The Effectiveness of Measures Adopted to Curb Illegal, Unreported and Unregulated (IUU) Fishing in Liberia.
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Thesis for MSc Degree in Environment and Natural Resources
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Faculty of Business Administration, School of Social Sciences,
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June, 2019
The Effectiveness of Measures Adopted to Curb Illegal, Unreported and Unregulated (IUU) Fishing in Liberia.

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To my family, I am appreciative of the support. Especially my mom, Hawa E. Sherif, your sacrifices will never be forgotten. And to my father Abubakar K. Sherif, I say thank you. To my little brother Abbas M. Sherif, I say thank you. Thanks for sharing my joy and sadness, as well as my failures and successes; this success. You always wanted this for me, especially at times I did not even consider. Your help during this period was immeasurable and for this, I will always be in your debt.

Lastly to my kids, Kasim Abbas Sherif and Ahmed S. Sherif, though very young when I started, you both inspired me. I needed to achieve this so that this aspect of my life motivates you to do better. My life is now dedicated to making yours better than what I always dreamt of but never had.
Dedication

Dedicated to J. P. Arthur for being there before, now and always. And my dearest mom,
for the uncountable sacrifices in guiding and grooming the man I have become.
Abstract

Illegal, Unreported and Unregulated (IUU) fishing continues to attract global attention due to its ability to undermine the development of coastal nations, degrade the marine ecosystems and destabilize the ability of the environment to recover from exploitations. Developing nations, especially in Africa, are the most vulnerable due the lack of adequate management tools and mechanisms to avert and discourage IUU fishing. The devastation caused by IUU fishing in this part of the world is most alarming due to the dependency rate of coastal nations to fisheries for livelihood and nutrition intake.

Liberia being a developing coastal nation continues to be affected by varying forms of IUU fishing. Majority of the population live on the coast and rely heavily on these resources, especially as fish provide a cheaper means for animal protein.

This study provides an assessment of the effectiveness of institutionalized structures employed to combat IUU fishing. The study investigates the effectiveness of policies to demarcate zones for fishing by vessel types by comparing the catch size of Artisanal and industrial fishing before and after the structures and policies went into effect. The data shows huge difference in catch size before 2010, favoring the industrial fishers. After 2010, the advantage is reversed and there was a spike in artisanal catch and steep decline in the industrial fishing. This study also provides a MSY-catch analysis to determine how much IUU fishing affects the stock size. It is seen that while the revenue generation by the fisheries sector is indeed affected by IUU fishing, the proportion of catch to stock is extremely low and has been near constant for almost two decades. This allows for the temptation to increase effort which could increase the contribution of the fisheries sector to the national GDP of Liberia. However, the analyses fall short of including IUU catch records from vessels arrested, fined or penalized during the same period, as well as the inclusion of tuna fishery catch records. A review of the COBECOS project is discussed and possible applications of the model to Liberia is discussed and recommended.
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<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIS</td>
<td>Automatic Identification System</td>
</tr>
<tr>
<td>BIN</td>
<td>Bureau of Immigration and Naturalization</td>
</tr>
<tr>
<td>BNF</td>
<td>Bureau of National Fisheries</td>
</tr>
<tr>
<td>CDS</td>
<td>Catch Documentations Scheme</td>
</tr>
<tr>
<td>CECAF</td>
<td>Fisheries Committee for the Eastern Central Atlantic</td>
</tr>
<tr>
<td>CMA</td>
<td>Community/Collaborative Management Association</td>
</tr>
<tr>
<td>COFI</td>
<td>Committee on Fisheries</td>
</tr>
<tr>
<td>COMHAFAT</td>
<td>Ministerial Conference on Fisheries Cooperation among African States Bordering the Atlantic</td>
</tr>
<tr>
<td>CZ</td>
<td>Contiguous Zone</td>
</tr>
<tr>
<td>EEZ</td>
<td>Exclusive Economic Zone</td>
</tr>
<tr>
<td>FAO</td>
<td>Food and Agriculture Organization</td>
</tr>
<tr>
<td>FCWC</td>
<td>Fisheries Committee of West Central Gulf of Guinea</td>
</tr>
<tr>
<td>FMC</td>
<td>Fisheries Monitoring Center</td>
</tr>
<tr>
<td>FOB</td>
<td>Forward Operating Base</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GoL</td>
<td>Government of Liberia</td>
</tr>
<tr>
<td>HF</td>
<td>High Frequency</td>
</tr>
<tr>
<td>IATTC</td>
<td>Inter-American Tropical Tuna Commission</td>
</tr>
<tr>
<td>ICCAT</td>
<td>International Commission for the Conservation of Atlantic Tuna</td>
</tr>
<tr>
<td>IEZ</td>
<td>Inshore Exclusive Zone</td>
</tr>
<tr>
<td>ILO</td>
<td>International Labor Organization</td>
</tr>
<tr>
<td>IMO</td>
<td>International Maritime Organization</td>
</tr>
<tr>
<td>IOTC</td>
<td>India Ocean Tuna Commission</td>
</tr>
<tr>
<td>IPOA-IUU</td>
<td>International Plan of Action to Deter, Prevent and Eliminate IUU Fishing</td>
</tr>
<tr>
<td>Acronym</td>
<td>Full Form</td>
</tr>
<tr>
<td>---------</td>
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<tr>
<td>IUU</td>
<td>Illegal, Unreported and Unregulated</td>
</tr>
<tr>
<td>LAFA</td>
<td>Liberia Artisanal Fishers Association</td>
</tr>
<tr>
<td>LCG</td>
<td>Liberia Coast Guard</td>
</tr>
<tr>
<td>LiMA</td>
<td>Liberia Maritime Authority</td>
</tr>
<tr>
<td>LNP</td>
<td>Liberia National Police</td>
</tr>
<tr>
<td>LRA</td>
<td>Liberia Revenue Authority</td>
</tr>
<tr>
<td>MCS</td>
<td>Monitoring, Control and Surveillance</td>
</tr>
<tr>
<td>MCSCC</td>
<td>Monitoring, Control and Surveillance Coordinating Committee</td>
</tr>
<tr>
<td>MFDP</td>
<td>Ministry of Finance and Development Planning</td>
</tr>
<tr>
<td>MoD</td>
<td>Ministry of Defense</td>
</tr>
<tr>
<td>MoJ</td>
<td>Ministry of Justice</td>
</tr>
<tr>
<td>MOU</td>
<td>Memorandum of Understanding</td>
</tr>
<tr>
<td>MRAG</td>
<td>Marine Resource Assessment Group</td>
</tr>
<tr>
<td>MRU</td>
<td>Mano River Union</td>
</tr>
<tr>
<td>MSY</td>
<td>Maximum Sustainable Yield</td>
</tr>
<tr>
<td>NaFAA</td>
<td>National Fisheries and Aquaculture Authority</td>
</tr>
<tr>
<td>NOAA</td>
<td>National Oceanic and Atmospheric Administration</td>
</tr>
<tr>
<td>NPA</td>
<td>National Port Authority</td>
</tr>
<tr>
<td>NPOA</td>
<td>National Plan of Actions</td>
</tr>
<tr>
<td>PSMA</td>
<td>Port State Measure Agreement</td>
</tr>
<tr>
<td>RFMO</td>
<td>Regional Fisheries Management Organization</td>
</tr>
<tr>
<td>SFPA</td>
<td>Sustainable Fisheries Partnership Agreement</td>
</tr>
<tr>
<td>SOP</td>
<td>Standard Operating Procedure</td>
</tr>
<tr>
<td>SPRFMO</td>
<td>South Pacific Regional Fisheries Management Organization</td>
</tr>
<tr>
<td>SRFC</td>
<td>Sub-Regional Fisheries Commission</td>
</tr>
<tr>
<td>TW</td>
<td>Territorial Waters</td>
</tr>
<tr>
<td>UNFSA</td>
<td>United Nations Fish Stocks Agreement</td>
</tr>
<tr>
<td>UNMIL</td>
<td>United Nations Mission in Liberia</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>UNODC</td>
<td>United Nations Office on Drugs and Crimes</td>
</tr>
<tr>
<td>VGCDS</td>
<td>Voluntary Guidelines for Catch Documentation Scheme</td>
</tr>
<tr>
<td>VGFSP</td>
<td>Voluntary Guideline for Flag State Performance</td>
</tr>
<tr>
<td>VHF</td>
<td>Very High Frequency</td>
</tr>
<tr>
<td>VMS</td>
<td>Vessel Monitoring System</td>
</tr>
<tr>
<td>WARFP</td>
<td>West Africa Regional Fisheries Project</td>
</tr>
</tbody>
</table>
1 Introduction

Illegal, unreported and unregulated (IUU) fishing involves varying fishing methods, or conditions under which they are executed. Fishing activities that are misreported or not reported to the appropriate national institution or Regional Fisheries Management Organizations (RFMO) is referred to as Unreported fishing. Unregulated fishing includes fishing activities within areas of pertinent RFMO but do not have the requisite authorization to carry out such activities. IUU fishing is considered a serious menace to the health of fish stocks and a high risk to food security for countries, especially developing nations that rely on the resources (Leroy, Galletti, & Chaboud, 2016).

All fisheries in the world are faced with the constraint of mismanagement at the highest levels. Most fish stocks are highly commercial and yield huge net profits; however, very few manage to be lucrative. According to rough approximations on a worldwide scale, the loss of profits due to poor administration of fisheries could sum up to 50% or more of the global landed value of about US $100 billion per annum. The amount in loss of US$50 billion is comparable in magnitude to the total development assistance from developed nations annually to underdeveloped nations worldwide (Arnason, 2009).

1.1 Objectives

As one of the major sources of income and protein intake, mainly for the locals, as well as revenue generation for the Liberian economy, any practice negatively impacting the fisheries sector is necessarily at the forefront of challenges to be faced by the government of Liberia.

There has not been any extensive review on the subject tied to analysis of available data relative to Liberia. Even the available data is sparse and similar data from different sources inconsistent. This project aims to provide the first such extensive review.

Liberia has most of its population situated on the coast of the country. The coastal and marine resources provide livelihood and cheap means of animal protein for most of the population; which provide intimation to the significance of adequately managing and conserving these scarce resources. The fisheries sector has suffered from weak or no management for an extended period and though there have been numerous efforts in
establishing mechanisms to resolve the situation, illegal, unreported and unregulated (IUU) fishing has persisted.

The practice of IUU fishing therefore stands out as a major obstacle to national development and is consequently being tackled by the fisheries authority of Liberia. There is a natural question to ask: How effective have the existing measures to curb IUU fishing in Liberia been since its inception in 2010?

The objective of this thesis is to

- First and foremost review the structures and measures in place to combat IUU fishing.
- After analysing existing data and review of scientific articles on the subject, make statement about the level of effectiveness of existing measures against IUU fishing.
- Make statements about the economic impacts on fishing communities, before and after the introduction of these measures.
- Suggest additional measures and/or make suggestions to modify existing measures where necessary.

1.2 Structure of Thesis

This thesis is structured as follows:

In chapter 1 we give a background on IUU fishing in a broad sense and narrowed down to the Liberian context. In chapter 2 the Liberian fisheries is discussed, the management setup of the Liberian fisheries and its various components are introduced and discussed. The importance of the fisheries sector to the national economy is also highlighted, as well as the legal framework. Chapter 3 outlines IUU fishing in a global context while drivers of IUU fishing and its impacts in Liberia are examined. Efforts put in place to combat IUU fishing are also discussed. Models developed by the COBECOS project and Sumaila et al. are briefly discussed. Chapter 4 provide the methodology used in the conduct of the research. In chapter 5 some analyses of the available data is carried out. The analyses focus primarily on pre and post 2010, when measures to specifically put a stranglehold on IUU fishing were introduced in Liberia. Chapter 6 discusses the measures in place to combat IUU fishing in Liberia. Chapter 7 details assessment of these measures is given. Chapter 8 provides discussions of points highlighted within the paper,
while possible applications of models to the Liberian system are suggested. We then conclude in chapter 9 with summary of the research and results.
2 The Liberian Fisheries

For about a century Liberia has been having great potential for coastal and marine fisheries. The location, as well as the topology of the country with coastline about 580 km and a continental shelf with a width of about 34 km makes for an attractive prospect (FAO, 2006). According to Ssentongo (1988), Liberia affords an area of fishing ground approximated at 20,000 km² with an extended 200 nautical mile of Exclusive Economic Zone (EEZ), approx.18, 400km². Liberia is strategically situated between Sierra Leone (bordered southwest) and Ivory Coast (southeast). Liberia inland fisheries are supported by six major rivers: the St. John, the Lofa, St. Paul and Cestos rivers flow within Liberia. The Cavalla and Mano Rivers run through the borders of Ivory Coast and Sierra Leone respectively. The country possesses about 1,800 km of river, most of which are rocky, shallow, but passable as reported in Ssentongo (1988). The estimated maximum sustainable yield of the continental shelf of Liberia before 1989 was about 180,000 and about 40,000 tons from fresh waters tons per annum respectively. According to BNF (2006), fish landed domestically by licensed industrial vessels was estimated at 1500 tons in 2004 and 2800 tons in 2005. These limited reported figures were associated with misreporting and unreported transhipment activities by industrial fishing vessels that were not reflected in the national records. There were suspicions that the catch per annum within the EEZ of Liberia was greater as there was proliferation of IUU fishing due to the extreme lack of monitoring, control and surveillance (MCS) according to FAO (2007).

2.1 Fisheries in Liberia

The fisheries of Liberia are subdivided into the following:

- Marine fisheries; Artisanal and industrial
- Inland fisheries; dominantly Artisanal fisheries
- Aquaculture; subsistence fish farming
- Deep sea fisheries; tuna
- Recreational fisheries; sports and pleasure
2.1.1 Marine Fisheries

The marine fisheries sector in Liberia is comprises of two subsectors: a.) Industrial and b.) Artisanal or small-scale fisheries. The artisanal fisheries have proven over time to be the most important in terms of catch landed and supplied for local consumption. There is a rather varied pelagic fishery resource.

2.1.1.1 Industrial Fisheries

Industrial fisheries began in middle of 1950 and its primary target was shrimp within and around the Sherbro area which extends into Sierra Leone (Drammeh, 2007; FAO, 2004; Marquette et al., 2002). The Mesurado Group of Companies was established and transformed into the leading force in Liberia fisheries in the early 1960s. Owned by the Tolbert’s family (Vice President at the time), it utilized about 25 vessels which included trawlers and shrimpers, along with its own pier and handling facilities with capacity to freeze 3,000 tons. The major export commodity for the company was shrimp, with 60 tons of shipment to Europe and Asia annually. It is believed that the Mesurado Group of Companies was one of the major fishing establishments in sub-Saharan Africa up to 1980 when it declined as a result of the military coup in Liberia.

Industrial fishery reported catch in 1971 was 470 tons and improved gradually to 3,000 tons in 1978. The industrial finfish catch, and finfish landed in Liberia varied between 4500 tons and 9000 tons respectively after 1980, FAO (2007a). As was mentioned earlier, it was estimated in Ssentongo (1988) that the maximum sustainable yield of the continental shelf area of Liberia before 1989 was 180,000 metric tons annually. In a 2006 survey, however, the reported biomass was 152,000 and 27,000 tons of pelagic and demersal resources respectively according to BNF (2006). This then meant that the reported maximum sustainable yield of 180,000 metric tons was questionable, as biomass of such size cannot sustain such yield annually. This was an indication of the limitation of adequate understanding of the biological productivity of Liberia waters.

There was a noticeable decline of catch landings during the period of 1990-1997 which could be attributed to the civil crisis in the country. The first phase of the crisis began 1990 and ended 1997. During this period, economic activities were interrupted including fishing activities.

Average catch landed for industrial fisheries ranged from 1,104 to 10,500 between the years 1995-2007 (See Table 2.1). There was a steady increase in landing in 1998 and a sharp improvement a year after. There was a sustained decline in in early 2000 probably
due to the other phase of the civil unrest. Between 2004 and 2006 there were little fluctuation in landings and a sharp increase in 2007 which could be ascribed to increase in number of vessels with unrestricted fishing activities.

Table 2.1 Total Production (in tons) of industrial fisheries for period of 1995 to 2007.

<table>
<thead>
<tr>
<th>Year</th>
<th>Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>1,675</td>
</tr>
<tr>
<td>1996</td>
<td>1,104</td>
</tr>
<tr>
<td>1997</td>
<td>1,579</td>
</tr>
<tr>
<td>1998</td>
<td>2,700</td>
</tr>
<tr>
<td>1999</td>
<td>4,493</td>
</tr>
<tr>
<td>2000</td>
<td>2,425</td>
</tr>
<tr>
<td>2001</td>
<td>2,229</td>
</tr>
<tr>
<td>2002</td>
<td>2,201</td>
</tr>
<tr>
<td>2003</td>
<td>2,020</td>
</tr>
<tr>
<td>2004</td>
<td>3,191</td>
</tr>
<tr>
<td>2005</td>
<td>3,584</td>
</tr>
<tr>
<td>2006</td>
<td>2,894</td>
</tr>
<tr>
<td>2007</td>
<td>10,500</td>
</tr>
</tbody>
</table>

Source: (BNF 2006)

Before 2009, illegal, unreported and unregulated (IUU) fishing was not considered in reports regarding fishing activities and catch landed. However, there were many reports on IUU activities; fishing without license or authorization, underreporting, misreporting, transhipment at sea without authorization or monitoring, amongst others were prevalent as a result of the lack of management tools and mechanisms to prevent, deter and combat the menace. This became even clearer when the Marine Resource Assessment Group (MRAG) in their report stated that Liberia lost up to US$12 million every year to IUU fishing activities as seen in Table 2.2. The catch volume of IUU fishing is generally determined as a proportion of reported catch. In principle, this proportion is the estimate of unreported fishing, but is generalized to account for total IUU fishing (See also Pauly and Maclean, 2003). According to MRAG (2005), countries within the Central Western Region of Africa including Liberia, have been exposed to IUU fishing due to the availability of commercially lucrative shrimps and demersal resources. Additionally, MRAG (2005) also reported that IUU fishing constituted about 60% of total marine capture at the time and suggested that to tackle the situation, Liberia needed to establish an effective monitoring, control and surveillance scheme which could ultimately lead to an increment in fisheries contribution to national GDP by about 4.38 percent and per capita fish consumption of 8.18 kg.
Table 2.2 Estimated losses (in millions of $USD) due to IUU fishing in Liberia.

