on Foreign Relations*. (K. Brown, F. F. Thaler, Producers, & Media Strom) Retrieved January 23, 2016 from Global Governance Monitor/oceans: http://www.cfr.org/global-governance/global-governance-monitor/p18985#!/oceans?gclid=CN_QxJjLwMoCFSTecgodjDoHAw#Issue-Brief

Pietrzykowski, Z., & Magaj, J. (2016, March 25). *Ship domains in Traffic Separation Schemes*. Retrieved July 25, 2016 from Scientific Journals of the Maritime University of Szczecin: http://repository.scientific-journals.eu/bitstream/handle/123456789/1196/20-zn-am-45-117-pietrzykowski-p.pdf?sequence=1

Plata, J. (2009). *Protecting Marine Biodiversity in the South Eastern Pacific Ocean* (Vol. 1). Malmo, Sweden: WMU.

PNNC-RUNAP. (2016). *Unique National Registry of Protected Areas – RUNAP*. Retrieved June 05, 2016 from National Natural Parks of Colombia: http://www.parquesnacionales.gov.co/portal/es/sistema-nacional-de-areas-protegidas-sinap/registro-unico-nacional-de-areas-protegias/

Ramirez, L. (2016, March 31). *Marine protected areas in Colombia: Advances in conservation and barriers for effective governance.* Retrieved July 8, 2015 from Ocean & Coastal Management: http://www.sciencedirect.com/science/article/pii/S0964569116300308

Roberts, C. M., Andelman, S., Branch, G., Bustamante, R. H., Castilla, J. C., Dugan, J., et al. (2003). Ecological Criteria for Evaluation Candidates Sites for Marine Reserves. *Ecological Applications , 13* (1), S199- S215.

Roberts, J. (2007). *Marine Environment Protection and Biodiversity Conservation: The application and future development of the IMO's Particularly Sensitive Sea Area Concept.* Berlin, German: Springer.

Roberts, J., Tsamenyi, M., Workman, T., & Johnson, L. (2005). *The Western European PSSA proposal: a ''politically sensitive sea area''.* Retrieved July 26, 2016 from Marine Policy Journal: http://ac.els-cdn.com/S0308597X04000624/1-s2.0-S0308597X04000624-main.pdf?_tid=171aaa08-5304-11e6-a6da-00000aab0f27&acdnat=1469518951_2d66a39fab5cef71272f8d5d681671c3

Rodrigue, J.-P., & Ashar, A. (2015, October 2). Transshipment hubs in the New Panamax Era: The role of the Caribbean. *Journal of Transport Geography* , 10.

Romero, C. (2016, April 13). Law and Policy related to the marine environment. *University Lectures subject WMU 253* , 27. Malmo, Sweden: WMU.

Ruiz-Ochoa, M. (2011). Variabilidad de la cuenca Colombia (mar Caribe) asociada con el niño-Oscilación del sur, vientos Alisios y procesos locales. *Doctoral Thesis* . Medellin, Colombia.

Sanín Posada, N., & Ceballos Arevalo, M. (2013). *La llegada del Dragon ¿Falló la Haya? / The arrival of the Dragon ¿Do the Hague fail?* Bogota D.C., Colombia: Panamericana Editorial.

Silber, G. K., Vanderlaan, A. S., Arceredillo, A. T., Johnson, L., Taggart, C. T., Brown, M. W., et al. (2012, May 15). *The role of the International Maritime Organization in reducing vessel threat to whales: Process, options, action and effectiveness* . Retrieved July 26, 2016 from Marine Policy Journal: http://ac.els-cdn.com/S0308597X12000528/1-s2.0-S0308597X12000528-main.pdf?_tid=3fe6125c-5308-11e6-a84f-00000aab0f6c&acdnat=1469520737_dad3a0e6e4a1251719a48a34d394f2d8

Spadi, F. (2000). *Navigation in Marine Protected Areas: National and International Law.* Retrieved September 29, 2015 from Ocean Development & International Law: http://dx.doi.org/10.1080/009083200413172

Speed, J. R., & Levine, A. (2014). What makes a "successful" marine Protected Area? The unique context of Hawaii's fish replenishment areas. (Elsevier, Ed.) *Marine Policy , 44*, 196-203.

Stewart, R. H. (2003). Chapter 3 the physical setting. In R. H. Stewart, *Introduction to physical oceanography* (pp. 21-37). Texas: Department of Oceanography, Texas A&M University.

Tamelander, J., Riddering, L., Haag, F., & Matheickal, J. (2010). *Guidelines for Development of a National Ballast Water Management Strategy.* Retrieved August 30, 2015 from Globallast - IMO: http://globallast.imo.org/wp-content/uploads/2014/11/Mono18_English.pdf.

