Large Marine Ecosystem Fisheries Management with Particular Reference to Latin America and the Caribbean Sea

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Abstract

Regional fisheries management organizations (RFMOs) addressing the management of living marine resources have a long history, beginning in 1811 with the North Pacific Fur Seal Convention followed by the International Pacific Halibut Convention in 1924. Following the expansion of fisheries after WWII, RFMOs proliferated and after the general acceptance of a 200 mile extended jurisdiction in the mid-1970s many more nations became involved. There are approximately 17 RFMOs (depending on the definition of "management") of the over 40 marine Regional Fisheries Bodies (RFBs) identified by the Food and Agriculture Organization (FAO) of the United Nations. The Large Marine Ecosystem (LME) approach has roots in the experience of the International Commission for the Conservation of Northwest Atlantic Fisheries (now defunct and replaced by the Northwest Atlantic Fisheries Organization (NAFO)) which pioneered ecosystem based fisheries management. The LME approach to the assessment of coastal ocean goods and services was included in the operational guidelines for project proposals by the International Waters Focal Area of the Global Environmental Facility (GEF) in 1995. LMEs have fisheries as one of five major components to be addressed under the modular assessment and management framework for LME project development. As LME Programs enter the stage where they need to move to develop their governance responsibilities, the relationship with existing RFMOs is critical. This paper examines possibilities for this interaction with special attention to Latin American and Caribbean LMEs particularly in relation to their three northeastern LMEs. Possible inferences from the experiences of the coastal states of the US are also addressed, considering the Gulf and Atlantic States Marine Fisheries Commissions as a pseudo RFMO with the states assuming a role similar to countries.

Keywords: Large Marine Ecosystems (LMEs), Regional Fisheries Bodies (RFBs), Regional fisheries Management Organizations (RFMOs), Fisheries, Latin America, Caribbean, US

1 Introduction

1.1 Latin America and the Caribbean have moved to the forefront of Large Marine Ecosystem (LME) activity. There are 10 LMEs in the Caribbean and Latin America (Fig. 1), four of which are funded for the introduction and practice of ecosystem based management projects of countries bordering the LMEs by the Global Environmental Facility (GEF). These projects are in the Humboldt Current LME, the Gulf of Mexico LME and the Caribbean Sea and North Brazil Shelf LMEs. The latter two are entering a second phase devoted to implementing Strategic Action Plans (SAPs) developed during the first phase.

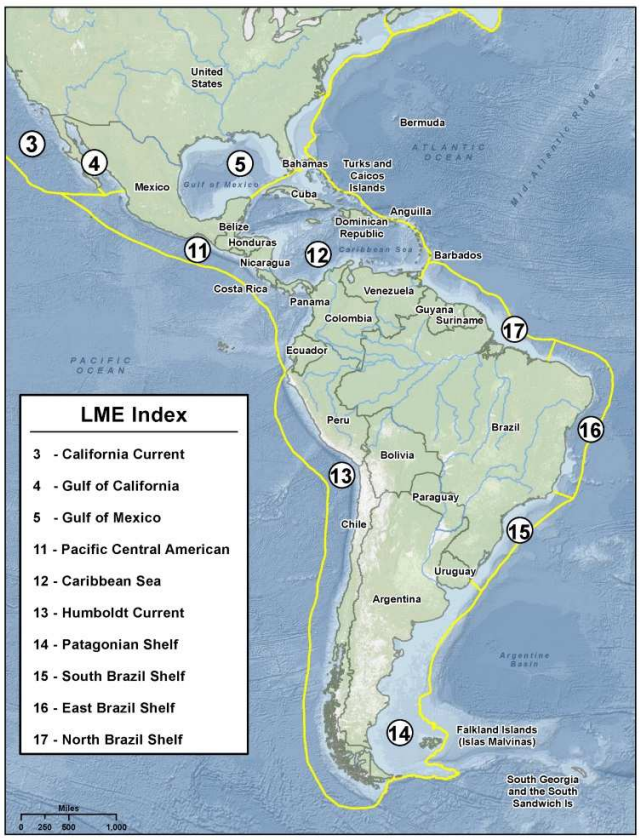

Figure 1. Latin American and Caribbean Large Marine Ecosystems. Numbers represent LMEs as depicted on the LME world map (www.lme.noaa.gov).