<table>
<thead>
<tr>
<th>Species</th>
<th>Value</th>
<th>% of Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shrimp</td>
<td>0.8</td>
<td>6.8</td>
</tr>
<tr>
<td>Demersal</td>
<td>4.5</td>
<td>38.5</td>
</tr>
<tr>
<td>Pelagic (tuna)</td>
<td>6.4</td>
<td>54.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>11.7</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Source: (MRAG 2005)

2.1.1.2 Artisanal (Small-scale) Fisheries

Artisanal fisheries offer livelihoods for more than 33,000 permanent fishers and fish processors situated in the nine coastal counties of Liberia according to BNF (2009).

This fisheries is exploited by the Kru tribe, which uses dug-out canoes that are about 6m long with depth approximately 60 cm, carrying 1-3 crew; the Ghanaians or Fantis, use large dug-out or plank canoes that are as long as 12 m, having carrying capacity of 12 or more crew members. These fishermen employed a more advanced fishing method than the Kru. They are better organized and operate in a group of 20. They have inhabited lots of areas along the coast of Liberia according to Ssentongo (1988). There are migrant fishers from Gambia and Senegal who use bigger fishing canoes about 20 m in length and conduct their fishing activities further in deep sea, they have also inhabited areas along the coast as reported in Subah (2010). The categories of boats used by these migrants and some of the Fantis are referred to as semi-industrial vessels. Due to their size and distance they cover, they operate with exterior motors and engines in the range of 10-40 horsepower. They target pelagic, both large and small using gill-nets, set-nets and ring-nets according to Sherif (2014).

The artisanal fishing activities are based on the type of fishing gear being used, depth of the water, and season. For example, the Kru fishermen are unable to operate in deep waters with rough sea conditions. Furthermore, stocks availability are influenced by seasons as well; there will be rise and fall in the catch rate consistent with a particular season in which a stock is more abundant according to Ssentongo (1988). As shown in Table 2.3, between 1960 and 1981, the number of canoes operating in this sub-sector ranged from 26-252.
According to Drammeh (2007), there existed approximately 18,000 fish mongers and 13,000 artisanal fishers living in about 139 fishing communities, they operated about 3,470 canoes, 8 percent of which used outboard motors.

Between 1995 and 2007 as seen in Table 2.4, landings from artisanal fisheries ranged from 2,036 to 5,654 tons. There was slight but stable decline between 1999 and 2003, probably due to the third phase of the Liberian civil crisis, and then a slight increase in 2004, which was immediately after the civil crisis officially ended. In 2005 there was an increase in landings which remained slightly stable up to 2007. An estimated 7,000 metric tons were landed at about ten landing sites in 2004. Average catch for artisanal canoe in 2004 was 2.2 tons and 1.16 tons in 2005 as recorded in BNF (2006). This is slightly less than annual the average landings of 1.5 tons for an artisanal canoe according to FAO (2007a).

Table 2.3 Number of Artisanal canoes in Liberia from 1960 to 1981.

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Canoes</th>
<th>Year</th>
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<tbody>
<tr>
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<tr>
<td>1970</td>
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</tbody>
</table>

Source: (Ssentongo 1988)
Since 2006 there have been variations in the amount of artisanal fishing canoes and landing sites. There were about 3,500 artisanal canoes and 137 landing sites between 2006 and 2009 according to Kebe et al. (2009), and 3,257 artisanal canoes and 111 landing sites between 2009 and 2011 as reported in Thiao (2011).

### 2.1.1.3 Aquaculture

This sub-sector activity began in the 1970s when the Central Agriculture Experimental Station in Suakoko, Bong County, developed fishponds for experiments involving common carps (*Cyprinus Carpio*), varieties of catfish and Nile tilapia (*Oreochromis niloticus*). This initiative was supported by the Peace Corps and promoted in other counties like Lofa and Nimba, recording 29 tons of production before 1990. The European Union supported hatcheries Klay, Bomi County, Douyee, in Grand Gedeh County and Salaya in Lofa which provided feeds (fingerlings) to fish farmers. Production increased from 22 tons in 2000 to 38 tons in 2004. *Oreochromis niloticus*, redbelly tilapia (*Tilapia zili*), *Clarias* sp. and *Heterobranchus* sp. became the primary culture species while the number fish farmers soared from 350 to 1,050 between 2000 and 2004 according to FAO (2007a).

### 2.1.1.4 Deep Sea Fisheries (Tuna)

Liberia serves as a path way for migratory fish stock such as tuna and tuna like species. This fishery was being exploited by foreign trawlers, unknown to the
government and fisheries authority before the advent of the West Africa Regional Fisheries Program (WARFP) in 2010. The exploitation was then unknown to government because there were no mechanisms and/or structures in place to monitor and enforce compliance of certain regulatory policies preventing foreign vessels from fishing in restricted waters. Such exploitations naturally affected the catch volumes by licensed fishers and thus limited their source of income and protein.

2.1.1.5 Recreational Fisheries

This sub-sector has been in existence since 1848 when the first president of Liberia owned a yacht. However, it has been overlooked for decades even though there are commercially valuable fish caught during this exercise. There have been reports in recent years about the catches being sold to supermarkets which are contrary to the intent of the fishery. Though recreation fisheries have gone unnoticed over the years, there are plans underway to assess this sub-sector to monitor and record landings so as to inform management on the trend of policies.

2.2 Importance of the Fishing Sector to the National Economy

Fishers operated on the Liberian coast and inland waters primarily for sustenance. They harvested fish to feed their families and battered with the excess for other important commodities. A German company named Woerman was the first to operate a fishing trawler in Liberian waters in the late 1930s. Fishing became a regular routine and to avoid losses due to lack of means to preserve their fish, they returned at the end of a fishing trip to sell their catches. Seeing the achievement of Woerman and the appreciating the prospect of fisheries contributing to national socio-economic development, the Liberian Government sought assistance from FAO and the United States Government to develop the fisheries sector as reported in FAO (2007).

The country is endowed with diverse demersal and pelagic fish resources that offer food security and nutrition, employment and as well as income. In 2015, the fisheries sector contributed 12% of agricultural GDP and 3% of national GDP according to BNF (2015). There are fifteen political sub-divisions, nine of which are situated on the coast, and serve as homes for more than half of the population which includes rural communities, women and children, that are fully or partly dependent on fisheries as a source of livelihood and revenue generation. Fish offers 65% of animal protein intake in Liberia, mostly due to it being inexpensive and obtainable as compare to meat according to BNF (2015). Liberia has the lowest per capita consumption of fish in the region, 4.9
kg. This is significantly lower than FAO estimate of 22 kg protein intake for countries in sub-Saharan Africa (Béné & Heck, 2005; FAO, 2007b), and also lower than 14 kg recorded in the 1980s.

Even though there exist 15,050 km² of fresh water bodies which constitute 14% of the total land area of the country, the impact of inland fisheries to the fish supply situation has been insignificant according to BNF (2015). Prior to the civil war in 1990, the potential yield of the marine fisheries was estimated at 150,000 tons annually, of which less than 10,000 tons were captured legally from both artisanal and industrial fisheries. Due to improvements in the legal structure and institution of monitoring, control and surveillance systems; and enforcement mechanisms, there was enhancement in the contribution of fisheries to the economy as revenues increased from US$400,000.00 in 2010 to more than US$6 million by 2013. This was the result of fines and penalties from illegal, unreported and unregulated fishing.

2.3 Fisheries Management in Liberia

In 1956, the Bureau of National Fisheries (BNF) was established through an act of legislation within the Ministry of Agriculture to have oversight on the management and conservation of the fisheries resources of Liberia, which included obtaining regular statistics for the marine resources, and developing policies to tie fishing in the Liberian waters to national revenue generation. The BNF was originally organized into three divisions: Marine, Research & Statistics and Aquaculture & Inland which were serviced by the following units: Aquaculture, Research & Biology, Artisanal, Industrial & Inland; and Statistics. It was guided by a Coordinator who was appointed by the Minister of Agriculture. Before the establishment of the BNF, the Liberian water was open to exploitation, and as far as I have researched the literature, there was no existing statistics available on fishing for marine resources. According to FAO (2007), the catch of industrial fishery was approximately 470 tons in 1971. In 1972, through the assistance of FAO, the government of Liberia revised the then legal framework, the Natural Resource Law of 1956, which provides regulations for various fishing activities, including obtaining of licenses (for boats and their owners), types of gear used, fishing zones, reports from licensed fishermen, dynamite use, etc. However, the revision was not endorsed by the President until the military coup in 1980 due to how less interest was shown to the sector. From 1972 the catch increased steadily to about 3000 tons, probably due to these FAO interventions. During the period from 1972 to 1980, the industrial fin-
fish catch and fin-fish landed (those offloaded on land for immediate marketing) fluctuated between 4500 and 9000 tons respectively, again, probably due to the institution of a new government after the coup. From 1980 to the end of the Liberian civil crisis in 2013, there were no legislative policies on fisheries, probably because the fisheries was not seriously considered a major contributing sector to national revenue. This seriously impeded government ability to operate suitably. Coupled with the extreme lack of trained and skilled personnel to execute the mandates of the institutions, the FAO undertook a study to make an assessment of the state of fisheries in Liberia according to FAO (2007). The report highlighted series of constraints that the Liberia fisheries faced at the time:

- No fishery policy and national fishery developmental plan
- Lack of fisheries regulations and operational procedures
- Low and poor institutional capacity in the BNF
- Limited fisheries port/pier to facilitate landings of fish
- High import and landing charges for locally caught fish
- Antiquated fish processing methods in artisanal fisheries especially for preservation (fish smoking),
- Limited to no comprehensive studies and research on the marine and fresh water resources, etc.

The report also noted that the existence of these limitations, and many others, made the fisheries vulnerable to IUU fishing, thus undermining the sustainable growth of the sector. The World Bank, through the Aide Memoire, World Bank (2011) emphasized these constraints, undertaking similar study to obtain an update on the 2007 FAO report, highlighting aspects regarding increased impairment to ecosystems and fish breeding grounds from illegal trawling. In this document, data available from the flights by the United Nations Mission in Liberia (UNMIL) in 2007, in and around coastal zones, revealed that there were about 250 fishing vessels observed conducting fishing activities of all kinds without licenses or authorizations, while there were only 50 licensed vessels; 83% of every known industrial fishing vessel in Liberia waters was observed engaging in serious infractions, excluding the violations within the Inshore Economic Zone (IEZ); an area restricted for artisanal or small-scale fisheries to protect spawning grounds for variety of fish species, and as well avoid the destruction of the ecosystems of these species by trawling activities. According to Braimah (2012), WARFP Appraisal
Document (2009) estimated 60-100 IUU fishing vessels were sighted by UNMIL surveillance flights. The estimates of IUU vessels between 2007 and 2009 are a little below MRAG (2005) report which indicated between 150-200 illegal fishing vessels contributing to the estimated loss of about US$12 million annually, 53% of which was associated with the tuna fisheries.

2.4 Legal Framework

The legal instruments of fisheries management in Liberia consist of the Revised Fisheries Regulations of 1963, preserved into the Natural Resource Law of 1956, the Fisheries Regulations of 2010, the National Fisheries and Aquaculture Policy of Liberia and the National Fisheries and Aquaculture Act of Liberia. There is also a Co-Management Charter established by the Collaborative Management Association (CMA) and erstwhile Bureau of National Fisheries (BNF) for Robertsport, Grand Cape Mount County and the Monitoring, Control and Surveillance Coordinating Committee (MCSCC) established through a Memorandum of Understanding between the erstwhile BNF and other relevant stakeholders within the Government. The EEZ declaration of Liberia Maritime Zones through Executive Order 39 in 2016, and the IEZ establishment for management purposes and reserved for small-scale fisheries (Artisanal and semi-industrial).

The 2010 Fisheries Regulation became the primary instrument to regulate the sector, replacing the outmoded Natural Resource Law of 1956. The Liberia National Fisheries and Aquaculture Policy provides a framework towards harmonizing long and short – term expectations while sustainably managing and conserving an economically viable fishery. In BNF/MOA (2015), the Policy accounted for legislations and policies of other sectors that are related to the maritime domain; some instruments considered for consistency are:

- “Liberia National Policy on Decentralization and Local Governance (2010) – regionalizing government is a crucial governance approach that is pertinent for artisanal fisheries, mostly inland fisheries;
- ‘Maritime Act’ (2010) – creates the Liberia Maritime Authority (LiMA) as a corporate body and emphasized the importance of inter-agencies and inter-departments collaboration;
• National Defense Act (2008) – creates the role of the Liberian Coast Guard regarding the maritime regions and its association with the BNF;

• Environmental Protection Agency Act (2003) – creates a monitoring, coordinating and supervisory authority that is to provide a structure to deal with and coordinate resolutions amongst ministries and agencies for Liberia’s environmental problems.

• Executive Order # 39 of 2012 (2012) – demarcates Liberia maritime zones and domesticized the 1982 UNCLOS;

• National Capacity Development Strategy (2010) – offers vision for capacity development to be sustainable, comprehensive, results-oriented, and associated with the broader development programs of the country; etc.”

“The National Fisheries and Aquaculture Act of Liberia created the National Fisheries and Aquaculture Authority (NaFAA) as an autonomous agency of government, through an act of Legislature by the amendment of Title 23, Natural Resource Law, and Liberian Code Revised. The following are some functions of the Authority:

• Manage fisheries and aquaculture activities, while promoting the management and conservation of the sustainable use of fisheries and aquaculture resources;

• Manage and conserve fisheries and aquaculture environment, protecting water quality and biodiversity;

• Develop and implement plans, policies and strategies within the scope of the Act

• Act on behalf of the Government in regard to national or international agreements relating to fisheries, aquaculture and any other matter which falls within the scope of the Act. These include but not limited to access agreements and fisheries management agreements.

• Collect, analyse and maintain register, data and information regarding fisheries and aquaculture;

• Undertake monitoring, control and surveillance in collaboration with relevant institutions or states or relevant regional or sub-regional organizations. There are rule and regulations governing all actions of the Liberian fisheries sector. Liberia, as a member of various international bodies, naturally adopts rules and regulations put in place by these bodies”.
We now discuss international legal framework designed to regulate maritime and fisheries related activities.

International framework has been developing to address fisheries management issues since the agreement of United Nations Conventions on the Law of the Sea (UNCLOS) in 1982. There were an increased number of fisheries management instruments in the 1990s. The framework encompasses both binding agreements and non-binding (voluntary) instruments which support fisheries management at the global, regional and national levels. These instruments contain tools to combat IUU fishing, especially if states fulfil their obligations and responsibilities under these frameworks:

UNCLOS offers the international legal foundation for the shielding and exploitation of living and non-living resources of all oceans.

United Nations Fish Stocks Agreement (UNFSA) entered into force in 2001 and aims at ensuring long-term conservation and sustainable exploitation of straddling and highly migratory fish species within the framework of UNCLOS. This Agreement provides duties of flag states regarding registration and records of vessels, MCS, authorizations and compliance and enforcement.

FAO Compliance Agreement encourages compliance along with international conservation and management measures by fishing vessels on high seas. Its objective is to enhance the role of flag states in ensuring their vessels are fishing on high seas with authorizations and ensure they can comply with international instruments. This instrument was approved by FAO in 1993, November and came into force 2003, April.

Code of Conduct for Responsible Fisheries was adopted in 1995 and aims at establishing international standards of behaviour for responsible practices in order to guarantee conservation, management and development of aquatic resources considering biodiversity and ecosystem.

International Plan of Action to Prevent, Deter and Eliminate IUU fishing (IPOA-IUU) was adopted by FAO in 2001 and subsequently viewed as a broad toolbox as a means to combat IUU fishing in different situations. It engenders states to develop and adopt their individual National Plan of Actions (NPOAs), exercise flag state responsibilities, port, coastal and market state measures.

Port State Measures Agreement (PSMA) is the first compulsory international agreement to explicitly target IUU fishing. Its primary aim is to prevent, deter and eliminate IUU
fishing through averting the use of port and landing of catches by vessels that have engaged in IUU fishing.

*Voluntary Guidelines for Flag State Performance (VGFSP)* offers direction to toughen and monitor compliance of flag states in terms of their international responsibilities and obligations with regards to flagging and control of fishing fleets. It provides variety of options countries can use in ensuring vessels registered under their flag do not engage in IUU fishing, including monitoring, control and surveillance (MCS) activities; including VMS and observers.

*Voluntary Guidelines for Catch Documentation Schemes (VGCDS)* is the first international policy document with full explanation on Catch Documentation Scheme (CDS). Its aim is to offer support to states, RFMOs and intergovernmental organizations when forming and executing new CDS or revising or harmonizing existing CDS. FAO (2019).
3 Theory

Illegal, Unreported and Unregulated (IUU) fishing has all the markings of a global crime that affect developing nations through economic losses at the costs from $2-$15 billion every year Liddick (2014). The culprits include fishers and organized groups. There are lots of economic drivers which stimulate these activities like fish species which attracts high commercial values, and Flag of Convenience (FOC) system of vessel registration. The undesirable effects of IUU fishing are enormous, and involve social, economic and environmental damages worldwide. An inspiring amount of interventions, both private and public, have been commenced to deal with the situation. However, the multi-faceted nature of IUU fishing has rendered every attempt to combat it more difficult (Liddick, 2014; MRAG, 2005; OECD, 2005).

