SOCIAL-ECOLOGICAL CHANGE AND MARINE PROTECTED AREAS: INSIGHTS FROM THE RÍA LAGARTOS BIOSPHERE RESERVE, MEXICO

by

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AUTHOR'S DECLARATION

I hereby declare that I am the sole author of this thesis. This is the true copy of the thesis, including any required final revisions, as accepted by my examiners. I understand that the thesis may be made electronically available to the public.

ABSTRACT

This research examined social-ecological regime shifts (SERSs), and their relation to the governance and human dimensions of marine protected areas (MPAs). Characterized by their rapid and long-term onset, SERSs pose a major challenge for managers of coastal and marine resources. The world's oceans are being overexploited at an unprecedented rate, resulting in what many experts are referring to as a maritime "tragedy of the commons," steered by large-scale drivers such as overfishing and climate change. These drivers of change result in localized, regional and global impacts on both marine biodiversity and human wellbeing. Abrupt social and environmental changes can be constituted as SERSs, or disruptions of social-ecological system structure that can potentially have enduring and detrimental influence on ecological health and the social stability of coastal communities. The establishment of MPAs as a management tool can be used in coastal nations around the world, including Mexico, to avoid or mitigate the impacts of SERSs in a coastal and marine context. MPAs strive to safeguard flora and fauna by restricting certain exploitative activities in a given area of the marine environment or land-sea interface. Previous research indicates that MPAs governed with the integration and inclusion of local community perceptions, as opposed to conventional state-led approaches, have been particularly effective. This study focused on the Ría Lagartos Biosphere Reserve, an MPA located in the southern Mexican state of Yucatán, where overexploitation driven by Asian market demand of the local sea cucumber fishery and the emerging tourism industry have brought an influx of social-ecological changes to the region. The research objectives included: 1) establishing a thorough understanding of the environmental and social changes occurring in the region, 2) studying local perceptions of the MPA and how they relate to the changes and community wellbeing, and 3) determining if community involvement in the MPA can enhance its governance to withstand change and improve wellbeing. It followed a largely qualitative and inductive methodology, using semi-structured interviews, focus groups and a survey as its data collection methods. The results indicated that local perceptions can provide valuable insights to strengthen MPA governance, better community-government relations, bolster community wellbeing and improve responses to social-ecological change. The co-management approach is found to be the way forward for MPA governance.

Keywords **–** Social-Ecological Regime Shift, Marine Protected Area, Natural Resource Governance, Small-Scale Fishery, Coastal Tourism, Community Wellbeing, Co-Management

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LIST OF ACRONYMS

CBD - Convention on Biological Diversity

CITES - Convention on the International Trade in Endangered Species of Wild Flora and Fauna

DCS - Decompression Sickness

IBA - Important Bird Area

IUCN - International Union for Conservation of Nature

MAB - Man and Biosphere Programme

MPA - Marine Protected Area

CONANP - National Commission of Protected Natural Areas (Comisión Nacional de Áreas Naturales Protegidas)

RLBR - Ría Lagartos Biosphere Reserve

SEMARNAT - Secretariat of Environment and Natural Resources (Secretaría del Medio Ambiente y Recursos Naturales)

SSF - Small-Scale Fishery

SERS - Social-Ecological Regime Shift

SES - Social-Ecological System

UNESCO - United Nations Educational, Scientific and Cultural Organization

CHAPTER ONE: INTRODUCTION

This research examines the application of a social-ecological lens on natural resource management and marine protected areas (MPAs) in the context of small-scale fisheries (SSFs) and coastal communities. The emergence of potent and rapid coupled environmental and social changes, known as social-ecological regime shifts (SERSs), are increasingly making the governance and management of natural resources difficult. Marine and coastal environments in particular are becoming vulnerable to their occurrence, with most regime shifts documented to date being commonly found in marine and coastal systems (Biggs et al., 2018).

MPAs have long been heralded as an important area-based management tool to combat such changes and conserve natural resources, biological diversity, and historical and cultural facets of the landscape. The implementation of an MPA strives to diminish the risk of degradation to marine and coastal ecosystems by reducing pressure on fisheries and other related marine activities. They, "serve to protect delicate ecosystems so that they remain productive and healthy, maintain areas of biodiversity and genetic variation within the flora and fauna populations, ensure that endangered, threatened, or rare species are protected…" (Ginsburg, 2013). They are known as a "well-established conservation strategy, employed around the world to protect important marine species and ecosystems and support the recovery of declining populations" (Jessen et al., 2017). However, while there is extensive literature evaluating the biological and ecological implications of MPAs, a research gap linking MPA governance and SERSs exists (Fraga and Jesus, 2008). In some instances, MPAs have contributed to local exclusion from livelihood and cultural activities (Bezaury-Creel, 2005). Consequently, an MPA can be considered, "both a 'biological success' and a 'social failure', devoid of broad participation in management, sharing of economic benefits, and conflict-resolution mechanisms" (Fraga and Jesus, 2008). As the social components of an MPA are often the instrumental determinant of its success (Gall and Rodwell, 2016; Gallacher et al., 2016; Loury et al., 2017; Sowman and Sunde, 2018), their consideration in the MPA design process is therefore crucial to ensure its effective management and lasting benefits to local communities. Analyzing the governance of natural resources by using MPAs as a tool is a recurring theme of this thesis. It provides a broad linkage to the three areas of research, namely: SERSs, MPAs and community wellbeing. The Ría Lagartos Biosphere Reserve (RLBR), located on Mexico's Yucatán Peninsula, serves as the case study for the purposes of this investigation wherein

the researcher conducted fieldwork through participant observation, semi-structured interviews and focus groups to collect data and achieve the research objectives listed below.

1.1 Problem Statement and Research Objectives

The study focused on the concept of governance to navigate regime shifts and seek to examine how the establishment of co-managed MPAs as an institutional framework, through the cooperation of both community members and management authorities, can be used as a tool to alleviate both the ecological and social impacts of SERSs. Specifically, the implications of community involvement in the governance of the RLBR and its potential for ecological conservation and community wellbeing will be examined. The research is guided by the following three objectives:

1. Characterize the nature of environmental and social changes taking place in the RLBR;
2. Examine local perceptions of the MPA in relation to community wellbeing and the historical and ongoing processes of rapid environmental and social changes; and
3. Determine whether community involvement in MPAs can provide novel governance arrangements to better respond to change and help achieve conservation goals along with community wellbeing.

Attaining a baseline understanding of the types of changes taking place in the study area, their associated drivers and impacts on the surrounding ecology and local communities will help to establish the severity and extent of their influence on the changing relationships between communities and coastal and marine ecosystems. In addition, evaluating how local peoples understand such changes and envision the current or projected implications of a co-managed MPA in relation to their community's wellbeing is important for the improvement of both and ecological and social dimensions of the MPA. Finally, determining what applicable responses can be derived from the research results attained has important implications for future policy in relation to the governance of MPAs to more effectively achieve ecological and social goals.

The important terminology used in and fundamental to the understanding of this research is relayed below:

1. **Social-Ecological Regime Shift**

   Abrupt, long-term and often irreversible changes in social–ecological system structure and function, with possibly considerable adverse impacts for human wellbeing and ecosystem processes (Nayak and Armitage, 2018). Regime shifts from one ecological state to another are often portrayed as sudden, dramatic, and difficult to reverse, whereby social-ecological systems go through substantial reorganizations in system structure, functions and feedbacks (Crépin et al., 2012; Hughes et al., 2013).

2. **Marine Protected Area**

   Any area of intertidal or sub-tidal 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 (IUCN, 2008).

3. **Small-Scale Fishery**

   Traditional fisheries involving fishing households (as opposed to commercial companies), using relatively small amount of capital and energy, relatively small fishing vessels (if any), making short fishing trips, close to shore, and mainly for local consumption (FAO, 2003).

4. **Community Wellbeing**

   The combination of social, economic, environmental, cultural, and political conditions identified by individuals and their communities as essential for them to flourish and fulfill their potential (Wiseman and Brasher, 2008); The satisfaction with the local place of residence taking into account the attachment to it, the social and physical environment, and the services and facilities (Forjaz et al., 2011).

5. **Co-Management**

   The sharing of power and responsibility among local resource user communities and resource management agencies (Kofinas, 2009); A governance system that combines state control with local, decentralized decision making and accountability and which, ideally, combines the strengths and weaknesses of each (Carlsson and Berkes, 2005).

1.2 Study Area

The RLBR and three of the four communities located within its boundaries, San Felipe, Río Lagartos and Las Coloradas (herein collectively known as the communities of "Ría Lagartos" for the purposes of this thesis), encompassed the study area for this research. This section delineates the study in its national, regional and local contexts. Further information regarding the governance of MPAs in Mexico and the SSF context of the RLBR is detailed in Chapter 3.

1.2.1 National Context

The North American, Spanish-speaking nation of Mexico has a varied tropical to desert climate and is bordered by the United States to the north, the Pacific Ocean to the west and south, and the Caribbean Sea to the east (Maddicks, 2017). It has a total surface area of 1,964,375 sq. km, making it the 15th largest county in terms of land mass in the world (Central Intelligence Agency, 2019). It also ranks 11th in terms of population, housing almost 126 million people, with a quarter of them residing in its capital, Mexico City, majority within the ages of 25-54 years and growing at a rate of 1.09% (Central Intelligence Agency, 2019). It is governed as a democratic, representative federal republic, divided constitutionally between executive, legislative and judicial branches and distributed over the federal, state and municipal levels. State and local budgets are largely dependent on federally allocated funds because of its highly centralized government (Encyclopaedia Britannica, 2019a). 80.2% of the population is urbanized and 94.9% over the age of 15 is literate. Mexico is recognized as an emerging market and upper middle-income economy (The World Bank, 2019). Its $2.4 trillion USD economy, 11th largest in the world, is increasingly focused on manufacturing, with GDP growing at a rate of 2% annually. Despite this, income distribution remains highly disparate, with 46.2% of the population below the poverty line and an unemployment rate of 3.4% (Central Intelligence Agency, 2019). Squatter settlements lacking basic services are commonplace in its urban centres, while affluent groups have access to amenities and control most of the political and economic activity of the country (Encyclopaedia Britannica, 2019b). Drug related crimes also continue to be a major concern in the country, with 20,000 people falling victim to cartel violence in 2016 (Fisher and Taub, 2017).

Mexico is known as one of the world's Megadiverse Countries, a term used to describe 17 countries housing majority of the Earth's species and having high numbers of endemic species

(UNEP, 2014). It ranks fourth in the world in terms of biodiversity (first in reptilian species, second in mammalian species, fourth in amphibians species, and fourth in flora), housing over 200,000 different species, which constitutes 10-12% of all known biodiversity on earth (CONABIO, 2008). It is also second in terms of ecosystems diversity, which includes wetlands, mangrove forests, barrier islands, dunes, coral reefs, seagrass meadows and nearshore islands, distributed along four different seas, namely: the Pacific Ocean, the Gulf of California, the Gulf of Mexico and the Caribbean Sea (Fraga and Jesus, 2008). Furthermore, Mexico is party to a number of international environmental agreements, including: the Convention on Biological Diversity (CBD), Convention on Fishing and Conservation of Living Resources of the High Seas, Convention on the International Trade in Endangered Species of Wild Flora and Fauna (CITES), Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar), International Convention for the Regulation of Whaling, United Nations Convention on the Law of the Sea and the Paris Agreement (Central Intelligence Agency, 2019). Despite this, under Mexican law, there are officially 49 extinct species, 475 endangered, 896 threatened and 1,185 under special protection, at risk largely due to habitat loss and the wildlife trade (Olivera, 2018). In addition, climate change is projected to bring surface air temperature increases between 1.8° to 5.0°C by the end of the century and a 9-48% decrease in precipitation (Karmalkar et al., 2011), resulting in deadlier hurricanes, droughts, wildfires and El Nino events (Liverman and O'Brien, 1991). Such issues and abrupt changes especially pose a significant concern for coastal and MPA governance, which will be one of the focus areas of this research.

1.2.2 Regional Context

The state of Yucatán has a population of almost 2.1 million people (INEGI, 2015), comprised of 106 municipalities, with its capital city being Mérida. Along with the states Campeche and Quintana Roo, it comprises the Mexican portion of the Yucatán Peninsula, known to be the impact site of the Chicxulub crater, formed by an asteroid that struck the earth 66 million years ago and initiated global climatic disruption leading to a mass extinction of 75% of all life on earth, including the non-avian dinosaurs (Central Intelligence Agency, 2019). Its northern coastline is bounded by the Gulf of Mexico (Prado and Chandler, 2017). Once the seat of the Mayan civilization, it houses a number of important archeological sites, including Chichén Itzá (Figure 1.1), one of its main centres and now a UNESCO World Heritage Site (UNESCO, 2019). The

Figure 1.1: Chichén Itzá and Ik Kil Cenote, some of the most important tourist destinations of the Yucatán state amd contributors to its economy (photographs by author)

ancient ruins of Yucatán draw almost 4,000,000 visitors a year, comprising an important part of its economy (The Yucatán Times, 2018). Other significant touristic attractions are its coasts and its many freshwater pools and subterranean sinkholes, or "cenotes," (Figure 1.1) formed due to its limestone bedrock, used by the Maya as a source of drinking water and for cultural ceremonies (Encyclopaedia Britannica, 2019b). Yucatán is still home to the nation's highest Mayan population and the highest percentage of indigenous language speakers in the country.

Sea level rise poses a significant risk for the region, jeopardizing coastal "tourism hubs" and infrastructure, an industry that contributes to over $8 billion/year USD into the Mexican economy. The Yucatán Peninsula is also predicted to experience the highest levels of temperature warming and precipitation decreases in Central America, between 4.7°C and 3.9°C, and 25-39% respectively, aggravating food insecurity and storms (Karmalkar et al., 2011). The Climate Change Strategy for the Yucatán Peninsula, established by the states of Yucatán, Campeche and Quintana Roo, strives to develop a regional climate adaptation strategy and implement a regional programme aimed at reducing emissions from deforestation and forest degradation (CCPY, 2018).

1.2.3 Local Context

The RLBR (Figure 1.2) is listed as a category VI protected area, i.e., protected area with sustainable use of natural resources (IUCN, 2008). It is located on the eastern coast of the Yucatán Peninsula, within the Gulf of Mexico. The reserve is home to important wetlands that are designated under the Ramsar Wetlands Convention (UNESCO, 2007). It includes a diversity of ecosystems such as: mangroves, evergreen forest, deciduous forest, coastal dune vegetation,

coastal lagoons, marshlands, estuaries, grasslands and reedbeds, which are critical habitats for nesting sea bird species. The wetlands are also habitat to a variety of rare, vulnerable or endangered species, including: the muscovy duck (*Cairina moschata*), wood stork (*Mycteria americana*), peregrine falcon (*Falco peregrinus*), and a protective zone for nesting hawksbill (*Eretmochelys imbricate*) and green sea turtles (*Chelonia mydas*) in numbers considered important on a worldwide scale (Savage, 1993). In addition to its biodiversity, the RLBR is also an important source of food and livelihood for the residents that live in its buffer zone and directly depend on the wetlands (UNESCO, 2007). The local communities situated within the vicinity of the reserve are San Felipe, Río Lagartos, Las Coloradas and El Cuyo (UNESCO, 2007). The former three are used as the case studies for this research, collectively known as communities of "Ría Lagartos."

Figure 1.2: Ría Lagartos Biosphere Reserve in a national and regional context (Sánchez and Audefroy, 2017)

The region has been strongly impacted by human activities such as: fishing, agriculture, livestock raising, salt extraction, tourism, aquaculture and urban development (UNESCO, 2007). These issues are further aggravated by limited interactions between fishers and the government, leading to ineffective coordination and management of marine resources. Large number of drivers have contributed to abrupt, long-term and significant changes in linked systems of people and nature with uncertain implications for ecosystem services and human wellbeing. Understanding and responding to such changes has remained a significant challenge for resource managers, as will be explored throughout this study (Walker and Meyer, 2004).

1.3 Research Design and Methodology

This research uses a qualitative case study methodology, using participant observations, semi-structured interviews, a survey and focus group activities as the main data collection methods. Results were analyzed using a descriptive research design, chosen to understand the different relationships between various social actors (Dulock, 1993) involved in coastal and marine resource management. The literature review was a continuing component throughout the research, and fieldwork occurred throughout June-September 2018. The research methodology is further described in Chapter 3.

1.4 Thesis Organization

The nature and governance of natural resource management and use is entrenched in a coupled social-ecological system (SES), whereby both environmental and human dimensions are inherently linked. This thesis strives to empirically assess this intricate relationship in a coastal and marine context as it relates to SSF communities and governance. Chapter 1 commenced the thesis by introducing its theoretical background, the study's objectives, and significance of the issues it is trying to address, briefly introducing the study area, research design and methodology. Chapter 2 relays the pertinent literature in its three research areas: SERSs, MPAs and community wellbeing, also introducing the conceptual framework that shapes this research. Chapter 3 further details the case study and the nature of coastal and marine resource governance in the context of the RLBR. Chapter 4 delineates the research methodology and data collection methods used to obtain information and conduct the study. Chapter 5 presents the data to answer research objective 1, analyzing the various drivers and instigators of social-ecological change in the RLBR. Chapter 6 evaluates research objective 2 and local perceptions on the changes analyzed in the previous chapter, their relation to the reserve and the state of the community's wellbeing. Chapter 7 relays the findings for the final research objective and the potential for community involvement in the reserve's management in order to add resilience against environmental and social change and improve overall community wellbeing. Finally, Chapter 8 concludes the thesis by highlighting its key points and presents propositions for any future potential research in the realm of SERSs and MPA governance.

CHAPTER TWO: LITERATURE REVIEW

The following chapter relays an assessment of the pertinent narratives, accounts and histories of the three key research areas of this study with respect to the research objectives, namely: social-ecological regime shifts (SERSs), marine protected areas (MPAs) and community wellbeing. The conceptual framework for the research is also introduced.

2.1 Social-Ecological Regime Shifts

Social-ecological systems (SESs) are intricately multifaceted, composed of "a resource system (e.g., a coastal fishery), resource units (lobsters), users (fishers), and governance systems (organizations and rules that govern fishing on that coast) are relatively separable but interact to produce outcomes at the SES level" (Ostrom, 2009). The application of the SES framework (Figure 2.1) to the management of marine common-pool resources, such as those used by community members of Ría Lagartos, provides for a mechanism to better understand any changes impacting these networks. Such phenomena can be construed as SERSs. SERSs are a result of external shocks, or drivers, which may be naturally (i.e. floods, hurricanes, earthquakes) or anthropogenically (i.e. harvest and resource consumption, adoption of new technology) induced, pushing the system towards a critical threshold (Figure 2.2) after which the regime enters a new state that is often irreversible (Crépin et al., 2012). They can be defined by their spatial scale (i.e. local, regional or national – Río Lagartos, state of Yucatán, Mexico as a whole), types of drivers (i.e. natural or anthropogenic) and potential for human response (deYoung et al., 2008). If left unchecked, such shifts can pose significant problems in the management of resources, as will be explored in Chapter 5 in the analysis of SERSs in Ría Lagartos. Coastal communities dependent on marine common-pool resources in particular are often "exposed to some of the greatest risks of environmental and climate change" (Steenbergen et al., 2017). SERSs are contextualized by six dimensions, as identified by Nayak and Armitage, 2018, including: different drivers of change, shifting degrees of impact and subsequent intervention mechanisms, equity and social justice considerations, influence of power imbalances on resource use, social and ecological units of analysis, and the use of governance frameworks to mitigate against change. The six-dimension framework is relevant for communities such as those of Ría Lagartos due to its ability to thoroughly analyze and conceptualize social and ecological change.

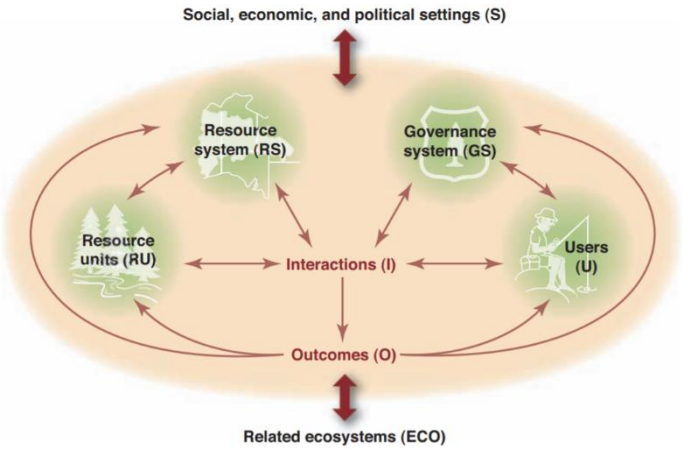

Figure 2.1: The core subsystems in a framework for analyzing social-ecological systems (Ostorm, 2009)

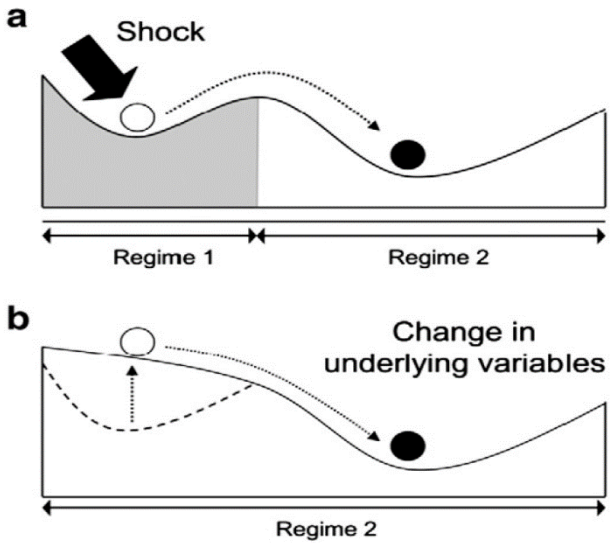

Figure 2.2: Dynamics of a regime shift (Crepin et al., 2012)

2.1.1 Differentiating Drivers of Regime Shifts

Marine SESs can be impacted by varying drivers occurring in a multilevel scale context. Drivers often work and interact to reduce ecosystem resilience and disrupt social wellbeing, resulting in regime shifts (Möllmann et al., 2015). They may be biophysically derived (i.e. climate and biodiversity loss), or rooted in economic and political facets (Nayak and Berkes, 2014). Resultant regime shifts may be negative or positive in nature (Nayak, 2014), contingent on the initial drivers and how they interact. For instance, some community members of Ría Lagartos identified increased income from tourism as a positive livelihood change, while others stated that the decreased income from the waning fishery stock was a negative livelihood change. Thus, it is

important to understand the sources and directionality of drivers (Biggs et al., 2009), as they can approximate the threshold at which SESs can become irreversible. They can have multiple drivers and consequences that transpire often in a non-random order (Rocha et al., 2015). Drivers also occur at various temporal and spatial scales (Möllmann et al., 2015), sometimes making their predictability difficult. Rocha et al.'s study on 13 different types of marine regime shifts resulted in a prioritization ratio of drivers for management purposes and emphasized "the need for coordinated actions across multiple drivers and scales to reduce the risk of marine regime shifts." Understanding the nature of SERSs drivers, the social and ecological sources from which they are derived, and the direction in which they will proceed, has significant policy implications for management and governance frameworks of marine common-pool resources to mitigate against ensuing impacts on ecological health and community wellbeing. Appropriate policy tools specifically established to address drivers of SERSs can work to effectively reduce the magnitude and/or frequency of impacts on marine commons.

2.1.2 Levels and Scales of Intervention

The application of the SES framework to the management of marine common-pool resources also highlights the necessity to account for the various scales and levels that SERSs can take place. Scale can transcend disciplinary boundaries and is defined by spatial and temporal dimensions (Cumming et al., 2006). As a result, SESs can have links across temporal and spatial scales, and the organization structure of institutions and policy decisions made in one location have the potential to impact individuals elsewhere (Folke, 2007). Due to this wide variation, anticipating the probability of the SERS occurring can sometimes be a challenge (Biggs et al., 2009). SERS are an area of increasing concern as human impacts are escalating the likelihood of their occurrence at local to global scales (Biggs et al., 2009). Understanding of regime shifts, their associated drivers and impacts, often occurs at the larger scale of the overarching system (i.e. at the ecosystem or climatic system scale), with implications for long-term analysis (Mayer et al., 2006). Analyzing the occurrence of regime shifts at the SES scale and giving due consideration to their temporal and spatial variations can have significant policy implications for means of intervention in marine commons.

In the case of Ría Lagartos, many citizens determined that lower fishing income and declining catches were factors that were impacted first, highlighting key areas for policy interest. Depending on the drivers of change and their associated levels of impact, policy interventions can occur at the national, regional or local levels, and at varying scales of sub-systems. For instance, a driver can be considered local if "mitigated substantially by changes made at the landscape or municipality level" (Rocha et al., 2015). Consequently, if policy changes at the watershed or regional level can mitigate against a driver, it is classified as regional or national; and if policy actions to avert drivers necessitate global coordination, it is analyzed at an international scale (Rocha et al., 2015). It is contested that human actions shaping the biosphere at local and global scales in a SES context have propagated and cascaded across countries and regions (Conversi et al., 2015).

Möllmann et al. (2015) further argue that the success of management interventions is reliant on routine monitoring of system dynamics at a "temporal and spatial scale relevant to the ecological threshold, and with local- and regional-scale management rather than decision-making at larger spatial scales." Interventions must also consider the speed and intensity at which impacts can occur and the threshold that the SES must overcome before it is vulnerable, and changes become irreversible. Appropriate management interventions become especially important in this context where social and/or ecological factors interact with one another at differing spatial or temporal scales, resulting in marine ecosystem tipping points (Selkoe et al., 2015). Cumming et al. (2006) argue that in this intricate nexus, the problems encountered by societies in natural resources use arise due to the mismatch between scales of management and scales of the ecological processes being managed. Scale mismatches may be temporal, spatial and functional in nature, and caused by the dynamics of social-ecological interaction. Problems in scale alignment can lead to significant problems and disruptions in the function of the social institutions responsible for management, and/or the ecological processes being managed, leading to degradation of the SES (Cumming et al., 2006). This has significant policy implications, as Selkoe et al. (2015) contest that "identifying how and at what level activities and actions lead to ecosystem tipping points has high relevance to choosing effective management targets or limits." Significant changes in ecosystem processes can alter the scale at which management and policy solutions may be required (Cumming et al., 2006). To deduce the levels and/or scales at which interventions are warranted, a thorough understanding of SERSs occurring in a marine context and their associated temporal and spatial settings at the sublevel is required.

2.1.3 Social-Ecological Units

A key component in Ostorm's (2009) framework (Figure 2.1) is the resource unit (e.g. trees, shrubs, plants, types of wildlife, and amount and flow of water) that interacts with the users, resource and governance systems to comprise the overarching SES. Regime shift literature often focuses on the study of a singular resource unit (Biggs et al., 2009), overlooking the complex, multifaceted, uncertain and fluid nature of human and ecological interactions occurring within SESs that are often fundamental to ecosystem health and community wellbeing. Resource units interact with users, social and governance institutions to form a broader social-ecological unit of analysis. Both social and ecological systems contain units interacting interdependently, and also containing interactive subsystems (Anderies et al., 2004). They "inhabit and interact with a broader resource system that is characterized by particular ecosystem types and biophysical processes, also at one or more geographic scales" (Leslie et al., 2015). Human interactions with resource systems are often mediated through these interdependent relationships with biophysical and non-human biological units (Anderies et al., 2004). A SES lens highlights the complexities of sub-systems at varying temporal and spatial scales (Möllmann et al., 2015) in the context of the environments in which they are embedded. For instance, a study concerning biodiversity in cultural landscapes found that the application of an SES approach was able to provide better input for the development of effective strategies for conservation (Hanspach et al., 2016). This type of analytical approach can help to anticipate, navigate and possibly mitigate against the occurrence of SERS in marine commons, and inform policy and the development of indicators to define boundaries for social-ecological units, adherent to Ostorm's (2009) design principle of clearly defined boundaries.

2.1.4 Equity and Social Justice Concerns

Equity and social justice considerations associated with marine commons can help to better anticipate and plan for SERSs. The occurrence of threshold changes leading to regime shifts has disproportionate impacts on social groups depending on how they interact with the various components of the SES. As will be explored in Chapter 5, some members of the Ría Lagartos community felt that the impacts from the declining fishery were inequitably endured by certain actors over others, while tourism provides disproportionate benefits. Selkoe et al. (2015) contest that "sudden and/or large shifts in ecosystem services associated with ecological tipping points

highlight and possibly exacerbate potentially inequitable distribution of costs and benefits among stakeholders and sectors." Equity can be construed in either a distributive framework, concerning the distribution of benefits and costs; a procedural framework, concerning decision-making with regards to marine resource use; and a contextual framework, concerning pre-existing conditions that limit or facilitate user access to decision-making procedures, resources and benefits (McDermott et al., 2013). In often cases, "environmental problems bear down disproportionately upon the poor," (Agyeman et al., 2002) leading to further exacerbation of the impacts brought on by SERSs. It is frequently those who are the least politically powerful and most marginalized individuals of society who are at the most risk and victimized to the greatest degree by environmental and social changes. For instance, a study on the distribution of ecological impacts from human activities found that increasing consumption of a fishery by middle-income and rich nations indirectly led to fishing damages suffered by poor nations (Srinivasan et al., 2008). Engagement of user groups to facilitate discussion of equity and the costs and benefits across stakeholders under potential tipping point circumstances can help to inform the decision-making process about managerial options to mitigate impacts (Selkoe et al., 2015). Groups with the largest proportion of benefits will most likely have a louder voice compared to marginalized groups, which can be seen in the case study of this research as many stated that the fishing cooperatives, identified as one of the responsible parties for the changes occurring, were also the most powerful and a key governance actor. Management that recognizes this disparity will work to avoid inequitable outcomes. Recognition and incorporation of equity and social justice aspects as both drivers and impacts (i.e. who benefits and who loses) within the context of SESs can lead to the development of novel and effective mechanisms to combat against SERSs that may further aggravate such concerns.

2.1.5 Power and Politics

The dynamics of power and politics when applied to marine common-pool resource management have significant implications for effective and sustainable governance frameworks. Research suggests that there is has been limited attention given to the role that social inequities, power imbalances, and social and environmental injustices has in the study of SERSs, particularly in a fisheries and coastal management context (Nayak et al., 2016). As SERSs may sometimes be a result of varying power disparities caused through interactions between the positions of social

actors and institutions in society, the neglect of power and politics hinders the prediction, navigation and potential aversion of rapid social and environmental changes. Social inequities, power imbalances and injustices themselves may be considered drivers of SERSs (Nayak et al., 2016). Uncertainty in relation to the distribution of costs and benefits between varying groups of people in society can work to complicate management systems regarding regime shifts (Crépin et al., 2012).

In addition, understanding the role that power plays in the governance and management of resources is significant to planning for rapid change. Power may be defined from: an emic perspective (inside-in, understanding power from within individuals/groups that rely on a specific resource governance context); etic perspective (outside-in, understanding power from perspective of broader social theory through ideas, observations and research questions; considering the role of externalities such as political, economic, social and ecological factors); or a generative perspective (inside-out, using lessons on power drawn from case study analysis that attribute to social theories), to conceptualize its impact on common-pool resource use (Nayak et al., 2016). It may also be construed through an agent-centered perspective, in which it is used as a coercion/constraint by an individual/group to manipulate others' behaviour or as a tool for excludability; or structural approach, where power is sourced from structural forces through the institutions (norms, rules, customs, practices, traditions, etc, that enforce conformity) and positions that people or groups hold in society (Nayak et al., 2016). Such is the case in Ría Lagartos, where majority believe that one's power is based on his or her type of income.

Finally, power can also be viewed through the prism of a "power cube" which delineates visible (actors explicitly hold power), hidden (power determined by a concealed agenda to achieve objectives, thereby excluding and determining certain members) and invisible (power is socially and culturally derived through norms, values, worldviews, knowledge, perspectives and belief systems) views of power (Nayak et al., 2016). The interplay of power dynamics can work to exacerbate inequities in distributions of costs and benefits caused by SERSs, thereby influencing the degree to which specific members and institutions in society have vulnerability to social and environmental changes. Nayak et al. (2016) contest that due consideration must be given to who benefits and who loses in a SES when regime shifts occur, illustrated through a case study in which power imbalances caused by caste and political party affiliations aggravated social changes in

India's Chilika Lagoon. This is also supported by Cumming et al.'s (2006) argument that certain individuals in society, particularly those that fulfill organization roles, have the ability to influence ecosystem patterns and processes. Depending where the power and decision-making is held in an SES, certain relations between social actors may work to push the system towards an advantageous regime shift, often inducing negative consequences at the expense of and disempowering the most marginalized individuals and groups in society. Consideration for these aspects can contribute to the development of effective governance approaches that combat against unfair and inequitable manipulation of power and avert SERSs in marine commons.

2.1.6 Governance to Navigate Regime Shifts

Different strategies of environmental governance can provide novel tools for coupled marine SESs to recover from environmental and social degradation. Environmental governance is defined as "the set of regulatory processes, mechanisms and organizations through which political actors influence environmental actions and outcomes" (Lemos and Agrawal, 2008). It has been found that conventional forms of governance have resulted in "a fundamental mismatch between institutional prescriptions and environmental problems" (Epstein et al., 2015). Emerging forms of environmental governance are defined by the relationships between state, market and community actors, and can take the form of different mechanisms embedded in each nexus, including, public-private and private-social partnerships (Figure 2.3). These frameworks involve interaction between at least two social arenas of SESs, exemplifying the "…dynamic and fast-changing nature of contemporary environmental governance. The emergence of these hybrid forms of environmental governance is based upon the recognition that no single agent possesses the capabilities to address the multiple facets, interdependencies, and scales of environmental problems" (Lemos and Agrawal, 2008). Thus, the building of trust between various governance actors is essential. When asked what they believed to be the level of trust amongst governance actors, community members of Ría Lagartos stated that there was "moderate" trust, while subsequently being equally divided between "high" and "no trust."

Governance arrangements can influence social and ecological processes in SESs and may impact the emergence and outcome of SERSs. Due to the interconnected nature of social institutions across regional, national and global levels, effective environmental governance frameworks

necessitate the cooperation of various actors. This is especially true when considering the degree of uncertainty and change involved with SERSs and the multi-level governance mechanisms involving a diversity of social actors and networks designed to combat them (Ostrom, 2010). Multilayered governance can provide novel approaches to moderate interplay amongst institutions. It has been argued that they improve the alignment between knowledge and action in a SES context and enable societies to counter more adaptively to environmental and social change (Lebel et al., 2006). They rely on the collaboration of stakeholders that operate at diverse levels through social networks (Folke et al., 2005). Co-management in particular highlights the significance of learning and collaboration necessary to improve understanding of SESs.

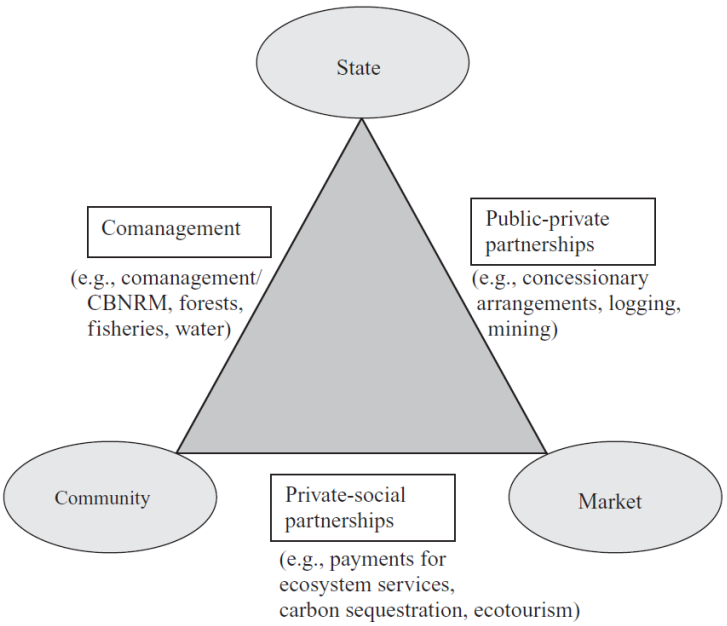

Figure 2.3: Mechanisms and strategies of environmental governance (Lemos and Agrawal, 2008)

Furthermore, in order to overcome wellbeing challenges associated with SERSs, governance interventions must strive to be linked to social justice, sustainable livelihoods and ecosystem health (Jentoft and Chuenpagdee, 2018). Failure to do so may result in a mismatch between impacts of SERSs and the policy and governance tools designed to combat them. Jentoft and Chuenpagdee, 2018, use case studies of SSFs in marine commons as examples of governance interventions contributing to community wellbeing. They argue that without the link between governance and wellbeing, challenges and concerns associated with marine commons such as SSFs will not be sufficiently addressed. It is therefore crucial that governance frameworks become more adaptive

to better navigate SERS. Such frameworks can enhance the ability of a SES to cope with uncertainty (Adger et al., 2005). However, multi-level or joint governance frameworks are not without their disadvantages, requiring more time to make decisions and potentially aggravating political, economic or livelihood conflict if not appropriately facilitated. As such the application of any governance framework to combat against environmental and social change must be thoroughly analyzed before implementation. The following section of the literature review examines MPAs as a governance tool to manage the abovementioned SERSs.

2.2 Marine Protected Areas

Marine protected areas (MPAs) like the RLBR have long been known as a robust and effective management tool in the conservation of natural resources, biological diversity, and historical and cultural facets of the landscape. The International Union for Conservation of Nature (IUCN) defines an MPA as an "any area of intertidal or sub-tidal 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" (Wells et al., 2016). Historically, MPAs were established by Indigenous peoples, and eventually for traditional and cultural purposes focused on food security reservations. Following the Second World War, attention shifted towards an increased awareness of threats to the ocean, with the IUCN leading a "science-based critical marine habitats approach," using the MPA concept as a tool to conserve vital species, ecosystems and habitat (Wells et al., 2016). Today, the implementation of an MPA strives to diminish the risk of degradation to marine and coastal ecosystems by reducing pressure on fisheries and other related marine activities, ensuring the protection and conservation of biological diversity. The ecological conservation benefits of MPAs are well known and studied, including: the maintenance of biodiversity and provision of refuge for endangered and commercial species, protection of critical habitat from destructive fishing practices such as bottom trawling, establishment of recovery zones for species to reproduce and recover, increase of fish catch due to spillover effects, and the building of resilience against external impacts such as climate change (Bennett and Dearden, 2014; Christie et al., 2017; Gallacher et al., 2016; Loury et al., 2017; Roberts et al., 2018). MPAs have been considered useful in the implementation of the ecosystem approach and the precautionary principle, as "their design involves managing pressures from human uses by adopting a degree of protection, which can range from strict protection, where all

use activities are barred, to less stringent measures like sanctioning areas where multiple uses are allowed and regulated" (Fraga and Jesus, 2008). At the Seventh Meeting of the Conference of Parties to the CBD, it was agreed that "marine and coastal protected areas, implemented as part of a wider marine and coastal management framework, are one of the essential tools for the conservation and sustainable use of marine and coastal biodiversity" (Fraga and Jesus, 2008). Their implementation is construed as vital in the achievement of the CBD's Aichi Biodiversity Target 11 for 2020 of "at least 17% of terrestrial and inland water, and 10% of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas" (Jones et al., 2013; Nikitine et al., 2018; Rees et al., 2018; Roberts et al., 2018). They are also an important instrument in the achievement of sustainable development goal (SDG) 14, which strives to "conserve and sustainably use the oceans, seas and marine resources for sustainable development" (UN Department of Economic and Social Affairs, 2017).

2.2.1 Critiques of MPAs

While there is extensive literature evaluating the biological and ecological implications of MPAs, a research gap examining the influence of MPAs on community and societal wellbeing remains to be thoroughly addressed. Loury et al., 2017, have found that biophysical indicators are frequently given greater seniority in MPA management, as compared to socio-economic or governance ones. Often times, the "social-ecological fit" (Alexander et al., 2017) of MPAs is misaligned, neglecting the complex nexus that involves a multitude of actors and policy sectors and causing institutional and social fragmentation, thereby hindering its successful governance. "Social-ecological fit" is defined by Alexander et al., 2017, as cohesion between socio-economic, governance and biophysical systems. Improving fit necessitates a shift in attention beyond considering only ecological processes in the governance of MPAs to a more integrative perception. An ineffectively managed MPA, with an exclusive focus on biophysical indicators while neglecting to consider "a community's perceived benefits, impacts and general satisfaction with a protected area" can be construed simultaneously as a "biological success" and a "social failure" (Loury et al., 2017). Such an MPA is often, "devoid of broad participation in management, sharing of economic benefits, and conflict-resolution mechanisms" (Fraga and Jesus, 2008). Often times local stakeholders are not consulted in the initial stages of MPA development, if at all (Bennett and Dearden, 2014).

Management recurrently fails to recognize the unique social, economic, ecological, cultural and political context of the region in which the MPA is implemented. Lack of considering community engagement and socio-economic characteristics are two themes routinely cited with MPA failure and incompliance (Gall and Rodwell, 2016), sometimes given greater weight by influencing success cases. As will be explored in later chapters, failure to inform and engage some local communities in Ría Lagartos has led to increased instances of incompliance with respect to the reserve's regulations.

There is a clear need to understand the connections between the conservation goals and the perspectives of local stakeholders on the current and projected implications of the MPA in relation to their community's wellbeing, as social problems can spill over to induce ecological problems. A social-ecological lens is critical in deriving effective solutions to the mismanagement of some MPAs worldwide. In its application, "the social-ecological systems approach emphasizes that people, communities, economies, societies, cultures are embedded parts of the biosphere and shape it, from local to global scales" (Folke et al., 2016). As the ineffectiveness of many MPAs is ultimately rooted in social causes, attention to this area is critical to create a more robust overall response to mismanagement. Broadly speaking, "the dynamics of human behaviour in response to ecological changes can be crucial in determining the overall dynamics of the system" (Lade et al., 2013). This is especially important during the current time as the Anthropocene has resulted in highly complex and intricate social-ecological issues with cross-scale (both spatial and temporal) causes. It is evident that, "the scale, speed, spread, and connectivity of human actions in the Anthropocene generate new dynamics that connect previously unconnected domains" (Folke et al., 2016). Social and ecological dimensions are therefore intrinsically linked in human-environment systems and should not be studied in isolation or diverged when developing solutions to problems such as MPA ineffectiveness.

2.2.2 Overview of Governance

As explored earlier in this chapter, environmental governance tends to follow either a top-down, bottom-up or market-based approach (Jones et al., 2013). MPAs can be classified into six different governance categories ranging in stringency of anthropogenic influence and based on the objectives under which the area was designated (Wells et al., 2016). These vary from MPAs principally designed for biodiversity conservation (i.e. no-take zones) to those promoting

extractive, recreational and commercial activity (Roberts et al., 2018). Governments around the world apply the IUCN categories to their MPAs, providing a globally recognized standard to compare MPA governance across jurisdictions (Roberts et al., 2018). The governance of MPAs has evolved to include "secondary objectives to the primary one of biodiversity conservation, and it has always been recognized that they can play a key role in sustainable development…given the dependence of many local communities and national economies on the marine environment" (Wells et al., 2016). The RLBR is classified as a Category VI Protected Area, allowing for sustainable use of natural resources. The respective protected area categories and their associated objectives as defined by the IUCN (2019) are as follows:

Table 2.1: IUCN Protected Area Categories

Category	**Title**	**Objectives**
IA	Strict Nature Reserve	Conserve outstanding ecosystems, species and/or geodiversity features: these attributes will have been formed mostly or entirely by non-human forces and will be degraded or destroyed when subjected to all but very light human impact.
IB	Wilderness Area	Protect long-term ecological integrity of natural areas that are undisturbed by significant human activity, free of modern infrastructure and where natural forces and processes predominate, so current and future generations have the opportunity to experience such areas.
II	National Park	Protect natural biodiversity along with and supporting environmental processes and promote environmentally and culturally compatible, spiritual, scientific, educational, recreational, and visitor opportunities.
III	Natural Monument or Feature	Protect specific outstanding natural features (i.e. landform, sea mount, submarine cavern, geological feature such as a cave or even a living feature such as an ancient grove) and their associated biodiversity and habitats.
IV	Habitat/Species Management Area	Maintain, conserve and restore specific species and habitats.
V	Protected Landscape/Seascape	Protect and sustain important landscapes/seascapes and the associated nature conservation and other values created by interactions with humans through traditional management practices.
VI	Protected Area with Sustainable Use of Natural Resources	Protect natural ecosystems and use natural resources sustainably, when conservation and sustainable use can be mutually beneficial.

Socio-economic objectives, including the maintenance of public support and prevention of local income loss are sometimes included in MPA policy planning (Roberts et al., 2018), with many studies finding that benefitting local development outcomes are an important pre-cursor of local support for MPAs (Bennett and Dearden, 2014). Amalgamating biophysical and socio-economic objectives, governance frameworks, adapted to local conditions, can work to provide a supportive policy environment for the effective management of MPAs, enabling the achievement of said objectives (Bennet and Dearden, 2014). Based on the degree of coherence and cooperation across actor levels, governance institutions can serve as drivers, restrictors or supporters of both effective MPA management and local development. Quality of horizontal and vertical interaction between various government levels, communities, and private, non-governmental and scientific-based institutions is a key determinant of project success (Bennet and Dearden, 2014). In addition, policies that facilitate meaningful participation of citizen actions in MPA design and implementation and incorporate local management are found to be the most successful. Without harmonization between institutions, MPA governance outcomes may be conflictive or counterproductive.

2.2.3 Community-Based Management

Community-based management is a "bottom-up" approach that involves empowerment of the local community to manage their resources. Its implementation requires a degree of devolution of decision-making power and authority to communities. It strives to encourage better resource management outcomes with the full participation of communities and resource users in decision-making activities, incorporation of local institutions, customary practices, and knowledge systems in management, regulatory and enforcement processes (Fabricius and Collins, 2007). When applied to MPAs, governance in a community-based framework is characterized by local peoples, which take the lead on the conservation and sustainable use of marine commons and combat against SERSs. In this model, "community organisations (e.g. local fishing cooperatives) are often granted a significant level of autonomy to collectively decide the rules governing MPA management" (Jones et al., 2013). The 1990s saw a rise in marine conservation areas that were community managed (Wells et al., 2016), finding that community participation is an important factor for the successful implementation of an MPA (Loury et al., 2017; Mangubhai et al., 2015). A co-management approach, one in which "responsibility for the protected area is shared between

local communities and government officials" (Loury et al., 2017) was found to be vital, focusing on the "essential role of local communities and stakeholders in planning and management" (Wells et al., 2016). As community institutions may not have sufficient technical capacity to effectively manage resources, co-management in an MPA context is considered to be "the most effective and acceptable management approach" (Bennett and Dearden, 2014). Government agencies work in partnership with communities and facilitate community participation by providing the necessary finances, monitoring, law enforcement and technical expertise to ensure that the MPAs meet their management objectives.

Members of the Ría Lagartos community agreed that reserve management solely run by locals would be ineffective as they lacked the appropriate education and technical training, and instead advocated for a scenario wherein government worked alongside the community. Jones et al., 2013, advocates this approach, stating that "external organisations, such as government departments and conservation NGOs, may have an important role in enabling and reinforcing such community initiatives, and ensuring that community efforts are consistent with existing legal and policy objectives at a national or supranational level." Studies have shown that the most positive examples of livelihood-sensitive conservation through MPAs comes from communities that are at the forefront of demanding and setting up of sustainable-use marine reserves. Instances where local and indigenous communities were heavily involved in the management of MPAs have been found to be some of the most robust in meeting sustainable development goals, including a New Zealand example which "compared the efficiency of national parks, co-managed reserves and traditional managed areas in conserving reef resources." The study concluded that "traditional management, characterized by reef closures instigated and maintained by the community, provides more efficient protection (i.e., higher fish average size and biomass) because rules reflect local understandings of human-environment interactions and provide real material benefits" (López-Angarita et al., 2014).