LMEs have been designated throughout the world as effective units for assessing, managing, recovering and sustaining the resources of the continental shelf and coastal ocean areas (Sherman and Alexander, 1986; Wang, 2004; Hennessey and Sutinen, 2005; McLeod et al., 2005; Duda, 2009; Lubchenco, 2013; Ishii, 2013; Watson-Wright, 2013; Sherman and Hamukuaya, 2016). They have become the "gold standard" for integrated ocean management, and have been adopted by the United Nations for their World Oceans Assessment (WOA) and by the Transboundary Waters Assessment Programme (TWAP) of the GEF on the status of the ocean as part of their mandate to meet General Assembly instructions

(www.unesco.org/new/en/natural-sciences/ioc-oceans/high-level-objectives/ecosystem-health/transboundary-waters-assessment-programme/) (2014). The GEF adopted LMEs beginning in 1995 with the Gulf of Guinea (GOG LME pilot project) as the core of their coastal ocean international waters programs. They are supporting projects in 19 of the world's 66 currently designated LMEs (Hume and Duda, 2012). Unlike many development projects, the success of an LME Project cannot be judged by a final report on how well the project followed its implementation plan or even on the scientific results from a successful research cruise. This is because the ultimate goal of LME projects is to have, at the end of the day, a management structure capable of making LME policy decisions which has an ongoing stream of information from all of the five LME modules - Productivity, Fish and Fisheries, Pollution and Ecosystem Health, Socioeconomics, and Governance (http://lme.edc.uri.edu/) (2014) (Sherman and Duda, 1999).

1.2 One of the major driving forces in an LME is its fisheries. The LME approach emphasizes that fisheries be assessed and managed holistically taking into consideration not only the ecosystem approach to fisheries (www.fao.org/fishery/topic/16034/en) (2014) but all of the services of the ecosystem. Fisheries has a long history of establishing bodies to address global and transboundary fisheries issues going back to the first half of the 20th century. Thus, as LMEs move to address fisheries management issues the effectiveness of existing fisheries organizations needs to be addressed.

1.3 This paper will examine the interrelationship between LME management's future efforts and regional fisheries management organizations. It will focus primarily on the Gulf of Mexico, the Caribbean and the North Brazil Shelf LMEs. It will also look at the US experience particularly with the South Atlantic and Gulf of Mexico Fisheries Management Councils and the Gulf States and Atlantic States Marine Fisheries Commissions (GSMFC and ASMFC) for possible inferences where the ASMFC is a pseudo-RFMO, with the states which are responsible for fisheries management within three miles of shore (with Texas and the Gulf Coast of Florida extended nine miles due to historical reasons related to their Spanish history) assuming the role of countries.

2 Regional Fisheries Bodies (RFBs) and Regional Fisheries Management Organizations (RFMOs)

2.1 Regional Fisheries Management Organizations (RFMOs) have a long history, as the nature of living marine resources drives efforts for sound management to transboundary agreements. Brown (2016) has described the history of RFMOs in the context of African LMEs and this section follows from that paper but addresses Latin American and Caribbean issues. The first RFMO for a living marine resource was the fur seal convention of 1911 signed by the US, Great Britain (for Canada), Japan and Russia (http://pribilof.noaa.gov/documents/ THE_FUR_SEAL_TREATY_OF_1911.pdfm) (2014). The governments of Canada, Japan and the Union of Socialist Soviet Republics in 1976 updated it in the Convention on Conservation of North Pacific Fur Seals (sedac.ciesin.columbia.edu/entri/texts/acrc/fur.seals) (2014). The second RFMO was the International Pacific Halibut Commission established in 1923 by a convention signed by the US and Great Britain (for Canada) (www.iphc.int/) (2014). There were some efforts to establish fisheries commissions in the

1930s but they failed to come to fruition because of WWII. After WWII, fisheries commissions began to expand in response to rapidly expanding fisheries. Prior to the extension of coastal jurisdiction these conventions covered what now are both international waters and those within country jurisdiction. One of them, the International Convention for the Northwest Atlantic Fisheries (ICNAF) for the "investigation, protection and conservation of the fisheries," came into being in 1950 (www.nafo.int/about/frames/hist-early.html)(2014) and became a laboratory for the early developments of the LME approach.

2.2 In the mid-1970s, countries rapidly extended their fisheries jurisdictions to 200 miles, resulting in most of the continental shelf areas coming under national management (Burke, 1983). This led to the further development of RFBs and RFMOs.

2.3 The United Nations' FAO lists over 40 regional fisheries bodies (RFBs) (www.fao.org/fishery/rfb/en) (2016), of which around 17-18 are considered regional fisheries management organizations (RFMOs) depending on how one defines management. Less than half of the RFBs have any regulatory authority and do not reach the status of RFMOs, while some could possibly assume such authority in the future. Some bodies are creations of FAO and these would likely have to change to an independent body before assuming management authority. Nevertheless, bodies such as WECAFC, the Fishery Committee for Western Central Atlantic which covers three LMEs in addition to providing an interchange between managers, does provide assessments of the stocks and has the potential for application in relation to LME wide assessments. The Canary Current LME project has chosen to use CECAF, the parallel Committee for the Eastern Central Atlantic Fisheries, as its Fisheries Committee for addressing stock assessment issues.

