THE EFFECTS OF FOREIGN FISHING VESSELS ON THE COMMERCIAL FISH STOCKS: A CASE STUDY OF EYL PUNTLAND SOMALIA

BY

ABAS IMAN ABDULLE

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DECLARATION

I, **ABAS IMAN ABDULLE**, hereby declare that this dissertation is my original work and has never been submitted for any academic award in any other institution or University.

Signed _____ Date_____

ABAS IMAN ABDULLE

APPROVAL

This dissertation has been prepared under my supervision and I have cleared it for submission to the school of Post Graduate Studies and Research

Signature: _____ Date_____

Prof. Faustino L. Orach-Meza

SUPERVISOR

DEDICATION

This dissertation is dedicated to my beloved Mother, Maryan Husssein Ali,for her financial, spiritual, moral and social support.

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Every work is certainly impossible to accomplish single handedly. It is therefore with heartfelt gratitude that I convey thanks to all of you-family, colleagues and friends.

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ACRONYMS

AFZ	:	Australian Fishing Zone
COFI	:	Committee on Fisheries
CVI	:	Content Validity Index
EEZ	:	Exclusive Economic Zone
EU	:	European Union
FAO	:	Food and Agricultural Organization
FFP	:	Fishery production potential
FSA	:	Fish Stocks Agreement
FVIS	:	Fishing Vessel Information Scheme
HMS	:	Highly Migratory species
ICCAT	:	International Commission for the Conservation of Atlantic Tunas
IOTC	:	Indian Ocean Tuna Commission
IUU	:	Illegal, Unreported, Unregulated
LME	:	Large Marine Ecosystem
MSY	:	Maximum Sustainable Yield
MT	:	Million Tons

ABSTRACT

The study examined the effect of foreign fishing vessels on the commercial fish stocks with special emphasis on Eyl Puntland Somalia. Specifically the research assessed the commercial fish stocks in the waters of Somalia, identified the fishing capacity of foreign fishing vessels in the waters of Eyl Puntland Somalia and assessed the commercial fish catches of foreign fishing vessels in an effort to determine the effects of foreign fishing on the commercial fish stocks and national fish catches.

A descriptive research design where interview and administration of questionnaires were used in the study involving qualitative and quantitative research approaches. Data were collected from a sample of 144 respondents. Descriptive content analysis was used to analyze the data and documentary reviews to supplement the information obtained from the randomly and purposively selected respondents.

The study revealed that in Somalia, the commercial fish catches estimated for Puntland is 58,800mt per year and Somali waters is 922,930 mt per year only achievable if significant increases in catch are made for benthivores and planktivores which are predators to other smaller fishes. The fishing capacity of the foreign fishing vessels are combinations of Freezer Trawlers and Fishing fleets capable of catching on average 4,590 mt per year while fishing fleets are capable of catching on average 3,092 mt per year and the motorized boats having a capacity of catching on average 1,440 mt. per year. The findings also revealed that the Commercial fish catches of foreign fishing vessels account for 32,000 mt on average and these catches were composed of various tuna species (including bonito) skipjack and mackerel, of which Spanish and king mackerel is one of the most highly priced species. The effect of foreign fishing vessels on the commercial fish stock in Eyl, Puntland, Somalia showed that there is extreme overfishing in the waters of Somalia and at large in Puntland.

The study recommends that Somalia and Puntland Ministries of Fishing sets standards and catch limits to which in the long term will limit fishing on near extinct specifies and increase on their production. They should also establish joint monitoring programmes in the implementation of their fisheries laws and policies so as to evaluate the status of the marine resources. This will provide a basis for issuing licences to actors and promote coordination which will improve on the quality of commercial fish caught and reduce on overfishing by the foreign fishing vessels.

CHAPTER ONE

INTRODUCTION

1.0 Introduction

This study focused on examining the effect of foreign fishing vessels on the commercial fish stocks; a case study of Eyl Puntland Somalia. This chapter presents the background to the study, statement of the problem, purpose of the study, research objectives, research questions, research hypotheses, significance of the study, scope of the study, justification of the study, conceptual framework, and operational definitions of terms and concepts.

1.1 Background to the Study

1.1.1 Historical Background

The fisheries resources of the world were once thought to be limitless. It is now all too obvious that these resources are finite and in jeopardy. There have been repeated calls for a Global Record of fishing vessels for a number of years (Arnason,2009). The 2001 FAO International Plan of Action on IUU fishing called on flag States to maintain records of fisheries vessels and in 2005, the Ministerially-led Task Force on IUU Fishing on the High Seas and the Rome Declaration on IUU fishing called for a "Fishing Vessel Information Scheme (FVIS)" as a way of recording fishing vessels, supply vessels and refrigerated transport vessels. In 2008, the FAO carried out an expert consultation on a Global Record, which was followed by a technical consultation in 2010. The FAO Committee on Fisheries (COFI) endorsed a Global Record in both 2011 and 2012, however there remains lack of clarity about how it will come into existence (UN, 2010).

According to the Carvelho, (2010), capture fisheries and aquaculture supplied the world with about 110 million tonnes of fish for human consumption in 2006, providing an apparent per capita supply of 16.7 kg, which is among the highest on record. Of this total, aquaculture accounted for 47 per cent. World capture fisheries production in 2006 was about 92 million tonnes, with an estimated first-sale value of US$91.2 billion, comprising about 82 million tonnes from marine waters and 10 million tonnes from inland fisheries.

The number of motorized fishing vessels in 2016 was estimated to be 2.1 million, of which almost 70 per cent were in Asia. Almost 90 per cent of motorized fishing vessels are less than 12 metres long, and these vessels particularly dominate in Africa, Asia and the Near East. According to the Lloyd's database, the number of industrialized fishing vessels and fish carriers (that is, above 100 gross tonnage) operational in 2007 was 23,000 and 740, respectively. Since 2001, there has been a dramatic decrease in the number of new fishing vessels being built, and this number has dropped to under 200 per year in the last few years. Several major fishing nations have established programs to cut the size of their fishing fleets (UN, 2010).

