2014

The development of fisheries management in Liberia : vessel monitoring system (vms) as enforcement and surveillance tools : national and regional perspectives

Sheck Abdul Sherif
World Maritime University

WORLD MARITIME UNIVERSITY

Malmö, Sweden

THE DEVELOPMENT OF FISHERIES MANAGEMENT IN LIBERIA

Vessel Monitoring System (VMS) as enforcement and surveillance tools - national and regional perspectives

By

SHECK ABDUL SHERIF

Liberia

A dissertation submitted to the World Maritime University in partial Fulfilment of the requirements for the award of the degree of

MASTERS OF SCIENCE

In

MARITIME AFFAIRS

Marine Environmental and Ocean Management

2014

DECLARATION

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

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

Signature: 

Date 17|09|14

Supervised by: _____

Professor Neil A. Bellefontaine

World Maritime University

Assessor : _____

Professor Larry P. Hildebrand

World Maritime University

Co-assessor : _____

Professor Bernard M. Leonard

World Maritime University

ACKNOWLEDGEMENT

I extend profound gratitude to my sponsor, the Liberia National Capacity Development Trust Fund (LNCDTF) for affording me the sponsorship which has provided me the opportunity to study at the World Maritime University.

I extend thanks and appreciation to Honorable George K. Werner, Director General of the Civil Service Agency in Liberia and Chair, Inter-ministerial Scholarships Committee. To Mrs. Lovetta B. Sendolo, Director of Management Services, Civil Service Agency, thank you for the moral support. I appreciate all those that provided materials or supported me in any other form, without which I would not have been able to complete my academic programs.

I am honestly most grateful to my supervisor, Professor Neil A. Bellefontaine, for his most valuable guidance, support and mentorship. My sincere gratitude goes to Professor Larry P. Hildebrand, for his patience, time, tolerance and encouragement. To all WMU staff and faculty, I say thank you.

I wish to extend thanks and appreciation to Mr. Chris Hoebeke and Ms. Anna Volkova, both of WMU Library for their valuable and resourceful assistance.

To my family, particularly my parents, Mr. Abubakar K. Sherif and Mrs. Hawa E. Sherif, I say thank you for the prayers, support, and encouragements for the duration of my studies. I extend profound thanks and gratitude to my wife Mrs. Miatta S. Sherif for being patient and strong while I was away.

Lastly, and most importantly, I give glory and honor to the Almighty God for being my strength and sustainer.

Abstract

Title of Dissertation: **The Development of Fisheries Management in Liberia: Vessel Monitoring System (VMS) as Enforcement and Surveillance Tools – National and Regional Perspectives.**

Degree: **MSc.**

The development of the fisheries sector in Liberia is highlighted by little or no legislative framework to govern or manage the fisheries, the intervention of the West Africa Regional Fisheries Project (WARFP) and the introduction of the New Fisheries Regulations of 2010.These developments have given rise to the establishment of the Fisheries Monitoring Center (FMC) and the Monitoring, Control and Surveillance Coordination Committee (MCSCC) to promote interagency collaboration for the development of the fisheries sector.

This dissertation seeks to explore the background of the fisheries management system in Liberia and its current status, in addition to challenges posed by Illegal Unreported and Unregulated (IUU) fishing and the use of VMS as an enforcement and surveillance tool. As the Fisheries Regulations of 2010 seeks to standardize fishing activities in the Liberian waters, VMS, in Part VII (Article 55), Monitoring, Control, Surveillance and Compliance, has been set forth as a condition of licensing of all industrial and commercial fishing activities. Furthermore, an analysis of the different management regimes of the fisheries sector establishes the link between the management system employed by the Bureau of National Fisheries (BNF) before the intervention of WARFP and the current system in place, considering personnel and technological resources and their impacts on VMS applications and its enforcement. Moreover, in an effort to examine the overall use of VMS as an enforcement and surveillance tool in comparison with Liberia and impacts on the fisheries sector, observations and experience from the sector were drawn to supplement the literature review and provide reasonable conclusions and recommendations from the analysis.

The findings from the analysis of the transition of the fisheries sector describe the deficiency in the application of VMS as an enforcement and surveillance tool for Liberia's fisheries, not only considering personnel and technological resources, but also highlighting efforts by the BNF and the potential for stakeholders' collaboration and transboundary cooperation on fisheries enforcement issues. In conclusion, the dissertation provides recommendations based on best practices drawn from the literature review and deductions from the SWOT analyses. If adopted, these recommendations would augment the implementation of a VMS system that is sustainable and improve fisheries enforcement mechanisms; thus preventing, deterring and eliminating IUU fishing in the Liberian waters and the sub region.

Key words: Fisheries, VMS, IUU fishing, Technological resources, Liberia

Table of Contents

List of Tables

List of Figures

List of Acronyms

ALC	Automatic Location Communicator
ATLAFCO	Cooperation of African States Bordering the Atlantic Ocean
BIN	Bureau of Immigration and Naturalization
BNF	Bureau of National Fisheries
CAADP	Comprehensive Africa Agriculture Development Program
CZ	Contiguous Zone
EEZ	Exclusive Economic Zone
ERS	Electronic Recording and Reporting System
FAO	Food and Agriculture Organization of the United Nations
FCWC	Fishery Committee of the West and Central Gulf of Guinea
FDA	Forestry Development Authority
FIMS	Fisheries Information Management System
GIS	Geographic Information System
GPS	Global Positioning System
GOL	Government of Liberia
HF	High Frequency
ICCAT	International Committee for the Conservation of Atlantic Tuna
IEZ	Inshore Exclusion Zone
IMARSAT	International Maritime Satellite
IMO	International Maritime Organization
IPOA	International Plan of Action
IPSMA	International Port State Measures Agreement
IUU Fishing	Illegal Unreported and Unregulated Fishing
ITLOS	International Tribunal for the Law of the Sea
LCG	Liberian Coast Guard
LISGIS	Liberia Institute Statistics and Geographic Information System
LiMA	Liberia Maritime Authority
LOP	Liberia Observer Program
LOSC	Law of the Sea Convention

MCI	Ministry of Commerce and Industry
MCS	Monitoring, Control and Surveillance
MCSCC	Monitoring, Control and Surveillance Coordination Committee
MOA	Ministry of Agriculture
MGD	Ministry of Gender and Development
MLME	Ministry of Lands, Mines and Energy
MOD	Ministry of National Defense
MOH	Ministry of Health
MOJ	Ministry of Justice
MOU	Memorandum of Understanding
MRU	Mano River Union
MTU	Mobile Transceiver Unit
MYS	Ministry of Youth and Sports
NEPAD	New Partnership for African Development
NFDS	Nordenfjeldske Development Services
NIC	National Investment Commission
NGO	Non-Governmental Organization
NM	Nautical Mile
NOAA	National Oceanic and Atmospheric Administration
NPA	National Port Authority
RFMM	Regional Fisheries Management Mechanism
RFMO	Regional Fisheries Management Organization
SatComms	Satellite Communications
SB	Standard Board
SBD	Short Burst Data
SOP	Standard Operating Procedure
SRFC	Sub Regional Fisheries Commission
SWOT	Strengths Weaknesses Opportunities and Threats
TURF	Territorial Use Rights Fisheries
TW	Territorial Waters
UN	United Nations

UNMIL	United Nations Mission in Liberia
VHF	Very High Frequency
VMS	Vessel Monitoring System
VSAT	Very Small Aperture Terminal
WARFP	West Africa Regional Fisheries Project
WB	World Bank

CHAPTER ONE

INTRODUCTION

1.1. BACKGROUND

Fishermen in Liberia have been engaged with traditional fishing practices for centuries, including fishing their coastline, lagoons and rivers with nets, hooks and lines, and traps. The earliest records only date from 1960 when 44 canoes were recorded fishing along the coastline.[1] By the 1980s this fishery had expanded with the Kru of Liberian ancestry, the Fanti and Ewe of Ghanaian ancestry and the Popoh of Togolese ancestry.

In the 1970s, a fleet of around 20 industrial vessels were also fishing in the Liberian waters for shrimp and other demersal fish species. The large commercial fishing vessels accommodated crews of up to ten men and were often at sea for several weeks for a single fishing trip. These vessels landed approximately 3,000 tons of finfish and 2,000 tons of shrimp per year.[2]

Following several years of a success in the fisheries sector and industry, the Liberia civil crisis in the early 1990s affected the country in all aspects including its infrastructures and human resource development, resulting in several major governance frameworks including the fisheries regulations, becoming outdated. There is very little known about the fisheries of Liberia including the status of the stocks or ecosystem supporting the fisheries. Historical fishery data over a long period is not readily available. The exact catch magnitudes of both the artisanal and industrial sectors are not known because of inadequate sampling of the marine landings along the Liberian coast (FAO, 1986). However, monitoring and research more or less came to a halt during the period of the civil upheaval, worsening the situation in acquiring information on the fisheries and related activities. This period, therefore, provided an opportunity for illegal fishing activities, with foreign vessels targeting fish in the waters of Liberia, thus draining potential for national revenue, destroying habitats, interrupting the ecosystem, polluting the waters by ships,

[1] PAD. (2009). West Africa Regional Fisheries Program.
[2] Liberia PAD. (2009). The World Bank.

among others. This situation led to negative impacts on the health of the fish stocks and the ecosystem in its entirety. Recently, the BNF has improved its governance mechanism of fisheries, putting in place monitoring and control measures that have resulted in apprehending fishing vessels in contravention of Fisheries Regulations with more than 40 vessels monitored and fined for committing infractions in Liberian waters.

The fisheries sector is important to the agricultural sector of Liberia as well as to the national economy. In 2002, fisheries contributed to 12% of agricultural GDP and 3.2% of the national GDP. Fisheries play a key role in the livelihoods of the coastal population, consisting of 15,000 to 20,000 families that use approximately 2,500 boats. The fisheries sector has vital roles in food security and national economic growth (NEPAD/CAADP/FAO, 2006). Revenue to the government from license fees, vessel registration fees, inspection fees, fisheries observer fees, import and export charges, and fines charged to vessels for violating the fisheries regulations amounted to US $400,000 in 2011 and increased to approximately US$ 6.0 million by the middle of 2013 which was a result of fines gathered from the successful prosecutions of foreign vessels fishing illegally in the fisheries waters.[3]

Of the 15 counties (political subdivisions) of Liberia, 9 of them are coastal counties in which more than half of the population of the country is estimated to live. Populations along the coast are dependent or partly dependent on fisheries for livelihoods, including many rural communities, women and youth. Fish provides an estimated 65 % of animal protein intake within the country, mainly because it is significantly cheaper than meat or other sources of protein and is readily available. However, the average per capita consumption of fish is 5 kilograms[4] per year, which is significantly lower than it was in the 1970s and 1980s.

In spite of its numerous fisheries resources, Liberia still imports cheaper small pelagic species for local consumption, while exporting some high value species such as shrimp. Trade figures are not considered reliable. This is due to the illegal trade in fish and the weak monitoring and enforcement systems in place.

[3] Annual Report. (2013). West Africa Regional Fisheries Project, Bureau of National Fisheries.
[4] See www.st.nmfs.noaa.gov

Generally, the fisheries sector of Liberia is recognized to have huge potential and can significantly contribute to the development of the country. In recent years, the Government of Liberia has embarked on a campaign to sustainably manage the fisheries and protect associated environments. For example, in 2010 the New Fisheries Regulations were adopted and published as a way forward. This action has resulted in an increase in revenue not only for the Government but local fishermen and also created a market for fishers generally, as well as for consumers.

1.2. BACKGROUND INFORMATION

The coastline of Liberia is 570 km (approximately 350 miles) in length, and the country has an Exclusive Economic Zone (EEZ) that extends 200 nautical miles (NM) offshore, consisting of relatively warm waters with low nutrient content. The continental shelf extends from Ivory Coast to Robertsport in Liberia, with an average width of 34 km and the widest part in the central region of Liberia.[5] An Inshore Exclusion Zone (IEZ) reserves the six nautical miles closest to shore for the sole use of subsistence, artisanal and semi-industrial fishing activities. Consequently, trawling of any type by industrial and commercial fishing activities is not allowed inside the IEZ.

Figure 4. Map of Liberia showing the IEZ, CZ, TW and EEZ of Liberia's Maritime Domain

Source: Sherif (2014). Snapshot-Google Earth Maritime Boundaries Delimitation.

[5] Natural Resource Law of Liberia (1956).

The fisheries resources of Liberia are exploited by different combinations of fishing gear and craft and these are generally divided into the following four groups:

1.2.1. Marine small-scale fisheries

Marine small-scale fisheries are comprised of both artisanal fisheries and semi-industrial fisheries, which provides livelihoods for approximately 33,000 full-time fishers and processors located in the nine coastal counties (i.e., Grand Cape Mount, Montserrado, Grand Bassa, Sinoe, Grand Kru, Rivercess, Margibi, Bomi and Maryland). Approximately 80 % of those working in the sector are Liberians and 60 % are female. They operate from some 140 fish landing sites along the coastline (The World Bank, 2009).

The largest craft are the motorized semi-industrial vessels that target mainly small pelagic species and some larger pelagic species using ring-nets, drift-nets, set-nets and gill-nets. There are more than 500 of these craft registered to fish in Liberia, which are generally referred to as the Ghanaian fishing boats or 'Fanti' boats, operated predominantly by Ghanaians living and working in Liberia.[6] These boats are specialized, and are constructed with a combination of different types of logs and planks. Each boat has a carrying capacity of 12 to 20 crew members and operates with an outboard motors and/or engines ranging from 10 - 40 horse power. Additionally, Senegalese fishermen are also involved with semi-industrial fishing activities in the country and use similarly designed and constructed boats.

The artisanal fleet dominates the fishing industry of Liberia, using a variety of canoe sizes powered by oar, sail, and increasingly outboard motors. Most artisanal fishers operate wooden dug-out non-motorized canoes, generally targeting demersal species using different types fishing gears and methods. The artisanal fishery which uses purse-seines, beach-seines, gillnets, lines and hooks accounts for about 60% of coastal pelagics (with about 50% of Sardinella). Tuna, billfish and bonito account for about 10% of the artisanal catch. The other major fish species

[6] Government of Liberia. (2013). Liberia Fisheries and Aquaculture Policy.

groups exploited by artisanal fishermen are barracuda (5%), soles (5%), croakers (5%), and sharks and rays (4.5%).[7]

The canoes mostly used by fishers are assembled from tree trunks and other forms of wood and propelled by sails and paddles. There are around 3,000 of these canoes fishing in coastal waters. These canoes are of varying sizes; a smaller boat-like canoe less than 6 meters in length, with a depth of approximately 60 centimeters and mostly operated by a crew of 1 to 3, and a larger canoe greater than 6 meters in length, with crews ranging from 3 to 5 persons.

According to reports of the Bureau of National Fisheries (BNF),[8] most of the catch of this sub-sector, estimated to be around 3,000 tons per year, is processed locally, mainly through salting, drying and smoking. Most of the fish harvested are either consumed locally by the fishers' families or sold in the local markets. However, some of the fish is transported for sale to other parts of the country or to neighboring Sierra Leone, Guinea or the Ivory Coast. High valued fish species are mostly sold fresh and transported immediately to restaurants or directly to the market or to individual homes.

1.2.2. Marine industrial fisheries

The marine industrial fishery can be divided into a trawl fishery for shrimp and demersal finfish that provides frozen fish and shrimp for the local markets and an off-shore large pelagic fishery. The mixed demersal fishery is not operating in an optimal manner. It utilizes outdated, and at times, damaged vessels, equipment, ports and processing facilities, within an environment that is often not safe for workers and polluting the environment. The sector lacks the infrastructure, equipment and expertise to process export-quality fish products. It has traditionally been dominated by foreign companies, with only a few Liberian flagged vessels operating. The introduction of the six mile Inshore Exclusion Zone (IEZ) in 2010, as mandated by the Fisheries Regulations, which restricts and bans industrial fishing activities in the area. Many vessels registered to fish in the waters prior to the introduction of the New Fisheries Regulations were

[7] See www.oceandocs.org
[8] Annual Report. (2013). West Africa Regional Fisheries Project/ Bureau of National Fisheries.

recalled by their owners. According to reports,[9] vessels caught high valued cassava croakers, which are highly priced on the Asian markets within the 3 to 5 nautical miles zone but are now denied to fish in the 6 NM zone. However, most of these vessels enter the IEZ and Territorial Waters at night to fish illegally which has become a new challenge for the new fisheries regimes of the BNF. In spite of the many challenges, this situation has changed since the signing of a Memorandum of Understanding (MOU) on Fisheries MCS by stakeholders in the maritime domain and the inauguration of the Monitoring Control and Surveillance Coordination Committee (MCSCC). The Liberian Coast Guard which represents the Ministry of National Defense on the MCSCC is charged with the responsibility to restore integrity to the fisheries waters of Liberia including surrounding environments. As a result of the improved governance of this sector the number of vessels fishing has decreased, resulting in reportedly improved catches by small-scale fishers and a reduction in situations of conflict, and thus improving safety.