Likewise, the incorporation of stakeholder traditional knowledge into the design of a Colombian MPA had led to the reserve to be dubbed a "providential conservation outcome because enclosed reefs are some of the healthiest in the Caribbean and local community is highly involved in management" (López-Angarita et al., 2014). This study reinforced that traditional knowledge types and management techniques, including gear restrictions, fishing seasons, local norms, rules of use

and resource patterns should be included in MPA planning. Finally, an analysis of the San Felipe Marine Reserve, Yucatán, México found that community perspectives towards MPAs are vital information which "if incorporated in the design of the marine reserve, can enhance the chance of successful policy implementation. The starting point of this process involves a discussion with the community, experts, managers, and policy makers to find some agreement or consensus about the importance of the resources and how they should be managed" (Chuenpagdee et al., 2002). This would also work to alleviate poverty through the provision of alternative livelihoods in conservation and management.

Local stakeholder participation, consultation and engagement are important themes emerging in MPA literature and should be done at all stages in MPA design, development, execution and management (Bennett and Dearden, 2014). This ensures the confidence and empowerment of local peoples in the management of their own resources and lasting results. Because of their proximity, locals and indigenous peoples are often at the forefront of marine resource use. They are more cognizant of the ecological processes responsible for enabling marine resources, and as a result, often have better knowledge of how to more effectively manage said resources. This is often referred to as "traditional ecological knowledge" (López-Angarita et al., 2014). By incorporating multiple knowledge types through local stakeholder engagement in MPA design, management and evaluation, this structure could work to build the deteriorated trust and rebuild strained relationships between locals and government bodies, potentially leading to enhanced compliance and improved conservation outcomes.

Associated with the above theme of coupled local involvement and social-ecological systems, the last section of the literature review assesses community-wellbeing in relation to SSFs (such as those found in Ría Lagartos) and MPA governance.

2.3 Community Wellbeing

The concept of wellbeing is defined as a "state of being with others and the natural environment that arises where human needs are met, where individuals and groups can act meaningfully to pursue their goals, and where they are satisfied with their way of life" (McGregor, 2008).

Wellbeing literature identifies three perspectives that may be applied, namely:

1. Material wellbeing – focusing on the resource units in an SES (Ostrom, 2009) that an individual possesses and the degree to which individual needs are being met (i.e. income, infrastructure, assets, and natural resources);
2. Relational wellbeing – focusing on the social relationships an individual is engaged in during the pursuit of wellbeing (i.e. relationships that provide an avenue to resource units, markets and access to public goods, or influence individual behavior through institutions, family and social structures); and
3. Subjective wellbeing – focusing on individual satisfaction with the quality of life that one has achieved (i.e. happiness, cultural values, self-identity, ambitions).

When applied more broadly at a community scale, wellbeing can be construed as "the combination of social, economic, environmental, cultural, and political conditions identified by individuals and their communities as essential for them to flourish and fulfill their potential" (Wiseman and Brasher, 2008); or "the satisfaction with the local place of residence taking into account the attachment to it, the social and physical environment, and the services and facilities" (Forjaz et al., 2011). Community wellbeing involves a spectrum of economic, social, environmental, cultural and governance goals that are determined as being of the most significant for a specific community, population or society (Cox et al., 2010). Community wellbeing has roots in ancient Grecian literature, with Aristotle arguing that individual capacity to attain potential wellbeing is entrenched in social and collective relationships. Therefore the "wellbeing of communities is…an essential precondition for the wellbeing of individuals" (Wiseman and Brasher, 2008). This is supported in more recent studies, with the Organization for Economic Cooperation and Development (OECD) stating in a 2016 report that, "people's happiness depends to a large extent on the circumstances of the broader community they are part of and their relationship to it'' ("Society at a Glance", 2016). The epitome of wellbeing in a community is one in which "the needs, values, and norms of different community segments" (McCrea, Walton, and Leonard, 2014) are met. A promotion of community wellbeing can therefore play a significant role in advancing individual mental and emotional wellbeing.

2.3.1 Wellbeing and SSF Communities

A wellbeing lens applied to the context of SSF communities concerns certain outcomes beneficial to the livelihood of fishers, the primary breadwinners of the community, including: material goals like economic yield, food source and employment; and non-material goals such as work safety, equitable working conditions; or the preservation of ecological values in their marine and coastal environments (Allison et al., 2012; Coulthard et al., 2011). Wellbeing constituents as identified by the fishers and other community members of Ría Lagartos are explored in Chapter 6. The application of a wellbeing lens, encompassing all three dimensions, enables a better understanding of the multifaceted reality that many SSF communities live in and better relation to the social-ecological system perspective. It provides analysis of the conflicts and trade-offs that fishers face and can contribute to governance approaches by providing the basis of fishery management measures. Previous fisheries literature placed a large emphasis on a narrow single-objective view-

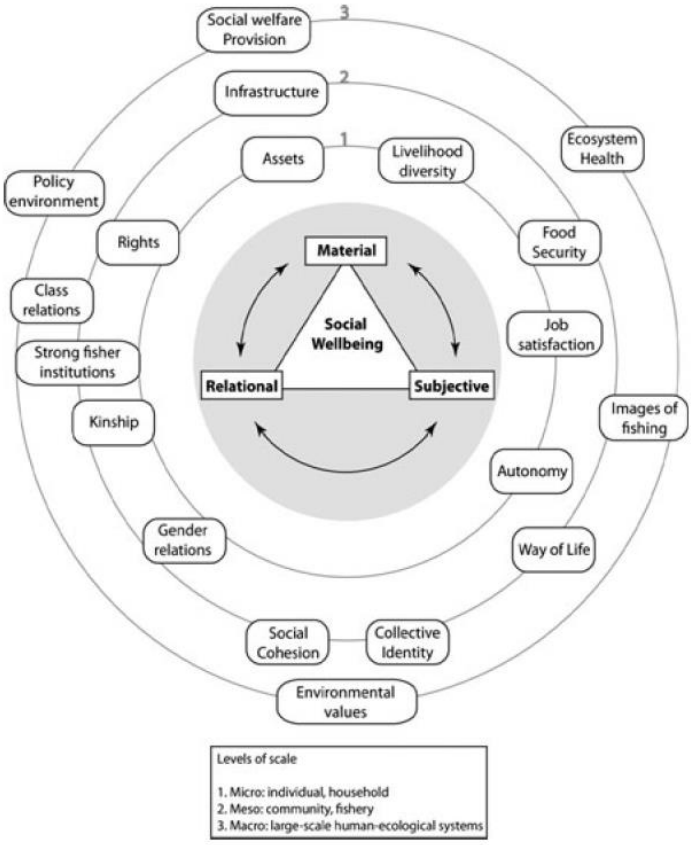

Figure 2.4: Facets of social wellbeing in SSFs (Weeratung et al., 2014)

-point of wellbeing, portrayed as follows: "…proper use of a fish stock requires that resources be utilized to exploit it such that the present value of future net returns is maximized…such that the stream of net incomes that it earns, properly discounted, is a maximum" (Anderson, 1987). This restricted perspective confines individual and community wellbeing in a fisheries context to solely monetary constituents, without giving regard to the intangible relational and subjective components. Analysis of fisher behaviour and decision-making reveals that individual choices made are often complex, and involve economic, social and ecological considerations, for instance where, when and what species to harvest, and concern factors such as reputation, social status and external peer pressure influencing behaviour (Weeratunge et al., 2014). As fisheries are multi-scaled and concern a multitude of objectives, all three dimensions (material, relational and subjective) should therefore be equally considered in governance decision-making. Consideration of the triangulated view of community wellbeing can work to bridge the gap between a community's socio-economic development and ecological integrity. Figure 2.4 depicts different wellbeing facets typical of an SSF community, differentiated in their respective categories.

As aforementioned, material wellbeing is concerned with the resources a community has and the degree to which they meet the community's needs. Relational wellbeing can be argued as being rooted in how rich a community's social capital is, which allows individuals to steer themselves within their community's social hierarchy and enter social networks. Social capital is defined as, "features of social organizations, such as networks, norms and trust that facilitate action and cooperation for mutual benefit" (Weeratunge et al., 2014). Having a diversity of social relationships for "dependency, obligation, support, reciprocity…and collective action in fishing communities can determine both a persons' wellbeing outcomes and fisher behaviour" (Coulthard, 2012). One's "capacity for meaningful action, and what satisfies us, are ultimately influenced by our relationships with others" (Armitage et al., 2012). This is aligned with the emergence of co-management governance schemes (as described earlier in this literature review) in coastal communities, which recognize the relational dimension of wellbeing through the institutionalization of the governance interactions amongst individual fishers and also between fishers and government (Allison et al., 2012). Community wellbeing can thus provide novel insights for sustainable governance of marine environments.

Finally, the subjective wellbeing dimension relates to the importance that many view of fishing as a "way of life" and job satisfaction of fishers (Allison et al., 2012). A core concept of this dimension of wellbeing is identity, embodied as one's fears, hopes and aspirations (Weeratunge et al., 2014). Many fishers associate their occupation with their identity, taking great pride and high devotion to the fishing way of life. It is argued that "the fishing occupation often conferred not only important markers of self-identity and individual pride among fishers, but a 'satisfaction bonus', which could not be measured on economic grounds alone" (McGoodwin, 2001). Most fishers regard their occupation not only as a means to accrue income, but also an "intrinsically rewarding activity in its own right–as a desirable and meaningful way of spending one's life." It is seen as a means of self-actualization, with strong occupational attachment driven by adventure and challenge. In most coastal communities like Ría Lagartos, fishing is an interwoven component of society, highly influencing cultural, economic and political facets.

2.3.2 Indicators of Community Wellbeing

Wellbeing literature offers a multitude of indicators with which to measure and quantify the state of an individual's and community's wellbeing. Wellbeing indicators, either as an index or suite, are argued as being effective tools for "understanding and shaping policy priorities" (Wiseman and Brasher, 2008). However, in order for them to be effective, the key elements in relation to wellbeing causing life to get better or worse for citizens must be identified. Most community wellbeing studies have been established around facets such as poverty, education, health, participation, business services, government, non-profit organization and environment (Forjaz et al., 2011). Community wellbeing indicators have been developed as frameworks and to serve as tools to inform, engage and integrate community planning and policy making (Wiseman and Brasher, 2008). For the purposes of this research, a combination of resources were consulted (Weeratunge et al., 2014; Maynard et al., 2015; White, 2010; Cox et al., 2010; Morton and Edwards, 2013; Salvaris, 2000; Barrington-Leigh and Escande, 2018; Kroll, 2011; Seaford, 2015; Sirgy et al., 2013; Biedenweg et al., 2016; Breslow et al., 2016; Kim et al., 2015) to derive examples of community wellbeing indicators as noted in Table 2.2. These indicators were chosen to provide an empirical basis of analysis and for their application to communities in an SSF context as ascertained by the literature consulted. They have been developed for use at a multitude of local,

regional and national scales to inform a diversity of theoretical assumptions and perspectives (Cox et al., 2010).

As community priorities vary depending on the culture and society, the literature agrees that therefore a single or universal objective of wellbeing should not be established, but rather a "common framework of concepts and measures which can assist citizens and communities (to) arrive at working agreements about the goals important to them – and the extent to which these goals are being achieved" (Cox et al., 2010). In this context, indicators are viewed as statistical tools that translate community goals into clear and tangible results used for the assessment and communication of progress of community wellbeing.

Table 2.2: Community Wellbeing Indicators and Examples

Wellbeing Dimension	**Indicator Example**
Material	Assets, source of livelihood and diversity, public infrastructure, social welfare provision, clean and healthy environment (i.e. air, water and land), food and water, food security, shelter, natural resources, physical health, lengthened life expectancy, health services, secure and continuous supply of/access to resources and services, business development, security of person and community, public safety, education, literacy rate, library usage, school retention rate, employment rate, job security, per capita income, housing affordability, internet access, sport and recreational opportunities, natural areas and parks, protection from natural hazards
Relational	Rights, kinship, strong fisher institutions, class relations, policy environment, social (community and family) cohesion, community connectedness and organizations/centres, social support and infrastructure, family values, personal relationships, support networks, citizen participation, political affiliation, global markets
Subjective	Food security, job satisfaction, autonomy (social and economic freedom), way of life, self and collective identity, mental health, cultural values and beliefs, ambitions, self-actualization, sense of place

2.3.3 Critiques of Wellbeing Indicators

The development of community wellbeing indicators has been praised across the literature for improving the responsiveness and effectiveness of community-based policy development and planning (Cox et al., 2010). They relay and are a valuable source of cross-cutting and high-quality data in an accessible manner concerning how a society is doing, an important precursor for and supporter of policy and reporting, leading to increased transparency and accountability, and

elevated sustainable development outcomes. They also provide a firm basis and opportunities for fostering local engagement in governance, enabling individuals to participate and identify key environmental, social and economic trends in their community (Salvaris, 2000). They can show how key dimensions of community wellbeing integrate and piece together and which ones need improvement, ensuring that decisions made in local governments are based on accurate evidence concerning community priorities.

Finally, they foster relationships between communities and government to support ongoing research testing effectiveness and usefulness of wellbeing indicator systems. Cox et al. argue that community wellbeing indicators are important as:

1) democratic tools to engage citizens in informing governance decisions;
2) policy tools to guide evidence-based planning and address key issues recognized for their significance by locals; and
3) reporting tools to track and community progress towards wellbeing objectives.

However, the use of wellbeing indicators has also come under great scrutiny in the literature largely due to the context of the politics in which it is embedded, interpreted and implemented. The practical application of wellbeing in policy and politics brings into question its effectiveness, and in some cases, even working against communities by validating the withdrawal of material support in the form of state-sponsored welfare or aid programs (White, 2010). Another critique concerns the "preoccupation of affluence." Focusing on indicators suggests that wellbeing is inappropriate for the poor, who have more pressing matters to tend to. In the most extreme, it can dilute the importance of relation and subjective wellbeing or construe them as a luxury for those trying to meet material needs (White, 2010). Furthermore, it is contended as exaggerating individualism (Angner, 2010), conforming to the dominant philosophies of Western societies, as supported by anthropological and historical evidence (Christopher, 1999). The Western way of life is seen as the epitome of wellbeing, indicating a superior quality of life compared to others, which may not be the case. The responses of non-Western subjects may also be misinterpreted, attributing them to lower quality of life than may be accurate (White, 2010). Finally, wellbeing indicators are criticized for being difficult to precisely quantify and repeat, varying based on the respondent's mood and the country, culture and demography in which the study takes place. This makes results challenging to generalize and apply to other cases (Krueger and Stone, 2014). The use of uni-

dimensional indicators or a "one-size-fits-all" model neglect the complexities of coastal communities (Winterton et al., 2014). This can be seen in Ría Lagartos, where differences were noted in the identification of wellbeing factors amongst communities located in close proximity to one another. It is therefore argued that indicator data should not be relied on a sole source of knowledge and should inform rather than drive policy and governance decisions (Cox et al., 2010). Exclusively relying on an aggregation of wellbeing data can lead to false presumptions (Barrington-Leigh and Escande, 2018), and exclude negative experiences and dimensions. The following section presents the conceptual framework guiding this study, amalgamating all three research areas as analyzed above in relation to the research objectives.

2.4 Conceptual Framework

The application of a conceptual framework is useful in any field of research and is often employed to determine: what will and will not be included in the study; the relationships between research areas based on logic and theory; and giving the researcher a platform wherein to congregate paradigms into "intellectual bins" (Baxter and Jack, 2008). It functions to anchor the study, being further developed, completed and consulted in the data analysis stage, highlighting important connections amongst constructs as they emerge. Referencing it during the analysis ensures that data interpretation has a reasonable scope and structure (Baxter and Jack, 2008).

The conceptual framework used for the purposes of this study is depicted in Figure 2.5, visualizing the research constructs and the connections between them. The template for this framework is

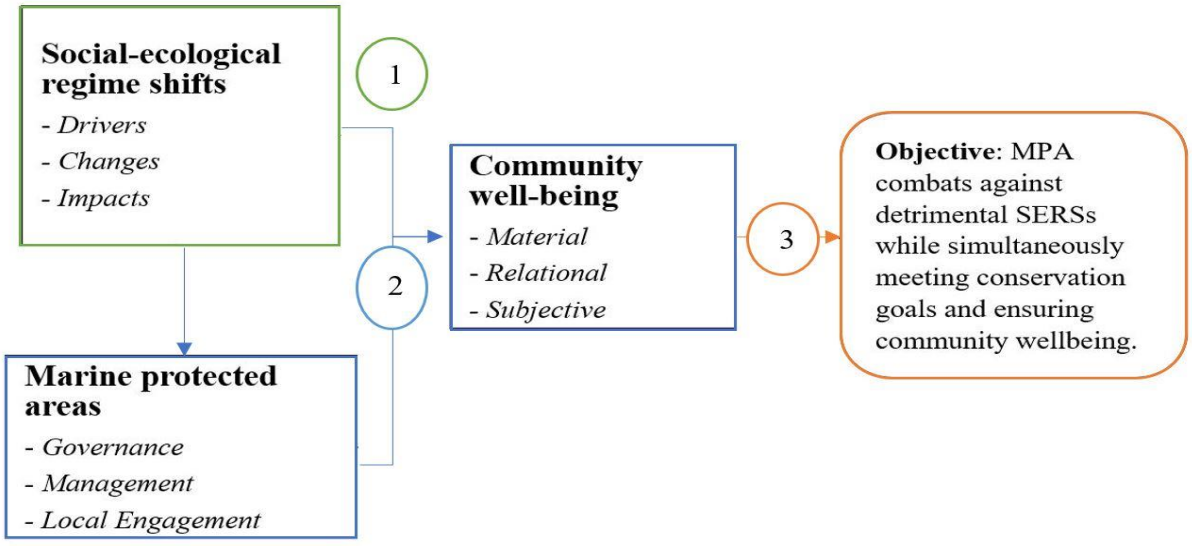

Figure 2.5: The thesis conceptual framework as created by the author for the purposes of the study

based on the work of Pomeroy et al., 2005. The three research objectives are colour-coded in the framework, represented in green, blue and orange, respectively. SERSs, characterized by the factors that drive them, the changes they induce and the impacts they inflict, are denoted in the box in the top-left corner, along with its affiliation to research objective "1" - characterize the nature of environmental and social changes taking place in the Ría Lagartos Biosphere Reserve. Research objective "2" investigates all three research areas – SERSs, the management of MPAs (bottom-left box) and the three dimensions of community wellbeing (central box), as it explores local perceptions of the MPA in relation to community wellbeing and the changes occurring. Finally, research objective "3" serves to determine if the ideal objective of a superlative MPA governance structure, one in which the MPA can combat against change through community involvement, meeting both conservation and wellbeing goals, is possible. The colour-coded arrows correspond with their respective objectives, illustrating the interconnected nature of the research and how all concepts link to one another in the course of the study, from its initiation to end goal. The conceptual framework offers a theoretical perspective on the three research areas of the literature review. The following chapter explores the case study used for this research – the RLBR – in greater detail, including its ecoregions, international designations, communities, setup of the fishing cooperatives, types of fish species harvested, and the MPA governance framework in Mexico as a whole.

CHAPTER THREE: CASE STUDY – THE RÍA LAGARTOS BIOSPHERE RESERVE

The following chapter explores the case study context in this research – the Ría Lagartos Biosphere Reserve (RLBR - Figure 3.1). This expands on the brief overview Section 1.3, and includes more information on its ecoregions, international designations, communities, setup of fishing cooperatives, types of fish species harvested, and the MPA governance framework in Mexico.

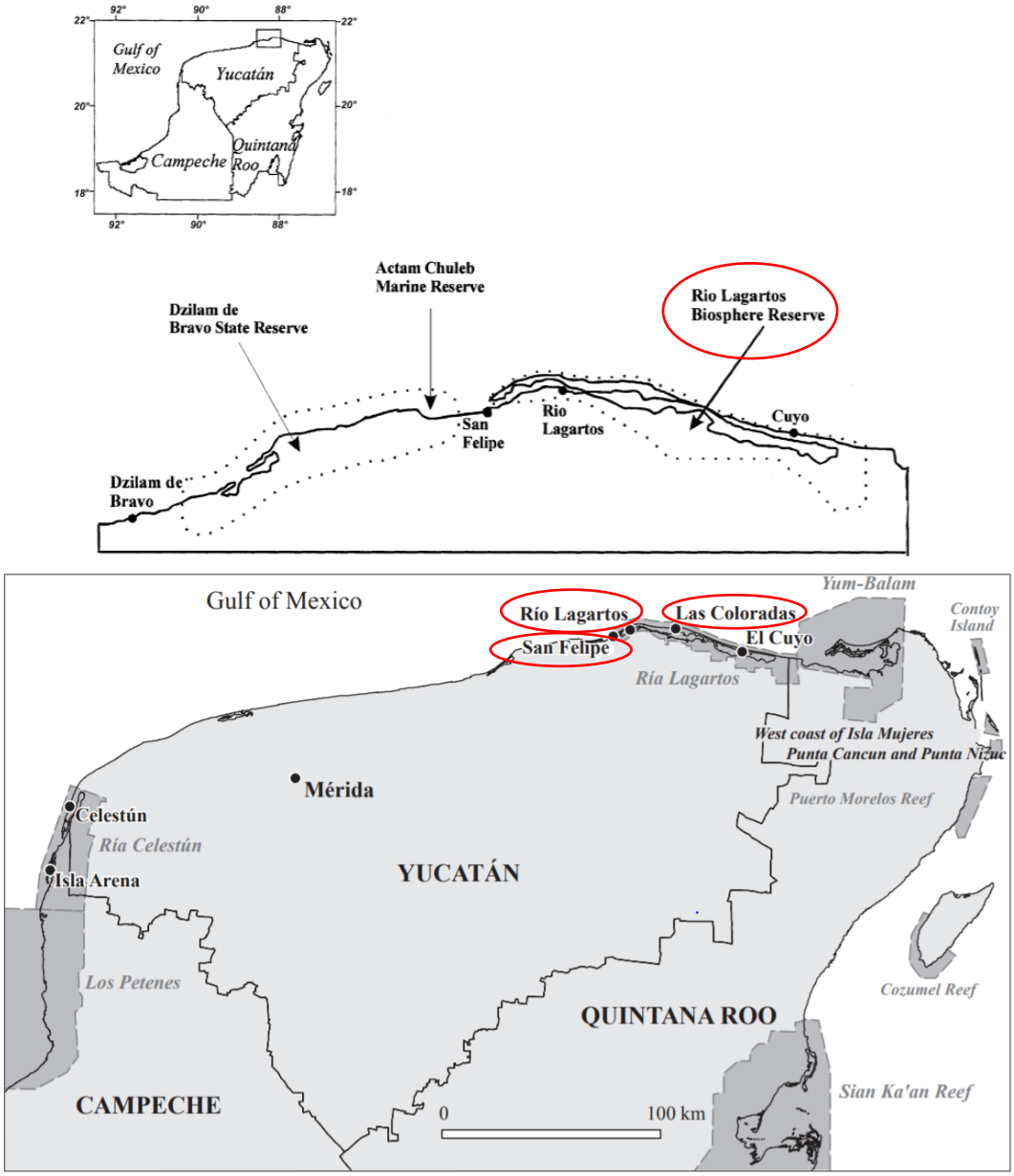

Figure 3.1: The Boundaries of the RLBR and the three communities used as case studies for this thesis in a regional and local context highlighted in red (Hernandez-Flores, 2015; Doyon and Sabinot, 2018)

3.1 Current Status and Legislative Foundations of MPAs in Mexico

As the 12th largest country in the world in terms of coastline extent and marine surface, with an exclusive zone of 314,992,000 ha (Figure 3.2), a continental platform of 39,460,300 ha and a coastline that stretches 11,500 km, of which 1,600,000 ha is covered by estuarine areas and about 1,250,000 ha by coastal lagoons (Fraga and Jesus, 2008), Mexico has a special interest to protect its coastal areas. The Mexican coastal zone provides a wide diversity of goods and environmental services, and is an area of great ecological, economic and social importance to the people of Mexico. The jurisdiction of the Mexican coastal zone is centralized, as everything associated with water resources has an adjacent federal zone. Coastal resources management is delegated to the relevant Mexican state, and only devolved to municipalities under particular circumstances through legal instruments such as General Laws, enabling decentralization of federal jurisdiction and regulatory authority for specific purposes (Fraga and Jesus, 2008). In Mexico, legal instruments such as laws, decrees, secretarial agreements and official standards regulate the access and use of coastal and marine resources. Two environmental management tools in particular are ecological zoning programs, used to plan land and water use, and protected areas (PAs), both governed by the General Law for Ecological Equilibrium and Environmental Protection (LGEEPA). LGEEPA came into effect in 1988 and required the government to include environmental considerations in its national plans (Havard et al., 2015). The Law further defines

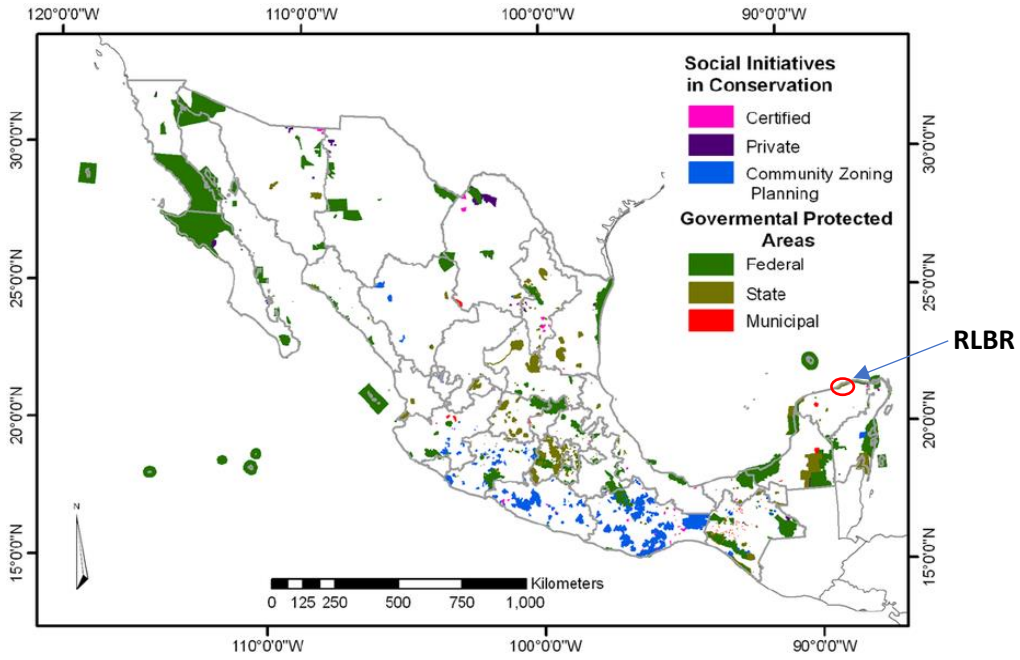

Figure 3.2: Protected areas of Mexico (Ochoa-Ochoa et al., 2009)

the tools of the national environment policy in the strive of sustainable use of natural resources, including obtaining economic benefits while preserving ecological integrity. As of 2000, the Secretariat of Environment and Natural Resources (SEMARNAT) and the National Commission of Natural Protected Areas (CONANP) has overseen the implementation of environmental zoning programs and management of PAs in Mexico (Havard et al., 2015). In Mexico, 17 million hectares of land in 176 sites are considered PAs (Figure 3.2), 41 of which are biosphere reserves (Doyon and Sabinot, 2014). The Law mandates that each PA should have its own management plan, ruled through a regulation that is derived from the LGEEPA (Fraga and Jesus, 2008). In addition, the Penal Code of Mexico incorporates provisions intended to protect marine life, including penalties of up to nine years of imprisonment for individuals who entrap or harm marine turtles, mammals, coral reefs, and any aquatic species exploited outside of harvesting seasons, with an additional penalty of up to three years if the offence is committed within the boundaries of a PA (WIPO, 2010).

The establishment of a PA must consider the area's biological features, social conditions of local and indigenous communities, and traditional land use. A proposal put forth for a PA is mandated to include studies carried out by the government, in collaboration with other institutions such as universities and research centres that delineate: general information about the subject area, ecosystem description and its relevance to the national and regional levels, rationale to justify the PA status, historical and cultural facets of the area, socio-economic status of the area, description of traditional and potential land uses, and a management plan which describes the zoning, administration, operation and funding of the PA (Fraga and Jesus, 2008). At their conclusion, the studies are to be made publicly available for a 30-day comment and consultation period. The government is legislated to solicit the feedback of local governments, government agencies with jurisdiction over the area, public and private social organizations, the indigenous people, universities, research centres and other institutions interested in and impacted by the establishment, administration and monitoring of protected areas (Fraga and Jesus, 2008).

The establishment of PAs in Mexico has risen steadily over the years, as can be see in Figure 3.3. In recent years, Mexico has bolstered these numbers even more, with the establishment of four new MPAs declared by former President Enrique Peña Nieto ahead of the UN Biodiversity Conference to the CBD (COP13) in Cancun, increasing national MPAs to 23%, which more than

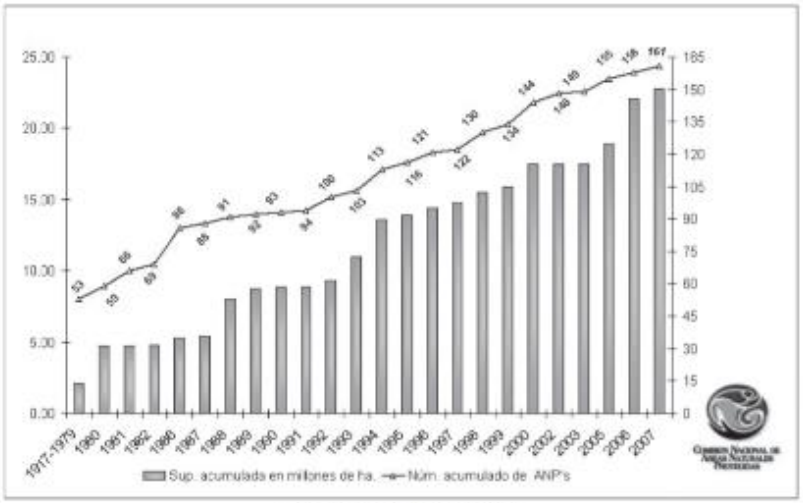

Figure 3.3: Number and area size of Mexican PAs, 1917-2007 (CONANP, 2007)

doubles the CBD goal of 10% set for 2020 (Wahlen, 2016). In addition, Mexico declared the establishment of a new MPA in 2017 in the Pacific Ocean, which is considered to be the largest in North America, covering more than 57,000 square miles (Howard and Greshko, 2017). The environmental legislation of Mexico strives to preserve ecological integrity, safeguard wildlife genetic diversity and ensure the preservation and sustainable use of biodiversity and ecosystems, with particular regard to endangered and endemic species, encourage scientific research of ecosystems, and protect the identity and culture of local and indigenous peoples. However, the mandates of the environmental legislation are not always effectively realized.

Historically, there has been an absence of ecological management of the coastal zone in Mexico due to the fact that the government did not want to decrease opportunities for its four main coastal activities; oil and gas extraction, fisheries, tourism, and marine transportation. It is argued that, "Mexico has historically let these industries manage themselves, and such a policy has resulted in use conflicts and lack of ecological consideration in coastal development decisions" (Smardon, 2009). While recent efforts have been made to more adequately manage the marine and coastal environment in Mexico, they have not been the most effective in some cases. In an assessment to evaluate the impact on performance and biodiversity outcomes of MPA management, nine management indicators were identified, including "legal designation, clearly defined boundaries, appropriate regulations, implemented management plans and sufficient administrative capacity, specifically staff, budget, and enforcement capacity" (Jessen et al., 2017). Many Mexican MPAs have shortcomings in the aforementioned areas, most notably neglecting the implementation of a

management plan. The IUCN encourages an "ongoing management planning process and written management plan that details management measures, desired outcomes, indicators of success, and monitoring plan" for the establishment of a PA (Jessen et al., 2017). While the creation of a management plan is mandated by the LGEEPA, with a revision every five years to evaluate efficiency and propose modifications, as of May 2005, only 37.5 % of Mexican MPAs had proper management plans in place (Ginsburg, 2013). It is legislated that that a year after the establishment of a PA, a management plan must be formulated which contains a description of the physical, biological, social and cultural characteristics of the PA; property rights regimes within the PA; short, medium, and long-term activities that will be carried out within the boundaries of the PA such as research, environmental education, protection; sustainable use of natural resources, recreation, building of infrastructure, fundraising and enforcement; and the PA's administrative structure and participatory mechanisms (Fraga and Jesus, 2008). Because of this absence, many PAs in Mexico are considered "paper parks" or parks in theory, unable to meet conservation goals. The inexistence of management plans is one of the key drivers that is impacting the effectiveness of law enforcement mechanisms and governance in Mexican MPAs.

Enforcement of environmental legislation is also another major issue in Mexico, particularly in coastal and marine environments where access is difficult to oversee and manage (Ginsburg, 2013). Adequate and consistent funding sources is the main driver that is vital to successful law enforcement, and overall design, establishment and management of MPAs. Ginsburg (2013) cites the lack of sufficient funding as "the most pervasive threat to MPAs in Mexico."

Moreover, a lack of coordination is evidently one of the challenges in achieving MPA effectiveness in Mexico, "one reason for Mexico's difficulty in creating effective MPAs is that they do not yet have an integrated coastal management (ICM) system…ICM would streamline all of the different coastal management plans throughout the country into one consistent plan for the entire country" (Ginsburg, 2013). There is a lack of inter (i.e. municipal, state and federal) and intra (sectoral) government coordination, which is leading to excessive bureaucracy and hindering effective MPA management and enforcement. Mexican legislation on use of and access to marine and coastal resources remains highly fragmented and incomplete, with large overlaps and inconsistencies (Havard et al., 2015; Smardon, 2009). This is because it is based on legal instruments that were initially created from a sectoral perspective with no cooperation amongst departments. The

implementation and enforcement of the legislation is carried out by uncoordinated government agencies, which are responsible for varying components of the coastal and marine environment (Bezaury-Creel, 2005; Fraga and Jesus, 2008). The greatly disjointed sectorial responsibilities concerning marine management, as well as the separate departments belonging to varying States and municipalities along with their operative units, has deeply uprooted the cohesiveness of MPA management.

In addition, all 31 Mexican states have their own environmental legal instruments (Ginsburg, 2013). Despite there being an extensive body of laws and regulations, the efficiency of the legal framework governing MPAs has never been analyzed or evaluated, "the legal instruments lack mechanisms to evaluate their efficiency–whether they are having the desired impact on natural systems, whether the outcome of regulations is what was envisaged and whether real progress is being made in terms of the sustainable use of ecosystems" (Fraga and Jesus, 2008). There is a clear lack of institutional collaboration between Mexican government sectors responsible for environmental protection and other activities that impact marine resources, which creates a major handicap to increasing levels of compliance in MPAs. Coordination between and amongst varying levels of government is crucial in the implementation of an appropriate legal framework for the integrated management of Mexico's coastal and marine zones.

Finally, management of MPAs often fails because the social context is not adequately considered. There is a widespread lack of involvement from local stakeholders and consideration of local values, which often leads to conflicts regarding marine resource use (Bennet and Dearden, 2014). This disengagement creates an information disconnect between locals and government authorities, which in turn leads to mistrust amongst locals of government bodies, causing violations of rules and regulations that undermine the effectiveness of the MPA. Although participative processes are encouraged by CONANP, they are rarely carried out in Mexican MPAs (Havard et al., 2015). According to a survey of local communities situated within the vicinity of Mexican MPAs (Fraga and Jesus, 2008), key informants listed "the lack of compliance by local users, often because of their poor involvement in management" as a major weakness that impacted the effectiveness of MPAs. Local stakeholders are not part of the design process of MPAs nor involved in the implementation of management initiatives, despite the minimum 30-day consultation as cited above, and as a result often resist and breach the regulations put forth. The aforementioned lack of

coordination may partially be causing this deficiency as the top-down governance structure disallows for participant engagement and lack of local consideration in the creation and management of MPAs. There is often a lack of transparency and communication between resource users and government bodies in regard to the rationale behind restrictions and regulations, management programs, park creation, the appointment process of superintendents, and accountability of managers. Because locals are often unaware and lack knowledge, this leads to widespread perceptions that management officials are corrupt (Bennett and Dearden, 2014). They see the MPA as negatively impacting their livelihoods based on the harvesting of marine resources. It is evident that to be successful and overcome deficiencies, MPAs require wide cooperation from local stakeholder agencies, local and indigenous peoples, and government bodies.

3.2 Geography, Ecology and Management of the RLBR

The Yucatán Peninsula has about 2,600,000 ha of nature reserves in 22 different sites, mostly located at the land-sea interface (Doyon and Sabinot, 2014; Lutz et al., 2000) such as the RLBR. Its climate is considered tropical wet/dry with a mean temperature of 26°C, and mangroves surround the coasts of the peninsula with a total area of 423,751 ha, frequently impacted by tropical storms and hurricanes from August-November (Adame et al., 2013). Yucatán's coastline, 378 km in length (Audefroy and Sánchez, 2017), receives about 1000-1500 mm of rainfall annually (Smardon, 2009). The limestone geology of the peninsula renders it largely devoid of surface water. As a result, groundwater travels to the coast where it intermingles with seawater before discharging into the ocean. Because of this, the coastal wetlands of the peninsula are largely flooded with a mixture of fresh and seawater (Adame et al., 2013).

The RLBR is considered to be situated in a neotropical, pentenes mangroves ecoregion (Figure 3.4), characterized by its brackish waters and high salinity content (WWF, 2019). Pentenes are described as pools of groundwater that are forced up from the limestone, mixing with the saline water above. The change in geology alters the area's vegetation, becoming an ideal environment for the growth of mangrove ecosystems (Smardon, 2009). The reserve encompasses a total site area of 603.5 km^2 (Wood, 2007), of which is a coastal lagoon extending over 80 km in length (21% of the state's coastline), varying between 0.02 to 3. 5 km in width and 3 m at its deepest point. The lagoon is separated from the rest of the Gulf of Mexico by a vegetated barrier island (Figure 3.4),

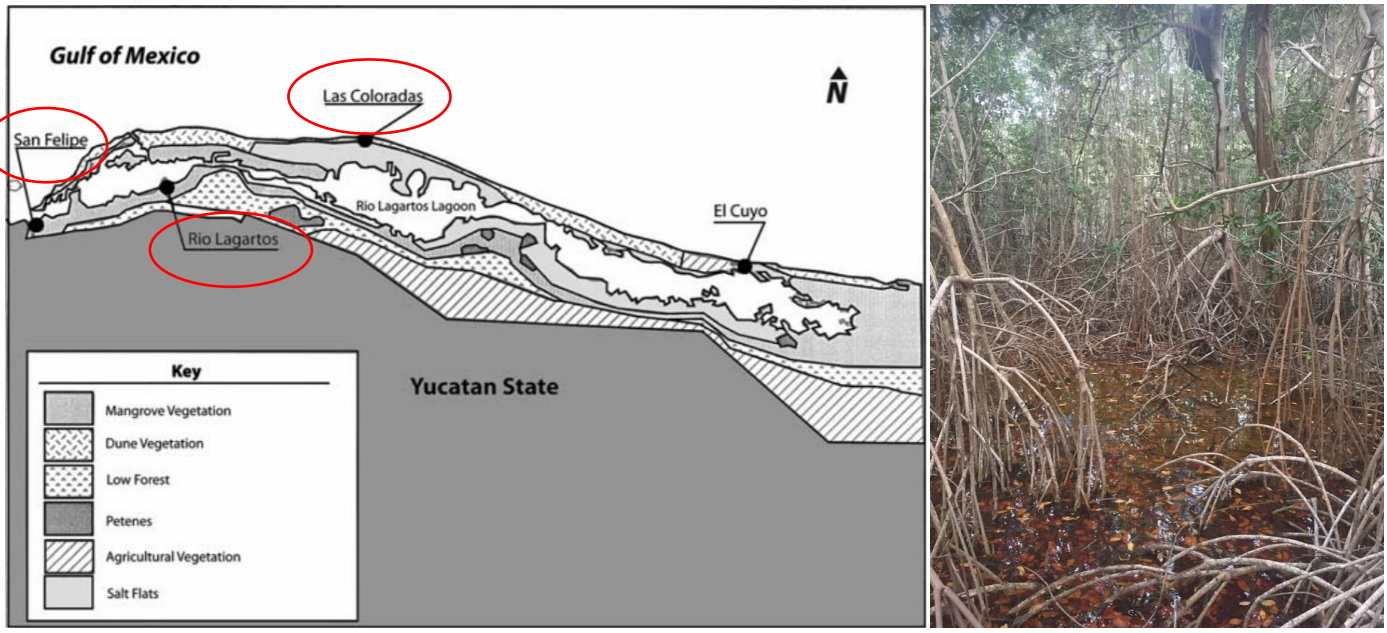

Figure 3.4: The vegetative communities and lagoon boundary of the RLBR, depicting openings to the Gulf of Mexico and the Atlantic Ocean. Study sites circled in red (Smardon, 2009); the mangrove forest that characterizes the reserve (photograph by author)

with two major inlets: Boca San Felipe, a natural mouth that connects it to the ocean, and the Ría Lagartos inlet, created artificially to allow easier accessibility to the gulf by fishermen (Smardon, 2009). It is impacted by strong prevailing north winds, called "nortes" by the local peoples, from November to March and is considered a high-risk hurricane zone as it is situated in the trajectory of hurricanes originating from the Caribbean and Gulf of Mexico. Since the past 88 years, 12 tropical hurricanes have made landfall on the peninsula (Audefroy and Sánchez, 2017). A coastal barrier island called the Ría Lagartos Peninsula borders the northern coast of the reserve, which, along with the mangrove forests, safeguards the inland areas from hurricane and storm surges. It has a large diversity of floral biota, housing 280 different species in nine different vegetative community types (Figure 3.5): mangroves, low thorny forest, coastal dune scrub, pentenes, savanna, hammocks, cattails, sawgrass and mudflats, stabilizing landforms (Smardon, 2009).

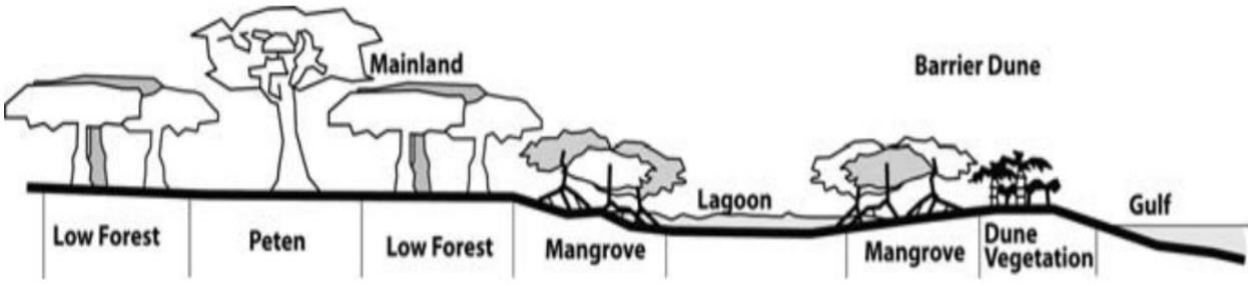

Figure 3.5: Cross-section of the vegetative communities in the RLBR (Smardon, 2009)

The RLBR was designated as a "Wildlife Refuge Zone" in 1979 by the federal government (Doyon and Sabinot, 2014; Fraga, 2006) to deter against "environmental degradation caused by human activities" and "protect natural ecosystems in order to conserve animal species." It is home to 41 species of mammals, including: the jaguar, white-tailed deer, gray fox, armadillo, and peccary; 56 species of reptiles, including: the hawksbill and green sea turtles, Morelett's crocodile and American crocodile; 10 species of amphibians, 16 species of fish, and 50 species of crustaceans, gastropods and bivalves (Fraga, 2006; Smardon, 2009). However, the reserve's 300 species of avifauna are of special interest and the principal reason for its upgrade to special federal biosphere reserve in 1988 under Mexico's Environmental Protection Law (Savage, 1993; Smardon, 2009) and eventual official designation and international recognition as a UNESCO Biosphere Reserve in 2004 (UNESCO, 2007). The resource-rich lagoon is a safe wintering haven for both migratory and endemic waterfowl (Figure 3.6), most notably being the only place in the continental Americas where the Greater Flamingo (*Phoenicopterus ruber*) nests due to its varied vegetative communities, hyper-salinity and strategic location on the eastern flyway (SEMARNAT, 2016).

Figure 3.6: Some of the diversity of bird species found in the RLBR – top left to right: great blue heron (Ardea herodias), roseate spoonbill (Platalea ajaja), American white ibis (Eudocimus albus), northern crested caracara (Caracara cheriway), brown pelican (Pelecanus occidentalis); bottom left to right: great egret (Ardea alba), bare-throated tiger heron (Tigrisoma mexicanum), cinnamon hummingbird (Amazilia rutila); photographs by author

The RLBR became designated as the first Mexican wetland of international significance under the Ramsar Treaty in 1986 due to its high biological diversity. The Ramsar Convention is the principal global instrument for international recognition of importance and cooperation on wetland conservation (Smardon, 2009). It is also an Important Bird Area (IBA), an internationally recognized standard for the conservation of bird populations (BirdLife International, 2019). Its induction into the UNESCO's Man and the Biosphere Programme (MAB) and the World Network of Biosphere Reserves in 2004 gave it further international recognition "to promote solutions for reconciling the conservation of biodiversity with its sustainable uses" (Azcárate, 2010). A park ranger interviewee explains the objectives of the reserve under the MAB programme:

> "Biosfera" means that the place intends to protect and let all living beings to live there in harmony, including humans. Because the reserve is a "biosfera," humans are allowed to live in its area. If the reserve was a national park, humans wouldn't be allowed to live or get in. The aim of this reserve is to employ its natural resources in a sustainable way (Park Ranger 2, August 2018).

The above statement highlights the coupled, social-ecological mandate of the programme, specifically the "sustainable use and conservation of the resources of the biosphere and for the improvement of the overall relationship between people and their environment" (UNESCO, 2017). Inclusion in MAB opened up opportunities for the reserve to an international conservation network, building relationships with various government and nongovernment institutions (Smardon, 2009). The RLBR's management and designation history is summarized in Table 3.1 below:

Table 3.1: History of the RLBR's management and designation

Year	Event
1979	Declared a Fauna Refuge through a presidential decree
1986	Designated as the first Mexican wetland of international importance under the Ramsar Convention
1988	Upgraded to "special biosphere reserve" status in 1988 under Mexico's Environmental Protection Law
1999	Management Plan published
2004	Designation under UNESCO's MAB programme

Designation under the MAB programme also means that the reserve is divided into zones, varying in different degrees of protection and "aimed at the fulfilment of the objectives of the Biosphere Reserve, prescribing activity for the use of the natural resources in each zone" (UNESCO, 2007).

The buffer zone of the RLBR is 36,666.26 ha and contains restoration areas, salt extraction areas, farming and human settlements, and two types of management practices, namely: restricted use and moderate use of natural resources. The core zone is 23,681.55 ha (UNESCO, 2007). An interview with the park rangers of the RLBR reveals the management of the two different zones:

> Nowadays, most resources from the reserve are not allowed for use, but there are some places where community members could rightfully and legally use/extract said resources, such as wood. They are not allowed to cut down wood from the core zone called "zonas nucleo," but they can cut down a reasonable amount for the domestic use from other/surrounding areas of core zones within the reserve (Park Ranger 1, August 2018).

> The reserve is a place designed for conservation. It has certain areas where people can use its resources or perform primary production activities. What we call "nucleo zones" are off limits (Park Ranger 2, August 2018).