Fishing is a highly profitable venture throughout the world; the tuna industry alone is worth $6 billion globally. Surveys of Somali waters show that there are significant fish stocks off the coast of Somalia. These waters are in fact considered to be some of the richest fishing grounds in the region. Many profitable species live in the waters off the coast of Somalia and data is supported by the Sea around Us Project management, which studies the impact of fisheries on marine ecosystems across the globe.

Among the more commercially valuable fish currently landed in Somali waters through both inshore and offshore fishing are the tropical spiny lobster, swordfish, and multiple species of tuna. Miscellaneous other species are also available, and those varieties combined comprise 81%

of Somalia's annual landings by tonnage, and 61% by value. These catch totals show that there is considerable value in Somalia's undeclared Exclusive Economic Zone (EEZ) i.e. the 200-mile area to which Somalis could lay fishing claims if they were to officially declare ownership the development of which could greatly benefit Somalia's coastal communities (Mohamed and Herzi, 2005).

Although current figures on the number of Somali fishing vessels are unavailable, a UNDP report estimates that in 2005, Puntland, which is equal to about one-third of Somalia's land area, approximately 1,687 artisanal vessels including motorized watercraft, sailboats, and canoes. These vessels have the potential capacity to bring in a total of between 84 and 253 MT of fish per day, depending on the season, and based on the estimated capacity of between 0.05 and 0.15 MT per day per vessel. Using the provided average annual catch value from the "Sea around Us" Project of $1,416 per ton, these vessels combined have the potential to bring in catches worth between $119,406 and $358,218 each day (Mohamed and Herzi, 2005).).

1.1.2 Theoretical Background

This study was underpinned by Bioeconomic theory (Model) of the Fishery Resource. In order to analyze the economic aspects of the fishery resource it is useful to first consider a biological model of the resource and then build the economics on top of that. It is useful to have a biological model in the background in order to take into account the biological evolution and behaviour of the fishery while making an economic analysis. Linking together biology and economics in this way results in what can be referred to as bio-economics (Gordon, 1954).

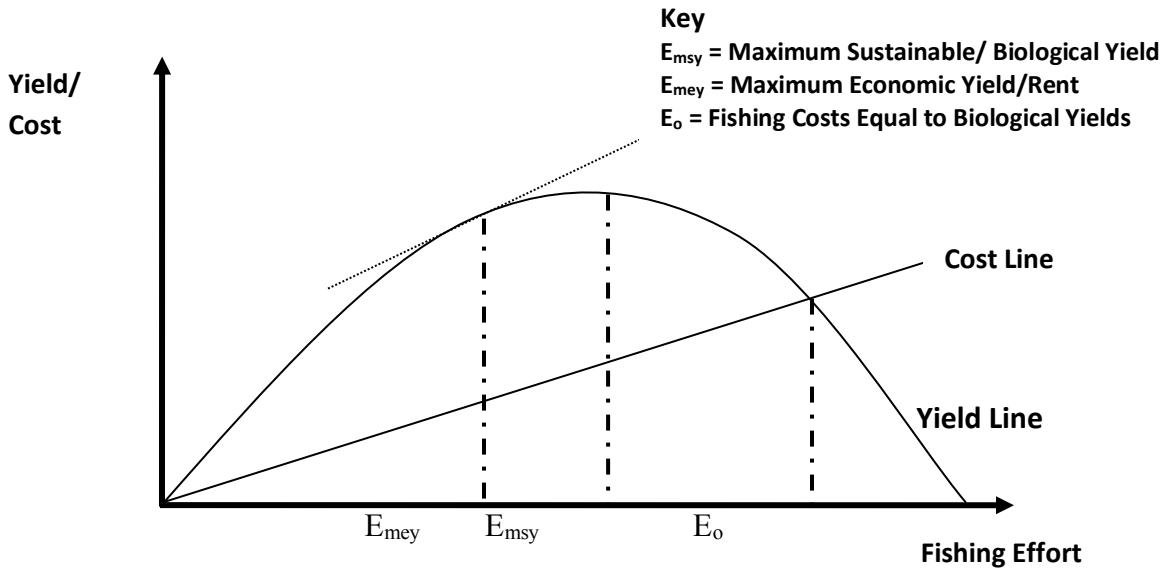

Figure1: Bio-Economic Model (Gordon, 1954)

Under exploitation, Costello (1954) introduced the catch rate Y(t) as: Y(t) =qf(t) B(t)……(i)

Where *f(t)* is the fishing effort and q is the catchability coefficient, defined as the fraction of the population fished by an effort unit (Costello, 1954). Biomass changes through time. When the population is at equilibrium, i.e., *Db/dt=0,* and thus losses by natural and fishing mortalities and compensated by the population increase due to individual growth and recruitment, thus the equilibrium biomass (*Beq*) as a function of fishing effort.

A given amount of fishing effort will lead to a specific level of *Beq*, being both variables inversely correlated. Equilibrium yield as a function of effort can be obtained by substituting the equilibrium biomass in catch rate.

$$\mathbf{Y} = \boldsymbol{qfK}\ (\mathbf{1} - \frac{\boldsymbol{qf}}{\boldsymbol{r}}) \quad \text{(ii)}$$

Equation above gives a parabola that represents the long-term production function of the fishery, where the corresponding yield (Y) for a given level of fishing effort (f) in a population at equilibrium is called sustainable yield. Equilibrium yield will increase with f up to the point of Maximum Sustainable Yield (MSY), falling onwards as fishing effort increases.