Liberia falls within the migratory path of the offshore large pelagic tropical tuna species, including the yellowfin, skipjack and bigeye species that migrate throughout the Atlantic Ocean. In 2012 following the fining of 40 foreign vessels for illegally fishing in Liberian waters, discussions were initiated with foreign companies to start a licensing regime to permit access to foreign vessels to fish in the Liberian waters.

1.2.3. Inland fisheries

Liberia has two kinds of river systems: major basins that drain 97 percent of the territory and originate from the Fouta Djallon highlands in Guinea, and short coastal water courses, which drain about 3 percent of the country. There is a total of 1,800 km of rivers, most of which are shallow, rocky and with cataracts and fallen logs that render them unnavigable. There are also large areas of inland valley swamps and numerous coastal lagoons, including Lake Piso, one of West Africa's largest lagoons.[10]

[9] Sherif (2012). Monitoring, Control and Surveillance (MCS) Operations in Liberia: Workshop on West Africa Regional Collaboration for MCS-Liberia, Sierra Leone, Ivory Coast & Ghana. 30-31 October 2012. Monrovia, Liberia.
[10] See www.fao.org

Table 1. Artisanal Fisheries Survey

County	No. Registered Canoes
Cape Mount County	132
Bomi County	80
Montserrado County	516
Margibi County	86
Grand Bassa County	561
Rivercess County	283
Sinoe County	491
Grand Kru County	377
Maryland County	277
Total:	**2805**

Source: BNF Dashboard (2013)

However, Table 1 provides the number of artesanal canoes registered to fish in Liberia in 2013. The inland fisheries are based on rivers, lakes and wetlands such as swamps and coastal lagoons. There are two major lakes in Liberia: Lake Shepherd and Lake Piso. The river network is extensive, the largest and longest of which is the Cavalla River. There are six major rivers and 71 % of the land of Liberia falls within one of the international river basins (Brandolini & Tigani, 2006). The rivers are shallow and rocky and therefore do not support water transport, fishing on a large scale or navigation. Monrovia is surrounded by the Mesurado river wetland, which despite high pollution provides a harvest of tilapia (*Pelmatolapia mariae).* Although neither the number of people engaged in inland capture fisheries, nor the volume or value of catch is known, it is considered an important seasonal subsistence activity for riverside communities, using mainly traditional fishing gears and methods. Meanwhile, decisions that impact on inland fisheries have historically been driven by interests other than fisheries, such as the water and forestry sectors.

1.2.4. Recreational fisheries

Today recreational fisheries are not of great significance but are a likely area where growth and new opportunities may arise in the future both in marine and inland environments.

1.3. IMPORTANCE OF THE FISHERIES SECTOR

The fisheries of Liberia are comprised of both marine fisheries and aquaculture. The marine fisheries involve both industrial and artisanal fishing activities; an inland fishery which is solely practiced by artisans; and aquaculture which is practiced mostly outside the capital city through pond culture.

The production of fish by the marine fisheries subsector between 1994 and 2005 has fluctuated between 6,857 tons to 15,472 per year (Table 2). However, sixty percent (60%) of the fish produced during this period was harvested by the artisanal fishery, most of which is consumed locally.

Table 2. Total fish production (tons) including inland fisheries and aquaculture

Year	Total
1994	7,721
1995	8,829
1996	8,308
1997	85,80
1998	10,830
1999	15,472
2000	11,748
2001	11,300
2002	11,014
2003	11,714
2004	10,359
2005	6,857

Source: FAO (2005), BNF (2006)

However, fisheries statistics between 2006 and 2011 are not available either because of lack of reporting or vast inconsistencies in the data received due to poor management of the fisheries, and lack of monitoring, control, surveillance and compliance.

On the other hand, recent statistics for 2012 shows that efforts still need to be applied and management strategies reformed and emphasized for the sustainability of the sector and the benefits to its citizenry (Table 3).

Table 3. Total fish production (kg) by species in 2012

Fish Type (common names)	Total
Shrimps	7568
Cassava fish	9940
Sole fish	5660
Yama	40,100
Stinger	4,920
Loose fish	200
Crabs	40
Mixed fish	660
Kappa	60
Ink fish	20
Total:	**75,108**

Source: West Africa Regional Fisheries Project/Bureau of National Fisheries (2012)

The average catch per canoe/annum was 2.2 tons and 1.16 tons in 2004 and 2005 respectively (BNF/GOL, 2006). The major species exploited are the Sardinella, Barracudas, Croakers, Sharks and *Ilisha africana*, which make up the major commercially valuable species for the local markets, and constituted 83 % and 59.06% of local fish supply in 2004 and 2005 respectively (Drammeh, 2007). However, fisheries revenues are generated from several sources including those from institutions related to the maritime and marine environment (Table 4).

Table 4. Sources of Fisheries Revenue

Agency/Type of Charges	Import permit	Import Duty	Export	GST	Sea Worthiness	Licenses	Custom Charges on local catch
LMA					$25/GRT		
Commerce	1.5% FOB						
Finance		2.5%		7%			$25/ton
BIVAC	$5/ton						
BNF	$1.5/ton		2%			$15/GRT/yr	

Source: Statistics and Regulatory Unit, Bureau of National Fisheries, 2005

The value chain for the artisanal fishery is very short, and in most cases there is very little or no value addition at all. There is no use of ice or chillers for post-harvest fresh fish preservation. Fish once landed on the beaches, are available for sale (NEPAD/CAADP/FAO, 2006). The processes of value addition are simple. The fish is first washed with seawater and then gutted

(for small sized fish) and for larger fish, decapitated and dismembered, before being smoke dried using firewood. Metal drums are most commonly used for smoking in all coastal communities. There are, however, some improved chokor smoking ovens built of clay in use particularly in Margibi and Grand Bassa Counties (Drammeh, 2007). Artisanal fisheries within inland fishing communities use traditional smoking ovens that are constructed using sticks from branches of trees or wire mesh. Additionally, traditional fishers preserve fish using other methods such as smoking, salting and fermentation. These methods are predominantly carried-out by Fanti (Ghanaian) and Kru (indigenous) fish processors.

The industrial fisheries sector, however, involves high capital investment involving fishing trawlers, administrative offices and cold storage facilities. Presently, foreigners dominate the sector, particularly because of its increasingly intensive capital cost. Although there have been significant efforts by the Government and other international partners to sustainably manage this fishery. It is believed that the catch is under reported, and there is strong suspicion that a number of industrial fishing vessels are engaged in illegal transshipments in the high seas which is not reflected in the statistics recorded by the BNF. Catch statistics reported by the fisheries observers on board licensed fishing vessels are also considered unreliable for several reasons including training in monitoring and statistics. Because of its limited surveillance capabilities, there have been reports of pirate fishing, illegal bunkering, and illegal transshipments, among others.

In spite of its fisheries resources, Liberia still imports small pelagic species from the West African region for local consumption, while exporting some high value species such as shrimp and cassava croaker, mainly to Asia.

Overall, it is widely recognized that the fisheries sector has potential to make a significant contribution to the country's development. Initial steps have already been taken. In 2010, for example, the New Fisheries Regulations were endorsed to support development and management of the fisheries sector. Published in 2011 and enforced in 2012, the fisheries regulations with its mandate has increased catch for local fishers thus providing food for the local population, and more fish for the markets. However, to maximize the potential contribution of the sector many challenges need to be overcome such as: rehabilitation and recovery of the fish stocks and

improved fisheries governance. The sector policy and strategy, therefore, aims to provide a framework for the continuous transition to a sustainable fisheries management regime.

1.4. OBJECTIVES

The fisheries sector in Liberia has evolved over the last few years, specifically between 2010 and 2013, and can be considered one of the most effective fisheries management regimes in the sub-region. As discussed earlier, there has been an increase in production in the fisheries due to the enforcement of the New Fisheries Regulations of 2010, establishment of the Fisheries Monitoring Center (FMC) in 2011 and the set-up of the Monitoring Control and Surveillance Coordination Committee (MCSCC) to guarantee stakeholders' participation in the development of the fisheries. This is principally because of the intervention of the World Bank led West Africa Regional Fisheries Project starting in 2009.

As presented in this document, the topics are arranged as follows: this chapter provides the objective of the research including the research questions; chapter two is the literature review; chapter three presents the methodology; chapter four and five discuss the legal basis for management and Monitoring, Control and Surveillance (MCS), respectively; chapter six looks at Vessel Monitoring System (VMS); chapter seven on Port State Measures Agreement (PSMA), and conclusions and recommendation are outlined in chapter eight.

To understand how the fisheries sector in Liberia could be successful with the use and application of VMS as an enforcement and surveillance tool in an enabling legal environment, the following research questions have been considered:

1. How effective is the use of VMS on commercial fishing vessels in Liberia?
2. Does the legal regime support the application and enforcement of VMS throughout the country?
3. What is the type of technology is involved with the use of VMS?
4. What is the total number of industrial and commercial fishing vessels actively engaged in fishing and related activities?

5. What is the cost structure of the VMS and how accessible is it to fishermen in the country?
6. What is the position of all stakeholders in the maritime domain to collaborate and promote sustainable fisheries management?

The goal of this work is to provide a framework and standard for the installation and application of a Vessel Monitoring System (VMS) as an enforcement and surveillance tools for the fisheries of Liberia. The approach, as discussed in this paper will be submitted to the Bureau of National Fisheries (BNF) as a proposal for the management and use of VMS on commercial fishing vessels. Furthermore, it could be extended and applied to the sub-region based on the success rate in Liberia over the next few years. Benefits that could derive from this work include: 1) a description of the transition of the fisheries sector of Liberia, highlighting strengths, gaps and opportunities by reviewing the past and present fisheries management regimes of Liberia towards sustainable fisheries development, 2) assessment of how VMS applications have played a crucial role in restoring the depressed state of Liberia's fisheries (including the management and protection of coastal ecosystems and fish spawning and nursing grounds), and have been mandated as a condition for licensing and engaging in fishing activities within the Liberian waters; 3) provision of a holistic approach to effective MCS in Liberia and the region by the standardization of Mobile Transceiver Units (MTUs) on fishing vessels for VMS monitoring and reporting, and harmonization of legislations and frameworks for its application, and 4) provision of recommendations for the participation of national stakeholders and regional collaboration for effective and sustainable fisheries management in Liberia and the West Africa Sub region.

1.5. LIMITATION OF STUDY

Some of the information including data required to support this work was not made available either because of time or the lack of availability of the data.

CHAPTER TWO

LITERATURE REVIEW

2.1. FISHERIES MANAGEMENT REGIME FROM 1956 to 2010

Liberia has one of the longest coastlines in West Africa, 590 kilometers, slightly longer than that of Ghana or Senegal. However, fish resources are much poorer due to a combination of conditions unfavorable to large scale fish reproduction: narrow continental shelf, no major upwelling and a lack of long-term temperature gradients (Smart & Sheves, 1979). However, if the available resources are exploited responsibly and to a sustainable level the industry could satisfy the long standing demand of its citizenry and the modest fish requirements (Ssentongo, 1987).

One problem in this connection is the poor knowledge available on Liberian maritime resources, which is essentially based on quick surveys by research vessels. Estimates of potential yields vary greatly but normally fall within the ranges of 9,000-15,000 tons for demersal species, 19,400-41,000 tons for coastal pelagic species and 1,200-1,600 tons for shrimps (The World Bank, 2009).

Catch statistics over the years have been poor, thereby, providing management with no accurate information on the status of fish stocks or the impacts to the surrounding environments and associated habitats. Early on, Liberia possessed a fairly large industrial fishing fleet which particularly concentrated on the rich shrimp resources at the northern end of the fisheries waters of Liberia and to some extent in the Sierra Leonean territory (Smart & Sheves, 1979). The industrial era in Liberian fisheries started in 1955 and witnessed the growth of one particularly large company, Mesurado, which was supplied with up to 30 vessels by the late 1970 (Eppler, 1986).

In 2010, some 33,000 fishers and fish processors were directly employed in the small-scale fisheries, operating roughly 3,500 canoes (only 8 percent were motorized) and utilizing 137

landing sites.[11] However, the motorized small-scale fishing vessels are generally used by large communities of Ghanaian (and in some cases from Benin or Cote D'Ivoire) fishers, and these vessels are far bigger than the small, wooden dug-out canoes that are often paddled and sailed by Liberian fishers, in what are almost parallel fisheries. Further, the West Africa Regional Fisheries Project (WARFP) operational manual emphasized that while motorized canoes particularly target small pelagic stocks, the small dug-out canoes particularly aim for high value demersal species. In terms of the communities participating in small-scale fisheries, many are cut off from supply lines for 5 months during the course of the rainy season, and lack infrastructure for their small-scale landing sites, chilled storage, and ice, as well as access to micro-credit and/or supplies and repairs to vessels. Virtually all fishing gear is currently imported by Ghanaian fishermen using subsidized credit from Ghana.

In 2007, there were more than 50 different licensed industrial vessels, and currently 33 vessels are reportedly legally operating in Liberia (BNF/GOL, 2006). Although in 2007 and 2008 there were roughly 14 local companies affiliated with these 50 vessels, providing them with support services and receiving some fish from them for the local markets, much of the catch is still transshipped at sea for export without authorization from the BNF. This is in sharp contrast to the past, when in 1973 industrial fish processing made the country the highest value exporter of fish products in Africa (The World Bank, 2010). Currently, there is no functioning fishing harbor; no competent authority for the certification of fish and fish related products, for example, legislation, training and equipment are all required; and no cold storage/holding facilities at major fish landing sites along the coast.

During the period between 1956 and 2010, the fisheries sector was faced with key specific issues (The World Bank, 2010): (i) very limited institutional capacity in the National Bureau of Fisheries which currently has no fisheries research capacity, leading to weak governance and management of the fisheries, (of note is that current foreign industrial fishing vessel license fees are very low compared to Sierra Leone and other countries), (ii) increasing damage to coastal ecosystems and fish spawning and nursing grounds (as well as to small-scale fisheries) from trawling (the country needs enforcement of an inshore 6-mile zone free from trawling), (iii)

[11] Project Operational Manual. (2010). West Africa Regional Fisheries Program (WARFP) in Liberia.

reportedly high levels of illegal fishing (some recent estimates cite 60 to 100 illegal vessels fishing in Liberian waters), (iv) numerous negative factors affecting local value addition and trade, such as lack of port and fish landing infrastructure, training, and quality control capacity for export certification, and (v) deep poverty and a high level of social fragmentation in fishing communities which will make implementation of some reforms very challenging. As a result, there are no legal fish exports from the country at the moment. Past evaluations and foreign surveys have shown the coastal demersal fish stocks to be either fully or overexploited.

2.2. WEST AFRICA REGIONAL FISHERIES PROJECT (WARFP) IN LIBERIA INTERVENTIONS

Liberia is endowed with valuable and shared natural resources in the form of its marine fish stocks. This natural asset is currently providing the local population and national economy with far lower economic and social returns than it should be due in large part to overexploitation and subsequent depletion of the resources by both legal and illegal operators. Consequently, the returns that the resources provide currently accrue and benefit mostly foreign fleets and businesses, because most of the fish caught in Liberia's waters is not landed in the country, but rather is taken directly to foreign ports where further value is added and jobs are created.

However, the objective of the West Africa Regional Fisheries Project (WARFP) is to strengthen the capacity to govern and manage targeted fisheries, reduce illegal fishing, and increase local value added to fish products. In order to meet the development objective, the project will focus on achieving several key outcomes in the first 5 years, including (The World Bank, 2010):

(i) Improved governance indicator: At least one Territorial use rights fisheries (TURFs) legally established in targeted coastal fisheries;
(ii) Reduction of illegal fishing indicator: 67% reduction of fishing vessels observed by aerial/surface patrol or by radar and satellite monitoring, that are committing a serious infraction (i.e. fishing without a license, or fishing in a prohibited zone or using prohibited gear); and
(iii) Increased local value added indicator: Increase in the volume of exports from targeted fisheries from 0 to 1,000 tons.

With the inception of the WARFP project in 2009, there are several milestones that have been achieved so far to ensure the protection, preservation and sustainable management of the fisheries. There have been reduced conflicts between the artisanal and industrial fishers with the introduction of the six mile IEZ for the exclusive rights of artisanal fisheries, increase in catch by artisanal fishers, guaranteed protein source (from fish) for the local population, and increased revenue for the national economy, among many others.

Table 5. Fish production (tons) in 2013

Vessel	Fish Caught (tons)	Percentage Caught
Hae Jeong 3	58.6	16%
Global 7	22.249	6%
Global 8	15.82	4%
Hae Jeong 7	267.267	73%
	363.936	**100%**

Source: West Africa Regional Fisheries Project/Bureau of National Fisheries (2013)

As compared to the 1990s and early 2000s, vessels expressing interest to engage in fishing and related activities in the waters of Liberia have drastically decreased due to the 'so-called' stringent fisheries regulations that most companies and vessel owners considered inflexible in terms of allowing them to adopt and adjust during the transition. However, the four vessels from Table 5 and Table 6 that were licensed to fish in Liberia in 2013 carried out fishing activities responsibly and in accordance with the fisheries regulations, thus improving production.