According to Environmental Justice (2005), most of the world fish stock, about 75% is either overexploited or depleted. The depletion can be attributed to legal but careless overconsumption. It is also reported that 11 – 26 million tons, which accounts for about 15% of total global catch is associated with IUU fishing. Fish forms part of the most traded food commodities with 38% of all documented fishery production imported or exported across national borders in 2010 according to McClanahan et al. (2015). Considering the hassle on fish stocks and related adverse effects on the marine environment, IUU fishing hastens impairment to food security and livelihood to the populations of coastal communities; and economies worldwide may loss $10 - $23 billion annually according to Agnew et al. (2009). Possibly half of all seafood consumed in Europe has illegitimate roots as reported in House (2000), and about one-third of all catches is associated with illegal activities (Environmental Justice, 2005; MRAG, 2005).

IUU fishing approaches are alterations of the same concern; whether explicit or evasive of regulations, the fallouts are unchanged- unsustainable yield of fish stocks. IUU fishing is considered a serious menace to the health of fish stocks and a high risk to food security for countries, especially developing nations that rely on the resources according to Leroy et al. (2016). These activities are perfectly illustrated in

Figure 3.1, where there might be poaching, no reporting or unauthorized fishing within certain areas within or outside EEZs.
Lindley & Techera (2017) defines IUU fishing as including capturing excess (catch limits), contravening fishery authorization guidelines, or conducting fishing activities in waters of other states without approval. In other cases, fishing out of bounds of regulations under national or regional laws such as fishing for species that are high value, in restricted zones or with prohibited gear and equipment.

IUU fishing is most often depredatory even though it may not always be illegal. IUU fishing is made complex when there is an attempt to treat it as a joint activity rather than a fragmented case especially during compliance enforcement. This weakens the effective application of regulatory actions by addressing several purposes which distinguish between the categories of IUU fishing; ‘Illegal, Unreported and Unregulated’ according to Miller et al. (2014).

One common activity of IUU operatives is the discarding of fish, referred to as ‘high grading’ according to Liddick (2014). The retention of only qualities of high commercial values, and large fish, the stock is still depleted which render stock assessments inexact. Other regular infractions involve targeting and catching proscribed species, overfishing allowable species, misrepresenting catch reports, conducting fishing activities without authorizations, fishing within prohibited areas, and using prohibited gear according to Stop Illegal Fishing (2008). Predominantly damaging to developing nations is the act of conducting fishing activities in a nation’s waters without permission (Environmental Justice 2007; Kelleher 2002; UNODC 2011)
3.1 IUU Fishing With Respect to Region

IUU fishing remains a worldwide problem; these illegal undertakings can be witnessed around coastlines and high seas around the globe. There are noteworthy areas where IUU fishing thrives. An area particularly notable for discussing IUU fishing is East Central Atlantic, where states in West Africa are consumed with civil unrest, and with bad governance which provoke the ultimate circumstances for forbidden fishing activities according to Liddick (2014). The area is vast and covers several countries with a huge diversity of fisheries and governance (Morocco to Angola), some of which include Liberia, Guinea and Sierra Leone affected by growing illicit catches as a consequence of political instabilities in the 1990s as reported in Agnew et al. (2009).

The coasts of Africa, characterized by shallow seas, are mostly rich coastal and marine environment, and developing or poor nations in the region are basically incapable to adequately conserve and manage their resources (Kelleher 2002; Environmental Justice 2007; Brenthurst 2010).

Another region which is susceptible to IUU fishing is the Pacific Russian Coast. Between 1950 and 1970, plundering of spawning grounds of salmon intensified. There was virtually no effective protection for rivers. IUU fishing became pervasive within Kamchatka, generally known as “economy within an economy” which employed numerous illegal workers. Illicit catch of salmon in Kamchatka accounts for 55,000 tons between 2002 and 2006, while in waters around Sakhalin was 80,000 tons according to Dronova & Spiridonov (2008).

3.2 Recent Trends

While it is generally acknowledged that IUU fishing is phenomenal and a worldwide issue, there is variations in the trends and level of occurrences across regions. In 2008, study shows illegal and unreported catches within the territorial waters of 54 countries and 15 high seas regions, illegal operations were highest in Eastern Central Atlantic; inclusive of Liberia, Cote d’Ivoire, Guinea, and Ghana; and least in the Southwest Pacific; inclusive of Australia, New Zealand and Papua New Guinea according to Agnew et al. (2009). Illegal activities were rampant from 1970 to the 1980s with overwhelming effects on cod stock which only improved lately in the Northeast Atlantic. The prohibition of foreign vessels within territorial waters of the Southeastern Atlantic starting in late 1980 massively reduced illicit catch. Enhancement in control mechanisms by coastal states has stimulated a reduction in illegal fishing in the Western Indian Ocean.
Ocean, at the same time, an upsurge in illegal operations in the Northwestern Pacific in attributed to Chinese and Russian vessels inadequately regulated by coastal states according to Liddick (2014).

Illegal and unreported catch estimates in Northeastern Pacific has reduced and continues to decrease, but the Western Central Pacific persists and remains comparatively high. The waters of Indonesia are specifically infamous for high amount of unreported catches. Largely, the issue of IUU fishing appears to be reducing in certain areas, and rising in others, with the highest degree of illegal activities linked to high-value shrimps, lobsters and demersal fish according to Agnew et al. (2009).

### 3.3 Corruption, Economic Drivers, and Other Conditions that Facilitate IUU Fishing

IUU fishing is objectified by lucrative companies and systematized criminal clusters enthused by the prospect for huge profits. Besides, rational conclusion could be that occurrence and frequency of unlawful and untenable fishing activities is expressly connected to weak governance. A review utilizing the United Nations Code of Conduct for Responsible Fisheries, on 53 nations involved in fishing awarded failing marks to more than half (30 out of 53) evaluated, and just one-fourth graded as pass (Agnew et al., 2009; Liddick, 2014). Regrettably, regarding IUU fishing, weak governance, demonstrated as the nonexistence of political will, ineptitude and shortage of resources, is very often accompanied by unwholesome degree of corruption according to UNODC (2011)).

The licensing and authorization processes, and quota systems are susceptible and subject to corruption according to current research. A study also established that fisheries officials issued permits for fishing without accountability or supervision, and deposited fees into individual bank accounts in Pacific Island states as reported in Hanich & Tsamenyi (2009). In 2005, an audit conducted within the Fisheries and Marine Resources Department of the Solomon Island uncovered massive fraud in licensing which cost the nation an estimated $9million according to UNODC (2011). In other places like African nations, conflicts of interest are customary in cases where officials in charge of licensing have direct links to fishing companies (Martini, 2013; Standing, 2008). In another context, what amounts to the ‘mode of operation’ is the registration of fishing vessels to states that are incapable or unwilling to manage and monitor vessels operating under their flag-IUU fishing. Many registries are operated by private companies; the inducement to
register fishing vessels to developing nations, especially in West Africa which are economically vulnerable, provides the platform for corrupt dealings, UNODC (2011)

Latest reports validate this perception over commercial shipping registries when the Liberian Government selected an independent commission that indicated irregularities in the license renewal of the Liberian International Ship and Corporate Registry (LISCR) to operate the Liberian register of fishing vessels according to UNODC (2011). Accusations comprised corruption while negotiating between the LISCR, and Liberian officials; as well as the diverting fishing revenue intended for the Liberian Government. In total, the operators of fishing registries are content to organize vessels being flagged to states that lack capacity or will in administering and implementing regional and territorial regulations; thus diminish the cost of IUU fishing, profits maximized, and revenue projected for local population and genuine fishing operators diverted Liddick (2014).

There are substantial incentives and nominal disincentives to fish legally. Considering the prospect of conducting illegal fishing is the same as the benefits of such operation barring the costs, it is obvious the benefits exceed the costs according to OECD (2005). Both legal and illegal fish are traded in the same marketplace even though lawful operators are laden with greater cost of operations which derive from management and conservation measures. For example, a longline vessel sets its lines to reduce bycatch consistent with laws, but disadvantageous to a longline vessel which disregards regulations as reported in MRAG (2005). Illicit financiers are not encumbered with peripheral costs which relate to vessel monitoring, catch documentation or licensing; certainly, this imbalanced competition creates the outlet for legal operators to cheat as well, thus worsening the problem by developing a domino effect which proliferate the destructive and illegal methods of fishing (OECD 2005; Environmental Justice 2005).

Furthermore, regulatory insecurity triumphs when regulations are prejudiced. Minimal thought is placed in the direction of the ability of fishing operators to generate income; coastal nations and international bodies pay less attention to the issue of overcapacity, more burden on legal fishers are likely to induce IUU fishing according to OECD (2005).

Combined with the inducement of high profits, a lack of adequate enforcement capacity propels IUU fishing. Due to the vast nature of the oceans and limited resources dedicated to law enforcement, even the marginal chances of misgiving are surmounted; penalties and fines are not deterrent enough relative to illegal profits garnered from illicit activities (OECD 2005; Environmental Justice 2005). Monitoring and enforcement are
costly, and many coastal nations, especially developing nations, lack the resources to adequately monitor and regulate large-scale (Industrial) fishing in their Exclusive Economic Zone (EEZ). Ainsworth & Pitcher (2005) reports that bycatch which are discarded accounts for the largest component of IUU fishing, though it may be legal or illegal.

One aspect that mostly influences IUU fishing is a legal exercise which involves fishing vessel registration associated with large-scale commercial fishing. States are allowed to issue ‘Flags of Convenience’ (FOCs), under international law, to foreign fleets, usually for comparatively small fees. Under International Maritime Law, the country whose flag a vessel flies has responsibility to that vessel which creates a significant loophole that allows IUU operators evade conservation and management measures (OECD, 2004 and 2005; Environmental Justice 2005). For instance, vessels are involved in “flag-hopping”; they reflag numerous times annually to thwart surveillance according to UNODC (2011). The nature of FOC is considered intricate due to the absence of a connection to the flag state and vessel owner. Most often, FOC are supported by joint ventures, shell companies, and owners that are hidden, increasing the difficulties in identifying and fining owners through enforcement of regulations. Confidentiality associated with banks facilitates the operations by shielding the ownership. There are some observable similarities amongst countries with robust bank confidentiality laws; Gibraltar, Belize, Bahamas and Liberia as few examples of countries that apply the FOC system according to Environmental Justice (2005).

The FOC system is characterized by flag states that are incapable of, lack political will, or care less to exercise the responsibilities of a flag state provide under international laws, over fishing vessels operating in EEZs of foreign nations. While home governments amass millions of dollars by trading their flags to foreign vessels, concurrently accepting bribes to authorize infractions regarding catch limits. The local populations are the typical losers, being deprived of the fish resources, and tax revenue that should benefit the public is lost under the FOC arrangement (OECD, 2005; Environmental Justice 2005; MRAG, 2005)

Largely, a lot of economic drivers which include high incentives associated with IUU fishing are complemented by a surfeit of complications, nationally and internationally in terms of controls which render efforts to improve difficult. The FOC scheme, inadequate monitoring, tax havens, confidentiality in the banking systems which expedite money
laundering, and corruption, hinders national and international efforts to prevent, deter and eliminate IUU fishing.

3.4 The Impacts of IUU Fishing

According to the United Nations Food and Agriculture Organization, 52% of fish stocks are completely exploited, 17% are overexploited and 6% depleted; IUU fishing contributing mostly to the problem (FAO, 2006; Petrossian, 2015). According to Black, R. (2007), developing countries comprised of about 79% of all countries in the world and IUU fishing directly impact them. According to reports, IUU fishing activities deprive African countries of $1 billion out of $9 billion which is lost by developing countries annually. Additionally, FAO (2006) reported that all or most of West African fishing grounds are completely or over-exploited. Diminishing stocks, and as well catches, escalates adverse effects on the coastal populations of West Africa. Overfishing, the extraction of catches from a coastal or marine population that adversely affects its regeneration capability continues to derail most of the world’s fisheries (Froese & Kesner-Reyes, 2002; Grainger & Garcia, 1996; Pauly et al., 1998; Srinivasan et al., 2010). Moreover, IUU fishing has been documented as the primary conduit for the global destruction of coastal ecosystems (Jackson et al., 2001; Srinivasan et al., 2010).

The Marine Research Assessment Group reported that IUU fishing cause the loss of $372 million from Liberia, Guinea, Mozambique, Seychelles, Kenya, Sierra Leone, Namibia, Angola, Papua New Guinea and Somalia, which represent 19 percent of the total value of catch according to MRAG (2005). At the same time, according to Atta-Mills et al. (2004), the demand for fish is beyond domestic supplies in most West African countries and fishing grounds that are more accessible have become partially depleted, or completed exploited. Fish is losing its position in food security delivery (cheap animal protein and micronutrients) due to persistent decline in fish stocks in the region according to Asiedu & Nunoo (2015).

IUU fishing undermines economic development in addition to human and food security globally; a phenomenon that has existed for many years according to Lindley & Techera (2017). This menace causes substantial damage not only to the marine environment, but depletes and in most cases destroys fish stocks. It is also accompanied by serious social problems, particularly amongst developing nations (OECD 2005; UNODC 2010).
The main economic impact associated with IUU fishing is the loss to high-value catch. Besides the loss to gross national product (GNP), there is loss in revenue due to uncollected fees on landings and associated taxes. Some macroeconomic impacts involve strain on national budget and loss of employment in the fisheries sector— including processing, packaging, marketing and transporting. There are also losses associated with bunkering, vessel maintenance, port dues and transhipment fees because IUU catches are mostly landed outside the country whose water was exploited.

Like the economic impact, social impacts associated with IUU fishing are of importance, particularly in countries where fish is a major source of protein intake and livelihood, IUU fishing fuel hunger and poverty; countries like Liberia, Guinea Bissau, Senegal, Somalia and Sierra Leone. Skirmishes among foreign fleets and native fishers are familiar in Liberia, and the inland fisheries in Mauritania and Senegal; and Africa’s shrimp fisheries. A decline in fish stocks in waters diminishes employment prospects, consequently decreasing household incomes which aggravates the prevalence of poverty (Environmental Justice 2005; MRAG, 2005)

In addition to the severity of economic and social constrains, IUU fishing endangers target species and destroys the ecosystems, accelerating the decline in biodiversity and ecosystem resilience as reported by UNODC (2011). According to Leroy et al. (2016), IUU fishing serves as the principle cause of destruction to the biodiversity, marine habitats and their connections. It economically affects the resources available to all participants engaged in legal fishing activities, regularly generating biased rivalry with the costs to lower revenue and, eventually unemployment. Destruction of mangroves and spawning grounds impedes regeneration and natural restoration of fish stocks. IUU fishing also exhaust non-targeted and less lucrative species that are vital source of food for local population according to MRAG (2008).

Some methods of fishing are particularly damaging to the environment. For instance, the bycatch of longline vessels can be dangerous to non-targeted species like turtles, sea birds, sharks, etc. (OECD 2005; MRAG 2008). Prohibited driftnet fishing in the Mediterranean has threatened biodiversity and is reported to have triggered the death of numerous cetaceans annually according to Environmental Justice (2005).

The most noticeable effect of IUU fishing in terms of economic losses is the immediate loss to catches with high values that could have been harvested by licensed vessels in the absence of IUU fishing activities. Coastal nations benefit from actual revenue through
IUU fishing affects the stream of revenue generation. It impacts employment and income in supporting industries and supply chain. The economic activities affected by IUU fishing are seen summarized in Table 3.1

Table 3.1 Economic impact from IUU fishing (modified from MRAG, 2005).

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<th>PARAMETER</th>
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<th>IMPACTS</th>
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<tr>
<td>Contribution of fishing to GDP/GNP</td>
<td>Value-Added; value of landings</td>
<td>IUU fishing reduces the contribution of EEZ or high seas fisheries to the national economy and lead to a loss of potential revenue from resources</td>
</tr>
<tr>
<td>Employment</td>
<td>Employment in the fisheries sector; fish processing, vendors, etc.</td>
<td>IUU fishing reduces potential employment for locals and others</td>
</tr>
<tr>
<td>Export revenue</td>
<td>Monthly, Quarterly and annual export earnings</td>
<td>IUU fishing reduces local landings and evades payments of taxes (export and port revenue).</td>
</tr>
<tr>
<td>Port revenues</td>
<td>Transhipment fees; port taxes, bunkering or vessel maintenance</td>
<td>IUU fishing reduces local landings and value-added</td>
</tr>
<tr>
<td>Service revenues and taxes from legitimate operations</td>
<td>License fees, observer fees, etc.</td>
<td>IUU fishing reduces resources which directly or indirectly reduces other sources of revenue from companies providing legitimate fishing services</td>
</tr>
<tr>
<td>Expenditure on Monitoring, Control and Surveillance (MCS)</td>
<td>Annual expenditure on MCS linked to IUU fishing</td>
<td>The presence of IUU fishing will attract budget allocation for MCS activities</td>
</tr>
<tr>
<td>Destruction of ecosystems</td>
<td>Reduces catch and biodiversity of coastal areas</td>
<td>Loss of value from coastal areas e.g. inshore prawn fishing areas and from mangrove areas that might be damaged by IUU fishing. Reduction in income for coastal</td>
</tr>
</tbody>
</table>
The impacts of IUU fishing are highly unsustainable on target species and the marine or coastal ecosystem. This in turn undermines the productivity, reduces biodiversity and damages the resilience of the ecosystem. It also threatens food security especially for artisanal fisher which is primarily vital in coastal communities in Liberia that rely heavily on these resources as source of revenue and protein intake. Besides the rule of law, IUU fishing undermines other social standards as captured in Table 3.2

| Conflicts with local artisanal fleets | Incidences recorded of conflict between IUU fishing vessels and local fishing fleets. | Reduces the volume and value of catches for local fishing fleets. Possible increased health and safety risks because of conflicts between the artisanal and industrial fleets. |
| Conflicts with MCS officers and vessels | Armed resistance by IUU vessels to MCS enforcement. | Increase loss of effectiveness of MCS activities. Costs of MCS escalate and there is a loss in cost effectiveness of MCS. |
| Food and health security | Availability of fish for local consumption (food and protein balance sheets) | The reduction in fish availability on local markets may reduce protein availability and national food security. This may increase the risk of malnutrition in some communities. |
Table 3.2 Social Impacts from IUU fishing (modified from MRAG, 2005).