The economic model developed by Gordon (1954) is based on Schaefer's model, and introduced the concept of economic overfishing in open access fisheries. The model establishes that the net revenue π derived from fishing are a function of Total Sustainable Revenues (TSR) and total costs (TC):

As in the biological model, Gordon (1954) assumes equilibrium to obtain the long-term production function of the fishery. The open-access equilibrium yield occurs when TSR equals TC and thus $\pi(t) = 0$, and there will be no stimulus for entry or exit to the fishery. If, additionally, biomass is assumed a: equilibrium, the yield thus established will provide a simultaneous equilibrium in both an economic and a biological sense, leading to Bioeconomic Equilibrium (BE).

B(t) will be always greater than 0, because fishing effort will be reduced or even ceased at TC $\geq$TSR. Thus, the model predicts: overexploitation, if the TC curve intersects the TSR curve at higher effort levels than those required to operate at MSY; and (2) non-extinction of the resource, because at effort levels above BE there will be no stimulus to entry to the fishery. The non-extinction prediction will depend on the rate of growth of the stock and the form of the function.

1.1.3 Conceptual Background

A fishing vessel is a boat or ship used to catch fish in the sea, or on a lake or river. Many different kinds of vessels are used in commercial, artisanal and recreational fishing. According to the Carvelho, (2010), there are currently four million commercial fishing vessels About 1.3 million of these are decked vessels with enclosed areas. Nearly all of these decked vessels are mechanized, and 40,000 of them are over 100 tons. At the other extreme, two-thirds (1.8 million) of the undecked boats are traditional craft of various types, powered only by sail and oars (FAO, 2007).These boats are used by artisan fishers.

Artisan fishing boats are usually small traditional fishing boats, appropriately designed for use on their local inland waters or coasts. Many localities around the world have developed their own traditional types of fishing boats, adapted to use local materials suitable for boat building and to the specific requirements of the fisheries and sea conditions in their area. Artisan boats are often opening (undecked). Many have sails, but they do not usually use much or any mechanized or electronic gear. Large numbers of artisan fishing boats are still in use, particularly in developing countries with long productive marine coastlines. For example, Indonesia has reported about 700,000 fishing boats, 25 percent of which are dugout canoes, and half of which are without motors (FAO, 2015). The Philippines have reported a similar number of small fishing boats. Many of the boats in this area are double-outrigger craft, consisting of a narrow main hull with two attached outriggers, commonly known as *jukung* in Indonesia and *banca* in the Philippines (Carvelho, 2010).

For many commercial fish stocks in European waters an assessment on whether they are within safe biological limits has not been made. In the north-east Atlantic, the percentage of stocks that

are non-assessed ranges from 3 % (west of Scotland and Ireland) to 34 % (Irish Sea and Iberian Peninsula). Moving from north to south the percentage of stocks that are non-assessed generally increases. In the Mediterranean region, the percentage ranges from 23 % in the Adriatic Sea to 70 % for tuna and tuna-like species for the entire Mediterranean. In the Black Sea no stocks have been assessed.

For a while, market demand for fish and dramatic developments in fishing technology - larger fleets, open ocean factory ships, transparent lines and nets, huge drift nets, bottom trawlers and electronic fish finders led to increases in annual catch. However, total annual catch has leveled off. The global fishing fleet capacity is nearly double the sustainable supply. Many populations of formerly abundant high tropic level species (such as cod) have collapsed. Fishermen are now fishing "down the food web" - catching smaller species that used to be considered "bait" or were food for the larger fish that are no longer abundant enough to catch increase in which many lead to depletion resources/stocks.

1.1.4 Contextual background

Regarding to joint ventures, unilateral fishing by foreign vessels has played a large role in Somali waters. Foreign fishing in Somali waters can be broadly divided into two categories: vessels fishing for tuna and tuna-like species (Highly Migratory Species - HMS), and vessels fishing for coastal pelagic or bottom-dwelling species, including lobsters and squid. Foreign vessels targeting HMS are primarily large, industrial long line or purse seine vessels from Asian and European distant water fleets or smaller gillnet vessels from neighboring countries such as Yemen and Iran (Ibid). These vessels are managed under the regional management framework of the IOTC. Foreign vessels pursuing coastal and bottom-dwelling species are a mix of industrial

trawlers and coastal dhows that may target shrimp, squid, emperors, or snappers, and they represent a diverse geographic range from Kenya to South Korea.

Fishing for HMS by foreign parties in Somali waters has occurred since the early twentieth century, beginning with Italian investment in tuna canneries to support an export market (Dyck & Sumaila, 2010). Publicly available catch datae from the IOTC shows long lining by Japanese vessels in the 1950s and by Taiwanese vessels in the late 1960s in what are now Somali waters.

The foreign HMS fleet has dramatically reduced its reported presence in Somali waters since 2006 for various reasons. First, private agreements between the EU purse seiners and Somali authorities expired in 2006 and have not been renewed. Second, the risk of piracy grew significantly during the mid-2000s,(Oceans, 2014) and many foreign vessels chose to avoid Somali waters as a consequence (Indian Ocean Tuna Commission, 2013). Today, with a decline in pirate activity in the region, foreign fishing for HMS has rebounded for some fleets.

Capture of coastal and demersal fishes by foreign vessels tends to be carried out by demersal and midwater trawlers. Foreign commercial trawling not associated with any joint venture began in the 1980s. Singapore, Greece, and France operated trawlers during the 1980s, but records of their catch are not available. After the dissolution of SHIFCO (a joint venture with Italy) in 1998, Italian trawlers remained in Somali waters and supplied the Italian market with squid and demersal fishes. South Korean trawlers took over the Italian market in 2006; in early 2015, four of them re-flagged to Somalia and operate to this day. Finally, three dozen Egyptian trawlers have operated in the Gulf of Aden under license from Somaliland since at least 2003.

We include here these values for reference, but it is likely that they do not contribute to the Somali economy. Using the prices calculated here, the landed value of fish caught by industrial

vessels ranged from between US$6.9 million to US$39.7 million (average US$20.5 million). Licensing foreign vessels could bring in, at most, about 10% of the landed value, so landing the catch from these vessels in Somalia would be a significantly greater retention of revenue (Glaser,. *et al.,* 2015***).*** However, realizing the additional benefits from landing in-country would require additional investment in fleet, port, and transport infrastructure.