Table 6. Fish Species production (tons) in 2013

Hae Jeong 7		
Target Species	**Quantity (tons)**	**Percentage**
Demersal species	251.083	94%
Shrimps	16.184	6%
Total:	**267.267**	
Global 7		
Demersal species	12.185	55%
Shrimps	10.064	45%
Total:	**22.249**	
Global 8		
Demersal species	9.7	61%
Shrimps	6.12	39%
Total:	**15.82**	

Hae Jeong 3		
Demersal species	58.6	100%
Shrimps	-	0%
Total:	**58.6**	

Source: West Africa Regional Fisheries Project/Bureau of National Fisheries (2013)

The cumulative outcome of the development objective of the West Africa Regional Fisheries Program over 10 years (i.e., this first phase of 5 years-2009 to 2014 and then a second phase of another 5 years-2015 to 2020) will be: the initial recovery of the resource base of at least 7 overexploited fisheries in West Africa; at least a 25% increase in annual net economic benefits to Liberia from the fisheries targeted by the project; and an increase in the average household wealth status of fishing households in targeted communities - including comparisons to non-targeted community households (The World Bank, 2009).

2.3. FISHERIES MANAGEMENT REGIME FROM 2011 TO PRESENT

Since 2011, there have been several changes in the management of the fisheries in Liberia. The intervention of the WARFP project has shifted, positively, the future of the fisheries sector in the country, including; institutionally, and legally.

The new fisheries regime, as it is most often referred to, provides financial and technical supports to adjust the regulatory environment for industrial fisheries and to increasingly develop the institutional capacity of the Bureau of National Fisheries (BNF) through the WARFP project. This is basically to strengthen MCS functions and the capacity of the BNF through a combination of external technical assistance and training of local staff (The World Bank, 2009). Over the years, this strategy has focused on the monitoring and control of the activities of industrial fishers and establishing one Territorial Use Rights Fisheries (TURF) through a co-management initiative for artisanal fisheries.

Among many initiatives, the BNF with support from the WARFP project has reform the fisheries sector to an extent. Since its inception in 2010, there has been put in place a New Fisheries Regulations, a Memorandum of Understanding (MOU) on fisheries MCS issues for all

stakeholders in the maritime domain, the formation of the MCS Coordination Committee (MCSCC) to support interagency collaboration and avoid overlap of functions, and the establishment of the Fisheries Monitoring Center (FMC) with a wide range of equipment for the monitoring and control of commercial fishing vessels within the fisheries waters of Liberia. This support has seen the fisheries sector grow with an increase in revenue for the national economy, institutional reforms for enhanced management initiatives, increase in fish catch and market for artisanal fisheries and the local population, development of the fisheries observer program, establishment of a database to host fisheries and fisheries-related information, and reduction of illicit activities including IUU fishing.

This period has seen more cooperation between the BNF and institutions with interests and mandates to protect the environment and associated habitats. For example, the Liberian Coast Guard (LCG), a line department under the Ministry of National Defense, charged with maritime security and protecting the integrity of the maritime domain of Liberia.

Most importantly, and as a condition of licensing of industrial and commercial fishing vessels, the Fisheries regulations mandate all vessels to be mounted with VMS for monitoring and enforcement purposes, and to manage ecosystem impacts of the fisheries. The VMS is an essential factor of the MCS system and has provided a significant contribution to the protection of shrimp resources and artisanal fisheries. The Ministry of Agriculture (MoA) and its BNF have provided the following (Sherif, 2009):

a) Recruitment and training of staff;
b) Physical installations;
c) Discussions with fishing industries on the detailed application of the VMS, specific to fishing zone definitions and coordinates; and
d) Modification of the fishery legislation with regards to the nature of the VMS encroachment and penalties to be applied.

CHAPTER THREE

METHODOLOGY

3.1. MATERIALS AND METHODS

Many documents on VMS as an enforcement and surveillance tools have been written by experts globally which are sometimes specific to a particular type of fisheries. The methodology used for this work involves the revision of existing public records relating to the dynamics of IUU fishing in Liberia from 1955–2013. Reports on the transition of the BNF and the fisheries sector and the application of VMS and alleged IUU activities (fishing, landings, transshipments) were derived from publicly available documents, from the BNF, national and international partners, reports from fisheries inspections, reports and web pages from NGOs and the fishing industry, journal articles and books.

In addition, the research examined past and current fisheries regimes in Liberia as well as fisheries policies and regulations and describes the transition of the fisheries sector. This study also highlighted additional benefits, with illustrations, that Liberia has received since the inception of the New Fisheries Regime: in approving and publishing a New Fisheries Regulation, establishment of the Fisheries Monitoring Center, development of the Fisheries Observer Program, training of Fisheries Inspectors and Monitoring, Control and Surveillance (MCS) staff and identification of Coastal Stations (forward operating bases).

Moreover, the study has reviewed the existing mandatory VMS applications in accordance with national legislation, type of VMS system employed, installation and procedural requirements, monitoring and reporting, effective use of VMS systems to address IUU problems (detecting infractions) in Liberia and the sub region, and human capacity development needs to guarantee the use of data generated from VMS monitoring and thus increase surveillance and enforcement capabilities.

CHAPTER FOUR

LEGAL BASIS FOR MANAGEMENT

4.1. LEGISLATION

Primarily, the core instrument for the governance of the sea is the United Nations Convention on the Law of the Sea (UNCLOS), which was adopted in 1982. This was a result of the third United Nations Conference on the Law of the Sea. The protection and preservation of the marine environment from anthropogenic activities and pollution from ships have today become a very technical and legal area (Gold, Chircop, & Kindred, 2003). Under international law, states are sovereign and have equal rights and duties as members of the international community, notwithstanding differences of an economic, social, political or other nature.[12]

In the early 1970s, the Food and Agriculture Organization (FAO) of the United Nations assisted the Government of Liberia to revise the Natural Resources Laws of 1956. This was not achieved because Presidential the approval required was not obtained up to the time of the Coup d'etat in 1980. Also in 1999, an effort to address challenges posed to the fisheries sector resulted to the draft of fisheries legislation. The legislation was prepared but never finalized, by the House of Representatives and relevant stakeholders, or approved by Government.

With support from the West Africa Regional Fisheries Project (WARFP), the government along with international partners has produced a New Fisheries Regulation to replace the Natural Resources Laws of 1956. In addition, a Fisheries Act is being drafted to support the management of fisheries in the country, with consideration to the coordination of activities in the maritime domain. The new fisheries regulations have incorporated significant aspects and provisions of major international agreements and frameworks, including the Code of Conduct for Responsible Fisheries, IMO and other conventions, International Plan of Action (IPOA) to combat IUU fishing, and protocols addressing fisheries, among numerous others.

[12] Declaration on Principles of International Law Concerning Friendly Relations and Cooperation Among States in Accordance with the Charter of the United Nations, UNGA Res. 2625 (XXV) (1970)

Since 2010, the New Fisheries Regulation has strengthened the management of fisheries in the country and at the same time has strengthened national capacity for Monitoring, Control and Surveillance (MCS) to manage and regulate fishing activities and effectively curb and eventually eliminate poaching and other forms of IUU fishing within the Exclusive Economic Zone (EEZ) of Liberia.

4.2. LEGISLATIVE FRAMEWORK OF OTHER SECTORS

The development and fisheries management in Liberia takes into account the legislative frameworks of other sectors that have a relationship to the fisheries sector. The following are the main instruments of interest for coherence:

- *"Liberia National Policy on Decentralization and Local Governance(2010)* – decentralizing government is a key governance strategy that is relevant for artisanal fisheries, particularly inland fisheries;
- *'Maritime Act' (2010)* – establishes the Liberia Maritime Authority (LiMA) as a corporate body and highlights the need for cooperation between agencies and departments;
- *National Defense Act (2008)*– establishes the role of the Liberian Coast Guard including in respect to maritime regions and its relationship with the Bureau of National Fisheries;
- *Environmental Protection Agency Act (2003)* – establishes a monitoring, coordinating and supervisory authority that is to provide an inter-ministerial mechanism for addressing and coordinating responses to Liberia's environmental problems.
- *Executive Order # 39 of 2012 (2012)* – delimits Liberia maritime zones and embeds the 1982 UNCLOS in domestic law;
- *National Capacity Development Strategy(2010)* – provides a vision for capacity development to be sustainable, inclusive, results-oriented, and aligned with the broader development agenda of the country;
- *National Food Security and Nutritional Strategy (2008)* – makes the provision of access to food in order to live an active and healthy life, a right of Liberian citizens;

- *National Adaptation Program of Action (2008)* – guides government in relation to adapting to climate change induced impacts and notes that fisheries are a key area of concern; and
- *Liberia Agriculture Sector Investment Program (2010)* – aims to empower women and youth and increase the fishery sector contribution to food and nutrition security and GDP through: improving capacity of the BNF; instituting good governance and sustainable management of fisheries; and reducing illegal, unreported, and unregulated fishing."[13]

[13] National Fisheries and Aquaculture Policy. (2013). Bureau of National Fisheries, Ministry of Agriculture, Government of Liberia.

CHAPTER FIVE

MONITORING, CONTROL AND SURVEILLANCE (MCS)

5.1. OVERVIEW OF FISHERIES MONITORING, CONTROL AND SURVEILLANCE (MCS)

Generally, the fisheries sector is crucial to the development plan of a state to manage and protect the fisheries and other marine resources. For example, utilizing resources and protecting associated environments are significant to sustainable management of fisheries resources. However, the goal of fisheries management is to maximize the benefits and economic opportunities from the State's territorial waters and exclusive economic zone, considering strong and cost-effective MCS.

In the most basic form, monitoring, control and surveillance is an integrated information gathering, rule-making and enforcement system used to manage fisheries. Everett (2005-2009) and Flewwelling et al. (2002) define each component more specifically as follows:

- *Monitoring* consists of the collection, measurement and analysis of fishing activity. The monitoring component of MCS should receive, integrate and verify information from the licensing unit, sea-going units (sightings and inspections), observers, vessel monitoring systems (VMS) and satellite imagery, radar, port inspection, regular dockside monitoring of landings, fishing logbooks, production logbooks, and air sightings for vessel identification, activity and location. This information is primary data that fisheries managers use to arrive at management decisions. If this information is unavailable, inaccurate or incomplete, managers will be handicapped in developing and implementing management measures.

- *Control* involves the specification of the enforceable terms and conditions under which resources can be harvested. These specifications are normally contained in national fisheries legislation and other arrangements that might be nationally, sub-regionally, or

regionally agreed. The legislation provides the basis for which fisheries management arrangements, via MCS, are implemented.

- *Surveillance* involves the regulation and supervision of fishing activity to ensure that national legislation, conditions of access, and management measures are observed. The surveillance component of MCS will require fisheries personnel who not only collect data for the monitoring aspect of MCS during their surveillance duties, but can also communicate with and educate stakeholders involved in participatory conservation activities. These personnel must have the appropriate equipment and facilities, operating funds and training both to encourage voluntary compliance and to enforce laws where necessary. Surveillance is usually the largest and most expensive component to fund. This activity is critical to ensure that resources are not over exploited, poaching is minimized and management arrangements are implemented.

MCS is simply a tool for implementation of agreed policies, strategies and frameworks for fisheries management and other aspects of ocean and environmental governance. In essence, MCS is critical for the implementation of a successful fisheries management strategy; and the absence of an MCS development plan and strategy renders a fisheries management regime or administration ineffective, thus leaving the sector vulnerable and unsustainable.

Fisheries management in its simplest terms comprises the following activities (Flewwelling, et al., 2002):

- *Data collection and analysis* – data for management planning and operations from socioeconomic studies, rural development studies, fisheries population studies, fisheries research cruises, licensing (national, provincial and district), catch and effort/logbooks, onboard observers (if established as a program), dockside monitoring/landings, VMS, satellite imaging, and inspections at sea and in port.

- *Participatory management planning* – planning of fisheries management policies and strategies at the national level, and detailed planning for management zones or areas with input from stakeholders (provinces, districts and fishers).
- *Establishing a regulatory framework* – management plans need to be supported by appropriate legal instruments by means of which the plans are implemented. These legal instruments detail all the control mechanisms available for fisheries management including, but not limited to:

    - *Input controls* – such as access (number of fishers, number of vessels by fishery), licenses, closed seasons, gear restrictions, vessel limitations, area restrictions (Protected Areas), VMS requirements, and vessel identification.
    - *Operational and output controls* – such as species and catch limits, by-catch limits, reporting requirements, air surveillance, sea patrols/inspections, boarding, logbooks, dockside monitoring, observers, port inspections, and catch documentation schemes.
    - *Implementation* – this includes such measures as:
        (i) participatory community-based management (CBM);
        (ii) "preventive" MCS activities to encourage voluntary compliance;
        (iii) public awareness and education campaigns;
        (iv) assistance to small scale fishers for supplemental livelihood development to reduce coastal area pressures; and
        (v) full enforcement to ensure compliance by those minority of fishers that persist in ignoring the law.

Similarly to fisheries management, MCS involves all of the above considering the full context of monitoring, control and surveillance as described earlier in this chapter.

MCS is a relatively new tool as compared to other forms of fisheries management. For this reason most fisheries managers do not understand MCS or its critical role in implementing strategies and agreed frameworks for the management and sustainability of fisheries. Some view

the arrest of vessels as the only relevant indication of the effectiveness of MCS efforts.[14] The core indicator for MCS is the level of compliance and not the number of arrests or number of violations committed. This is however governed by many factors including the number of fishing vessels registered and licensed, fishing effort, area covered by sea and aerial patrols, results of patrols, number of fishers, increase in voluntary compliance, and number of vessels fitted with VMS.

5.2. MONITORING, CONTROL AND SURVEILLANCE (MCS) IN LIBERIA

Monitoring, Control and Surveillance (MCS) in Liberia seeks to reduce the illegal fishing activities threatening the sustainable management of marine fish resources and the wealth they can generate. More specifically, it will improve the fisheries MCS system of Liberia and adapt it to the needs of fisheries management; within the framework of a coordinated approach between countries of the sub-region.

Fisheries MCS in Liberia is focused on achieving compliance with fishery management measures, i.e., monitoring the gathering of information on the fisheries that is used to assist in developing and establishing appropriate management controls, whereas surveillance utilizes the data available to ensure compliance. Generally, the core objective of effective MCS is to ensure maximum compliance with fisheries management measures and approaches in the most cost-effective way. This core objective will contribute towards long-term sustainability and successful management of the fisheries through encouraging compliance, ensuring that the required information and legal environment are available to set the appropriate fisheries controls, and that these controls are monitored and complied with.

[14] There is still the mistaken perception that MCS is "unproductive" if it does not result in arrests. This does not follow the emerging idea of MCS as a key tool for the implementation of the Code of Conduct for Responsible Fisheries, nor the concept of preventive MCS (voluntary compliance) and deterrent MCS activities operating in parallel for successful and cost-effective fisheries and coastal resource management.

5.2.1. Effective Monitoring, Control and Surveillance (MCS) mechanisms to prevent IUU fishing in Liberia

The implementation of a successful MCS strategy to prevent, deter and eliminate IUU fishing in the country must encourage, enforce and monitor compliance with national strategies and frameworks toward fisheries and marine management which will adopt innovative and adequate technology and tools; information sharing and exchange and cooperation at national, and regional levels, initially.

According to the National Fisheries Policy, there are interventions that are most likely to ensure the implementation and success of an effective MCS strategy in support for the development of the fisheries sector in Liberia:

- "Develop and implement a national action plan, in accordance with the FAO International plan of action to prevent, deter and eliminate IUU fishing.
- Support and strengthen the inter-agency institution, the MCS Coordinating Committee, to be effective in its work in reducing illegal fishing in the Liberian fisheries waters.
- Implement a cost effective MCS system involving a reasonable mix of land, sea and air based capabilities that provides the greatest chance of ensuring compliance of operators. These capabilities include: at-sea observer program, vessel monitoring system, port inspections, vessel registers and logbooks, sea and aerial patrols.
- Encourage community participation in MCS by strengthening and supporting the pilot community surveillance program of the Robertsport Co-Management Association.
- Establish a follow through mechanism and institute deterrent fines and penalties to curb or discourage indulgence in illegal fishing activities.
- Establish a clear penalty scheme for varying levels of illegal fishing activities.
- Conform to ICCAT recommendations by denial or cancellation of permits to fish to any vessel that is on the ICCAT blacklist of IUU vessels or any contracting party's list of IUU vessels.
- Accede to the International Ports States Measures Agreement (IPSMA) and operationalize a Port State Measures Scheme that is cost effective to combat IUU fishing by local and foreign vessels.