2.4.1 With the need for management of coastal transboundary fisheries, various RFMOs have been established. Some have limited authority and their operational areas are not always optimal. In addition to coastal RFMOs, there are the ocean commissions for management of highly migratory tuna and tuna like fisheries. These species move in and out of LMEs and can be very important economically and ecologically in the waters of LME coastal states. LMEs are the logical body to interact with the five large tuna commissions for sustainable management and in particular for the socio-economic interests of the coastal states. The International Commission for Conservation of Atlantic Tunas (ICCAT) and the Inter-American Tropical Tuna Commission (IATTC) are very significant for fisheries management in Latin America and the Caribbean. There is also the South Pacific Regional Fisheries Management Organization (SPRFMO) which addresses non tuna type resources in the South Pacific areas beyond national jurisdiction. Although less interactive with coastal resources than the tuna like fishes, these stocks need to be considered for possible interactions on biological and socio-economic levels.

2.4.2 In Latin America and the Caribbean, in addition to oceanic bodies and the FAO's WECAFC, there are four other RFBs in this region. Argentina and Uruguay have formed the Joint Technical Commission of the Maritime Front (CTMFM) to address their Common Fishery Zone which will be critical to effective management should an LME project develop in that region. The other three RFOs are critical in the Gulf of Mexico and the Caribbean and North Brazil Shelf LMEs projects that are underway and also are important to a proposed Pacific Central American Coastal LME project. None of them are regulatory bodies and exist mainly to promote and facilitate the responsible utilization of the region's fisheries and other aquatic resources.

2.4.3 The Caribbean Regional Fisheries Mechanism (CRFM) consists of Anguilla, Antigua and Barbuda, Bahamas, Barbados, Belize, Grenada, Guyana, Haiti, Jamaica, Montserrat, Saint Lucia, Saint Kitts and Nevis, Saint Vincent/Grenadines, Suriname, Trinidad and Tobago, Turks and Caicos Island and includes a Memorandum of Understanding (MOU) with the Dominican Republic. Originating with English speaking countries, it has been broadening its reach but does not include most coastal countries and there are significant "holes" in its coverage in the island area.

2.4.4 The Latin American Organization for Fisheries Development (OLDEPESCA) consists of Belize, Bolivia (plurinational state), Costa Rica, Cuba, Ecuador, El Salvador, Guyana, Honduras, Mexico, Nicaragua, Peru and the Bolivarian Republic of Venezuela. The territorial seas cover a huge area but with many gaps. In addition, some groups of countries that might come together as a block within one LME would not be involved in another.

2.4.5 The Central America Fisheries and Aquaculture Organization (OSPESCA) with members Belize, Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras, Nicaragua and Panama covers both the Atlantic and Pacific sides of all of Central America and would be a logical "block" within the Caribbean and Pacific Central American Coastal LMEs, but would be unable to address the entire area of these LMEs.

2.5 In 2010, the effectiveness of the world's 18 RFMOs was quantitatively assessed, based on a two-tiered approach, concentrating "first on their performance 'on paper' and secondly, in practice" (Cullis-Suzuki and Pauly, 2010). The assessments concluded that RFMOs performed poorly in both cases. They also found that there was a disconnect between the two sets of scores, indicating that there was a disconnect between intentions and actual implementation of effective management. In a Policy Options Paper of November 2013, the Global Oceans Commission reviewed RFMOs in high seas fisheries and concluded that there was a general lack of effectiveness in managing world fisheries (www.globaloceancommission.org/wp-content/uploads/POP-9_Reform-of-Fisheries-

Management_FINAL-1.pdf) (2014). There have been a few successes, such as Atlantic swordfish management by ICCAT, which show that under the right conditions positive results supporting sustainable management can be obtained by RFMOs. However, limited success by RFMOs now leaves the LME movement with the potential to play a significant role in seeing that evaluation change.