The most economically significant catches in Puntland are finfish, shark, and lobster. Sea cucumber, clams, cuttlefish, and oysters are also targeted at lower levels (Kulmiye, 2010). While there are no recorded domestic industrial fisheries in the region, there are recent reports of trawlers being flagged to Puntland. The sector is therefore almost exclusively based on small-scale artisanal activities and some subsistence capture (Mohamed & Herzi 2005; Kulmiye, 2010).

In 2010, there were approximately 3,136 artisanal vessels in Puntland (Ibid). Seven vessel types are commonly used in the region and the vessel types used in the Gulf of Aden coast and the Indian Ocean coast vary to suit the predominant fisheries and landing conditions. The majority of fishers (70%) do not own the boats they work on (FAO, 2005). The most recent estimate of the number of fishers operating in Puntland is 6,500, with approximately one-third of those being part-time fishers (Ibid). Fishing activities occur in 90 settlements, villages, and towns along the coastline. Some of these settlements are active only during the lobster fishing season (Kulmiye, 2010).

1.2 Statement of the problem

Recent studies show evidence that more than 20 percent of fish stocks have been extricated, another fully 40 percent are overexploited, and the remaining 35 percent are fully exploited. The

forecast is that many more stocks may collapse, and that over-fishing will not only lead to low yield and poor income but will actually threaten many marine ecosystems. The most common form of rights-based fisheries individual transferable quotas has been shown to dramatically reduce the risk of stock depletion (Costello *et al.* 2008). The current performance of the world's marine fisheries however, is far below potential and the annually lost economic benefits are estimated at $50 billion (World Bank and FAO 2008). The illicit nature of IUU fishing means that the size of the problem and its negative consequences can only be roughly estimated. The continuing foreign fishing vessels may therefore lead to a massive overfishing which has resulted to reduction of the fish stock in the waters of Somalia. This study examined the effect of foreign fishing vessels on the commercial fish stocks with a view of making management recommendations for sustainable fisheries resource.

1.3 Objectives of the Study

1.3.1 General Objective

The general objective of the study was to examine the effect of foreign fishing vessels on the commercial fish stocks with special emphasis on Eyl Puntland Somalia

1.3.2Specific Objectives

1. To identify the commercial fish stocks in the waters of Somalia.
2. To assess the fishing capacity of foreign fishing vessels in the waters of Eyl Puntland Somalia.
3. To determine the commercial fish catches of foreign fishing vessels in the waters of Eyl Puntland Somalia.

1.4 Research Questions

1. What is the commercial fish stocks in the waters of Eyl Puntland Somalia?
2. What is the fishing capacity of foreign fishing vessels in the waters of Eyl Puntland Somalia?
3. What is the commercial fish catches of foreign fishing vessels in the waters of Eyl Puntland Somalia?

1.5 Justification and significance of the Study

Fish and fisheries are an integral part of most societies and make important contributions to economic and social health and well-being in many countries and areas. It has been estimated that approximately 12.5 million people are employed in fishery-related activities, and in recent years global production from capture fisheries has tended to vary between approximately 85 and 90 million tonnes. The products from these fisheries are used in a wide variety of ways, ranging from subsistence use to international trade as highly sought-after and highly-valued items.

There are many reasons for this unacceptable state of affairs, but the primary reasons all come down to a failure in fisheries governance in most countries. The responsibility for declining stocks and falling economic returns and employment opportunities in fisheries must be shared amongst fishers, fisheries management authorities, fishery scientists and those involved in environmental degradation. Not all of the underlying problems lie within the realm of fisheries management, but the fisheries manager is the person who is most often in the best position to observe and record what is happening in the fisheries under his or her jurisdiction, to establish the underlying cause or causes of any problems, to rectify those within their jurisdiction, and to bring the others to the attention of both the interested parties in fisheries and those with a

responsibility covering the external causes. This study focused on how the foreign fishing vessel has affected the commercial fish stock in Somalia.

1.6 Scope of the study

1.6.1 Geographical Scope

The study was conducted in Eyl. Eyl is an ancient port town in the northeastern Nugal province of Somalia in the autonomous Puntland macro-region at the longitudes and latitudes of 7°58′00″N 49°51′00″E on the globe.

1.6.2 Content Scope

The study focused on the effect of foreign fishing vessels on the commercial fish stocks. More specifically, the study looked at the commercial fish stocks in the waters of Somalia, fishing capacity of foreign fishing vessels in the waters of Eyl Puntland Somalia and commercial fish catches of foreign fishing vessels in the waters of Eyl Puntland Somalia.

1.6.3 Time Scope

The data was collected during the period between March 2016 to July 2017 considering the complexity and broadness of the study and noting that some of the respondents are government personnel and fisher men who have little time to participate by the nature of their works and the degree of sensitivity of the topic and the state of the nation being in political turmoil and instability.