- Support mechanisms for bi-lateral, sub-regional and regional cooperation to combat IUU by working with neighboring countries, the Fishery Committee of the West and Central Gulf of Guinea (FCWC), Sub Regional Fisheries Commission (SRFC) and Mano River Union (MRU) such as joint operations, sharing of assets and information and cooperation on training and expertise.
- Adopt a system that monitors catches and facilitates regional and international efforts to ensure that fish imports particularly transshipped fish are legal."[15]

The Bureau of National Fisheries (BNF) with the support of the West Africa Regional Project (WARFP) and other national and international partners has assisted the government, over the years, to develop policies and frameworks in accordance with major international conventions for the management of fisheries. This effort has also strengthened the fisheries management regime in the country by empowering MCS personnel and as well as stakeholders charged with the responsibility of protecting and preserving the environment. The options available for an MCS system are diverse and the various combinations of these options are almost limitless; however, what is achievable must be assessed and developed based within the resources (human, infrastructure and financial) that are, or will be, available to the Government of Liberia. MCS options include a range of separate or interlinked components of hardware in varying degrees of sophistication, various levels and types of human resources, a host of approaches to implementation ranging from military type enforcement to community driven compliance programs (WARFP-Liberia/BNF, 2013). With the changing environment and advancement of technology, fishing methods are well advanced and fast growing into operations that exceeds geographical boundaries. However, the MCS system, once well developed, must be adaptable enough to address new challenges and incorporate new options into operations.

5.3. INSTITUTIONAL ARRANGEMENTS

The Ministry of Agriculture, through the Bureau of National Fisheries (BNF) is in charge of the overall management of the fisheries in Liberia. While BNF is the lead agency, it continues to

[15] National Fisheries and Aquaculture Policy. (2013). Bureau of National Fisheries, Ministry of Agriculture, Government of Liberia.

collaborate with other institutions and stakeholders such as; Ministry of Finance, National Port Authority, Environmental Protection Agency, Ministry of Justice, Liberia Maritime Authority and UNMIL. A Steering Committee is charged with the responsibility to coordinate the activities of all stakeholders and partners which is chaired by the Ministry of Agriculture and Co-Chaired by the Liberia Maritime Authority.

5.3.1. Monitoring Control and Surveillance Coordinating Committee (MCSCC)[16]

It is essential to define also the legal framework within which the Monitoring, Control and Surveillance Coordinating Committee will operate and its relationship with the Bureau of National Fisheries. The functions of the MCSCC is dedicated to fisheries surveillance activities and financially and legally independent of the enforcement activities of the Liberia Coast Guard. The BNF will shortly implement a national MCS plan and strategy that is being drafted and currently under review. Fisheries surveillance capacity (i.e., Monitoring Centers and satellite-based vessel monitoring systems) has since been established. Sites for coastal stations have been identified with constructions to commence in 2015. Sea and aerial patrol capabilities are gradually being developed through the Monitoring, Control and Surveillance Coordination Committee (MCSCC) while national equipment has been procured and local staff are trained.

The MCSCC is comprised of the Ministry of Agriculture (Bureau of National Fisheries), Ministry of National Defense (Liberian Coast Guard), Ministry of Justice (MOJ), National Port Authority (NPA), Liberia Maritime Authority (LMA) and Bureau of Immigration and Naturalization (BIN) and other relevant partners including the United Nations Mission in Liberia (UNMIL) and the Community Science Program. The MCSCC was established as a result of a Memorandum of Understanding (MOU) signed with relevant maritime stakeholders with mandates to:

- develop a combined unit of stakeholders in the marine sector in order to establish and maintain control of Liberian waters;

[16] The International Fisheries Observer and Monitoring Conference (IFOMC) Abstract Book. (2013). Monitoring, Control and Surveillance Coordination Committee, the success of interagency collaboration in Liberia by Sheck Sherif. See http://www.ifomc.com/web2/LibroIFOMC.pdf, p. 99.

- protect Liberia's fishery and marine resources from illegal, unreported and unregulated fishing and poaching;
- provide for the sustainable exploitation of marine resources thereby increasing the revenue generating potential of the Government of Liberia;
- promote and enhance the integrity of Liberia's territorial waters, contiguous zone and exclusive economic zone;
- ensure the safety of life at sea, and promote sea-borne commerce and trade;
- 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 has developed an Administrative and Operational Framework which serves as a Standard Operating Procedure (SOP) and supports the day-to-day activities of the Coordination Center that hosts the Fisheries Monitoring Center (FMC). The MCSCC has promoted and demonstrated the effectiveness of interagency collaboration and how this coordination brings desirable and robust results. In 2011 and 2012, the BNF through the MCSCC and relevant partners successfully investigated, apprehended and/or charged 2 Chinese paired trawlers, 1 demersal trawler, 1 trap vessel/boat and 34 tuna purse seiners.

5.3.2. The National Maritime Security Committee

Recently, the National Maritime Security Committee was established by the President of Liberia for developing and implementing the nation's maritime security strategy; implementing, enforcing and reviewing all related activities consistent with maritime security-related International Maritime Organization (IMO) conventions, protocols and treaties to which Liberia is a signatory; and planning for maritime security incidents and coordinating the response(s) of the various stakeholder. The committee is comprised of: both, the Ministry of Justice and Liberia Maritime Authority as co-chairs, the Ministry of Foreign Affairs, the Ministry of National Defense, the Liberia National Coast Guard, the Ministry of Agriculture-Bureau of National Fisheries, the National Port Authority, the National Security Agency, the Ministry of Finance,

the National Oil Company of Liberia, the National Port Authority, the Environmental Protection Agency, and the Office of the National Security Advisor.

5.4. OTHER GOVERNMENT INSTITUTIONS

National Investment Commission (NIC): the investment promotion drive for the fisheries sector will be handled in collaboration with the National Investment Commission. The Commission already co-operated with the BNF for the extension of the Mesurado fishing pier in Liberia for lease from 10 to 25 years and has indicated its willingness to take up the new challenge in fisheries investment promotion.

Ministry of Commerce and Industry (MCI): the Ministry of Commerce and Industry will lead the sensitization drive to get Liberian participation in the establishment of value addition facilities at the designated land located at Mesurado. This could be helpful in facilitating credit for the realization of the facilities.

Forestry Development Agency (FDA): responsible for forestry and forests related conservation including mangroves which are used for fish preservation. It will be essential in sensitization on minimization of use and introduction of fuel efficient and energy saving systems in the fisheries.

Environmental Protection Agency (EPA): responsible for environmental monitoring and management including limiting of excessive exploitation and pollution of the fisheries waters. Its supervision of the preparation of ESIAs and ESMPs is even more relevant in the establishment of fisheries infrastructure.

Liberia Institute Statistics and Geo Information Systems (LISGIS): responsible for data management including fisheries data and already works closely with the Statistics Division for estimation of contribution of fisheries to GDP.

Ministry of Justice (MOJ): responsible for adjudication of cases particularly, infringements of the fisheries regulations.

Ministry of Lands, Mines and Energy (MLME), Lands Commission and Ministry of Internal Affairs: concerned with land issues for fisheries development, acquisition, surveys and facilitation of land titles.

Ministry of Finance: will work to provide the mechanisms for revenue management and projections.

The Ministry of Health (MOH) and the Standards Board (SB): will be responsible for fish sanitary certification through the competent laboratory to be established for fish imports and exports.

The Ministry of Youth and Sports (MYS) and the Ministry of Gender and Development (MGD): will mobilize the disadvantaged groups, including youths, women and other vulnerable groups for engagement in aquaculture and post-harvest activities.

The Ministry of Education (MOE) and Ministry of Information, Culture and Tourism (MICAT): will be involved in curriculum development and sensitization for capacity building for fisheries education programs.

Universities involved in fisheries work: a fisheries curriculum is being developed at the University of Liberia and that will provide the workforce for fisheries extension and research. The Cuttington University in Liberia has an aquaculture program and will be involved in training of managers as well as short courses for capacity building for aquaculture. There are ongoing collaboration with the University of Iceland, as well as other partners and stakeholders.

5.5. Fisheries Monitoring Center (FMC) in Liberia

The Fisheries Monitoring Centre (FMC) is a crucial central pillar to achieving effective fisheries monitoring, control and surveillance (MCS) in Liberia. If it is not operational, very basic MCS functions cannot be completed. In addition, further important capacity building and increased

efforts to combat IUU fishing cannot be achieved if the basic technical needs of the FMC are not in place.

The Fisheries Monitoring Center (FMC) of the Bureau of National Fisheries (BNF) is set up to:

- maintain Geographic Information System (GIS) database information for later feedback into the central database;
- monitor Vessel Monitoring System (VMS) information in accordance with Standard Operating Procedures (SOP's) and report offences to the Operational Coordinator (MCS Specialist) with recommendations for subsequent actions;
- maintain a comprehensive plot for all fisheries MCS operations and fishing vessel positions through HF radios and VMS 24 hours a day and 7 days a week for briefing senior staff and as a basis for subsequent operations;
- effect detailed logging systems and provide charts for all fisheries MCS operations;
- receive and process fisheries MCS inspection data from inspectors and observers reports and feed back into the central database on a daily basis;
- provide regular access to databases and websites in researching new MCS equipment and techniques, and advise stakeholders on recommendations for syllabus changes arising;
- collate photographic and GPS information arising from operations to support the prosecution process and to enhance training; and
- provide monitoring of VMS and AIS information, and plotting on Google Earth.

Table 7. Liberia MCS organization and operations in 2012

MCS Asset	Operational (Y/N)	Days of Year available	Number of monitored/sighted vessels
VMS	Y	365 days	7 vessels (2011) 2 vessels (2012)
AIS	Y	365 days	All vessels > 299 GRT (fishing, cargo, tankers) within the Liberian waters since 2011
Coastal Patrol Vessels	Y	365 days-available based on periodic fisheries sea patrol schedule, intelligence reports from BNF staff	7 vessels sighted in 2011 3 vessels sighted in 2012

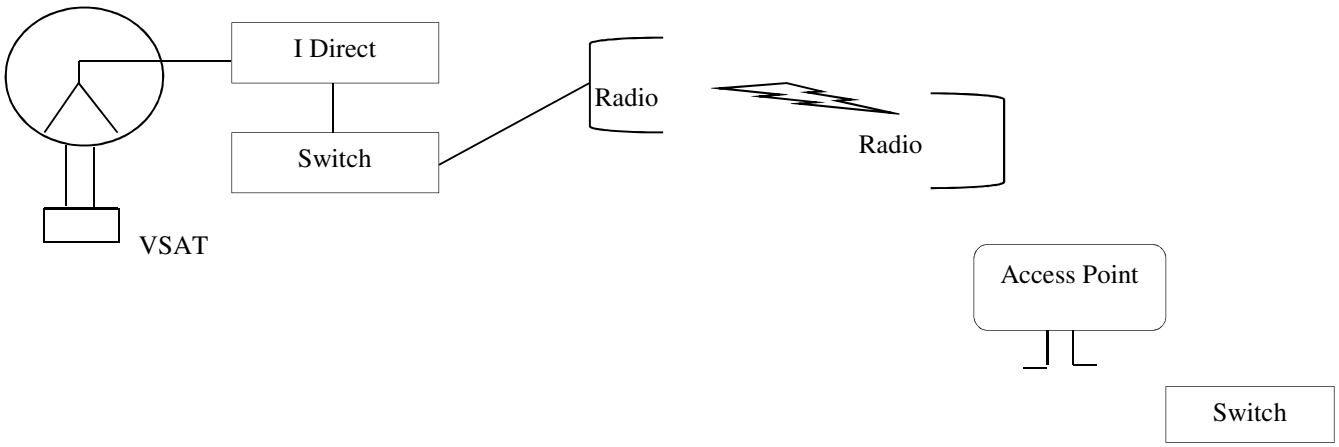
		& relevant partners	
High Sea Patrol Vessels	N	NA	NA
Air Craft	Y	24 to 30 days a year	86 vessels (fishing, cargo, tanker) in 2011 & 2012
Community MCS Program	Y	365 days	-
Operating Bases	Y	365 days	4

Source: Sherif (2012). Monitoring, Control and Surveillance (MCS) Operations in Liberia: Workshop on West Africa Regional Collaboration for MCS-Liberia, Sierra Leone, Ivory Coast & Ghana. 30-31 October 2012. Monrovia, Liberia.

The FMC, which is run by the BNF, is supported by a host of ocean viewing software and equipment, all of which require a high speed and reliable internet connection to effectively run and provide the valuable services required. Based on the above needs, mandates and responsibilities of the FMC, it is a requirement that the Fisheries Monitoring Center (FMC) is provided with a complete and reliable internet connection to support software and equipment for the effective monitoring and reporting of vessels' activities in the Liberian waters.

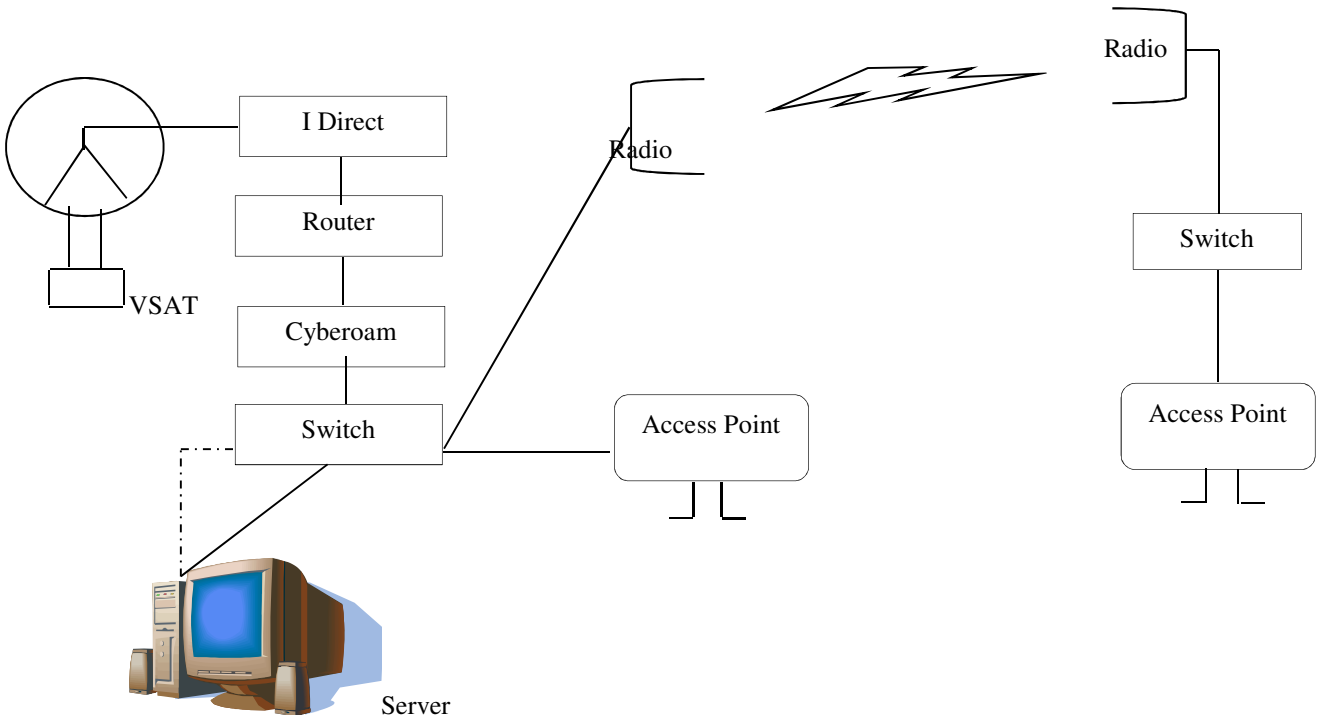
5.5.1. Liberia FMC Internet System Analysis

Figure 1. Schematic of FMC equipment and internet connectivity of current set up



Source: Sherif (2013). FMC Communications and Internet System Review

Figure 2. Schematic of recommended set up for the Liberia FMC equipment and internet connectivity



Source: Sherif (2013). FMC Communications and Internet System Review

Table 8. Comparative analysis of current and recommended setup of FMC internet system connectivity

EQUIPMENT	FIGURE 1: FMC SET UP	FIGURE 2: RECOMMENDED FMC SET UP
VSAT *Very Small Aperture Terminal*	Allocated bandwidth (126/126) for this set-up is inadequate to support full implementation internet system coverage for all of the users (FMC, WARFP, BNF) and systems (VMS, AIS, CMAPS) installed.	A recommended bandwidth for an adequate internet connection to support coverage of signal broadcast from the VSAT is in the range of (768/256). This bandwidth range is applicable to drive as many as 50 users of the internet and support system and server applications at the FMC through reliable, efficient and sustainable internet connectivity.
I-Direct	This circuit is installed and is currently supporting the interpretation of signals from the VSAT for application.	There should also be a requirement to support this set up with an I-Direct with applicable specifications to support the VSAT connectivity and as well as other equipment within the network.
Router	There is not a router in the current set up at the FMC	A router is of a significant asset to the network and is a requirement for all such

	which could put the system at a serious disadvantage. If a router is installed at this location-where is it connected?	set-ups to include. The router should be responsible to provide IP addresses, control services (data traffic in and out of the network). An enterprise router is most ideal to support this set up.
Cyberoam	There is no Cyberoam connected to this set up. This is one key reason why the entire set up is vulnerable to internet insecurity and prone to acute virus invasion.	The cyberoam will assist this set up in managing the different bandwidths for different systems and as well as giving priorities to more useful websites. This will also deny access to users that are not authorized to browse the network-password protected.
Switch	There is a switch available within this setup which grants access to desk top PC's.	This requirement will make provision for desk top PC's to access the internet.
Access Point	There is no access point within this set up. This should be functional to grant laptop PC's access to the internet.	This circuit/device will allow laptop PC's to access the internet from FMC, WARFP, BNF and any other as may be required.
Radio	There is an established point-to-point connection within this set up that allows the broadcast of wireless signals to other points on the network.	The radio facilitates point-to-point or point-to-multipoint connection on the network based on the established links. This is a requirement for the recommended set-up at the FMC, WARFP, BNF and any other to be identified to share this connection.
Server	The server which is already available at the FMC is not connected to this network.	The server on this network is essential to allow computers (desktops &laptops) share information on the internet. The server should also be configured to serve as a Domain Controller (DC)-a server that responds to security authentication requests. Provision should be made for a licensed Operating System (OS)-i.e. MS 2008 Server (most recent version)

Source: Sherif (2013). FMC Communications and Internet System Review

5.6. LIBERIA FISHERIES ENFORCEMENT CAPABILITIES

5.6.1. Adequate Surveillance Infrastructure

Patrol Aircraft: there is not yet a state owned aircraft for fisheries surveillance. Aircraft used for fisheries surveillance is owned by the United Nations Mission in Liberia (UNMIL). There is an existing MOU that promotes interagency collaboration in view of shared human resources and assets. The UNMIL is an Observer to the party agreement. To operationalize the MOU, an Administrative and Operational Framework was developed as a standing order which clearly

indicates roles and responsibilities of relevant agencies to avoid overlap of functions. There are 3 to 4 aerial patrols monthly. This joint patrol includes personnel from the Bureau of National Fisheries (BNF), Liberian Coast Guard (LCG), Liberia Maritime Authority (LMA) and UNMIL representative(s). A week before a patrol is scheduled an intelligence brief by the BNF is submitted to the UNMIL suggesting flight path and waypoints. Table 8 presents an analysis of joint aerial patrols with the UNMIL and the LCG which are used as a benchmark to gauge the participation of stakeholders and deliverables set out in work plans for MCS and the sector as a whole.