3 The Large Marine Ecosystem Movement and Fisheries

3.1.1 The genesis of the LME approach has one of its roots in the work of NOAA's Northeast Fisheries Science Center (NEFSC) (and its predecessors) within the International Commission for the Northwest Atlantic Fisheries (ICNAF), which had come into existence in 1950 as an RFMO. By the mid-1960s it had become evident that the single species approach was inadequate in the face of large trawlers with high opening nets which fished all of the continental shelf off the coast of northeastern United States. The scientists of the NEFSC of NOAA's National Marine Fisheries Service responded by developing a multipurpose bottom trawl survey that piggy backed other sampling (initially ichthyoplankton) in what was then known as ICNAF Sub-Areas 5 and 6, a close match to the Northeast US Continental Shelf LME. The area survey was carried out two to three times a year. Other countries, such as the USSR, Poland, Federal Republic of Germany and the German Democratic Republic, joined in cooperative surveys. By 1977 primary productivity was being monitored by NEFSC under Dr. Kenneth Sherman's direction (Sherman, 2015). Multispecies analyses were also undertaken and several papers published on the results (e.g. Brown et al., 1976; Clark and Brown, 1977). On the management front, with regard to the management of the total resources, ICNAF established an overall catch limit less than the sum of individual species allowable catch known as the "second tier" quota (Anderson, 1998). This recognized that Maximum Sustainable Yield (MSY) is always a conditional estimate together with the existence of fishing interactions through the existence of bycatch. When looking at the record of ICNAF and fisheries management it is important to recognize that without extended jurisdiction, enforcement and compliance were always contentious issues. However, the record does show that at one time it was possible for a RFMO to set fishery regulations based on an LME spatial domain using an ecosystem approach. Despite the fact that some progress in controlling fishing was being made in ICNAF, the political winds were strong in favor of extending national jurisdiction. The importance of fishers seeing visible effective enforcement on everyone was, and still is, critical to achieving more effective regulation.

3.1.2 During 1976, the US extended its fisheries jurisdiction. Shortly after that ICNAF ended and was replaced by the Northwest Atlantic Fisheries Organization (NAFO), which covered areas outside of the 200 mile jurisdiction. US jurisdiction encompassed the entire shelf area of the Northeast US Continental Shelf LME, except for a small piece assigned to Canada. A Regional Fishery Management Council system was established to address management within this LME. While the US continued to monitor the area on an ecosystem basis, the analyses necessary for Council management focused initially on single

species and removing foreign effort. The latter goal was achieved and subsequent efforts focused on trying to rebuild stocks, a goal which has been partially successful in this LME.

3.2.1 In 2012, the Swedish Agency for Marine and Freshwater Management produced a survey review entitled Large Marine Ecosystems: Study of the Concept of Large Marine Ecosystems and its Institutional Relevance for Ecosystem-based Management and Development (Anna Tengberg & Arne Andreasson 2012, unpublished document available at http://iwlearn.net/publications/ll/study-of-the-concept-of-large-marine-ecosystems-and-its-institutional-relevance-for-ecosystem-based-management-and-development) (2014) to provide guidance for the Swedish International Development Agency (SIDA). The methodology used was a questionnaire and did not involve direct interviews on the ground. Tengberg and Andreasson looked at the relationships between LME projects and the regional based organizations (RBOs), the Regional Economic Communities and Regional Seas Programs (RSPs). Their final recommendation was: "Further efforts are needed to strengthen coordination and collaboration among LME programmes, RSPs, RFBs and other regional bodies with a mandate in coastal and marine management, to improve communication and information flows, harmonization of approaches and interventions, and donor coordination. Before establishing institutions for joint ecosystem based management to implement agreed LME Strategic Action Programs (SAPs), such as a new LME Commission, an institutional assessment should be conducted that examines different options in terms of opportunities for embedding the LME approach into existing regional institutional and policy frameworks of e.g. regional economic communities."

3.2.2 In East Asia, Partnerships in Environmental Management for the Seas of East Asia (PEMSEA) incorporate six LMEs including the Yellow Sea LME and are looking at ways to help strengthen LME governance (www.un.org/depts/los/consultative_process/documents/7abstract_chua.pdf) (2014). Tengberg and Andreasson (2014) state, "the Yellow Sea LME is planning to capitalize on the policy and institutional framework established by PEMSEA . . . to establish a Commission for the YSLME based on a legally nonbinding agreement." In South Asia, the Bay of Bengal LME Project (BOBLME) has been active in developing fisheries management plans and working with a Regional Fisheries Management Advisory Committee (RFMAC) to "interpret the information and deliver ecosystem based fisheries management advice"
(www.boblme.org/eventDocs/03%20%20Prospectus%20and%20draft%20agenda%2BOBME%20Regional%20Fisheries%20Management%20Advisory%20Committee%20Meeting.pdf). There is a working effort jointly funded by the BOBLME and the Indian Ocean Tuna Commissions (IOTC) to strengthen the linkage between science and tuna fisheries management (IOTC, 2015). For the East Asian Seas, Tengberg and Andreasson (2014) specifically recommended strengthening coordination and collaboration between the LMEs and the plethora of organizations addressing components of the six Large Marine Ecosystems.

3.2.3 Tengberg and Andreasson also looked at the West Coast of Africa with its three LMEs. They noted the close relationship of the Canary Current Large Marine Ecosystem (CCLME) to the Sub-Regional Fisheries Commission (CSRP) as a positive development. The Guinea Current Large Marine Ecosystem (GCLME) was noted for its tenacity in supporting an Interim Guinea Current Commission (IGCC) and its cooperative efforts with regional RFBs including developing MOUs with them. The Benguela Current Commission (BCC) stands out as a singular achievement. It is now working on transboundary fishery management plans and its formal relationships with related entities were noted. Although not mentioned in the Swedish document, the BCC has a strong working relationship with the adjacent offshore Regional Fisheries Management Organization (RFMO) and the Southeast Atlantic Fisheries Organization (SEAFO), with which it is co-located.