While the reserve is designed with the intention to create balance between its ecological and human dimensions, this application is much more intricate in reality, as will be explored in Chapters 5-7.

3.3 SSF Communities of the RLBR

It is well known that fisheries support the livelihood of innumerable people and households around the world, with 54 million peopled employed globally in this sector (Huchim-Lara et al., 2016). SSFs in particular are often the primary source of income, employment and nutrition for many coastal communities around the world (Saldaña et al., 2017), constituting 90% of the world's fishers and nearly half of global fish catch (Bennett and Basurto, 2018). In Mexico specifically, 90% of the national fishing fleet consists of small-scale boats (between 8-12 m in length), and around 300,000 people are dependent on SSFs. 15,000 direct jobs and 85% of vessels are generated by this sector in the Yucatán alone, bringing in 45,000 tonnes of fish catch of 60 different species with a value of more than $75 million USD (Salas et al., 2011; Salas, 2000). Many of the towns along Yucatán's coast rely on SSF as a resource and are therefore considered "SSF communities," defined as, "a community whose livelihoods are dependent on the natural marine resources, with people actively involved in harvesting the resources as a primary means of income; and whose social and cultural identity is integrated into these practices" (TBTI, 2014). In Yucatán, there are three types of strategies whereby fishers are organized, namely: operating independently and individually, part of a producer cooperative, or running their own business enterprises (Salas et al.,

2011). The Federation of fishing cooperatives in particular are an alliance that have facilitated easier access to market processes and management of the resources (Salas et al., 2015).

The communities of the RLBR, originally small Mayan fishing villages, evolved into town-run cooperatives with sizable fishing fleets in the early 1950s as lobster harvesting became more profitable (Smardon, 2009). Today, there are over 8,000 inhabitants residing in the four communities with 838 SSF boats amongst them, as delineated in Table 3.2 below (Audefroy and Sánchez, 2017; SIEGY, 2017; Smardon, 2009):

Table 3.2: Population and SSF fleet of the RLBR communities

Community	**Population**	**Number of Fishing Boats**	**Number of Fishers**
San Felipe	1,945 (2015)	211	406
Río Lagartos	3,502 (2015)	328	920
Las Coloradas	1,151 (2010) *	56	105
El Cuyo	1,748 (2010) *	243	710
TOTAL	8,346	838	2,141

**** Updated statistics unavailable for Las Coloradas and El Cuyo***

Río Lagartos and San Felipe (Figure 3.7) are the two most productive fishing communities, with 84% and 65% of the economically active population earning its living from fishing respectively, while El Cuyo and Las Coloradas are third and fourth to support a total of 1,400 families (Salas et al., 2011; Smardon, 2009). In Río Lagartos, two fishing cooperatives employ a total of 303 members, more than half of the fishing fleet, belonging to a national federation providing political representation at the state and federal levels (Audefroy and Sánchez, 2017; Bennett and Basurto, 2018). Majority of the fishers in San Felipe are in two operating fishing cooperatives as well (Salas et al., 2011). Other socio-economic activities are tourism, salt production (supporting around 100 families), agriculture and cattle ranching (Audefroy and Sánchez, 2017). Locals are cognizant of the importance fishing has on the community, stating in the interviews that "if we have good wellbeing, that is because of fishing," and, "if we have a good fishing season, it immediately results in prosperity for the community, translating to more money flow, so trading and businesses are more active" (Fishermen). Fishermen of Ría Lagartos report fishing a multitude of species, as seen in Table 3.3, listed based on their local name in Spanish, common name in English, scientific name, IUCN Red List classification (Gärdenfors et al., 2001; DD - Data Deficient, LC - Least Concern, NT - Near Threatened, VU - Vulnerable), and the frequency that they were mentioned in the data.

Figure 3.7: SSF boats docked in Río Lagartos; and San Felipe respectively; the town of Río Lagartos seen from afar at sundown (photographs by author)

Three species in particular, the Caribbean spiny lobster (*Panulirus argus),* identified in Figure 3.9*; epinephelus*, a genus of fish in the family *serranidae* (grouper), identified in Figure 3.8 and 3.10; and the Mexican four-eyed octopus (*Octopus maya),* were identified as being the most commercially important, with the first two also fetching for the highest price at the fishing cooperative landing site, as seen in Figure 3.11 (*Octopus maya* not featured due to a seasonal fishing ban). This observation is consistent with previous studies, with Huchim-Lara et al., 2015, noting that catches comprise mainly of lobster, red grouper and octopus, with lobster being the most profitable. The market value of these three species is $23/kg, $0.4-5/kg and $3/kg USD respectively (Saldaña et al., 2017). Spiny lobster constituted 91% of the national yearly catch of Mexico during 1985-1997 (Phillips and Kittaka, 2008), and an income of about $16 million USD in 2014 (Saldaña et al., 2017). It contributes high revenues to fishers and is considered among the most important fisheries in the region (Rios-Lara et al., 2007). Furthermore, red grouper is the dominant fin-fish landed in southeastern Mexico, with catches between 8,000-14,000 tonnes (Salas, 2000), its filleting and freezing qualities making it highly demanded in markets (Solís-Ramirez, 1970). Finally, *octopus maya* in the Yucatán Peninsula supports the largest octopus fishery on the American continent (Gamboa-Álvarez et al., 2015), generating more than $27 million/yr USD and a fishery production between 10,000-20,000 t/yr. (Rosas et al., 2014). Together with the red grouper, it comprised 50-60% of fish landings in Yucatán by 1998 (Salas, 2000). It is evident that fisheries comprise the most significant component of the socio-economic fabric in the RLBR. The next chapter describes the methodological approach used to conduct this research.

Table 3.3: Fish species identified by respondents

Common name in Spanish	Common name in English	Scientific name	Frequency Mentioned
langosta	Caribbean spiny lobster	Panulirus argus (DD)	21
mero	Epinephelus - a genus of fishes in the family Serranidae (grouper)	Epinephelus spp	20
pulpo	Mexican four-eyed octopus	Octopus maya (LC)	17
canané	Yellowtail snapper	Ocyurus chrysurus (DD)	9
mojarra	Eucinostomus - a genus of fish in the family Gerreidae	Eucinostomus spp	8
pepino de mar	Sea cucumber	Holuthuria floridana (LC) or isostichopus badionotus (LC)	8
boquinete	Hogfish	Lachnolaimus maximus (V)	7
pargo (in general)	Lutjanus is a genus of snappers	Lutjanus spp	7
rubia	Lane snapper	Lutjanus synagris (NT)	6
esmedregal	Cobia	Rachycentron canadum (LC)	6
corvina	Speckled seatrout	Cynoscion nebulosus (LC)	5
mero-negrillo	Black grouper	Mycteroperca bonaci (NT)	5
robalo	Common snook	Centropomus undecimalis (LC)	5
cazon	Several shark species	N/A	4
cangrejo	Crab, Atlantic horseshoe crab	Limulus polyphemus (V)	4
carito	King mackerel	Scomberomorus cavalla (LC)	4
chakchí	White grunt	Haemulon plumieri (LC)	3
abadego	Cod	N/A	3
cherna	Atlantic goliath grouper	Epinephelus itajara (V)	3
avadejo	Gag	Mycteroperca microlepis (V)	2
barracuda/picuda	Great barracuda	Sphyraena barracuda (LC)	2
coronado	Longfin yellowtail	Seriola rivoliana (LC)	2
jurel	Crevalle jack	Caranx hippos (LC)	2
lisa	Mugil – A genus of mullet in the family Mugilidae	Mugil spp	2
pargo perro	Dog snapper	Lutjanus jocu (DD)	2
caracol blanco	White sea snail (Strombus)	N/A	1
caracol rojo	Red sea snail (Strombus)	N/A	1
huachinango	Northern red snapper	Lutjanus campechanus (V)	1
liseta	White mullet	Mugil curema (LC)	1
mantarraya	Stingray	N/A	1
mojarra plateada	Spotfin mojarra	Eucinostomus argenteus (LC)	1
pargo lunar	Mutton snapper	Lutjanus analis (NT)	1
sabalo	Tarpon	Megalops atlanticus (V)	1
sierra	Atlantic Spanish mackerel	Scomberomorus maculatus (LC)	1
tambor	Red drum	Scianops ocellatus (LC)	1

Figure 3.8: Poster of different grouper species in fishing cooperative (photograph by author)

Figure 3.9: Caribbean spiny lobster catch (panulirus argus), pen for size comparison and measuring tool for marketability (photograps by author)

Figure 3.10: Fish catch before processing at fishing cooperative (photography by author)

Figure 3.11: Price listings of different species in fishing cooperative. Caribbean spiny lobster/langosta (Panulirus argus) and grouper/mero (serranidae) are the two highest valued species (photograph by author)

CHAPTER FOUR: METHODOLOGY

This chapter defines the methodology and data collection methods employed to execute the research study, including the researcher's role and types of sampling used. Limitations of methods and strategies used to mitigate against them are also described.

4.1 Summary of Research Approach

Achievement of the research objectives entailed primary data collection in the form of semi-structured interviews, a survey, and focus groups carried out in the study area. In combination, these methods of data collection allowed for better understanding of local perspectives in relation to the MPA and its effectiveness in addressing environmental and social changes occurring in the region. Community perceptions provided invaluable insights into the opportunities and challenges of MPAs.

As the study focused on social actors and their behaviours with respect to MPA governance, the research was analyzed through a descriptive research design, which was chosen due to its ability to portray the relationship of persons with certain phenomenon that occur (Dulock, 1993). The methodology followed a largely inductive and qualitative approach, justified for its rigour to describe the importance of human interactions (Anderson, 2010), which was the objective of this study. Some quantitative analysis was also conducted through the tallying of results, as will be described below.

4.1.1 Case Study Approach

The case study approach is argued as being "useful to employ when there is a need to obtain an in-depth appreciation of an issue, event or phenomenon of interest, in its natural real-life context" (Crowe et al., 2011). It allows for detailed analysis of multi-faceted issues in their natural settings. It is further defined by contemporary research issues and contexts where researcher control is limited (Yin, 2013). The research study emphasizes the significance of issues affecting contemporary coastal communities, including fisheries collapse, globalization and resource management; and encompassing a dynamic social-ecological context unable to be influenced by the researcher. The central principle of the case study approach is exploring an issue in its natural and real-world context, as opposed to experimental design, in which the researcher strives to

control and manipulate variables in question. They can be used to explain events, and understand casual links and pathways resulting from, for example, the initiation of the reserve. In addition, the application of the case study method aims to capture explanatory information, and answer questions such as "how", "what" and "why," describing and exploring events in everyday contexts (Crowe et al., 2011). It can help to understand casual links between different aspects, leading to new policy initiatives. In the context of the RLBR, it focuses on "how" community involvement in management can provide novel insights to improve wellbeing and achieve conservation goals, "why" environmental and social change is linked to MPA governance, and "what" gaps exist in current MPA governance. Finally, the case study approach aligns with the constructivist standpoint, as it is built upon a social construct of reality and enables participants to share their stories (Baxter and Jack, 2008). The rapport building between researcher and respondent allows for different views of reality to be described, and for a better understanding of respondents' actions. The selected case study of Ría Lagartos, Mexico, has the potential to contribute to a broader understanding of MPA governance in Latin America and other contexts as well. It provides exploratory elements to generate data for future research on MPA governance and community wellbeing linkages, describe environmental and social change, and document local perceptions on the MPA and community wellbeing. The findings of this research may provide vital insights for issues concerning social-ecological change and MPA governance.

4.2 Research Design

A descriptive research design was chosen for this study, with the objective to "portray the characteristics of persons, situations, or groups and the frequency with which certain phenomenon occur; these studies observe, describe and document aspects of a situation as it naturally occurs" (Dulock, 1993). This study aimed to assess the role of social interactions, institutional collaboration and community engagement in the effectiveness of MPA governance. Because the study analyzed the social linkages between various actors in the region, a descriptive research design was therefore chosen to "discover associations or relationships between or among selected variables" (Dulock, 1993). Descriptive research design strives to "describe responses to the independent, mediating, or dependent variables" (Creswell and Poth, 2017). In this case, the independent variables included community engagement and social collaboration; and the dependent variable would be the effectiveness of the MPA in meeting social and environmental

goals. Justification for choosing this type of research design over other, more positivist ones is based on the premise that it is able to systematically describe the characteristics of a given population and its focus on social factors, aligning with the objectives of the study.

The methodological approach chosen for this study was largely qualitative, defined by its "collection, analysis, and interpretation of data that are not easily reduced to numbers. These data relate to the social world and the concepts and behaviors of people within it" (Anderson, 2010). It was chosen because of its alignment with the study objective to analyze social interactions and phenomenon in depth. It can be argued that "qualitative research is great for addressing 'how' questions…; for understanding the world from the perspective of those studied (i.e. informants); and for examining and articulating processes (Pratt, 2009), which is precisely the aim of the study – to determine how human interactions and behaviour influence MPA effectiveness.

The scientific method was inductive, deriving final inferences and conclusions from the observations made; follow a relativist ontology, one in which multiple realities or "truths" exist which are all subject to change and what is real is shaped by context and evolves based on human experience; and a largely empiricism epistemology, in which the source of knowledge is input from sensory experience (Potter, 2016). Thus, it can be construed as a constructivist or critical theorists paradigm, chosen over positivism due to the study being based in human interaction and experience and recognizing that realities are relative and will be based on respondent's perspectives.

4.3 Data Collection Methods

The selected data collection methods were used in Mexico to gain a richer understanding of 1) the current and historic processes of rapid and abrupt social and environmental change; 2) how local peoples are adapting to change; 3) how community members are interacting with the marine resources; 4) how local peoples view the role of the MPA as a way to combat social and environmental change; and 5) how local perceptions can be incorporated in the governance of the MPA through a co-management approach to better achieve social and ecological wellbeing goals.

4.3.1 Literature Review

A preliminary literature review, defined as a, “comprehensive study and interpretation of literature that addresses a specific topic” (Aveyard, 2014), was conducted to obtain a conceptual and theoretical understanding of previous research on the three areas of interest, namely: SERSs, MPAs and community wellbeing. The literature review surveys scholarly articles, books and other secondary sources for historical information prevalent to the three areas of research. It provided a theoretical baseline for the researcher, allowing her to become familiar with the research and identify any gaps that she may attempt to address through her study, warranting why further work was required. By conducting the literature review, the researcher was able to “systematically search, critique and combine the literature to demonstrate a gap in the existing research base" and demonstrating her “understanding of both the research and the methods previously used to investigate the area” (Aveyard, 2014).

In the case of the RLBR, a preliminary literature review allowed the researcher to complement previous studies conducted in similar marine and coastal community contexts, understand the setting of the reserve as an MPA characterized by environmental and social change and having implications for community wellbeing, validate collected data, and build upon existing theories. It was conducted with the help of Zotero reference management software (Figure 4.1), chosen for its web browser and word processor integration, in which the bibliographic data of 414 research

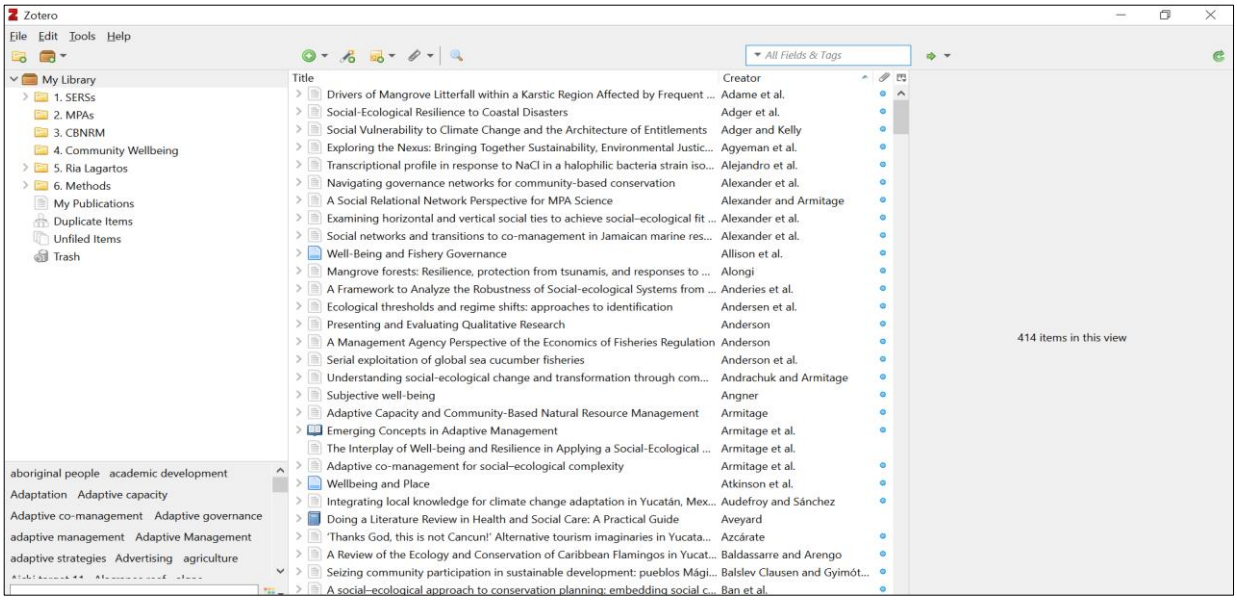

Figure 4.1: Use of Zotero reference management software to organize secondary sources for the literature review

materials was added and organized based on the three research areas, the case study and methods used. It was also used to generate the references' list.

4.3.2 Scoping and Participant Observation

It has been proven that a researcher's prolonged involvement in the community where the research is being conducted "enhances sensitivity to discrepancies between the meanings presumed by the investigator and those understood by the target population"(Long and Johnson, 2000). Previous literature contests that, "spending more time on data collection in a particular setting provides time for trust to be established with participants. With increased trust (and intimacy), you will get better, richer data. More will be revealed, and therefore, data will be more valid" (Morse, 2015). Through long-term engagement with respondents and by spending a significant amount of time in the community, the researcher is able to build trust and rapport with respondents, enhancing the validity of the research. This also "allows time for emerging concepts to develop and for potential implications to be recognized" (Long and Johnson, 2000).

During this initial scoping stage, the researcher was initially engaged in several informal meetings and participant observation in order to attain a thorough comprehension of community and cultural dynamics. The researcher became accustomed to her new environment and exposed to community life, sought out potential research participants and established an understanding of the community context and setting. She was able to understand how the reserve was being managed and acquaint herself with the fishers of the community. The researcher documented her findings and observations made during the fieldwork phase in a dated journal. She kept notes on the interviews/focus group activities that took place during the day, physical observations of the community or the reserve, anecdotes from community members, her insights on conversations with respondents, and important analytical concepts that emerged.

4.3.3 Semi-Structured Interviews

Semi-structured interviews are largely used in the social sciences, and are defined as "a qualitative data collection strategy in which the researcher asks informants a series of predetermined but open-ended questions" (Given, 2008). They are described as a verbal exchange between the interviewer and the interviewee, unfolding in an informal and conversational manner (Clifford et al., 2016). The semi-structured interview approach was chosen over other, more positivist techniques for its

ability to understand issues as they are perceived by the actors involved (Bolderston, 2012). Interviews can "reveal ideas and deliver insights no other method can provide" (Diefenbach, 2008). They allow for flexibility in the data collection as new topics emerge (Bolderston, 2012), while also maintaining their consistency throughout so that they may be compared (Rowley, 2012). This technique thoroughly explores the relationships between participants and their setting.

The semi-structured interview questionnaire was created before fieldwork commenced, and the researcher modified and altered it (i.e. length of questions, complexity of terminology used) during the data collection after receiving feedback from the first five interviewees. The interviews began with an initial discussion about the interviewee's life in the community to build rapport, and then questions were differentiated based on the research objective they strived to addressed. Two different versions of the interview questionnaire were created, catering to community members and park rangers, respectively (Appendix A). The design of the park ranger interview guide was similar to the community member one in order to ensure that results could be directly comparable. It allowed for a richer understanding of locals perceptions on the environmental and social changes taking place, the management of the MPA, and the community wellbeing aspects that are most valued. The audio recording of the interviews allows data to be captured more effectively, making it "easier for the researcher to focus on the interview content and the verbal prompts and thus enables the transcriptionist to generate 'verbatim transcript' of the interview" (Jamshed, 2014). Interviews were recorded on a voice recorder based on individual permissions. A total of 45 interviews with 74 respondents were conducted in three of the four communities in the RLBR: San Felipe, Las Coloradas and Río Lagartos, ranging from 30-60 minutes in length, with majority of them (40 of 45) occurring in the latter (Table 4.1), and 25 were audio recorded. Some interviews were conducted in pairs or groups, at the request of the interviewees. Because the researcher did not have proficiency in the common language of the community (i.e. Spanish), a research assistant was hired to facilitate the translation and transcription of the interviews.

Table 4.1: Details of the interviews

Community	**# of Interviews**	**# of Interviewees**
Río Lagartos	40	68
San Felipe	3	4
Las Coloradas	2	2

4.3.4 Focus Group Activities

In focus group activities, “invited groups of people are interviewed in a discussion setting in the presence of the session moderator” (Jamshed, 2014). The researcher “assembles a group of individuals to discuss a specific topic, aiming to draw from the complex personal experiences, beliefs, perceptions and attitudes of the participants through a moderated interaction” (Nyumba et al., 2017). They are conducted “in an informal setting to talk about a particular topic that has been set by the researcher. The facilitator keeps the group on topic, but is otherwise non-directive, allowing the group to explore the subject from many angles” (Clifford et al., 2016). They differ from semi-structured interviews in that they rely on and promote interactions and engagement between the different members of the community, allowing the researcher to gather the opinions of a large number of people. They also allow for the generation of visual outputs, validate the data collected in the semi-structured interviews, and differentiate the various opinions of community members.

Focus groups were used for this study to derive inferences from local experiences on the MPA’s ability to meet its set targets. The researcher, with the help of the translator, assumed the role of the facilitator and led a discussion (Gill et al., 2008). It was chosen for its ability to allow for interaction between participants, beyond interviewer and interviewee as seen in the first method. As participants conversed with one another, it was anticipated that they would derive a more enriched discussion and collective views from various experiences and participant backgrounds

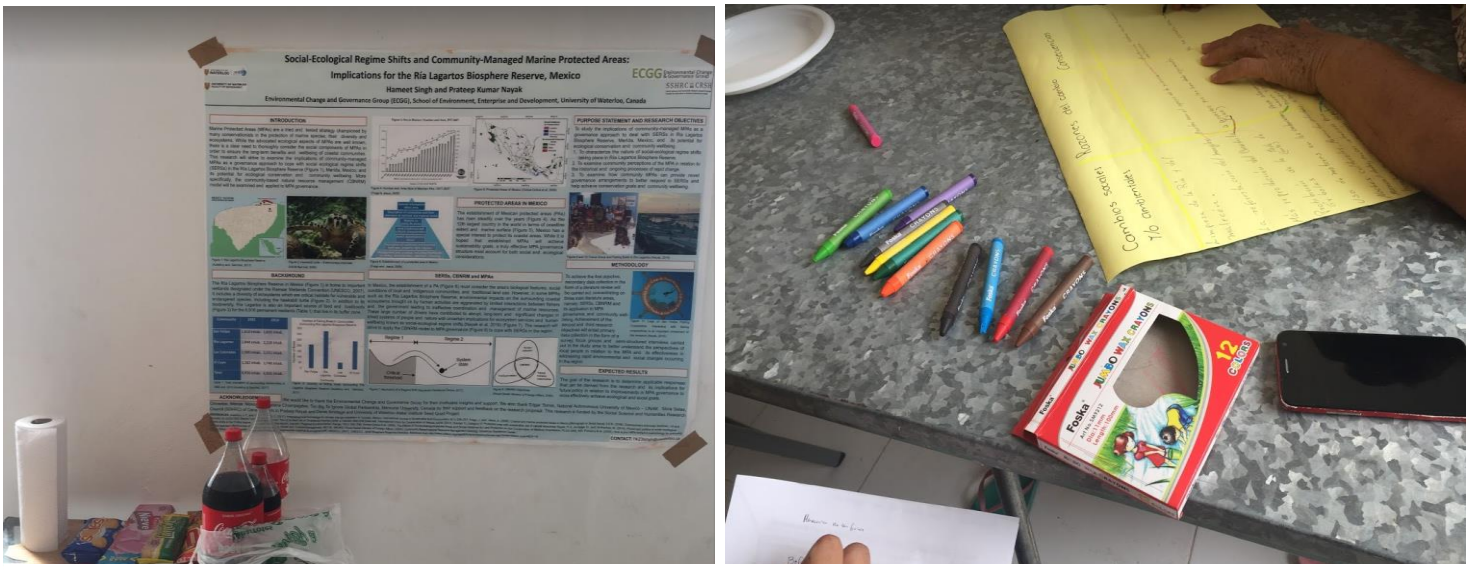

Figure 4.2: Set-up of one of the focus group activity sessions, with linking exercise being carried out (photographs by photographer)

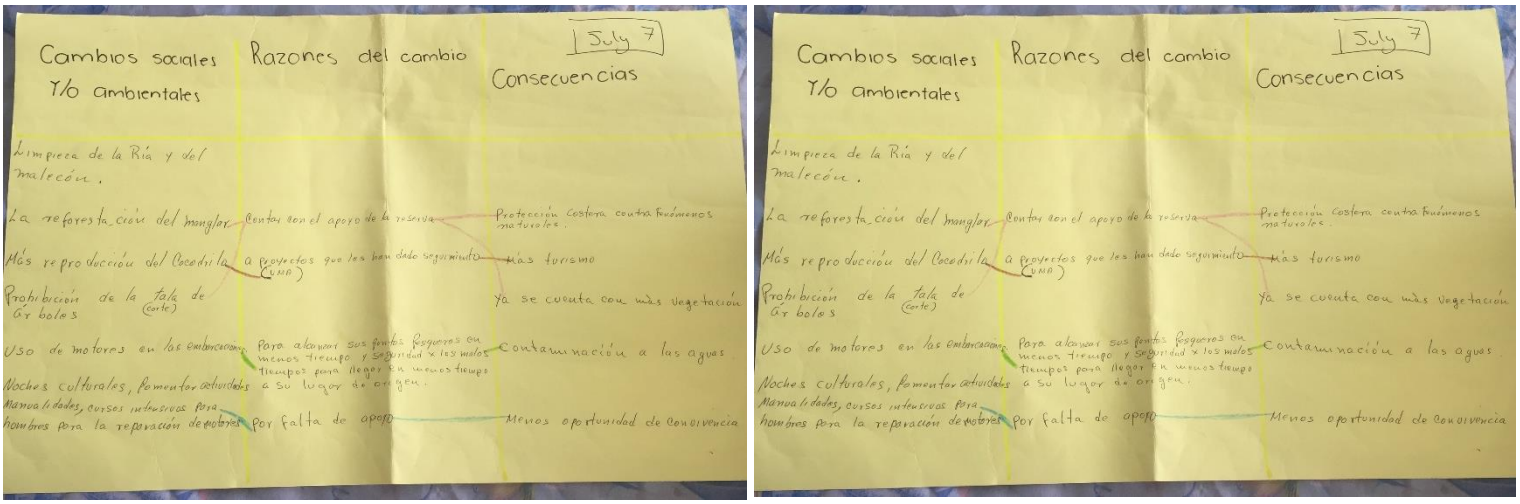

Figure 4.3: Results from one of the sessions of Focus Group Activity 1, asking respondents to identify the linkages between drivers, changes and impacts; and changes impacting their community's wellbeing (activities conducted in Spanish, later translated into English)

(Merton, 1987) surrounding community participation in the MPA. Focus groups were useful for this research, recognizing that there is a core population or sample that the research is focused on (those involved in or impacted by MPA governance in Yucatán, Mexico). Focus groups also helped to overcome biases of individual opinions and created a more robust view of factors contributing to or hindering the effectiveness of MPA governance mechanisms in achieving ecological and community wellbeing goals. In this case, focus groups facilitated the numerous levels of stakeholders to share knowledge and perspectives on the state of MPA governance, the success of mechanisms and the obstacles present. Finally, focus groups can offer, "a wide range of approaches to community members to engage in research that increases citizen power and voice in communities" (Jason et al., 2004). Focus groups recognized that community involvement is fundamental for natural resource management and can enhance conservation efforts. As such, the use of focus groups as a data collection method aligns with the community-focused theme of this study.

Four focus groups were carried out with three participants each, all taking place in Río Lagartos, resulting in a total study population of 12. They were divided in the following groups: 1) housewives; 2) tour guides; 3) fishers; and 4) business owners. Housewives, for the purposes of this study, are defined as married women in charge of the household, tending to occupational duties such as cooking, dishwashing, house cleaning, laundry work and childcare (Bergmann, 1981). The activities were conducted in the public library of Río Lagartos, which was arranged beforehand with municipal staff. Light refreshments were served as an incentive for community members to

participate (Figure 4.2). Participants were guided through two focus group activities, a listing and linking exercise (Figure 4.3), and a mapping activity (Appendix B). Part four of Focus Group Activity 1 and Focus Group Activity 3, the knowledge map/Venn diagram, and seasonal calendar exercises were excluded due to lack of time during fieldwork. After an initial relaying of the semi-structured interview results, Focus Group Activity 1 (listing and linking exercise) asked participants to make three columns on a bristol-board, ranking the top five environmental/social changes they have seen occurring in their community, the reasons why the changes have occurred, and the consequences arising from these changes in the columns, respectively. Participants were then asked to link the drivers, changes and impacts, highlighting the causality between different aspects of SERSs and helping to achieve the first research objective. The second part of the activity asked participants to list the top five-six most important elements for their community's wellbeing and link them to changes impeding their achievement, helping to answer the second research objective. Conducting the activity generated a productive and insightful discussion amongst the participants involved about the most significant changes impacting their community and the most important aspects of their wellbeing. Focus Group Activity 2 (mapping exercise) presented participants with a map of Ría Lagartos and asked them to identify at least five areas of the reserve that are most important to them and their community's wellbeing and why, based on different categories such as economic, ecological, cultural or social. They were then asked some follow-up questions concerning the reasons behind their selection, whether their selection would be different without the existence of the reserve, and the various resources found at these locations. This focus group activity helped to achieve research objective 2. The results and analysis of Focus Group Activity 1 and 2 are presented in Chapters 5 and 6, respectively.

4.3.5 Survey

The SERSs survey (Appendix C) was created to nominally quantify the environmental and social changes occurring in the region, characterized by the six-dimension framework as defined by Nayak and Armitage, 2018 (described in Chapter 2.1). The survey was segregated based on the six dimensions of SERSs, with questions pertaining to each dimension. 20 surveys were conducted with 20 participants, all taking place in Río Lagartos and a total of 30-90 minutes to complete. The main purpose of the survey was to triangulate the data concerning changes gathered during the semi-structured interviews and focus groups, defined as "a data corroboration process in which

different angles and methods are adopted to study the same phenomenon" (Gibbert and Ruigrok, 2010), and allow for a comparison between different study sites. Data triangulation can "facilitate the integration of qualitative and quantitative findings, help researchers to clarify their theoretical propositions and the basis of their results…offer a better understanding of the links between theory and empirical findings, challenge theoretical assumptions and develop new theory" (Östlund et al., 2011). Three other student researchers, part of a larger, overarching SERSs project, conducted their thesis work in coastal communities in India, China and Indonesia around the same time this study took place, all carrying out the SERSs survey in their respective locations. It is hoped that when the data from all the study sites is analyzed, a comparison analysis of the results can be conducted to derive theoretical generalizations concerning the nature of social and environmental changes impacting coastal communities around the world. The results of the survey helped largely to attain all three research objectives and are analyzed in Chapters 5-7.

4.4 Sampling, Participant Selection and Recruitment

MPA governance invokes diverse groups of stakeholders that interact in the context of social and ecological systems. Participants in this study included members of the three SSF communities near the reserve previously mentioned, members of community groups, rural inhabitants and government officials. The RLBR served as a physical boundary to narrow the geographical scope of the reserve, in which three of the four communities (i.e. San Felipe, Río Lagartos, Las Coloradas), as previously mentioned, were approached for research participation. The communities were chosen based on previous knowledge and familiarity of established social networks that facilitated recruitment, and ease of accessibility based on availability of transportation, remoteness and closeness to the researcher's place of residence. For example, El Cuyo, the fourth community in the reserve, was excluded from the scope due to it being almost 95 km from the researcher's place of residence in Río Lagartos and the non-existence of an efficient means of transportation. Common characteristics of participants included those involved in and knowledgeable about the chosen case study project for MPA governance and were 18 years of age or older. For data to be credible and of optimal quality, the chosen sample must be appropriate and consist of participants who best represent or have knowledge of the research topic (Morse et al., 2002). Participants were selected based on their perceived relationship with the reserve (i.e. fishers

and tour guides were targeted as they directly derive their livelihood from the marine resources of the reserve, park rangers because of their experience in managing and conserving the reserve). Recruitment was conducted using the snowball technique, whereby existing interviewees are asked to recruit future subjects (Bolderston, 2012), which frequently occurred during data collection as the researcher was given further contacts by interviewees. For instance, certain well-known fishers

Table 4.2: Summary of semi-structured interview participants

Livelihood Category	**Example**	**# of Participants**
Fishing	Fishers (current and retired), fishing co-operative and federation workers	25
Tourism and Hospitality	Tour guides, restaurant and hotel owners, managers and employees	15
Domestic	Housewives	18
Agricultural	Farmers, ranch workers	2
Municipal	Past and current vice-mayors/mayors	3
Federal staff	CONANP park rangers	2
Small business owners	Shop keepers, convenience store proprietors	3
Industry	Salt company and recycling plant workers	3
Other	Janitor, health care worker, landlord	3
TOTAL		**74**

Table 4.3: Summary of survey respondents

Livelihood Category	**Example**	**# of Respondents**
Fishing	Fishers (current and retired), fishing co-operative and federation workers	8
Tourism and Hospitality	Tour guides, restaurant and hotel owners, managers and employees	11
Federal staff	Marine captain secretary	1
TOTAL		**20**

tour guides were recommended by respondents for their knowledge in the matters of the reserve. One community member in particular was frequently cited for their extensive knowledge of the reserve's ecology and popularity in the community. Park rangers were interviewed based on previous contact and affiliation with the researcher's host supervisor. There were 74 participants for the semi-structured interviews and 20 respondents for the survey. Community members were recruited in consultation with initial informants the researcher was in contact with prior to arriving in Yucatán and also while she was there. The nature of snowball sampling allows to have one or

two initial contacts who then become instrumental in connecting the researcher to other potential key informants. Potential participants were approached by the researcher and her assistant usually in the morning (9-11 am) and evening (5-10 pm) hours, which were found to be the most convenient for the community. Locations such as fishing landing sites, the fishing cooperative building, hotels, restaurants, touristic piers and the municipal centre were chosen as they were the most active parts of the community to recruit the intended participants for the research. The interviews were conducted in a manner that would strive to be the most convenient for the participants. For instance, in the case of the fishers, the research team waited for the fishers to arrive at their landing stations, and then walked along the pier and attempted to reach as many fishers as possible when they were finishing up their workday.

Moreover, the semi-structured interviews and survey in particular targeted key informants who were knowledgeable about the MPA and rapid changes taking place. Table 4.2 and 4.3 relay the details of the semi-structured interview and survey participants, respectively, with the categorization based on the work of Kaplan-Hallam et al., 2017. Because the semi-structured interview results revealed that environmental and social changes were largely characterized by fishing and the tourism industry in the region (described in Chapter 5), the survey largely concentrated on these two groups to attain a richer understanding of potential SERSs in the RLBR. The focus groups were targeted towards a diversity of stakeholders (i.e. housewives, tour guides, fishers and business owners) who could offer a range of insights regarding the reserve, environmental and social changes, and community wellbeing.

4.5 Data Analysis

This section delineates how the data results attained using the methods described above (i.e. semi-structured interviews, surveys and focus groups) was qualitatively analyzed.

4.5.1 Semi-Structured Interview Analysis

Qualitative data coding is defined as “a way of indexing or categorizing the text in order to establish a framework of thematic ideas about it… (it is) how you define what the data you are analysing are about” (Gibbs, 2007). Coding entails the process of labelling and identifying patterns in the data, and the relationships between them, linking it to the research objectives. The concepts that emerge as a result enable the researcher to organize the data so that it can be examined and

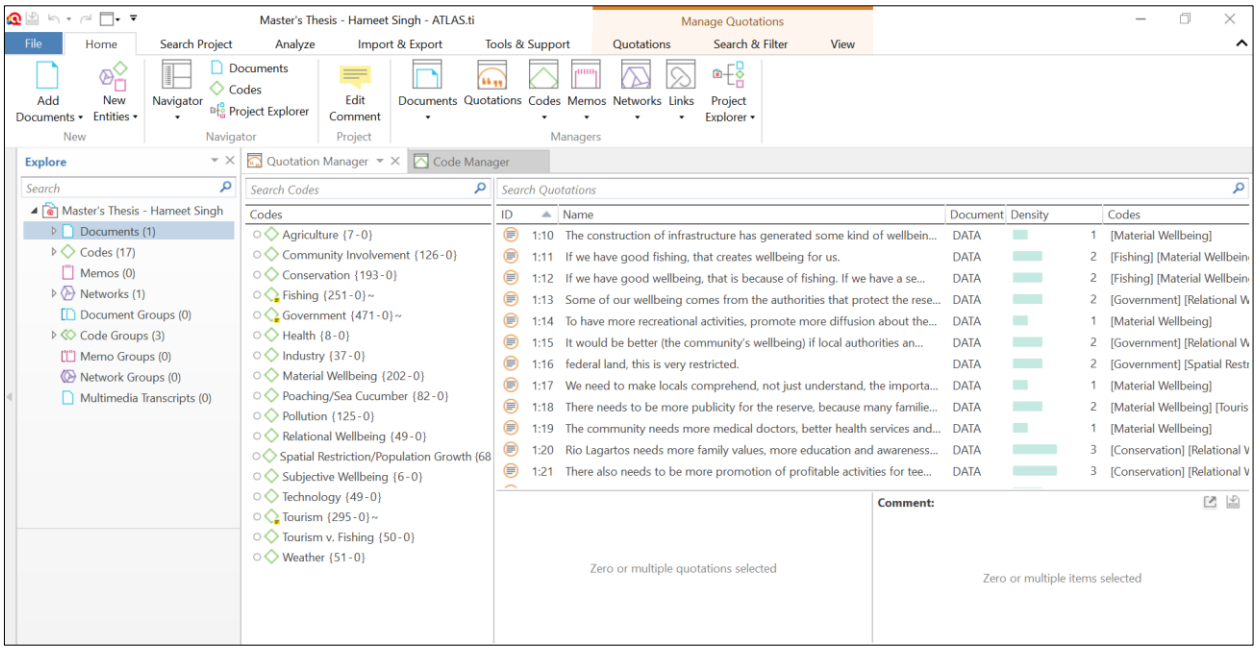

Figure 4.4: A screenshot from the data analysis program ATLAS.ti, used to code the interview transcripts for this research

analyzed in a structured way. It is argued that "in qualitative inquiry, the major strategies for determining reliability occur primarily during coding" (Morse, 2015). The semi-structured interview data first underwent a thematic analysis using qualitative coding with the help of ATLAS.ti data analysis software. ATLAS.ti was chosen as the data management tool for this study because of its organizational prowess to analyze the interview transcripts, intuitive design and simplicity of use. Stage one of the coding process entailed open coding, in which category codes were generated from emerging ideas in the data, relationships between different aspects, and frequent keywords used by respondents as indicators of research themes. Here, the interview data was organized based on the identification of keywords, topics and phrases. An initial set of codes was developed based on the theoretical framework, and supplementary codes emerged from the interview data (Alexander et al., 2017). The final list of codes is depicted in Figure 4.4. Some of these included "Conservation, Fishing and Tourism" to name a few. The literature review served as a foundation for this process. Focused coding was then conducted in stage two, wherein coding categories were eliminated, combined or subdivided (Nyumba et al., 2017). ATLAS.ti served as a digital organizational platform, in which codes and their subsequent quotations constituted its contents. It was beneficial to keep track of the various themes emerging from the research and account for the number of quotes for each code. This allows for thoroughness of the data, which, "implies attention to connection between themes and full development of ideas" (Whittemore et

al., 2001). The relationship between codes was more thoroughly defined and highlighted with respect to the three research objectives and the thesis conceptual framework. Each quotation from the interview transcripts was assigned a code, which sometimes resulted in intersecting codes that overlapped (i.e. “If we have good fishing, that creates wellbeing for us” - associated with the themes “fishing” and material wellbeing”). This interconnection was particularly beneficial for the “network” feature of ATLAS.ti, which, using the interrelations between codes, creates a visual graphic to depict the relationships between different themes. Given the highly intricate nature of SERSs, the drivers that cause them and the changes and impacts that are produced as a result, this feature of ATLAS.ti was especially helpful to highlight the connectivity of SERSs and the wider themes connecting the codes. A graphic created using the network feature of ATLAS.ti is presented at the end of Chapter 5. Finally, Microsoft Excel was also used to quantify the numerical data (i.e. community wellbeing points; types of drivers, changes and impacts experienced) in tables and create graphic charts to visually portray the results, presented in Chapters 5-7.

4.5.2 Focus Group Analysis

The focus group activities were analyzed using the visual outputs that resulted from the sessions, using a similar technique applied to the semi-structured interviews above. It took into account aspects of the sessions such as frequency of comments mentioned, and extensiveness and depth of the issues being discussed. The recurring themes and topics of interest were the relationships between the drivers, changes and impacts of SERSs, the most important community wellbeing components, and how they are being affected as a result of the prior. The ranking and linking exercise of Focus Group Activity 1, in which participants were asked to draw connections between different aspects of SERSs, was evaluated and quantified using Microsoft Excel. Similarly, the results of the frequency of the locations mentioned in the mapping exercise of Focus Group Activity 2 was tallied in Excel to ascertain which were the most common. Focus groups enabled a thorough and more enhanced understanding of the case study and gave an opportunity to examine connections between the different themes that emerged as a result of the interview process in the context of rapid changes and community wellbeing. The results of the focus group activities are presented in Chapter 5 and 6. No direct quotes are used from the focus group activities in later chapters as they mainly served to contextualize the data obtained from the semi-structured interviews.

4.5.3 Survey Analysis

The survey data results were quantitatively analyzed using a Microsoft Excel spreadsheet. Descriptive statistics were attained regarding each dimensions of SERSs (i.e. % of community members that believed a specific environmental or social change was "significant"). The data inputted in the Excel spreadsheet was then used to create visual outputs such as chart, bar and pie graphs. The results of the survey analysis are presented in Chapters 5-7. Conducting the survey confirmed the results from the semi-structured interviews and focus groups through triangulation and created a quantitative element to the analysis.

4.6 Limitations

The limitations of this study arose primarily from its use of largely qualitative techniques. While qualitative methods allow issues such as community engagement to be studied in detail and in-depth, findings did not generate a final statistical numeric of how much better (i.e. exact percentage) an MPA is managed with community involvement. As well, the study's quality is heavily contingent on the individual skillset of the research and is more prone to a researcher's personal bias compared to more quantitative/positivist approaches (Anderson, 2010). The way in which the researcher conducted the recruitment may potentially increase sampling bias as there might have been a tendency to select participants based on their willingness, approachability, and availability, meaning that the study population may not truly represent the community overall. Factors such as the researcher's and translator's personal safeties may also have worked to increase sampling error (i.e. not carrying out interviews in certain areas due to their remoteness or after dark, excluding fishers or tour guides who operated, for instance, nightly crocodile tour excursions). It is clearly evident as well that Río Lagartos community members were vastly overrepresented in the sample due to snowballing sampling and ease of accessibility. Another important concern to note is the language barrier and translation of data results, possibly resulting in data misinterpretation and neglection of cultural cues on part of the researcher. Finally, the selection of a descriptive research design means that there is lack of generalizability of the data results and potential for multiple interpretations of the data (Dulock, 1993).

In addition, the use of the case study approach, viewed through critical epistemological standpoint can lead to neglection of other factors by "focussing only on power relationships and may give the

researcher a position that is too privileged" (Crowe et al., 2011). Case study research has been further criticized for being devoid of scientific precision and offering a poor base for generalization. Its inability to produce results that are transferable or applicable to other contexts is also scrutinized (Merriam, 1988). These concerns are contended in a number of ways, including: theoretical sampling or drawing on a particular conceptual framework; respondent validation by asking participants to verify the accuracy of emerging results; and transparency (Cho and Trent, 2006; Coombs, 2017). Transparency is attained through detailed description of steps involved in

Table 4.4: Limitations of the case study approach

Limitation	**Mitigation/Counter**
Incorrect selection of case, leading to a deficiency of theoretical generalizations applicable to other contexts (Lewis, 2015; Ruddin, 2006)	Development of thorough knowledge, having the potential to contribute to body of literature, validating the selections made (Flyvbjerg, 2006; Simons, 1996)
Collecting large quantities of irrelevant or valueless data, over-saturation of information (Tight, 2010)	Data collection methods align with research objectives, while allowing for flexibility and adaptability to changes (Ruddin, 2006)
Focusing on a question or topic that is too broad or research study with too many research objectives (Baxter and Jack, 2008)	Restrict and place boundaries on the case in question, concentrating on only relevant facets (defined by i.e. time and space, activity and context) and clearly define what is outside the boundaries of the scope (Baxter and Jack, 2008)
Lack of scientific thoroughness, prone to researcher's bias(es) (Hyett et al., 2014)	Data triangulation, participant validation, and transparency during the data collection process, provide thorough methodological descriptions with strong theoretical foundations and frameworks, adding credibility to the study (Hyett et al., 2014)
Ethical concerns (Harland, 2014)	Anonymization and informed consent of participants (Simons, 1996)
Inability to be integrated in a conceptual theory framework (Cavaye, 1996)	Allow for unexpected results to arise and do not coerce results to fit conceptual framework, assess initial findings, and distinctly outline researcher's epistemological stances (Hyett et al., 2014)
Inability to be reproduced over different times and locations (Ruddin, 2006)	Research is context-specific, with little control over the social and ecological conditions that arise, cannot be easily replicated in a different locations as circumstances are always changing and unique to the environment in which they occur (Ruddin, 2006)

selecting the case and data collection, describing why certain methods were selected, the researcher's experience and the extent to which he/she was involved (i.e. how the researcher's presence influenced the data collection). Providing alternative explanations and explaining clearly

how results and findings came about builds the creditability of research that uses the case study method (Feagin et al.,1991). Limitations of the case study approach is summarized in Table 4.4. If used accurately, findings arising from case study research can have significant policy implications for theory development and testing beyond the specific context being studied, and can work to create, reinforce or reject historic accounts of a case (Boblin et al., 2013).

Interviews also pose "some special problems for internal generalizability because the researcher usually is in the presence of the person interviewed only briefly, and must draw inferences from what happened during that brief period to the rest of the informant's life" (Huberman and Miles, 2002). Interviews can therefore miss other aspects of the interviewee's perspectives and easily lead to false inferences about their actions outside of the situations presented during the interview. Response bias is also a factor in the use of semi-structured interviews as a technique and may have occurred unintentionally amongst participants due to the complexities of social interactions being analyzed (Diefenbach, 2008). The researcher's presence in the data collection may have influenced the participants' responses, and participants may have deceived the interviewer or responded in a misleading way (Anderson, 2010). The use of snowball sampling may have worked to aggravate response bias, resulting in participants on how well they know one another. As well, it was made known by a few respondents that the RLBR has garnered a considerable amount of academic attention from a variety of institutions both national and international (University of British Columbia, Instituto Politecnico Nacional, Université Laval, CINVESTAV, University of Waterloo), causing some community members to express their fatigue of being research subjects. One respondent in particular stated that often, students would come to their community, conduct their work and then leave, never to be heard from again. The resultant research would never directly benefit the community. Because of this, some participants may have been reluctant to be fully engaged and give meaningful responses. To limit such response biases, early and broad scoping is key in order to establish trust and build rapport amongst research participants (Bolderston, 2012). This can work to improve participants' inclination to partake in the study. The researcher's initial scoping phase to build rapport and establish a relationship with community members was in attempts to overcome such issues, as well as the execution of the research in various phases to generate feedback of initial results. For instance, the findings of the interviews were relayed at the focus group sessions. It was hoped that this would enhance trust and engagement for the study. Lastly, the researcher noted the contact information of some key

informants in the community and after the final publication of the thesis, she hopes to relay the most important results back to them in a summary information document, translated in Spanish.