Table 9. Result indicators for joint aerial patrols for 2013

Ministry of Agriculture, ***BNF***	**Section**	**Indicator**	**2013 (January to present)**	**Remark**
	MCS	Number of Licensed Fishing Vessel per Fishery	o Shrimper-2 o Demersal-2 o Tuna-0	The BNF anticipates licensing several tuna vessels after finalization of MOU with tuna companies this year.
		Number of Aerial Patrols	A total of 7 aerial patrols were conducted during the months of January to present: **January 3, January 24, February 4, February 25, March 28, April 12, May 1, and July 23.** The last flight was on 1st May before the suspension of flights due to BNF insurance issues. Aerial flights were suspended temporarily from 6th May to 23rd June 2013. Aerial reconnaissance flights were suspended in the 2nd quarter (May) due to the BNF initiative to provide insurance coverage for BNF and WARFP staff. Further, the aircraft for patrols was shortly assigned to the UN operations in Mali. Joint reconnaissance flights by BNF, UNMIL and other stakeholders resumed as of 23rd July 2013 after 2 months.	The BNF has completed insurance coverage for 10 of its staff to guarantee the active participation aboard aerial flight. 5 BNF personnel have been trained to become Air Patrol operatives, including the use of telephoto lenses. Training is ongoing, and each flight provides invaluable experience. Aerial patrols contributed significantly to joint operations in northern Liberia held in the period March-June 2013, targeting illegal trawlers. Operations involved the BNF, LCG, UNMIL and local Community Association providing air, sea and shore cover. The fishing vessel Nine Star was arrested on 7th June 2013 as a result of this operation. Anticipated licensing of several tuna purse seiners highlights the crucial need for air cover, as these vessels will be operating beyond sea patrol capabilities. Air patrol will be the only means of visual monitoring of their fishing activities. Aerial patrol identified the presence of a pole and line tuna vessel in the

				Liberian waters. Although the vessel was not identified, it was the first indication that this type of vessel was operating in Liberia. Monitoring Control and Surveillance (MCS) Operations Manual is currently being developed. SOPs will be drafted in consultation with UNMIL in order to improve cooperation and information sharing.
		Number of vessels sighted	A total of 16 vessels were sighted in 2013 (January to present): 10 cargo vessels 1 crude oil tanker vessel; 2 oil platforms; 2 fish carriers and 3 fishing vessels (2 fishing vessels are registered with the BNF to engage in fishing and/or related activities in the Liberian waters in 2013)	Photos of vessels are available based on request (for stakeholders only).
		Number of vessels sighted committing infractions	None	The primary objective of MCS is to ensure compliance with the Fisheries Regulations. JMAP flights provide an important monitoring platform, as well as a crucial deterrent to IUU fishers and to-be-violators.
		Number of arrests, type of violation, penalties	None	The F/V Panofi Discoverer was sighted fishing illegally in December 2012 during a JMAP flight. The vessel was fined. Subsequent investigations of the company and its vessels led to the identification of 2 other Panofi vessels operating in Liberia illegally, both vessels were fined. Consequently, other Panofi vessels have been barred from licensing in Liberia until evidence is provided that they were not fishing in Liberia illegally.

Source: MCS Annual Report. (2013). West Africa Regional Fisheries Project (WARFP), Bureau of National Fisheries.

Sea-based patrol Vessel: The Liberian Coast Guard (LCG) has 2 Defender Class Vessels that are shared with the BNF in accordance with the MOU of the MCS Coordination Center. There are targeted/scheduled fisheries sea patrol(s) monthly. Patrols are also planned intermittently based on intelligence from the BNF and other stakeholders. The MCS Coordination Committee (MCSCC) has agreed to a draft Standard Operating Procedure (SOP) detailing processes and responsible institution(s) at each stage.

Coastal Patrols: the BNF is yet to embark on a full-scale coastal patrol. There are ongoing stakeholder consultations to support this effort.

5.6.2. At Sea Inspection

*Identification by sight***:** Recently, there have been few industrial fishing vessels that are authorized/ licensed to fish in the Liberian waters. There has not been much activity of IUU fishing vessels within the territorial waters of Liberia since the commencement of the new fisheries regime in April 2011 (Table 10). There have been numerous reports of IUU fishing activities off the coast of the fisheries waters. However, vessels engaging in such acts were, over the period, apprehended and fined in contravention of the fisheries regulations. With 4 scheduled sea patrols monthly, vessels are inspected at sea randomly during routine fisheries sea patrols with the few legal trawlers authorized.

Table 10. Total Industrial Foreign and National Fishing Vessels Licensed to Fish in 2011 and 2012

Year	Fishery	Number of Licensed Foreign Vessels	Number of Licensed Domestic Vessels
2011	Demersal	4	2
	Pelagic (Tuna)	NA	NA
	Reefers	NA	NA
	Other	1	NA
2012	Demersal	0	2
	Pelagic (Tuna)	0	0
	Reefers	NA	NA
	Other	NA	NA

Source: Sherif (2012). Monitoring, Control and Surveillance (MCS) Operations in Liberia: Workshop on West Africa Regional Collaboration for MCS-Liberia, Sierra Leone, Ivory Coast & Ghana. 30-31 October 2012. Monrovia, Liberia.

*Boarding for Inspections***:** With little activity of IUU fishing vessels in the Liberian territorial waters, LCG and BNF are authorized to board any fishing vessel suspected of IUU fishing activities, inshore and offshore. There are reporting forms and SOPs that support these exercises.

5.7. CASES OF ILLEGAL FISHING ACTIVITIES IN LIBERIAN WATERS[17]

In accordance with the Fisheries Regulations of 2010, the Bureau of National Fisheries (BNF) in Liberia seeks to reduce illegal fishing activities threatening the sustainable management of the marine fish resources and the wealth they can generate. More specifically the BNF is working towards improving the fisheries monitoring, control and surveillance (MCS) system of Liberia and adapting it to the needs of fisheries management, within the framework of promoting collaboration between the BNF (observer program and fisheries inspectors) and the artisanal monitoring community science program.

In June 2011, the F/V Seta 70, a bottom trawler represented by the Inter Burgo Fishing Company was monitored, and observed from 17 -28 June 2011 fishing in the Inshore Exclusion Zone (IEZ) reserved for artisanal fishing vessels. The evidence for the illegal entry into the IEZ came from the Vessel Monitoring System (VMS) based in the Fisheries Monitoring Center (FMC), community reports and from the Fisheries Observer assigned aboard the vessel.

In contravention of Liberia's Fisheries Regulations, the F/V Seta 70 was found to be: engaging in industrial fishing activity within the IEZ; switching off the MTU for VMS monitoring; failing to stow and secure fishing gears while in an authorized fishing area and actively engaged in fishing activities with such gears; unauthorized transshipment at sea; failing to report the vessel's position to the Coordinator and FMC by High Frequency Radio every twenty-four hours while in Liberia's Fisheries Waters; failing to maintain a fishing log for each fishing trip in the licensed area and reporting such information to the Coordinator each day while the vessel was in Liberia's Fisheries Waters; neglecting and refusing to provide the BNF fisheries observer material information on location, fishing activities and vessel speed and direction; restricting observer movement on board, refusing catch sampling and Observer access to ship's bridge.

[17] The International Fisheries Observer and Monitoring Conference (IFOMC) Abstract Book. (2013). F/V Seta 70 and other cases of illegal fishing in the Liberian Waters by Sheck Sherif. See http://www.ifomc.com/web2/LibroIFOMC.pdf, p. 95.

With details of the vessel's activities analyzed and infractions documented, the BNF ordered the detention of the F/V Seta 70 for engaging in illegal fishing activities in the Liberian waters. The arrest of the F/V Seta was conducted at sea by the Liberian Coast Guard (BNF) and the BNF on 22nd July 2011in Buchanan and the vessel was escorted to Monrovia on 23rd July 2011. A case was established by the BNF and submitted to the Ministry of Justice which led the successful prosecution of the vessel. The vessel pleaded guilty and negotiated for a settlement. The F/V SETA 70 was fined and banned for 6 months in September 2011. In addition to the SETA 70, engaged in IUU fishing activities in the Liberian waters, other cases of tuna purse seiners suspected to have engaged in illegal fishing activities in the Liberian EEZ in 2011 and 2012 including EROS and DONIENE were fined in accordance with the fisheries regulations.

5.7. FISHERIES ENFORCEMENT PERSONNEL

The requirements for MCS include personnel to address each of the components of monitoring, control and surveillance and the numbers of these personnel will vary with the MCS scheme in place, but the basic requirements would remain fairly constant. These personnel need varied levels of expertise (Flewwelling, et al., 2002). For example, those personnel responsible for collection and tally of fisheries and MCS data need to be literate with good intercommunication skills with knowledge of the fishery and its legislative framework. This includes fisheries observers for vessels engaged in fishing activities in the fisheries waters of Liberia. An observer scheme is only appropriate if capable, honest and dedicated personnel are available, preferably with offshore sea experience. In many States, close supervision of the Observer program is necessary to ensure safe working conditions and minimum interference with the observer's duties (Dietrich, et al., 2010).

Effective MCS requires well-trained and qualified staff, and MCS-specific training and capacity building must be given priority to develop a strong and confident MCS regime. MCS personnel will frequently be required to operate in hazardous environments, in the field, out of office hours, and in an environment where the opportunity for corruption is high. Currently there is little recognition within the BNF and the wider Government that MCS personnel are playing an enforcement role, instead they are categorized as similar to other Ministry of Agriculture staff

(NFDS, 2012).

- Very few BNF staff have terms of reference, and MCS personnel and operations are limited by the lack of job descriptions, defined responsibilities, and structured working and reporting conditions. While those based in Monrovia are for the most part well equipped, there is little support provided to personnel working additional hours and in hazardous conditions.
- The capacity of MCS personnel has improved significantly; however, training for the majority of MCS personnel must be built upon and expanded, particularly considering that almost none have a fisheries educational background. Staff that have received formal training in an area of expertise are frequently assigned a different role within the BNF indicating inadequate HR planning. BNF does not make use of their training to the benefit of the BNF, MCS or each individual's career.

5.7.1. Fisheries Observer Program[18]

In order to address deficiencies in fisheries management and research following the civil conflict, the Bureau of National Fisheries (BNF) established the Liberia Observer Program (LOP) in April 2011. This was done in accordance with the Fisheries Regulations of 2010 (Section 48) which stipulates a 100% observer coverage for industrial fishing vessels licensed in Liberia. Fisheries observers were recruited by the Bureau of National Fisheries (BNF) and trained by the National Oceanic and Atmospheric Administration (NOAA). The Observer Program is staffed with 17 observers including a 3-person management team.

With support from the West Africa Regional Fisheries Project (WARFP) in Liberia and NOAA, the BNF has developed along with the LOP a new database for observer information, vessel registration and IUU activity. The observer program works primarily with the research and statistics division of the BNF, but also supports the work of the Monitoring, Control and Surveillance Coordination (MCS) team. The mandatory reporting system of the LOP has substantially increased fisheries data collection, and contributed to the reduction of illegal

[18] The International Fisheries Observer and Monitoring Conference (IFOMC) Abstract Book. (2013). The Liberia Observer Program by Sheck Sherif. See http://www.ifomc.com/web2/LibroIFOMC.pdf, p. 128.

discards. Further observer initiatives have contributed to MCS efforts, including information leading to the arrest and prosecution of IUU fishing vessels.

The effectiveness of the observer program has fostered a greater understanding of fish stocks and industrial catch effort in Liberia, as well as increased compliance with the Fisheries Regulations. It is the plan of the West Africa Regional Fisheries Project (WARFP) in Liberia to gradually develop the Liberia Observer Program to support efforts to establish, and be an integral part of a West Africa Regional Observer Program.

5.7.2. Fisheries Inspectors

Fisheries inspectors of the BNF have received standardized training from senior MCS staff and other international partners. In accordance with Article 45 of the Fisheries Regulations of 2010, fisheries inspectors are authorized to exercise monitoring, control and surveillance compliance functions within areas under national jurisdiction and in relation to other laws and international conservation and management measures beyond areas of national jurisdiction in accordance with any international agreements. However, inspectors are responsible for monitoring landing sites and collecting data for species landed as well as monitoring and enforcing compliance requirements.

5.7.3. Fisheries Monitoring Center Staff

Like the fisheries observers and inspectors, fisheries monitoring center staff have received training from both local and international MCS staff. FMC staff are responsible for the monitoring and recording of vessels plying Liberian waters. These include commercial fishing vessels that are registered and licensed to engage in fishing activities in Liberian waters and other vessels (non-fishing) that are greater than 299 GRT. In addition, FMC staff conduct these operations for 10 hours each day with the exception of weekends.

Figure 3. Development of maritime patrol capabilities in Liberia (2012)

(L) Joint Maritime Aerial Patrol with the United Nations Mission in Liberia, Liberia Maritime Authority, the Liberian Coast Guard, and the host, Bureau of National Fisheries. *(R)* Liberian Coast Guard Personnel and 2 patrol vessels jointly used by the BNF and the LCG for fisheries sea patrols.

5.8. SWOT ANALYSIS ON STRATEGIC ISSUES FOR LIBERIA MCS

The SWOT analysis below analyzes Strengths, Weaknesses, Opportunities and Threats of Liberia MCS. It is a simple tool that targets sensitive areas of a particular sector by providing indicators which identify challenges and Threats and could be the solution for fostering sustainable development.