1.7 Conceptual Framework

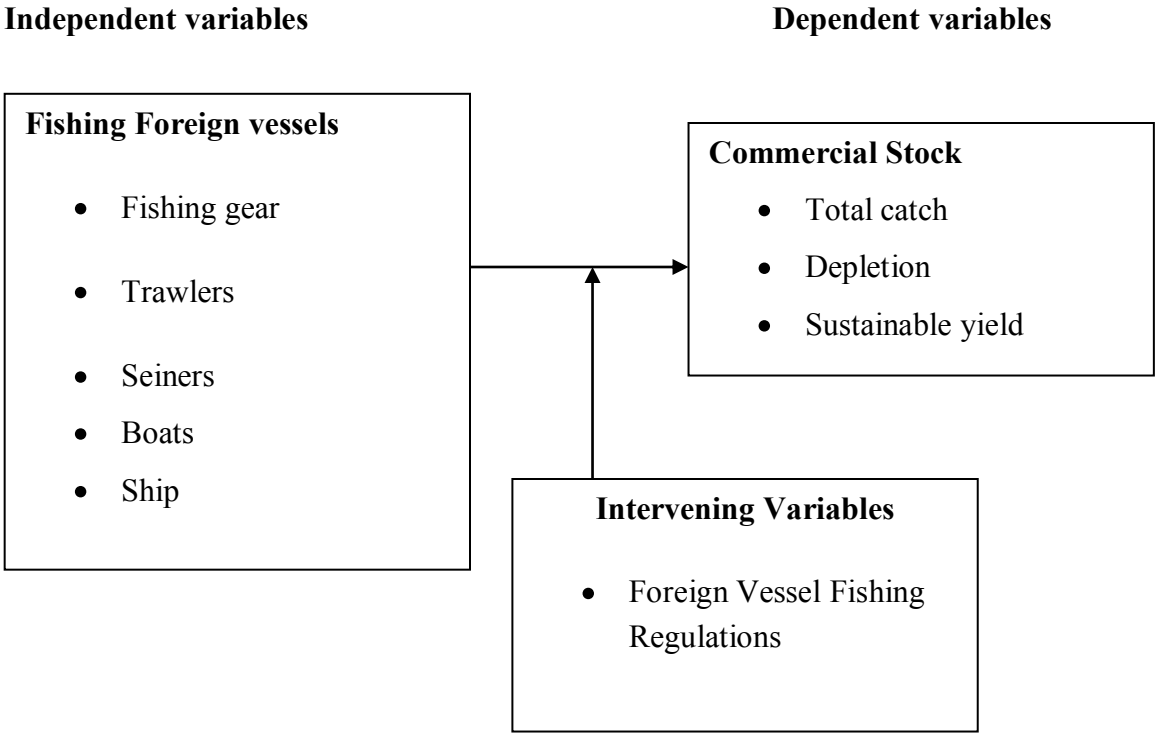

Figure 2: Conceptual Framework

Source: ***As adopted by the researcher 2017 from the literature review***

For non-cultivated fishery, which constitutes marine and fresh water resources, changes in stocks are due to depletion, other accumulation and other volume changes. Depletion is accounted for when fish caught exceeds the sustainable yield, that is, when harvest exceeds natural growth. Since fish is a renewable resource, the stock of fish can be increased if allowed to regenerate. But fish can only regenerate to a level allowed by the carrying capacity of the ecosystem. Given the capacity of the fish to regenerate and its natural life span, the use of this resource, when provided for by its natural growth is not considered depletion. Other accumulation is the conversion of non-cultivated fish stocks to economic control, considered as "economic appearance" in the 1993 SNA.

1.8 Definition of Key Terms

Foreign Fishing vessels; A fishing vessel is a boat or ship used to catch fish in the sea, or on a lake or river. Many different kinds of vessels are used in commercial, artisanal and recreational fishing. According to the FAO (2004), there are currently four million commercial fishing vessels.

Fish stocks: Fish stocks are subpopulations of a particular species of fish, for which intrinsic parameters (growth, recruitment, mortality and fishing mortality) are traditionally regarded as the significant factors determining the stock's population dynamics, while extrinsic factors (immigration and emigration) are traditional.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter presents a review of related literature on foreign fishing vessels and how they affect commercial fish stocks in the world over based on scholars' views, opinions and findings from journal articles, empirical research with a view of throwing more light on the study variables, their relationships and identifying the literature gaps.

2.1 Commercial fish stocks

Although stock assessment methods and abundance indices show somehow healthy stocks of demersal deep water species, there's a common perception among fishermen that some stock may be facing serious problems. Additionally, local fishers fear that open access regime under the current CFP reforms will allow foreign vessels to decimate their fish stocks (Carvalho et al., 2011). They argue that they are an ultra-remote island community, with fragile resources and economies and many rural communities heavily dependent on the fishing sector for their economic wellbeing (Carvalho et al., 2011). They need special recognition and special protection from the threats of open access and free-for-all fishing, which would encourage over-exploitation of fish stocks. Additional, there are some concerns on the potential exploitation of demersal fish stocks outside international trawlers.

The bottom longline and handline fishing is by far the most valuable in terms of landed value. Data available from the Regional Service for Statistics (SREA, http://estatistica.azores.gov.pt) for the period 2000-2010 indicates that the annual landed value of this fishery varied from 18 to 29 million Euros. The average price per kilo of demersal species remained stable for the whole

period at about 5.3 Euros. Although bottom longline and handline catch represented in average 42% of all landed weight their landed value for this period averaged 76% of all landed value in the region. According to Carvalho et al. (2011) the bottom longline fisheries directly employed in 2005 about 350 crew members while the handline fishing about 930 fishermen, representing about 60% of all professional fishermen in the Azores.

According to the New Partnership for Africa's Development: The international trade in fish and fish products is expanding and in 2007, it was valued at $92 billion with developing countries accounting for 50 percent of all fish exports. The EU is the world's largest market for fish, reflecting growing domestic consumption. The EU imported USD23 billion worth of fish and fisheries products from non-EU suppliers in 2007. Although Africa is a huge continent, with an enormous coastline, the continent only accounts for 8 million tons [MT] or 5.1 percent of the world's total fish production capture plus aquaculture [in] 2007.10

The type of industrial fishing most appropriate for Somali waters is purse seining. A typical purse seiner can catch 30 MT a day with a crew of 30. Purse seining does not require a large crew, but the crew members must be well trained in order to safely and effectively operate the machinery. Purse seining uses large nets weighted at the bottom with floats on top. The nets are deployed in the form of a circle around a school of fish and may be closed at the bottom to form a "purse." These nets can measure up to 610 meters long by 200 meters deep. They are too large to handle manually and require specialized equipment to set the net around a school of fish and to haul in the catch. Industrial purse seining vessels have the capacity to freeze and carry 1,000 MT of tuna on board, which is important for preserving the quality of the fish. Given that the average purse seiner catches 4,655 MT each year, this storage capacity means the vessel must

return to port only a handful of times each season. The picture below depicts a typical purse seiner.