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>INDICATOR</th>
<th>IMPACTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutrition and food security</td>
<td>Availability of fish on local markets at affordable prices.</td>
<td>IUU fishing through its negative impact on fish stocks and availability may have a detrimental impact on the availability of fish, an important source of protein in the countries.</td>
</tr>
<tr>
<td>Conflicts with local artisanal fleets</td>
<td>Incidences recorded of conflict between IUU fishing vessels and local fishing fleets.</td>
<td>Increased health and safety risks because of conflicts between the artisanal and industrial fleets. Loss of family/community cohesion and workforce through conflict.</td>
</tr>
<tr>
<td>Household incomes</td>
<td>Gross and net household incomes</td>
<td>IUU fishing through conflicts with local fishing fleets and by over exploitation of certain species may lead to reduction in household incomes and thereby aggravate poverty. Possible negative impacts on income distribution.</td>
</tr>
<tr>
<td>Gender Issues</td>
<td>Employment of women in fishing and fish marketing</td>
<td>IUU fishing may have a negative impact on shore fishing by women and on the marketing opportunities for women who in many societies have an important role in basic fish processing and marketing.</td>
</tr>
</tbody>
</table>

The destruction to fish population due to overfishing or overexploitation catalysed by IUU fishing lean towards diminishing future harvesting opportunities, thereby leading to the subsequent loss of possible resource rent. Records show that extreme unregulated fishing efforts means that catch volume exceeds sustainable levels which lead to overfishing and or depletion.

Destruction to the coastal and marine ecosystem, ecology and environment is induced by the use of incorrect fishing gear and method, or equipment in sensitive or regulated areas (breeding and spawning grounds).
Table 3.3 Environmental/biological Impacts from IUU fishing (Modified from MRAG, 2005).

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>INDICATOR</th>
<th>IMPACTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target species</td>
<td>IUU fishing outside quota in EEZ.</td>
<td>IUU fishing impacts the target species negatively. IUU fishing depletes target stocks to very low levels, which have impact on licensed vessel catch.</td>
</tr>
<tr>
<td>Target species</td>
<td>IUU fishing in high seas</td>
<td>Similar effect as EEZ, but transmitted only if the species concerned are straddling or highly migratory, and the stock exists both in high seas and EEZ waters; or if the depletion of the stock in high seas waters reduces fishing opportunities for developing states in those high seas waters under RFMO agreements.</td>
</tr>
<tr>
<td>Target species</td>
<td>Underreporting catch, especially by DWFN in EEZ fisheries agreements</td>
<td>Under-reporting in any fisheries system (including the large-scale under-reporting in developed country waters) has the same effect as fishing outside of quota. Not only does it impact negatively on the stock, but it can also severely compromise scientific stock assessments, which usually rely on some reasonably good estimate of total extractions (data).</td>
</tr>
<tr>
<td>Target species</td>
<td>Unmonitored discard.</td>
<td>The same issues relate to discarding as to under-reporting, but here impacts are often on the</td>
</tr>
<tr>
<td>Dependent and related species</td>
<td>Direct impacts of IUU fishing: bycatch</td>
<td>Large numbers of associated species can be caught in all fisheries. This has an effect on the populations of these animals. The issue is usually highlighted with respect to “charismatic mega fauna” such as birds, seals, cetaceans and turtles, attention has spread recently to consider endangered and slow-growing fish such as sharks and skates/rays. But other species are similarly affected, and if they are slow-growing, bycatch can significantly affect their ability to recover. Obviously all fishing activity has the potential to cause these impacts, but IUU fishing is thought to be particularly destructive because IUU fishermen do not generally use management measures aimed at reducing the impacts.</td>
</tr>
<tr>
<td>Dependent and related species</td>
<td>Indirect impacts of IUU fishing: bycatch</td>
<td>These impacts are much more difficult to quantify than direct impacts. They arise because of the removal or overfishing of a target species (or bycatch species) which is a critical ecosystem component, causing a change in trophic functioning.</td>
</tr>
<tr>
<td>Habitats</td>
<td>Destruction of habitats by</td>
<td>Vessel gear, particularly trawls,</td>
</tr>
</tbody>
</table>
Impacts on the Sustainable Development Goals

The United Nations, through its adoption of the Sustainable Development Goals (SDGs) on September 25, 2015 highlights the importance of the oceans and the natural resources contained within according to Okafor-Yarwood (2019). The SDGs aim at shifting the sequence of the 21st century by undertaking measures to resolve concerns such as poverty, hunger, inequality against women and the management and conservation of the resources within the oceans which are all pertinent to humanity. Particularly, Goal 14, Goal 1 and Goal 2 focus on managing the oceans and the marine resources, eliminating poverty, and hunger which can be fulfilled through the enormous supply of fish. Fisheries contribute substantially to revenue generation of many developing countries which aid in the realization of Goal 8; aims at ensuring sustainable economic growth. Conversely, destructive practices to the marine ecosystems such as overfishing, pollution and IUU fishing undermine the capacity of developing countries, specifically in West-Central Africa to adequately utilize the resources from the ocean according to Erceg (2006). About 40% of the population in the West African region resides in coastal areas, while approximately 9 million people are partially or fully reliant on the fisheries sector for income. Furthermore, West African artisanal fishers accrue an approximate income of $3.6 billion (Brown & Crawford, 2010; Okafor-Yarwood, 2019). The

| Waste dumping and Other negative environmental impacts | Availability of opportunity for dumping toxic waste | IUU vessels may often destroy habitats. As with other direct effects, IUU vessels are probably more destructive than licensed vessels because they ignore management actions such as closed areas which aim to reduce habitat destruction. Habitat destruction may have far-reaching impacts, because many sensitive habitats. | A breakdown of MCS and the rule of law in an EEZ, especially in terms of enforcement of MARPOL/Dumping Convention rules will lead to other impacts on the environment, including dumping of waste, especially toxic waste. |
European Union is reported to have paid a staggering $307 million annually for fishing access through the ‘Sustainable Fisheries Partnership Agreement’ in West Africa between 2000 and 2010 (Belhabib et al., 2016; Brown & Crawford, 2010).

Ensuring the fulfilment of SDG 14 is essential to the realization of other SDGs, specifically SDGs 1, 2, 3, 4 and 8. The components of the SDGs that are impacted by IUU fishing are depicted in Figure 3.2.

![Figure 3.2 Components of SDGs impacted by IUU fishing.](image)

### 3.6 Addressing IUU Fishing

The fight against IUU fishing is extremely complex and as such needs the integration of multiple mechanisms to adequately tackle it. According to Erceg (2006), employing only one method creates avenues for illegal operators to exploit. Developing countries struggle to effectively enforce measures in controlling IUU fishing because of scarce resources.

IUU fishing has attracted increased international attention in recent years thus advancing numerous efforts aimed towards extenuation. The outcomes from those initiatives have varied. The United Nations has endeavoured to establish laws and regulations to combat IUU fishing. In the 1990s, several global legal regulations were discussed under the patronage of UNCLOS.

There are hard and soft laws (legally and non-legally binding respectively) which defined specifics to fight against destructive fishing and encourage the management and
conservation of marine and coastal resources. Examples of ‘hard laws’ are the 1993 Food and Agriculture (FAO) Compliance Agreement and the 1995 United Nations Fish Stock Agreement (UNFSA). The 1995 FAO Code of Conduct for Responsible Fisheries is an example of a ‘soft law’. The Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) was the first Regional Fisheries Management Organization (RFMO) to officially address IUU fishing in 1997 according to Miller et al. (2014).

In 1999, a meeting on the implementation of the Code of Conduct for Responsible Fisheries (ICCRF) was held by FAO and decided on a joint International Plan of Action (IPOA) to appropriately deal with the menace that is the IUU fishing according to Bray (2001). In subsequent years, technical consultations with regional fisheries management organizations were organized by the FAO with the goal or organizing a global system to effectively combat IUU fishing.

IUU fishing did not have a clear definition until 2001 when it was published in the United Nations Food and Agricultural Organization (FAO) International Plan of Action to Prevent, Deter and Eliminate IUU fishing (IPOA-IUU); the primary tool geared towards dealing with the problem. Aspects of this instrument include port enforcement, vessel registration and licensing system, catch documentation schemes, trade restrictions and implementing monitoring, control and surveillance processes (Organization for Economic Co-operation and Development 2005). Signatories to this instrument were expected to have advanced National Plan of Action (NPOA) to combat IUU fishing by 2004, but just 6 countries conformed to the target date while the majority did not begin executing the instrument. However, there were renewed commitment and pledge to eradicate networks used to heighten IUU fishing as reported in Tsamenyi et al. (2008).

Other initiatives taken were establishment of a High Sea Task Force in 2003 by the OECD and Rome Declaration on IUU fishing called on developed countries to offer technical and financial support to developing nations for the development of MCS structures (Environmental Justice 2005; Tsamenyi et al. 2008). The Sub-regional Fisheries Commission in West Africa was established March 29, 1985 and amended July 14, 1993 coordinate tracing, controls and surveillance activities amongst member states.

The establishment of Regional Fisheries Management Organizations (RFMOs) is one of the primary fisheries management initiative formed under international agreements to manage high seas fisheries including straddling stocks which migrate through member
states. RFMOs have developed blacklists and whitelists of vessels prohibited and permitted to fish in waters of member states. Some prominent RFMOs are:

- The Northwest Atlantic Fisheries Organization (NAFO)
- The Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR)
- The Indian Ocean Tuna Commission (IOTC)
- The Commission for the Conservation of Southern Bluefin Tuna (CCSBT)
- The Northeast Atlantic Fisheries Commission (NEAFC)
- The Western and Central Pacific Fisheries Commission (WCPFC)
- The International Commission for the Conservation of Atlantic Tunas (ICCAT)
- The Inter-American Tropical Tuna Commission (IATTC)

Tsamenyi et al. (2008).

Advanced technologies have the ability to combat IUU fishing. Technology constitutes a high ground and is an asset in combating illegal, unreported and unregulated fishing. It categorizes and defines IUU fishing, where it happens, why it occurs and what the effects are. MCS allows the regulator to act locally and think globally. It’s an open secret that fisheries management will always contain an element of uncertainty; the increasing availability of electronic technology will play an ever-important role in reducing the guesswork when accurate conclusion and predications need to be made according to Miller (2010).

The vessel monitoring system (VMS) provide information on vessel activities which include but not limited to the coordinates, course and speed which are conveyed to a fisheries monitoring center via Global Positioning System (GPS). However, according to Environmental Justice (2005), fishing operators have learned to tamper with the on-board unit known as Mobile Transceiver Unit (MTU). According to Agnew et al. (2009), there have been some successes observed through the applications of these measures. About 12 EEZs and high seas were analysed in a 2008 study which concluded that illegal and unreported fishing reduced in 11 regions and increased in just 5 of those explored.

Market-oriented methods can aid in reducing IUU fishing. Tax on nations that utilize the FOC scheme and are recognized as having vessels which are involved in IUU fishing, trade restrictions on countries that are tolerant or support IUU fishing activities, and
easing the market on legal catches, especially those harvested by artisanal fishers are all measures that could yield noticeable outcomes according to Agnew et al. (2009). Reduction in the quantity of worldwide fishing fleet would engender economic productivities by eradicating the need for distant water fleets which would weaken the burden from IUU operatives as reported in Clark et al. (2005).

The next two sections discuss two models that deal with the calculation of risks by rational IUU fishers as well as optimal enforcement strategy of fisheries management authorities.

### 3.7 Costs and Benefits of Risks to IUU fishers

This model by Sumaila et al. (2006) considers how the decision of IUU fishers to conduct IUU fishing is affected by the associated risks. In particular, their resolve to engage in IUU fishing will depend on the relative difference between the costs and benefits to them (including social and moral benefits).

#### 3.7.1 The model

The net benefits \( B \) to the potential IUU fisher is given by

\[
B = [(ph - T) - \pi \cdot f] - (m + s).
\]

(1)

Here, \( p \) is the unit price of the fish caught, \( h = h(A, \bar{e}, x) \) is the IUU catch, \( T = T(A, \bar{e}) \) is the total costs to conducting IUU fishing, \( \pi = \pi(A, \bar{e}, r) \) is the probability of getting caught and penalized, \( f \) is the penalty, \( m \) and \( s \) are the moral and social benefits respectively, \( \bar{e} \) is effort put into IUU fishing, \( A \) is the level of avoidance by the perpetrators, \( x \) is biomass, and \( r \) is the set of regulations in practice. The model operates under the additional constraints that \( h_x, h_\bar{e} > 0; h_A < 0; \pi_e, \pi_r > 0; \pi_A < 0. \)

Now the object of any potential perpetrator can be mathematically presented as an optimization problem, in which the fisher seeks to maximize equation (1).

Suppose the fisher chooses not to engage in IUU fishing. Then equation (1) is identically zero, and one has

\[
ph = T + \pi \cdot f + m + s.
\]

(2)

If, however, there is a non-zero level of IUU fishing with very little to no regulation in place, i.e. \( r \approx 0 \), then \( A = 0 \), which gives \( \pi \approx 0 \). In this case the fisher just needs to ensure a marginal revenue so that \( m + s \) is at least covered. In other words,

\[
(ph)_e = (T + m + s)_e.
\]
If on the other hand we have $A, f, \pi > 0$, then the optimality condition is given by the set of equations

$$ph_e = (\pi \cdot f + T + m + s)_e \quad (3)$$
$$ph_A = (\pi \cdot f + T)_A.$$

This interprets as “for optimality, the fisher needs to ensure that marginal revenue is at least equal the sum of the marginal costs and marginal fine, as well as ensure the marginal gain from avoidance is at least equal to the sum of the marginal costs and marginal loss in revenues from avoidance.”

The authors then went to apply the model to sixteen different cases (see Table 3.4). While data is generally insufficient to exactly obtain $\pi$, in undermanaged systems it is assumed to be well less than 0.2. It should also be noted that $m, s$ are neglected during their application due to their limited effects.

Even at $\pi = 0.2$, with fixed $f, h, T$, it turns out that only four of the sixteen cases considered had costs exceeding the benefits of the perpetrators which suggests that in most cases, there is less chance of compliance (the cases for $\pi = 0.1, 0.05$ were considered with only one of the sixteen having costs exceeding benefits).

The authors point out that at fixed levels of $h, T$, with $\pi = 0.2$, $f$ had to be increased by a multiple of 24, to have the costs greater than or equal the benefits, which would help ensure compliance. The cases for $\pi = 0.1, 0.05$ required $f$ to be increased by multiples of 74 and 173 respectively.
### Table 3.4 Table of cases and result considered by Sumaila et al in their model.