Table 11. SWOT analysis based upon four strategic areas of Liberia MCS

Strategic Area	Strengths	Weaknesses	Opportunities	Threat
MCS (Fishing Activities)	A well designed organizational structure. Unlicensed fishing in the EEZ is practically under control. Sea and aerial patrols are in place and operational with assistance from collaborating partners. Patrols are however well planned and briefed. Mobile Transceiver Units for VMS monitoring are deployed on all registered	Lack of integration between MCS platforms. Poor internet connectivity at the FMC which slows down reporting time of VMS and impede information sharing. Fisheries observers and inspectors lack adequate surveillance training. Standard Operating Procedures (SOPs) in place do not cover all aspect of MCS activities. However,	Young Liberians are being trained every year which could be an asset to the sector. The University of Liberia is now reviewing a draft curriculum to start a fisheries course. Strengthening skills and capacity of VMS application and operations. Constructions of the new BNF headquarters and	Suitability and technical standards of MCS platforms are not adequate. No fisheries lawyer for the adjudication of fisheries cases in the earliest possible time. The process of outsourcing is delayed. Long coastline with extensive fishing grounds which makes management challenging.

	fishing vessels. Coastal patrols are regularly carried out NOAA is working closely with the BNF to train all fisheries observers including inspectors and MCS staff. Strong international partners.	SOPs available are not adhered to. No evaluation scheme to rate and motivate personnel. No much knowledge on fisheries science and management. No offshore patrol capability.	FMC are underway. Strong partnership in the region.	
Strategic Area	**Strengths**	**Weaknesses**	**Opportunities**	**Threats**
Landing and Catch Controls	The BNF has skilled staff that monitor nearly all landings Monthly landing reports are submitted to the dashboard office of the BNF to further advise management. There is good cooperation between the operational and statistical/dashboard sections of the BNF.	Functions of the Fisheries Information Management System are inconsistent due to intermittent internet connections. Poor management of resources especially overtime. Poor information on baseline activities. Mechanisms in place to weigh landings are not monitored. Knowledge on fisheries science and management is limited.	Restructuring the VSAT and internet connectivity will make fully operational the VMS and the Fisheries Information Management System which will aid in data flow and management. New competent authority will add value to landings and exports.	Willingness to adapt to change is not acceptable to all staff members. The sector expansion expansion that is too widespread for us to consistently monitor. FIMS remains un-operational or does not meet the overall requirements of the BNF. Lack of transparency in the monitoring of landings interferes with accurate catch control estimations. Too high demands on inspectors for other duties to allow adequate monitoring of landings.
Strategic Area	**Strengths**	**Weaknesses**	**Opportunities**	**Threat**
Support Services	Trained personnel in senior positions. Fisheries centers being constructed in 2 counties. Basic infrastructure is in place including the identification and construction of 3 coastal stations.	An out of date structure, limits the efficiency to perform required functions. No updated working practices and duty guidelines. Poor information on baseline activities. Complete lack of an IT support section. Un-operational computerized maintenance system for the FMC, WARFP and BNF.	Implementation of the new MCS strategy and development plan when it is finalized. Increased IT communication with technology advancement.	Adaptive management will not be acceptable to all staff. Unclear personnel management due to ineffectiveness of TORs.

		Lack of internet connectivity between offices.		
Strategic Area	**Strengths**	**Weaknesses**	**Opportunities**	**Threat**
Management	A good and well defined management structure. A positive image in the Ministry of Agriculture and industry of an adaptable management. The development and integration of VMS operations into MCS activities. MOU on MCS activities.	Lack of information sharing Lack of understanding of modern management strategies with the sharing of responsibilities based on TORs. A lack of capacity of technical staff. Lack of information sharing in the BNF.	Making the Fisheries Information Management System fully operational. New strategic planning for the BNF and considering autonomy in the short term. A new MCS strategy and development plan for 5 years beginning 2015. Cooperation with relevant stakeholders in the maritime domain.	No strategy for regional participation and evaluation of transboundary cooperation. If the MCS strategy and development plan will be implemented as developed and recommended? Fear of taking unpopular Decision. Lack of effecting TORs resulting in overlap of functions.

Table 11, SWOT analysis based upon four strategic areas for Liberia MCS, has examined core areas relating to the implementation of fisheries MCS in Liberia over the past four years. Weaknesses and threats have been identified for fishing activities, landing and catch controls, support services and management. Also highlighted, are strengths and opportunities which have identified potential for the development of the sector. The weaknesses and threats identified trigger solutions that would resolve some of the challenges faced by the fisheries sector and the implementation of MCS strategies. If adopted, these recommendations would augment the implementation of fisheries MCS in Liberia, thereby improving enforcement mechanisms, preventing, deterring and eliminating IUU fishing in the Liberian waters.

CHAPTER SIX

VESSEL MONITORING SYSTEM (VMS) AS ENFORCEMENT AND SURVEILLANCE TOOL

6.1. OVERVIEW OF VESSEL MONITORING SYSTEMS (VMS)

A satellite-based VMS involves the monitoring of vessels within certain areas for the purpose of ascertaining vessels' location and/or the type of activity in which they are engaged. In the context of this work, this activity will focus on fishing. Conventional types of VMS do not rely on satellites but on vessel movement reports by radio, aerial or surface surveillance, land based radar, sea based sonar, observer programs or incidental reports by other (fishing) vessels or airplanes.[19]

A preliminary distinction which has to be made is between vessels that have or have not installed the so-called 'automatic location communicators' (ALCs).[20] This equipment is capable of automatically transmitting a signal with position and other information to a satellite or another type of receiving station.[21] Currently, the main satellite systems which can be used for this purpose, in addition to a variety of other purposes, are Inmarsat and Argos.[22]

[19] Certain States, for instance Mozambique, have adopted a system of 'self-surveillance' under which licensed fishing vessels are required to report on (alleged) illegal fishing activities (noted in FAO Doc. GCP/INT/606/NOR, *Report of a Regional Workshop on Fisheries Monitoring, Control and Surveillance (Albion, Mauritius, 16-20 December 1996)*', Rome, FAO, 1997, at p. 10). This imposes therefore an obligation on those who would already have an incentive to oppose free riders.

[20] These are transmitters or transceivers integrated with Global Positioning System (GPS) and an automated reporting system (*cf.* FAO VMS Guidelines, p. 8). Terminology used instead of ALCs includes: Vessel Location Device (VLD; used by FAO VMS Guidelines) and 'vessel tracking device' (EC Commission Regulation No 1489/97, of 29 July 1997, *Official Journal* 1997, L 202/18). See also the developments on automatic identification systems (AIS) within the International Maritime Organization (IMO) in Section 4.2.

[21] For example by radio (VHF).

[22] Quite recently, Argos became also capable of two-way communications. Inmarsat is operated by the International Maritime Satellite Organization. A variety of regional systems exist as well, for example Euteltracs and Boatracs in Europe and the United States respectively. Eutelsat stands for the European Telecommunications Satellite Organization (J. Fitzpatrick, *Satellite Data Communication Systems, Remote Sensing and Other Techniques as an Aid to Monitoring, Control, Surveillance and Enforcement*, in: '1996 Mauritius Workshop', *supra* note 11, at pp. 131-132).

6.1.1. Fisheries Enforcement Equipment

There is a long list of equipment requirements for the implementation of a cost-effective MCS system. This list must be designed to reflect the needs of the State and the priority of its fisheries. However, relevant equipment required will vary according to the intent, priority and degree of commitment of the State involved, the location, types and value of its fisheries (NOAA Fisheries, 2013).

Most states, however, determine the system best suited for the fisheries based on the type of vessels engaged in fishing, fishing methods employed, and the types of fisheries. These also determine the combination of different tools and equipment to develop an appropriate cost-effective MCS system. Interagency collaboration and information sharing and exchange to benefit relevant stakeholders in the maritime domain will support justification of the costs of system development and maintenance, which is important for the sustainability of the MCS system in place. Generally, states mounting VMS on fishing vessels as a condition of licensing and as well as other equipment for monitoring and enforcement purposes are encouraged to ensure that all stakeholders are committed to procure and maintain this equipment for the sustainability of effective management operations. This, however, must be considered before the arrangement for new MCS equipment. This equipment is often expensive, both in procurement and operations and in maintenance.

Currently the most popular VMS systems use INMARSAT C (and more recently D) and ARGOS. Others such as POLESTAR and EULTRACS are also making an appearance. FAO has prepared detailed guidelines as part of the *Code of Conduct for Responsible Fisheries* series for Fisheries Administrators contemplating the introduction and use of such technology.[23] Although the new IRIDIUM technology has not only made an appearance, it is becoming widely used including in Liberia, West Africa.

[23] FAO (1998).

6.1.2. VMS Hardware

The transmitter or transceiver, a device that is used in a circuit or equipment to boost signal strength to reach farther or receive from a distance, has been manufactured to automatically fix positions and calculate the speed and course of the vessel (Elbert, 1999). In the case of the operations of VMS systems, the transceiver is most often referred to as a Mobile Transceiver Unit (MTU) otherwise known as the black box. The Global Positioning System (GPS) is a component of the VMS unit that has a separate antenna for transmission of signals. It has been used successfully by the fishing industry which is generally an ideal system because of its accessibility, high level of accuracy, and low equipment cost. This component can be used independently or in combination with the VMS to increase accuracy of reporting (European Commission, 2012). The automated reporting functions and system achieve their purpose through a combination of computerized instructions in the transmitter and functions available in the communications system (FAO, 1998). The automated reporting system is capable of being programmed to send position reports periodically or at specified time intervals.

Figure 4. Faria WatchDog 750VMS is Type Approved by the Bureau of National Fisheries

Source: Satcomms Australia. (2012). Watch DOG Inc. Leading the Way in Satellite Tracking

The communications system moves data between the transmitter/transceiver on the vessel(s) and the Fisheries Monitoring Center. On the other hand, satellite communications can be described as a microwave repeater station that permits two or more users to deliver and exchange information in various forms (Elbert, 1999). The need and use of satellite is specific for the case of VMS although may not be necessary for other applications of shipboard equipment used for MCS purposes. Also, other tracking programs for shore based equipment use cellular phones, Very High Frequency (VHF) and High Frequency (HF) radios. For example, China had on trial a VMS which uses Single Side Band radio as part of the communications system (Molenaar & Tsamenyi, 2000). However, for monitoring and control of commercial and industrial fishing vessels, satellite based communications systems are considered the most appropriate. As compared to other forms of communication systems, satellite based communications have global coverage and high reliability which is often considered as an added advantage.

The Mobile Transceiver Unit (MTU), a VMS hardware mounted on board the vessel, is an integrated satellite based communications system which transfers data from the vessel to a satellite and then to an earth station. This information is received by the monitoring agency from the earth station through a secure public data network (Molenaar & Tsamenyi, 2000).

6.1.3. Processing of VMS Data

The VMS data processed contain the vessel identifiers. They relate to a person who can be identified once combined with data available in other databases, for example the Fleet Register and Electronic Recording and Reporting System (ERS). The following personal data are concerned (European Commission, 2012):

- Vessel identifier (directly)
- Vessel owner's and agent's name and address (indirectly)
- Vessel master's name and address (indirectly)

In Liberia, the FMC which is responsible for collecting, processing and storing data from the earth station, which is SatComms in Australia, is computerized. FMC monitoring is capable of collecting the data received from the earth station, storing that data for subsequent review,

analyzing the data to detect and highlight exceptional conditions of interest to monitoring officers, and displaying that data in a meaningful way, typically against a background map. A specialized Geographical Information System (GIS) is also a highly desirable element of the FMC, particularly for historical and statistical analysis of both position and catch data.

This mode of operation remains essentially unchanged from the earliest days of VMS. The improvements that have been made include more integrated shipboard equipment in that the earliest installations linked satellite communications terminals with external GPS receivers, whereas these two elements are now systematically integrated (The High Seas Task Force, 2005). The accuracy of the integrated GPS system has however reduced with each position error to less than 10 meters, from the 100 meters margin of error in the first VMS systems, though this improvement often provides little real advantage to the day-to-day operations (FAO, 1998).

6.2. LIBERIA VMS SYSTEM

6.2.2. Liberia VMS Equipment Type

In 2011, the Bureau of National Fisheries (BNF) in Liberia approved Faria WatchDog 750VMS as the official Mobile Transceiver Unit (MTU) for VMS monitoring and reporting, following the enforcement of the Fisheries Regulations of 2010.

The Faria WatchDog VMS reporting system is an iridium satellite-based location tracking, communications and monitoring system. Faria WatchDog pioneered the use of Iridium Satellite's SBD (Short Burst Data) network for vessel monitoring, communication and tracking.

6.3. Technical Integrity and Installation Procedures

There are many different procedures and processes involved with the installation of a VMS system. These processes are dependent on several factors such as the type of fisheries, vessel types, fishing methods deployed, and laws and policies. However, before the application of a VMS system and installations of MTUs, technical specifications of the VMS system must be defined. To do this, it is important to ask questions, such as which fisheries can benefit from a

VMS and, specifically, how the activities of the different types of fisheries will be improved by gathering data on the movements and activities of vessels (Molenaar & Tsamenyi, 2000).

Like most other countries, VMS applications in Liberia are based upon the size of the vessel. This means that the larger the vessel, the more effort put into installations, and, therefore, the more the need for the implementation of VMS. However, this must not be the case. Instead, the questions of technical specifications for the application of a VMS system and installation of MTUs must be considered to ensure the consistency and sustainability of the system.

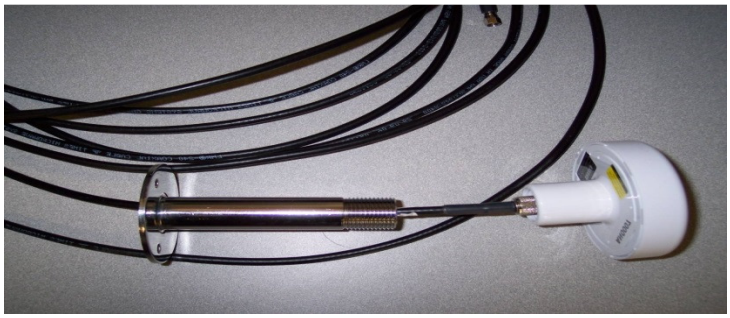
The Faria WatchDog has recommended specific procedures for the installation for the equipment and system. These include:

1. *The unit serial number is also shown on the product label on the WatchDog transceiver.*

2. *Check all the parts in the kit box (this is a picture of an open kit box).*

3. Check all the parts in the kit box (this is a picture of all the components packed in the kit).

3. Locate an area to mount the two antennas that has a clear view of the sky.



4. Connect iridium and GPS antenna cables with the antennas through the antennas mount.

4. *Drill holes for the antennas to run to and connect to the Faria WatchDog MTU. However, glands must be used to protect the cables from damage and prevent water ingress.*

Source of the Above Photos: Satcomms Australia. (2012). Watch DOG Inc. Leading the Way in Satellite Tracking.

In spite of the procedures listed above; there are performance limitations due to several factors which determine the signal strength throughout fishing trips. The strength or performance of a satellite system and its transmission efficiency is principally based on the quality and strength of the VMS type approved and used by the vessel and communications system including internet connectivity of the FMC. The power available in the satellite and the extent to which the satellite can focus on a geographical area are interrelated factors which determine the size and power requirements of the vessel MTU and antennas (FAO, 1998). In addition to these procedures, there can be other measures applied to ensure that the VMS systems on board fishing vessels are not frequently tampered with.

6.4. LIBERIA VMS WEAKNESSES

Misperceptions surrounding MCS activities continue to impact how fishers and even fishery managers view the process of MCS and enforcement which include the implementation of VMS systems. A common misperception is that all fisheries problems stem either from a failure to control illegal foreign fishing, or from the fishers themselves; while foreign fishing fleets have had documented impacts on activities and impact on fisheries and associated habitats, the greater impact on fisheries often stems from the domestic fishing industry in the coastal and near shore fishing zones (Flewwelling, et al., 2002).

The use of VMS in Liberia has considerably reduced IUU fishing activities with violators being brought to justice and would-be violators deterred. Increasingly, the activities of every vessel authorized to fish are consistently monitored, documented and reported 365 days of the year. Since 2011, the introduction of VMS has seen the likelihood of detecting IUU activities such as fishing in prohibited areas. Once the data received from the FMC on VMS operations continues to be reliable, the fisheries sector will increasingly be boosted with responsible and sustainable fishing practices.

However, the principal advantages of VMS include: authorities being aware in real time of the accurate positions of all licensed fishing vessels, the efficiency of protection and compliance activities improved (Molenaar & Tsamenyi, 2000). In spite of these advantages, VMS is just a deterrent tool that is used by fisheries enforcement officers and MCS. Nonetheless, it provides the position, speed and course of vessels enhancing the work of MCS and making fisheries management easier and less stressful.

6.5. TAMPERING WITH VMS OPERATIONS

Tampering may be carried out or aided by a range of parties with particular interests and resources to devote to tampering, including (The High Seas Task Force, 2005):

Fishermen: While the electronics and computing skills of the crew of smaller vessels may be limited, larger vessels are likely to have well trained radio operators and crewmembers with marine electronics skills on-board. However, the financial and human resources they are able to devote to the development of tampering methods will be limited.

Marine Electronics Organizations: It is conceivable that a marine electronics company could devote sufficient resources to developing an "off-the-shelf" tampering kit to sell to fishing vessel owners. The resources available to devote to this are likely to be greater than those available to a single crew.

Fishing Companies: Larger fishing companies or co-operatives are likely to be able to devote greater resources to tampering than individual vessels. This could extend to commissioning the production of a tampering system from a third party electronics company.

Governmental Institutions: Finally, there may even, under exceptional circumstances, be the possibility that governmental organizations may perform tampering with position reporting or communications equipment. In such cases, the resources that may be devoted to the development of tampering techniques may be virtually limitless.