2.2 Fishing capacity

The pelagic long line is defined as a series of baited hooks regularly attached to mainline suspended from buoys close to the sea surface. Longlines can be many kilometres long and carry thousands of hooks. The surface longline is very effective in catching swordfish and blue shark. The most common gear used in the Azores is the Spanish type (Coffen *et al.,* 1998), which consists of a multifilament mainline on which 11 m branch lines are attached successively with hooks at a fixed distance of 45 m. Fishing campaigns of the larger vessels can last for about a month from May/June to December. These large vessels deploy an average of 2500 hooks per set and extend their fishing areas outside the exclusive economic zone of the Azores (Ferreira *et al.,* 2001).

The local pelagic longline fishing fleet is quite small. According to Carvalho et al. (2011) there are about 5 pelagic longliners: 4 vessels of length between 12-20 m, and 1 vessel of length between 20-30 m. However, several vessels from mainland Portugal, Madeira or the European Union, usually fish in the Azores EEZ. According to a recent study on VMS data analyses (Morato, unpub. data), there must be around 30 pelagic longliners from mainland Portugal and 1 from Madeira Islands operating in the Azores waters. Spanish longliners returned to the Azores waters in 2004, when European vessels were allowed to fish 100 miles off the Azores, through the Western Waters Regulation, under the Common Fisheries Policy (Reg. EC Nº 1954/2003). The number of EU vessels operating in the Azores waters may be between 35 and 45.

The pelagic longline fleet operating in the Azores region traditionally targets swordfish was first introduced in 1987 (Pereira, 1988a). Other species frequently caught by the longline fleet include blue sharks (*Prionace glauca*) and short-fin mako sharks (*Isurus oxyrinchus*). Other pelagic fish are occasionally caught but never exceeds 1% of the total catch. For recent years, observers' data reported that swordfish catches represent 20% of the total catch (Vandeperre, personal communication); i.e a typical longline set with about 1,000 hooks would catch on average 0.44 tonnes of swordfish, 1.18 tonnes of blue shark and 0.04 tonnes of shortfin mako shark. Total landings in the Azores of the pelagic longline fleet for the period 2000 to 2010 averaged 150 t, ranging from about 90 t in 2008 to 233 in 2000. The annual contribution of this fleet to the total landings in the Azores is averaged about 1.5%. Catch in the Azores but landed elsewhere averaged 1,500 t (Christopher Pham et al., unpub. data), varying from 700t in 2001 to 2,400t in 2007. Reported annual landed values averaged 110t for blue sharks, 30t for swordfish and about 12t for mako shark. Annual landings outside (Christopher Pham et al., unpub. data) may average 1,200t for blue sharks, 260t for swordfish and about 60t for mako shark.

2.3 Commercial fish catches

There are no specific stock assessments for swordfish or blue shark in the region. These assessments have been conducted by the International Commission for the Conservation of Atlantic Tunas (ICCAT). The swordfish and blue shark stocks fished in the area assessed as part of the Atlantic stock. The last assessment for Atlantic swordfish was conducted in 2009. For the past decade, the North Atlantic estimated catch has averaged about 11,500 t per year (ICCAT, 2012). The catch in 2010 represented a 40% decrease since the 1987 peak in North Atlantic landings. These reduced landings have been attributed to ICCAT regulatory recommendations and shifts in fleet distributions, including the movement of some vessels in certain years to the

South Atlantic or out of the Atlantic (ICCAT, 2012). In addition, some fleets, including at least the United States, EU-Spain, EU-Portugal and Canada, have changed operating procedures to opportunistically target tuna and/or sharks, taking advantage of market conditions and higher relative catch rates of these species previously considered as by-catch in some fleets.

The 2011 Swordfish Species Group reviewed new information from Canada, which provided updated age and sex-specific nominal catch rate series for its pelagic longline fishery for the period from 2002 to 2011. The trend indicates that relative abundance has continued to increase since the series low in 2006 and is near the historical high observed in 1990 (ICCAT, 2012). The current results indicate that the stock is at or above level and that the Commission's rebuilding objective has been achieved. However, since 2003 the catches have been below the TAC's greatly increasing the chances for a fast recovery (Airat, 2014).

The status of the stocks of blue shark and short fin make were last assessed in 2008. Ecological risk assessments for priority species of sharks caught in ICCAT fisheries demonstrated that most Atlantic pelagic sharks have exceptionally limited biological productivity and, as such, can be overfished even at very low levels of fishing mortality (Airat, 2014). For both North and South Atlantic blue shark stocks biomass is believed to be above the biomass that would support MSY and current harvest levels below the normal levels (Airat, 2014).

Estimates of stock status for the North Atlantic shortfin mako indicated stock depletion to about 50% of biomass estimated for the 1950s. There is a non-negligible probability that the North Atlantic shortfin mako stock could be below the biomass that could support MSY (Airat, 2014).

2.4 Legal and Institutional Framework

Internationally, for example the Philippines law prescribes penalties for fisheries violations by both Filipino and foreign fishers. In the case of the local Filipino fishers, the prohibitions and penalties under Chapter VI of RA 8550 and relevant fisheries administrative orders apply. Related violations on IUU fishing also consider infringements that may have an impact on fish habitat and the marine environment. The severity of the penalties for most of these violations varies, although most penalties increased after RA 8550 was enacted. Depending on the type of fisheries offence, penalties may come in the form of imprisonment, application of statutory and administrative fines, and forfeiture of fishing vessels, equipment, and fish catch.