<table>
<thead>
<tr>
<th>Cases</th>
<th>Vessel/gear</th>
<th>Arresting country</th>
<th>Fishery</th>
<th>Catch (t)</th>
<th>Catch value (USDD)</th>
<th>Expected revenue (USD)</th>
<th>Variable cost (USD)</th>
<th>Fine (USD)</th>
<th>Expected Penalty (USD)</th>
<th>Total cost (USD)</th>
<th>Total cost/ expected revenue</th>
<th>New fine</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Longline</td>
<td>Australia</td>
<td>Patagonian toothfish</td>
<td>116</td>
<td>630 000</td>
<td>504 000</td>
<td>(0.70%) 439 091</td>
<td>435 000</td>
<td>87 000</td>
<td>526 091</td>
<td>1.04</td>
<td>0.75</td>
</tr>
<tr>
<td>2</td>
<td>Trawler</td>
<td>Unknown</td>
<td>Cod &amp; haddock</td>
<td>24</td>
<td>1 138</td>
<td>916</td>
<td>(0.66%) 747</td>
<td>22</td>
<td>4</td>
<td>752</td>
<td>0.83</td>
<td>38</td>
</tr>
<tr>
<td>3</td>
<td>Trawler</td>
<td>Australia</td>
<td>Abalone</td>
<td>11 000</td>
<td>75 000</td>
<td>60 000</td>
<td>(0.70%) 52 500</td>
<td>26 250</td>
<td>5250</td>
<td>57 750</td>
<td>0.96</td>
<td>1.4</td>
</tr>
<tr>
<td>4</td>
<td>Longline</td>
<td>Chile</td>
<td>Patagonian toothfish</td>
<td>33</td>
<td>610</td>
<td>488</td>
<td>(0.45%) 273</td>
<td>420</td>
<td>84</td>
<td>357</td>
<td>0.73</td>
<td>2.55</td>
</tr>
<tr>
<td>5</td>
<td>Trawler</td>
<td>Unknown</td>
<td>Finfish</td>
<td>48</td>
<td>1 138</td>
<td>910</td>
<td>(0.66%) 747</td>
<td>22</td>
<td>4</td>
<td>752</td>
<td>0.83</td>
<td>38</td>
</tr>
<tr>
<td>6</td>
<td>Trawler</td>
<td>Russia</td>
<td>Cod and haddock</td>
<td>60</td>
<td>47 820</td>
<td>38 256</td>
<td>(0.62%) 29 648</td>
<td>7 414</td>
<td>1483</td>
<td>31 131</td>
<td>0.81</td>
<td>5.8</td>
</tr>
<tr>
<td>7</td>
<td>Trawler</td>
<td>Argentina</td>
<td>Fish include anchoveta</td>
<td>2 685</td>
<td>485 985</td>
<td>388 788</td>
<td>(0.62%) 300 399</td>
<td>24 138</td>
<td>4828</td>
<td>305 227</td>
<td>0.79</td>
<td>18</td>
</tr>
<tr>
<td>8</td>
<td>Pots</td>
<td>Japan</td>
<td>Crab</td>
<td>80</td>
<td>2 200 000</td>
<td>1 760 000</td>
<td>(0.70%) 1 533 333</td>
<td>100 000</td>
<td>26 000</td>
<td>1 553 333</td>
<td>0.88</td>
<td>11</td>
</tr>
<tr>
<td>9</td>
<td>Longline</td>
<td>Mexico</td>
<td>Shrimp</td>
<td>5</td>
<td>27 575</td>
<td>22 060</td>
<td>(0.56%) 15 337</td>
<td>5 455</td>
<td>1091</td>
<td>16 428</td>
<td>0.74</td>
<td>6.2</td>
</tr>
<tr>
<td>10</td>
<td>Bottom</td>
<td>Russia</td>
<td>King crab meat</td>
<td>0.214</td>
<td>2 456</td>
<td>1 965</td>
<td>(0.66%) 1 621</td>
<td>34</td>
<td>7</td>
<td>1628</td>
<td>0.83</td>
<td>50</td>
</tr>
<tr>
<td>11</td>
<td>Bottom</td>
<td>Alaska Pollock</td>
<td>Alaska Pollock</td>
<td>6</td>
<td>11 022</td>
<td>8 818</td>
<td>(0.39%) 4 304</td>
<td>1 171</td>
<td>234</td>
<td>45 39</td>
<td>0.51</td>
<td>19.4</td>
</tr>
<tr>
<td>12</td>
<td>Gillnet</td>
<td>Russia</td>
<td>Greenland halibut</td>
<td>132</td>
<td>119 328</td>
<td>95 462</td>
<td>(0.59%) 69 833</td>
<td>690</td>
<td>138</td>
<td>69 971</td>
<td>0.73</td>
<td>185</td>
</tr>
<tr>
<td>13</td>
<td>Longline</td>
<td>Canada</td>
<td>Sablefish</td>
<td>2.72</td>
<td>12 063.2</td>
<td>9 651</td>
<td>(0.70%) 8 408</td>
<td>15 385</td>
<td>30 777</td>
<td>11 485</td>
<td>1.19</td>
<td>0.4</td>
</tr>
<tr>
<td>14</td>
<td>Longline</td>
<td>Mauritius</td>
<td>Patagonian toothfish</td>
<td>200</td>
<td>440 000</td>
<td>352 000</td>
<td>(0.70%) 306 667</td>
<td>2 400 000</td>
<td>480 000</td>
<td>786 667</td>
<td>2.23</td>
<td>0.38</td>
</tr>
<tr>
<td>15</td>
<td>Longline</td>
<td>Uruguay</td>
<td>Patagonian toothfish</td>
<td>201</td>
<td>2 122 560</td>
<td>1 689 600</td>
<td>(0.70%) 1 472 000</td>
<td>1 632 000</td>
<td>326 400</td>
<td>1 798 400</td>
<td>1.06</td>
<td>2.6</td>
</tr>
</tbody>
</table>

*Expected revenue = $\theta P + (1 - \theta)C$ catch value. This captures the fact that when apprehended catch from IUU fishing is usually confiscated.

bVariable costs are the cost of operating the vessel as distinct from the fixed costs of acquiring the vessel.

cThe product of the probability of detection (in this example 0.2) and the fine imposed.

dThe sum of variable cost and the expected penalty.

eThe ratio of the potential total cost of IUU to the potential value of engaging in IUU. A value of 1 and above implies engaging in IUU activity is not a profitable proposition.

fThe number of times the reported fines need to be multiplied by in order to make the potential gain equal to the potential cost of engaging in IUU when $\theta = 0.2$. This gives an average multiple of
3.8 Costs and Benefits of Combating IUU Fishing

While development of measures to curb IUU fishing is heavily emphasized, the mere existence of the measures is less than half of the story. Enforcement of these measures plays arguably the most fundamental role in fisheries management. However, enforcement efforts of measures are costly, and overtime, these costs can outweigh the benefits. This leads to a natural question of optimal enforcement efforts to ensure the costs stay below the benefit. If the costs are sufficiently close to the benefits, the net benefit remains limited, and as such the practice of imposition of fines/penalties is introduced. An advantage of a fine is that it incurs no cost. According to Sumaila et al. (2006), the framework for the theory which unites enforcement efforts, biomass, benefits to individuals (or collection of individuals) involved in violations, volume of harvests etc., has been set up by the costs and benefits of control strategies (COBECOS) project which is a collaboration among EU member states and Iceland and Norway. This has been particularly useful for European countries in the last decade and could offer potential solution for West African countries (even if not immediate due to resource constraints). Most of the literature follows JRC (2009) and Arnason (2013) and the references therein, unless otherwise stated, in which case the appropriate reference will be duly indicated.

3.8.1 The Costs and Benefits of Control Strategies (COBECOS) Project

The costs and benefits of control strategies project (COBECOS) is a project that was under the EU’s Sixth Framework Programme (FP6). It was a collaborative effort of partner institutions from the EU, Iceland and Norway, with aim of helping with the drafting and implementation of community projects.

COBECOS provided a consistent and very robust theoretical framework of fisheries enforcement that allowed for empirical studies of specific cases as well as modelling realistic situations of fisheries management which predicted outcomes. Fisheries management questions resolved by the project included questions of the costs and benefits of enforcement strategies, the changes in costs and benefits as compliance of violators with deterrent measures is varied and impacts of higher penalties for violations.

3.8.2 Theory and Model

We now provide a discussion on the model. The development of the model assumes homogeneity of management systems, by which is meant that no distinction is made
among management systems. The model of fisheries dynamics is also made as simple as possible, with generalizations being possible, sometimes in a straightforward manner. Finally, the model tries to incorporate the minimum amount of external influence factors.

The benefit function, defined as the benefits fishers gain from fishing, is given by

\[ B(q, x) = B(q, x) - \lambda[q - G(x)] \] (4)

where \( q \) is generally taken to be the management tool, \( x \) the fish stock biomass, \( G(x) \) the growth function of the biomass (assuming the usual properties of at least first differentiability and non-multiplicity of the maximum), and \( \lambda \) the shadow biomass. The product \( \lambda q \) is the charge associated with the depletion of social resources. The function \( B(q, x) \) is the individual benefit function which is assumed to be concave in \( x \) and \( q \), declining in \( q \), and monotonically increasing in \( x \). The assumption of differentiability of \( G(x) \) ensures that \( B(q, x) \) is differentiable, with the mixed partial derivative \( B_{qx} = B_{xq} \) being strictly positive. The bracketed term in equation (4) gives the evolution of the biomass, denoted \( \dot{x} \). The model then makes a choice of the management measure and chooses to enforce compliance.

The enforcement relies to two main components; the effort, \( e \), of the enforcement and the penalty, \( f \), levied in the case of non-compliance. The measure \( q \) is assigned a certain monotonically increasing probability function, which determines imposition of fines. This probability function has \( e \) as the dependent variable. Suppose there is a violation of \( q \). Then \( \pi(0) = 0 \) and \( \log_{e \to \infty} \pi(e) = 1 \). In other words, no fines for violations imply zero enforcement effort, and the certainty of fines implies maximum applied effort.

Fixing the measure \( q = q^* \), where violation of the measure is given by \( q > q^* \) and compliance is given by \( q < q^* \). Write \( q - q^* = k \). The penalty function is given by \( F(f, k) \), where \( f \) is now just the basic level of fine. This function is assumed to be linear and increasing in \( f, F \geq 0 \), and \( F_{kk} \geq 0 \). Of course, \( F > 0 \) if and only if \( f \neq 0 \) and \( k > 0 \). For \( k \) non-negative, there is a non-zero cost to fishers operating under enforced \( q^* \), defined by

\[ \vartheta(q, e, f, q^*) = \pi(e) \cdot F(f, k). \] (5)

Thus, the expected individual and collective benefits for fishers are given by \( B(q, x) - \vartheta \) and \( B(q, x) - \lambda q - \vartheta \), respectively. We see that if \( e = 0 \) (this includes the case \( f = 0 \)) or \( k \leq 0 \), then benefits are maximum. In realistic situations we do not have the cases
\( e = 0 \) and \( k \leq 0 \). The fisher can however maximize the expected benefits via the behavioural equation

\[
q = Q(e, f, q^*, x),
\]

known as the enforcement response function (ERF). The ERF is decreasing in \( e \) and \( f \) and increasing in \( x \) and \( q^* \), i.e. \( Q_e, Q_f < 0 \) and \( Q_x > 0 \). This is obtained by setting the derivative of \( B(q, x) - \lambda q - \vartheta \) with respect to \( q \) equal to zero, or in the individual case, setting the derivative of \( B(q, x) - \vartheta \) with respect to \( q \) (implicitly \( k \)) equal to zero. The enforcement response function and the fine \( f \) are entangled in the sense that, the level of fines actively determines the success in ensuring compliance at \( q^* \); below a certain critical \( f \), no amount of increase in \( e \) can ensure compliance. This critical \( f \) is needed to ensure the obtaining of the desired \( q^* \).

In any enforcement situation, there is always costs incurred from enforcement, which is denoted \( C(e) \). The social benefits are given by subtracting the cost of enforcement from equation (1).

The level of compliance with measures is given by \( q^* - Q \). The compliance measure, denoted \( \Omega \), can be normalized to a probabilistic set, i.e. \( \Omega \in [0,1] \), and is given by

\[
\Omega = \frac{q_{com} - Q}{q_{com} - q^*},
\]

where \( q_{com} \) is the unmanaged level of \( q \). No compliance implies that \( \Omega = 0 \) and full compliance that \( \Omega = 1 \). No compliance therefore means the ERF is the unmanaged \( q \) level, and full compliance gives \( Q = q^* \). Social optimality follows the same formulation, with \( e \) and \( \Omega \) optimal.

We have discussed the most fundamental aspects of the model. There is however an important aspect to mention; the benefits of increased compliance. This turns out to be dependent on the course of the compliance and the efficiency of the management authority. We briefly cover the case of an undermanaged system. The compliance could be independent of or dependent on \( e \). In this case \( B = 0 \) and the social benefit function reduces to

\[
-\lambda \cdot q - C.
\]

Therefore, the benefits of increased compliance with \( C = 0 \) is simply

\[
\lambda \cdot dq,
\]

and the for non-zero \( C \) is
\[ \lambda + C_e \cdot \frac{\partial e}{\partial q} dq. \]  

(10)

All these are generalized in a straightforward manner in JRC (2009).

Once the MSY is known, there is certain critical level of harvest that once exceeded, can have consequences. For different reasons, this level is bounded above. One such reasons is associated with the cost of enforcement. This is encoded in the optimal enforcement problem. Adjusting enforcement effort is akin to maximizing

\[ B - C - \lambda[q - G(x)], \]  

subject to \( q = Q \) and \( q, e, x \geq 0 \). The solution is given by

\[ B_q - \lambda = C_q. \]  

(11)

This is known as the optimal enforcement rule. The quantities \( B_q \) and \( C_q \) measure the marginal benefits and marginal enforcement costs respectively. Since \( C_q < 0, B_q < \lambda \).

Since the standard models, for which case \( C_e = 0 \), requires \( B_q = \lambda \), the basic theorem of fisheries enforcement states that optimality requires more harvest.

The standard models fix \( x, \lambda \) at each given time. The flaw with this is that \( \lambda_{t+1} = \lambda_{t+1}(e_t) \) and \( x_{t+1} = x_{t+1}(e_t) \). This inherent dependence of future \( x, \lambda \) on current \( e \) meant that equation (9) had to be modified, and this was achieved, Anarson (2013). This problem is to select an \( e \) path maximizing present benefits. This all reduce to a system of evolution equations for \( e \) and \( x \), which in general is quite complicated to solve. Arnason (2013) considered a particular case, one of optimal equilibria, in which the shadow biomass is time-independent. This case yields the differential equation

\[ G_x + \frac{B_x + A Q_x}{B_q - A} = r, \]  

(13)

where \( A = C_e/Q_e \), and \( r \) is the rate of interest. The second term on the left-hand side is the marginal stock effect (MSE). Various conditions can be placed on equation (10) to obtain particular solutions. Consider the case where \( Q \) and \( B \) are \( x \)-independent. In such case equation (10) reduces to \( G_x = r \), which is known in the literature as the golden rule of capital accumulation in Arnason (2013). Another case is where \( C = 0 \) which implies \( A = 0 \). In this case equation (10) reduces to \( G_x + \Gamma = r \), which is the traditional equilibrium condition, where \( \Gamma = B_x/B_q \). For the case where there is cost is non-zero, the optimal stock level might be well below the MSY. This is of particular interest to my studies and an area I intend to explore in the near future.
4 Methodology

Both qualitative and quantitative methodologies (mixed methods) are used. Documents from the fisheries sector of Liberia and academic articles from open sources on IUU fishing form the qualitative aspect of this research. Data collected by academics and officials (Research and Statistics Department, NaFAA) associated with fisheries will be fully utilized. We will focus on data that span the years 2001 to 2016. These data were attained through various surveys sponsored by either the Fisheries Authority or NGOs which had specific interest in trends in the sector. These are data containing information of catch volume categorized by fishing “type” (industrial and artisanal).

The theoretical framework discussed in the previous chapters is used to help with my analyses. I will look at the variation in catches over the period from 2001 to 2016. This will be done separately for the artisanal and industrial fisheries and then combined. The effect of regulatory policies adopted and implemented year on year will be assessed. As policies to combat illegal fishing were introduced, we consider how effective these policies were by looking at the trends in the plots. Also considered will be other factors that might contribute to the trend aside the catch efforts by the two fishing segments.

We will also look at data sets of the maximum sustainable yield (MSY) and determine whether we can consider the level of fishing as dangerous or moderate.

I will also study models to improve the effectiveness of enforcing compliance with IUU fishing regulations so as to assess how these models should be adapted to the Liberian fisheries management system.
5 Data Analysis

We consider here the relationship between artisanal and industrial fisheries (catch volume), in terms of how change in one affects the other. We primarily use plots to study the trend over the period from 2001 to 2016. We also match the stock size and MSY against the industrial fisheries, artisanal fisheries, and the total (artisanal plus industrial), to see the level of exploitation.

I will emphasize beforehand that the particular choice of data for the plots and analysis (Table 5.1) was made from different data set with varying entries. The primary reason for the choice of the data was that it happens to be the most recent from the FAO, in addition to the fact that it correlates with what we know about the effects of the measures to curb IUU, before and after they were instituted.

5.1 Trawling Restrictions on Industrial Fishing Vessels in Waters Exclusive to Artisanal Fishers

Figure 5.1 presents plots arranged in matrix form that shows the relationship among industrial, artisanal and total (artisanal plus industrial). The plots can be read as follows: the second plot of the first row has ART as the x-axis and TOT as the y-axis. The third plot on the second row has IND as the x-axis and TOT as the y-axis. The third plot on the second row has ART as the x-axis and IND as the y-axis. We note the “matrix” is symmetric. We use the data of Table 5.1 which gives the catch volumes for Artisanal and industrial fisheries catch volume. It is seen in the third panel of the second row and second panel of the third row, that there is a negative correlation between the artisanal and industrial catch volume. An increase in industrial fishing is accompanied by a decrease in artisanal fishing.
Table 5.1 Artisanal and Industrial Catches for 2001 to 2016.

<table>
<thead>
<tr>
<th>Year</th>
<th>Art</th>
<th>Ind</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>6,303</td>
<td>14,300</td>
</tr>
<tr>
<td>2002</td>
<td>6,842</td>
<td>15,560</td>
</tr>
<tr>
<td>2003</td>
<td>6,650</td>
<td>13,464</td>
</tr>
<tr>
<td>2004</td>
<td>10,314</td>
<td>13,725</td>
</tr>
<tr>
<td>2005</td>
<td>9,095</td>
<td>9,560</td>
</tr>
<tr>
<td>2006</td>
<td>5,701</td>
<td>16,935</td>
</tr>
<tr>
<td>2007</td>
<td>4,560</td>
<td>18,007</td>
</tr>
<tr>
<td>2008</td>
<td>2,813</td>
<td>14,585</td>
</tr>
<tr>
<td>2009</td>
<td>2,968</td>
<td>4,115</td>
</tr>
<tr>
<td>2010</td>
<td>9,700</td>
<td>3,028</td>
</tr>
<tr>
<td>2011</td>
<td>10,781</td>
<td>2,454</td>
</tr>
<tr>
<td>2012</td>
<td>10,869</td>
<td>1,964</td>
</tr>
<tr>
<td>2013</td>
<td>13,149</td>
<td>1,571</td>
</tr>
<tr>
<td>2014</td>
<td>12,744</td>
<td>204</td>
</tr>
<tr>
<td>2015</td>
<td>13,727</td>
<td>688.22</td>
</tr>
<tr>
<td>2016</td>
<td>13,914.9</td>
<td>4,010</td>
</tr>
</tbody>
</table>

Source: (Anarson 2016; BNF 2016)

Figure 5.1 shows plots of artisanal and industrial catch volumes from 2001 to 2016. For Artisanal fisheries, there was a doubling of catch from 2001 to 2004, followed by a steep decline until 2009. After 2010 there was a sharp rise in the catch size and the trend
has continued ever since. Besides policies to restrict the zone of fishing for industrial vessels, there were policies aimed at encouraging local fishermen to increase their efforts, which led to an increase in the number of artisanal vessels. For industrial fisheries, there was a steep decline in 2005. In fact, this was the only time post-war Liberia, and before 2010 when the artisanal catch was more than the industrial catch. It was in 2007 that industrial fishing experienced its peak, after which there was a sharp decline. Here it is noteworthy to mention that industrial fishing was in decline after 2007 up until 2010 when policies were introduced, and only started experiencing slight recovery in 2015. Of course, the increase in artisanal fishing and the law prohibiting industrial fishers from trawling in zones exclusive to artisanal fishers, as well as reduction in the amount of licensed industrial vessels have contributed.