3.3. On the Indian Ocean side of Africa, the countries along the coasts of the Agulhas Current and Somali Coastal Current LMEs experienced considerable political concern about establishing an LME Commission, as there were a number of bodies addressing various components already in existence. "A Western Indian Ocean Alliance of Partners for Implementation of a Strategic Action Programme for LME Management" is proposed in their Strategic Action Plan and has the potential for future growth into a body whose actions will result in integrated resource management and ocean governance (www.asclme.org/SAP/Final%20SAP%20English%20131007.pdf) (2014).

3.4. Fisheries are a key component of LMEs' goods and services and if this management style is to be successful it must be based on the sustainability of resources. Thus, there is risk in ignoring RFBs. Strong support and political will by Fisheries Ministries are critical to the success of the LME integrated management approach, especially given the socioeconomic and political importance of fisheries for food security, livelihoods and foreign exchange. Fisheries and Environmental Ministers also need to work together to ensure successful management at the LME scale. Coordination, not competition, is needed for the LME approach. Fisheries Ministers invest in RFBs which have the potential to become RFMOs. They also play a critical role in achieving the goal of ecosystem based management on which the LME approach is based.

4 The Humboldt Current LME

4.1 The GEF supported Humboldt Current LME Project has recently completed its first five year phase. A description of the Humboldt Current LME and the work of that project are given by Gutiérrez et al. (this volume). This Eastern Boundary Current LME supports the largest single species fisheries in the world, the Peruvian anchovy. There are significant other fisheries resources as well. The small pelagic fisheries are essentially within the exclusive fishing zones of Peru and Chile but they are transboundary. The first phase of the LME Project produced a Transboundary Diagnostic Analysis (TDA) which described the major issues within the LME, the scientific and technical information available and the additional

information needed for effective LME management. This was followed by a Strategic Action Plan (SAP) where the actions to be implemented by the countries to address these issues were adopted. Gutiérrez et al. (this volume) state, "In the SAP a framework for coordinated action is proposed between the two countries during the next decade with the vision of 'A healthy and resilient HCLME through an ecosystem approach to management (EBM) that guarantees the conservation and sustainable use of its goods and services for the benefit of the people.'" This addresses both the large commercial fisheries such as anchovies and the smaller more artisanal ones such as lobster. Initially the SAP was signed by both countries' focal points in their respective marine science institutions, but on August 9, 2016 several ministries from both countries signed onto the SAP and the news release headline noted their agreeing to sustainably manage together on an LME basis the Peruvian anchovy fishery (www.pressreleasepoint.com/chile-and-peru-sign-landmark-agreement-sustain-worlds-largest-single-species-fishery).

4.2. The Humboldt LME is also linked to the RFMOs in the region. The South Pacific Regional Fisheries Management Organization (SPRFMO) covers the entire South Pacific Ocean, about a fourth of the earth's high seas areas. Currently, the main commercial resources managed by the SPRFMO are jack mackerel and jumbo flying squid in the Southwest Pacific and deep-sea species associated with seamounts in the Southeast Pacific. Both Chile and Peru are members of this RFMO (www.sprfmo.int). As they increase activities in the Southeast Pacific there can be a viable role for the Humboldt LME Project. Likewise, there may be potential involvement in the future with the Inter-American Tropical Tuna Commission of which Peru but not Chile is a member.

5 The Gulf of Mexico, Caribbean and North Brazil Shelf LMEs

5.1 In the Gulf of Mexico, Caribbean and North Brazil Shelf LMEs there are a number of RFBs and RFMOs that are presently operating in these LMEs. They are the International Commission for Conservation of Atlantic Tuna (ICCAT), the Western Central Atlantic Fisheries Commission (WECAFCE), the Caribbean Regional Fisheries Mechanism (CFRM), the Organization of Fishing and Aquaculture in Central America (OSPESCA) and the Latin American Fisheries Development Organization (OLDEPESCA), of which two are RFMOs. There are also Regional Economic Bodies (REBs) such as the Caribbean Community and Common Market (CARICOM) and El Sistema de la Integración Centroamericana (the Central American Integration System, SICA).