To prevent and deter foreign intrusion, RA 8550 and DA-FAO 200 established the rule that mere entry of foreign fishing vessels in Philippine waters is considered a prima facie evidence that the vessel is engaged in poaching, except in cases of force majeure and exercise of the right of innocent passage. Section 87 of RA 8550 imposes a fine of USD 100,000 for poaching by foreign fishing vessels, in addition to the confiscation of catch, fishing equipment, and fishing vessel. An administrative fine for this violation which ranges from USD 50,000 to USD 200,000 can also be imposed. The Philippines recognizes its obligation to ensure the consistent and transparent application of sanctions against fishing vessels, companies, and other entities supporting or engaged in IUU fishing. Such sanctions, particularly those applied to foreign fishing vessels, should be made consistent with international law.

The Philippine Fisheries Code of 1998 adopted the international definition of monitoring, control, and surveillance for fisheries. This definition states that MCS is not limited to enforcement activities but also includes the enactment of sound fisheries legislations and policies and establishment of reliable data collection system. Department of Agriculture Administrative Order No. 3 states that the main objective of the MCS system in the Philippines is to provide a

deterrent to the violation of fishery laws and regulations, particularly the unlawful foreign and domestic fishing in Philippine waters.

Under RA 8550, fishing vessels are required to keep a daily record of fish catch and spoilage, landing points, and quantity and value of fish caught and offloaded for transhipment, sale and/or other form of disposal. DA-FAOs 223 and 223-1 and Marina Memorandum Circular 198 were also formulated to help generate a more accurate and realistic profile of the country's fishing fleet. The Philippines further recognizes its obligations under international law to maintain a record of fishing vessels that will include detailed information about the vessel and determine its compliance with international and national fishing regulations.

The Philippines has ratified, accepted, and acceded to numerous international fisheries-related instruments such as the United Nations Convention on the Law of the Sea (LOSC), Chapter 17 of Agenda 21, UN Fish Stocks Agreement, and the FAO Code of Conduct for Responsible. Fisheries and its associated international plans of action, and relevant International Maritime Organization (IMO) and World Trade Organization (WTO) agreements. However, it has yet to accede to the 1993 FAO Compliance Agreement. The country recognizes that the mere act of ratification or acceptance of these instruments is not sufficient to effectively address IUU fishing. The Philippines acknowledges its obligations under international law to fully implement the provisions of these international instruments by incorporating them in national legislation or by formulating appropriate plans of action.

Also under national laws, for example, most of the illegal fishing activities are directly stated as prohibitions or fisheries offences. Examples of the legislation of Australia, Canada, New Zealand, and the United States are representative. The Australian Fisheries Management Act 1991 (Cth) contains prohibitions against certain types of fishing and against the taking of specific

species such as blue marlin. It further identifies fisheries offences applicable to Australian commercial fishing boats operating within the Australian fishing Zone (AFZ), foreign fishing vessels conducting fishing operations in the Australian fishing zone, and Fish Stocks Agreement (FSA) boats in the high seas. Some of these offences include engaging in commercial fishing without a permit or concession, fishing contrary to the condition of the license, using a foreign boat for recreation fishing in the AFZ, landing of fish by a foreign vessel without permit, and large-scale driftnet fishing. Canada also lists a number of prohibitions in its Fisheries Act such as: use of explosives, use of seines and nets that obstruct navigation or the passage of fish, unlawful sale or possession of fish, processing or exporting of fish without permit, and harmful alteration of fish habitat

Paragraph 3.1.1 of the IUU also implies that activities of fishing vessels conducted contrary to measures and provisions of bilateral fishing access agreements to which they are bound may be considered illegal fishing. Most fishing access agreements and protocols stipulate the terms and conditions within which vessels may conduct their operations. Some of the agreements which clearly stipulate these conditions involve fishing access of European Community (EC) vessels in the EEZs of other States. These agreements contain provisions relating to total allowable catch, number of fishing vessels, declaration of catches, by catch, mesh size, position reporting, fishing zones, and landing of catches

The FAO Compliance Agreement also requires vessels fishing in the high seas not to engage in any activity that undermines the effectiveness of international conservation and management measures. Although the agreement did not specify activities of this nature, it stated that any act undermining conservation and management measures is considered an offence. Similarly, the FAO Code of Conduct refers to the contravention of applicable conservation and management

measures as “illegal activities”. The FAO Compliance Agreement and the FAO Code of Conduct also emphasize that only fishing vessels with licenses or authorization to fish and carrying out their activities in accordance with the conditions of the license may be allowed to operate in the high seas

The legal policies provisioned by the Constitution of Puntland State of Somalia of 2001stipulates environmental protection measures related to fisheries, including protection of endangered species and regulating aquaculture (Ahuge, 2005).

2.5. The gaps

The literature in this dissertation mainly focused on fishing vessels as general concepts leaving out issues relating to foreign fishing vessels such as the foreign fisheries law, registration of fishers and fishing vessels-small scale fishing boats and industrial scale vessels; Requirements for fish landing data collection, analysis and dissemination by the Ministry of Fisheries, Ports and Maritime Transport; Controlled access of the fisheries in the waters of the State for local and foreign fishing vessels; limitations on fishing methods, gear type (mesh size), age and other characteristics of fish that may be caught, landed or traded; and requirements for licenses for Some domestic and all foreign fishing vessels valid for one year. It also notes that a foreign fishing vessel license shall be subject to compliance with management measures and the payment of agreed fees, royalties or charges; and the enforcement capacity of the fisheries institution at Federal and states needs to be improved in terms of human resources and equipment.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter presents the methods that were used in this study which includes study design, population of study, sampling method and sample size, data collection methods and analysis and instruments, reliability and validity, data management and presentation.