Finally, the validity and reliability of a study are two significant factors and points of concern for any qualitative research design. Qualitative research has been repeatedly scrutinized for simply being a series of personal anecdotes prone to bias. If qualitative studies are unable to produce valid and reliable results, "then policies, programs, or predictions based on these studies cannot be relied on" (Huberman and Miles, 2002). As there is "no accepted consensus about the standards by which such research should be judged" (Noble and Smith, 2015), it is therefore difficult to establish scientific rigour. Rigour is noted as being useful to establish a consistent study method and providing a precise portrayal of the population being studied (Coombs, 2017; Creswell and Miller, 2000; Thomas and Magilvy, 2011). Integration of reliability and validity in the research design are contended as important concepts to attaining scientific rigor in qualitative studies (Maxwell, 1992; Morse et al., 2002). A number of strategies have been suggested to counter the defect of validity (the precision to which results reflect data), including having the research recognize personal biases and experiences that may have produced those biases, and that multiple realities exist (Leung, 2015). It is the onus of the investigator to clearly state any study validity threats that he or she may see arising during the data collection stage (Whittemore et al., 2001).

To retain reliability, or the consistency of analytical procedures and data collection methods so that the study can be replicated (Golafshani, 2003), the researcher must make clear the reasons behind his or her decisions, so that similar or comparable results arise if the study is conducted again. Ongoing reflection of methods and detailed record-keeping that establish a clear decision trail will certify that the researcher's understanding of the data is consistent and sensible (Morse, 2015). In this research study, a reflexive journal was maintained which documented perspectives and decisions made during the data collection phase, as well as any challenges and issues that arose. In the reflexive journal, the researcher recognized her positionality with respect to the study (i.e. ethnic background, nationality, race, previous experiences, coming from a position of privilege, earning a place amongst the community, etc), and how this influenced her view on the results, major events that took place during her time in the field, as well as her emotional and mental state. For instance, the researcher, coming from a second generation Canadian-Punjabi and Sikh background, encountered certain obstacles unique to her upbringing and position as a

researcher. Her background, perspectives and identity impacted how she interacted with the community in which she was living and trying to integrate in. Some interviewees referred to her as an "outsider student researcher," without having knowledge of the local languages of "Spanish or Mayan." They spoke about how the community had become oversaturated with being a research subject, visited by student researchers from other countries who rarely followed-up with the community on the results of their investigation. As a result, they may have believed that the researcher was not personally vested in the issues of the community, and she had to acknowledge that this perspective impacted the execution of the research. Moreover, the researcher faced unique hindrances living in Mexican culture as a woman and outsider, including being heckled by male community members after completing interviews and walking home, and sexual comments being made about her appearance during the interviews (told to her after the interviews by the translator). In order to account for and be conscious of these occurrences and how they influenced her work, the researcher was reflexive and kept records of her mental state. Immediately following each semi-structured interview and survey, the researcher wrote in her reflexive journal concerning personal feelings, insights and biases with respect to each experience.

4.7 Ethics

This research project received full ethics clearance from the University of Waterloo Office of Research Ethics under ORE # 23047 on June 04, 2018 (Appendix D). A modification was requested while the researcher was on field to include park rangers as a new group of participants in the study, approved on August 29, 2018.

CHAPTER FIVE: CHARACTERIZING CHANGES OF RÍA LAGARTOS

This chapter describes the analysis and findings for research objective one of the thesis, namely: to characterize the nature of environmental and social changes taking place in the RLBR, represented in the thesis conceptual framework below (Figure 5.1 encircled in red). As previously mentioned, SERSs are defined as "abrupt, long-term and often irreversible changes in social–ecological system structure and function, with possibly considerable adverse impacts for human wellbeing and ecosystem processes" (Nayak and Armitage, 2018). A change needs to meet certain characteristics before it can be construed as a SERS, specifically being sudden, abrupt, dramatic, long-term and difficult to anticipate (Crépin et al., 2012; Hughes et al., 2013). In the following sections, the data collected is analyzed to interpret the environmental and social changes taking place in Ría Lagartos. The need to characterize such changes in the region is significant as they are increasingly posing challenges for managers and resource users alike in the communities, as will be subsequently examined. The chapter will commence by introducing the data results and the nature of changes, their associated drivers and impacts. Then, two case studies, the local sea cucumber fishery and tourism industry are used to highlight the severity of change in the context of Ría Lagartos. Moreover, the six-dimension framework of SERSs, as outlined by Nayak and Armitage, 2018, is used and applied to understand change in Ría Lagartos. Finally, the connectivity between the various drivers, changes and impacts is shown to highlight the issues' complexity.

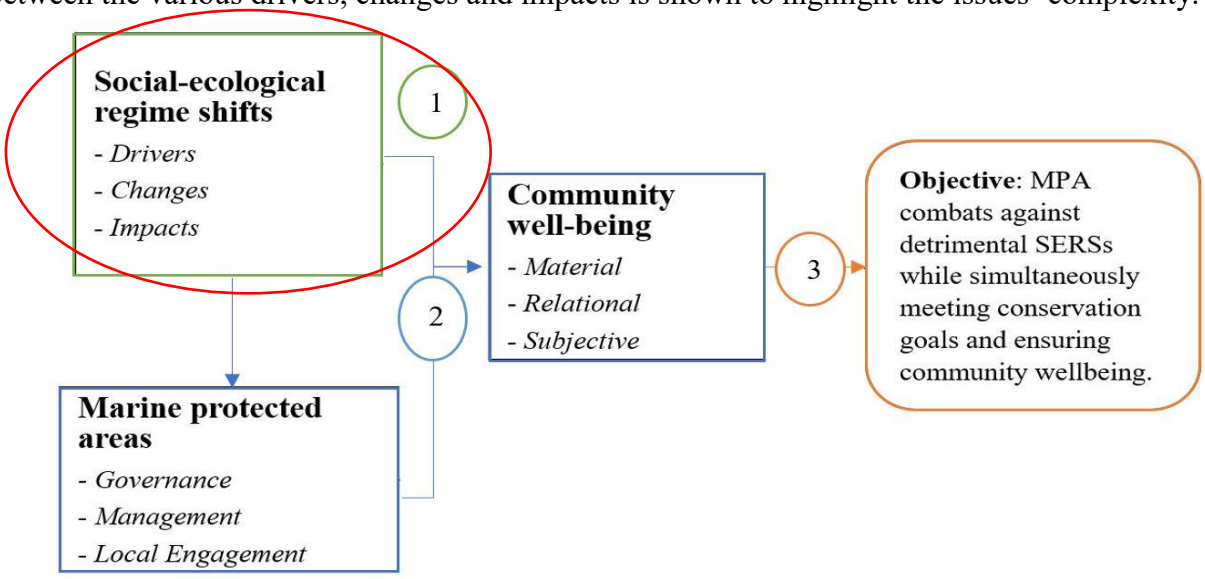

Figure 5.1: The thesis conceptual framework, as it relates to research objective 1

5.1 Data Results – The Nature of Change in the RLBR

The SERS survey sought to determine how community members view the social and environmental changes they have seen occurring (if any) by asking respondents to select a series of characteristics defining the changes. Tables 5.1 and 5.2 depict the results of this survey section, noting the environmental and social changes respectively using the descriptors of the survey. The most notable characteristic used to describe both environmental and social changes is "significant/substantial," with 85% (n=20) of survey respondents agreeing that the changes they have been experiencing are considerable to the point of having long-lasting impact on the community, prescribing to the definition aforementioned. Other traits of interest include: "dramatic" "long-term" "difficult to predict" "came without early warning signs" and "difficult to reverse" in the case of social changes, meeting most of the criteria used to define a SERS. SERSs can pose significant implications in the management of marine resources for unit users and managers (Lade et al, 2013), supported by 40-45% (n=20) of locals.

Table 5.1: Environmental change descriptors

Definition of Environmental Change	**Percentage of Respondents (n=20)**
Sudden/abrupt	15%
Dramatic	60%
Long-term	50%
Significant/substantial	85%
Difficult to predict/anticipate	60%
Came without early warning signs	60%
Difficult to reverse	25%
Pose significant challenge to local fisher communities, managers, others	45%

Table 5.2: Social change descriptors

Definition of Social Change	**Percentage of Respondents (n=20)**
Sudden/abrupt	35%
Dramatic	50%
Long-term	65%
Significant/substantial	85%
Difficult to predict/anticipate	55%
Came without early warning signs	55%
Difficult to reverse	55%
Pose significant challenge to local fisher communities, managers, others	40%

A SERS is also bounded and delineated by time and space. When asked about the duration of the changes in the interview questionnaire (Table 5.3), all respondents described them in terms of years, with most stating that the changes occurred within 1-5 years (44%, n=45) *.

Table 5.3: Temporal duration of change

Duration	**Percentage of Respondents (n=45)**
1-5 years ago	44%
6-10 years ago	16%
11-15 years ago	11%
16-20 years ago	7%
Over 20 years ago	22%

n=20 survey respondents; n=45 interview respondents

When asked whether the changes they identified (if any) have a local (Río Lagartos Municipality), regional (Yucatán state) or national (Mexico) impact (Table 5.4), majority of respondents agree that the changes they are experiencing are common in "the [Yucatán] peninsula and all ports" (Fisher). 44% (n=45) confined the impacts of change to the local level, while no one stated that they were a country-wide phenomenon.

Table 5.4: Spatial extent of change

Extent of Impacts	**Percentage of Respondents (n=45)**
Local	44%
Regional	56%
National	0%

The above noted descriptors are beneficial for determining the level and scale at which to implement interventions. They are important to note as SERS transcend various temporal and spatial boundaries and occur at various scales (Cumming et al., 2006). SERSs vary across time and space, making their predictability difficult (Biggs et al., 2009). As such, the policies and institutions to address them must be made accordingly (Folke, 2007), and determining when and where to intervene can work to avoid ecosystem tipping points (Selkoe et al., 2015). The success of management measures is largely dependent on having system dynamics aligning with the temporal and spatial characterises of the SES (Mollmann et al., 2015). A mismatch in scales of management and SES processes can result in superfluous or insufficient resources and time being spent to address changes (Armitage et al., 2015; Cumming et al., 2006). Since it is known that changes are largely occurring within 1-5 years at a regional level, they can be mitigated against

"at the landscape or municipality level" (Rocha et al., 2015). The types of changes taking place in the RLBR will be discussed below.

In addition to the temporal and spatial characteristics, deducing the connectivity between the causes and consequences of changes can also help to determine appropriate management tactics. A SERS has certain drivers that cause the changes and push the SES from one state to another, resulting in associated impacts (Nayak et al., 2016). The drivers causing the changes in Ría Lagartos and their subsequent impacts are explored below. As parts of the semi-structured interview questionnaire and the SERS survey sought to collect similar data, the results were combined for the purposes of this section, resulting in a data population of n=65. Terminology of the drivers, changes and impacts was obtained from the Regime Shifts Database, which provides case studies of different SERSs, focusing specifically on those having lasting impact on ecosystems and human wellbeing (Biggs et al., 2015).

5.1.1 Drivers of Change in the RLBR

The drivers of SERSs can occur within multi-level contexts, interacting to degrade ecosystem health and community wellbeing. The changes occurring as a result of such drivers (i.e. fisheries decline, etc) will be discussed below. Drivers can either be ecological or social in nature (Nayak and Berkes, 2014; Geist and Lambin, 2002), and result in negative or positive change (Nayak, 2014). Identifying the drivers and understanding their nature can work to anticipate the course they

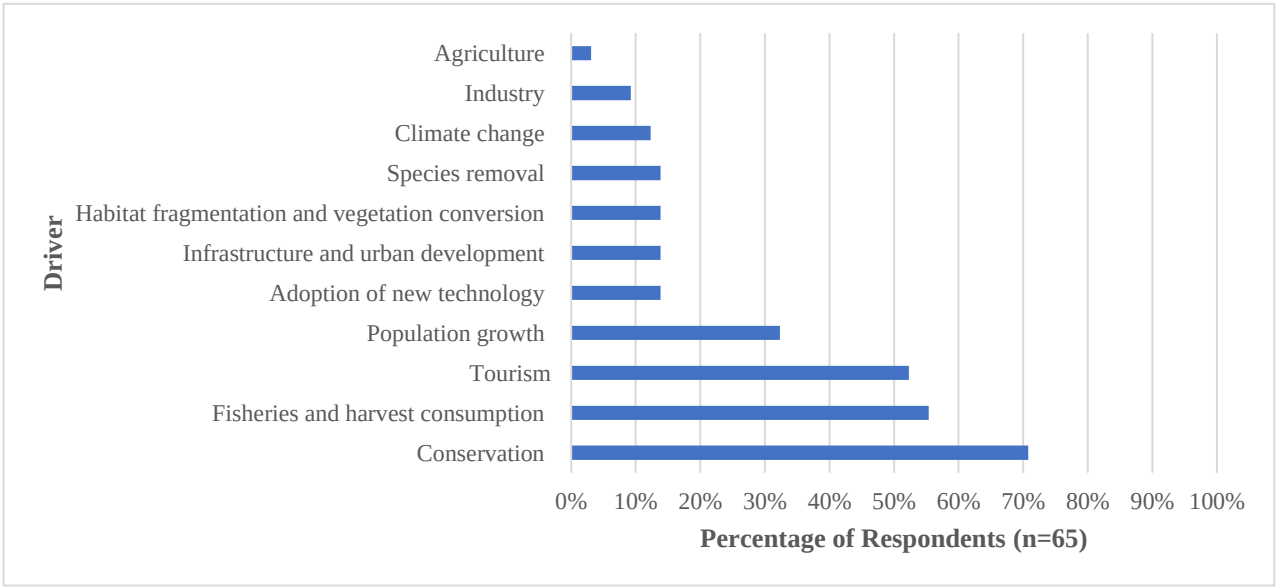

Figure 5.2: Drivers of environmental and social change, as identified by respondents

will take and when changes become immune to intervention, an important management and policy factor. Figure 5.2 depicts the drivers identified by respondents during the data collection. Table 5.5 contextualizes each listed driver with a perspective from locals of Ría Lagartos. The most frequent drivers cited are conservation (71% or 46 of 65), followed by fisheries and harvest consumption (55% or 36 of 65), and tourism (52% or 34 of 65). Conservation is defined as a land use driver, delineated in the Regime Shifts Database. For the purposes of this study, it is described as the implementation and existence of the RLBR. Locals have noted other more significant exacerbations in their community dynamics. They are examined in the subsequent sections below.

Table 5.5: Drivers of change, as understood by local peoples of Ría Lagartos

Driver	**Sample Quote**
Conservation	Many flamingos' nests have been recovered if we compare how it was some years back, people have realized this species is highly attractive, so they protect it more (Tour Guide 14, July 2018).
Fisheries and harvest consumption	Fishers from Río have always taken care of their marine products, so they are quite disappointed from the impacts by poachers of sea cucumber. I think the arrival of poachers is the result of organized crime (Hotel Manager 4, June 2018).
Tourism	There is the possibility that our place becomes as touristic as Cancun, this brings changes in social organization and insecurity. This change impacts all of us (Hotel Manager 7, June 2018).
Population growth	There is more population now, the number of boats has doubled, fishing production has decreased (Fisher 20, July 2018).
Adoption of new technology	I think the use of technology in fishing has contributed to the decrease of wellbeing in our community. The use of GPS endorses the overexploiting of species (Fisher 23, July 2018).
Infrastructure and urban development	Some people want parts of the reserve built up, even mangrove areas, to serve as touristic spots (Hotel Worker, 13, July 2018).
Habitat fragmentation and vegetation growth	There is the destruction of habitat of animals, like birds, who have to find other places to be (Restaurant Worker 7, June 2018).
Species removal	Sometimes there are still poachers around that take flamingos and turtles (Housewife 7, June 2018).
Climate change	Now there's more heat, that's the consequence and climate change makes it worse (Retired Fisher 2, June 2018).
Industry	There has been increased waste flow to waters of the Ría from the salt company since 3-5 years ago and therefore greater fish morality (Hotel Worker 9, June 2018).
Agriculture	There is more drought and rain – because of "quemas" (controlled burns) – is a way of agriculture, remains of crops are burned, and the ashes help the next generation of crops (Hotel Worker 3, June 2018).

5.1.1.1 Population Growth and Spatial Restriction

The population of Yucatán state as a whole is steadily increasing, with models predicting a rise from 1.4 million in 1990 to 3.8 million in 2030 (Lutz et al., 2000). Population growth was cited as a factor in the increasing competition amongst fishers and fisher-tour guides, having various social-ecological impacts:

> There are much more people in Río now. Our town used to be very small, there were only 3 streets when I came here (Retired Fisher 22, July 2018).

> People have taken over the reserve, they are taking space of wetlands, this didn't happen before because population increase wasn't an issue (Tour Guide 6, June 2018).

A rising population, coupled with the restrictions put on community land because of the reserve, has left many community members frustrated. The reserve has limited the use of mangrove wood as a resource (i.e. for building materials, as wood fuel, etc). Furthermore, as the community is surrounded by reserve lands, its urban development has been constrained spatially (Kaplan-Hallam et al., 2017). This caused many community members, most notably young adults, to express their discontent:

> There's more population nowadays and there's no space to grow because most surrounding areas are mangroves, therefore, are protected areas. Many young couples have to stay in their parents' homes because they can't find a place to go (Mayor 2, July 2018).

> There is no space for young couples, our community doesn't have urban development because our surroundings are territory of the reserve now (Landlord 1, July 2018).

> With the presence of the reserve, there's barely any free land left to build, and those lands that are still free have now a much higher cost. Most land within the reserve is considered federal land, non-buildable (Tour Guide 8, June 2018).

The restriction has caused some social and cultural impacts in the form of outmigration, as youth with little choice have left behind their families and traditional livelihoods such as fishing in search of houses elsewhere, "Our community has a tendency of slow urban growth, because we are surrounded by the limits of the reserve. Many young people left Río" (Tour Guide and Restaurant Owner). Such an event has wide-ranging repercussions on social wellbeing, family and community dynamics of those that are left behind, particularly older adults (Guo et al., 2009).

5.1.1.2 Industrialization

Salt production is an important economic activity carried out in the communities of Ría Lagartos (Lutz et al., 2000), particularly for Las Coloradas where "around 60% of community members are employed by the salt company" (Tour Guide). In this town, the company "Industria Salinera de Yucatán S.A. de C.V. (ISYSA) has its operation of primary production of salt by solar evaporation" (Ortiz-Milan, 2013). This facility is considered to be one of the important salt productions in southeast Mexico, forming in the 1970s (Smardon, 2009), and reaching an annual production of 500,000 tons (Alejandro et al., 2014). Despite the economic benefits it generates for the community, some are concerned that its operations are having an increasingly negative impact on fishing production and the ecology of the reserve:

> The salt company in Las Coloradas is damaging the flamingo nests, this company is damaging the reserve. They use chemicals as part of their work for salt processes, but this damages the reserve, specifically the nesting spots of the flamingoes. It also impacts fishing (Retired Fisher 21, July 2018).

> Some fish that swim close to the salt company waste pipes get killed because the filtered water has a very different pH level (Tour Guide 5, June 2018).

Previous studies have noted the salt production impacts on flamingos, who "have specialized habitat requirements wherein they occupy shallow lakes that usually are of high salinity" (Baldassarre and Arengo, 2000). An increased demand for salt by the "large, mechanized, high-volume production" company has altered the habitat occupied by these sensitive and economically important species. Some participants point to the previously identified loophole in legislation that enables such operations on reserve land, "The salt company is allowed to take land of the reserve, authorities allow this because the salt company gets a "concession," they pay some documents and are thus authorized by law to remain there" (Fisher 8, June 2018). It has been shown that the operation greatly impacts water quality, hydrology and fisheries habitat, with the solar extraction process of salt production requiring large areas of the lagoon to be dammed off into shallow pans, often resulting in breaches that pump contaminated water into the lagoon (Smardon, 2009). The operations are built in areas where prime nest sites are located, forcing species such as flamingos, roseate spoonbills, egrets and cormorants to less desirable sites. In addition, heavy industrial equipment that is used to haul the salt further disturbs the nesting and feeding of birds. Smardon, 2009, found that most of the original breeding sites have been lost due to the salt company.

Another form of industrial activity that was identified concerned the construction of wind turbines near reserve lands. Wind power promises to be an "environmental friendly energy source" for Mexico in the coming years (Soler-Bientz, 2011). Studies on wind power generation potentiality have indicated that the Yucatán is an ideal spot for the development of turbines, with multiannual wind speeds of 3–5 m/s and estimates of 4050-6500 useful hours of wind per year, generating 15,000 kW of power annually (Hernández-Escobedo et al. 2010). Coastal areas in particular show greater potential for wind resources, with wind speeds over 6 m/s (Soler-Bientz, 2011). However, the turbines used to generate energy can create significant challenges for wildlife, particularly posing hazards for migratory birds (Kuvlesky et al., 2007). As noted in Chapter 3, the Yucatán peninsula is a hub for migrating birds from Canada and the United States, who follow long and complex routes to reach their wintering grounds (Deppe and Rotenberry, 2008). Collisions with wind turbines (Hüppop et al., 2006) and habitat destruction (Kuvlesky et al., 2007) have been increasingly noted as causes of avian morality in the Yucatán. Such changes and impacts were acknowledged in the interviews:

> Mangroves are destroyed by the construction of windmills, built close to the reserve (Tour Guide 6, June 2018).
>
> Windmills have now been installed in the entry of Río Lagartos inside ranch areas, but this is hurting bird species because many of them crash with it and die (Retired Fishers 20, July 2018).
>
> Flamingos arrival this year was delayed because of the windmills, they were supposed to start coming February. We had some complaints from tourists because they were not spotting flamingos on months you'd normally would. I get windmills are a source of clean energy, they are, but they can be installed in other areas that are not migratory routes, such as Dzilam or Isla Mujeres (Tour Guide 2, June 2018).
>
> There are windmills being constructed close to a road, around 5 km close to the reserve. I think these windmills are going to be installed the way it was done in Dzilam (that's 50-60 km away from our reserve). However, I think these windmills will have consequences because they are placed in a migratory route for birds. I think flamingos arrival was delayed by one month because of the windmills (Tour Guide 1, June 2018).

5.1.1.3 Agriculture

The communities of Ría Lagartos fall under the cattle-producing social-ecological region of Yucatán, as defined by Lutz et al., 2000. The economy of the region relied on timber, traditional maize and cattle production during the 19th-mid 20th century. While Ría Lagartos today is largely

characterized by fishing, tourism and salt production activities, agriculture and cattle-rearing still remain an important part of the region's economy. Cattle ranching composes most of the land south of the RLBR, and as of 1995, 7,000 ha of land had been cleared for this purpose in the region. It employs 4% and 2.7% of the economically active populations of Río Lagartos and San Felipe respectively (Smardon, 2009). Some interview respondents indicated that agricultural activities on the peripheries of reserve land have impacted the ecology of the region, particularly the use of the "controlled burn" technique by ranchers. As a respondent explains, "Ranchers sometimes burn their used crop lands. It is common to burn remaining bushes and plants so that ashes would help the growth of next generation of seedlings/crops" (Fishing Cooperative Worker 2, July 2018). Past studies have shown that the use of controlled burns results in degraded soil quality, increased run-off to surrounding water bodies and a decline in carbon stock (Uhl, 1987). Increased pollution from the use of agricultural pesticides can additionally impact water quality, especially in the case of the RLBR as the lagoon is a closed ecological system (Smardon, 2009). In addition, there are concerns that reserve lands are being deforested and soil eroded for agricultural purposes, "There is deforestation of areas inside the reserve to make space for cattle" (Hotel Worker 3, June 2018). Land clearing for agriculture has resulted in the destruction of large quantities of the reserve's densely forested wildlife habitat in the past, forcing wildlife to compete for dwindling, less desirable habitat and resulting in long-term reduction in the diversity of flora and fauna (Smardon, 2009). Vegetation removal can also impact the protective filter-life buffer keeping excessive nutrients and particulate matter from entering the lagoon and increase erosion levels, destabilizing the shoreline.

5.1.1.4 Climate Change

Many interviewees reported increasingly irregular rainfall patterns, "There have been changes in weather patterns such as more rain since 2 years ago" (Hotel Worker 9, July 2018). Such occurrences are potentially linked to climate change in the Yucatán peninsula (Lutz et al., 2000). Climate change is known to have a myriad of impacts on coastal communities, such as increased hurricane activity, with the recent incidences of Hurricanes Gilbert and Isidore (Batllori and Febles, 2007) in the region, decreased fisher livelihoods, and degraded community security. Hurricane damage, critical towards mangroves at wind speeds exceeding 144 km/h (Adame et al., 2013), has been known to cause breaches in the barrier peninsula and strip mangrove forests of their vegetative protection. Hurricane Gilbert, with windspeeds of 315-335 km/h, was the most

powerful storm of the twentieth century in the Yucatán, striking in 1988 and devastating Ría Lagartos. It resulted in heavy structural damage, destroyed most of the salt processing plant, and eliminated food sources and nesting sites for flamingos and other species (Savage, 1993; Smardon, 2009). Moreover, Hurricane Isidore made landfall in Yucatán in 2002 at speeds exceeding 160 km/h, leaving 300,000 people homeless (The Associated Press, 2002). Hurricane Isidore has been particularly mentioned numerous times during interviews with local peoples as considerably impacting the town of Río Lagartos, "In 2002, we had a great loss of mangroves as a result of Hurricane Isidore. A lot of animals species were impacted because of that hurricane" (Tour Guide 3, June 2018).

5.1.2 Social-Ecological Changes in the RLBR

Depending on the quantity and severity of the associated drivers to inflict the changes, the state and nature of an SES may fundamentally be altered to the degree that it cannot be reverted back to its previous form. These changes may cause reorganizations of the SES structure and have consequences for human wellbeing. Figure 5.3 visualizes the most common changes as identified by locals of Ría Lagartos, almost equally split between socio-economic changes (31% or 20 of 65) and fisheries collapse (28% or 18 of 65), followed closely by marine food web changes (23% or 15 of 65) and governance changes (18% or 12 of 65). Such alterations can have a multitude of social, economic and environmental impacts on community dynamics, as explored in the following section. The details and contextualization of each change will be explored in depth using case studies later in the chapter.

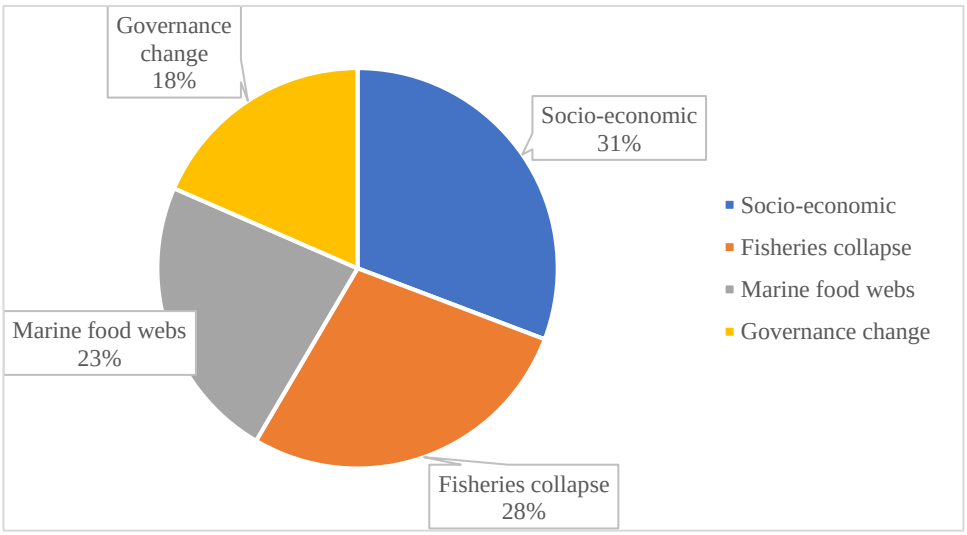

Figure 5.3: Environmental and social changes, as identified by respondents

5.1.3 Impacts of Change in the RLBR

The impacts of social and ecological changes are wide ranging and often severe in nature. Changes may lead to SERSs, driving coupled human-environment systems into a highly degraded state that is difficult to reverse, and impacting their biodiversity, ecosystem services and human wellbeing at regional to global scales (Leadley et al., 2014). Accounting for the SES linkages may highlight potential solutions to the challenges such changes are posing for SSF management. Figure 5.4

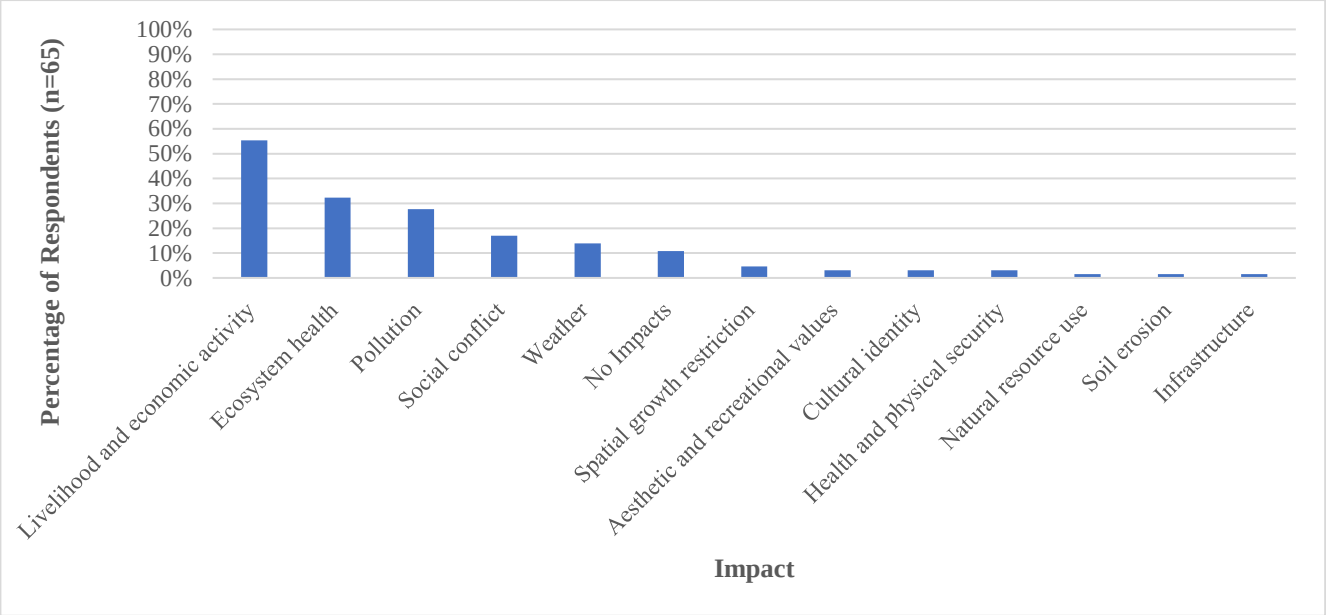

Figure 5.4: Impacts of environmental and social change, as identified by respondents

relays the results of the data collection for impacts of change in Ría Lagartos, denoting that locals perceive livelihood and economic activity impacts to be the most devastating (55% or 36 of 65), followed by ecosystem health (32% or 21 of 65) and pollution (28% or 18 of 65). Table 5.6 describes the impacts listed as they are viewed from the perspective of community members in the RLBR. They are analyzed in greater depth in the section below, using the case studies of the sea cucumber fishery and tourism as examples. As will be explored, overexploitation of the sea cucumber has had wide ranging social, ecological, economic and cultural implications for the communities of Ría Lagartos. Similarly, the surge in tourists has resulted in both human-related and ecological impacts, disturbing important species, limiting breeding and feeding times, increasing resource demands and straining water usage (Smardon, 2009). The two case studies reveal the wide extent and degree of impact abrupt and long-term social and environmental changes can have on coupled SESs such as those characterizing the RLBR.

Table 5.6: Impacts of change, as understood by local peoples of Ría Lagartos

Impact	Sample Quote
Livelihood and economic activity	Tourism has increased, and this has created income alternatives to the community (Retired Fisher 17, June 2018).
Ecosystem health	The fishing of sea cucumber has decreased the stock of other species (Retired Fisher 3, June 2018).
Pollution	There is more pollution of the water, air and soil because of tourism (Hotel Worker 13, July 2018).
Social conflict	The fishing of sea cucumber has generated a lot of conflict (Housewife 4, June 2018).
Weather	There is a change in the weather because of "quemas" - controlled burns (Hotel Worker 14, June 2018).
Spatial growth restriction	Our community can't grow or develop spatially because we are surrounded by the reserve (Housewife 10, July 2018).
Aesthetic and recreational values	Increased trash impacts the beauty of our community (Housewife 7, July 2018).
Cultural identity	The decrease in marine species has impacted our culture as a fishing community (Fisher 15, July 2018).
Health and physical security	Increase in hurricanes has destroyed some of the houses in the community (Fisher 22, July 2018).
Natural resource use	People can't use wood from mangroves anymore because of the reserve, unless they have a permit, otherwise they get a sanction (Housewife 6, June 2018).
Soil erosion	We're seeing more erosion of soil inside the Ría, its more noticeable in surrounding lands, due to cattle grazing (Park Ranger 2, August 2018).
Infrastructure	Flooding damages infrastructure, some people are more impacted than others, people with houses that are not well constructed (Hotel Worker 9, July 2018).

5.2 Case Study Overview

SERSs arise in cases where the interacting drivers, the changes they cause, and the ensuing impacts are significant enough that they have lasting implications for ecosystem viability and community wellbeing. This section will explore the drivers, changes associated with two key areas of concern: the sea cucumber fishery, and the implications of tourism.

5.2.1 The Sea Cucumber Fishery – Strain by Asian Demand: Violent Conflict, Health Implications and Ecological Destruction

Problems concerning fisheries are prevalent all over the world, with many coastal communities facing dilemmas of fisheries collapse, income generation, and the difficulty of sustaining fishing

livelihoods (Salas et al., 2007). More than half of the world's finfish fisheries are at their maximum sustainable limit, and another 28% are overexploited, depleted or recovering (Purcell et al., 2013). Decline of Mexican fish catches in particular have been exacerbated by a deterioration of habitat, water and plastic pollution, hurricane impacts, red tides, increased fishing pressure and poor governance mechanisms (Salas et al., 2015). They have brought concerns to those dependent on fishing, reflected in the responses of the interviews, "Impact on fishing has been severe. Fishers are now in crisis and fishing production is really bad. Fishing is so low that some days, they do not have enough money to pay for their gas" (Housewife 7, July 2018). In the case of red tides (algal blooms), fishing operations are often reduced as fish die or move away during the phenomenon, which reduces catch (Salas et al., 2011). Red tides have been cited as a cause of distress for fishers in Ría Lagartos, "Fishing production has decreased, since the last 2 years. Red tides presence impacts fishing a lot, we usually have one once every 3 years" (Fisher 12, July 2018). Stress on the fishery is further aggravated and driven by the arrival of newcomers in the community, who temporarily or permanently add pressure to already strained resources, "With every year, there are more fishers. For octopus season, some people from Campeche, Tabasco and Veracruz (neighbouring states) come to fish it…there's definitely a decrease in fishing, we have too many fishers now so the production decreases" (Fisher 21, July 2018). The resultant consequences are threatened livelihoods and local conflict, increasing the vulnerability of the coastal community.

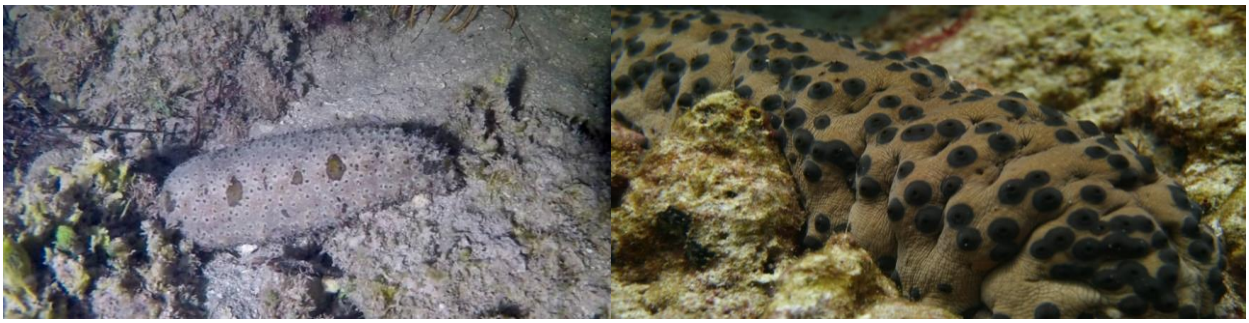

Figure 5.5: Isostichopus badionotus - three-rowed sea cucumber and holothuria floridana - florida sea cucumber (IUCN Red List, 2018)

The attraction of the sea cucumber fishery in particular has brought a slew of outsiders and poachers to the communities of Ría Lagartos. The sea cucumber is a marine invertebrate whose exploitation in a fisheries context has been driven worldwide primarily by Chinese demand (Purcell et al., 2013). Globally, over 70 species of sea cucumber are commonly exploited (Purcell et al., 2018), 58% of fisheries being overexploited and are active in at least 70 countries, with

majority (66%) of them involving SSF operations. Since the mid 20th century, worldwide catch has increased over 13-fold, from 2,300 mt to 30,500 mt (Bennett and Basurto, 2018). 27% of sea cucumber fisheries operate illegally, that is, being harvested outside of the official season or during moratoria (Purcell et al., 2018), as is often the case in the Yucatán. The two commonly fished species of sea cucumber in this region are *isostichopus badionotus*, or the three-rowed sea cucumber and *holothuria floridana*, or the Florida sea cucumber, a seen in Figure 5.5, with the prior being one of the most highly commercial species in the Caribbean region (Food and Agriculture Organization of the United Nations, 2008). Although sea cucumbers have been caught illegally in the Yucatán since the early 2000s, the commercial fishery began in 2012 (Hernández Flores et al., 2015). To harvest and establish sea cucumber for commercialization into export markets, the National Fisheries Commission (CONAPESCA) allowed harvest of *isostichopus badionotus* and *holothuria floridana*, under fishery development permits to determine the commercial and ecological viability of the species (Bennett and Basurto, 2018). This allowed for 215-303 initial fishing vessels to harvest 1280-1773.6 mt of sea cucumber, with the discovery of un-fished stocks allowing the Yucatán fishery to quickly overtake the Pacific sea cucumber fisheries. Both species of sea cucumber were incorporated into the Mexican National Fisheries Chart shortly after, detailing information concerning species abundance, fishing fleet and regulations, and the first commercial fishing permits were issued in April-May 2013, November-December 2013, and February-April 2014. 140-569 fishing vessels were permitted a total harvest of no more than 1171 mt (Bennett and Basurto, 2018). In Río Lagartos, the first commercial sea cucumber permits were issued in the spring of 2013 (Kaplan-Hallam et al., 2017).

However, market pressures from Asia have driven an increasingly illegal overexploitation of the fishery, threatening SSF livelihoods. The lucrative sea cucumber trade in Ría Lagartos has brought outsiders and poachers from neighbouring Mexican states, often at the social, economic and ecological expense of the community. Changes in regard to sea cucumber have received significant attention in the interview transcripts. Many of the respondents in the interviews declared their plight and discontent at the hands of illegal poachers from outside states targeting sea cucumber:

> Fishing of sea cucumber started 5 years ago and ever since then it has only created problems and it has decreased a number of other fishing products…Many foreign fishers came here and took everything. They were from Celestun, Progresso, Veracruz and Campeche (Housewife 16, July 2018).

The lucrative profit to be made from the sea cucumber has driven its overfishing. In the region, sea cucumber is often referred to as "oro negro," or "black gold," due to its high value. Sea cucumber prices range between $28-$50/kg MXN ($2-$3.70/kg USD) for fresh product, and $270-$370/kg MXN ($20-$26/kg USD) for dried product (Bennet and Basurto, 2018). This translates to significant earnings, with daily landing records from fishing cooperatives averaging totals of $6037.85-$9698.80 MXN ($459-$737 USD) per fishing vessel during sea cucumber season. Product sold to external buyers can range even higher, with one interview respondent stating that, "1 kg of processed sea cucumber (boiled, dehydrated and salted) is worth $1300/kg USD, and to get 1 kg of processed sea cucumber you need 20 kg of raw product" (Fisher 13, July 2018). Such profitability has driven a "boom-and-bust" dynamic, whereby the sea cucumber fishery is "declining nearly as quickly as they expanded." In their study of the serial exploitation of global sea cucumber fisheries, Anderson et al., 2011, depicted the quick boom-and-bust trends of 23 large sea cucumber fisheries. The responses of the community members align with this "gold rush" scenario, with them stating that:

> Sea cucumber fishing season is only open for 15 days per year. This year, I only went 3 days to look for it, but we found nothing. It wasn't worth it or profitable to keep looking for the rest of the open season. It's gone now because people from Dzilam and Celestun have already fished the sea cucumber before the season opened (Fisher 2, June 2018).

Responses like these indicate that the community members themselves were the least likely to have profited from the surge in demand and rapid onset, with outside fishers forcibly taking most of the benefits. The product is largely destined for Asian markets, with Hong Kong being cited as

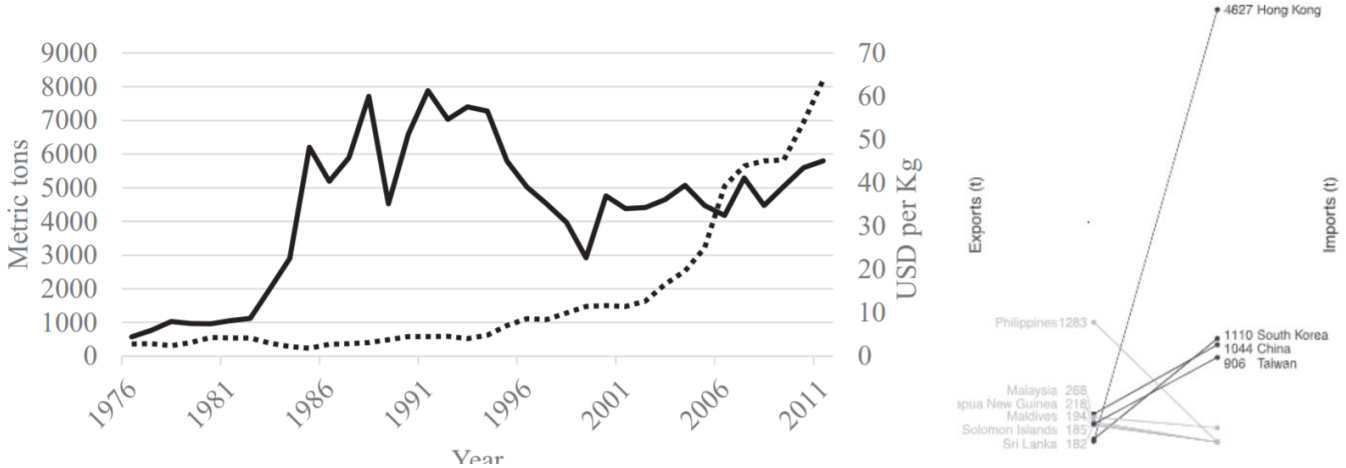

Figure 5.6: Hong Kong sea cucumber imports throughout the years based on volume and price (Bennett and Basurto, 2018); bump chart of sea cucumber exports and imports in 2006. Only countries with greater than 150 t of product shown (Anderson et al., 2011)

the largest importer of sea cucumber, reporting almost 6000 mt in 2011 (Bennett and Basurto, 2018; Figure 5.6), where it is then mainly re-exported to mainland China (Purcell, 2014). In 2006, Hong Kong was responsible for 58% of global sea cucumber imports (substantially from Latin America), with the remaining majority being shipped to nearby Asian countries. These numbers may still be understated, as Anderson et al., 2011, have found that in many Asian countries, there is often pressure to underreport catches for tax evasion purposes, and some countries report sea cucumber catch under combined categories of 'benthic invertebrates' (China reported sea cucumber as 'other' until 2001).

In China, sea cucumber is considered a luxury food, rooted in historical, cultural and social drivers. Consumption is not only concerning the acts of purchasing and consuming the product, but placed in a broader social context, and that there is a "inseparability of the material and social processes involved" (Fabinyi, 2012). The consumption of sea cucumber has been long enjoyed in China, dating back to times of royalty, equating it to a high-status, socio-economic symbol of wealth (Eriksson et al., 2015). With the opening up of the Chinese economy in the 1980s and 90s, a "victory of man over nature" mentality, and an increasingly affluent middle class, the consumption of luxury seafood such as sea cucumber rose (Purcell et al., 2018). Sea cucumber has been included in many traditional Chinese medicines, with "wild foods" (i.e. freshly caught) being preferred over farmed product due to their perceived empowering form, and "unpolluted," "pure" and "special" nature (Fabinyi, 2012). This is why despite the presence of sea cucumber farming in China, wild caught product is still in high demand (Anderson et al., 2011). The taste preferences in consumption of luxury foods such as sea cucumber are used as a tool and linked with class identity, a common delicacy featured at Chinese weddings and banquets, where they are a display of the host's social status and a way to gain prestige, marking the host in the rich, elite class, out from lower classes (Fabinyi, 2012). It is evident that the consumption of sea cucumber in China is driven and embedded in a complex and intricate social, economic, cultural and historic nexus, where it is used as an "expression of economic power and status attainment."

Notwithstanding, it has been argued that, "for many coastal communities…China's seemingly insatiable demand for luxury seafood products has driven increasing exploitation of wild stocks at a global scale" (Purcell et al., 2018). Fabinyi, 2012, also contends that "Chinese consumption patterns have evidently had significant effects on seafood source populations." In Río Lagartos,

sea cucumber catches dropped to 150-300 kg in 2014 from 400-500 kg in the previous year (Bennet and Basurto, 2018). As the species have declined in oceans around China, the exploitation has shifted to distant regions. Because sources are now found mostly outside of China, rising levels of consumption is having a significant impact on ecosystems and livelihoods where they are derived. In their geographic study of sea cucumber fisheries in relation to distance from the main importing nation, Hong Kong, Anderson et al., 2011, found that sea cucumber sourcing networks are located increasingly further away from Hong Kong. Sea cucumber fisheries catering to Chinese markets have expanded to over 90% of global tropical coastlines (Eriksson et al., 2015). This speaks to the profound impact that globalization has as a driver of environmental and social change, as modern trade networks have become increasingly efficient, creating a platform in which almost any global stock of sea cucumber is within the reach of Asian markets (Bennett and Basurto, 2018). Eriksson et al., 2015, liken the commercial sea cucumber trade for the Chinese market to "contagious resource exploitation – a fast-moving system resembling a disease epidemic." While sustainability issues concerning other luxury seafood such as shark fin soup have benefitted from high-profile attention and campaigning at the international level, the same level of attention has yet to be directed to the sea cucumber (Fabinyi, 2012). Kaplan-Hallman et al., 2017, depict the global sea cucumber trade as a rapid social driver of change. Demand is so strong that it has overwhelmed local conservation efforts where governance capacity is already scant, resulting in unprecedented stock decline.

Such is the case in Río Lagartos, where rising rates of illegal poaching by "roving bandits" or mobile agents (Berkes et al., 2006) have exhausted the local fishing cooperatives' capacity to respond in an effective manner (Kaplan-Hallam et al., 2017), establishing the fishery as too unsustainable and rapid for effective management responses. The arrival of outsiders targeting the sea cucumber has brought conflict and violence to the fishing communities of Ría Lagartos. Territorial conflicts amongst resource users and between fishers and government authorities have been recurrent, with newspapers frequenting headlines such as "War of the sea cucumber fishers: Fishers detained, boats burned, and roadways blocked" (Bennett and Basurto, 2018).