It is apparent that the scenarios cited by the High Seas Task Force present the possibility for every system to be compromised, and Liberia faces the challenges of some of the above. In addition, both the fishers and fishing companies have been suspected over the years of tampering with the systems on board vessels. There have been some inconsistencies with reports for some vessels by the FMC. Findings and reports have suggested that electrical faults and power failures have been to an extent responsible for the break in transmission. Although not yet fully established by the BNF, there are suspicions that the system is intermittently disconnected, possibly to facilitate fishing operations of illegal scope (i.e., illegal fishing, fishing in unauthorized zones, illegal bunkering, and illegal transshipment).

6.5.1. External Data Verification

Verification of data from VMS reporting from outside the FMC is important to cross-check and validates data before it is used to advise management. One means of addressing such weakness is to use reports from Liberia's fisheries observers on the activities of vessels and sea and aerial patrols to corroborate the consistency and reporting time as well as location and position of fishing vessels.

6.5.2. Data Authentication and Analysis at FMC

The FMC in Liberia was primarily established to support the new fisheries management regime as well as monitor and report on violations identified within the framework of the fisheries regulations. Data from VMS have the potential of identifying infractions in the IEZ and EEZ with high levels of accuracy. It is important to note that the major challenge of the industrial fisheries in Liberia today is fishing or the presence of industrial fishing vessels in the IEZ or unauthorized zones.

Presently, the FMC is limited in its scope of operations and efficiency. Data that are generated and analyzed by staff of the FMC to record, every two hours, include position, course and speed of each vessel registered, licensed and engaged in fishing activities in the Liberian waters. The Fisheries Information Management System (FIMS) used by the FMC for VMS monitoring and reporting delineates the different zones set forth in the fisheries regulations: 1) presence in the

IEZ and 2) reporting speed of vessels beyond 50 NM that suggests transshipment at sea, particularly without authorization.

6.6. LIBERIA VMS – STAKEHOLDERS COLLABORATION AND INTERNATIONAL COOPERATION

Beyond VMS, Liberia is cooperating with national stakeholders and regional and international partners in its fight against IUU fishing. In this effort, Liberia continues to cooperate with partners such as the Fishery Committee of the West and Central Gulf of Guinea (FCWC), Cooperation of African States Bordering the Atlantic Ocean (ATLAFCO), the International Committee for the Conservation of Atlantic Tuna (ICCAT), and the Sub Regional Fisheries Commission (SRFC). There has yet to be an adequate source of funding to manage the coordination of activities between Liberia and its stakeholders. However, a mechanism to address funding issues it is being discussed. Liberia is a lead player in MCS and related activities in the West African sub region. Some key initiatives undertaken include the establishment of a regional database for information sharing and exchange as well as transparency and cooperation. Similar to the national Memorandum of Understanding (MOU) on stakeholders' collaboration on MCS issues, it will be critical to encourage and develop an MOU on regional MCS cooperation which will enhance and facilitate enforcement capability and thus promote transboundary cooperation. To guarantee success and the active involvement of states in the sub region, the involvement of both the FCWC and SRFC are highly anticipated.

VMS is considered a useful tool against IUU fishing. However, it must be re-emphasized that its high level of accuracy is limited to the position, course and speed of the vessels on which it has been installed. It should be pointed out once again, however, that VMS, for all its qualities, provides only the position, speed and course of a vessel. Based on this, it can be made clear that VMS systems do not solve IUU fishing in totality or respond to all MCS needs which calls for a holistic approach. Such potential can become a reality only in the context of widespread, and timely, sharing of the data gathered via VMS between coastal and flag states. Unfortunately, there are remarkably few examples of such exchange and sharing that have produced success (Flewwelling, et al., 2002).

6.7. SWOT ANALYSIS ON STRATEGIC ISSUES FOR LIBERIA VMS

The SWOT analysis of Liberia VMS has identified efforts of the BNF to enforce the use of VMS as a management tool and areas that need improvement. This is necessary for future planning which focuses on the areas that need immediate improvement. In assessing strengths and weaknesses of the application of VMS in Liberia, potential threats may become an obstacle for the implementation of an action plan. However, by recognizing these factors the success of a strategic planning process is achievable.

Table 12. SWOT analysis on strategic areas of Liberia VMS

Strengths	Weaknesses	Opportunities	Threat
Willingness for the SRFC and FCWC member states, including Liberia, to cooperate on VMS applications. Existence of SRFC joint MCS program of which Liberia is a participant. Existence of major MCS conventions and bilateral/multilateral protocols. Improved economic performance by ensuring that all catch from vessels is landed. VMS fully operating in Liberia. Liberia dashboard and vessel register Potential for the cooperation on research and information exchange for the BNF.	No adequate source of funding for investment and recurrent budgets is a major constrain for Liberia. Lack of skilled personnel and technical capacity to build and maintain VMS systems.	Proven to be adequate for the monitoring of fishing activities. Maritime security a global problem and requires a concerted effort: -drugs, illegal immigration -safety and oil pollution EU access agreements by this time include provisions for VMS -Future cost reductions is possible -Operating costs jointly negotiated with stakeholders of the MCS Coordination Committee.	Vendors marketing proprietary (closed) VMS systems. Suppliers are not represented in Liberia and the sub region. Opposition by vessel operators Cost of the system and its implementation can be substantial considering sustainability.

This SWOT analysis for the application of VMS in Liberia has considered several aspects of the operations and implementation of the VMS system for fishing activities. Findings could be adopted to strengthen the use of VMS as a deterrent tool for fisheries MCS in the Liberian

waters. Also described in Table 12, weaknesses and threats identified could provide policy options that will boost VMS operations and management. If adopted, these recommendations would augment the implementation of VMS as an enforcement and surveillance tool thus improving MCS and preventing, deterring and eliminating IUU fishing in the Liberian waters.

CHAPTER SEVEN

PORT STATE MEASURES

7.1. PORT STATE MEASURES AGREEMENT

The evolution of the legal foundation for port State measures began with the 1982 United Nations Convention on the Law of the Sea (1982 UN Convention),[24] a landmark instrument described as a "Constitution for the Oceans", which was some 14 years in the making and provides the international legal basis for the protection and use of living and non-living resources of the world's oceans (Doulman & Swan, 2012).

In the 1982 Convention of UNCLOS, Port State Measures are addressed in Article 218 as an approach to deter violators and would-be violators within the context of national and regional maritime domains. At this time, the Port State measures were tailored towards the mitigation and enforcement of marine pollution issues by Port States which was basically an environmental rather than a fisheries related issue. This was, however, formulated for large merchant ships and did not make provisions for port State measures to be used as a fisheries management tool, or to promote the protection and preservation of fisheries resources for sustainable development.

Having this in mind, the Food and Agriculture Organization of the United Nations (UNFAO) has continued its efforts over the years to include fisheries and the environment as part of its development policies to enhance maritime safety and encourage sustainable ocean governance. This however led to the approach of the FAO to develop instruments to guide and direct anthropogenic activities that impact fisheries and associated habitats including the negotiation of the 1995 FAO Code of Conduct for Responsible Fisheries (1995 FAO Code of Conduct).[25] Chapter 17 of Agenda 21 addressed fisheries challenges and described prescriptive ways forward. The chapter was entitled "Protection of the oceans, all kinds of seas, including enclosed and semi-enclosed seas, and coastal areas and the protection, rational use and development of

[24] United Nations Convention on the Law of the Sea of 10 December 1982. The Convention entered into force in November 1994. However, many of its provisions were being applied by the international community prior to the conclusion of negotiations in 1982.

[25] FAO. 1995. *Code of Conduct for Responsible Fisheries*. Rome. 41 pp.

their living resources". Comprehensive in approach and content, Chapter 17 considered fisheries and other issues under eight main headings, including (Doulman & Swan, 2012):

- the sustainable development of coastal and marine areas including exclusive economic zones (EEZs);
- marine environmental protection;
- sustainable use and conservation of marine living resources of the high seas;
- sustainable use and conservation of marine resources under national jurisdiction;
- critical uncertainties for the management of the marine environment and climate change;
- strengthening regional and international cooperation and coordination; and
- the sustainable development of small islands.

7.2. LIBERIA AND THE PORT STATE MEASURES AGREEMENT (PSMA)

The Liberia Fisheries Policy identifies under Article 3.2.5 '*Implementing effective Monitoring, Control and Surveillance (MCS) mechanisms to prevent IUU fishing*' several interventions to assist in curbing IUU fishing activities in the waters of Liberia including Accession to the FAO Ports States Measures Agreement and operationalize a Port State Measures Structure that is cost effective to combat IUU fishing by local and foreign vessels.

The Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing, is commonly called the Port State Measures Agreement or the PSMA. Adopted in 2009 by the UN FAO, the treaty requires parties to exert greater port controls on fishing vessels, and as a result keep IUU fish out of the market. Ports known for lax law enforcement or limited inspection capacity are a pathway for illegal fishing operations to get their catch from ship to both local and international markets. The PSMA provides guidelines for strong port controls, and ratification by Liberia will provide an effective, cost efficient and easily implemented MCS framework that will improve controls and compliance in the industrial sector (Government of Liberia, 2013). Key outcomes will include:

- The Government of Liberia ratification of the PSMA;

- Port controls legislation and administration that meets or exceeds international requirements;
- Understanding of port control responsibilities and obligations;
- Implementation of an effective port State control system; and
- Known illegal fishing operators refused port entry or access to port services, including landing and transshipment of fish.

Although Liberia has neither signed nor ratified the PSMA, Table 13 is an illustration of the country willingness to monitor and manage the activities of vessels and ensure that vessels entering the Port of Monrovia act in accordance with international laws and principles.

Table 13. Port activities by fishing vessels and reefers in 2011 and 2012.

Year	Foreign Fishing Vessel	Foreign Reefer and Supply Vessel	Port	Fish Landed (tons)	Fish Exported/Transshipped (tons)
2011	5	14	Monrovia	7,768.08 *(Imported)* + 498.45 *(landed)* **Grand Total:** 8, 266.53	7,800 *(exported)* + 40.98 *(transshipped)* **Grand Total:** 7,800.98
2012	NA	9	Monrovia	4, 620 *(imported)* + 30.42 *(landed)* **Grand Total:** 4, 650.42	NA

Source: Sherif (2012). Monitoring, Control and Surveillance (MCS) Operations in Liberia: Workshop on West Africa Regional Collaboration for MCS-Liberia, Sierra Leone, Ivory Coast & Ghana. 30-31 October 2012. Monrovia, Liberia.

Nonetheless, there have been several proposals and strategies to guide the process of signing, ratifying and implementing the Port State Measures Agreement by Liberia. Some of which include (NFDS, 2013):

1. designate the Monrovia Fishing Port as the only port foreign fishing vessels may enter;
2. conduct dockside inspections following set standards;

3. deny entry to vessels known or believed to have been involved in IUU or those on an IUU vessel list of a Regional Fishery Management Organization (RFMO); and

4. Share information with Flag States and regional partners of vessels with IUU product, when discovered during inspection.

These recommendations provided above will encourage the Government of Liberia to sign, adopt and successfully implement the Port State Measures Agreement considering all parties and stakeholders. This is therefore a workable prospect that will ensure strong interagency collaboration and transboundary cooperation.

CHAPTER EIGHT

CONCLUSION AND RECOMMENDATIONS

8.1. CONCLUSIONS

Satellite-based vessel monitoring system (VMS) is but one example of applied modern technology which has the potential to profoundly change fisheries management in the immediate future. The availability of near real-time information on fishing activities within enormous ocean areas opens up almost unimagined management options, particularly for those concerned with gathering data and ensuring compliance (Molenaar & Tsamenyi, 2000). The recognition of this potential is reflected in its rapidly expanding use by States, regional fisheries management mechanisms (RFMMs) and ship operators alike. Ongoing developments indicate that the obligatory use of Automatic Location Communicators (ALCs) as part of a VMS is likely to be applied in all major industrial fisheries within the next few years[26].

Like many fisheries authorities, the BNF is mandated by law to protect, manage and conserve fisheries resources in Liberia, as well as to promote transboundary cooperation and regional and international collaboration. Under the new fisheries regime (2011 to present), stakeholders relevant to the protection and management of the coastline, marine environment and ocean resources are encouraged by the BNF and bound by the MOU on MCS collaboration to cooperate and support the management of fisheries and associated habitat and environment. Liberia's policy for the development of the fisheries is to improve the livelihood of artisanal fishermen and provide food for the citizenry by enhancing MCS initiatives which include the operations of VMS, a computerized FMC and trained staff.

The main objective behind the development of fisheries in Liberia is to improve the standard of living of the local population and increase revenue to the national economy. This development objective has seen huge support from the World Bank and other development partners, regional and international.

[26] FAO Doc. COFI/97/INF.6 (*supra* note 42), p. 2.

The application and management of the VMS system by the BNF has been described by its function, activities of fishing vessels, type of fisheries being monitored and sustainability of the system, all of which is under the strategic planning of the government. The full involvement of the government guarantees the provisions of VMS application as a condition of licensing of industrial fishing vessels.

In addition to policy considerations, a fisheries management authority will have to accept that the scope of application of its satellite-based VMS will have to comply with applicable rules of international law. The ensuing restrictions are particularly apparent if it takes a coastal or port State approach, as defined in Section 4.1. Rather than exercising jurisdiction over ships that bear their own nationality, which Section 4.1 categorizes under flag States, jurisdiction exercised by coastal and port States relates to foreign vessels that engage in certain activities in the coastal State's maritime zones or even beyond. The main conclusions which can be derived from the complex analysis are (Molenaar & Tsamenyi, 2000):

- foreign vessels that wish to engage in fishing, fish processing or fish transshipments in a coastal State's maritime zones can be required to install ALCs;

- foreign fishing vessels with fishing licenses cannot be required to have the ALC switched on for a considerable time in advance of entering the coastal State's maritime zones, or after departure therefrom. The flag State may of course require its vessels to have the ALC switched on continuously and thereby alleviate the coastal State's concerns. Likewise, RFMOs may impose such a requirement on ships operating in the high seas adjacent to a coastal State's maritime zones;

- foreign vessels without fishing licenses cannot be asked to install ALCs or to have them switched on if they merely exercise rights of navigation in a coastal State's maritime zones. Arguably, it would not necessarily amount to an abuse of rights to require such vessels to install ALCs as a condition for entry into port. However, as port States would

not have a basis of jurisdiction to require such ships to have the ALC switched on prior to entry into port, this previous requirement appears useless;

- the situation with regard to foreign fishing support vessels that engage in bunkering of fishing vessels in EEZs might be the most controversial. The resolution of this conflict in use will depend on classifying bunkering as freedom of navigation or the use associated therewith under Article 58(1) Law of the Sea Convention and the extent of coastal State jurisdiction under Article 62(4) LOSC. In the end, the matter may have to be treated as a residual right under Article 59 LOSC and necessitate resolution by a body like the International Tribunal for the Law of the Sea (ITLOS), even though the ITLOS did not resolve the issue in the *Saiga (Merits)* Case.

When implementing a VMS system for a new and rigorous fisheries regime, like the case of Liberia, there needs to be sound understanding of the objectives for the operationalization of the system to be successful. Close working relationships between the BNF and lead agencies on marine and environmental issues are critical in delivering successful outcomes and providing required information of the system. It is important to note that identifying risks in the management and control of a VMS system is important; and this should include the transparency of the data produced, and critically managing the expectations of fishers and potential benefits including how the benefits should to be realized (FAO, 1998).

It is crucial to mention that trust and confidence are the fundamental issues associated with implementing a VMS system. Where there is a collective understanding of outcome and benefits for both fishermen and the fisheries sector, it is certain to produce accurate data throughout with no disparity. This will give relevance to the data produced and enable its used by the government, national stakeholders and the international community.

Overall, it has been proven that, since 2011, the use of VMS in Liberia has been highly effective. This will continue to be subject to a systematic installation procedure, a well-functioning FMC and well trained and skilled staff. On the other hand, it is incumbent on relevant stakeholders to provide the requisite support, particularly in accordance with the MOU on MCS cooperation, to

the development and management of the fisheries and linked habitats so that discrimination will be avoided.

In the future, the operations of VMS should show the benefits not only for the country but also for the region. The government should ensure and increasingly improve the status of the FMC and integrity of the VMS with the advancement of technology. However, this will depend on bilateral and regional initiatives and on domestic efforts in providing funding and sharing information for the development of the sector.

8.2. RECOMMENDATIONS

The use of VMS as a fisheries management tool is essential considering its value and potential to the fisheries sector. Nevertheless, VMS must not in any way be considered a fisheries management tool to address all aspects of declining fish stocks including the revitalization of the fisheries. VMS can provide valuable access in solving these problems, but realization will primarily depend on how an MCS strategy and development plans integrate VMS into fisheries management plans to produce desired outcomes.