![Figure 5.2 Plots of catch volume of industrial and Artisanal fishing vessels, 2001 to 2016.](image)

Figure 5.2 Plots of catch volume of industrial and Artisanal fishing vessels, 2001 to 2016.

Figure 5.3 shows the total catch volume (combining artisanal and industrial fisheries), from 2001 to 2016. We see there was a wide fluctuation in the overall catch between the years of 2001 and 2006, and then a sudden drop in 2008, and then in 2009, the lowest recorded catch. While it is still not clear why such decline occurred, it is probably linked to IUU fishing where vessels were either not reporting or misreporting their catches, or due to the general national drop in economic activities in Liberia at the time. The catch volume picked up after 2010, when there was a spike in Artisanal fisheries after the implementation of measures by the BNF to safeguard zones for the small-scale fishers.
5.2  MSY vs. Artisanal and Industrial Catch Volumes

In 2016, WARFP, with technical and expert support from the University of Iceland, compiled a comprehensive report on the fish stock assessment in the Liberian territorial water. This report calculated the stock, maximum sustainable yield, and maximum sustainable yield biomass of the different fisheries in Liberia waters; small pelagic, medium pelagic, shallow water demersal and deep water demersal. We consider here the MSY in relation to the catch size (see Table 5.2).

Table 5.2 The four most important fish stocks and their MSY. Tons.

<table>
<thead>
<tr>
<th>Fish Stock</th>
<th>MSY biomass (tons)</th>
<th>MSY (tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small pelagics</td>
<td>48,602</td>
<td>17,011</td>
</tr>
<tr>
<td>Medium Pelagics</td>
<td>14,617</td>
<td>4,897</td>
</tr>
<tr>
<td>Shallow water demersals</td>
<td>19,474</td>
<td>5,812</td>
</tr>
<tr>
<td>Deeper water demersals</td>
<td>4,336</td>
<td>1,324</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>57,029</strong></td>
<td><strong>29,043</strong></td>
</tr>
</tbody>
</table>

Source: (Anarson 2016)

Figure 5.4 shows the plots of the maximum sustainable yield and the total catch of all species type against the years from 2001 to 2016. The red line in the plot is the MSY and the green is the total catch. It is evident that there was high catch volume, relative to the MSY, from 2001 to 2007. Sharp falls in the catch volume followed the next two years.
While growth in catch volume appeared a year later and minor growth has been experienced, the growth has been modest, and the catch volume has been fluctuating. This is largely due to the low effort by industrial vessels.

Figure 5.4 Plot of the MSY of all species type as well as the total catch between 2004 and 2016.

After the introduction of the measures in 2010, the total catch volume dropped from about 80 percent of the MSY to just above about 60 percent of the MSY. The main limitation of this plot is it does not account for the tuna fisheries from 2016 to present and IUU fishing vessels catch record, both of which would have increased the catch volume beyond the economic sustainable yield (ESY) or closed to or beyond the maximum sustainable yield (MSY) which will be indicative of unsustainable exploitation of the resources.
6 Measures against IUU Fishing in Liberia

In this chapter we discuss in depth the existing measures in Liberia to fight against IUU fishing.

6.1 Establishment of the West African Regional Fisheries Project (WARFP) in Liberia, and the Fight against IUU Fishing

The estimated maximum sustainable yield of the continental shelf of Liberia before 1989 was about 180,000 and about 40,000 tons from fresh waters tons per annum respectively. According to BNF (2006), fish landed domestically by licensed industrial vessels was estimated at 1500 tons in 2004 and 2800 tons in 2005. The reductions in these figures were associated with misreporting and unreported trans-shipment activities by industrial fishing vessels that did not reflect in the national records. There were suspicions that the annual catch within the EEZ of Liberia was greater as there was proliferation of IUU fishing due to the extreme lack of monitoring, control and surveillance (MCS) (FAO, 2007).

Against this backdrop, coupled with the important role the fisheries sector play in the livelihood of more than 50 percent of the population, nutrients intake and revenue generation for the government, it became necessary for the international community, through the World Bank to sustain the prospects and development of the sector; through establishing sustainable mechanisms to combat the growing threats of IUU which the revised Natural Resource Law of 1973 could not address due to its obsoleteness. The West Africa Regional Fisheries Program (WARFP) was established to sustainably improve the aggregate wealth created through the exploitation of marine and coastal fisheries resources of West Africa. Liberia was one of four countries selected for the first phase of the WARF Project in West Africa; Cape Verde, Senegal and Sierra Leone being the others. The Project began in 2010 in Liberia. WARFP objectives were defined in four components in World Bank (2009):

Component 1: “Good Governance and Sustainable Management of the Fisheries. This objective was to build capacity of the Governments and stakeholders in implementing a method that would guarantee the sustainable use of marine resources and its environments; thus, providing social fairness and economic profitability.”
Component 2: “Reduction of Illegal Fishing. The objective was to decrease the illegal fishing activities that endangered the sustainability of managing the marine fisheries resources.”

Component 3: “Increase Contribution of Marine Fisheries Resources to the Local Economies. The objective was to improve the benefits from the marine fisheries resources to West Africa by increasing the share of value-added captured in the region.”

Component 4: “Coordination, Monitoring, Evaluation and Program Management. The objective was to support to the countries in implementing the program in the context of Sub-Regional Fisheries Commission Strategic Action Plan, and to monitor the results.”

After the inception of WARFP in 2010, the program recruited and trained staffs to implement the mandates of each component. Various tools and policies were employed for the implementation of the four (4) components as provided in World Bank (2009):

Component 1: Strengthening Fisheries Governance
- Recruitment of personnel to serve as Focal Point for Governance
- Declared the Exclusive Economic Zone (EEZ)
- Prepared a policy vision (long-term) for Liberia’s fisheries
- Developed a transparent fishing vessel and license registry
- Developed a fishing catch and effort database using fisheries observer reports
- Launch a capacity building and training program by recruiting an international university to work along with the University of Liberia and the Fisheries Institution.

Component 2: Reducing Illegal Fishing
- Built the legal capacity of government to prosecute fisheries violations including the recruitment of a legal advisor to the erstwhile Bureau of National Fisheries to facilitate in developing cases of arrested vessels, and work with the Ministry of Justice to identify and train prosecutors in maritime law.
- Enhance the implementation of the Memorandum of Understanding (MOU) for the Monitoring, Control and Surveillance Coordinating Committee (MCSCC) which include the installation of fuel tank to support fisheries surveillance patrols, identify forward operating bases (FOBs) to launch surveillance patrols
- Identify a patrol vessel to be used by the erstwhile Bureau of National Fisheries in the long-term
Component 3: Increasing Local Value Added to Fisheries Product

- Finalize lease for the Mesurado Pier that would be rehabilitated to serve as the erstwhile BNF Fisheries Monitoring Center (FMC) (one of the sub-structures under WARFP, which I will discuss in detail) and quality control laboratory
- Complete the architectural designs for the landing sites at Robertsport and Mesurado

Monitoring and Evaluation (M&E)

During this period, a dashboard (database) for catch and effort monitoring was established and information relating to IUU fishing was recorded at the FMC which was commissioned February 2, 2011. The Project recorded information on the issuance of export permit which provided an avenue to analyse the trends of fisheries product being exported from the country.

The initial stages of the WARFP implementation proved very successful, especially with regards to Component 2, Reducing Illegal Fishing. Liberia generated about US$6 million through fines and penalties from about 38 foreign vessels, industrial trawlers and tuna fleets with eleven (11) different nationalities between the years of 2011 and 2013 as seen in Table 6.1. BNF/WARFP (2013).

According to Braimah (2012), illegal fishing constituted 58.9%, 37.9% unreported fishing and 2.8% unregulated fishing between 2010 and 2012. The highest violation category was fishing without license and fisheries observer which amounted to 42.2%; fishing without license was 21.1% and fishing without fisheries observer was 21.1%. Licensed demersal trawler fishing within the prohibited IEZ (6 nautical miles offshore) was 8%.

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of vessels</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>4</td>
<td>2013</td>
</tr>
<tr>
<td>South Korea</td>
<td>7</td>
<td>2011,2013</td>
</tr>
<tr>
<td>Spain</td>
<td>10</td>
<td>2011,2012</td>
</tr>
<tr>
<td>France</td>
<td>5</td>
<td>2012</td>
</tr>
<tr>
<td>Belize</td>
<td>1</td>
<td>2012</td>
</tr>
<tr>
<td>Panama</td>
<td>5</td>
<td>2012,2013</td>
</tr>
<tr>
<td>Ghana</td>
<td>3</td>
<td>2012</td>
</tr>
<tr>
<td>Curacao</td>
<td>1</td>
<td>2012</td>
</tr>
<tr>
<td>Guatemala</td>
<td>1</td>
<td>2012</td>
</tr>
<tr>
<td>St. Vincent and the Grenadines</td>
<td>1</td>
<td>2012</td>
</tr>
</tbody>
</table>

Source: MCS Report 2013
During the period of 2010 to 2013 there were numerous training conducted at every level of the Project. The Liberia Observer Program was established (April 2011) through rigorous training conducted by National Oceanic and Atmospheric Administration (NOAA); becoming the first of its kind in the region. The Program was staffed by 17 inclusive of a management team of three consisting of an observer manager, debriefer and logistician according to Sherif (2014). The new Fisheries Regulations was also drafted and finalized in 2010, becoming the official guideline governing the sector. Unlike the revised Natural Resource Law of 1973, the Fisheries Regulation of 2010 considered and encompassed international fisheries laws and regulations; UNCLOS, FAO Port States Measures Agreement (PSMA), FAO Code of Conduct for Responsible Fisheries, etc.

There was subsequent decentralization of WARFP, which established sub-structures to oversee the implementation of the policies to achieve objectives of WARFP.

6.1.1 Monitoring, Control and Surveillance (MSC) in Liberia

The monitoring, control and surveillance (MSC) Unit was established within the WARFP as a strategic tool in curbing IUU fishing in Liberia; this was non-existent in the erstwhile BNF since its establishment in 1956 and the revision of the Natural Resource Law of 1973. MCS involves the fishers and fishing activities and not necessarily the fish stock. This includes routine fishery operations in four dimensions as indicated in BNF (2015a):

- before fishing
- during fishing
- during landing of the fish
- post landings

As a formal system, monitoring, control and surveillance (MCS) is relatively new. This derived from UNCLOS in 1982 which established the EEZ within which a state has sovereignty over its marine resources. It forms the pivot for all successive international agreements and agreements regarding the usage of the seas and oceans. The unit was headed by a Focal Person who was a part of the management team that included an international MCS consultant. Supervised by this team, WARFP established the fisheries monitoring centre (FMC) in 2010, which was commissioned in early 2011 to serve as the monitoring and surveillance arm of the erstwhile BNF. There were four personnel
recruited to man the centre while monitoring activities of licensed and unlicensed fishing and fishing related vessels in Liberia waters. Fisheries inspectors were also trained along with the fisheries observers to enhance their skills in the execution of their duties. Fisheries Sea and aerial patrols were also conducted to keep surveillance and enforce the fisheries laws and regulations. Standard Operating Procedures (SOPs) were drafted to guide the implementations of various duties associated with the MCS Department.

6.1.2 **The Fisheries Monitoring Center (FMC)**

The FMC was commissioned on February 2, 2011 by Dr. Florence Chenoweth, then Minister, Ministry of Agriculture, Liberia. The FMC carries out monitoring and surveillance of all fishing vessels equipped with the Mobile Transceiver Unit (MTU) and Vessels greater than 299 GRT equipped with Automatic Identification System (AIS) operating within the territorial waters of Liberia.

The monitoring and surveillance include the entry and exit of all vessels in Liberia waters. The FMC is responsible for the retention of all VMS data in a computer readable form for specific periods.

**TECHNOLOGIES**

*Vessel Monitoring System (VMS)*

The VMS is used on licensed industrial fishing vessels which allows for the constant monitoring of the vessels’ activities while on their fishing expeditions as prescribed in the Fisheries Regulations (Part VII, Section 55). It is cardinal for MCS at national, regional and international levels. VMS is used to monitor vessels within the territorial waters (12 nautical miles) or within EEZ which extends 200 nautical miles off shore.

The FMC uses two VMS systems: Faria Watchdog provides the date, time (1 hour interval), coordinate, speed and heading of a fishing vessel; and Fisheries Integrated Management System (FIMS) which provides the demarcations of the maritime zones (IEZ, CZ, TW and EEZ), (see Figure 6.1). The Inshore Exclusive Zone (IEZ) measures at 6 nautical mile (nm) from shore (baseline); established to protect the breeding grounds of numerous fish species, sustain the regeneration of exploited fish species and as well avoid conflicts between artisanal and industrial fishers. In this zone, trawling is prohibited as this method of fishing is destructive to the marine ecosystem. The Contiguous Zone (CZ) measures from 6 nm to 12 nm from shore upwards, the Territorial Waters (TW) measures from 12 nm to 20 nm and the EEZ covers 20 nm to 200 nm.
Automated Identification System (AIS)

The FMC uses two AIS systems: AIS Live, ExactAIS and SeaVision; both have exclusive coverage of the world oceans and tracks variety of vessels (Cargo, Oil Tankers, Fish Carriers, etc.) as seen in Figure 6.2.

Source: Liberia Fisheries Monitoring Center, 2013
**VHF Radio and HF Radio**

Very High Frequency and High Frequency Radios are installed at the FMC for communication purposes. Vessels are required by the Fisheries Regulation (Part V, Section 30) to communicate with the Fisheries Regulatory Body through its FMC for reporting purposes.

*Fisheries Hotline (+231 880 431 581)*

Besides the radios, the FMC is also responsible to monitor and receive calls through the Hotline on fisheries related issues both nationally and internationally.

**Custodian of MSC Equipment**

The FMC stores and supervises the signing in and out of MCS equipment. All equipment purchased by the project for the purpose of MCS activities are logged in at the FMC, stored and regulated through the MCS department. There are forms used to sign out equipment for field use and signed in when returned.

**Custodian of Records**

Before both sea and aerial patrols, participants are required as Standard Operating Procedure (SOP) to collect forms that are to be used, along with other equipment (camera, telephoto lens, etc.) and return used forms and equipment after use to the FMC.

**6.1.3 The Fisheries Observer Program**

As part of the effort to alleviate the deficit in fisheries scientific research and management, the Liberia Observer Program was established in April, 2011. This was in fulfilment of Part VII, Section 48 of the Fisheries Regulation. In all, 17 fisheries observers were recruited by the Fisheries Authority and trained by the National Oceanic and Atmospheric Administration (NOAA). The main objective of the fisheries observer is to exercise scientific monitoring and compliance roles in accordance with the Fisheries Regulations of 2010.

Some responsibilities of the fisheries observers are as follow:

- Estimate total fishing effort (i.e., position, time, total catch) for all hauls;
- Estimate weight and/or numbers of all species caught (catch composition) and establish disposition (e.g., retained, discarded, dead or alive) on a subsample of hauls;
• Collect biological information (e.g. lengths) on target and non-target species on a subsample of hauls;
• Collect catch and biological data on marine mammals and sea turtles (including sightings);
• Monitor fish or fish product offloads and trans-shipments;
• Monitor IUU activity;
• Document types of vessel equipment utilized (e.g. gear characteristics, electronics) and record vessel characteristics (e.g. registration numbers, licenses, etc.); and
• Document the presence of marine debris.

6.1.4 The Fisheries Inspector

Like the fisheries observers, the fisheries inspector is required to exercise MCS and compliance tasks within areas under national jurisdictions and as well beyond national jurisdiction in accordance with any international law as prescribed in Part VII, Section 45 of the Fisheries Regulation of 2010. Some responsibilities of the fisheries inspectors are as follow:

• Stop, board, enter and stay aboard in order to apply his/her power in accordance with the Regulations;
• Enter and search any area including that are part of or attached to dwelling area which he/she reasonably suspects are being used for activities which falls within the scope of the regulations;
• Inspect and take samples, logbook, documents, records, copies of logbooks and any other documentations from the vessel which falls within the scope of the Regulations;
• Monitor landings and trans-shipment operations;
• Examine gear, equipment, record or anything that that is found in the vessel that she/he reasonably believes has been used, is being used or was intended to be used for fishing related activities which requires license un the Regulations, etc.

6.1.5 The Fisheries Sea and Areal Patrol

Through WARFP, the erstwhile BNF constructed fuel tanks in Monrovia, and a Coast Guard Base in Buchanan, which would be fuelled periodically in order to facilitate and enhance sea going capabilities of the Liberia Coast Guard (LCG). According to World
Bank (2011) this strategy proved partially successful as it allowed for the deployment of fisheries inspectors at different intervals consistent with patrol schedules.

The United Nations Missions in Liberia (UNMIL) also played a pivotal role in securing Liberia waters from poachers. WARFP/BNF along with UNMIL conducted aerial surveillance periodically consistent with schedules and Standard Operating Procedures (SOPs). This in particular was huge in regard to deterrence as through previous UNMIL flights, Liberia was able to determine the level of illegal fishing that had been conducted between 2007 and 2009 according to World Bank (2011).