Illegal fishing and social conflict reports were common in the interview transcripts, describing poachers as having no incentive to follow rules designed to protect local stocks:

> Sea cucumber is fished "underground" in Campeche and Quintana Roo. People from these states come to Río Lagartos by boats and catch the sea cucumber, it's a very conflictive issue and has generated many conflicts. People from Progresso and Dzilam overexploit the marine life, sometimes they even fish at night so they can avoid getting seen by the authorities. These outsiders fish all year, even during the fishing ban months of sea cucumber (Fisher 4, June 2018).

Some respondents accused corruption by government at all levels, stating that the poachers were assisted by authorities, resulting in sometimes armed conflicts:

> The roads were closed because of foreigners, blocked communication, and were helped by the authorities (Hotel Manager 8, July 2018).

> They come from Campeche and Tabasco and fish all marine resources; some people say poachers are brought by politicians. San Felipe and Río Fishers have joined and had operations against poachers, but poachers were highly equipped, had guns. Foreign poachers have a lot of supplies, better boats, which can go further into the ocean than locals. I know poachers from Campeche arriving here with 2 engines more powerful than our boats, these poachers are spotted extracting sea cucumber throughout the year (Marine Captain Secretary 1, August 2018).

> A person lost his arm because of conflict, this happened about 2-3 years ago. It's a social issue, generated by poachers. There has been conflict and violence, burning of boats, here and in all of Yucatán, very severe, we must act against it (Hotel Manager 11, July 2018).

This has been reinforced by previous studies as well, with Kaplan-Hallman et al., 2017, stating that the participants of their study done in the region also pointed to corruption in the state government supporting illegal sea cucumber harvesting. Poachers were described as "mafia" to "reflect an association with drug traffickers and are seen as having influence over (or being in partnership with) corrupt authorities and decision makers − those also responsible for enforcement." Others have complained about thefts at the hands of outsiders, with one fisherman lamenting that, "Not long ago during a long fishing season someone stole one of my boat engines, that's worth around $130,000 MXN (about $6700 USD)," indicating disruptions in security of property.

Previous studies in the Yucatán on the matter have reported similar incidents along the coast, as Bennett and Basurto (2018) recount:

> Poachers were often armed and in one instance opened gunfire at co-op members…the poachers had arranged a block formation of more than 40 vessels including one larger vessel with a powerful motor. The co-op vessels were unable to flee quickly enough. Armed poachers forced co-op members onboard their vessel, set fire to one co-op vessel, and kidnapped the members.

In their study of the fisheries of Yucatán, Kaplan-Hallman et al., 2017, have also found that the start of the sea cucumber fishing triggered many violent conflicts between local cooperative fishers and external fishers across the state, with some reports of kidnapping and murder. News media of Yucatán described the "gold fever" of the sea cucumber fishery as "people rushed to benefit from local sea cucumber stocks" (Kaplan-Hallam et al., 2017). It brought with it an influx of non-local actors, who's values clashed with those of the community. Locals have reported a sense of insecurity, disruption to personal physical safety and eroded social cohesion due to the arrival of newcomers. They have said that the usual community ideals of peacefulness, trust and friendliness were disrupted:

> The sea cucumber fishing has brought many negative impacts and the arrival of outsiders has brought conflict. We are a relaxed town, but because of these people, our boat equipment began to get robbed. There was overfishing of other marine species as they (outsiders) caught it. Many fishermen involved died (Tour Guide 3, June 2018).

The arrival of outsiders and onset of rapid changes evidently conjured xenophobic feelings amongst residents as their community was impacted by the fishery. It has been attributed by community members as exacerbating other changes occurring in the region and has driven discord of the structure and functioning of the social system.

One such change is the adoption of new technologies to overexploit marine species. Many fishers have adopted the use of diving and breathing compressed gas at increased barometric pressure, known as hookah diving. (Huchim-Lara et al., 2016). The hookah diving system comprises of a 5-6 horsepower gas driven engine powering a pump that compresses 100-120 pounds/inch gauge of ambient air into a 1-2 cubic foot volume tank, which delivers gas to the fisher via a plastic hose (Huchim-Lara et al., 2015). Alongside the hookah diving apparatus, gillnets, longlines, handlines and harpoons are also used (Saldaña et al., 2017), as can be seen in Figure 5.7. Hookah diving

allows fishers to extend the time they spend underwater and access deeper fishing grounds. It has been employed by fishers in Ría Lagartos in the harvesting of sea cucumber as the species became scarcer in shallower waters and was only found deeper in the ocean.

However, breathing compressed gas under such conditions can lead to decompression sickness (DCS), or "the bends," resulting from an inflammatory response to bubbles of inert gases forming in one's blood and body tissues when pressure is significantly and rapidly lowered (McMullin, 2006). DCS is the most common health condition fishermen are hospitalized for (Huchim-Lara et al., 2016). 209 cases of DCS were reported in the region per year between 2003 and 2012 by the hyperbaric centre of the Mexican Institute of Social Security, located in Tizimin City (Huchim-Lara et al., 2015), the closest DCS treatment centre for community members of Río Lagartos, about 53 km away. In the case of one fisherman and his family, the distance was too great to be overcome, "I had two sons that are fishers too, but one died last September as a result of hookah diving. He suffered decompression and was taken by car, the Fishing Federation car, to Tizimin because that's where the closest hyperbaric chamber is." Unfortunately, this was not the only case of death via DCS that was encountered during the interviews, as another respondent noted, "The sea cucumber (fishery) has brought economical benefits to fishers, but (it) also has caused several cases of decompression and deaths." Other fishermen recount near-miss instances, "I stopped fishing after I had an accident when diving by hookah system, one of the tubes broke and I was out of oxygen. Luckily, I made it to the surface intact." During their study on DCS in the region, Huchim-Lara et al., 2015, found that the lack of secure means of transportation, location and distance to the hyperbaric chamber were all reasons why some fishers did not seek treatment after experiencing symptoms of DCS, further increasing their risk and jeopardizing health. This is further supported by Kaplan-Hallman et al., 2017, who have found that:

> Many sea cucumber fishers have been compelled to dive more often and at greater depths than is physically safe, increasing their vulnerability to health complications from decompression sickness…as competition is growing, divers are inclined to work longer hours for more consecutive days than are safe and increase their likelihood of decompression illness or death.

It has been argued that the tempting financial profits to be gained and market demands have influenced fisher behaviour to use the hookah diving technique and risk DCS (Huchim-Lara et al., 2015). As the sea cucumber declined, there has been increased pressure put on other marine species

of commercial and subsistence viability (in terms of catch and minimum size requirements), reinforced by Kaplan-Hallman et al., 2017, “Increased harvesting pressure from the growing number of non-local fishers…was described as having a tangible impact on marine resources both sea cucumber and other species, including grouper and crustaceans.” Such species have already been facing declines since the early 2000s, as noted by fishers. Many of the fishermen interviewed observed declines in other fishable species since the start of sea cucumber fishing, “there has been a decrease in all marine species ever since sea cucumber fishing started.”

Along with the hookah technique, other types of technologies have also contributed to the decline of fish stock. Many fishers indicated to the use of Global Positioning System (GPS) as a means to return to previous fishing spots, sometimes breeding grounds, where lucrative species such as lobster are often found:

> Fishing has decreased because of technology; the use of GPS technology changed our way of fishing. By using GPS, we overexploit the same place (Fisher 14, July 2018).
>
> GPS wasn't used 20-25 years ago. People relied on luck, sometimes not getting to the same place twice. Now we exploit the same places, I myself have around 2,500 coordinates saved (Fisher 12, July 2018).
>
> The use of technology has contributed to overexploitation of fishing, such as use of GPS (Fisher 3, June 2018).
>
> The use of technology like GPS and hookah diving makes fisher work easier but then species are overexploited (Fisher 22, July 2018).

Even protected species have suffered and been targeted as a result of the insatiable sea cucumber fishery. This has been the case for the horseshoe crab, *limulus polyhemus* (Figure 5.8), a species persisting for more than 200 million years (Smith et al., 2017) and is considered a living fossil and is protected under Mexican law under the highest risk category (Salas et al., 2011). Fishermen have targeted the crab for octopus bait as other species have declined, at great personal risk as the harvesting of the crab is considered a federal crime and reprimanded with jailtime and high penalties. It is evident that the development of the sea cucumber fishery has amplified previous ongoing changes in the decline of fish stock, as exploitation pressures on species like lobster and grouper have intensified.

Finally, the removal of the sea cucumber has significant ecological ramifications for the entire marine food web. The sea cucumber fulfills an important ecological niche as a bottom-feeder and detritivore, an animal that consumes organic matter present in the ecosystem (Mann, 1988). They work to disturb the sedimentary deposits where they live, thereby filtering and recycling nutrients, making them available in the food web and oxygenating sediment (Conand, 2017). They are important as suspension feeders, cleaning their environments, and regulating water quality and pH levels (Anderson et al., 2011). In addition, they also increase the calcium bioavailability and thus buffer coral reef acidification through the excretion of ingested carbonate sands (Eriksson et al., 2015; Purcell et al., 2013). Such substances and nutrients would be trapped within the sediment.

Figure 5.7: Hookah diving apparatus and mural depicting fisher using hookah diving to catch lobster on fishing cooperative wall; Equipment used during hookah diving (photographs by author)

They increase the overall productivity of the ecosystem by helping produce food available for herbivores, meaning that their removal may reduce primary production and threaten to dismantle the entire marine food chain (Purcell et al., 2013), having potentially dire consequences for coastal communities dependant on fishing as a primary source of income. Their significance has also been noted in the interview transcripts, "The sea cucumber has importance to marine life as detritivores" (Marine Captain Secretary 1 August 2018). It has been found that extirpation of sea cucumbers can result in the hardening of the sea floor, eliminating potential food sources and habitat for other organisms (Anderson et al., 2011). Studies have found that overfishing of sea cucumber causes a direct and significant impact on reef and soft-bottomed ecosystems. Their removal in experiments resulted in the development of algal mats, negatively impacting sediment fauna and lowering overall dissolved oxygen levels (Purcell et al., 2013). A further study conducted in Fiji found that the removal of sea cucumber impeded ecosystem function and productivity of shallow coastal ecosystems, impacting water quality, inhibiting larval development and potentially leading to fish kills (Lee et al., 2018). This study saw an ecosystem regime shift from one dominated with sea cucumber to being overrun by cyanobacterial mats, forming a potential health risk in the form of toxic algae blooms, hypoxia and red tides, and impacting the local fishery and tourism sectors. Combined with other stressors, it can work to drive such events over thresholds to catastrophic levels. Finally, the sea cucumber is characterized by late maturity, slow growth and low breeding rates, further aggravating their decline as they are overexploited (Anderson et al., 2011). It is clear that the presence of sea cucumber reinforces ecosystem health and attributes to the resiliency of marine environments, with their elimination having implications for the entire marine food web.

Figure 5.8: Atlantic horseshoe crab, a protected species, sometimes used as octopus bait (photographs by author)

The results presented in this section depict how a driver such as the sea cucumber fishery can work to produce rapid and abrupt changes having lasting impact on an SES. The presence and impact of the sea cucumber fishery in Ría Lagartos speaks to the global nature of social-ecological change and exemplifies the far-reaching magnitude of human action. Responses of locals in the interview transcripts illustrate how it has produced significant community changes, putting pressure on already strained resources, inhibiting community function and disabling local management and sustainability of marine resources. As it is caused by high demand and rooted in a worldwide trade network, the sea cucumber epitomizes the significant consequences associated with species with a high market value. The rapidity and connectedness of universal networks imposes severe challenges for local governance frameworks, and has social, ecological and economic implications for the communities of Ría Lagartos. Locals are experiencing rapid social-ecological changes driven by the globalized fishery, posing challenges by the 'gold-rush' arrival of outsiders in the form of overexploitation of fish stocks, increases in poaching, armed conflict, deterioration of security and community cohesion, health implications, and ecosystem degradation as a vital species is driven to near extinction.

5.2.2 Rising Tourism Industry

Tourism is one of the most significant components of the Mexican economy and its largest service sector, producing the third-highest foreign exchange earnings and the second largest employer in the country (Clancy, 1999). It has grown faster in Mexico than most developing countries in absolute terms (Brenner and Aguilar, 2002). During the past two decades since 2008, Mexico attracted the most foreign tourists and foreign currency of any country in the Third World (Wilson, 2008). Mexican tourism development, steered by the Secretaría de Turismo (Secretariat of Tourism), was initiated as part of an economic strategy in the late 1960s through the establishment of the National Trust Fund for Tourism Infrastructure, with loans from the Inter-American Development and World Banks dedicated to touristic infrastructure and the construction of hotels and facilities (Wilson, 2008). Between 1974 and 1992, Mexico quickly hastened the pace of its hotel construction, adding more than 100,000 rooms to produce a total of more than 300,000, 71% affiliated with foreign chains (Clancy, 1999), with the seaside city of Cancun quickly becoming one of the largest destination hubs in the world (Torres and Momsen, 2005). Presently, tourism accounts for about 10% of the Mexican GDP, with the vast majority of it being derived from

coastal communities (Faber and Gaubert, 2016) such as those of Ría Lagartos. There are now eight touristic programs running throughout the country headed by the Secretariat, with the state of Yucatán falling in the "Programa Mundo Maya" ("Maya World Program"). The economy of Yucatán is largely derived from tourism (Azcárate, 2011), with the other sectors being fishing, agriculture, local services and construction (Kandelaars, 1997). The expansion of the tourism industry is still top-of-mind amongst government priorities, as an interviewee explained the substantial investments being put in the overhaul of tourism signage in locations of interest by the Secretariat nationwide as a means to attract visitors (Figure 5.9).

The establishment of biosphere reserves has grown to be a favoured mechanism of tourism development in the Yucatán peninsula, taking advantage of the natural coastal communities and rich biodiversity of the region (Savage, 1993). Ría Lagartos is one such site, where locals have leveraged the presence of the reserve by promoting ecotourism ventures. As fishing stocks have declined (noted above), tourism has been employed as a common strategy amongst the populace to alternatively generate income and diversify livelihoods (Kaplan-Hallam et al., 2017). Fishers have started to double as tour guides, escorting sightseers to the mangrove forests, beaches, sink holes and birdwatching areas (Salas et al., 2011). There is a tourist cooperative established in all the communities of Ría Lagartos by cooperative fishers and other community members, including the women's cooperative. Locals have indicated that touristic changes are incurred in all communities of Ría Lagartos, "Touristic changes happened on a regional scale, from San Felipe to El Cuyo" (Hotel Manager 5, June 2018). Many interview respondents have spoken about the importance of tourism as a source of livelihood for the community:

> Tourism from the reserve helps people, it's a source of livelihood and economic alternative and money entrance not just for tour guides, but hotels and restaurants also (Tour Guide 4, June 2018)

> It is good that we have more tourism today, this provides an alternative income for the community. From 2 years onwards, I have seen much more tourism; this is also reflected in the presence of hotels, we have more of those now. I cannot say a particular month where there are more tourists around, in general, they come throughout the year (Ranch Worker 2, July 2018).

> Because of tourism, you find less in-debt people in low fishing season. Many people would live from their savings during fishing bans, but thanks to this alternative (tourism) people and fishers have a bit more economic stability (Tour Guide 7, July 2018)

Some interview respondents expressed the desire for the community to be included in the "Pueblos Magicos" ("Magical Villages") program, a government led initiative that recognizes rural areas through tourism and aims to achieve sustainable development via the involvement of local communities and a decentralized structure (Clausen and Gyimóthy, 2016). Participation in the

Figure 5.9: Río Lagartos touristic sign (photograph by author)

program allows the selected town to receive multi-level government funding for the construction of touristic infrastructure and businesses, a large incentive for being chosen:

> We want to become a "pueblo magico" ("magical village") is a concept that refers to little towns in Mexico that, because of their features and natural/cultural richness, are categorized with a higher rank in Mexico's touristic destinations (Housewife 8, July 2018).
>
> We want to improve as a community and be entitled as a "pueblo magico." We want a better place for our children (Tour Guide 2, June 2018).

The main attraction of the biosphere reserve are the species that inhabit it, as it is a landing and breeding site for many migrating aquatic birds, including the American flamingo, *phoenicopterus ruber* (Savage, 1997). The flamingo has become "one of the most globally distributed promotional images of Mexico in the tourism international market" (Azcárate, 2010). The proliferation of protected areas and their identification with certain charismatic species for tourism purposes has risen throughout the years. In Ría Lagartos, animals such as the flamingos and crocodile (Figure 5.10) attract a multitude of tourists annually, who come to see the species in their natural habitat via birdwatching tours or night excursions.

Figure 5.10: American flamingo (phoenicopterus ruber) and morelet's crocodile (crocodylus moreletii), two charismatic fauna found in the reserve that are important for tourism in the region (photographs by author)

Locals have indicated that the popularity of the animals have led to the implementation of better conservation measures:

> There is now a better sense of protection of the reserve. Before, many people's livelihood was the hunting/preying of crocodiles, particularly crocodile's meat. Because of this, it was unusual to see them before. Nowadays, you can see crocodiles really close, you don't need to go far away. We know crocodiles attract tourism, so we try to protect it (Retired Fisher 3, June 2018).

> This place has the potential of becoming a very important touristic site (Hotel Owner 10, July 2018).

> The flamingos act as our flag species for all this region. With the rising of tourism there are new houses and hotels inside of the reserve (Tour Guide 3, June 2018).

The region was also an important Mayan zone dating back over 1500 years to the pre-Hispanic period of 300-50 BC. 18 archeological sites have been located within the vicinity of the RLBR (Smardon, 2009; UNESCO, 2007). Tourists, national and international alike, are attracted to the reserve as "a place to foster wild encounters with nature" (Azcárate, 2011). Ecotourism has been used as a tool in Ría Lagartos to generate income and protect natural habitat and species, encourage local support for preservation and raise awareness of the importance of conservation (Monteros, 2004).

Figure 5.11: Pink waters of Las Coloradas, a major touristic attraction of the region and recurrent feature on social media (photograph by author)

Furthermore, the proliferation of the internet and social media have garnered attraction to the region and "are increasingly utilized as part of Mexico's marketing mix" (Ely, 2013). Social media has especially been important for the town of Las Coloradas, where the pink lakes of the site (Figure 5.11) are a frequent feature on social media platforms, bringing innumerable visitors yearly. The residents of Ría Lagartos regularly pointed to social media in the interviews as a driver to create awareness about tourism and the reserve:

> Thanks to social media and internet, touristic demand for this place has increased (Tour Guide 12, July 2018).
>
> Touristic growth of Las Coloradas relies on social media, they didn't receive tourists before 3 years ago (Vice-Mayor 1, June 2018).
>
> Promotion of tourism has been through the use of the internet and social media (Retired Fisher 23, July 2018).
>
> Social media helps promote our activities (Tour Guide 11, June 2018).
>
> Social media and the internet are one of the main drivers of change in this region (Hotel Owner 3, June 2018).

However, there have also been some negative impacts due to the influx in tourism. In Mexico, rising tourism in popular destinations such as Cancun has led to heavy outsider traffic, urban congestion, water and plastic pollution, shore erosion and threats to native flora and fauna (Clancy, 2001; Kandelaars, 1997). Cases of eutrophication, destroyed lagoon systems, dredged wetlands, destruction of coral reefs, over-extraction of freshwater, beach degradation and deforestation have become rampant ever since the start of the Mexican tourism industry (Torres and Momsen, 2005).

Increases in pollution may drive tourists away, leaving behind the community with a polluted environment and no means of tourism income, a largely "boom-and-bust" dynamic (Kandelaars, 1997). It has also raised social concerns such as the ethical treatment and provision of adequate housing and infrastructure for seasonal workers (Berger and Wood, 2009). Increased crimes, changes in cultural values and health have all been cited as social consequences of rising tourism rates (Brown et al., 2001). In addition, it has been known to drive division amongst the social classes of Mexico, particularly the Mexican elites and Indigenous Mayans of the region (Torres and Momsen, 2005), and cause degradation of the present Mayan culture. For instance, the island of Cozumel near Cancun, once an important pilgrimage site for the Mayans, is now home to over 200 all-inclusive hotels and cruise ships (Evans, 2004), largely ousting the present Mayan community. Tourism has been described as a "double-edge sword" while on one hand accrues economic benefits, but also places stress on the social and ecological fabric of the destination and communities that live in them (Harrison and Hitchcock, 2005). It may lead to a replacement of traditional jobs for tourism jobs, making the local population dependent on tourism as a source of income (Kandelaars, 1997). Many locals, including descendants of the Mayans, frequently work as low-income staff (i.e. hotel workers, waiters) in the tourism industry often at the expense of their heritage, as they are marginalized in the exploitation of heritage sites and rarely benefit from the income accrued based on their culture (Evans, 2004). Previous studies have expressed concern over the impact of the Mexican tourism industry on such disenfranchised members of the community, who mostly reside "outside of the cultural mainstream of Mexico" (Ely, 2013). Tourism often results in an uneven distribution of benefits (Brenner and Aguilar, 2002) and an exacerbation of inequality at local levels (Clausen and Gyimóthy, 2016), as a large portion of the revenue generated usually goes to foreign investors of the hotel industry. The remaining local gains disproportionately go to the rich, while low-income individuals are excluded (Ely, 2013). Some groups have protested against their omission of consultation in tourism planning and the country's "aggressive tourism plans dictated by the distant department of the federal government…with questionable benefits to local people" (Ely, 2013).

In Ría Lagartos, many respondents voiced the concern that they did not want the community to become like the tourist hub Cancun, which was a very small fishing village of 100 inhabitants in 1974, growing to a population of more than 600,000 in 2005 (Azcárate, 2011). It has been characterized by unprecedented urban growth, poor planning and infrastructure, upsurges of

violence and insecurity, and reduced social cohesion (Azcárate, 2011; Kaplan-Hallam et al., 2017). Increased levels of social conflict, delinquency, alcoholism and prostitution are now all common features of the city (Ely, 2013). Community members recount that Cancun was once like how Ría Lagartos is now, but the coral reefs and mangroves were systematically destroyed to make way for tourism. They fear that if the current rate of tourism in Ría Lagartos goes unchecked, it may result in a community akin to Cancun:

> We're happy that we have the reserve, because after all, it is part of inheritance for our kids. I'm also glad that it has more diffusion, but we don't want it to turn like a new Cancun (Fisher 23, July 2018).

> Río Lagartos nowadays is how I remember Cancun used to look like when I was a kid, or like Cancun was 60 years ago. We need to make locals comprehend, not just understand, the importance of their natural resources. They need to look at different and several towns' history, someone who does not know his past is lost. They/people here should look at what happened to Cancun. Cancun used to be like this place, but it got destroyed (Tour Guide 14, July 2018).

There is a growing distress that the escalating tourism levels have contributed to a rising incompliance of the reserve's rules and regulations. The most commonly cited was the failure to conform to the 50 m distance rule when observing the flamingos. An interview with the local CONANP official explained that because the flamingos are a sensitive species and require a specific set of conditions for breeding, the 50 m rule was enacted for tour boats entering the reserve to observe them. However, the responses of many of the tour guides interviewed found that this rule was largely unheard of or ignored. When asked what distance they take tourists to go see the flamingos, answers ranged between 10-30 m, with one interviewee even stating that the "flamingo distance restriction of 50 m doesn't apply here, here we can be close to the flamingos" (Tour Guide). In addition to this, there is a large discrepancy between the number of tour boats with official permits that are allowed to enter the reserve and the number that actually do, as a CONANP park ranger explained:

> There are only 63 official permits that tour guides have to get inside the reserve. But we know in reality, there are many more boats getting into the reserve daily. But we cannot grant/give more permits because we have done impact studies, and the reserve can't take in more boats if we want it to remain healthy/sustainable (Park Ranger 1, August 1).

One informant even stated that there are sometimes over 200 boats entering the reserve daily, a large divergence from past years.

This discrepancy means that a large portion of tour guides operate illegally without an official permit:

> There's a law that states that every person that works as a tour guide and takes tourists to the reserve, requires a permit to do so. Every person with a boat should have a permit. However, many people work as tour guides without such permits (Tour Guide 9, June 2018).

> CONANP released 45 permits 10 years ago, later they released some more and reached 60. But in reality, there are around 110 boats entering Río per day (Tour Guide 6, June 2018).

> Tour guides see natural resources as a means of income, and they take for granted something that will always be there. I know the reserve has a maximum capacity of 63 boats per day. Some years, when the flamingos didn't nest here, maybe it was because too much traffic of boats (Hotel Manager 14, July 2018).

A surplus of boat traffic in the reserve significantly disturbs the fauna that inhabit it, limiting their feeding and breeding success (Smardon, 2009). A study concerning the effects of motorized tour boats on the behaviour of flamingos in Yucatán found that there was a 40% reduction in feeding time as a result of increased traffic. This has implications for pair formation and reproduction, indicating that tour boats have a spatial and behavioural influence on the species (Galicia and Baldassarre, 1997). One study revealed that tourists looking to, "obtain photographs of flamingos in flight would request that the guides flush the feeding flocks, which was a major cause of disturbance for the bird" (Baldassarre and Arengo, 2000). The same study, using aerial evidence, found that harassment and disturbance by tourists caused significant losses of eggs and juveniles. A CONANP park ranger stressed that tourism may soon push past a tipping point, after which there will be irreparable damage done to the local flamingo population:

> Right now, we are at a somewhat balance between tourism and flamingos' population. But this balance is assumed if tourism flow remains the same in numbers, and in the last couple of years, there's been a bold increase of more tourists. Flamingos are probably the most important species for tourism, so it is important that flamingos distance and areas remain preserved with least perturbation as possible, regardless the increase in tourism (Park Ranger 1, August 2018).

Increased tourism has also been known to degrade resources needed by other species, such as open beaches required by sea turtles to lay eggs (Smardon, 2009).

Locals have noticed other instances of regulation incompliance as well, concerning the construction of touristic infrastructure like hotels on reserve lands:

> When we pass by with our boats, we can see that on the beach between Río Lagartos and Las Coloradas, there are big houses/hotels that are placed within the reserve, meaning they shouldn't be there (Fisher 14, July 2018).

> Around/close to Las Coloradas, there are beaches that have been privatized now. I believe they've had owners for a long time, but now they are taking in construction machines less than a kilometre away from the coastline. People say its for hotel construction (Fisher 12, July 2018).

While most hotels are built within town boundaries and are therefore legal (Figure 5.12), the above responses indicate that some are being built in the reserve and therefore operating outside of the law. One of the interviews with a CONANP ranger revealed that an ambiguity in Mexican legislation enables such occurrences:

> Because of the touristic demand, birds are flying away or hiding in deeper parts of the reserve. Between Río Lagartos and Las Coloradas, there are some houses and hotels that are placed on the coastline, I think there are 5 constructions of this kind currently functioning. They are inside the reserve, we as park rangers must report this because it is part of our duty. Owners get a fine/sanction, they pay it because they can afford it and then keep constructing/operating. In Mexican law, this is a legal loop, but it is "allowed" as long as they pay their fine. Eventually, owners get a "concession" to live/stay there (Park Ranger 1, August 2018).

Figure 5.12: One of the many hotels in Río Lagartos (photograph by author)

Lack of follow-up, insufficient monitoring and absence of enforcement means such incompliances will continue to occur. Discrepancies in the Mexican law concerning conservation have been previously cited (Chapter 3) as an obstacle hindering sustainable development and marine resource

preservation. Such loopholes can be construed as drivers of change, fuelling unsustainable tourism trends in the region. Previous studies reveal increased population and tourism infrastructure in coastal communities of Yucatán has resulted in rampant conversion and dredging of wetland habitat (Baldassarre and Arengo, 2000). Further interviews predict that the constructions are most likely the result of foreign investors from neighbouring states who are benefitting from the influx in tourism and want such changes to occur:

> Influence of outsiders, like people from Cancun migrate here and they implement what they know and tourism related activities here (Tour Guide 12, July 2018).

> Hotel owners want to get richer. They are normally from Playa del Carmen (city of neighbouring state Quintana Roo) or Cancun. Haven't heard of any owners from Yucatán (Restaurant Worker 5, June 2018).

The arrival of external actors and the visitors they bring have led to further environmental degradation of the region. There is an increase in resource demand, stressing necessities such as potable water beyond capacity, and an increase in garbage and sewage, spreading disease throughout the community. The populations of scavengers, such as raccoons, turkeys and vultures, which primarily prey on flamingo eggs and young, also increases, further threatening the nesting success of flamingos (Smardon, 2009). Sewage is particularly becoming a growing problem in the RLBR, where disposal is largely taken care of by outdoor latrines, which empty out into stagnant pools of standing water that create optimal disease vector conditions. The waste also enters groundwater and the lagoon through the porous limestone (Smardon, 2009). Locals recount some of the damage done to the community as a result of the increase in tourism:

> Two years ago, we could see more flamingos and birds, now we see less because of more tourism, more destruction of mangroves, more trash (Tour Guide 7, June 2018).

> The town has suffered many environmental changes as a result of visitors and increase in population (Fisher 9, June 2018).

> The increase in tourism has led to increase in contamination, trash in the "Ría" (Retired Fisher 6, July 2018).

> An increase in tourism means more impact on the reserve, more boats, and a decrease in flora and fauna (Tour Guide 5, June 2018).

> If ecotourism is not properly regulated, all of our resources could get destroyed (Marine Captain Secretary 1, August 2018).

> With the rising of tourism there are new houses and hotels inside of the reserve and they produce waste, which can be a problem (Tour Guide 3, June 2018).

The rise in tourism has caused some social disruptions as well, particularly concerning the competition between those who operate solely as tour guides, and those who operate as both tour guides and fishers. In a hurry to profit, many have taken up the occupation of serving as tour guides, as one respondent notes, "Fishers are interested in or working as tour guides because they see it as a growing money/income opportunity" (Hotel Owner). However, this has caused discontent amongst those who only rely on tourism as a means of income:

> Some fishermen get involved as tour guides, this creates competition for us because they already have fishing income and we don't (Tour Guide 9, July 2018).

> There is competition amongst those who are tour guides and those who are fisher tour guides, so not everyone has equal share (Fishing Cooperative Worker 2, July 2018).

A past study done in the neighbouring coastal town of Celestun depicted an extreme case where tourism had "deeply inflamed the social relations at the ría (beach) by bringing new agents with competing interests" (Azcárate, 2010). Here, abrupt increases in fisher and tour guide competition brought on by immigrants aggravated the pressure put on natural resources and those who traditionally worked the landscape.

In addition, regardless of the rise in tourists, it was found that only a few members of the community received direct benefits from them. It is probable that without adequate management and controls, the current rate of tourism in the communities of Ría Lagartos may be pushed beyond an unsustainable threshold. One respondent voices and summarizes the anxiety of his community members:

> I think in 8 years from now, with our growing rate, our tourism activities won't be sustainable any longer. There is tendency of more people involving in tourism without awareness and values of conservation. I'm not only speaking of tour guides as the problem, tourists also create an impact. We are having more tourists with the attitude of "I'm just here to take a pretty picture, I don't care if by getting too close, I ruin the environment" like it sometimes happens in the pink lagoons and distance towards flamingos (Tour Guide 11, July 2018).

The above analysis shows that while tourism can result in positive benefits in the form of greater income and conservation awareness for communities, such an abrupt transformation of the

economy can also drive negative impacts like ecological degradation, displacement of local culture, power imbalances, social equity issues, regulation incompliance, and loss of sense of identity and place. The change in power dynamics brought on by tourism have lasting social, economic and environmental impacts, and have tended to "transform local populations into a servile class catering to the needs of foreign visitors" (Ely, 2013). In the absence of sufficient administration and constraint, tourism has the potential to move towards a state where change is permanent, and the resultant impacts are lasting. The next section analyzes SERSs as the drivers of such states, viewed using the six-dimension model and from the perspective of the RLBR community.

5.3 Dimensions of SERS

Nayak and Armitage, 2018, have used empirical data to develop a framework and six dimensions for SERSs to better understand their nature and the integration of social and ecological facets. The SERSs survey used in this research collected data in each dimension and the results are described below. This research is primarily concerned with governance to navigate regime shifts, which is described at length in Chapter 7. Examining all six dimensions of SERSs is crucial as they provide the basis to understand the nature of abrupt changes occurring, their impacts and where to possibly intervene and avoid detrimental and long-lasting transformations.

5.3.1 Differentiating Drivers of Regime Shifts

As previously mentioned, a driver is a natural or human-induced phenomenon directly or indirectly causing changes in coupled social-ecological systems (Nayak and Armitage, 2018), and may operate at various scales. Depending on the way drivers interact, their source and how they induce change, the resultant impacts may be perceived as positive or negative in nature based on how they develop in a social context (Mooney et al., 2009). Tables 5.7 and 5.8 display some of the results of this section of the SERS survey, asking respondents to identify both positive and negative impacts as a result of changes, respectively. Livelihood and economic activity impacts are the top ranking in each case, but for disparate reasons. 95% of respondents stated that the changes of tourism brought increased income and job opportunities for the community and were therefore considered to be beneficial for communal welfare. As a community member described it, "there is more money for the community due to tourism and more jobs for families" (Housewife 2, June

2018). Negative livelihood and economic activity impacts, identified by 45% of those surveyed included: decreased income as a result of declining fish catch, ineffective tour services offered by fishers-turned-guides without training in haste to profit from the increasing tourism rates, and increased competition between certified tour guides and fishers-turned-guides. Other positive impacts included improved ecosystem health as a result of conservation measures of the reserve, and infrastructure in the form of power generation. Pollution resulting from the increased tourism, ineffective monitoring and follow-up by reserve officials, social conflict due to sea cucumber poaching and arrival of outsiders, deforestation of some reserve lands for hotels and restaurants, and spatial restriction of the community caused by the presence of the reserve were the remainder negative impacts described.

Table 5.7: Positive impacts of change, as identified by respondents

Positive Impacts?	**Percentage of Respondents (n=20)**
Livelihood and economic activity (increased income for community from tourism, increased employment opportunities for people, increased trade of marine products)	95%
Ecosystem health	15%
Infrastructure (power generation)	5%
No positive impacts	5%

Table 5.8: Negative impacts of change, as identified by respondents

Negative Impacts?	**Percentage of Respondents (n=20)**
Livelihood and economic activity (decreased income from low fishing, ineffective tour services, increased competition amongst fishers and tour guides)	45%
Pollution (of air, water or soil)	20%
Conservation (ineffective monitoring and follow-up)	15%
Social conflict (arrival of poachers, discontent of community, crimes and drug addiction)	30%
Ecosystem health (deforestation and loss of habitat, red tide)	15%
Spatial growth restriction (overpopulation, surrounded by reserve)	10%
No negative impacts	25%

5.3.2 Levels and Scales of Occurrence and Interventions

A thorough understanding of SERSs must consider the multiple levels and scales at which changes occur and where responses should be targeted. Tables 5.9 and 5.10 identify the social and ecological factors respondents believe were impacted first, respectively. Acquiring this data can help to better anticipate changes and determine where intervention efforts should be concentrated and made first (Nayak and Armitage, 2018). Consistent with the results of the previous section, livelihood and economic activity factors were identified by 85% of the survey population to have been impacted first. These included: the increase in tourism and fishing (and declining community income from fish catch), increased use of motor vehicles for fishing, increase in product prices overall, and livelihood changes from fishing to tourism. Other factors identified were increased conservation efforts, pollution, social conflict and spatial growth restriction. Ecological factors initially impacted included ecosystem health (seen by a decrease in marine species and deforestation of reserve land) and weather changes (i.e. irregularities in rainfall patterns, etc). The two case studies previously discussing the sea cucumber fishery and rise in tourism highlight the severity of impacts resulting from such changes, their early onset and the need to address them. Implementing policy and other management measures at the apposite temporal and spatial scale can work to enhance their effectiveness in dealing with change.

Table 5.9: Order of social impacts

Social Factors Impacted First?	**Percentage of Respondents (n=20)**
Livelihood and economic activity (increase in tourism, increase in fishing, increased use of motorized vehicles for fishing, increase in product prices, livelihood changes from fishing to tourism, lower community income from fishing)	85%
Conservation (increased conservation efforts)	15%
Pollution (of air, water or soil)	15%
Social conflict (arrival of poachers, discontent of community, crimes and drug addiction)	10%
Spatial growth restriction (outmigration)	5%
Not answered	15%

Table 5.10: Order of ecological impacts

Ecological Factors Impacted First?	**Percentage of Respondents (n=20)**
Ecosystem health (decrease in marine species, deforestation of mangroves and reserve land)	40%
Conservation (protection of and increase in species)	25%
Pollution (of water, air or soil)	25%
Weather (changes/increases in rainfall patterns, increased temperatures)	10%
Not answered	15%

The vulnerability of ecological and social factors was also examined, displayed in Tables 5.11 and 5.12 respectively. Berkes, 2007, defines vulnerability as a system's tendency "to suffer some degree of loss from a hazardous event," in this case being a regime shift. The most vulnerable ecological component was the mangrove forests, identified by 50% of respondents and the most vulnerable social component was deemed to be the fishers, also by 50% of the survey populace. Collecting data concerning vulnerability is beneficial to discern which components of the coupled SES require the most immediate consideration, time and resources (Berkes, 2007). Configuring the vulnerability of a SES can work to identify the occurrence of a SERS early on and prevent any subsequent impacts from taking place. It was noted that most of the ecological components were made increasingly vulnerable due to a rise in tourism (i.e. cutting of mangrove forests for hotels, increased waste in ocean and beaches, destruction of habitat, etc), while the most vulnerable social components of the community such as fishers were prone to fish stock decline and loss of income.

Table 5.11: Vulnerability of ecological components

Most Vulnerable Ecological Components?	**Percentage of Respondents (n=20)**
Mangrove forests	50%
Ocean	30%
Fauna and habitats	20%
Beaches	20%
Entire reserve	15%
Fish	10%
Flora, endemic plant species	5%
None	5%

Table 5.12: Vulnerability of social components

Most Vulnerable Social Components?	**Percentage of Respondents (n=20)**
Fishers	50%
None	20%
Fishing cooperative	10%
Tourism related individuals	10%
Less educated individuals	10%
Outsiders	10%
Ill/weak people	5%
Single mothers	5%
Municipality	5%

Finally, the nature of interventions made by external agencies (if any) was inquired of from survey participants. 50% of participants identified interventions made by government (at either the national, state or municipal levels) either through policy or regulations, followed by private companies (i.e. corporate initiatives, government collaborations) and community members themselves (i.e. community efforts such as weekly trash cleanup). This data (Table 5.13) is important to take note of as it relays where resources are being spent the most, if they are being effective and if action from other sectors is required. It has policy implications as the identification of how and at which levels actions are being taken can lead to choosing effective management limits and the avoidance of tipping points. Depending on the scale at which changes materialize at the ecosystem level can influence which management and policy solutions are required. Determining the level and scale at which an intervention is required necessitates a comprehensive understanding of changes and their associated dimensions in the context of time and space.

Table 5.13: Interventions of change

Nature of Interventions?	**Percentage of Respondents (n=20)**
Interventions from government (Support, monitoring, protecting the reserve, setting regulations)	50%
Interventions from private companies	20%
No interventions made	20%
Interventions from community members	10%

5.3.3 Social-Ecological Units

Units of coupled social and ecological systems may have either a physical (i.e. coastal, rivers, vegetation) or normative (culture, rituals, laws, institutions, social interactions) dimension to their boundaries (Nayak and Armitage, 2018). Recognizing and understanding these dimensions can help anticipate and navigate changes that may result in SERSs by influencing the type and scale of drivers considered and the associated impacts. Tables 5.14 and 5.15 portray ecological and social units identified by participants, respectively. The boundary within which these units were identified is defined in the physical peripheries of the RLBR itself and the surrounding ocean where fishers conduct their work. 45% of those surveyed stated that marine products (i.e. fish species from the ocean) were the natural resources they most used, followed by the flora and fauna of the reserve for tourism purposes (30%). The survey revealed that majority of participants (60%) believed that they did not rely on any sort of social organization in their day to day life. Data concerning units of SESs recognizes the interconnected nature of the coupled system that is important for both ecosystem health and human wellbeing. Going beyond the singular unit perspective, the complex and fluid nature of human and ecological interaction is recognized.

Table 5.14: Ecological units

Natural Resources Used?	**Percentage of Respondents (n=20)**
Marine products (i.e. fish species for SSFs)	45%
Flora and fauna of reserve (for tourism)	30%
None used	20%
Mangroves (for resources such as construction material or fuel)	10%
Ocean	5%

Table 5.15: Social units

Social Organizations Used?	**Percentage of Respondents (n=20)**
None used	60%
Fishing cooperative	15%
Touristic cooperative	15%
Cleaning program	5%
Government organization	5%

5.3.4 Equity and Social Justice Concerns

Regime shift studies have found that the impacts are highly differentiated amongst various social groups (Hammond, 2012). Those whose actions are principally responsible for the changes are often least affected by the impacts that result. On the other hand, "marginalized actors with relatively small contributions to the regime shifts often bear the brunt of the impacts." It is therefore important to view issues of social and ecological change from an equity and justice perspective to determine the source of drivers. When asked who they believed were responsible for the changes taking place, the majority (30%) indicated to fishing cooperatives (Table 5.16).

Table 5.16: Responsible groups of change, as determined by respondents

Responsible Groups?	**Example**	**Percentage of Respondents (n=20)**
Fishing cooperatives	Inequitable sharing of fishing permits	30%
Federal government	Through corruption, allowing hotels and industry to operate inside reserve land while community is restricted	15%
No one	No one party is responsible	15%
Touristic cooperatives	Increased boat traffic in reserve impacts sensitive fauna, increased waste and pollution	10%
Business/industry (salt company, hotels)	Industry operations cause higher fish morality, declining stock; destroy important habitat for fauna, impacting tourism	10%
Entire community	Everyone equally responsible	5%
Mayoral team	Not intervening in poaching issues	5%
Permit holders	Overfishing of marine species	5%
Don't know	N/A	5%
Fishers	Overexploitation of certain species	5%
Outsiders/poachers	Decimating sea cucumber populations	5%

The application of the equity and social justice viewpoint can also help to clarify if environmental and social changes disproportionately impact a certain sector of society (i.e. the poor, disempowered and other marginalized groups) and disproportionately benefit another via an uneven distribution of benefits and impacts (Nayak and Armitage, 2018). 35% of respondents believed that those directly involved in fishing dealt with the biggest burden of the impacts (Table 5.17), while 50% believed that there was an inequal distribution of the income that the community received from tourism, contesting that only those directly involved in tourism benefited (Table

5.18). This imbalance in the distribution of benefits produced by tourism is supported by the work of Wilson, 2008, whose study found large discrepancies in wealth amongst those in the Mexican tourism industry. The data shown here can help to determine which community members are most at risk and which ones may be driving the changes as a result of the benefits. Regime shifts can work to provide new opportunities and upward social and economic mobility for some, but also simultaneously exclude others (Nayak and Armitage, 2018).

Table 5.17: Impact related equity issues

Equal Impacts?	**Percentage of Respondents (n=20)**
Those directly involved in fishing are impacted more by declining stock	35%
Equally impacts entire community	30%
Those directly involved in tourism are impacted more by industry operations disturbing charismatic fauna, and in turn, the livelihood of tour guides	25%
No negative impacts	25%
Inequal impacts due to politics (i.e. depending on the party in power, those who are opposed to them are more likely to be impacted by, for example, not receiving fishing permits)	10%

Table 5.18: Benefit related equity issues

Equal Benefits?	**Percentage of Respondents (n=20)**
Inequal distribution of income from tourism (only those involved in the industry such as guides, hotel owners)	50%
Equal distribution of income from tourism	45%
Only those directly involved in fishing	10%
No benefits	5%

In addition, regime shifts may also discriminate the distribution of benefits and impacts on the basis of gender. It is well known that women tend to bear a disproportionate burden of global environmental changes as opposed to their male counterparts (Cutter, 1995). They often lack the necessary capabilities and opportunities to combat change, making them more vulnerable to environmental and social transformations. However, in some communities such as San Felipe in the RLBR, women have found ways to adapt to a male-dominated profession in order to derive income and become resistant in the face of environmental and social change. An interview with

the head of the women's cooperative in San Felipe reveals the obstacles that had to be overcome before women were permitted to fish, "A friend of mine and I were the first women to sell crabs as bait for octopus. People from our community didn't accept at first that women could get involved in fishing activities that were supposed to be 'man's work.'" When attempting to join the community fishing organizations at the time, hindrances were again encountered, "The fishing cooperatives didn't want to include or support me because I was a woman". However, to provide for their families and cope with the changes inflicting their community, some of the women of the town decided to form their own institution, "In 2011, a group of 17 women (including me) organized ourselves and formed the first women fishing cooperative in the region 'Mujeres trabajadoras del mar.' (women sea workers)." The institution has helped to empower women of the region and enable them to navigate change with the resources and tools derived from self-organized governance, including the creation of new fishing instruments, such as the one seen in Figure 5.13, a net used to catch crabs, crafted by the women's fishing cooperative.

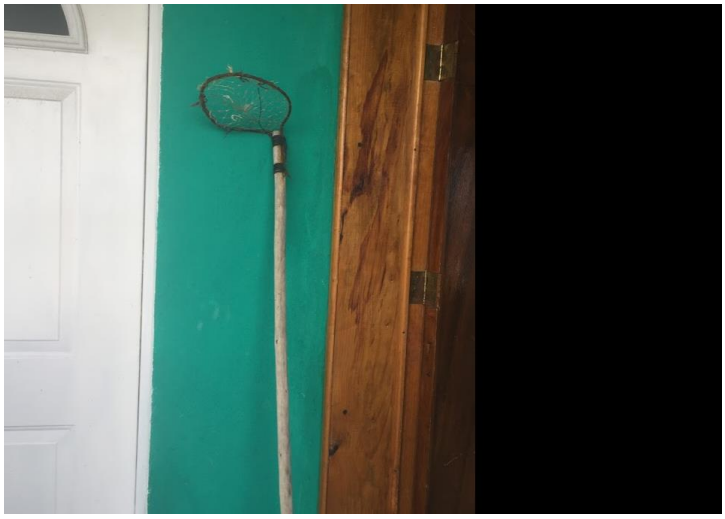

Figure 5.13: Fishing tool crafted and used by women's fishing cooperative (photograph by author)

5.3.5 Power and Politics

Regime shift literature recognizes the importance of considering social relations of power, expressed through institutions, and the positions of various members of society in understanding and responding to regime shifts (Nayak and Armitage, 2018). Assessing who wins and loses in the context of environmental and social changes can help anticipate whether a SES is being deliberately steered towards a regime shift. However, before this can be derived, it is important to

determine how the community being studied defines power. How power is viewed can vary based on the context of the community and how it is perceived by locals. Power may be defined based on the material wealth one owns, or the strength and usefulness of the relational ties he or she is involved in. Table 5.19 relays the criteria that community members use to define power, with the vast majority (80%) basing it off of the type of employment and income one has earned.

Table 5.19: How power is defined in Ría Lagartos

Definition of Power?	**Example**	**Percentage of Respondents (n=20)**
Type of employment/income earned	Hotel or restaurant owners likely to earn more income, and in turn, have more influence in community matters as opposed to fishers, whose income is in decline	80%
Social organization affiliation	Fishers belonging to a fishing cooperative known to have more influence as opposed to independent fishers	35%
No answer	N/A	15%
Political party affiliation	Those affiliated with the reigning political party of the time are more likely to have influence	10%
Age	Young adults and middle-aged individuals have more influence than the elderly	5%

It is often the case that those who are most powerful and benefitting from changes attempt to protect their self-interests and allow "the social ecological system to cross critical thresholds and accept large-scale changes in system dynamics" (Nayak and Armitage, 2018) by manipulating drivers. In contrast, those who are least powerful struggle with the changes being inflicted and try to maintain system dynamics in the current state, advocating for a reversal of the processes leading to the shift. When asked who they believed to be the most powerful actors in their community (Table 5.20), locals identified governance actors, equally indicating to the mayor and fishing cooperatives (40%). 25% agreed that fishers were the least powerful group due to declining stock and decreased income (Table 5.21). This data can help to ascertain whether drivers are deliberately being aggravated by certain actors gaining from the changes, and whether others are losing.