Taylor, E., Baine, M., Killmer, A., & Howard, M. (2013). Seaflower marine protected area: Governance for sustainable development . *Marine Policy , 41*, 57-64.

The World Bank. (2016, May 07). *Panama Canal expansion: A smart route for boosting infrastructure in Latin America*. Retrieved July 30, 2016 from The World Bank: http://blogs.worldbank.org/voices/panama-canal-expansion-smart-route-boosting-infrastructure-latin-america

The World Bank. (2006, February 25). *Republic of Colombia: Mitigating Environmental Degradation to Foster Growth and Reduce Inequality.* Retrieved April 21, 2016 from Earthmind.org: http://earthmind.org/files/coed/04-COED-Colombia.pdf

Toro, J., Requena, I., & Zamorano, M. (2009, October 24). *Environmental impact assessment in Colombia: Critical analysis and proposals for improvement.* Retrieved April 20, 2016 from Science Direct: https://www.sciencedirect.com/science/article/pii/S019592550900122X

Tripp, E. (2014, January 14). *Marine Protected Areas: A Timeline of MPAs in the U.S.* . Retrieved February 22, 2016 from marine science today: http://marinesciencetoday.com/2014/01/14/marine-protected-areas-a-timeline-of-mpas-in-the-u-s/#ixzz40ua695zE

UK Legislation. (2004). *The Merchant Shipping (High Speed Craft) Regulations 2004.* Retrieved July 11, 2016 from Legislation.gov.uk: http://www.legislation.gov.uk/uksi/2004/302/pdfs/uksi_20040302_en.pdf

Umana, U. A. (2002). *Marine Ecosystems and the Role of Marine Protected Areas as Sustainable Development Strategies. Dissertation of MSc in Maritime Affairs.* Malmo, Sweden: World Maritime University.

UNCED. (1992). *Agenda 21- United Nations Conference on Environment and Development* (Vol. 1). Rio de Janeiro, Brazil.

UNCLOS. (1982). *United Nation Convention on the Law of the Sea.* New York: United Nations.

UNCTAD. (2015). *Review of Maritime Transport 2015.* Retrieved July 10, 2016 from UNCTAD/RMT: http://unctad.org/en/PublicationsLibrary/rmt2015_en.pdf

UNEP. (2012). *Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region and its Protocols* (Second edition ed.). Kingston, Jamaica: UNEP.

UNEP. (2016, April). *Enhancing Cooperation among the seven biodiversity related agreement and convention at the national level using national biodiversity strategies and actions plans.* Retrieved June 17, 2016 from United Nations Environment Programme (UNEP):

http://www.unep.org/environmentalgovernance/Portals/8/publications/role-mea-synergies-sdgs.pdf

UNEP. (2014a). *Measuring Success: Indicators for the Regional Seas Convention and Action Plans.* Retrieved March 13, 2016 from UNEP: http://apps.unep.org/publications/index.php?option=com_pub&task=download&file=011400_en

UNEP. (2010, October 5). *Seaflower Marine Protected Area- Colombia. Proposed areas for inclusion in the SPAW list.* Retrieved February 11, 2016 from Unite Nations Environment Program - Caribbean Environment Program: http://www.spaw-palisting.org/uploads/reports/Report_31.pdf

UNEP. (2014b). *Setting a Course for Regional Seas.* Retrieved March 12, 2016 from UNEP- Regional Seas Programme: http://apps.unep.org/publications/index.php?option=com_pub&task=download&file=011736_en

UNEP. (2012). *UNEP The first 40 years.* Retrieved March 12, 2016 from UNEP: http://www.unep.org/pdf/40thbook.pdf

UNEP. (2005). *Wider Caribbean Region Profile.* Retrieved February 11, 2016 from UNEP: http://www.unep.org/regionalseas/programmes/unpro/caribbean/instruments/r_profile_car.pdf

UNEP-MAP. (2012, April). *Support to the Barcelona Convention for the Implementation of the Ecosystem Approach, including the establishment of MPAs in open sea areas, including deep sea. Final Report.* Retrieved November 18, 2015 from european council-environment: http://ec.europa.eu/environment/marine/international-cooperation/regional-sea-conventions/barcelona-convention/pdf/SBCI_ECAP_FinalReport.pdf

UNEP-WCMC. (2008). *National and Regional Networks of Marine Protected Areas: A Review of Progress.* Retrieved July 30, 2016 from unep.org: http://www.unep.org/regionalseas/publications/otherpubs/pdfs/MPA_Network_report.pdf

UNESCO. (2015). *MAB Programme / United Nations Educational, Scientific and Cultural Organization.* Retrieved February 29, 2016 from MAB Programme:

http://www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/man-and-biosphere-programme/

UNESCO. (2016). *Malpelo Fauna and Flora Sanctuary*. Retrieved July 27, 2016 from UNESCO/ World heritage centre: http://whc.unesco.org/en/list/1216