6.1.6 The Establishment of the MCSCC

In an effort to encourage and enhance inter-agency collaboration in the fight against IUU fishing nationally, WARFP/BNF inspired the establishment of the MCSCC through a Memorandum of Understanding (MOU). The objectives (Article 4) are as follow as in BNF (2011):

- “to develop a combined unit of stakeholders in the marine sector in order to establish and maintain control of Liberia waters;
- to protect Liberia’s fishery and marine resources from illegal and unregulated fishing and poaching;
- to support the sustainable exploitation of marine resources thereby increasing the revenue generating potential of the Government of Liberia;
- to promote and enhance the integrity of Liberia’s territorial waters, contiguous zone and exclusive economic zone;
- to enhance the safety of life at sea, and promote sea-borne commerce and trade;
- to provide information that assists in the protection of Liberia’s coastline from threats emanating from illegal and unregulated fishing; and
- to enhance national security.”

The MCSCC became a coordination of participating institutions of the Government of Liberia receiving legal authority for fisheries management through the Fisheries Act of 2015. The MCSCC brought together the following Government Institutions with differing functions:

*BNF (now NaFAA)* - is responsible for managing the fisheries resources of Liberia in accordance with Government of Liberia (GoL) policy and the Fisheries Act, including
Monitoring, Control and Surveillance of the EEZ. BNF shall be responsible for referring offenders under the fisheries act and regulations to the Ministry of Justice for prosecution.

Ministry of Defence (MoD) – is responsible for the detection, prevention, and interception of criminal activities in the waters of Liberia. MoD shall assign coastguard resources to the MCSCC, shall head the operations team supporting the Fisheries Operations Unit, ensure MCSCC is compliant with GoL policy for the management of the Territorial waters (TW), Contiguous Zone (CZ) and EEZ and provide officers and men for training and operation of the patrol craft. Suspects apprehended by MoD will be turned over to the LNP for investigation and, if necessary, prosecution by the MOJ. MoD will turn over suspects to LNP along with its preliminary finding of facts. Nothing in this MOU shall preclude, inhibit, nor restrict the function of the LCG in keeping with Article 4, and other provisions of the New Defence Act of 2008 establishing the LCG.

Liberia Maritime Authority (LiMA) – is responsible for direct support of the MCSCC mission through means of serving as a central information and data communication relay platform. BMA personnel shall provide additional assistance in conducting inspections for vessel documents validity and, authenticity, as well as serve in a regulatory oversight capacity for effecting vessel code compliance with IMO international laws and regulations, on such matters as ILO labor laws, the marine pollution act, etc.

National Port Authority (NPA) - is responsible for areas declared by the GoL as Port areas in compliance with the Act that established the National Port Authority.

Bureau of Immigration and Naturalization (BIN) - Shall be responsible for all immigration related matters and shall inspect for proper travel and entry documents of crew on vessels.

Ministry of Finance (MoF) – is responsible for the collections of all Customs, Duties, and Excise related revenues consistent with their statutory provisions.

Ministry of Justice (MoJ) – is responsible to investigate and prosecute all cases for transgression of the laws of Liberia in the Territorial waters, Contiguous zone and EEZ.

BNF (2011)

6.1.7 Community Management Association (CMA)

As part of the development objective of WARFP (Operational Manual) was the establishment and operationalization of a Community Management Association (CMA)
as a pilot project in a coastal county. Community-centered management of fisheries is viewed as an effective tool for controlling fishing effort in artisanal section that entails considerable time and expertise to thrive. The CMA is also seen as an avenue to introduce new harvesting guidelines, local surveillance, stock development procedures and local monitoring, which helps in the recovery of stocks.

Consistent with the establishment of the CMA, a sub-committee on MCS was formed to act as a strong deterrence to IUU fishing and contribute to compliance in both industrial and artisanal sectors. All stakeholders; Liberia Artisanal Fishers Association (LAFA), community groups, NGOs, recreational fishing clubs will engage and support in monitoring and surveillance efforts by the BNF/WARFP (now NaFAA). There was also support; provision and subsequent trainings for activities which included the use of equipment and monitoring programs, and information sharing, and communication protocols will be established. Clear guidelines were established for the conduct of monitoring and surveillance.

6.1.8 Regional Engagements

Considering the nature of the marine fish resources in the region of West Africa where fish and fishers engage in trans-boundary activities, regional collaboration seems to be the most suitable means to enable countries to sustainably boost the impact of the resources to their national economies. Liberia is a member, non-contracting party and cooperating non-member of series of Regional Fisheries Management Organizations (RFMOs):

*Fisheries Committee of the West Central Gulf of Guinea (FCWC)*

Liberia is a member of FCWC along with Ghana, Togo, Nigeria, Ivory Coast and Benin. The FCWC has a regional plan of action on IUU fishing and is in the process of developing conventions on minimum terms of access and data sharing.

*Mano River Union (MRU)*

Liberia is a member of the MRU along with Ivory Coast, Guinea and Sierra Leone. Fisheries specific functions evades the primary objective of the formation of the MRU, there contains provision on regional cooperation on management of resources and has therefore been utilized in strengthening cooperation on fisheries enforcement, especially between Liberia and Sierra Leone.
Ministerial Conference on Fisheries Cooperation among African States Bordering the Atlantic (COMHAFAT)

Liberia is a member of COMHAFAT. The main objectives are to promote and strengthen regional cooperation on fisheries development, coordinate and harmonize cooperation efforts and capacities of stakeholders for the conservation and exploitation of fisheries resources.

International Commission for the Conservation of Atlantic Tuna (ICCAT)

Liberia is a member of ICCAT and is required to cooperate on the management of tuna and tuna-like species, assigned quota for certain species, provide reports in accordance with international requirements and domesticate ICCAT legal framework within national legal framework.

Sub-Regional Fisheries Commission (SRFC)

Liberia is a cooperating non-member of SRFC. The SRFC administers and supervises the operations of WARFP, and MCS staff of Liberia have benefited from several regional programs including trainings.

South Pacific Regional Fisheries Management Organization (SPRFMO)

Liberia is a non-contracting party of SPRFMO. The objective of SPRFMO is to apply the precautionary and ecosystem approach to fisheries management in ensuring the long-term conservation and sustainable use of marine fisheries resources.

Fishery Committee for the Eastern Central Atlantic (CECAF)

Liberia is a member of CECAF. The organization promotes the sustainable use of marine resources and development of fisheries and fishing operations.

Indian Ocean Tuna Commission (IOTC)

Liberia is a non-contracting party of IOTC. Its mandate is to manage tuna and tuna-like species in the Indian Oceans and nearby waters. IOTC aims at promoting conservation and optimally utilize stocks covered by IOTC Agreement.

Inter-American Tropical Tuna Commission (IATTC)

Liberia is a cooperating non-member of IATTC. Its objective is to ensure conservation and the sustainable exploitation of tuna and tuna-like species (long-term) in the Eastern Pacific Ocean, consistent with international laws.
7 **Assessment of existing measures in Liberia to Curb IUU Fishing**

The structures and mechanisms established by WARFP proved very successful from its inception as the following noticeable achievements have been realized since its introduction to curb IUU fishing in Liberia:


2) Establishment of the MCS department to combat IUU fishing, as well as the National Fisheries Dashboard to technically support the Research and Statistics Division of the erstwhile BNF to organize, secure and analyse fisheries data of Liberia.

3) Developed the draft Liberia MCS Strategy and Development Plan to streamline functionalities of the department.

4) The establishment of the IEZ ensured artisanal fishers were able to harvest more, which increased income generation; reduced conflict with industrial vessels, and created the enabling environment for fish stock to regenerate without disturbance from trawling activities.

5) Establish the MCSCC as an interagency committee whose sole mandate through a Memorandum of Understanding, to positively influence decisions which affect the maritime domain; each relevant institution having its responsibilities.

6) Conduct numerous trainings, nationally and internationally, to advance the skills and expertise of the all departments, especially the MCS department; fisheries observers, fisheries inspectors, FMC Staffs, MCS sub-committee of the CMA, etc.

7) Facilitate the LCG to ensure the conduct of periodic fisheries sea patrol on a weekly basis; conducting at least 48 annually which was non-existent before 2010.

8) Engaged and coordinate with the UNMIL to ensure aerial surveillance patrols bi-weekly; conducting at least 24 patrols annually.
9) Fined, penalized or arrested more than 50 IUU fishing vessels, generating more than $7 million in fines during the process which was deterrent enough to reduce IUU fishing in Liberia from 80% before 2010 to 30% in 2014.

10) The successes of Liberia MCS attracted the European Union, once victimized by the rigidity, to register interest and engage Liberia to negotiate the Sustainable Fisheries Partnership Agreement to harvest Liberia’s tuna fisheries which came into force June 2016.

However, there were obvious limitations associated with these structures and mechanisms, as in the case of most new developments.

A monitoring, control and surveillance unit was established in 2010 to have oversight on activities falling within the scope of monitoring licensed and unlicensed vessels movements in and out of Liberia, Fisheries Observers activities, Fisheries Inspectors activities, joint operations of the LCG and NaFAA for Fisheries Sea Patrols, joint operations with UNMIL, LiMA, LCG, and NaFAA for Aerial Patrols, MCS activities of the CMA, etc. Considering the task of this unit, there was shortage of adequately trained personnel to fully execute their respective duties. Between 2010 and 2013, the MCS unit had a Focal Point, supported by a MCS Consultant; three fisheries inspectors, 11 fisheries observers and four fisheries Monitoring Center (FMC) staff. The FMC could not be manned for 24 hours because the available personnel could not cover such rotary shift.

Even though there were limited personnel in these departments, the mechanisms employed through Standard Operating Procedures (SOPs) were to an extent effective, especially as all of these processes were monitored and evaluated. Training was conducted periodically for the sub-committee on MCS of the CMA where staff were trained how to monitor their waters, conduct surveillance and use of equipment (cameras, GPS, forms, etc). The MCSCC was effective as there were periodic meetings to discuss issues relating to the maritime domain of Liberia regardless of arrests and cases of IUU fishing vessels.

According to World Bank (2015), the prohibition of trawling within the 6 nautical mile as another measure proved a masterstroke for artisanal fisheries as there was an upsurge in catch volume, limited conflicts with industrial vessels, and more importantly, recovery of exploited fish stock as this zone also serves as spawning and breeding grounds for fish species.
In 2015 the untimely change at the helm of WARFP coincided with the decline in the effectiveness of these structures and mechanisms. Seen as a cardinal aspect of the fight against IUU fishing nationally due to the multi-dimensional nature of these activities, the interagency collaboration induced by the MCSCC declined. The once vibrant MCSCC degenerated into a group which only met to discuss the arrests of vessels as opposed to regular meetings to discuss developmental aspects of fisheries and other sectors. This became more evident when there became difficulties for fisheries personnel to enter the port to conduct inspections on vessels offloading fish or vessels suspected of IUU activities within Liberia waters.

Standard Operating Procedures drafted to guide the operations of the MCS department, used between 2010 and 2015 was evaded due to the lack of administrative control.

In the case of the Liberia Coast Guard (LCG), according to Sea Shepherd Global (2017), February 2, 2017 was the beginning of a joint operation, “Operation Sola Stella”, along with Sea Shepherd to tackle IUU fishing in Liberia. Even though the National Fisheries and Aquaculture Authority is charged with the responsibilities of managing and conserving the fisheries resources of the country through the Fisheries Regulations of 2010 and other administrative and operational guidelines, there was no consultation. This operation contravened the MOU and SOPs of the MCSCC and undermined the interagency collaboration that was established.

According to MarEx. (2017), between February 2 and May 7, 2017, Sea Shepherd had arrested five vessels using the M/Y Bob Baker; trawlers and a refrigerated cargo vessel for multiple reasons including FV Star Shrimper XXV for fishing without license, and Lian Run for transmitting false identity to port authorities. And due to the lack of coordination between NaFAA and LCG, fisheries sea patrols have also declined.
The CMA has been dormant for the past few years in regard to support for the conduct of regular monitoring and surveillance activities on the waters. The last MCS training of the CMA sub-committee on MCS was conducted in 2013 where equipment and forms were provided, since then priority has shifted.

The numbers of staff have improved in all departments, but quality is still lacking. Individuals lack the technical training and expertise to execute their duties which continues to raise concerns on capacity. Low salaries and lack of proper incentives for staff occupying strategic technical positions impedes their quest to commit efforts to the job.

7.1 Limitation of the Source of Revenue through Fisheries

There are reports from FAO dating as far back as 2005 which indicate the contribution of the fisheries sector to agriculture GDP is 12% and national GDP, about 3.2%. However, these reports were gathered before the inception of WARFP in 2010, and there are assumptions that with a better management within the industrial and artisanal subsectors, these values should have alternated by now. Besides, NaFAA has a long standing and unresolved issue with LiMA regarding the overlapping of institutional functions. LiMA registers and collect fees from distant water fleets which are defined under the Fisheries Regulations of 2010 as vessels conducting fishing-related activities (Part I, Definitions- Fisheries Regulation 2010). Some fees denied NaFAA in this process.
are associated with transhipment (Part V, Chapter 35 of the Fisheries Regulation, 2010) of fish and fish products at sea and authorization by the flag state (NaFAA) to engage in fishing or fishing related activities in another jurisdiction.

Another source that is being tampered with is the LCG arrests of fishing and fishing-related vessels without the involvement of NaFAA; charging and fining these vessels without the fines being paid into NaFAA dedicated account. All of such fees should be attributed to revenue generation of the fisheries sector which will not only improve fisheries contribution to agriculture GDP but to national GDP as well.

The Liberia Coast Guard (LCG) is limited in their capacity to patrol throughout the length and breadth of our shores due to the kind of vessels they have. These vessels are either small to contain the fuel needed to lengthen patrols or the consumption is too high for short distances and very unsustainable. Besides, there are limited forward operating bases from which LCG could refuel and launch patrols in order to assuage the limitations of the boats.

The UNMIL contribution in the joint aerial patrols was very strategic in the fight against IUU fishing in Liberia from 2010 to 2015. They provided the platform from which WARFP/BNF built upon. These patrols were directly involved with the sighting of AWO YAA 7, AWO YAA 8 and PREMIER; Ghanaian and South Korean flagged vessels respectively, as they conducted fishing activities in Liberia waters. The two Ghanaian vessels cases remain opened and PREMIER fined $1,000,000 by the government of Liberia. Before the UNMIL drawdown in 2016, there was drastic reduction in the amount of aerial patrols per month (4:2:1: none) which signalled what would have been in their absence. Notwithstanding, there was no contingency plan for the drawdown and now Liberia and NaFAA are left incapacitated by their departure.

It is a requirement by the Fisheries Regulation of 2010 (Part V, Chapter 31) that an industrial vessel communicate periodically report to the head of NaFAA providing information on the status and activities of the vessel. The activities include prior entry and or exit into or out of Liberia waters. The means of reporting as shall be prescribed by the head is through email, HF radio or a facsimile. However, the once dedicated email for NaFAA is either dormant or not functional at all, the HF radio has not been functional since 2012; yet this is often referenced for infraction when a vessel fails to communicate prior entry or exit.
7.2 Snippet of Irregularities in Liberia Fisheries

In 2011, there was a moratorium placed on all fishing activities within the waters of Liberia. During this period, forged fishing licenses, trans-shipment documents and government communications were uncovered (see Figure 7.2 and Figure 7.3) which originated from Liberia and other countries as presented by Kotze, J. (2016). This was associated with the more than 35 vessels fined and penalized for IUU fishing in Liberia. Some of the discoveries on these documents were:

- The flag and vessel name were regularly incorrect, issued during the period of the moratorium
- Stamp and signature were incorrect
- The licenses were printed on green Paper (Ministry of Agriculture/Bureau of National Fisheries) with outdated letterhead.
  - Font layout and spacing of license number
  - Watermark (the fish) shape is different
  - Signatures are incorrect for both the Minister of Agriculture and Coordinator of Bureau of National Fisheries
- The shape of the stamp of the Bureau of National Fisheries is incorrect
- The Minister ‘s stamp is missing on the forged document
- The expiration date of valid license in Liberia is December 31, annually.

Figure 7.2 An example of forged registration certificate created by fraudsters.

Source: Kotze, J. (2016)
Forgery

In 2013, the South Korean fishing group Dongwon Industries paid $2,000,000 for both SOLEVANT and PREMIER for fishing in Liberia waters with forged licenses. Like all other companies suspected of using counterfeit licenses, Dongwon claimed fraud and attempted suing its local agent Inter-Burgo and its owner Jeong Dal Park for the issuance of the forged licensed which fell within the fiduciary duties of the local agent as reported in Tallaksen, E. (2014). There were references made to similar processes being followed by EU vessels, and that fees paid might have been diverted by authorities according to Korea Herald (2013).

Interestingly, there was no internal investigations into the allegations from companies associated with more than 30 vessels fined for similar offenses, even though there were claims they had been working and paying fees to authorities within the Bureau of National Fisheries (BNF) at the time. This failure encouraged the culture of impunity as some of these individuals could still be in the hierarchy of institutions wielding similar influences.

Figure 7.3 Another example of forged registration certificate created by fraudsters.

Source Kotze, J. (2016)
8 Discussion and Recommendations

The world is alert with the evolution and variations of IUU fishing activities, combined with its enormous negative impacts; these activities have been transformed over time to evade international, regional and national efforts gear towards eliminating the threat. The impacts of IUU fishing cannot be overstressed as it has become more evident in developing coastal nations, especially in Africa. West Africa became a primary target ground for IUU fishing activities due to the incapacities (financial, skilled-manpower, infrastructure) of countries to adequately employ the requisite structures and systems to manage their waters thus leaving them vulnerable. The international community, through the United Nations, World Bank, European Union, and other benefactors has been instrumental by embarking on numerous support programs which aim at fighting IUU fishing thereby enhancing sustainable development in underprivileged countries.