Table 5.20: Most powerful actors

Most Powerful?	Example	Percentage of Respondents (n=20)
Mayor	Influences all governing decisions as head of the municipality	40%
Fishing cooperative	Distributors of the town's fishing permits	40%
Permit holders	Have legal advantage over non-permit fishers	15%
Owners of hotels and restaurants	Steadily earning greater income and thus, greater influence in community matters	15%
Business people	Have influence due to their higher incomes	15%
Everyone equally powerful	No discrepancies present in the community	10%
Marine captain	The regulating authority of land-sea interface	5%

Table 5.21: Least powerful actors

Least Powerful?	Example	Percentage of Respondents (n=20)
Fishers	Everyday fishers less likely to have influence in management of marine resources, as opposed to the cooperatives	25%
Community members/average people	Everyday community members not likely to have any sort of influence in governance	15%
Low income individuals	Individuals in poverty unlikely to have influence in decision making	10%
Outsiders	Unwelcome by the community in their affairs	10%
No one	No discrepancies present in the community	15%
Housewives	Women without income often have no power	5%
Elders	Have less influence due to their age	5%
Ranch workers	Employed in a declining industry of the region	5%
Alcoholics	Looked down upon by members of society	5%
Tour guides	Guides working alone are often isolated	5%
Fishers not belonging to a cooperative	Independent fishers least likely to be involved in management of marine resources	5%

5.3.6 Governance to Navigate Regime Shifts

Social and ecological processes are often influenced by governance arrangements and frameworks, and how decisions are made. Tables 5.22 and 5.23 depict the key governance and decision-making actors of the community, respectively, as identified by respondents. 80% agree that the mayoral team is the most significant governance figure in the community, and analogously, 80% state that the government is the main decision-making power. Due to the variability of changes at different

levels and across space and time, governance measures require cooperation of actors at municipal, regional and national levels, as well as the community.

Table 5.22: Governance actors of change

Key Governance Actors?	**Example**	**Percentage of Respondents (n=20)**
Mayoral team	Makes key community decisions	80%
Federal government	Through establishing the reserve	10%
Community members	Through management of reserve	5%
Fishing cooperative	Distributors of fishing permits	5%
Don't know	N/A	5%

Table 5.23: Decision-making actors

Who Makes the Rules?	**Percentage of Respondents (n=20)**
Government – local, district, provincial, federal	80%
Local institutions – village/community, regional, networks, others	15%
Don't know	5%

Nayak and Armitage, 2018, contest that governance arrangements and institutions should be made more flexible and that collaboration and co-learning are essential components for communities and decision-makers to anticipate and navigate change. Success of governance measures is often contingent upon decision-making processes that allow for social learning of regime shift drivers beyond the individual. However, such organizations can only work if there is trust between all actors. Tables 5.24 and 5.25 reveal the ways in which respondents believe different governance actors work together and the level of trust between them, respectively. 50% of individuals believe governance actors at varying levels collaborate when making rules and regulations together. Collaborative decision and rulemaking can help to build a more holistic and system-oriented understanding of change, critical for coupled social and ecological systems. Some advantages of this approach include: overcoming imbalances in power, equity and justice dimensions; and identifying indicators or early warning signals of impending change via knowledge of various resource users (Nayak and Armitage, 2018). Multi-layered and co-management approaches, yet to be implemented in the RLBR, have emerged to better align knowledge and action in SESs,

enabling communities to be more involved in management and decision-making, and effectively counter social and ecological change without strenuous difficulty.

Table 5.24: Collaboration in governance

Governance Actors Work Together?	**Percentage of Respondents (n=20)**
Make rules/regulations together	50%
Don't work together	30%
Don't know	10%
Policing/security	5%
Coordinate projects	5%

Table 5.25: Trust in governance

Level of Trust?	**Percentage of Respondents (n=20)**
Very High	0%
High	25%
Moderate	35%
Low	15%
No Trust	25%

In summary, a framework that fosters multi-level linkages and networks, investment in management and governance approaches reflecting openness to a multitude of knowledge types, and strategies for capacity building and flexible institutional adaptation can better understand and respond to potential regime shifts (Nayak and Armitage, 2018). The following section will analyze the connectivity between different drivers, changes and impacts.

5.3.7 Connectivity

A key aspect of social-ecological change is the connectivity between various drivers and impacts, as SERSs can have "multiple causes" and often involve "slowly unfolding changes and interactions…complex shifting patterns" (Hughes et al., 2013). Complex interactions and connectivity between factors can worsen the risk of SERS occurrence through the "contagious spread of disturbance" (Brondizio et al., 2009; Carpenter and Brock, 2010; Levin et al., 2013; Walker and Meyers, 2004). Connectivity between drivers, changes and impacts is important to note as it represents a "critical issue for planetary resilience because of its potential to increase the

likelihood of contagious spreading or scaling-up of local regime shifts to larger scale…as connectivity grows due to anthropogenic action, there's greater risk of regional and global regime shifts" (Hughes et al., 2013). Thus, deducing connectivity early-on can serve as an "indicator of early warning for an impending critical transition of regime shifts" (Zurlini et al., 2014). The interconnected nature of drivers in this study, studied in Focus Group Activity 1 (described in Chapter 4) is depicted in Figure 5.14 and Table 5.26, illustrating the complex nodes that characterize change (from source to endpoint), which in turn exacerbates the impacts endured by community members and the ecology of the reserve.

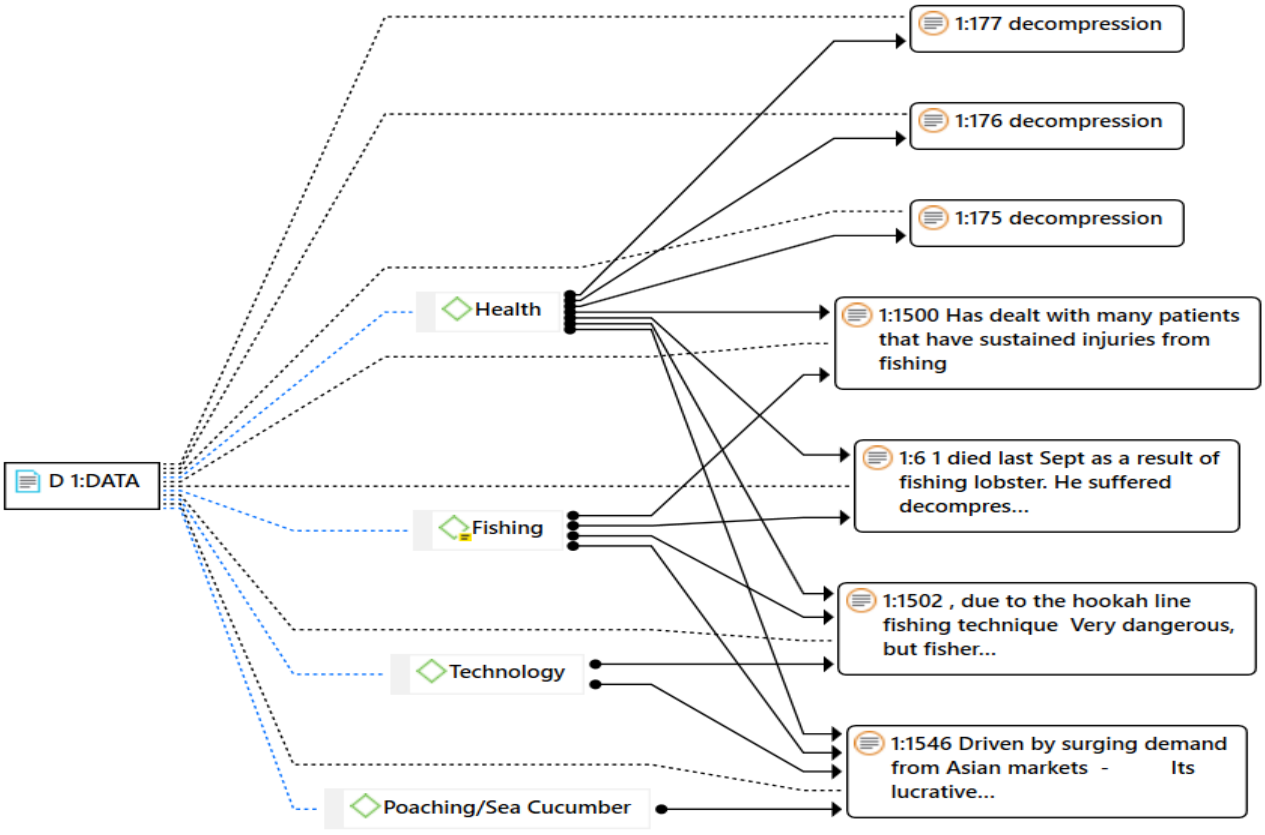

Figure 5.14: Graphic created using ATLAS.ti depicting the complex interconnectivity between drivers of change using results from Focus Group Activity 1, using the sea cucumber fishery as an example

Table 5.26: Major drivers, changes and impacts in Ría Lagartos

Drivers	Changes	Impacts
• Commercial demand (driven by Asian markets for sea cucumber as a luxury product and rise in wealth – historic and cultural roots) → • Fisheries/harvest consumption (more marine species fished as a result of sea cucumber)→ • Adoption of new technology (hookah fishing introduced to acquire sea cucumber as it becomes scarce closer to shore) → • Species removal (sea cucumber extirpated from ecosystem)	• Fisheries collapse (collapse of sea cucumber fishery) • Marine food webs (nature of ecosystem changes as sea cucumber, an important detritivore, is removed) • Governance change (fish bans introduced) • Socio-economic (dynamic of community changes)	• Food and nutrition (food security implications as marine species decline) • Ecosystem health (dynamic of ecosystem changes) • Livelihood and economic activity (decreasing income from fishing) • Social conflict (poaching and violence increases) • Health (more fishing related injuries/deaths due to decompression sickness)
• Conservation (reserve implemented) → • Adoption of new technology (use of social media to promote reserve)→ • Tourism → • Infrastructure and urban development (construction of hotels, restaurants) → • Habitat fragmentation and vegetation conversion (destruction of mangroves and beaches for hotels, etc)	• Governance change (CONANP implements reserve) • Marine food webs (dynamic of reserve food web changes) • Socio-economic (dynamic of community changes from fishing to incorporating tourism)	• Pollution (increased trash in community due to tourism) • Ecosystem health (parts of reserve protected AND destroyed) • Livelihood and economic activity (reserve creates opportunities for alternative/diversity of livelihoods, income for community) • Aesthetic and recreational values (reserve creates recreational opportunities for community and is pleasant to see) • Cultural identity (reserve is a source of pride for community) • Increased community autonomy (community is more self-reliant) • Wood fuel/natural resource consumption (presence of reserve restricts community from using mangrove wood as resource) • Urban development (presence of reserve restricts spatial growth of community) • Health and physical security (community impacted less by hurricanes flooding due to mangroves)
• Population growth of community	• Socio-economic • Fisheries collapse (more fishers puts greater strain on fishery)	• Pollution (increased trash and water pollution from more boats, oil) • Livelihood and economic activity (more people leads to increased competition amongst fishers and tour guides) • Urban development (no room to build houses for the increased population as community is surrounded by reserve land)
• Industrialization (salt company and construction of windmills)	• Marine food webs (dynamic of reserve food web changes) • Socio-economic	• Pollution (run-off from salt company) • Ecosystem health (degraded ecosystem, fish impacted by difference in pH levels and birds' migratory patterns impacted by windmills) • Aesthetic values (community believes presence of windmills and industrial run-off tarnishes aesthetic of reserve) • Livelihood and economic activity (fishing income impacted due to runoff and tourism income impacted due to windmills)
• Agriculture (ranches close to reserve) → • Habitat fragmentation and vegetation conversion (nearby land cleared for ranches)	• Socio-economic • Ecosystem health (degraded, spills over to reserve)	• Soil erosion • Pollution (smoke/smog from controlled burns) • Weather (disruptions in rainfall patterns) • Food and nutrition
• Climate change	• Ecosystem health • Socio-economic	• Weather (warmed temperatures, increased hurricane intensity, irregular rainfall) • Livelihood and economic activity (cannot fish as often during bad weather) • Health and physical security • Infrastructure (community buildings impacted by hurricanes)

5.4 Conclusion and Chapter Summary

Data collected from the SERS survey, the semi-structured interviews and focus groups reveals the severity of the social and environmental changes in the RLBR. Changes brought forth by the onset of the sea cucumber fishery in particular have led to a deterioration of "social–ecological system structure and function, with possibly considerable adverse impacts for human wellbeing and ecosystem processes." It has followed an abrupt, "boom-and-bust" cycle, leaving behind long-term and irreversible social and environmental deterioration in its wake. The fishery is characterized by a multitude of drivers that are cultural, historical, social, economic, and technological in nature. The changes shaped by its influence have caused ecological degradation, economic crises as fish stocks decline, social calamities and health related impacts on the community, with some residents even paying the price with their life in some unfortunate cases. Interview transcripts indicate that the changes are most likely everlasting, with little possibility of the SES returning to its previous state before the fishery was initiated. Measures to combat regime shifts are more likely to succeed if they incorporate the six dimensions and reflect the invariable nature of SERSs.

Another major change in Ría Lagartos concerns the transformation of its economic composition to amalgamate tourism as a major source of communal income. Tourism is increasing at an exponential rate in the region and some of the interviews revealed that it may quickly cross a threshold and overtake traditional jobs such as fishing. While it has brought economic prosperity and the establishment of increased conservation measures, tourism may also work to destroy habitat, increase pollution and widen social inequity gaps.

It is important to note that the six-dimension SERS framework was used to analyze change, not to measure or make a decisive conclusion on whether a SERS was occurring in the RLBR. To assess this, more quantitative data on for instance, sea cucumber historical and current catches or the amount of tourists visiting the region over time, is warranted for possible future research.

The next chapter will explore how local peoples view the reserve and their community wellbeing relative to the environmental and social changes analyzed above.

CHAPTER SIX: UNDERSTANDING LOCAL PERSPECTIVES OF RÍA LAGARTOS

This chapter analyzes and discusses the results for research objective two, namely: to examine local perceptions of the MPA in relation to community wellbeing and the historical and ongoing processes of rapid environmental and social changes. Previous research indicates that understanding the perceptions of local peoples is often one of the key contributing factors to the successful governance and support of an MPA (Audefroy and Sánchez, 2017; Bennett and Dearden, 2014; Ferse et al., 2010; Fraga, 2006; McClanahan et al., 2005; Ordoñez-Gauger et al., 2018; Pita et al., 2011). The findings of this section are represented in the conceptual framework by research objective "2", which connects all three research areas, seeking to determine how locals believe whether or not environmental and social changes are deterred or aggravated by the presence of the MPA and how this impacts their community wellbeing (Figure 6.1).

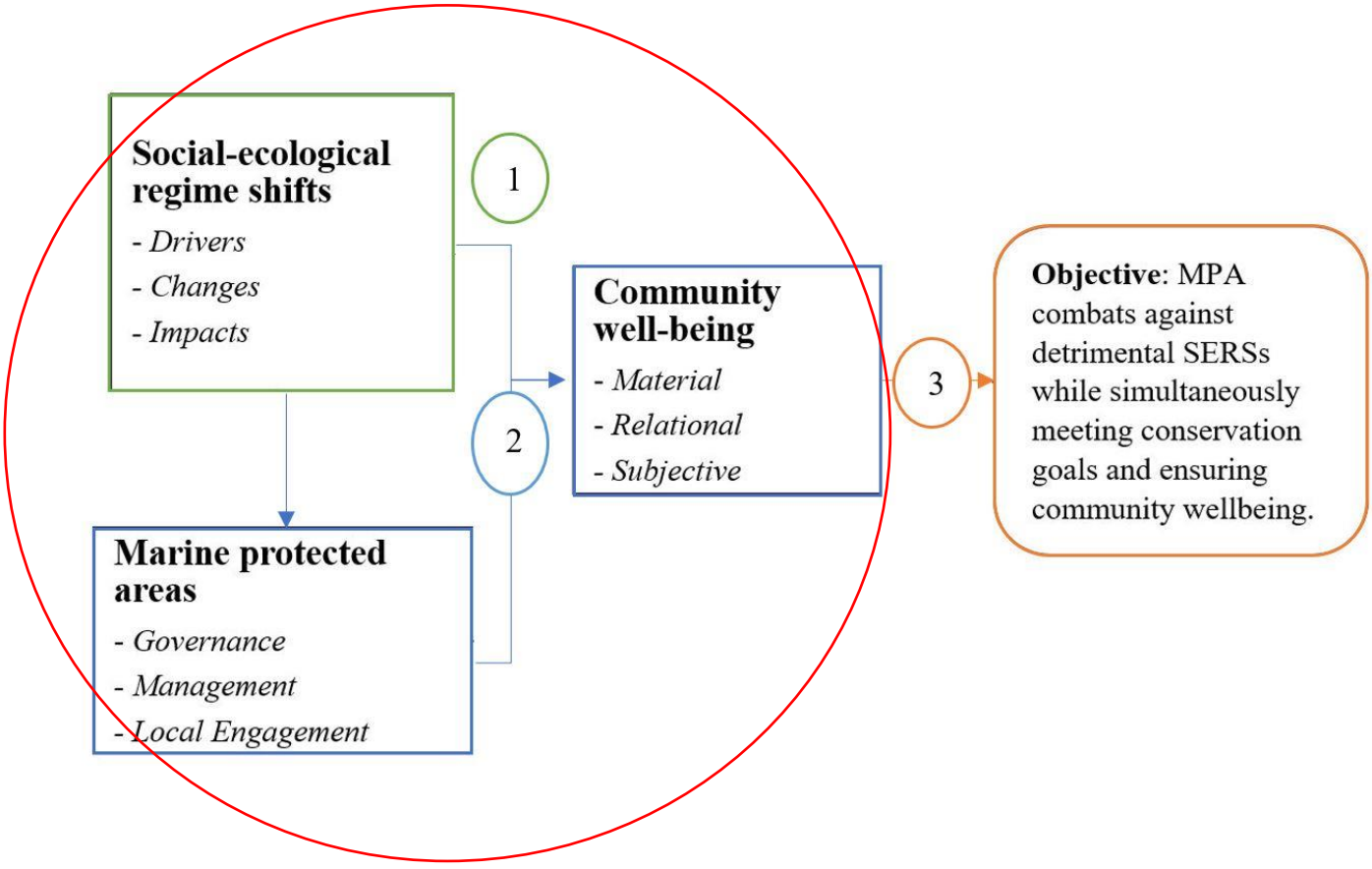

Figure 6.1: The thesis conceptual framework, as it relates to research objective 2

6.1 Overview of Results

Research shows that the success of MPAs are based on both ecological and social aspects (Pollnac et al., 2010), supporting the need to understand local viewpoints. The analysis will review community wellbeing as identified by locals. Then, community perspectives on the reserve are discussed, followed by how locals believe it influences their wellbeing. Moreover, views on the MPA's effectiveness to deal with environmental and social changes as identified in the previous chapter (i.e. sea cucumber fishery, tourism and conservation) are analyzed. Locals were then presented with an alternative view in which the reserve does not exist, and their perspectives on how this would influence their community are subsequently studied. Finally, the community's relationship with the government and their access to reserve resources is examined.

6.1.1 Community Wellbeing Factors

As defined in the literature review, community wellbeing is "the combination of social, economic, environmental, cultural, and political conditions identified by individuals and their communities as essential for them to flourish and fulfill their potential" (Wiseman and Brasher, 2008); or "the satisfaction with the local place of residence taking into account the attachment to it, the social and physical environment, and the services and facilities" (Forjaz et al., 2011). It encompasses three dimensions (McGregor, 2008; Armitage et al., 2012), specifically: material, or the tangible resource units such as income, infrastructure and natural resources; relational, or the social relationships/networks the individual is involved in such as family and personal relationships, community networks and markets; and subjective, or one's satisfaction with the quality of life he or she has achieved, expressed through factors such as self-identity, culture, ambitions and happiness. Indicators in these three realms are used in literature to assess the state of a community's wellbeing and to determine what should be prioritized in policy and planning (Wiseman and Brasher, 2008). Figure 6.2 below depicts the community wellbeing elements as identified by residents of Ría Lagartos.

The top two are material wellbeing factors, with 31% and 29% of respondents acknowledging the implementation of adequate public infrastructure and services such as water and electricity; and income accrued from tourism (Chapter 5), respectively, as the most important for the achievement of community wellbeing. Many agreed with the sentiment that the community needed "a better

water system, better streetlights and better public roads to improve wellbeing" (Housewife of Fisher). The recognition of income generated from tourism as a wellbeing factor speaks to the importance of this sector for the community's economy, as recognized in the previous analysis, "Tourism contributes to the community's wellbeing. When there are tourists around there is more jobs for us, people get employed, there is more entrance of money" (Housewife). Its priority over income generated from fishing in the list may indicate that tourism is gaining traction and importance as an economic sector in the region, as compared to prior, more traditional occupations such as fishing, which may be in decline.

A subjective wellbeing factor, conservation values, is also listed. Participants stated that "Río Lagartos needs more awareness towards conservation. We need to teach our people cultural and ecological values" (Tour Guide 4, June 2018). Statements such as these can indicate that the reserve has become an integral part of the community's fabric since its initiation, instituting

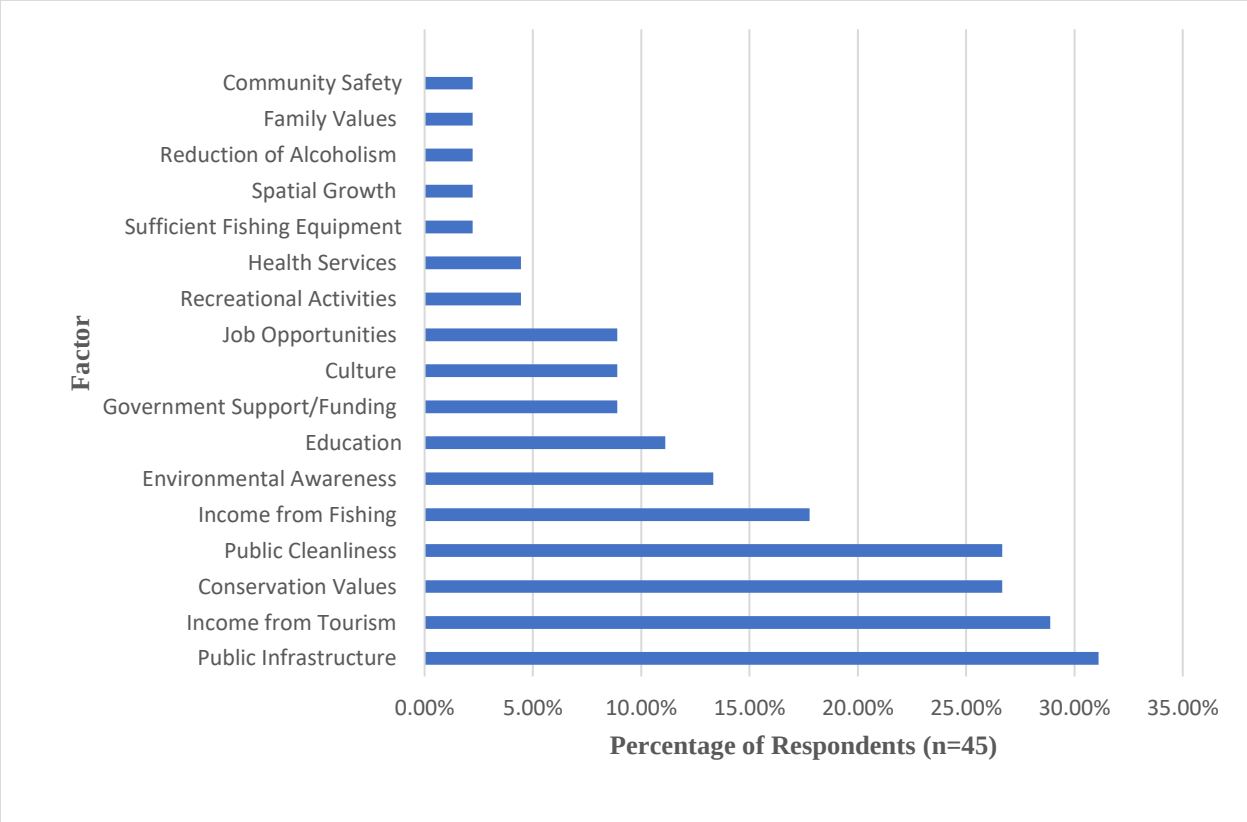

Figure 6.2: Community wellbeing factors, as identified by respondents

conservation values amongst the general public. This is also reflected in the subsequent community wellbeing factor that is identified, namely the maintenance of public cleanliness. Community

members recognized that, “management of trash contributes to our wellbeing. We must minimize trash impacts, especially around beach areas and ocean. Many people throw their boat’s oil into the water” (Housewife 7, June 2018). Income generation from tourism also serves as an incentive for the maintenance of public cleanliness, as fishermen point out, “there is a lot of trash inside the community and the reserve. That is a downside for us and for tourism” (Fisher 2, June 2018).

The next recognized factor is income generation from fishing, a sign of its identity as a fishing community, as seen in Chapter 5. Many residents generate material wellbeing from fishing, believing that, “if we have good wellbeing, that is because of fishing. If we have a season with good production, it immediately results in prosperity for the community. This translates to more flow of money, so trading and business are more active” (Fisher 6, June 2018). Fishing can have relational wellbeing influences as well, providing the opportunity to build community networks and access to multi-scale fishing markets. Many fishermen of the Ría Lagartos community report relying on one of the local fishing cooperatives as a type of community organization for social, economic and cultural needs. Finally, fishing is also often associated with subjective wellbeing elements like self-identity and way of life for communities such as those of Ría Lagartos (Allison et al., 2012; McGoodwin et al., 2001; Weeratunge et al., 2014).

The following component, environmental awareness, is also an example of subjective wellbeing, with some expressing that “there needs to be more information about the importance of the reserve” (Hotel Owner 5, June 2018), again signifying the importance of the MPA to the community’s identity. Environmentalism is reflected in the next wellbeing factor of education as well, with some interviewees asserting that, “there should be a subject in school, maybe taught in junior high, that teaches conservation and the importance of the resources of the reserve of Río Lagartos.” (Hotel Manager 4, June 2018). Education is a key factor identified by Salas et al., 2011, for communities of Yucatán to improve their standard of living and is also viewed under the material wellbeing lens, as a tour guide voiced that “investing in our schools, both in infrastructure and education improves our community’s wellbeing” (Tour Guide 9, July 2018).

Support or funding from government authorities is another factor residents believe enhances the state of their community’s wellbeing, especially in the case of fishing. As tourism grows exponentially and overtakes fishing as the main economic sector, some are worried that attention

is being diverted away from the traditional livelihood source. This is a big concern for fishers, as they contend that, “what we need is government support for fishing because its greatly reduced. If this issue would be taken care of, that would help a lot, because we live out of fishing” (Fisher 11, July 2018). In this case, the transformation of the community’s economy inequitably enhances the wellbeing of certain members (i.e. those involved in tourism such as guides, hotel and restaurant owners), while undermining it for others (i.e. those involved in fishing). It can be seen here that a shift or change induced by economic factors, as the community moves from being fishing to tourism dominated, has inflicted various human wellbeing impacts. For many coastal communities, fishing is embedded in the cultural identity of the populace. As fishing declines, because of the emergence of tourism and diminishing fish stocks, some fear that the community’s cultural identity will also be degraded, “we are losing our way of life and our culture as more outsiders come to our community” (Fisher 22, July 2018). To counteract this, some advocate that “there also needs to be more promotion of opportunities for teenagers and young adults, like cultural activities” (Hotel Owner 8, July 2018). There seems to be a concern that as the community changes, young people will forget their cultural roots that are entrenched in fishing.

The following wellbeing aspect of job opportunities is indicative of this, as some believe that there “needs to be more job opportunities for young people such as jobs related to the fishing industry to increase community wellbeing” (Rancher 2, July 2018). In order to engage the youth of their community, locals have suggested that “there should be more recreational activities for young people” (Park Ranger 2, August 2018).

Furthermore, the provision of adequate health services was cited as another factor to achieve community wellbeing, “the community needs more medical doctors and better health services” (Hotel Manager 6, July 2018). In its analysis of DCS related ailments amongst fishermen, the previous chapter revealed that important health services such as a hyperbaric chamber to combat against DCS are often far out of the reach of community members, with the nearest one being located in Tizimin, 53 km away. This has resulted in some extreme cases where fishermen have lost their lives as they were unable to attain treatment. Inaccessibility to health services is a major hindrance to the achievement of optimal community wellbeing, with Salas et al., 2011, reporting that 44% of communities in the coastal state of Yucatán do not have access to health services.

Their study found that fishers in Yucatán recognized the provision of better health services as a means to build-up wellbeing at the community level.

Moreover, many fishers voiced that the facilitation of sufficient fishing equipment for their work is also a necessity for community wellbeing, "We need more support for better equipment to maintain our livelihoods," again pointing to the decline of fishing as an economic sector.

In addition, restriction of the community's spatial growth, explored in the previous chapter, as an impact of the changes brought on by the implementation of the reserve, is again cited here as a hindrance to community wellbeing, "more houses, we need more, but because we are surrounded by federal land, this is very restricted" (Tour Guide 11, July 2018). Many believed that if some of the reserve's lands were freed for urban expansion, then this in turn would improve communal wellbeing, allowing the community to grow.

Locals also argue that there needs to be a reduction of alcoholism rates, "the community needs to reduce its alcoholism problems for better wellbeing" (Housewife 17, July 2018). Some credit declining fishing rates to social problems such as a rise in alcoholism, which is reported to have detrimental impact on family cohesion. To counteract such occurrences, promotion of relational and material wellbeing points like "family values" and "community safety measures" is suggested.

Focus Group Activity 1 queried participants on why they believed that some of the wellbeing indicators identified above are not being achieved, recognizing any obstacles hindering the attainment of optimum community wellbeing. Factors were then subsequently linked to obstacles brought forward by partakers. Respondents pointed to insufficient government support as a deterrent to attaining their community wellbeing ideals. For instance, after listing better infrastructure systems as a wellbeing objective, it was contended that this had not yet been improved because, "the government doesn't help enough, they only do some work during elections time" (Shop Keeper 1, July 2018). Statements such as these imply somewhat of a strained community-government relationship, aggravated by the occurrence of environmental and social changes, which may benefit from increased interaction.

Focus Group Activity 2 asked participants to identify on a map (Figure 6.3) which areas of their community they believe to be the most important for their community wellbeing. The top five

most commonly recognized areas were the hotel hub, the entrance to the ocean, the mangroves, city hall and the cemetery. Community members linked all three dimensions of wellbeing to the aforementioned areas, as follows: the hotel hub provides revenue to the community as it is where tourists reside, the ocean entrance is where fishers work to bring livelihood for their families, the mangroves safeguard the community from hurricane impacts, city hall is where the community has access to the local authorities, and the cemetery is important for Mexican cultural holidays such as the "Day of the Dead/ Día de Muertos." The results of this activity showcase how members of a community connect sense of place with their wellbeing, as revealed in previous studies on the subject (Atkinson et al., 2016). The presence of the reserve in particular, through the mangrove forests and the creation of alternative livelihoods, has become a point of pride for the community.

Finally, Table 6.1 below describes the six dimensions of SERSs as they are viewed from the outlook of community members and their wellbeing, with a sample quote from the interview transcripts, each corresponding with its relevant dimension. The first dimension, differentiating drivers of regime shifts, is recurrently characterized by the changes in marine species' population and the sea cucumber fishery (Section 5.2.1). In the context of Ría Lagartos, community members identify overexploitation of marine species by external markets as drivers of change in their community, leading to social, economic and ecological impacts (see Chapter 5 for a thorough case study of the sea cucumber fishery).

Figure 6.3: Focus group activity 2, asking participants to identify areas of importance on a map of the RLBR

Levels and scales of occurrences and interventions are described through the apparent cooperation between industry and government some community members have noted in dealing with changes. For instance, in the case of Ría Lagartos, community members have noted that during political elections and campaigns, private corporations have gotten involved in conservation measures if they align with the views of the favoured party. Moreover, many fishers identify the fish and marine species of the surrounding ocean environment as the primary social-ecological units on which they are dependant. In Ría Lagartos, fishers have stated relying on the reserve's many fish species (listed in Section 3.3) as their primary source of income, with lobsters, groupers and octopi being the most economically important species.

Next, locals depict the equity and social justice concerns around the issues of disproportionate sharing of earnings amongst members of the fishing cooperatives in Ría Lagartos. Such instances of corruption and inequity have been cited in previous studies as well, with SSF scholars finding that social impacts and benefits are usually not uniformly distributed amongst stakeholders, usually the most marginalized groups bearing the brunt of negative changes (McNeill et al., 2018).

In addition, equity concerns are apparent in the Ría Lagartos' tourism industry, as some respondents pointed out that local benefits from tourism are limited because revenues mostly go to outside benefactors, investors and owners of businesses and resorts. Loss of land ownership, tenure rights and access to resources in the community to the hotel industry is a consequence of increasing tourism as well. Such findings are also existent in previous studies conducted on MPAs linked to tourism (Bennett and Dearden, 2014; McClanahan et al., 2005; Sowman and Sunde, 2018; Nayak and Berkes, 2010).

Subsequently, in defining the power and politics dynamic of their community in the context of Ría Lagartos, participants often stated that certain stakeholders, namely the permit holders and fishing cooperatives, are one of the most influential groups in the town due to their position and access to external resources, funding, markets and networks. MPAs and power dynamics in other studies highlight issues of disparity and marginalization of everyday fishers, while more dominant groups, usually privileged fishers with political ties, are beneficiaries (McClanahan et al., 2005; Sowman and Sunde, 2018; Vázquez, 2017).

The final dimension of SERSs, governance to navigate regime shifts, outlines the various institutions, administration schemes and relationships present in MPA management. As the results

of the previous chapter indicate, community members of Ría Lagartos are divided in their perception of the level of collaboration and teamwork they believe different levels of government have in the governance of marine resources. Such varying findings may indicate that greater dissemination and communication between the government and community is required. The next section will discuss how community members perceive the reserve in relation to the wellbeing points mentioned here. The SERS dimensions provide a useful basis for the community to understand changes of the RLBR.

Table 6.1: The six dimensions of SERSs, as viewed by community members of Ría Lagartos

Dimension	**Sample Quote**
Differentiating Drivers of Regime Shifts	There has been an overexploitation of marine species as a result of sea cucumber fishing (Fisher 5. June 2018).
Levels and Scales of Occurrence and Interventions	Private organizations have tried to take actions and get involved with the governance of reserve's resources by working along with and financing political parties/elections (Ranch Worker 1, June 2018).
Social-Ecological Units	I depend on the ocean and its marine species as I am a fisher, for my economic needs (Fisher 24, July 2018).
Equity and Social Justice Concerns	Fishing cooperatives, if they receive economic support from the government, they don't spread it equally (Hotel Worker 8, June 2018).
Power and Politics	Permit holders and fishing cooperatives have the most power here in Río Lagartos, creating differences in the community (Fisher 19, July 2018).
Governance to Navigate Regime Shifts	Federal and state government work together with the mayor in rules establishment (Hotel Manager 3, June 2018).

6.1.2 Perspectives on the RLBR in Relation to Community Wellbeing

Previous literature indicates that conservation success of MPAs is often conditional on local support, strongly predisposed by perceptions of how the MPA influences the local community (Bennett and Dearden, 2014). The results of this section reveal that the communities of Ría Lagartos generally have a favourable view of the reserve, with 71% (Figure 6.4) stating that the presence of the reserve has added to the community's overall state of wellbeing and that pros of its implementation outweigh the cons. When asked to define the reserve, many described it based on its physical and ecological characteristics, "to me, the reserve is land extension between Río Lagartos, El Cuyo and Las Coloradas," (Restaurant Worker 5, June 2018), "the reserve is nature, is where you find birds, wild pigs, jaguars, deer and many other animals" (Fisher 17, July 2018);

while others also recognized its economic significance, “the reserve is a very beautiful place which has brought many benefits for our community because of its touristic importance” (Housewife 7, June 2018), “the reserve is a source of livelihood for many of us, it is a touristic place rich in mangroves, flamingos and birds” (Fisher).

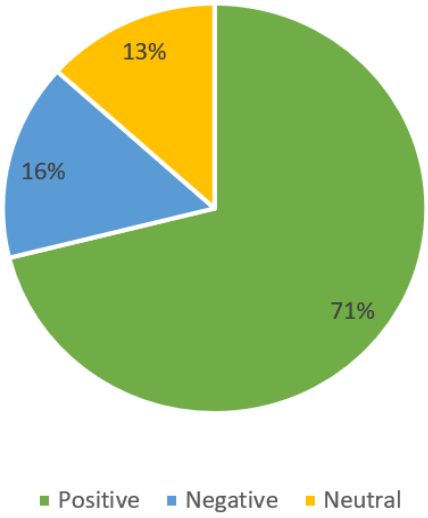

Figure 6.4: Perception of the Ría Lagartos Biosphere Reserve, as identified by respondents

Some community members acknowledged the reserve for its ecological contribution as well, “this place is paradise. It has eight ecosystems, four mangrove species, it’s a big food source and the nesting site of a lot of migratory birds,” (Hotel Manager 7 July 2018), “The reserve is a living element and an important ‘lung’ for Yucatán which is also rich in flora and fauna” (Fisher 6, June 2018), “The reserve is a unique place for its flora and fauna in Mexico and around the world” (Tour Guide 13, July 2018).

Many also agreed that the ecology of the reserve warranted conservation, instilling it on the community and posterity, “The reserve is the place where we live and where we find animals and birds. It is important that our community remembers that we must protect its resources and remind ourselves that there are activities that damage them” (Fisher 14, July 2015), “It is a very beautiful place with many birds, crocodiles and flamingos. It is where mangroves and birds live, and we must preserve it and teach our kids how to take care of it” (Housewife 7, June 2018). Previous studies align with such statements, finding that perceptions about coastal resource management and health is an important influencer of environmentally conscious behaviour. The identification of such factors that drive varying perceptions of distinct social groups can therefore be a significant

management tactic of marine resources to overcome existing knowledge gaps (Thomassin et al., 2010). Positive perceptions in particular, such as increased respect for the environment and greater recognition as a tourism destination, as seen in the Ría Lagartos example, are a critical area of concern for managers as they are a useful predictor of behavioural intentions and compliance (McNeill et al., 2018). In their study, McNeill et al., 2018, found that the presence of a marine reserve increased community pride and awareness to the marine environment, recognizing the outstanding natural values existent in the community. This in turn created a greater sense and encouragement to care and protect the local environment and a psychological feeling of comfort amongst stakeholders.

On the other hand, some respondents in Ría Lagartos brought to light the drawbacks of living within the vicinity of a reserve:

> The reserve has added to the community's wellbeing, but it has also taken away resources for some. You could use wood from the reserve before to build houses, not anymore. There are pros and cons, but I think cons outweigh pros (Housewife 12, July 2018).

> The reserve has created some impacts to the community because there's currently no more space to build houses, and the salt company is allowed to take land of the reserve, authorities allow this because the salt company gets a "concession," they pay some documents and are thus authorized by law to remain there (Tour Guide 9, July 2018).

> 50/50 of the community has benefited. There is currently more protection towards the reserves' resources and that is a plus. But on the negative side, the presence of the reserve has limited/stopped urban development. Being surrounded by protected areas doesn't leave you much space to grow. So, pros are for the environmental side but there are equally cons in the social side (Restaurant Worker 5, June 2018).

The above statements reveal some of the changes the reserve has brought in terms of urban development (Chapter 5) and the power dynamics at play in the reserve's management. Some residents feel that they have been restricted from using the surrounding natural resources and that the growth of their community has been stunted, generating environmental "pros" but social "cons." At the same time, exceptions are being made in the case of industry such as the salt company, which is bringing its own slew of changes to the reserve. Inequitable cases such as these may conjure feelings of resentment towards MPAs and lead to greater instances of regulation incompliance. Moreover, when asked to describe their relationship towards the reserve and

whether they were involved in its management or conservation, 71% stated that their line of work directly or indirectly related to the reserve. Some reported "working in a cleaning project within areas of the reserve" (Housewife 11, July 2018), participating in "volunteering work in SEMARNAT programs, such as cleaning of areas from trash, helping with monitoring flamingos during nesting season and tagging of crocodiles" (Restaurant Worker 8, July 2018), giving "a talk to students from University of Merida, about how to protect the environment" (Retired Fisher 7, July 2018), and receiving "courses and talks about its management" (Tour Guide 2, June 2018). Others acknowledged that "I am a fisher, that is my relationship with the reserve" or "working through tourism is how I am related to the reserve" (Tour Guide 8, July 2018), or simply "I live next to it" (Housewife 6, June 2018). The latter three statements indicate that community members recognize and relate the reserve to their material wellbeing as a source of income (through fishing and tourism) and residence. In the case of the park rangers, they relayed and explained their occupation:

> We conduct vigilance of its areas, protect it. Promote environmental awareness and education programs. We do patrols and follow-ups of farms/ranches, lands with owners inside and close to the reserve. We work on the management of waste/trash, monitoring of species such as sea turtles, mangroves, crocodiles, flamingos. This involves activities like labelling, counting of animals and nests. If we consider sea turtle nests are vulnerable/at risk, we move them to a safer place (Park Ranger 2, 2018).

It is generally the view of the community that the reserve has added to its wellbeing, whether being employed as a park ranger, tour guide or fisher, or through conservation measures, or simply by having a place to call home. While some trade-offs are present, many agree that, "the presence of the reserve has helped the community's wellbeing" (Fisher 8, June 2018). The next section will discuss how effective locals believe the MPA is in deterring against environmental and social changes.

6.1.3 MPA Effectiveness and Social-Ecological Change

In alignment with the previous section, 82% (37 of 45) of respondents believed that the reserve has been effective in resisting environmental and social changes and meeting conservation objectives. Analysis in the Chapter 5 indicated to various environmental and social changes taking place in the region. The decline in fish stock of marine species, exacerbated by the Asian demand

in sea cucumber, was one of the key drivers of change identified by respondents. Although it has induced various social and environmental impacts, many fishers agreed that without the reserve,

Figure 6.5: The mangrove forests of the reserve have been cited by community members as important to wellbeing due to the protection from hurricane impacts (photograph by author)

"fishing production and the issues related to sea cucumber would probably be worse. There would be no fishing bans, so there'd be less product." Literature repeatedly indicates that well-managed MPAs build the resilience of coastal communities through the spillover of fish, leading to benefits via increased catch (Bennett and Dearden, 2014). In the case of Ría Lagartos, it appears that the presence of the reserve has, to a degree, offset the pressures brought forth by the sea cucumber fishery. Furthermore, many community members advocated for the protection from climate change impacts established by the mangrove forests of the reserve. Mangrove ecosystems (Figure 6.5) play a pivotal role in buffering storm-surges caused by climate change intensified hurricanes, adding to the physical resilience of coastal communities (Alongi, 2008). Respondents asserted that, "the mangroves are an important part of the ecosystem. If we didn't have them, we would be more impacted by hurricanes and "nortes," which are bad weather conditions with strong winds and rain from the North" (Fisher 16, July 2018).

However, while many agree that the reserve has shielded against certain changes, some contend that its presence has worsened others. Research shows the conservation objectives of MPAs can sometimes come into conflict with community development goals (Mangubhai et al., 2015), as

some respondents agree is the case in Ría Lagartos where, as aforementioned, the reserve has confined the urban expansion of the community. As the population grows and changes, the conservation aims of the reserve have clashed with the community's progress:

> With the presence of the reserve, there's barely any free land left to build, and those lands that are still free have now a much higher cost. Most land within the reserve is considered federal land, non-buildable. This occurs while the salt and hotel industry receive immunity from the government (Tour Guide 11, July 2018).

As Bennet and Dearden, 2014, contend, MPAs can sometimes "lead to contrary socio-economic outcomes, including increased conflict and political struggle, exacerbated vulnerabilities, negative socio-cultural change, increased restrictions, decreased levels of power and alienation in natural resource management processes, forced migration, loss of assets, and increased social tension." In such a situation, the MPA widens socio-economic gaps, benefitting industry while community members who are already increasingly vulnerable to change are further restricted, disempowered and alienated. Finally, it is the opinion of some community members that the reserve has also been ineffectual in realizing its conservation targets:

> We need more surveillance and monitoring within the reserve. For example, some people fish horseshoe crabs from waters inside the reserve, it is used as bait for octopus. Horseshoe crabs are in danger of extinction. I can think of up to 10 people that fish it from the "Ría." I don't know if SEMARNANT knows this, but members of the community sure do (Tour Guide 13, July 2018).

Ineffective monitoring and follow-up has been previously cited as a cause of failure for many Mexican MPAs (Fraga and Jesus, 2008). As the above statement indicates, increased involvement of community members in the reserve's surveillance may help to mitigate such occurrences. In addition, increased tourism in the area may have further hindered the ecological performance of the MPA, as the influx of visitors, attracted by the natural features, have led to increased waste generation and habitat fragmentation. In the literature, tourism is often found to be increasingly linked to MPAs, and resource managers continually face the predicament of finding balance between the promotion of tourism and increase community revenue and controlling tourist pressure on fragile ecosystems (Wells et al., 2016)

It is evident that while majority of the community members of Ría Lagartos agree that the reserve has helped to dissuade against specific environmental and ecological changes, it has worked to intensify others, revealing the complex trade-offs involved in MPA management. The following

section presents a scenario wherein the reserve does not exist and explores how this would impact the community and its wellbeing.

6.1.3 Alternative Scenario – Absence of an MPA

The alternative scenario in which the community developed without the formal implementation of the reserve by the federal government was presented to locals to gauge their understanding of how their community would be different. This scenario sought to understand the relationship local peoples have with the reserve and how it influences their day to day life. When asked how their community would be different if the reserve had not been implemented, the unanimous verdict was that community wellbeing would be overall worse off without the reserve. Respondents generally pointed to the income the reserve generates from tourism, stating that without it, "there would be crisis. Tourism from the reserve helps people, it's an economic alternative and money entrance not just for tour guides, but hotels and restaurants also" (Tour Guide 12, July 2018) and that "things wouldn't be better. On the contrary, they would be less favourable for us, because we would only have fishing as our source of income" (Housewife 6, June 2018), referring to the alternative livelihood opportunities the reserve has helped create. Other studies done on MPAs (Bennett and Dearden, 2014; Daw et al., 2011) have found that they can contribute to poverty alleviation through tourism jobs as fishing declines, allowing locals to benefit and improve their wellbeing and socio-economic conditions through new employment opportunities and increased revenue. Many also contended that the local fishery would be even more overburdened than it is now, "Our situation would be worse. As bad as it is now because not everyone respects fishing bans or protect the environment, but without the reserve, we would be in a worse place" (Fishing Cooperative Member 3, July 2018). Besides providing commercial viability, the marine species of the reserve are also a source of sustenance for the families of fishermen. Absence of the reserve would render the communities of Ría Lagartos a "…no man's land. It would be a disaster and probably most of us would be starving. Our fishing cooperatives have helped us aiming to preserve our resources by the establishment of fishing bans" (Fisher 4, June 2018). As previously noted, community members also commend the presence of the mangrove forests, stating that without them, "the reserve would be destroyed. We would be in crisis. Mangroves wouldn't have protection, and would very likely be destroyed, this would be terrible for us because mangroves protect us from hurricanes and bad weather" (Fishing Cooperative Member 2, July 2018). In terms

of subjective wellbeing, there is the view that the reserve has added to the independence of the towns, "We have more autonomy as a community, we don't have to travel to Tizimin as much as before" (Housewife 4, June 2018). It is apparent that the reserve has contributed to the cultural identity of the communities as well, "The reserve has become a part of the culture of the community. Without it, there would be catastrophe" (Restaurant Worker 3, June 2018). Participants also asserted that in absence of the reserve's regulation by government authorities, individual self-interest would decimate the surrounding ecology:

> Everything would be and work out of freewill. There'll be no regulations to the mangroves so a lot of it would be destroyed (Housewife 4, June 2018).
>
> Without the reserve things would be worse, without rules and control of the resources we would be against each other, everything would be overexploited (Tour Guide 8, July 2018).
>
> Everyone would do as they'd please. It would be worse (Restaurant Worker 5, June 2018).
>
> Species like flamingos and turtles would still be hunted, so their population would be damaged (Housewife 14, July 2018).