UNESCO. (2014, April 17). *SC-14/CONF.226/14.* Retrieved July 7, 2016 from Twenty-sixth session of the International Coordinating Council of the Man and the Biosphere Programme: http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/SC/pdf/SC-14-CONF-226-14-Information_on_Seaflower-eng-rev.pdf

UNSD. (2015, September 27). *Transforming our World: The 2030 Agenda for Sustainable Development.* Retrieved Februray 14, 2016 from Sustainable Development Knowledge Platform: https://sustainabledevelopment.un.org/post2015/transformingourworld/publication

UNSD. (2015). *United Nations Sustainable Development.* Retrieved march 07, 2016 from Sustainable Development Knowledge Platform, Agenda 21: https://sustainabledevelopment.un.org/milestones/unced/agenda21

US Department of Transportation. (2013, November 20). *Panama Canal Expansion Study_Phase I Report.* Retrieved January 17, 2015 from U.S. DEPARTMENT OF TRANSPORTATION MARITIME ADMINISTRATION: http://www.marad.dot.gov/wp-content/uploads/pdf/Panama_Canal_Phase_I_Report_-_20Nov2013.pdf

Vallega, A. (2001). Ocean governance in post-modern society—a geographical perspective. (http://www.sciencedirect.com/science/article/pii/S0308597X01000240, Ed.) *Marine Policy , 25* (6), 399-414.

Vallega, A. (2002). The regional approach to the ocean, the ocean regions, and ocean regionalisation—a post-modern dilemma. *Ocean & Coastal Management , 45*, 721-760.

Van Tatenhove, J. P. (2013). How to turn the tide: Developing legitimate marine governance arrangements at the level of the regional seas. *Ocean and Coastal Management Journal , 71*, 296-304.

Vanderzaag, D. L. (2010). *THE GULF OF MAINE BOUNDARY DISPUTE AND TRANSBOUNDARY MANAGEMENT CHALLENGES: LESSONS TO BE LEARNED.* Retrieved July 22, 2016 from Ocean and Coastal Law Journal : http://heinonline.org/HOL/Page?handle=hein.journals/occoa15&collection=journals&index=&id=245

Vasilijević, M., Zunckel, K., McKinney, M., Erg, B., Schoon, M., & Rosen-Michel, T. (2015). *Transboundary Conservation: A systematic and integrated approach. Best Practice Protected Area Guidelines Series.* Retrieved July 22, 2016 from Global Transboundary Conservation Network : https://portals.iucn.org/library/sites/library/files/documents/PAG-023.pdf

Vousden, D. (2016, March 8). The Ocean Governance Course. *WMU Presentations* . Malmo, Skane, Sweden.

Webster, M. (2015, December). *Redrawing Global Shipping Routes: The Panama Canal Gets an Upgrade.* Retrieved January 17, 2016 from Brown Brothers Harriman: https://www.bbh.com/blob/10958/f7d1d1c2fd63c146c469fb0d384b1c75/redrawing-global-shipping-routes--the-panama-canal-gets-an-upgrade-pdf-data.pdf

White, A. T., Aliño, P. M., Cros, A., Fatan, N. A., Green, A. L., Teoh, S. J., et al. (2014, February 12). *Marine Protected Areas in the Coral Triangle: Progress, Issues, and Options.* Retrieved October 22, 2015 from Coastal Management Journal: http://dx.doi.org/10.1080/08920753.2014.878177

Wright, G. (2014). Marine Governance in an industrialised ocean: A case study of the emerging marine renewable energy industry. *Marine Policy , 52*, 77-84.

WWF. (2009). *Silent Invasion- The spread of marine invasive species via ships' ballast waters.* World Wildlife Fund International. WWF International.

Yip, T. L., & Wong, M. C. (2015, February). *The Nicaragua Canal: scenarios of its future roles.* Retrieved January 17, 2016 from Journal of Transport Geography: http://www.sciencedirect.com/science/article/pii/S0966692315000046

Zeeniya, A. (2013, June 6). *Legal Analysis of International Conventions for the Prevention of Vessel-source Marine Pollution: A Maldivan Perspective.* Retrieved June 10, 2016 from UNEP: http://www.rempec.org/admin/store/wyswigImg/file/News/Forthcoming%20Meetings/Offshore%20Protocol%20WG%20(Malta,%2013-

14%20June%202013/WG%20384-%20INF.7%20-%20IMLI%20Doc%20-%20Ms%20Sandra%20Betancourt%20-%20E.pdf

Zorrilla-Pujana, J., & Sergio, R. (2014, April 1). *Integrating environmental education in marine protected areas management in Colombia.* Retrieved March 23, 2016 from Ocean & Coastal Management Journal: http://www.sciencedirect.com/science/article/pii/S0964569114000660