Although this research paper highlighted several important issues of high relevance to the fisheries of Liberia, it is very important to make key recommendations that will strengthen the use and operationalization of VMS systems for the sustainable management of fisheries in the country and the sub region. Specific actions will include:

1. Review the existing type approval VMS system and installation procedures to reduce the risk of inconsistent reporting and data manipulation;

2. In addition to installation procedures from the Faria WatchDog cited in this paper, connections of the MTU should be made directly to the battery located in the engine room on the vessel instead of connections to a voltage regulator which will in essence reduce tampering. Once connections are placed this way, the VMS system remains on throughout even if the vessel has communications or electrical problems;

3. Develop standards for fishing vessels' VMS equipment to adequately address issues of data integrity and reliability and the prevention of tampering. These standards may apply regionally and could serve as a basis to standardize VMS implementation in the region;

4. Develop and implement a training package on VMS operations (monitoring and installation) for senior personnel of the Bureau of National Fisheries and other stakeholders including the Liberia Maritime Authority, National Port Authority, Ministry of Justice, and the Ministry of National Defense (Liberian Coast Guard) to eliminate any misconception about the operations of the system and to strengthen interagency collaboration;

5. Review the system set up at the FMC by conducting a communication system review (i.e., identify all equipment and investigate their performance ratings), conduct an internet connectivity survey (see Figure 3) and implement recommended actions, connect VSAT to the (*computerized*) FMC, etc.

6. Keep the FMC running and operational 24 hours a day-365 days a year. This will include the recruitment and training of additional staff.

7. Harmonize Vessel Monitoring Systems (VMS) including Mobile Transceiver Units (MTUs) within the region to address similar challenges faced by member states of both the SRFC and FCWC. This could include VMS type approval, technical specifications and integrity of the system, installation procedures and mechanisms (i.e., cables, platforms), Standard Operating Procedures (SOPs), and a standard configured internet communication system, among others to be identified based on the type of fisheries;

8. Harmonize legislation (laws and regulations), where applicable, including policies and MOU to address common challenges in the region relating to VMS and its integration with monitoring, control and surveillance and other fisheries management tools. Common legislation and policies could however address challenges in the region posed by illegal

fishing and other forms of environmental degradation in contravention of national laws and regulations; and

9. Identify adequate sources of funding for the operation and maintenance of the VMS system through the MCS Coordination Committee that will not be reliant on external or project-based sources. The BNF may put in place a mechanism to include but not limited to: (a) recurrent budgets of stakeholders and (b) funds generated by the Bureau of National Fisheries, i.e., quota fees, vessel certification fees, fishing licenses, and fines imposed for violations in the fisheries waters of Liberia;

10. Encourage the integration of activities of MCS functions to provide support to VMS operations for the monitoring and control of commercial fishing vessels with MTUs mounted on them. These activities will include platforms and mechanisms put in place to monitor reports from fisheries observers and inspectors, sea and aerial patrols, and dockside inspections to validate VMS data and reports from the FMC; and

11. Include Regional Fisheries Management Organizations (RFMOs) in the development of a working document to support governments in the region (institutional and administrative supports) to prevent, deter and eliminate IUU fishing, using a standardized and cost-effective VMS system and, peripherally, to ensure sustainability.

The following recommendations are indicators of the conclusions of this research paper. These recommendations will benefit and improve the management of fisheries resources of Liberia from both socio-economic and stock recovery perspectives. From the development and improvement of management initiatives of the BNF over the last few years, it has demonstrated that the potential of the fisheries sector relies chiefly on the success of management strategies and implementation mechanisms including adequate funding for sustainable development.

REFERENCES

Arthur, R., Béné, C., Leschen, W., & Little, D. (2013). *Fisheries and aquaculture and their potential roles in development: an assessment of the current evidence.* UK: MRAG.

BNF/GOL. (2006). *Annual Report.* Monrovia.

Bollmann, M., Bosch, T., Colijn, F., Ebinghaus, R., Froese, R., Gussow, K., . . . latif, M. (2010). *World Ocean Review: Living with the oceans.* Hamburg: maribus.

Brandolini, G. V., & Tigani, M. (2006). *Liberia Environmental Profile.* Monrovia: European Commission.

Chang, S. (2010). Application of a vessel monitoring system to advance sustainable fisheries management-Benefits received in Taiwan. *Marine Policy*, 117-121.

Dietrich, K., Turk, T., Wynne, K., & Tiwari, M. (2010). *West Africa Regional Scientific Observer Training Manual.* Silver Spring: Division of International Affairs, NOAA Fisheries.

Dolder, P. J., Mangi, S. C., Catchpole, T. L., Rodmell, D., Deas, B., & de Rozarieux, N. (2013). *Scopingg Industry Approaches to fully Documented Fisheries.* London: Fisheries Science Partnership.

Doulman, D. J., & Swan, J. (2012). *A Guide to the background and implementation of the 2009 FAO Agreement on Port State measures to prevent, deter and eliminate illegal, unreported and unregulated fishing.* Rome: FAO.

Drammeh, O. K. (2007). *The Fisheries Sub-Sector: Liberia.* Rome: FAO.

Elbert, B. R. (1999). *Introduction to Satellite Communication.* London: Artech House.

Eppler, B. (1986). *A Rural and Artisanal Fisheries Development Project.* Cotonou: IDAF.

European Commission. (2012). *Vessel Monitoring System (VMS) - Data Exchange.* Belgium: European Commission.

Everett, G. T. (2005-2009). *Fisheries Topics: Governance. Monitoring, Control and Surveillance.* Rome: Food and Agriculture Organization of the United Nations.

FAO. (1986). *The FAO Agricultural Production Index.* Rome: Food and Agriculture Organization of the United nations.

FAO. (1998). *Fishing Operations: Vessel Monitoring System.* Rome: FAO.

FAO. (2012). *The State of World Fisheries and Aquaculture.* Rome, Italy: Food and Agriculture organization of the United Nations.

Flewwelling, P., Cullinan, C., Balton, D., Sautter, R., & Reynolds, J. E. (2002). *Recent trends in monitoring,control and surveillance systems for capture fisheries.* Rome: Food and Agriculture Organization of the United Nations.

Gold, E., Chircop, A., & Kindred, H. (2003). *Maritime Law.* Ontario: Irwin Law.

Government of Liberia. (1956). *Natural Resource Law of Liberia.*

Government of Liberia. (2010). *Fisheries Regulations.*

Government of Liberia. (2013). *Liberia Fisheries and Aquaculture Policy.*

Molenaar, E. J., & Tsamenyi, M. (2000). *Satellite-Based Vessel Monitoring Systems International Legal Aspects & Development and State Practice.* Rome: FAO.

NEPAD/CAADP/FAO. (2006). *LIBERIA: Support to NEPAD–CAADP Implementation.* Rome.

NFDS. (2012). *Final Report: Workshop on West Africa Regional Collaboration for Monitoring, Control & Surveillance (MCS)-Liberia, Sierra Leone & Ivory Coast.* NFDS.

NFDS. (2013). *Towards a Strategic MCS Implementation Plan.*

NOAA Fisheries. (2013). *Improving international fisheries management:report to Congress.* Washington D.C.: US Department of Congress.

Sands, P., Peel, J., Fabra, A., & MacKenzie, R. (2003). *Principles of International Environmental Law.* New York: Cambridge University Press.

Sherif, S. (2009). *Monitoring, Control and Surveillance system design for Liberia.* Dakar: SRFC/WB.

Sherif, S. (2011). *Monitoring, Control and Surveillance: The Experience of the West Africa Regional Fisheries Program (WARFP) in Liberia, 2nd FCWC Working group meeting on IUU Fishing, Monrovia, Liberia.* Accra: FCWC.

Smart, J. K., & Sheves, G. (1979). *Draft report on the Artisanal Fisheries Development Mission to LIberia.* Rome: FAO.

Smith, A. (2001). *Vessel Monitoring Systems.* Rome: FAO.

Ssentongo, G. (1987). *Marine Fishery Resources of Liberia: A Review of Exploited Fish Stocks.* Rome: FAO.

The High Seas Task Force. (2005). *Fishing Vessel Monitoring Systems: Past, Present and Future.* Paris: OECD.

The World Bank. (2009). *Liberia Project Appraisal Document (PAD).*

The World Bank. (2009). *Project Appraisal Document - West Africa Regional Fisheries Program.*

The World Bank. (2010). *Project Operational Manual: West Africa Regional Fisheries Project (WARFP) in Liberia.* Washington D.C.: World Bank.

WARFP-Liberia/BNF. (2013). *Annual Report.* Monrovia, Liberia.

Witt, M. J., & Godley, B. J. (2007). A Step Towards Seascape Scale Conservation: Using Vessel Monitoring Systems (VMS) to Map Fishing Activity. *PLos ONE*, 1-5.

APPENDIX - A

Fisheries Vessel Standard Data Form for Aerial Patrol Reporting

Date: _____ Weather Conditions / Visibility _____

Time of vessel sighting: _____ Vessel Type: _____

Inspector Name(s): _____

INDUSTRIAL FISHING		
Vessel Position	Latitude and Longitude	
	Vessel Course and Speed	
Identification Markings	Name	
	Call Sign	
	Flag	
	IMO number	
	Other	
Vessel Activity	(fishing, anchored, in passage, other)	
Legality	Vessel licensed / not licensed	
IUU Fishing	Evidence of IUU fishing activities (see SOP)	
Vessel Not Fishing	Evidence of recent fishing activity? (see SOP)	
Any other observations	(fishing in company of other vessel, fleeing scene, vessel course etc)	
ARTISANAL FISHING		
Vessel Position	Latitude and Longitude	
Vessel Identification	Vessel Registration Number	
	Vessel Description	

IUU Fishing	Evidence of IUU fishing activities (see SOP)	
PHOTO IMAGERY	Summary of Photos	
FILM IMAGERY	Summary of Film	
COMMUNICATIONS	Communication Conducted (Y/N/attempted)	
Licensed Vessel	Name of Vessel Representative	
	Name of Vessel Observer	
	Reported Observer Reporting Codes	
Unlicensed Vessel	All Relevant Vessel Information (see SOP)	
Audio Recording	Audio Recording Achieved (Y/N)	
REPORTING	Report made to FMC while on patrol? (Y/N)	
	Any further action taken	
POST-MISSION SUMMARY	Date and time of De-brief	
	De-Briefing Officer	
	De-Briefing Officer Signature	

Source: MCS Department, Bureau of National Fisheries. (2012). Standard Reporting Forms.

APPENDIX - B

Bureau of National Fisheries

INSPECTION REPORT

1. Inspection report no			2. Port State	MONROVIA		
3. Inspection Bureau						
4. Name of Principal Inspection						
5. Port of inspection	BONG MINE PIER/MONROVIA					
6. Commencement of inspection	*YYYY*	*MM*	*DD*	*HH*		
7. Completion of inspection	*YYYY*	*MM*	*DD*	*HH*		
8. Advanced notification received	Yes	No				
9. Purpose(s)	*LAN*	*TRX*	*PRO*	OTH (specify) VESSEL INSPECTION		
10. Port and State and date of last port call		*YYYY*	*MM*	*DD*		
11.Vessel name						
12. Flag State						
13. Type of vessel						
14. Vessel Characteristics	GRT	NRT	Over-All Length	Reg. length	Reg. breadth	Reg. depth
15. International Radio Call Sign						
16. Certificate of registry ID						
17. IMO ship ID, if available						
18. External ID, if available						
19. Port of registry						
20. Vessel owner(s)						
21. Vessel beneficial owner(s), if known and different from vessel owner						
22. Vessel operator(s), if different from vessel owner						
23. Vessel master name and nationality						
24. Fishing master name and nationality						
25. Vessel agent						
26. VMS	No	*Yes: National*	*Yes: RFMOs*	Type:		
27. Status in RFMO areas where fishing or fishing activities have been undertaken, including any IUU vessel listing						
Vessel Identifier	RFMO	*Flag State Status*	*Vessel on authorized vessel list*	Vessel on IUU vessel list		
28. Relevant fishing authorization(s)						
Identifier	Issued by	*Validity*	*Fishing area(s)*	Species	Gear	

29. Relevant Transshipment information concerning donor vessel(s)					
Identifier		*Issued by*		Validity	
Identifier		*Issued by*		Validity	
30. Transshipment information concerning donor vessel(s)					

Name	Flag State	ID no.	Species	Product form	Catch area(s)	Quantity

31. Evaluation of offload catch (quantity)					
Species	Product form	Catch area(s)	Quantity declared	Quantity offload	Different between quantity declare and quantity determined, if any

32. Catch retained onboard (quantity)					
Species	Product form	Catch area(s)	Quantity declared	Quantity retained	Different between quantity declared and quantity determined, if any

33. Examination of logbook(s) and other documentation	Yes	No	Comments
34. Compliance with applicable catch documentation scheme(s)	Yes	No	Comments
35. Compliance with applicable trade information scheme(s)	Yes	No	Comments

36. Type of gear used			
37. Gear examined in accordance with paragraph e) of Annex B	Yes	No	Comments

38. Findings by inspector(s)
39. Apparent infringement(s) noted including reference to relevant legal instrument(s)
40. Comments by the master
41. Action taken
42. Master signature
43. Inspector signature

Source: Bureau of National Fisheries, Ministry of Agriculture. (2010). Fisheries Regulations of Liberia.

APPENDIX - C

Standard Data Form for Sea Patrol Reporting

Date: _____ Weather Conditions / Visibility _____

Time of vessel sighting: _____ Vessel Type: _____

Inspector Name(s): _____

INDUSTRIAL FISHING		
Vessel Position	Latitude and Longitude	
	Vessel Course and Speed	
Identification Markings	Name	
	Call Sign	
	Flag	
	IMO number	
	Other	
Vessel Activity	(fishing, anchored, in passage, other)	
Legality	Vessel licensed / not licensed	
IUU Fishing	Evidence of IUU fishing activities (see SOP)	
Vessel Not Fishing	Evidence of recent fishing activity? (see SOP)	
Any other observations	(fishing in company of other vessel, fleeing scene, vessel course etc)	
ARTISANAL FISHING		
Vessel Position	Latitude and Longitude	
Vessel Identification	Vessel Registration Number	

	Vessel Description	
IUU Fishing	Evidence of IUU fishing activities (see SOP)	
PHOTO IMAGERY	Summary of Photos	
FILM IMAGERY	Summary of Film	
COMMUNICATIONS	Communication Conducted (Y/N/attempted)	
Licensed Vessel	Name of Vessel Representative	
	Name of Vessel Observer	
	Reported Observer Reporting Codes	
Unlicensed Vessel	All Relevant Vessel Information (see SOP)	
Audio Recording	Audio Recording Achieved (Y/N)	
REPORTING	Report made to FMC while on patrol? (Y/N)	
	Any further action taken	
POST-MISSION SUMMARY	Date and time of De-brief	
	De-Briefing Officer	
	De-Briefing Officer Signature	

Source: MCS Department, Bureau of National Fisheries. (2012). Standard Reporting Forms.

APPENDIX - D

PRE-LICENSE INSPECTION SUMMARY REPORTING FORM

Guidelines: Fill out the table electronically for each vessel inspected. If more rows are needed, add them in. Each member of the inspection team should then sign and date the document before submitting to the Fishing License Committee, along with the completed vessel inspection forms and any documents obtained during the inspection.

DATE day / month / yr	**INSPECTION REPORT No.**	**VESSEL NAME** in capitals	**PORT OF INSPECTION**	**BNF INSPECTORS** minimum two (2)	**RESULTS**	**ACCOMPANYING DOCUMENTS**	**RECOMMENDATION**

Inspector Name: _____ **Signed:**_____ **Date:** _____

Inspector Name: _____ **Signed:** _____ **Date:** _____

Inspector Name: _____ **Signed:** _____ **Date:** _____

Source: MCS Department, Bureau of National Fisheries. (2012). Standard Reporting Forms.

APPENDIX - E

DOCKSIDE INSPECTION - CATCH TALLY FORM

Date of Inspection: _____ Date of Departure: _____
Date **Arrival**: _____

Vessel Name: _____ Fishing **Duration**: _____

Inspector Names: _____

Inspection Location: _____

Species	Container Type (bag or carton)	# of Containers	Container Weight / KG	Totals

Agent Signature: _____ **Inspector Signature**: _____

Source: MCS Department, Bureau of National Fisheries. (2012). Standard Reporting Forms.

APPENDIX - F

VESSEL MONITORING SYSTEM (VMS) DAILY REPORTING FORM
FISHERIES MONITORING CENTER (FMC)

REPORTING STAFF: _____ **NAME OF VESSEL:** _____ **DATE:** _____

TIME	FISHING ZONE (IEZ, TW,CZ, EEZ)	MTU OPERATIONAL YES/NO	OBSERVATIONS/REMARKS

Source: MCS Department, Bureau of National Fisheries. (2012). Standard Reporting Forms.

APPENDIX - G

AUTOMATED IDENTIFICATION SYSTEM (AIS) DAILY REPORTING FORM
FISHERIES MONITORING CENTER (FMC)

TIME	VESSEL NAME/CALL SIGN/IMO #	VESSEL TYPE	POSITION IN LIBERIAN WATERS	OBSERVATIONS/REMARKS

REPORTING STAFF: ---------- **DATE:** _____

Source: MCS Department, Bureau of National Fisheries. (2012). Standard Reporting Forms.