Statements such as these indicate that residents believe a management and governance scheme solely led by community members would be unsuccessful as everyone would act in their own self-interests. This will be further explored in Chapter 7. Moreover, there is a fear that absence of the reserve would cause an upsurge in social conflict like neighbouring regions, "If we didn't have the reserve there would be more violence just like in Cancun…Maybe we would have more influence of drug cartels" (Tour Guide 7, July 2018). Some predicted that residents would return to more traditional occupations that were once the primary economic driving force in the region, "Maybe there would be cattle raising. It's barely an option for living now" (Retired Ranch Worker 2, July 2018). Others believed that, "People would leave Río Lagartos in search of other job opportunities…Life would be difficult; many people would be in search for better opportunities" (Landlord 1, July 2018). On the other hand, referencing the spatial growth issue again, some suggested that without the reserve, the community would have more room to grow, "There would be more population because presence of the reserve acts as a limit for urban development…Maybe we could be more people because we wouldn't be spatially limited by the reserve. We are a lot of people already" (Housewife 9, July 2018).

One interviewee proposed a compromise between the two competing objectives of conservation and community expansion:

> I'm in favour of protecting mangroves and it is good that there are laws for that, but if we get to a good number of vegetation, it would be nice that the reserve would give something back to the community. Like to give wood for domestic use or land to grow the population. A two-sided system would be more beneficial (Mayoral Candidate 1, July 2018).

Such a notion, implemented in a co-management governance approach, may entice greater uptake and compliance of the reserve's regulations, and therefore more buy-in and involvement from the surrounding communities. Research shows that the proliferation of sustainable tourism provides an ideal opportunity to balance socio-economic and conservation outcomes, leading to a "win-win" situation for conservation and development and simultaneously meeting "the needs of conservationists, governments, fishers, tourism operators, and local communities…However, the successful achievement of this dual mandate is more complex in reality than in theory" (Bennett and Dearden, 2014). It is the prevailing belief that the existence of the reserve enhances communal wellbeing. However, integration of community views and engagement in decision-making may work to enhance both community wellbeing and environmental conservation of the region (Nayak and Berkes, 2008). The next segment investigates the relationship between community members and the government authorities responsible for the implementation and operation of the reserve, examining any hindrances to the achievement of a co-management governance approach that will be explored in length in Chapter 7.

6.1.4 Government and Community Relations

The quality of community-government relations are usually at the core of an MPA's ability to achieve its conservation targets in its respective area (Ordoñez-Gauger et al., 2018). Research shows that the social acceptability in the context of an MPA, defined as, "a measure of support towards a set of regulations, management tools or towards an organisation by an individual or a group of individuals based on geographic, social, economic or cultural criteria," (Thomassin et al., 2010) often correlates directly with non-compliance instances of its regulations. If social acceptability is degraded, it will undermine the creditability of an MPA manager to regulate natural resource use, leading to occurrences of regulation incompliance such as poaching (Voyer et al., 2015). As McNeill et al., 2018, contend, "Favourable opinions are considered a position of

acceptance and unfavourable opinions a position of rejection…support, or a reduction or lack of vocal opposition are considered indicators of communities granting a "social licence to operate" to a project." Social licence is defined as "an unwritten contract of community acceptance reflecting expectations and opinions about the costs and benefits resulting from a practice or project." Recognizing the full spectrum of social attitudes will help managers better MPA policy. Positive perceptions and opinions such as local community pride in the reserve can be used by MPA managers to grow support and convey advantages of the MPA's establishment, while negative ones can be used towards incompliance mitigation and prevention of community opposition (McNeill et al., 2018). Understanding the relationship between government and community and the drivers of stakeholder support is therefore critical for MPA management. When asked to comment on the nature of their community's relationship with the government authorities of the reserve and whether their access to resources had been changed since its initiation, the universal conviction was that the government has been generally supportive in their provision of access to the reserve's resources. Majority of interviewees pointed to the government's support for the community in generating tourism income from the reserve:

> Government has supported people that work as tour guides. If they need a new engine for their boat, government aids up to $30,000 MXN ($1600 USD) to acquire it (Housewife 12, July 2018).
>
> Government has provided support; they would pay for lifejackets and a percentage of motors if you had to buy a new one (Fisher 8, June 2018).
>
> Government has provided support. Tour guides have had the chance of only paying 50% of costs, like life jackets, boats, motors/engines…things they need to work as tour guides (Tour Guide 9, July 2018).
>
> Yes, there have been projects and support for infrastructure directed to tourism (Housewife 11, July 2018).
>
> There's been some economic support for us, particularly directed towards tourism, like boat equipment (Fishing Cooperative Worker 2, July 2018)
>
> There are programs financed for the construction of piers and resting areas for tourists. These programs are approved by the mayor and/or SEMARNAT (Housewife 4, June 2018).

Furthermore, as fish stocks have declined, community members have noted that the government has attempted to counteract against the impacts brought forth by these changes:

> During grouper fishing ban, government gives fishers economic support to avoid fishing of these species. For 2 months each 15 days fishers are given $700 MXN ($37 USD) and money for food pantry worth $500 MXN ($27 USD). I received this support once. I know their economic support is given to fishers in all Yucatán, not just Río Lagartos. It started 5 years ago, comes from an agreement between fishing cooperatives and government. The fishing cooperative you belong to will hand you this support as you have your documents in order (Fisher 8, June 2018).

Subsidies such as these incentivize adherence to reserve regulations while simultaneously striving to protect against the impacts from changes in fish stock. Community members also praised the efforts government has made in conserving the reserve's resources:

> Yes, the government has invested in the conservation and monitoring of the reserve (Retired Fisher 3, June 2018).
>
> Government has tried to preserve its resources. I believe it has been involved in the protection of the reserve (Retired Ranch Worker 2, July 2018).
>
> Yes, government has assigned budget to work the reserves protection. To those that have permits, governments aids with economic support for engine and canopies acquisitions. There are also restoration projects, last year $2 million MXN ($105,300 USD) were given to UMAs (farm animals/breeding programs) and $3 million MXN ($158,000 USD) were distributed to hotels and restaurants of Río Lagartos (Tour Guide 14, July 2018).
>
> Yes, government provides economic support to manage and maintain the areas within the reserve. Many young people hired by the government look after plants, flamingos and birds all year. There are also cleaning programs that the government organizes, and they usually target women and elders (Landlord 1, July 2018).

Previous studies highlight a relationship between local perceptions of an MPA and the amount of time the MPA had been established, finding that attitudes were generally more positive the longer it had been since the MPA was implemented (McClanahan et al., 2005; Pita et al., 2011). This is also true in the case of Ría Lagartos, as an interview with a park ranger pointed out, "At first, it was hard to make people understand the importance of the reserve's rules, but now that they see that those same resources generate an entrance of money thanks to tourism, they no longer complain" (Park Ranger 2, August 2018).

However, while many participants commended the government's involvement and strives at proliferating the community accessibility and participation, some also pointed to gaps in their tactics:

> Government is not present. It doesn't care, government prefers to privatize the resources instead (Fisher 24, July 2018).
>
> The government also allows rich people to get their way. They do protect the reserve, but when they know/see that someone with money doesn't follow regulations, they do nothing about it. There are no consequences for the "rich" (Fisher 13, July 2018).
>
> SEMARNAT should know. I personally haven't see direct support from the government (Fisher 9, June 2018).
>
> Government has not entirely done a good job, because support is not enough. We've asked the government to construct piers for tourism related activities, but they haven't done anything. They must standardize a fee that applies equally to all tourists, tour guides use their own prices (Fishing Cooperative Worker 3, July 2018).
>
> We never know, nor are informed of how the assigned resources are administrated/managed (Tour Guide 8, June 2018).
>
> The government does nothing (Fisher 23, July 2018).
>
> They are supposed to have a budget for conservation programs and activities, but how is that money used is unclear (Fishing Cooperative Worker 3, July 2018).

The above sentiments reveal some of the frustrations the community has due to the presence of the reserve and government regulations. Statements such as "government prefers to privatize resources instead" and "there are no consequences for the rich" reveal the belief that some residents have about the government preferring to inequitably lease reserve lands off to the hotel and salt industry in order to accrue tax revenue, while community members remain confined and unable to expand. Such resentments may work to impede the community's amenability to comply to the reserve's regulations.

6.2 Conclusion and Chapter Summary

The results of this chapter highlighted the importance of recognizing the insights local peoples have on their surrounding environment, their community wellbeing and the changes they have experienced occurring in their region. In the context of MPAs, an apt consideration and incorporation of local outlooks can improve compliance and acceptability, granting the "social

licence" for the MPA to operate effectively. On the other hand, failure to do so can conjure feelings of resentment and rejection amongst community members.

The communities of Ría Lagartos generally attribute the presence of the reserve to bettering their wellbeing and sense of place, largely through the generation of tourism revenue and promotion of conservation values. In dealing with environmental and social change, locals asserted that the reserve protected against climate change and hurricane impacts and provided resilience against declining fish stock, stating that the community would be worse off without it. Contrarily, some interviewees discussed the difficulties of living next to an MPA in terms of their community's urban growth restrictions and loss of access to some of the surrounding resources. A deeper analysis of the six dimensions of SERSs and how they are perceived helped to disclose some of the complex power nuances and trade-offs present in the community concerning a wide range of stakeholders, including the government, private industry and the local peoples. While some agreed that the present governance scheme has been effective, others highlighted some of the gaps that have yet to be covered, particularly in terms of community involvement.

The next chapter will attempt to address these gaps by examining governance schemes that integrate the local perceptions examined here, and their benefits and trade-offs, in order to enhance community wellbeing and safeguard against environmental and social change.

CHAPTER SEVEN: IMPROVING MPA GOVERNANCE IN RÍA LAGARTOS

The final data analysis chapter looks at governance to navigate regime shifts and assesses the findings for research objective three; i.e.: to examine how community involvement in MPAs can provide novel governance arrangements to better respond to change and help achieve conservation goals along with community wellbeing. Findings from previous studies (Christie et al., 2017; Gallacher et al., 2016; Seijo and Salas, 2014) indicate that the integration and engagement of the local community in MPA governance frameworks can work to improve the achievement of conservation objectives, better government-community relations and deal with environmental and social change. The co-management governance approach in particular, as explored in the Literature Review and defined in Chapter 1, is cited as the way forward in the realm of MPA management (Alexander et al., 2016). Local communities are better able to maximize both the social and ecological benefits of marine resource and biodiversity conservation measures such as MPAs. The results of this chapter are depicted in the conceptual framework via research objective "3," tethering everything together and serving as the end goal or aim of this study to ascertain the possibility of an MPA governance framework which simultaneously satisfies conservation and wellbeing through community participation (Figure 7.1). There is a need to work on the improvement of MPA governance as it has important implications for the many stakeholders involved in its management and who rely on marine resources.

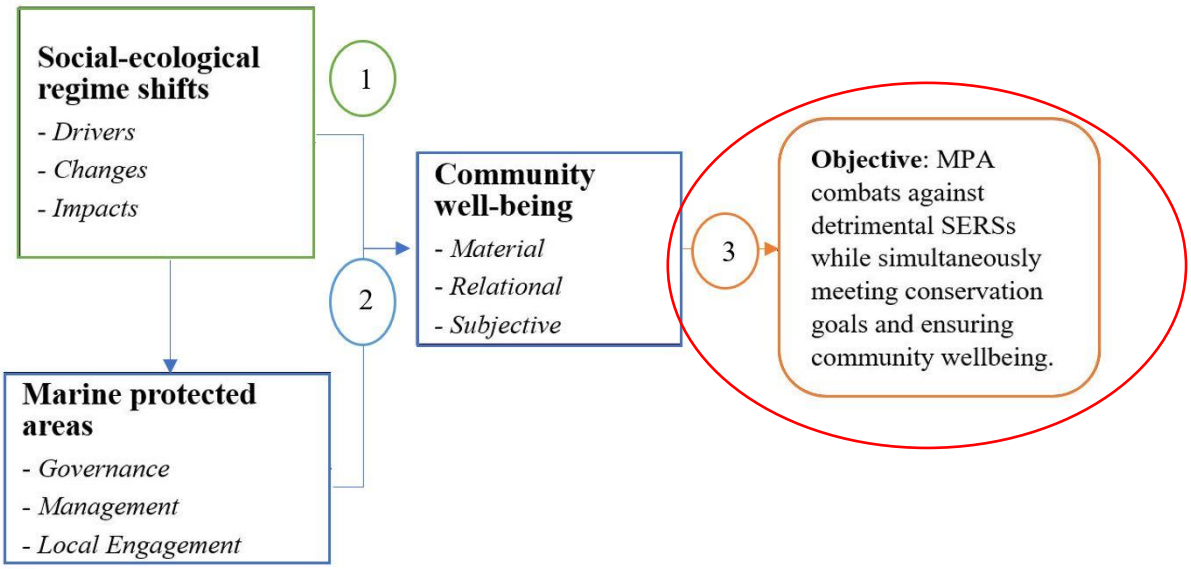

Figure 7.1: The thesis conceptual framework, as it relates to research objective 3

7.1 Overview of Results

A review of the MPA's regulatory background and its effectiveness as understood from the local point of view commences this section. Then, MPA governance improvements, as suggested by local peoples and authorities, are respectively analyzed in relation to the key social and ecological changes (Chapter 5). Next, both local and government perceptions on increasing community involvement in governance and its relation to social-ecological change are examined. Finally, hindrances to the achievement of an effective co-management governance approach entailing the full participation and engagement of the community is reviewed.

7.1.1 MPA Regulatory Background and Local Community

Chapter 3 discussed the current status of regulations, statutory framework and legislative foundations of MPAs in Mexico. Understanding the local governance of an MPA is important as it "can be seen as a social institution that is comprised of a series of laws, policies and processes that are enacted by various levels of government, as well as private sector and civil society actors" impacting all stakeholders in the community (Bennett and Dearden, 2014). However, in order to determine the degree to which communities are made aware of said conventions or interact with government authorities responsible for the management of marine resources, further analysis was warranted. To initiate this, participants in Ría Lagartos were asked who they believed was responsible for making the decisions concerning the reserve. Answers varied in degree of ambiguity, from vague ones such as "delegates who are in Mexico City" (Housewife 11, July 2018) to some specifically naming "the head in charge of the reserve is Cristóbal" (Fisher 16, July 2018), referring to Cristóbal Enrique Cáceres G. Cantón, the current director of the reserve (CONANP, 2019). 69% of respondents were able to recognize that the reserve is linked to either the CONANP or SEMARNAT branches of the federal government. The remainder of participants were unaware or cited "office people in Merida" as the accountable parties (Fisher 4, June 2018). Statements such as the latter may indicate either a greater need for information dissemination between government authorities and the community on the reserve, or indifference on part of residents to be informed about the reserve. Furthermore, when queried on the current rules and regulations of the reserve, 79% responded as having and stating some degree of knowledge concerning the reserve's protocols. The most commonly listed rules were "no cutting of mangroves," "maintenance of distance from fauna" and "6 people per boat during tour excursions."

Locals expressed that signboards, observed by the researcher during field study (Figure 7.2), were the main source of information for locals and tourists regarding the reserve's rules "these norms are indicated in signboards along the reserve" (Restaurant Worker 6, June 2018) and that "there needs to be more signboards with rules on what you can and cannot do" (Fisher 18, July 2018) for greater proliferation of the protocols. However, as described in Chapter 6, there is sometimes confusion regarding regulations, particularly discrepancies with the minimum distance to flamingo populations amongst the answers, ranging from 10 m to 30 m, as compared to the official 50 m restriction. One respondent approximated that "out of 100 boats, probably around 80 of them break this rule" (Hotel Owner 5, June 2018). Instances such as this may indicate a priority to meet tourist demands (i.e. closer interaction with fauna) over conservation needs, or that the reserve does not yet have the full "social acceptability" (López-Angarita et al., 2014) of the community. Another interviewee cited indifference as a reason for regulation incompliance, "if there are rules, it doesn't matter because people do not respect them" (Fisher 23, July 2018).

Figure 7.2: Information signboard for the reserve, depicting some of the regulations at the bottom (photograph by author)

This may suggest that greater incentives or penalties are required to guarantee increased compliance (Jones et al., 2013). Some respondents agreed that "in the end community members are not respecting norms because there is no sanction for it" (Fisher 4, June 2018). Finally, when asked whether they believed those in charge of the reserve's governance and management were doing it effectively, 62% stated that "they've done a good job" (Fisher 12, June 2018). It was the sentiment of many that the government had provided "balance between the reserve and the demands on natural resources from the community, there are benefits for both sides" (Restaurant Worker 2, June 2018). Community members acknowledged the greater proliferation of flora and fauna as a sign that the reserve is being managed effectively, "we see their results and that there are more animals, there is an increase of flamingos' nesting, which means they are protecting the reserve and doing a good job" (Housewife 11, July 2018). On the other hand, some pointed out the gaps that had been left unchecked by those in charge, particularly the follow-up and monitoring of the reserve, "more surveillance is needed as well…there are things they could improve, like increase personnel/authorities to monitor/protect the reserve better. CONANP's staff is too short and the reserve needs more monitoring" (Tour Guide 12, July 2018). One issue in particular, the administration of the "reserve fee" came up repeatedly in the discussions. According to an interview with one of the park rangers of the reserve, there is a fee that theoretically must be paid for entry to the reserve by tourists that goes towards maintenance and conservation measures, akin to the Parks Canada entry fees for Canada's national parks (Van Sickle and Eagles, 1998). However, the collection of this fee is much more complicated in reality:

> To enter the reserve, given that it's a national park, there's an entrance fee to be paid – a bracelet that costs $34.15 MXN ($1.80 USD) per person per day. The way to ask for this payment has created conflict between us and tour guides. Tour guides should charge it to their customers, but they don't do so, they fear asking this fee will scare away tourists. We have tried to tell them that this is not a problem, and they can say this to tourists in an inclusive way (i.e. not making tourists feel that they are paying two times, boat ride and bracelet apart, but present both things combined). But tour guides reject to do so, so we have to put someone from our staff at the Coloradas bridge to ask for the bracelet payment (Park Ranger 1, August 2018).
>
> There's a bracelet all tourists must wear: "The National Park fee", each of us (tour guides) must have a bunch of these bracelets but people do not give continuity to this. CONANP's staff had to take charge of counting/giving bracelets, and this is bad for them because they are always short on staff. We (tour guides) should be responsible of charging the bracelet fee but it is not done. Sometimes CONANP's people are not there in the bridge to charge the bracelets because they have many

> activities to attend, but they do try to have always someone when its high tourism season. Sometimes Yucatans are reluctant to pay, they think that because they belong to the same state, they think they are exempt to pay. And we have had cases where national tourists don't trust tour guides when the later ask for the bracelet fee, only trust uniformed CONANP staff (Tour Guide 11, July 2018).

The above statements reveal the multifaceted and complex nexus in which MPA management operates in Mexico, characterized by politics and conflict between government staff and local workers. The researcher herself noted the absence of fee collection and administration of the reserve bracelet when taking a tour of the reserve's mangrove forests. As discussed in previous chapters, insufficient resources and monitoring is a major obstacle hindering the effectual performance of MPAs. Despite being a vital contributor to the success of MPAs, monitoring often faces "challenges of insufficient funding and resources to perform long-term assessments…For MPAs established in a top-down fashion (such as the RLBR), a lack of administrative will can also inhibit effective monitoring" (Loury et al., 2017). In the case of Ría Lagartos, the deficiency may be due to financial restrictions, as an interviewee points out:

> Park rangers do good work for the reserve. The problem is budget costs, that makes it difficult to do vigilance for the reserve. They are not efficient, but it is not the fault of the staff. There is not much they can do if they don't have enough budget for their activities. And the government doesn't care (Hotel Owner 6, June 2018).

Discussions with a park ranger in Las Coloradas affirmed the implementation of budgetary cuts to the nation's conservation initiatives and its impact on her work:

> There are many activities that we attend. Each park ranger has a specific area/field. I am in charge of the turtle program and monitoring 74 km of beach/coastline…As a result of budget cutting, I'm the only permanent ranger at this station. We used to be two rangers in Coloradas, but now it is only me. In our regulations, it is even mentioned that when we go out patrolling the reserve, for security reasons, we must go in pairs. But that is simply not possible for me due to the downsizing of personnel. We used to be 17 people that worked for CONANP on this reserve, after the budget cuts from 2 years ago, 3 people were fired. These budget cuts were a national decision and impacted reserves and national parks all across Mexico. The only permanent people now are: 4 people in El Cuyo, 5 people in Río Lagartos and just one (me) in Las Coloradas station. During the sea turtles season, 2 workers from PRONATURA along 1-2 volunteers come to help me with all the activities involved to their nesting, hatching and monitoring. These people from PRONATURA come once the budget for sea turtles is released. Sometimes this money is delayed. And if the sea turtle nesting has started, I have to start working on my own, just by myself, and putting money from my own salary to make things happen (Park Ranger 2, August 2018).

This account provides significant insight concerning the political and governance complexities associated with natural resource management in Mexico. As outlined in Fraga and Jesus, 2008, insufficient funding and lack of coordination between different levels of the Mexican government to disseminate information concerning specific case hinders the prime operation of the nation's MPAs. In its analysis of the sixth dimension of regime shifts, Chapter 5 revealed that 35% of locals believe there is only a moderate level of trust between different levels of the government, highlighting the need for greater coordination. Furthermore, other studies show that department funding is the decisive contributor for management and incumbent upon a strong and favourable political will for MPAs (Jessen et al., 2017). The budget that is made available for conservation efforts is sometimes not clearly divulged:

> If authorities were really interested in protecting the reserve, things would be better, but if they work with corruption, conservation goals can be achieved only at 30%. They have budget, assigned budget to run the reserve, but they won't share all of it (Tour Guide 4, June 2018).

> There's a bracelet fee, but I don't know where that money goes to (Tour Guide 13, July 2018).

While some respondents initially noted that staff are doing their best and their work has had positive results in the MPA context, others have noted some loopholes in the systems of MPA management. Issues of transparency and accountability are listed as major MPA governance concerns in previous literature. For instance, in their study of MPAs in Thailand, Bennet and Dearden, 2014, found that lack of transparency concerning MPA programs, management plans, park fees, funding allocations, park creation processes and superintendent appointments further alienated local peoples from the government, leading them to perceive the managers as corrupt. it was also found that managers were exempting private industry from regulation compliance, something the locals of Ría Lagartos have accused their government of doing in the case of the salt company, "The government needs to put pressure to the salt company. They must also follow regulations to protect the reserve" (Fisher 3, June 2018).

Furthermore, the management plan of the RLBR, published in 1999, twenty years after the reserve's initial designation as a fauna refuge has come under scrutiny in the literature for failing to adequately include local peoples in its design (Fraga, 2006). During the 20 years between establishment and publication, the human dimension of the protected area was not considered. The

plan was also developed by a research university from Monterrey, Mexico, which was not familiar with the specific area or the people living within the reserve (Smardon, 2009). Initially, there was a large discrepancy in communication between the government and community members as many did not know that they lived in a protected area. Conflicts began to occur in the late 1980s and 1990s in the RLBR when regulations were established regarding the use of and access to natural coastal resources. During this time, contradictory views regarding conservation also arose amongst various stakeholders such as the state, academia, NGOs, the salt industry and the local community. In 2006, Fraga found that there was a lack of knowledge amongst the local population regarding the work, objectives and projects of the reserve. Community members felt "antipathy and revulsion towards administrators in this area because they are the 'ones that take wood away, prohibit wood cutting, enter ranchos, cut wires and take away everything'" (Fraga, 2006) as their perspectives were not taken into account. Even in cases where attempts were made to include locals, "participants said that lots were invested with little result. They acknowledge having learned things but there is no feedback for the actions carried out or learning acquired. Because of this, local people perceive there having been more failures than successes" (Fraga, 2006). The previous section (7.1.1) revealed that now, members of the RLBR community are largely (69%) aware of how the reserve is managed. As will be shown in the next section (7.1.2) this research study also found that the local peoples of the RLBR were initially reluctant to accept the new regulations, but gradually became accustomed to this as community-government relations improved. It is evident that while majority of community members agree the reserve is being managed effectively, some improvements are warranted. The next section discusses some of the propositions made by community members to better the governance of Ría Lagartos.

7.1.2 Governance Improvements

As examined in Chapter 2, environmental governance can take on various forms, most notably either a state, community or market-based approach (Lemos and Agrawal, 2008). In the context of MPAs in Mexico, authority is largely consolidated under the federal state, with minimal involvement from the municipal level (Fraga and Jesus, 2008). While there can be many advantages to this structure, research shows that it can also lead to a misalignment between environmental issues, parties accountable for their management and the stakeholders that are impacted (Epstein et al., 2015). Local communities in particular can often become alienated and

neglected in the complex, top-down bureaucratic processes that frequently characterize the management of MPAs around the world (Christie et al., 2017; Ferse et al., 2010). In the context of the RLBR, management is top-down, with some local NGOs such as DUMAC (Ducks Unlimited of Mexico) and PRONATURA (Programa para la Naturaleza) that support in funding through foreign government and international NGO investments (Smardon, 2009). They are usually involved in a variety of projects, including environmental education and conservation training for the members of local communities, sometimes partnering up with academic institutions.

As explored earlier, the management of fisheries falls under federal legislation, namely, the Federal Fisheries Law and Mexican Official Standards (NOM) that provides general guidelines on how to regulate fisheries and information on types of fishing gear allowed and mesh sizes. The government agency that is responsible for fisheries management and enforcement is the National Commission of Aquaculture and Fisheries (Solís-Ramirez, 1970). In 2000, an instrument called the National Fisheries Chart was implemented, defining the different levels of fishing effort and strategies for restoration and management of aquatic resources (Smardon, 2009). The fishing cooperatives, groups of fishers who "coordinate their fishing practices within an area to collaboratively use, manage or distribute their catch. Cooperatives work together to further the shared goals of a fishery, which may include coordinating fishing activities, jointly managing a fish stock" (Hamilton, 2017), are given, "fishing rights or concessions within a delimited fishing territory that are granted by the Mexican government for up to 20 years. Each cooperative hold processes and internal rules that govern how many people can fish" (Smardon, 2009). Members of fishing cooperatives often have exclusive access to marketing of the product at a local, regional or international scale, and are granted admittance to a fishing area by the local or state government. This security is an incentive and benefit for members to join and manage the fishery in a sustainable way (Hamilton, 2017). This also works to prevent illegal fishing at the hands of poachers. Cooperatives in Río Lagartos use local rules-in-use for fishing gears and promote rules such as prohibiting fishers from bringing spear guns or gaffs onboard their fishing vessels during certain periods, for instance, the sea cucumber fishing seasons (Bennett and Basurto, 2018). The intention is to prevent the harvest of other species like lobster, octopus and finfish by fishing divers who are targeting sea cucumber. Cooperatives have also tried to limit the number of fishing vessels going out to harvest sea cucumber and ensure that each authorized boat has a legal permit (Figure 7.3). A comparison of the federal rules and rules-in-use of Río Lagartos is listed in Table 7.1,

adopted from Bennet and Basurto, 2018. Meetings between cooperative leaders and local fishers in Río Lagartos have been carried out to establish an understanding of such rules, however, because there is no monitoring mechanism, enforcement only occurs when cooperative members are observing a vessel using the prohibited gears. Incompliance regularly occurs, especially during sea cucumber fishing seasons, where fishers work their entire fleet due to the government's limited enforcement capacity. As previously mentioned, ineffective monitoring such as this has been the root of failure behind many MPAs in Mexico (Fraga and Jesus, 2008).

Table 7.1: A comparison of the federal rules and rules-in-use of Río Lagartos, adopted from Bennet and Basurto, 2018

Category	**Written Federal Rules**	**Rules-in-use of Río Lagartos**
Fishing seasons	Fishers may only harvest sea cucumber during legal seasons	Fishers may only harvest sea cucumber during legal seasons
Fishing gear	None	Fishers may not bring gear other than that used for harvesting specific species on their vessel
Harvest quota	Fishers may not harvest more than the vessel's permitted quota	None
Commercialization	A seller may not sell species such as sea cucumber without an official invoice	A seller may not sell species such as sea cucumber without an official invoice
Fishing permits	Each fishing vessel must have its own permit	Each fishing vessel must possess a permit in order for its employees to fish
Number of fishing vessels	Only authorized vessels with fishing permits must be used	The number of vessels a fisher owns must relate to the number of permits they possess

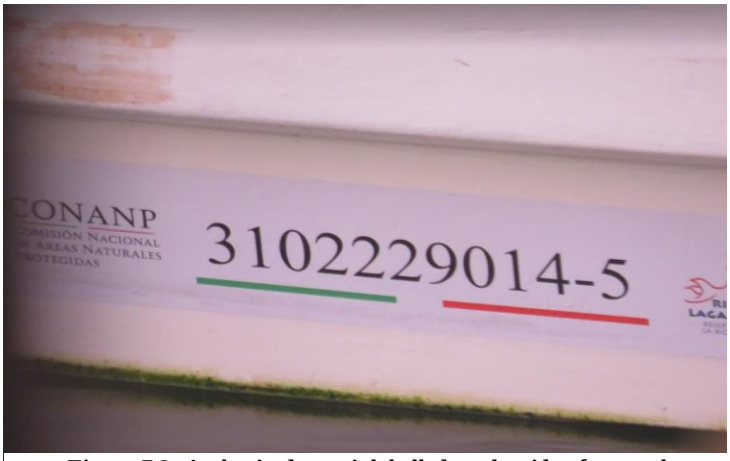

Figure 7.3: Authorized permit labelled on the side of a vessel (photograph by author)

When asked their opinions about what to change and how to improve the management of their MPA so that it better contributes to their wellbeing, meets conservation goals and responds to change, many listed having, "more participation from the community members" (Housewife 16, July 2018). A suggestion to motivate this was to increase the government-community exchange through "more seminars/talks on how to protect and preserve our resources, because at this point, we are not receiving any kind of training" (Tour Guide 7, June 2018). Many locals agreed that greater education and training of the community would "make people respect the reserve and generate awareness in people, especially fishers, so they would pollute less and clean our beaches" (Fisher 22, July 2018). There was also the proposition that such trainings should extend to tourists and visitors participating in recreational activities, not just residents, so that they are made aware of the reserve's significance. MPA governance shortcomings in previous studies were largely derivative of the non-existence of "programs of education or outreach" (Bennett and Dearden, 2014). Interviewees revealed that while such programs used to exist in Ría Lagartos, they are largely unheard of anymore:

> I used to participate in a summer kids programs organized by "Ninos y Crias" (Kids and Chicks) when I was in junior high school. The program consisted on environment education and awareness workshops with tour trips inside the reserve. Sadly, this initiative is not done here anymore (Restaurant Worker 11, July 2018).

> San Felipe hasn't had projects or programs for cleaning of beaches, reforestation or any other kind which are organized by CONANP in the last 4 years. We used to have cultural events, educational programs for children but there hasn't been much promotion of the reserve in the last years. These programs are very important if we want a positive social change. CONANP should approach the community more (Fishing Cooperative Worker 3, July 2018).

> People from SEMARNAT used to come here and give talks about the reserve and invite kids to summer programs where they would free baby sea turtles to the ocean, plant trees and see flamingos. These activities/programs are not done anymore. Some years ago, staff from SEMARNAT used to come monitor San Felipe once every 3 months, that stopped too (Retired Fisher 4, June 2018).

However, discussions with one of the park rangers revealed that previous attempts at such educational programs have been largely unsuccessful due to the priorities of the participants:

> There have been several support programs, but I think instead of helping, they have harmed/created conflict for us. Initially, these programs gave economic incentives to participants, but then people got used to this, they saw it as "easy money" so if there

> are new programs, they are only interested if there is money involved to them, not on what they could learn from it (Park Ranger 1, August 2018).

Comparably, an interviewee recalls being one of the sole participants from her community in an education program regarding the reserve, citing disinterest from residents:

> 6 years ago, I participated in a nature program about the importance of the natural resources and legal aspects of the law "NOM-09." The majority of the audience came from Cancun and Tizimin, only very few people from Río Lagartos went, many that by that time, already worked related to tourism didn't show interest in going. Thanks to the information on that course, I was able to truly see the importance of the reserve's resources (Hotel Owner 8, July 2018).

It is evident that there are many intricate nuances involved in facilitating government-community relations. Even in cases where there have been efforts made to create an environment for greater community engagement and awareness, the priorities and interest of locals may act as a hindrance to its successful execution. In such a scenario, a shift in cultural or behavioural norms, or the instatement of mandatory participation or penalties may be required.

Furthermore, many also contested that the authorities must "do more monitoring of the reserve areas" (Landlord 1, July 2018) and that "if a new statement or law is established, its follow-up should be continued and not change if a new party enters to govern" (Housewife 5, June 2018), however, as analyzed in the previous section, such concerns may be rooted in budgetary and political causes. They are known to be more exacerbated in centralized and top-down governance structures like the one present in Mexico due to lack of coordination and consideration (Bennett and Dearden, 2014). Some also cited greater "communication and more organization between ourselves and all involved participants" (Fisher 9, June 2018). This was particularly said to be true in the case of those involved in the tourism industry because of the issue with inconsistent tour prices, "I think we need more organization. Particularly when there's a bad fishing season, because of this, many fishers turn to tourism, but each one works with a different fee" (Fisher 19, July 2018). The insights of one respondent in particular offered a possible solution to the concern of ambiguity amongst the tour guide staff and incentive to attend support sessions, "I would also put restrictions on boat permits for tour guides. Additionally, I would put tour guides to a test twice per year to evaluate if they have updated information about the reserve. That would push them to attend trainings/courses" (Hotel Owner 8, July 2018). Insights such as this may go a long way to improve the operation of the reserve, if considered by local authorities. Moreover, to avoid any

exceptions in the case of the salt and hotel industries, it was asserted, "that consequences of regulations would apply to everyone, no omissions" (Tour Guide 9, June 2018). Finally, the issue of land restriction came up again repeatedly during the interviews. Many locals asserted that if the reserve's regulations were flexible in a way to enable the community to expand, it would greatly enhance wellbeing and entice better compliance:

> I would respond to the land property issues. Try on putting accessible territories for people that need a place to live, so that Río Lagartos can still grow. We have several lands currently surrounding the community, but they are federal lands. We cannot touch them. I think if someone took care of this matter, we would be better (Fisher 4, June 2018).
>
> Liberate some lands so that the community can grow, especially for young couples that don't have a place to establish. Improve the current status of legal rights/documents for housing. Most people don't have house deeds (Tour Guide 2, June 2018).
>
> To work on law regulations of mangroves. Allow the spatial growth of the community while still protecting mangrove lands. If we could make this last point possible, many more people would be interested in participating in activities concerning the reserve (Health Care Worker 1, July 2018).
>
> SEMARNAT should work harder on the protection of vegetation and should work on alternatives to solve the spatial growth issue of Río. Point to which lands can the community use for construction. We know many are home of birds and mangroves, but we need more space (Restaurant Worker 5, June 2018).
>
> Distribution of lands for housing and urban development, many young adults like me can't find a place to live/build (Restaurant Worker 2, June 2018).
>
> The authorities try to solve the problematic situation of young couples who don't have available space to live. Our community can't grow spatially, there is no urban development because we are surrounded by the reserve (Fisher 21, July 2018).

Statements such as these indicate that greater inclusivity of resident perspectives in the design and management of MPAs may work to create more acceptance and commitment to respect the stated regulations. It has been found that an increase in resource rights positively correlates with MPA compliance and regulations, as local peoples are more likely to conform in cases where they receive some benefit in return that enhances their wellbeing (Gall and Rodwell, 2016). It is contended that, "the manner in which MPAs shape the rights of resource users is not only an important indicator of social wellbeing, but may also influence stakeholder support for MPA

development and management" (Mascia et al., 2010). In their study, Bennet and Dearden, 2014, examine "good governance" of marine resources and reveal that "MPAs have the potential to conserve the environment and increase fisheries while contributing positively to social and economic development in local communities if (a) local development considerations are taken into account and (b) they are effectively managed and governed." Increased fisher participation in the decision-making process of MPAs can contribute to a shift in otherwise negative points of view, highlighting an important relationship between time engagement in co-management and positive perceptions. This signifies the potential of co-managed MPAs to gradually change local perceptions (Pita et al., 2011). MPAs may accrue increased support over time as associations with management personnel become more familiar and strengthened, and benefits of designation are realized (Gall and Rodwell, 2016; McClanahan et al., 2005), as has been the case in Ría Lagartos based on analysis in the previous chapter. One respondent recalled, "it was difficult at the beginning for people/the community to accept the reserve. But once people started to see the benefits of conservation, it was more accepted" (Fisher 8, June 2018). A failure to address historic social impacts may undermine the legitimacy of MPAs and achievement of objectives.

Increased consideration to social aspects in the planning and management of MPAs has also been "bolstered by the commitment of governments and conservation agencies worldwide to a host of international bilateral agreements relevant to conservation management. In particular, the CBD, 1992, contains several articles that require attention to social dimensions" (Sowman and Sunde, 2018). The literature reflects this as well, as the level of community engagement and socio-economic considerations are repeatedly associated with MPA success and can sometimes be more influential than biological or physical characteristics (Gall and Rodwell, 2016). An early onset to involve local peoples and continue to engage them can work to reduce conflict between management personnel and community members. Greater inclusion in the decision-making process can improve the effectiveness of management and "affect the social acceptability of MPA policy which can have ramifications for the level of community support, compliance and achieving the social licence to adjust policy settings in the future if required" (McNeill et al., 2018). Participation is particularly hindered due to tension and conflict between locals and government authorities, reducing community wellbeing and elevating equity concerns.

Furthermore, majority of MPA managers have marine biology or fisheries' management background, ill prepared to deal with the social complexities and conflict in coastal communities (Thomassin et al., 2010). Social management and conflict resolution are therefore considered essential for MPA management, achieved, perhaps, through the employment of personnel professed in such fields. Furthermore, managers are seen as being too far removed or not personally invested in the local community, only residing there for a short period of time with no relationships or social ties in the area (Bennett and Dearden, 2014). To enable improvements in MPA governance, policy changes are required to enhance transparency, accountability, and participation in governance. Bennet and Dearden, 2014, offer the following solutions to these common shortcomings of MPA governance and planning:

Table 7.2: Countermeasures to shortcomings of MPAs, as suggested by Bennet and Dearden, 2014

MPA Shortcoming	**Mitigation/Counter**
Transparency	Establishment of annual park reports and management documents in lay language, freely available in park offices and online (RLBR plan published online in 1999, but has not been updated since)
Accountability	Regularly conducted external monitoring, audits and reviews of management effectiveness by a credible, third party without any political or social group affiliation, increased coordination between management institutions (in the RLBR, monitoring remains to be a recurring issue as federal budget cuts to conservation restrict the number of park rangers)
Participation	Creation of programs to communicate rules and regulations, outreach and education, processes establishment for the improvement of participation in management and integration of local values and knowledge, and activities to increase trust and conflict resolution amongst the community (community participation occurs in the RLBR, but can be greatly enhanced)

An interview respondent relays some of the various differences in opinion regarding MPA management in Ría Lagartos and why it should be a community-led venture:

> Yes, there are different opinions on who should protect the reserve. Tour guides agree SEMARNAT does a good job. Some of them fishers think the mayor should be in charge of the reserve. I think the reserve would be better protected if the community members looked after it, we live next to the reserve and staff from SEMARNAT sometimes are only here for 6 months. They arrive, conduct studies and when they recognize what to do, they already have to leave (Restaurant Worker 5, June 2018).

This statement highlights a key area of concern for state-led MPAs, where the time constraints of management personnel and the current political standing may hinder the conservations success of

the MPA. As local peoples reside and work in the boundaries of the reserve, they may be better equipped in some cases to meet conservation objectives. However, consultation between government officials and community members is first required. Studies point to formal consultation processes, stakeholder engagement, equitably sharing benefits and impacts, ongoing training, enforcement of regulations and monitoring by authorities and the community alike as means to improve MPAs and enhance both their social and ecological success (Ordoñez-Gauger et al., 2018; Pollnac et al., 2010). In their study identifying 15 indicators of MPA success, Gallacher et al., 2016, found socio-economic factors such as level of stakeholder engagement and satisfaction, and understanding of local values and beliefs, to be some of the most important. Top-down governance structures frequently result in cases where the local context and perspectives are neglected, and even in scenarios where participation programs are instated, participants often feel patronized, dismissed and belittled due to the perceived ingenuine attempts, further degrading trust (Ordoñez-Gauger et al., 2018). Lackluster initiatives may also inhibit any future attempts to reconnect with the community based on any past negative experiences of locals in dealing with the state and their perceptions of the competencies of management entities. The restoring of trust between the state and community involves a series of positive interactions and opportunities for meaningful collaboration over time, ensuring that the promises made are kept. In their study, Ordoñez-Gauger et al., 2018, found that the level of trust in the implementing entity strongly correlated with local satisfaction in the MPA's planning process, while loss of trust created further challenges for future conservation initiatives. Insight from the park rangers of Ría Lagartos reveals the difficulties of overcoming local skepticism and distrust:

> It was hard to work with the community at first, when new protection rules were established regarding the reserve, people were untrusting of us. It was a little hard for them to accept that they couldn't use resources like they had been using since generations before the reserve was a "protected area." Local people have now adapted to the reserve's new regulations, but it is a new way of life, they had to learn, and it wasn't easy for them to understand at the beginning. They learned to report when they see someone breaking protection rules such as sea turtle poaching or "cuca" - endemic plant (Figure 7.4) grabbing/extraction (Park Ranger 2, August 2018).

> 5 years ago, people still didn't listen to CONANP about the protection of the reserve. But around 2-3 years from now, people started working alongside us, even reaching to us to ask where they could go if they needed some wood, so that they wouldn't harm areas of the reserve (Park Ranger 1, August 2018).

While the building of trust can be time consuming and requiring long hours of on groundwork to establish community and stakeholder relationships, sometimes delaying conservation targets or deadlines, it is integral to the "overall social acceptability and success of MPAs." Co-management schemes that work to build stakeholder trust, with integration of local inputs for aspects such as MPA boundaries, access and user rights, as explored in the Literature Review, are offered as an alternative to the conventional approach of governance (Sowman and Sunde, 2018). An emerging form of governance, co-management has been praised in the literature,

Figure 7.4: The "cuca" plant, endemic to the region and protected under Mexican law. According to respondents, adult cuca plants can fetch up to $30,000 MXN ($1,500 USD) on the black market (photograph by author)

particularly in the case of MPAs as "…a greater understanding of social responses to MPAs is required, given they are often met with resistance from local communities…We highlight the need for system reorganization and recommend bottom-up co-management schemes as a priority strategy to strengthen adaptive capacity" (López-Angarita et al., 2014). It entails strengthened community-government collaboration and the building of community capacity through the reinforcement of local knowledge. When done correctly, "alternative schemes different to the traditional top-down approach, such as co-management of natural resources in MPAs, have been demonstrated to be a more effective way of dealing with the challenge of conserving marine biodiversity" (López-Angarita et al., 2014). More specifically, the application of an SES lens to

co-management will allow for a greater understanding and prioritization of the social and ecological dimensions of MPAs to improve overall effectiveness. McNeill et al., 2018, have found strong evidence for the correlations between the social and ecological performance of MPAs, emphasizing the significance of social aspects in the achievement of ecological objectives. As MPAs manage societal access to natural resources, an SES approach is therefore critical, achieved through periodic monitoring of both ecological and social indicators, identification of major drivers of change, and increased community involvement. The following segment explores suggestions made by residents of Ría Lagartos to increase the participation of their community in the reserve to achieve the co-management approach.

7.1.3 Community Involvement

The previous analysis revealed that the governance of MPAs and coastal resource management is theoretically enhanced overall with the inclusion of community insights. However, the process by which local perceptions are integrated is much more complex in reality, intricated by varying social differences, political wills and personal interests. When asked whether the reserve's management would be bettered with the integration of local inputs, 62% believed that the community could provide a positive contribution. There were arguments that community inclusion "would be better for the reserve because we would be better prepared on the decision making for its protection" (Housewife 2, June 2018) and that "the reserve would be more monitored" (Fisher 4, June 2018). Increased participation would entail that "everyone would then understand the importance to protect the reserve" (Housewife 8, July 2018) and that "everyone could provide their point of view" (Fisher 10, June 2018). It is the hope of some that collaboration with the authorities will allow "our opinions to be considered" (Fisher 22, July 2018) and "help with our wellbeing" (Restaurant Worker 2, June 2018). It would also enable people to "work together alongside authorities and this would generate more jobs" (Housewife 17, July 2018). However, 33% of respondents stated a scenario where the reserve was solely community-managed would be ineffective as "people would do as they please, see for their own personal benefit" (Tour Guide 9, July 2018) and that "everyone would have a different idea on what's best" (Housewife 2, June 2018).

Some noted that lack of interest or will, or the prioritization of financial resources would overshadow conservation initiatives:

> I don't think it would be better because most people would only see the reserve as a money source, they wouldn't be interested in it's conservation. We just by ourselves are not prepared to take care of it with the information we have (Hotel Owner 8, July 2018).

> I don't think it would be best because many people lack knowledge/information. They don't respect natural resources. As long as people see natural resources as a source of profit, they will continue to exploit it (Housewife 3, June 2018).

> I don't think that would be best for the reserve, there wouldn't be enough responsibility, nor a commitment from the community members (Housewife 11, July 2018).

Such statements highlight some of the potential shortcomings of a co-management approach as conflicting opinions and personal interests may stand in the way of realizing social and ecological objectives (Kellert et al., 2000). Ideal in theory, the application of co-management sometimes falls short due to complex goals and interests, and challenges in the reconciliation of conservation and socio-economic development goals, rendering its implementation difficult. It highlights the issue of "tragedy of the commons," frequently cited in the case of commons resource management, wherein individual resource users who act independently in their self-interest equally deplete the resource as much as possible, leaving the overall communal wellbeing in a worse state (Hardin, 1968). While studies have been since conducted to contest the theory, it is believed that the instatement of common incentives and local customs (Berkes, 1985), and reciprocity and high levels of cooperation between government and community stakeholders (Milinski et al., 2002) may work to avoid such a scenario.

In addition, it was the opinion of some interview respondents that community members lacked the apposite technical expertise to solely manage the reserve effectively, "we do not have the tools nor knowledge to take actions and decide for the reserve. For that we need the vision of authorities" (Tour Guide 9, July 2018). They asserted that a management scheme in which community members were involved would work, "only if selected people from our community were trained and educated about the reserve" (Fishing Cooperative Worker 1, July 2018). This highlights some of the common characteristics of successful co-management instances such as knowledge sharing, co-production and bridging (Berkes, 2009). As local peoples sometimes do not have the apt

technical background to carry out the conservation measures required for the MPA, a management structure that is solely community-led would be ineffective. As summarized by a local fisher. “we are on the right track for the reserve’s governance, but we need help/support from the government” (Fisher 22, July 2018). Contrarily, local peoples often have generations of traditional knowledge systems built regarding the surrounding ecology, which are invaluable to effective conservation but may go largely unnoticed in an exclusively state-led structure. As such, bridging organizations and knowledge types are key enablers of effective co-management.