5.2 Although the Gulf of Mexico has long been recognized as a major fishery area since the late 1980s, there was the realization that it warranted being considered on a LME level. Browder et al. (1991) addressed this issue at the 1989 meeting of the International Council for the Exploration of the Sea (ICES), followed by Brown et al. (1991) in a 1990 symposium at the American Association for the Advancement of Science (AAAS). This was followed by another Gulf of Mexico symposium (Kumpf et al.,

1999). Thus began the long path towards a GEF funded LME Project. Although fisheries has been one of the driving factors, from a tactical management standpoint, such as setting allowable catches for numerous stocks, the northern and eastern Gulf being under US jurisdiction and the Southwestern Gulf being under Mexico jurisdiction is sufficient for much of fisheries management. However there are always transboundary issues, and there are the strategic issues of ecosystem wide responses to pressures which can be especially important during a time of rapid climate change. The GEF supported Gulf of Mexico LME Program recognizes these issues but the way forward is not clear. Yet there is reason for optimism. There is a long history of scientists from NOAA's Southeast Fisheries Science Center and the Institute National de Pesca of SEMARNAP of the Mexican Secretariat for the Environment, Natural Resources and Fisheries working together in the Gulf of Mexico through the research cooperation program, MEXUS-Gulf. In addition, there have been periodic US-Mexico Fisheries meetings at ministerial levels which have provided a forum to exchange views and plan cooperative projects. For example, the achievements in relation to Gulf of Mexico turtle conservation have been significant. While Cuba has been absent from all of these efforts, the Gulf of Mexico LME Project has an open door policy to welcome Cuban participation whenever they choose to do so.

5.2.1 The development of a GEF supported Caribbean Sea LME Project like the Gulf of Mexico began early with a paper by Richards and Bohnsack (1990) presented at the 1989 meeting of AAAS entitled, "The Caribbean Sea: A Large Marine Ecosystem in Crisis." By the mid-1990s, the GEF initiated the Gulf of Guinea Large Marine Ecosystem pilot project (GOG LME which later expanded to the entire Guinea Current Large Marine Ecosystem (GCLME)). IOCARIBE (UNESCO's Intergovernmental Oceanographic Commission's sub-commission for the wider Caribbean) started a process to have LME programs in both the Gulf of Mexico and in the Caribbean Sea and North Brazil Shelf LMEs. When Mexico took leadership for the Gulf of Mexico LME Project, effort became concentrated on the Caribbean Sea LME. There was skepticism about the likelihood of success due to the need for so many countries of diverse size and cultural backgrounds to work together for the common good. However, the membership of IOCARIBE reflecting several countries and a wider range of diversity also gave hope. Although development was slow, the first phase of a GEF supported Caribbean Sea LME Project (including the North Brazil Shelf LME) began in 2009 and significant progress has been made going forward into a SAP implementing phase. A great deal of effort has gone into the issue of governance and a very thorough assessment addressing regional collaboration has been produced (Mahon et al., 2013). In this study all institutions of relevance, which are far greater in number than just the RFBs identified by FAO, were included. They have also included work with the REBs. The report recommends a networking effort among the various bodies involved with the CCLME Coordinating Unit be to an overviewing entity of the bigger integrated LME picture. Some gaps were identified with suggestions for addressing them. The relative separation of the North Brazil Shelf was noted with fisheries issues being addressed within the spatial domain of both LMEs.

5.3 The question to be addressed is whether or not there are other LMEs that have faced similar problems and succeeded in getting their fisheries under control and turning them around. The US is such a place, see www.noaa.gov/new-report-shows-us-fisheries-rebuilding (2016) and Dr. Kathryn Sullivan, NOAA administrator, www.noaa.gov/americas-astounding-progress-ending-overfishing (2016). This paper will focus on the US Northeast Shelf, Southeast Shelf and Gulf of Mexico LMEs and their relevance.

6 The United States Experience

6.1 At first glance the United States would not seem to have much to offer in terms of lessons learned from an international boundaries situation. However, the United States was formed by a union of separate colonies of varying sizes, shapes and resources and the union only succeeded through making many compromises. One of them was that the Constitution of the United States reserved all powers not specified for the federal government to the states. The fisheries in the waters off each state are constitutionally the responsibility of the states out to territorial limits. Thus on the East Coast of the US, the states' control waters out to three miles and the federal government from three to 200 miles (and also the responsibility for representing US interests in international waters), so that LME fisheries management within the US has to face many of the issues that international LME management is required to address. Figure 2 shows the US East Coast with its 16 states varying in size and coastline much as the countries on the west coast of Africa. The Southeast and Northeast US Continental Shelf Large Marine Ecosystems provide examples of such multijurisdictional management within an LME framework. The Gulf of Mexico states face similar challenges but have fewer fisheries management plans. State jurisdiction for Texas and the Gulf Coast of Florida extends out nine miles. This is described not as a model to copy but as indicative of the complexities needed to address LME management in the US to achieve the holistic ecosystem approach and the importance of having the LME boundaries in place.