Liberia as a coastal nation enjoys a marine ecosystem that provides a rich source of fish varieties that can be harvested for economic and subsistence purposes. However, being a poor country, like many other countries in the sub-region and Africa as a whole, is pregnable to violations within its EEZ. Due to the vastness of Liberia’s EEZ, coupled with many other factors, managing its waters has proved difficult for most part of the history of the fishing industry. Not until 2010, with the intervention of the World Bank, Liberia has been able to gradually fight against IUU fishing; much like neighboring countries like Sierra Leone, Ivory Coast, Ghana, etc.

The measures which exist in Liberia now were instituted almost a decade ago, and as have been discussed, they are far from optimal. Limited resources (finance, skilled manpower and equipment, infrastructure, etc.), coupled with circumscribed political will continues to complicate the fight against IUU fishing. I will now state where the two models studying the costs and benefits of IUU fishing can be applied to the Liberian fisheries management system, to help improve compliance and thus preserve the fish stocks while at the same time improving revenue generation. Next, I provide additional recommendations to help improve the system overall.
8.1 Applicability of the COBECOS Model to the Liberian Fisheries Management System: A Brief Theoretical Feasibility Consideration

While the COBECOS project was primarily designed to study the costs and benefits of the control measures of management strategies to the EU Common Fisheries Project (CFP), the broad nature of the framework means that it is adaptable to most (if not all) fisheries management systems with established measures that can in principle be enforced to ensure compliance.

Most of the data required for the model is obtainable in Liberia. While some of the data will take time to obtain, the fact that they are obtainable is already positive. First and foremost, the effort $e$, falls under the MCS within NaFAA. Liberia has an MCS center under the WARFP structure. The size of the effort is the questionable aspect that needs to be addressed since this is dependent on manpower and equipment.

I am very interested in quantifying and qualifying the benefits from compliance. To do this, we will need to place Liberia in the category of undermanaged fisheries system (since it is not efficient). Quantifying the benefits will provide a justification for why government ought to invest more in manpower and equipment, considering the various constraints on the efforts as have been discussed.

Secondly, we have seen how under certain conditions the optimal stock level is well below the MSY. This can prove to be very important when considering what level of fishing will be considered safe.

8.2 Applicability of the Sumaili et al. Model to the Liberian Fisheries Management System: A Brief Theoretical Feasibility Consideration

Understanding the optimal stock from the COBECOS model is one thing. A major task will be to enforce compliance by fishers. As have been discussed any increase in enforcement comes with additional cost, and there is an optimal level of enforcement, beyond which the costs will start to outweigh the gains. As such one turns to fines, whose increase bears no cost to enforcement authorities. Determining the right level of fines to ensure that violations by fishers comes at a cost to them (their marginal costs outweighs their net benefits), one might rely on the costs and benefits of risks to fishers’ model, devised by Sumaili et al. (2005). Again, nearly all the parameters required by this model can be obtained in Liberian and therefore the applicability of the model is feasible. Table 8.1 gives the list of the parameters needed for both models and those that can be obtained or those that are available.
Table 8.1 A table listing the necessary parameters for the Sumaila et. al and the COBECOS models, along with those parameters that are either available or can be obtained in Liberia.

<table>
<thead>
<tr>
<th>Model</th>
<th>Required Parameters</th>
<th>Availability in Liberia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sumaila, Alder and Keith Model</td>
<td>Total cost $T$</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Fines $f$</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Regulations $r$</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Effort by perpetrator $\bar{e}$</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Biomass $x$</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Probability of being caught $\pi$</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>IUU catch $h$</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Social benefits $s$</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Moral Benefits $m$</td>
<td>Yes</td>
</tr>
<tr>
<td>COBECOS Model</td>
<td>Biomass $x$</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Shadow biomass $\lambda$</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Management tools $q$ (same as restrictions)</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Enforcement efforts $e$</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Fines $f$</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Probability of catching violators $\pi$</td>
<td>Yes</td>
</tr>
</tbody>
</table>

One possible impact the application of this model in Liberia would have is to gauge how much costs perpetrators are willing to incur as they weigh such costs against their benefits. Also this could also allow the regulatory bodies to understand how these violators adjust to minimize the impact of increased enforcement.

8.3 Recommendations

Consistent with the assessment of the measures employed to curb IUU fishing in Liberia, as well as what we know about enforcement efforts from the costs and benefits of control strategies via the COBECOS project, the following recommendations have been provided to point the management of NaFAA in the direction of plausible solutions to lapses and limitations this research has unveiled:

1) Consolidate cooperation with the National Port Authority (NPA) as much as have been achieved with LCG and LiMA. The Freeport of Monrovia remains the site for all
cargo vessels-importing fish and fish products into the country, and as such, these vessels are subject to fisheries inspections. There have been numerous occasions where vessels evade inspections due to the bureaucracy associated with personnel accessing the port facilities to conduct inspection, as well as prohibition on the use of gadgets (Cameras). Liberia is a signatory to the FAO Port State Measures Agreement whose aim is to prevent vessels involved in IUU fishing from using port facilities, thus reducing incentives from IUU fishing and blocking those products from reaching national and international markets. These provisions are embedded within the mandates of NaFAA, while the port authority has its own obligations in the implementation. NaFAA, NPA and LiMA could impress upon government for the ratification of the instrument in which time it will become binding.

2) Clearly define ‘Fishing-related activities’ and ‘Transhipment’ within all legal instruments which govern fisheries nationally. This will expunge the ambiguities related to NaFAA’s mandates and obligations over Liberian-flagged vessels in foreign waters or distant waters. This has been a controversial issue for some time now domestically, and it undermines the flag state responsibilities of NaFAA internationally.

3) NaFAA is a technical institution and focus should be directed towards incentivizing performances, efforts and sacrifices of technicians. Incentives serve as a conduit to motivation which stimulates result-oriented performances. Technicians who are in direct contact with vessels and the like will be beyond reproach if their job commensurate with salaries; it shows management has regard for the job they are performing.

4) Management should revisit discussions with LiMA in regard to monitoring and surveillance of Liberian-flagged vessels in distant waters. This is one component stressed by the EU and contributed to the “Yellow Card” issued in 2017. NaFAA needs to take full responsibility of all licensed and Liberian-flagged vessels, fishing or conducting fishing-related activities nationally and internationally, consistent with international obligations.

5) NaFAA should prioritize working with LCG to establish FOBs at more strategic locations to enhance fisheries sea patrols. Monrovia and Buchanan have FOBs; Rivercess, Greenville and Harper will be more strategic to have MCS presence in the Southeastern region of the country.

6) NaFAA should advance the completion of the FMC in Harper, albeit making minimum adjustment to the structure of the facility. The structure will enforce MCS
presence in the region and as well serve as deterrent for would be violators, particularly from Ivory Coast; and also help in the coordination with LCG operations in the Southeastern region of the country.

7) NaFAA should engage regional and sub-regional organizations on possibilities of joint aerial patrols to conduct fisheries surveillance missions. NaFAA could also seek support from other international partners like the World Bank, EU, etc. in this regard as aerial surveillance provides wider coverage than any other means as evident by previous joint mission conducted by UNMIL, NaFAA and others.

8) The importance of communication in fisheries management cannot be overemphasize. The HF and VHF radios at the FMC need to be another priority for NaFAA. A functional FMC cannot be efficient without the utilization of the radio systems. If it is a requirement by law for licensed and unlicensed vessels to report to NaFAA via the FMC, it is imperative that all means are made available for contact. Additionally, NaFAA also need to reinstate the use of the HOTLINE at the FMC, it proved very useful before, especially for coastal communities’ dwellers in reporting sightings of illegal activities to the MCS department.

9) Review and institutionalize all Standard Operating Procedures associated with the execution of various mandates of the MCS department to safeguard operations.

10) Ensure that all IUU fishing vessel account for quantity of catch on-board, species types, market value, etc. to enable NaFAA quantify IUU fishing in Liberia onwards as this has eluded management practices.

11) Conduct a study on the fisheries stock considering the exploitations within various fisheries to ensure sustainability. This will help guide attempts to increase or decrease efforts within the fisheries.

12) The Sumaili model can be used to study the appropriate level of fines that may be institutes to ensure compliance.

13) A case study should be done using the COBECOS model to determine the benefits from compliance with fisheries measures. A numerical study should also be carried out to determine the optimal fish stock level.

14) There are prospects of international partners donating fisheries patrol boats to NaFAA; looking at the long-term benefits of the institution, management should endeavour to train fisheries personnel to pilot these boats as it is an added advantage for trained and skilled fisheries personnel to spearhead patrols, while the institution fully controls operations.
9 Conclusion

The measures established to curb IUU fishing in Liberia can be easily described by dividing it into three periods; from 2010 - 2015, 2015 – 2017 and 2017 – 2019. The period of 2010 – 2015 is seen as when the greatest strides were made in the fight against IUU fishing, where the institution proved to be more impactful, result-oriented, and merit-based. This era is associated with Liberia being most vulnerable to IUU fishing due to the lack of institutional structure, skilled professionals, requisite technical tools and political will to combat the menace. From its inception in 2010, WARFP provided the platform for the missing link in fisheries management and development in Liberia; developing the necessary structure to implement key indicators, establishing links between Fisheries and other stakeholders within the maritime domain, setting up the MCS department with all its associated components, setting up the Dashboard unit to input, analyse and maintain data on the fisheries and most importantly, recruiting and training personnel with technical functions specific to these units. The impact of the establishment of these measures proved successful to an extent relative to its non-existence before 2010, coupled with the substantial fines and penalties levied against foreign vessels found violating international laws and new Fisheries Regulations of 2010. This became an obvious source for government revenue, albeit unsustainable as ensuring compliance is cardinal to a successful MCS implementation.

The period of 2015 – 2017 is associated with dormancy in all functions of WARFP which had since served as the technical arm of the erstwhile BNF. Supports to execute MCS mandates reduced, outputs from other key functionaries declined and lack of interest in the jobs from staff soared. The latency in the period can be ascribed to the lack of funding from the World Bank, especially certain components of the project; component 2, ‘Reducing IUU Fishing’, and the untimely change at the helm of WARFP in 2015.

From 2017 to present, the institutional arrangements of Fisheries have changed from being a technical unit under Ministry of Agriculture for more than 60 years, and under Liberia Maritime Authority for about a year, to an Autonomous Institution; National Fisheries and Aquaculture Authority. The administration has tweaked the previous set ups and only results will prove if they are successful or not.
Though Liberia fisheries remains fragile and susceptible to IUU fishing national and regionally, there are indicators which show the measures and mechanisms employed to discourage, avert and abolish the threats associated with IUU fishing have demonstrated success especially in certain periods. During these periods, Liberia outperformed her neighbours in the region and sub-region in terms of practical IUU cases and the associated outcomes showed Liberia’s willingness to levy fines and penalties which served as deterrent particularly in the early years of implementations of these measures.

There are still grey areas; NaFAA will have to revisit and make adjustments within the institutional arrangement, personnel and Fisheries Regulations as highlighted in my recommendations. Personal knowledge, experience and expertise have precipitated most of the recommendations within this paper thereby underlining the limitations of previous administrations.

Also, the COBECOS model and the costs and benefits of risks model by Sumaili et al., provide very exciting and attractive tools that can be applied to the Liberian fisheries sector. This is cast as a future project and has the potential to understand the appropriate levels of harvest as well as analyse benefits from compliance with measures. One may also be able to gauge the applications of fines from a rigorous understanding of which levels of fines would enforce compliance.
10 References


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FAO. (2004). Liberia Fisheries Country Profile


MRAG. (2008). Study and analysis of the status of IUU fishing in the SADC region and an estimate of the economic, social and biological impacts, volume 2: main report.


11 Appendix

Appendix A: IUU Arrest Vessel Procedure in Liberia

Source: BNF-MCS Archives, 2013
## Appendix B: Partial Summary of Fines and penalties in Liberia 2011-2017

<table>
<thead>
<tr>
<th>Year</th>
<th>Vessel</th>
<th>Flag</th>
<th>Violation</th>
<th>Fine</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>FV PREMIERE</td>
<td>South Korea</td>
<td>Fishing without license</td>
<td>$1,000,000</td>
<td>Settled</td>
</tr>
<tr>
<td></td>
<td>FV SOLEVANT</td>
<td>Ivory Coast</td>
<td>Fishing without license, forged license</td>
<td>$1,000,000</td>
<td>Settled</td>
</tr>
<tr>
<td></td>
<td>FV SETA 60</td>
<td>South Korea</td>
<td>Fishing without license, illegal transhipment</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>FV SETA 62</td>
<td>South Korea</td>
<td>Fishing without license, illegal transhipment</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>FV SETA 70</td>
<td>South Korea</td>
<td>Fishing without license, illegal transhipment</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>MV SETA 73</td>
<td>Panama</td>
<td>Fishing without license, illegal transhipment</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>HAE JEONG 3</td>
<td>South Korea</td>
<td>Tampering with MTU, Fishing within IEZ</td>
<td>$100,000</td>
<td>Settled</td>
</tr>
<tr>
<td></td>
<td>HAE JEONG 7</td>
<td>South Korea</td>
<td>Tampering with MTU, Fishing within IEZ</td>
<td>$100,000</td>
<td>Settled</td>
</tr>
<tr>
<td>2014</td>
<td>MV JINYUN</td>
<td>China</td>
<td>Offloading fish without authorization</td>
<td>$3,000</td>
<td>Settled</td>
</tr>
<tr>
<td></td>
<td>MV GABU REEFER</td>
<td>N/A</td>
<td>Offloading fish without authorization</td>
<td>$2,000</td>
<td>Settled</td>
</tr>
<tr>
<td>2017</td>
<td>FV YEUN HORN NO.2</td>
<td>Taiwan</td>
<td>Fishing without license, other</td>
<td>$110,000</td>
<td>Settled</td>
</tr>
</tbody>
</table>

**Source:** BNF-MCS Archives 2017
## Appendix C: Partial Summary of Arrest Record of LCG and Sea Shepherd Joint Operations

**Liberia Coast Guard/Sea Shepherd Operations since February 2, 2017**

<table>
<thead>
<tr>
<th>Vessel Name</th>
<th>Flag</th>
<th>Date of Arrest</th>
<th>Suspected Violation</th>
<th>Adjudication</th>
<th>Fine/Penalty</th>
<th>Payment Account</th>
<th>Status of Vessel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shenghang 808</td>
<td>Sierra Leone</td>
<td>Feb-17</td>
<td>No Entry/Exit Report</td>
<td>Out of Court Settlement</td>
<td>$15,000</td>
<td>Special Fisheries Account</td>
<td>Released</td>
</tr>
<tr>
<td>Shenghang 809</td>
<td>Sierra Leone</td>
<td>Feb-17</td>
<td>No Entry/Exit Report</td>
<td>Out of Court Settlement</td>
<td>$10,000</td>
<td>Special Fisheries Account</td>
<td>Released</td>
</tr>
<tr>
<td>Hispasen 7</td>
<td>Senegal</td>
<td>Feb-17</td>
<td>No Entry/Exit Report</td>
<td>Out of Court Settlement</td>
<td>$10,000</td>
<td>Special Fisheries Account</td>
<td>Released</td>
</tr>
<tr>
<td>Lu Rong Yuan Yu 9</td>
<td>Ghana</td>
<td>Mar-17</td>
<td>Unknown</td>
<td>Released</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Released</td>
</tr>
<tr>
<td>Shrimper XV</td>
<td>Nigeria</td>
<td>Multiple Offenses including Fishing without License</td>
<td>Out of Court Settlement</td>
<td>$100,000</td>
<td>Unknown</td>
<td>Released</td>
<td>Released</td>
</tr>
<tr>
<td>Lian Run</td>
<td>Sierra Leone</td>
<td>Multiple Offenses</td>
<td>Out of Court Settlement</td>
<td>$110,000</td>
<td>Unknown</td>
<td>Released</td>
<td>Released</td>
</tr>
<tr>
<td>Fu Yuan Yu 777</td>
<td>Sierra Leone</td>
<td>AIS Switched Off</td>
<td>Released Arranged by LCG</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Released</td>
<td>Released</td>
</tr>
<tr>
<td>Labiko 2</td>
<td>Senegal</td>
<td>Oct-17</td>
<td>Using Unauthorized Gear and Harvesting Unauthorized Species</td>
<td>Out of Court Settlement</td>
<td>$60,000</td>
<td>Unknown</td>
<td>Released</td>
</tr>
<tr>
<td>Sheng Huan Yu 5</td>
<td>Guinea</td>
<td>Nov-17</td>
<td>AIS Switched Off</td>
<td>Out of Court Settlement</td>
<td></td>
<td>Special Fisheries Account</td>
<td>Released</td>
</tr>
<tr>
<td>Guoji 809</td>
<td>China</td>
<td>2-Jan-18</td>
<td>Fishing with Expired License</td>
<td>Out of Court Settlement</td>
<td>$10,000</td>
<td>Special Fisheries Account</td>
<td>Released</td>
</tr>
<tr>
<td>Panofi Forerunner</td>
<td>Ghana</td>
<td>18-Jan-18</td>
<td>AIS Switched Off, Deployment of FADs</td>
<td>Released</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Released</td>
</tr>
<tr>
<td>Irene</td>
<td>Spanish</td>
<td>23-Jan-18</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Released</td>
</tr>
<tr>
<td>Hai Feng 823</td>
<td>Sierra Leone</td>
<td>21-Dec-18</td>
<td>False Documentation</td>
<td>MCSCC</td>
<td>No Fine Imposed</td>
<td>N/A</td>
<td>Released</td>
</tr>
</tbody>
</table>

**Source:** NaFAA-MCS Archives 2018