Finally, to understand the contrasting viewpoint, parallel questions were also posed to the park rangers that were interviewed, querying the extent of community involvement in management and whether or not it would better conservation and wellbeing. One of the park rangers interviewed agreed that the contribution of locals has made conservation efforts more effective:

> 100% yes. Because no matter how small or big our park rangers team is, we will always be dependent on the participation of the community. People of the community currently help me because they have understood that the protection of natural resources is for their own benefit. Now when they see something odd, they notify me. Community members now pass on to others the information we (park rangers) gave them, and thankfully, when they see any kind of rule-breaking/irregularity towards flamingos, sea turtles, and/or mangroves, they immediately report it to us (Park Ranger 2, August 2018).

However, while there is a degree of local inclusion, another insight highlights that greater effort to involve the community is required, testifying that:

> Only a few members of the community are involved. CONANP and SEMARNAT are the ones who run the reserve and protect it. The community still needs training on laws and decisions that are good for the reserve. Why are not more members of the community involved? Because they lack knowledge and environmental awareness. They need to learn how to protect their resources (Park Ranger 1, August 2018).

Perceptions like these highlight the need to increase information sharing and collaboration between community members and authorities such that local peoples are able to become active members of the management process and park rangers benefit from the knowledge of the community. This would also build trust between parties and discredit the notion that authorities are not personally vested or too far removed.

This analysis reveals while there are many social complexities that must be traversed and overcome before its implementation, a successful co-management approach will improve community wellbeing and the conservation objectives of an MPA. In effect, addressing the needs of the community and the influence of socio-economic and cultural factors is known to be critical to the success of MPAs, and communities are generally more receptive to conservation once their primary socio-economic concerns are considered (Mangubhai et al., 2015). While lengthy, an effective consultation process enables authorities to comprehend, for instance, certain aspects of the local ecology that would otherwise go unnoticed, while fostering their trust with the community. It is asserted in previous studies that, "the local stakeholders involved in the design and maintenance of marine protected areas are likely to have significant levels of local ecological knowledge and this local knowledge can provide a valuable source of evidence and information for protected areas" (Gallacher et al., 2016). Furthermore, mistrust of authorities responsible for management, poor communication, and unmet expectations, suggesting a failure to understand local perceptions are significant issues in the realm of protected area management that need to be addressed (McClanahan et al., 2005). This is likely to result in an absence of support, poor compliance, rejection of regulations and failure to meet management goals. Management personnel taking on a more active approach to integrate, build trust and educate local peoples will in turn improve community relations and conservation through strategies such as monitoring and citizen research (McNeill et al., 2018). As a community member put it, "we know how to take care of the reserve because we grew up with it" (Fisher 24, July 2018). The subsequent analysis section will review obstacles preventing the full involvement of the community in the reserve's management, as perceived by locals.

7.1.4 Participation Obstacles

While co-management is ideal in theory, there are many hurdles that must first be overcome before its effective implementation. As previously discussed, the presence of social complexities and varying interests make the establishment of a co-management scheme difficult. However, when done successfully, co-management is known to yield positive results both for conservation and community wellbeing. Community members of Ría Lagartos were asked what they believed to be hinders preventing the full involvement of the community in the reserve's management and governance, and if there were any methods to facilitate better engagement. 27% of respondents

stated that “difference in interests, not caring enough if they happened to see their own ideas or interests compromised, then they would stop helping/working for the protection of the reserve” (Housewife 11, July 2018) acted as the major barrier to community involvement. “Disinterest and lack of motivation” (Fisher 23, July 2018) and “people’s differences between social groups, friends, family” (Tour Guide 5, June 2018) were cited as other obstacles. When interviewed, park rangers also tended to agree that there is a “conflict of interests” (Park Ranger 1, August 2018) between themselves and local peoples and that “community members need conscience/more education. A hinder is to let people do as they please without consequences.” Previous studies showcase the multi-faceted nature and difficulty of executing co-management-based approaches in, “blending of local, national, and sometimes international interests and institutions, as well as reconciling multiple and sometimes conflicting objectives. By contrast, state management of natural resources…is often less complicated and difficult” (Kellert, 2000). Although less intricate than co-management governance, state-based models rarely acquire the social acceptability of the community and report higher incidences of non-compliance, hindering their effectiveness (Fraga and Jesus, 2008). Other research on co-management of natural resources offers resolutions to surmount the issues of conflicting personal interests and indifference through the process of social learning, defined as the enhancement of knowledge, awareness and skills through the act of mutual learning, thinking, discussing and acting together, known to be “crucial for co-management initiatives” (Nayak and Armitage, 2018; Schusler et al., 2003). Social learning can work to bring together diverse perspectives and experiences, alleviate differences, and establish common grounds for collaborative action beyond the individual. Techniques to promote social learning include deliberation on part of the authorities to communicate and interact with the community through public meetings and dispute resolution platforms. The instatement of mandatory participation may work to instill a sense of importance on the matters at hand and encourage partakers once the discussions commence. With successful facilitation, opportunities for collaborative discussion will allow members to realize the public values they jointly share about their community that go beyond their narrower self-interests, and possibly define goals of their own voluntary actions towards a common purpose. Responses of participants reveal that voluntary conservation campaigns led by the community in Ría Lagartos have already been initiated, “Cleaning campaigns to pick up trash from streets and public areas began 2 years ago, this initiative was born out of people’s interest, not government. Nowadays, all Mondays are known as social

labour days – for trash cleanup" (Vice-Mayor 1, July 2018). Moreover, relationships that are built through co-management enhance the capacity for joint actions as new networks are developed and adversaries are overcome through greater consideration of others' concerns.

In addition, social learning also evolves the understanding for resource management as "scientific knowledge is necessary for sound natural resource management but is not sufficient. Determining management goals also requires knowledge that reflects public values, providing purpose and guidance for policy and action" and can overcome the barrier of self-interest by "recognizing that others' interests are as legitimate as one's own" (Schusler et al., 2003). Furthermore, social learning may counteract other barriers brought forth by the residents of Ría Lagartos, namely that there is "not clear communication between members of the community" (Health Care Worker 1, July 2018) and "lack of knowledge/information to recognize the important of the reserve's resources…people don't have the sufficient knowledge to properly run the reserve" (Restaurant Worker 5, June 2018). In creating an environment for enhanced collaborative learning, government authorities and community members will be able to work with one another towards common goals. Community members agree that "we need more training, so we can know how to better manage the reserve's resources" (Retired Fisher 3, June 2018) to facilitate better engagement of local peoples in reserve management.

However, attempts to engage with the community often fail as they relayed in language too difficult for local peoples to understand, losing their interest. A local perspective offers the following suggestion to overcome this hurdle:

> Talks and trainings are very important, and we need them for all ages because each generation needs a different learning method that works best for them. When sharing information about the reserve, it is important to keep in mind that predominant audience, they are speaking to only have elementary school level education. So, they have to talk to them in a way they would understand. We are truly privileged to live next to these resources, I hope most of the community can agree to this and see their importance (Tour Guide 14, July 2018).

Finally, highlighting some of the drawbacks of state management, it was stated that "politics and follow-up inconsistency of rules/norms between different political parties" (Fishing Cooperative Worker 2, July 2018) also acted as hindrances to effective management and that "because of insufficient politics and strategies, there is bad administration from funds and/or resources. If this wasn't an issue, more people would get involved" (Tour Guide 11, July 2018). State-based

management schemes often run at the whim of the political affiliations in society, with years of conservation efforts sometimes becoming undone if it conflicts with the interests of the current political party (Schafer and Bell, 2002). A co-management approach would allow for a greater investment of local interest in MPA management, with the potential that coastal resources are safeguarded despite a change in the nation's or region's political standings. When applied correctly, the co-management approach to MPA governance has the potential to meet conservation objectives while simultaneously enhancing community wellbeing.

7.2 Conclusion and Chapter Summary

Through information collected from the members of the Ría Lagartos community, the final analysis chapter sought to understand if increased community involvement in MPA governance could better conservation while concurrently improving wellbeing. It was found that an MPA approach that takes into account the surrounding region's social considerations would have increased community buy-in, a significant finding for coastal resource managers and conservation planners. The perceptions of local stakeholders can prove to be an important indication of the success of MPAs and should be given equal weight as its ecological considerations. Research frequently points to social aspects as the main indicators of long-term MPA success. Governance that solely characterizes MPAs on the basis of their ecology fails to consider its social impacts on coastal communities, as is commonly the case with state-led governance approaches. While more complex to implement, co-managed MPAs establish greater community support, empowerment, trust in management personnel, and willingness to participate. Community insights can provide invaluable knowledge and opportunities for improvement for marine resource management that would otherwise go unnoticed in a state-led approach. To meet both ecological and social goals, MPA design principles should therefore thoroughly integrate community perceptions. In addition, local perceptions can better respond to social and environmental changes such as those brought on by the sea cucumber fishery or tourism industry in the case of the RLBR. Literature has repeatedly proven the effectiveness of MPAs in dealing of challenges of marine conservation and change. Increased community involvement further enhances the ability of MPAs through greater compliance and local buy-in. Integrating local perspectives is beneficial for dealing with change as by living and working in the reserve, community members are better able to and more quickly recognize the changes taking place and provide helpful insights on how to combat them. Such

local knowledge systems may work to improve the long-term operation of the MPA. Involvement can also increase wellbeing as the community feels empowered and encouraged as their viewpoints are genuinely integrated. The final chapter of the thesis provides a summary of the concepts covered in the research and proposes next steps for future research in the realm of MPA governance.

CHAPTER EIGHT: CONCLUSION

This chapter summarizes the key insights of the thesis, findings, policy contributions and directions for future research areas. It commences by re-examining the three objectives of the research and consolidating the key concepts from the three analysis chapters (i.e. Chapter 5-7). Important insights from the three research areas (i.e. SERSs, MPAs and community well-being) as delineated in the Literature Review (Chapter 2) are also assessed. Lastly, the most significant theoretical and applied contributions that were derived are used to pave the way forward for potential routes of future research. The findings of this thesis have the prospective to create important and novel opportunities towards a conceptual understanding in the realm of MPA governance.

8.1 Thesis Summary

The thesis explored extensive and rapid changes inflicting marine and coastal communities contextualized by SSFs around the world. In greater detail, the study involved an analysis of: 1) the nature of environmental and social change taking place in the research area; 2) local attitudes, values, emotions and beliefs as they relate to the MPA governance in light of the ongoing processes of change; and 3) increasing community involvement in MPA governance to better respond to change and improve community wellbeing. The methodology (Chapter 4) entailed a preliminary literature review, participant observation and scoping, semi-structured interviews, focus groups and a survey. It is widely known that "globally, SSFs support food security for many millions, employ more than 90% of the world's capture fishers, and by some estimates account for more than half of global landings…(they) play a large role in supporting household and community livelihoods" (Kittinger et al., 2014). Combinations of changes driven by human-induced factors such as climate change, land-based pollution and overexploitation have led to extensive ecological, economic and social impacts on fisheries resources and risk the livelihood, food security and culture of such communities (d'Armengol et al., 2018). The case study of this thesis (Chapter 3), the RLBR in Mexico, is a prime example of an SSF community undergoing significant changes and located within the boundaries of a marine reserve. In the RLBR, change is largely characterized by "local threats as well as external pressures, and vulnerability to these pressures…For example, emerging global markets incentivize the harvest of valuable species for export, resulting in increased vulnerability of SSF to drastic price changes driven by international

market dynamics" (Kittinger et al., 2014). The onset of the sea cucumber fishery driven by Asian demand and the rising tourism industry, as analyzed in Chapter 5, have largely altered the socio-economic and ecological dynamic of the Ría Lagartos community (Research Objective 1). To better meet the challenges of change and protect marine resources, "researchers and practitioners are focusing on understanding linkages between social and ecological dynamics — often referred to as linked or coupled social-ecological systems — and how these dynamics affect the potential for sustainability" (Kittinger et al., 2014). Such coupled SESs in the context of coastal communities was explored in the Literature Review (Chapter 2) and the first analysis chapter (Chapter 5). The application of an SES and community wellbeing conceptual lens to MPA governance allowed to uncover the challenges and opportunities of SSF communities like those in the RLBR. It was significant for the understanding of the trade-offs involved in community wellbeing and ecological conservation in a Mexican context.

In addition, a global network of MPAs has been established to combat against the marine issues (Crawford et al., 2006). As of 2019, there are 14,880 established MPAs around the world (IUCN Protected Planet, 2019). While MPAs have a proven capability for ecological conservation, they often fail to consider the social context and are created without consulting and accounting for the wellbeing of communities located in the vicinity of where they are implemented (Bennet and Dearden, 2014). MPAs often fail or perform poorly due to a lack of or ineffective local inclusion, and socio-economic factors have been found to be the determinants of MPA success or failure. The involvement of local communities can work to greatly enhance the management effectiveness of natural resources (McClanahan et al., 2005). It is argued that, "MPAs are embedded within the larger ecological, social, and political context of the coastal-ocean areas of which they are a part. Therefore, it is important to see MPAs in the overall picture of marine conservation, and of coastal livelihoods" (McClanahan et al., 2005). While the structure of the RLBR, like most Mexican MPAs, is conventional and top-down (Chapter 3), this research sought to understand the implications of a diversity of community perceptions in relation to the MPA and the processes of change (Research Objective 2) to incorporate a more community-integrated approach for the governance of the reserve (Research Objective 3). The findings of the thesis recommend that MPAs implemented with due consideration to community perceptions are often more effective and have higher rates of compliance, becoming better equipped to handle the ongoing processes of rapid and abrupt environmental and social changes.

8.2 Policy Implications and Future Research

The significance of this research lies in its ambition to incorporate community knowledge and perceptions into MPA governance and add to the ongoing processes of achieving coastal sustainability. For the research community, this has long-term implications for the policy framework and implementation of MPAs to better incorporate local communities in a co-management approach as a tool to address social-ecological change in coastal and marine ecosystems. The insights attained can help to facilitate and develop an MPA model more inclusive of all stakeholders in an SSF perspective. Furthermore, the findings can be presented in academic exchanges and fora such as the "Comprehensive Research for the Planning of New Management Measures Fisheries that Allow the Sustainable Fishing of Sea Cucumber on the Yucatán Coast" led by the Multidisciplinary Unit of Teaching and Sisal Research of the National University Autonomous of Mexico; and the "Too Big To Ignore World Small-Scale Fisheries Congress," both of which the author was in attendance in Merida, Mexico (June 2018) and Chiang Mai, Thailand (October 2018) respectively. Such platforms provide optimal opportunities of linkages between various academic sectors through the dissemination of scientific research. Moreover, for the industry, it is hoped that the research obtained will support potential future policy that will improve the function of MPAs, leading to greater spillover effect and fish catch, and thus greater economic return (Fox et al., 2014). For society as a whole, a better MPA governance structure and understanding local perceptions will enable for better relationships between the local peoples and government administrators, improving overall compliance and effectiveness of the MPA. In terms of theoretical implications, this research contributes to fulfilling the aforementioned gap of linking change in coastal environments with MPA governance and examining the influence of MPAs on community wellbeing.

It has been found that greater inclusion of local stakeholders increases compliance with MPA regulations as "compliance levels perceived by resource users are higher in MPAs where locals had been involved in the decision-making process than where they had not" (McClanahan et al., 2005). In addition, co-managed governance has been found to be more resilient to change, "the combination of formal institutional structures…coupled with informal global, regional, and community-based networks of diverse actors – has shown potential as a means of effectively tackling some of the most complex challenges associated with both pandemics and natural

resource use" (Eriksson et al., 2015). As MPAs are being used more recurrently in marine conservation, consideration of both their ecological and social facets is imperative in improving their ability to conserve oceanic resources and provide benefits to local communities. It was found that the success of MPAs can be enhanced through increasing local community involvement and a diversity of local experiences early in the planning process. In particular, "for biosphere reserves, participation is inherent to the concept, and there are successful examples of collaboration between stakeholders to address social and environmental issues…Participatory conservation guides the concept of UNESCO Biosphere Reserves. These reserves represent the interdependence of society and nature" (Onaindia et al., 2013). Co-management is defined as, "the sharing of responsibilities, rights and duties between the primary stakeholders, in particular, local communities and the nation state; a decentralized approach to decision-making that involves the local users in the decision-making process as equals with the nation-state" (Alexander et al., 2015; Carlsson and Berkes, 2005). A co-management approach towards MPA governance is based on the premise that those who live adjacent to and directly use natural resources are more knowledgeable about and motivated in their protection. Comparatively, "command-and-control kind of resource management is a poor fit for ecological uncertainty" (Carlsson and Berkes, 2005). State-led initiatives have "failed to recognise the socio-economic and cultural rights of resource-dependent communities…Failure to recognise and take account of these social dimensions undermines the legitimacy of MPAs and curtails the achievement of management objectives" (Jones et al., 2013). It is argued that, "multi-stakeholder environmental management and governance processes are essential to realize social and ecological outcomes" (Plummer et al., 2017). Furthermore, the "reasons for stakeholder participation have gained importance with the growing perception that ecosystems and societies are interdependent, forming social–ecological systems that are complex, adaptive, and nested across scales" (Schultz et al., 2011). The results of this work indicated that local inhabitants are crucial to creating successful MPAs as they can propose better management strategies based on the knowledge of their local area.

A co-managed MPA governance framework is successful if the different stakeholders, the way whereby they communicate with one another and the capacity to which they participate is discerned early in the planning process. Earlier engagement and consultation have been found to lead to more support for MPA creation and secure political will and buy-in (Christie et al., 2017). Stakeholder integration should occur throughout the duration of the MPA processes, from the

design of the site, to implementation and the development of management measures (McClanahan et al., 2005). It is argued that "since co-management is exercised through organized stakeholder partnerships, the pre-implementation process would be about preparing for, and the actual building of, such partnerships like identifying and forming core-groups who can move the process forward until the decisions are made" (Chuenpagdee and Jentoft, 2007). The initial phases would be characterized by informal and rapport building conversations, leading to more formal proceedings. Sometimes the involvement of external or international agencies, if trusted by the community, can serve as a significant pathway for the conceptualization of a co-managed approach. However, if there is distrust of such parties, it may act as a hindrance. Relational wellbeing can help steer a co-managed governance scheme as social connectivity can identify gaps in the community and a means to bridge those gaps. Viewed from the perspective of regional and national governance, it can highlight opportunities for multi-stakeholder collaboration through state representation and synergies. The role of government should not be downplayed in the implementation of co-management as it requires formal regulation and "the establishment of the legislation necessary to accommodate co-management is something that only the state can do" (Chuenpagdee and Jentoft, 2007). It is argued that, "it takes two parties to have co-management, and the government is a crucial partner. If co-management initiatives are to be successful, basic issues of government legislation and policy to establish supportive legal rights and authority frameworks must be addressed" (Pomeroy and Berkes, 1997). This entails the establishment of a government administrative structure and enabling legislative environment set up for the purposes of sustaining and overseeing local level fisheries management.

As is in the case of the RLBR, managers are often skeptical about natural resource management that is solely at the local level due to "the lack of appropriate knowledge and know-how on the part of the fishers, and the ability of fishers to organize themselves to manage for long-term sustainability" (Pomeroy and Berkes, 1997). However, the knowledge held by fishers, accumulated and culturally transmitted, has the potential to be extremely relevant for marine resource management and complement scientific knowledge (Brosius et al., 1998; Schusler et al., 2003). It has been found that "in all MPAs, there is a critical need to supplement biophysical and ecological data with people-orientated information: about the human values and goals that relate to the area, about historical and current human uses of the area" (McClanahan et al., 2005). Pomeroy and Berkes, 1997, contest that, "indeed, it is the complementarity between such local

knowledge and scientific knowledge that makes co-management stronger than either community-based management or government management." They have cited seven marine resource management functions that can be enhanced through the joint action of local users and government managers, including: data gathering, logistical decisions such as who can harvest and when, allocation decisions, protection of resources from environmental damage, enforcement of regulations, enhancement of long-term planning, and inclusive decision-making. Salas et al., 2015, also contend that, "fishers knowledge can match or complement technical knowledge, such a way that, if taken into account it can improve information for decision makers in charge of fisheries management and conservation programs, that could be otherwise costly or inaccessible."

Concurrently, "on their own and without financial support, communities generally do not have the human resources and funds that would facilitate management. More importantly, local communities do not have legal authority to manage the marine reserve without the endorsement and authorization from their governments" (Chuenpagdee et al., 2002). It is further argued that, "management processes can be improved by making them adaptable and flexible through the use of multiple perspectives and a broad range of ecological knowledge and understanding, including those of resource user communities…(they) have capacity to adapt to change" (Carlsson and Berkes, 2005). Knowledge sharing and social learning can work to bridge community members and management authorities, build trust and improve coordination (Alexander et al., 2016; Armitage et al., 2008; Onaindia et al., 2013; Plummer et al., 2017; Schusler et al., 2003). It is argued that "successful co-management is a knowledge partnership… Using science together with indigenous knowledge requires, not a synthesis of the two kinds of knowledge, but an ability to develop mutual respect and trust" (Berkes, 2009).

In addition, government cannot simply call for more community involvement, but also establish the legal rights that appropriately devolves authority (Bown et al., 2013). A platform must be provided for community members to have access to government officials and information, and express their concerns without the fear of intimidation (Elliott et al., 2001; Plummer et al., 2017). Such platforms include workshops, trainings and meetings to exchange information and consult with and educate the community (Kittinger et al., 2014). Long-term education and communication in particular are considered "aspects of key importance within the process of MPA planning and must continue into the implementation period. If the stakeholders are well-informed and can see

clear benefits from the existence of an MPA they are more likely to support it" (McClanahan et al., 2005). Moreover, the role of government and institutions in co-management is largely based on the creation of legitimacy for local organizations and institutions to succeed, and defining power sharing and decision-making arrangements (Leach et al., 1999). It is argued that, "a supporting legal and institutional framework facilitates the emergence of co-management, because it contributes to clarify and legitimize property rights over fish resources" (d'Armengol et al., 2018). This entails clearly establishing the powers and responsibilities entrusted to the community, penalties for when power is abused and responsibilities unfulfilled, and a conflict resolution mechanism in the case of disagreement (Kellert, 2000). In contrast, "lack of legal frameworks, institutional linkages and flexible multi-level governance systems may hamper both the adaptive management of community-based marine resource management and the successful integration of community-based management into wider MPA design" (Ferse et al., 2010).

Specifically in the Mexican case, "legislation on the use of and access to marine and coastal resources is still highly fragmented, overlapping, occasionally inconsistent and incomplete" (Havard et al., 2015). In some cases, laws and policies may need to be restructured or new policies developed to facilitate and legitimize co-management (Schultz et al., 2011). For instance, examples of successful co-management in Canada are based around legal instruments such as land claims that "provide legally defined management rights of local resource users-a feature missing in other kinds of co-management arrangements" (Armitage, 2005; Pomeroy and Berkes, 1997). Other examples of instruments include "formal and mutually binding agreements spelling out the sharing of power between the State and groups of resource users" (Carlsson and Berkes, 2005). Enforcement of such instruments is also important as it has been found that, "the failure of community-based resources management initiatives is often blamed on the lack of effective enforcement" (Crawford et al., 2004; Elliott, 2001). Enforcement includes active surveillance efforts, patrolling and apprehending offenders through the justice system. Formal enforcement measures led by a centralized police force and patrols can be complimented with informal, less costly systems wherein locals internalize costs, allowing benefits to accrue primarily to the community (Crawford et al., 2004). Thus, the establishment of administrative and policy structures outlining the legal status, rights and authorities, and their committed enforcement, is imperative for successful co-management. Factors that should be incorporated to achieve more effective MPA management include greater coordination amongst government bodies, improved transparency

through annual reports and management documents that are publicly available and subject to external audits and reviews (Bennett and Dearden, 2014), and the stringent requirement of a robust management plan for each MPA.

Strong and enabling legislation is critical to successful MPA operation, and as such, MPA governance in Mexico must overcome the evident jurisdictional complexities in its legislative and institutional structure. These obstacles currently impede both marine conservation and community wellbeing. Other solutions include: "the setting up of supervisory, advisory or oversight bodies, coordinating commissions, cooperation protocols, joint policy statements, prearranged agreements between various government departments and other stakeholders, or specific MPA authorities" (Jessen et al., 2017). However, funding of government agencies is often the deciding factor for management priorities, determined through political and administrative processes. As such, strong political will and support in favour of MPAs is critical (Jessen et al., 2017).

Finally, the conceptual framework created for this research has the potential to be applied to other studies in the realm of social and ecological change, community wellbeing and protected area governance, both in a marine and terrestrial setting. Particularly for other communities suffering from the impacts of overexploited sea cucumber fishing brought on by Asian demand, including Madagascar, South Africa and 70 other coastal countries around the world (Bennett and Basurto, 2018), this research can provide novel insights for management and deterrence. It illustrates and bridges the linkages between key concepts of marine natural resource management in cohesion and highlights the complexities within which it is embedded.

Future research not addressed in this thesis includes the practical formulation of measures, mechanisms and consultation tools to overcome barriers to local participation in MPA governance. This can be achieved through strengthening networks of government bodies, local communities, non-government organizations and academic institutions. In this study, some respondents indicated to an interest of the community receiving the results of and benefitting from research such as this, "Students and outsiders that have information about the reserve should share it with us. We have the experience, but they have knowledge and we can learn from each other. I'm happy to see students like you interested in the reserve and I strongly encourage you to keep studying." As aforementioned, the researcher hopes to share the outcomes of her study with the communities of the RLBR in their local language of Spanish.

Water-related issues such as the governance of the marine environment exist in an inherent nexus and a plethora of issues that should not be divulged or studied in isolation. When designed effectively, MPAs have the potential to conserve the marine environment and protect biodiversity, while simultaneously contributing positively to social and economic development in nearby communities if local development considerations are taken into account. The creation and establishment of MPAs provides a formidable defense against ecological degradation, but its operation must consider social aspects for long-term viability, so that they are both biological and social successes. Only this will ensure the preservation and sustainability of the earth's marine environment for generations to come.

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APPENDIX A – SEMI-STRUCTURED INTERVIEW GUIDE

Community Member Version

General Rapport Questions

1. Please tell me about yourself
    - Ex – home community, occupation, role in fishing cooperative (if applicable)

2. How long have you lived in the community?

RESEARCH OBJECTIVE 1

3. What social and/or environmental changes have you seen occurring in your region since the start of the reserve?
    - What do you think is causing these changes to occur?

4. What is the duration of change?

5. What is the extent of the impacts caused by the changes identified in question 4? (spatial scale – local: Río Lagartos Municipality, regional: Yucatán State or national: Mexico)

6. The changes that you mentioned previously, how have they impacted your community? (In terms of wellbeing, livelihood, coastal resource use, sense of place, social and cultural identity, etc) if any? Please describe them.

7. Do you derive your livelihood from the reserve?
    - If so, how is your income impacted by it?
    - If you are a fisher: What species do you fish? What techniques do you use while fishing?
    - Have you seen a change (increase/decrease) in the types of species that you fish over the years?

RESEARCH OBJECTIVE 2

8. What points of your community give you a good quality of life and make it better? What contributes to this?

9. What can you tell me about the Ría Lagartos Biosphere Reserve?
    - How do you define a "biosphere reserve?"
    - What is your relationship with the reserve?
    - Are you involved in any way in its management/conservation? If yes, what types of activities are you usually involved in?

10. Do you think the presence of the reserve has added to or taken away from your community's wellbeing? If yes, in what ways? - Think of the ways that the reserve influences your quality of life and your community's wellbeing (Positively or negatively or both). These can be leisure activities, livelihood activities, but also values such as sense of place.
    - Are there are any trade-offs in your livelihood, leisure, etc, due to the reserve?
    - Do you think the pros outweigh the cons?

11. Do you think the reserve has been effective in meeting its conservation goals and dealing with environment and/or social changes occurring in the region? If yes, in what ways? If no, why not?

12. How would things be different (in terms of your livelihood, community wellbeing, personal leisure, etc) if there was no reserve?

13. How has the government or other organizations impacted your access to the reserve's resources and your participation in its management/governance/conservation?

RESEARCH OBJECTIVE 3

14. Do you know who makes the decisions concerning the reserve?
    - What are the current rules and regulations that impact the reserve?
    - Do you think the people who make decisions about the governance of the reserve do it effectively? Why or why not?

15. If you could change one thing about the reserve to make it better contribute to the community's wellbeing, meet conservation goals and respond to environmental and social changes (as identified above), what would you change? Why?
    - What can be changed about the reserve to prevent environment and/or social changes from occurring, and lessen impact on the community?
    - What do you think would be the best way to facilitate this change?

16. If the community was a part of the reserve's management (if not already, how do you think they would contribute (i.e rule and decision-making, monitoring, resources assessment, etc)?
    - Would the reserve and community be better able to respond to social and environmental change?

17. What factors, if any, do you think are stopping/preventing, the full participation of the community in the management and governance of the reserve?
    - Are there better ways to enhance or facilitate local peoples' participation?

18. Is there anything else you would like to tell me?

Government Worker Version

General Rapport Questions

1. Please tell me about yourself
    - Ex – home community, occupation, etc

2. How long have you worked in your current position?

RESEARCH OBJECTIVE 1

3. What social and/or environmental changes have you seen happening in the region since when the reserve was created?
    - What do you think is causing these changes to occur?

4. What is the duration of change?

5. What is the extent of the impact? (spatial scale –local – Río Lagartos, regional - Yucatán or national - Mexico level)

6. The changes that you mentioned previously, how have they impacted the community in which you do your work? (In terms of community wellbeing, livelihood, coastal resource use, sense of place, social and cultural identity, etc) if any? Please describe them.

7. Do you derive your livelihood from the reserve?
    - If so, how is your income impacted by it?

RESEARCH OBJECTIVE 2

8. What points of your community give you a good quality of life and make it better? What contributes to this?

9. What can you tell me about the Ría Lagartos Biosphere Reserve?
    - How do you define a "biosphere reserve?"
    - What is your relationship with the reserve?
    - How is your work involved in its management/conservation (if at all)? What types of activities are you usually involved in?
    - What types of species do you usually see around the reserve in your work? Have they changed over time?

10. Do you think the presence of the reserve has added to or taken away from the community's wellbeing? If yes, in what ways? - Think of the ways that the reserve influences your quality of life and your community's wellbeing (Positively or negatively or both). These can be leisure activities, livelihood activities, but also values such as sense of place.
    - Are there are any trade-offs in your livelihood, leisure, etc, due to the reserve?

- Do you think the pros outweigh the cons?

11. Do you think the reserve has been effective in meeting its conservation goals and dealing with environment and/or social changes occurring in the region? If yes, in what ways? If no, why not?

12. How would things be different (in terms of your livelihood, community wellbeing, personal leisure, etc) if there was no reserve?

RESEARCH OBJECTIVE 3

13. What are the current rules and regulations that impact the reserve?

14. If you could change one thing about the reserve to make it better contribute to the community's wellbeing, meet conservation goals and respond to environmental and social changes (as identified above), what would you change? Why?
    - What can be changed about the reserve to prevent environment and/or social changes from occurring, and lessen impact on the community?
    - What do you think would be the best way to facilitate this change?

15. Are community members involved in the management, governance or conservation of the reserve?
    - YES - If community members are involved in the management/governance/conservation, do you think their involvement makes it more effective? If yes, in what ways?
        i. Imagine a scenario where community members were not involved in the management/governance/conservation of the reserve. How would the surrounding region be different in dealing with environmental and social changes?
    - NO - If community members are not involved in the management/governance/conservation, how do you think they would contribute (i.e rule and decision-making, monitoring, resources assessment, etc)? Would the reserve and community be better able to respond to social and environmental change if this were the case?

16. What factors, if any, do you think are stopping/preventing, the full participation of the community in the management and governance of the reserve?
    - Are there better ways to enhance or facilitate local peoples' participation?

17. Is there anything else you would like to tell me?

APPENDIX B – FOCUS GROUP ACTIVITIES GUIDE

Introduction **-** Thank you for participating in this focus group. Over the past few weeks, we have had the opportunity speak to members of the community through interviews lasting no less than hour regarding the reserve and we are going to start by summarizing what we have found so far. *Relay results of interviews.*

Activities **–** We will now walk you through some participatory activities to better understand your perception regarding the reserve and its resources. Throughout the discussions, please share your honest and open thoughts. This information may help in developing suggestions for how the reserve's planning and management can improve the benefits provided to fishers. Remember that you may withdraw from this activity at any time and that you may choose not to participate in parts of the activity or discussions if you do not feel comfortable. Please also remember that everything that's said in this group will remain anonymous and confidential.

Focus Group Activity 1 - Listing and Linking/ ~~Venn Diagram/Knowledge Map~~ Exercise

1. List the top five environmental/social changes you have seen occurring in your community in the past 20-30 years (*SERS).*
    a. List the top five reasons why you think these changes have been occurring (*drivers).*
    b. Draw links between the changes and reasons, indicating which changes are caused by which consequences.
    c. List the five biggest consequences you think these changes have on you and your community (*impacts).*
    d. Draw links between the changes and consequences, indicating which changes are causing which consequences.

2. *If applicable* Ask each group their top of each (change, reason and consequence) and list on Bristol board; run through whole activity with new answers.

3. List the top five points you think you need for a good quality of life in your community.
    a. Of the environmental and social changes, you identified in the previous activities (or new ones), list the top 5 which you think are having the biggest consequence on your community wellbeing (OR – what points are stopping you from having an ideal community).
    b. Link the changes to the community wellbeing points, indicating which changes are impacting which community wellbeing factors.

Focus Group Activity 2 - Mapping Exercise

Please identify on this map areas in the reserve which are most important to you and your community's wellbeing (at least 5). Please identify them based on categories that represent

different reasons why these areas are important. For example, an area may be economically valuable because it provides resources and fishing opportunities. Other areas may be socially or culturally important. You are free to choose any categories you wish. Please use the post-it notes provided for different categories (each colour represents a different category). Next, I'll ask you to indicate the importance of each region you've identified by writing a number from 1 to 5 on each sticker. You can use more than 1 category on a region, and you do not need to use all the categories if you do not wish. Are there any questions? Please go ahead with this activity. You have about 10 minutes.

Follow-up discussion questions:

Thank you for participating in this exercise. Now, I'd like to have a discussion about how these areas that are important to you interact with the reserve. I have some questions to ask, but feel free to discuss amongst yourselves and add anything that you feel is important to discuss.

- Why are these areas important for these reasons?
- How do you think your maps would be different today if there was no reserve?
- Who uses the resource in the different locations?
- Who regulates access to the resources in these locations?
- How do you feel the reserve has changed your overall quality of life or community wellbeing as a fisher since it was implemented?
    - What do you think is your fishing community's general overall level of satisfaction with the reserve?

Conclusions

Thank you for taking the time to speak with me today. I really appreciate your participation in this exercise. All the information you have disclosed is confidential. If you need to contact me, you can phone or email me any time (*give contact details to the participant*). Feel free to contact me if you have questions or if you think of anything else you want me to know.

APPENDIX C – SURVEY GUIDE

Name of the enumerator:

1. General Demographic Information

1.1 What is your name?

1.2 What community / village do you belong to?

1.3 What is your educational qualification?

1.4 How many members are there in your family?

1.4.1 Male adults and their educational qualification:

1.4.2 Female adults and their educational qualification:

1.4.3 Male children and if they are going to school:

1.4.4 Female children and if they are going to school:

2. Determining the nature of changes in the social-ecological system

2.1 For how many years have you / your family been fishing in *place*? (Mention number of years or event)

2.2 Have you observed any changes in the ecological character / subsystem of the *place*?

YES NO

2.2.1 If yes, what are some of the important changes? (List all changes mentioned by the respondent)

2.2.2 How would you define the changes you have explained above? (Circle all that apply)

1. Sudden / abrupt
2. Dramatic
3. Long-term
4. Significant / substantial
5. Difficult to predict / anticipate
6. Came without early warning signals
7. Difficult to reverse
8. Problem in understanding, comprehending, interpret
9. Problem in responding to (not easy to respond)
10. Caused substantial reorganization in the structure, functions and feedbacks of the ecosystem

11. Change from one ecological state to another. If yes, explain what to what.
12. Pose significant challenge to local fisher communities, managers, others

2.3 Have you observed any changes in the social character / subsystem of the *place*?
YES NO

2.3.1 If yes, what are some of the important changes? (List all changes mentioned by the respondent)

2.3.2 How would you define the changes you have explained above? (Circle all that apply)
1. Sudden / abrupt
2. Dramatic
3. Long-term
4. Significant / substantial
5. Difficult to predict / anticipate
6. Came without early warning signals
7. Difficult to reverse
8. Problem in understanding, comprehending, interpret
9. Problem in responding to (not easy to respond)
10. Caused substantial reorganization in the structure, functions and feedbacks of the social system
11. Change from one social state to another. If yes, explain what to what.
12. Pose significant challenge to local fisher communities, managers, others

3. Differentiating drivers of regime shift

3.1 What are the main natural / ecological factors influencing these changes?

3.1.1 Internally induced / proximate causes (i.e., activities or immediate actions and conditions at local level):

3.1.2 Externally induced / underlying forces (i.e., fundamental or systemic processes mainly impacting from national and global levels):

3.2 What are the main social / human factors influencing these changes?

3.2.1 Internally induced / proximate causes (i.e., activities or immediate actions and conditions at local level):

3.2.2 Externally induced / underlying forces (i.e., fundamental or systemic processes mainly impacting from national and global levels):

3.3 Are there positive outcomes or impacts resulting from these drivers? If yes, list what are they?

3.4 Are there negative outcomes or impacts resulting from these drivers? If yes, list what are they?

3.5 Are there specific natural or ecological factors that have directly impacted the social system?

3.6 Are there specific social or human factors that have directly impacted the ecological system?

3.7 Have some of these factors acted together to create an impact?

4. Levels and scales of occurrence and intervention

4.1 Can you identify some of the important parts (components) of the social system that were impacted or changed first? What are they and time period of when they changed or impacted.

4.2 Can you identify some of the important parts (components) of the ecological system that were impacted or changed first? What are they and time period of when they changed or impacted.

4.3 What parts (components) of the ecological system do you think are currently vulnerable and likely suffer adverse impacts or go through significant changes in the near future?

4.4 What parts (components) of the social system do you think are currently vulnerable and likely suffer adverse impacts or go through significant changes in the near future?

4.5. Are you aware of any interventions made by external agencies (i.e., government, non-government organisations, private) to address adverse changes / impacts listed above? Yes / No

4.5.1 If yes, please list them. Mention the type of interventions made, type of changes / impacts and social-ecological system components addressed.

5. Social-ecological units or the context of regime shifts

5.1 What are all the different types of natural resources (or ecosystems) in this area you depend on, or you think you have a relationship with, for your economic and social needs?

5.1.1 Do you see any linkages and feedbacks between these different types of natural resources (or ecosystems)?

5.2 What are all the different types of social organisations and institutions in this area and beyond you depend on (linked to, have relationship or a member of) for your social, economic and cultural needs?

5.2.1 How often you depend or come in relation with these organisations and institutions?

5.3 In terms of physical boundaries, how would you define the key features of the *place*? (e.g., what are the

5.4 In terms of normative boundaries, what are some of the norms / cultures / rituals / customs / traditions / customary laws / traditional institutions / forms of social interactions you think you are part of or follow in your engagement with the *place*?

5.5 Is the management *place*-specific or it includes a more comprehensive management approach that include linked resources (i.e., ecosystems)?

6. Equity and justice concerns in social-ecological regime shifts

6.1 In terms of social, economic and political groups, who do you think is responsible for the adverse social-ecological changes in the place?

6.2 What are the main adverse impacts of social-ecological changes in *place*? Does everyone in your community receive these impacts somewhat equally?

6.3 Are there specific positive impacts or benefits resulting from the social-ecological changes in *place*? Does everyone in your community have an equal share in these benefits?

6.4 Who are most affected by these changes (social groups who become losers in terms of livelihoods, culture, identity, etc.)? List who are they and what are they losing?

6.4.1 How often do you feel you have been affected by the changes?

6.5 Are there people or social groups (e.g., social elites, economically higher class, etc.) that are benefitting from these changes? List who are they and what are their benefits?

6.5.1 How often do you feel you have benefitted from the changes?

6.6 Are there social groups or people who are completely excluded from any involvement in the *place*?

7. Power dynamics and politics of change

7.1 How would you define power in relation to the place?

7.1.2 Who do you think (i.e., social groups or individuals) has most power in relation to the place?

7.1.2 Who do you think (i.e., social groups or individuals) has the least power in relation to the place?

7.1.3 Can you arrange the social groups and/or individuals from the most powerful to the least powerful?

7.2 Are those who benefit most want the changes to continue and do they in any way facilitate or intensify the change processes in *place*?

7.2.1 What strategies do they use to facilitate or intensify change?

7.3 Are those who are heavily impacted contest or oppose the changes?

7.3.1 ??What strategies do they use to oppose the changes and/or advocate for reversing change processes?

7.4 Are there major differences in the views of social groups / people on:

7.4.1 How the place should be maintained / managed?

7.4.2 What kind of benefits should be derived?

7.4.3 Who should be in decision-making role?

7.4.4 What are the key features of the place?

8. Governance and management in the context of social-ecological regime shifts

8.1 What are some of the key institutions and other (governance) actors active in managing the *place*?

8.2 What has been the response of different governance actors to the social-ecological changes in the *place*?

- Responses by your community institution
- Responses by government agencies
- Responses by non-government / private agencies
- Responses by individual fishers like yourself
- Responses by others

8.3 What is the nature of the responses by the governance actors to the social-ecological changes in the *place*?

- Anticipating change
- Navigating change
- Coping with change
- Preventing change
- Mitigating change

- Adapting to change
- Transforming

8.4 Do the responses target both the social and ecological aspects of the changes, or only one of them? Please explain?

8.5 Who makes rules for the *place*?

- Local Institutions – Village/community, regional, Networks, others
- Government – Local, district, provincial, Federal, others
- Others

8.5.1 Do these actors / rule making institutions interact and collaborate with each other? If yes, mention examples.

8.5.2 What is the level of trust between these rule-making actors?
Very high *High* *Moderate* *Low* *No trust*

8.6 Are there institutions that can mediate at times of need?

8.7 Are existing governance arrangements able to address adverse impacts of the drivers, and respond to issues of injustice, inequity, power dynamics and negative politics? Explain, if necessary.

9. Would you like to ask any questions to me?

APPENDIX D – ETHICS CLEARANCE

Ethics Clearance (ORE # 23047)

ORE Ethics Application System <OHRAC@uwaterloo.ca>
Mon 2018-06-04 9:39 PM
To: pnayak@uwaterloo.ca <pnayak@uwaterloo.ca>
Cc: Hameet Singh <hk23singh@edu.uwaterloo.ca>

Dear Researcher:

The recommended revisions/additional information requested in the ethics review of your application for the study:

Title: Social-Ecological Regime Shifts and the Governance of Community-Managed Marine Protected Areas: Ecological Conservation and Community Well-Being Implications for the Ria Lagartos Biosphere Reserve, Mexico
ORE #: 23047
Faculty Supervisor: Prateep Nayak (pnayak@uwaterloo.ca)
Student Investigator: Hameet Kaur Singh (hk23singh@edu.uwaterloo.ca)

have been reviewed and are considered acceptable. A University of Waterloo Research Ethics Committee is pleased to inform you this study has been given ethics clearance.

A signed copy of the notification of ethics clearance will be sent to the Principal Investigator (or Faculty Supervisor in the case of student research). Ethics approval to start this research is effective as of the date of this email. The above named study is to be conducted in accordance with the submitted application (Form 101/101A) and the most recent approved versions of all supporting materials.

University of Waterloo Research Ethics Committees operate in compliance with the institution's guidelines for research with human participants, the Tri-Council Policy Statement for the Ethical Conduct for Research Involving Humans (TCPS, 2nd edition), Internalization Conference on Harmonization: Good Clinical Practice (ICH-GCP), the Ontario Personal Health Information Protection Act (PHIPA), and the applicable laws and regulations of the province of Ontario. Both Committees are registered with the U.S. Department of Health and Human Services under the Federal Wide Assurance, FWA00021410, and IRB registration number IRB00002419 (Human Research Ethics Committee) and IRB00007409 (Clinical Research Ethics Committee).

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Renewal: Multi-year research must be renewed at least once every 12 months unless a more frequent review has otherwise been specified by the Research Ethics Committee on the signed notification of ethics clearance. Studies will only be renewed if the renewal report is received and approved before the expiry date (Form 105 - https://uwaterloo.ca/research/office-research-ethics/research-human-participants/renewals). Failure to submit renewal reports by the expiry date will result in the investigators being notified ethics clearance has been suspended and Research Finance being notified the ethics clearance is no longer valid.

Modification: Amendments to this study are to be submitted through a modification request (Form 104 - https://uwaterloo.ca/research/office-research-ethics/research-human-participants/modifications) and may only be implemented once the proposed changes have received ethics clearance.

Adverse event: Events that adversely affect a study participant must be reported as soon as possible, but no later than 24 hours following the event, by contacting the Chief Ethics Officer. Submission of an adverse event form (Form 106 - https://uwaterloo.ca/research/office-research-ethics/research-human-participants/report-problems) is to follow the next business day.

Deviation: Unanticipated deviations from the approved study protocol or approved documentation or procedures are to be reported within 7 days of the occurrence using a protocol deviation form (Form 107 - https://uwaterloo.ca/research/office-research-ethics/research-human-participants/report-problems).

Incidental finding: Anticipated or unanticipated incidental findings are to be reported as soon as possible by contacting the Chief Ethics Officer. Submission of the incidental findings form (Form 108 - https://uwaterloo.ca/research/office-research-ethics/research-human-participants/report-problems) is to follow within 3 days of learning of the finding. Participants may not be contacted regarding incidental findings until after approval has been received from a Research Ethics Committee to contact participants to disclose these findings.

Study closure: Report the end of this study using a study closure report (Form 105 - https://uwaterloo.ca/research/office-research-ethics/research-human-participants/renewals).

You are responsible for obtaining any additional institutional approvals that might be required to complete this study.

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Best wishes for success with this study.

Erin Van Der Meulen, M.A.
Research Ethics Advisor
Office of Research Ethics
East Campus 5 (EC5), 3rd Floor
519.888.4567 ext. 37046
ervandermeulen@uwaterloo.ca

Sign up for our listserv at http://uwaterloo.us10.list-manage.com/subscribe?u=734de426ca7ee1226a168b091&id=46fdcbfea2

Ethics Clearance of Modifications, no comments (ORE # 23047)

Office of Research Ethics <researchethics@uwaterloo.ca>
Wed 2018-08-29 1:57 PM
To: Prateep Nayak <pnayak@uwaterloo.ca>
Cc: Hameet Singh <hk23singh@edu.uwaterloo.ca>; Office of Research Ethics <researchethics@uwaterloo.ca>

Dear researcher(s):

A request for review of an amendment to your application:

Title: Social-Ecological Regime Shifts and the Governance of Community-Managed Marine Protected Areas: Ecological Conservation and Community Well-Being Implications for the Ria Lagartos Biosphere Reserve, Mexico

ORE # 23047

together with a copy of relevant materials, was received on

8/24/2018

- Add government workers as new group of participants

The proposed amendment request has been reviewed and received ethics clearance.

Research Ethics Advisor, Research Ethics
Office of Research, East Campus 5 (EC5), 3rd Floor 3157A
University of Waterloo
Waterloo, ON N2L 3G1 519-888-4567, ext. 37046

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This project must be conducted in accordance with the description in the application and amendment request for which ethics clearance has been granted. All subsequent amendments must receive ethics clearance before being implemented.
Researchers must submit a renewal report annually for all ongoing projects. In addition, researchers must submit a closure request at the conclusion of the project.

Best wishes,

Erin

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The NEW Research Ethics System is now live. Attend a drop-in training session and review the training guides.

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Stay informed. Sign up for our email notifications!

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Erin Van Der Meulen