Figure 2. The US Atlantic and Eastern Gulf of Mexico Coasts and Coastal States. (www.greenway.org/pdf/map_mefl.pdf, 2014)

6.2 As in Latin America and the Caribbean, coastal migrant species are very important off the US East Coast and states realized early that these resources could not be effectively managed separately by the individual states. To address this issue the states formed an interstate compact in 1942, the Atlantic States Marine Fisheries Commission (ASMFC) (www.asmfc.org/about-us/program-overview) (2014). "The purpose of this compact was and continues to be, to promote the better utilization of the fisheries, marine, shell and anadromous, of the Atlantic seaboard by the development of a joint program for the promotion and protection of such fisheries" (http://delcode.delaware.gov/title7/c015/index.shtml) (2014). It is important to note that this language did not deal directly with management, similar to the goals of many existing RFBs which focus on harmonization. It was not until the mid-1980s over 40 years after its founding and almost 10 years after extended jurisdiction that the ASMFC became significantly involved in fisheries management. This was not an easy task. The states had different socio-economic conditions in their fisheries, some having large commercial boats while others had primarily small boat recreational fisheries. Some had large, well-staffed fisheries departments while others had minimal capacity. One impact of establishing management plans has been the increase in technical capacity in all of the states. There are now 24 management plans. The goals are adopted to manage for

sustainability of the resource with each state issuing its own regulations which, when summed together, achieve the biological targets while allowing for different socio-economic choices by the different states. The Commission supports ecosystem based management and in its goals document states: "The Commission remains committed to seeking ecological sustainability over the long-term through continuing its work on multispecies assessment modeling and the development of ecosystem-based reference points in its fisheries" (www.asmfc.org) (2014). The East Coast of the US consists of two LMEs, the US Northeast Continental Shelf LME and the US Southeast Continental Shelf LME. The dividing line is at the northern third of the state of North Carolina. Thus, like OLDEPESCA and OSPESCA, the ASFMC covers more than one LME. Most of the management plans cover species within one or the other LME but some, particularly seasonal migrants, cross LME borders. The inclusion of all the states in ASFMC facilitates addressing those issues.

6.2.1 The Gulf States Marine Fisheries Commission (GSMFC) was established by an act of Congress in 1949 (Pl 81-66) essentially to develop a "joint program for the promotion and protection" of fisheries (www.gsfmc.org) (2016). It began to seriously consider management actions in the latter part of the 1980s. The GSMFS has completed 11 fisheries management plans.

6.3 With the Fisheries Conservation and Management Act in 1976, the US Congress established Fisheries Management Councils to manage fisheries in the waters between 3 and 200 miles (www.nmfs.noaa.gov/msa2005/) (2014). Three were established for the US Atlantic East Coast, one for the Gulf of Mexico and one for the US Caribbean. Two of these cover the Northeast Continental Shelf LME dividing it into two sub-units. The two councils coordinate very closely to ensure that there is a holistic LME consideration. The third covers the Southeast US Continental Shelf LME. One state belongs to both LMEs and thus sits on two councils. Again, the management of the two is very closely linked in order to maintain a holistic approach. For stocks primarily taken inshore, the Councils establish complementary management to reinforce the state plans. The composition of the Management Councils is designed to ensure that plans are developed that take into account the consideration of the states. The chief Regional Federal Fisheries Official is a voting member, as are the Chief Fisheries Officers of each state. The Council's remaining voting members are appointed by the federal government from persons nominated by state governors from the community of stakeholders. The language of all of the operational bases for both the Councils and the Commissions supports the ecosystem approach to fisheries within a large marine ecosystem context. Community based fisheries management has been advocated by many because of the realization that without local community support the management program would not be effective. However, all too often the movement of fish and fishing fleets can negate the benefits desired by local communities. To address this, the management plans developed by the Fisheries Management Councils are capable of, and in a number of cases do, assign specific components of a management plan to be developed and managed by a community of fishers. They are able to do this successfully because the overall plan protects them from being negatively impacted by other components of the same fisheries. The Councils are also involved in the development of the US

positions at the International Commission for Conservation of Atlantic Tunas, so that impacts of those decisions can be considered from the standpoint of their impact on the LME.

6.4 Recently, with the establishment of a US National Ocean's Policy (www.boem.gov/National-Ocean-Policy/) (2014) under the administration of President Obama, Regional Ocean Councils are in place on the East Coast (www.cmsp.noaa.gov/activities/index.html) (2014), aimed at protecting shared coastal waters and ocean resources and addressing regional issues of concern to the coastal and ocean waters of the Northeast Shelf LME. The Councils seek to develop an ecosystem based management approach to face present and future threats to the ocean and coastal areas. These provide the ability to address larger issues such as siting of wind farms within the context of ecosystem management.

6.5 The success in the US in restricting overfishing has already been noted. Although the overall management policy has focused on an LME approach that assured entire resources were addressed at an LME level, the path has not been smooth. Restrictive regulations have met with controversy and political struggles. The intensity of the efforts has resulted in a large number of single species assessments and regulations designed to specific targets to end overfishing. (www.digplanet.com/wiki/Magnuson%E2%80%93Stevens_Fishery_Conservation_and_Management_Act) (2014). This looks similar to the situation in the mid-1970s when the difficulties of pursuing this path resulted in ICNAF moving to a two tier system with an overall quota. The US National Academy of Sciences conducted a review of this situation, "Evaluating the Effectiveness of Fish Stock Rebuilding Plans in the United States" (NRC, 2014). The Committee concluded that the sum of the efforts achieved as NOAA had stated, the ending of overfishing and the rebuilding of the stocks. However when they examined the individual stock assessments and the management by biomass recovery targets, they added the following:

> *The committee attributes some of the variable or mixed performance of rebuilding plans to uncertainties inherent in specifying a rebuilding threshold and in assessing stock status relative to that threshold. Estimates of both the threshold and stock status are influenced by statistical variation associated with sampling and uncertainty inherent in modeling fish populations as well as the natural variation associated with the dynamic nature of ecosystems. As a result, estimates of stock size and productivity may change dramatically between successive assessments, leading to changes in stock metrics and the biological reference points to which they are compared. Given these uncertainties, the current policy dependence on biomass thresholds often triggers abrupt changes, or discontinuities, in management. Although scientific uncertainty contributes to the variable results of rebuilding plans, this should not be interpreted as a criticism of the science. Rather, mixed performance of rebuilding plans often reflects a mismatch between policy makers' expectations for scientific precision and the inherent limits of science because of data limitations and the complex dynamics of ecosystems.*

They further suggested that targets of fishing mortalities might be more robust and less subject to swings than biomass targets. This is reminiscent of the numerous discussions held among assessment scientists from ICNAF countries and from FAO in the late 1960s and early 1970s. At that time many scientists felt that fishing rate (F) targets would be more efficacious. There was also support for using effort control measures as opposed to quotas both in terms of estimation and enforcement. However, effort measures lost out to quotas because of equity concerns raised by countries who felt that if a measure such as days fishing were used, some fleets would be able to increase their efficiencies while others could not, resulting in a shift in proportions of the catch whereas with a quota the allocations to countries' shares would not be subject to shifts because of country actions.

7 Lessons learned

7.1 The principle conclusions from an examination of the US fisheries rebuilding experience are that it takes time, can work even when the process is complicated and is not without its controversies. The major element that allows for success is the commitment of all parties to consider the LME as the spatial domain for holistic action and to strive for an ecosystem approach, to move closer and closer to real ecosystem based management in a coordinated manner. RFBs will most likely continue to have support but to be effective in the future they will not only need increased authority to be become RFMOs but will need to become proponents of looking at the LME(s) as the unit within which management must be harmonized and coordinated with others. The success of the Interim Guinea Current Commission (IGCC) formed by the Guinea Current Large Marine Ecosystem Project in obtaining MOUs with RFBs is a very positive step. In the LME approach, fisheries and fisheries management take place within a larger socio-economic context, thus the involvement of Regional Economic Organizations (REOs) and the support for LME management is critical. The LME projects have all recognized that they need country buy-in to the LME approach but it is just as important that there be buy-in by the RMOs and REOs, particularly if there is to be any success with the management of transboundary fisheries.

7.2 Monitoring, control and surveillance (MCS) is a critical part of fisheries management (www.fao.org/fishery/topic/3021/en). In the US case, this has been true not only for the success of individual regulations but in creating a climate where fisheries management restrictions are more accepted (although the specific form can be very controversial) than they were before extended jurisdiction. MCS must be applied across the entire LME area to be effective and it is difficult to have it accepted in one area when resources are subject to harvest in another adjacent area. RFBs and REBs are critical to this effort. In addition to effective MCS programs, the need for increased capacity in stock assessment and in socioeconomics both in a total and in the individual states was evident. This was especially true with regard to the individual states. The experience of the US has been made available to existing GEF LME Projects through NOAA and this can be expected to continue at some level.

7.3 The LME as a place based management domain is serving as the catalyst for action on ecosystem based fisheries management. It is also the place where strategic issues important to fisheries such as climate change, ocean zoning and marine spatial planning can be dealt with, while the countries and RFPs are absorbed with tactical issues such as yearly adjustments in allocations to fishers. Without the LME focus to harmonize management plans between countries it is unlikely the management will be any more successful than they were in the earlier years of management on the US East and Gulf Coasts. However, with the application of cross sectoral and integrated ecosystem based management within the LME management model, success in controlling overfishing is possible.

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