3.1 Research Design

A descriptive research design was used in the study basing mostly on the qualitative and quantitative research approaches. This design was appropriate because it involved a descriptive analysis of respondents' ideas and views on the effects of foreign fishing vessels on the commercial fish stocks in Puntland, Somalia across a wide spectrum. This helped to yield in depth information on the study objectives. The study followed sequentially, beginning with interviews that were backed up by documents and records on fisheries of Eyl Puntland by FAO and the Ministry of Fisheries and Marine Resources of both Somalia and Puntland. The Quantitative approach was used because of the foreign fishing vessels and commercial fish stocks that were measured by numbers and analyzed with statistical procedures (Amin, 2005; Airat, 2014). The interview guide was designed to get qualitative views about foreign fishing vessels and the commercial quantity of fish stocks caught in Ely Puntland Somalia. These were then drawn up against expected responses which were then used as a basis for relating the responses from the field against the expected responses from respondents. The characteristics of the respondents were measured at both nominal and ordinal scales (Kothari, 2004).

3.2 Area of the Study

The study was conducted in Eyl Puntland Somalia**.** The study was conducted in **Eyl**, an ancient port town in the northeastern Nugal province of Somalia in the autonomous Puntland macro-region the center of the Eyl District. (Fig:1).

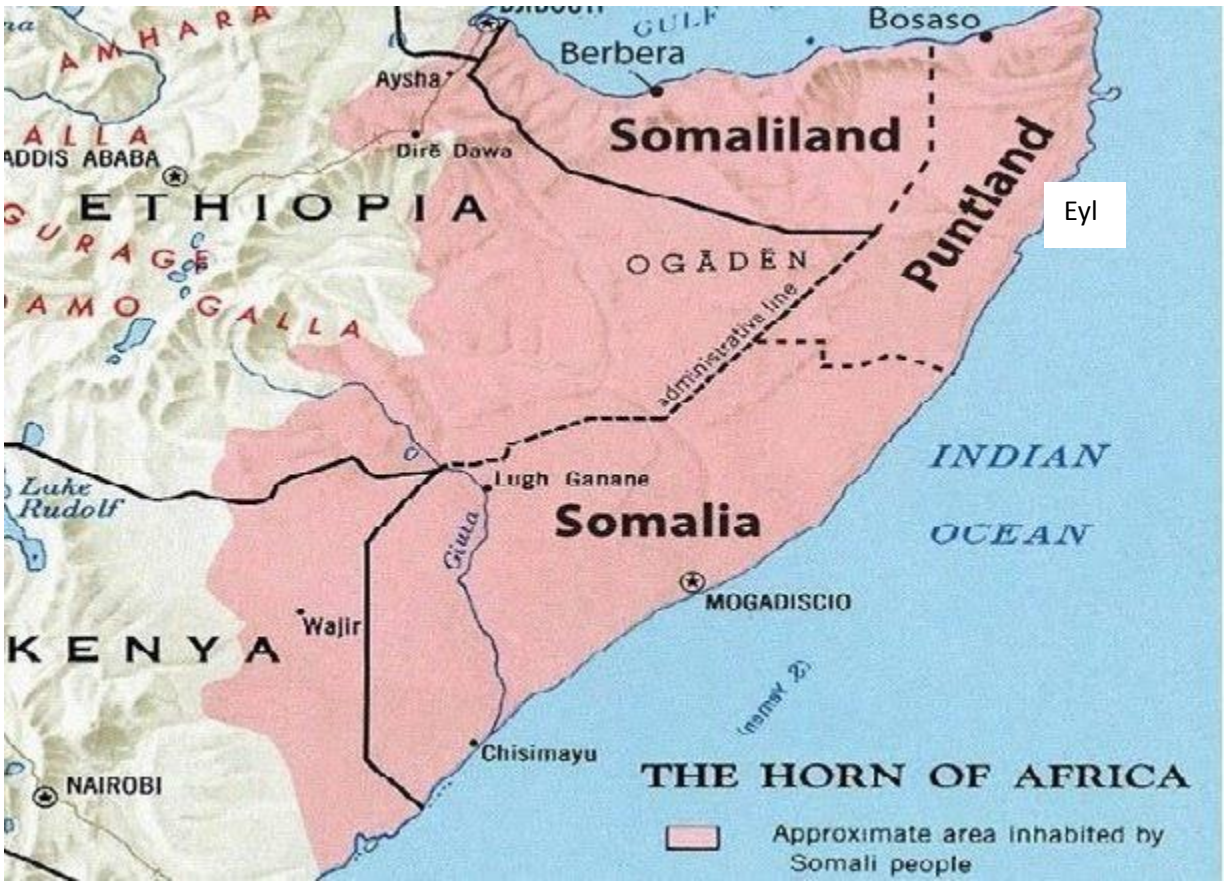

Figure 1: **Location of Eyl in Puntland (Source: Google Maps)**

3.3 Population of Study

The study targeted a population of 230 which included 197 fishermen, 11 marine officials, 11 Puntland authorities and 11 Puntland Fisheries ministry officials.

3.4 Sampling

Sampling was concerned with the selection of a subset of individuals from within a statistical population to estimate characteristics of the whole population (Amin, 2005).

3.4.1 Sample Size

The sample size was 144 respondents which based on Krejcie and Morgan (1970) sample size table (Appendix III). Table 3.1 below shows the summary of the sample size of the respondents and the sampling approaches to be used in the study.

Table 3. 1: Sample size of the respondents

Population category	**Access population**	**Sample size**	**Sampling techniques**
Marine official	11	10	Purposive sampling
Puntland authorities	11	10	Purposive sampling
Puntland fisheries ministry officials	11	10	Purposive sampling
Fishermen	197	114	Simple random sampling
Total	230	144	

Source: **Researcher (2018)**

3.4.2 Sampling Techniques

Sampling techniques refer to the procedure a researcher uses to select the needed study sample (Amin, 2005). The researcher employed simple random sampling and purposive sampling.

Simple random sampling

Sample were selected in such a way that all individuals in the defined population have an equal and independent chance of being selected, that is, a sample obtained from the population without bias. This produced representative samples of the fishermen's population. Fishermen's names were captured and written on pieces of paper which were folded, put in a container, and mixed up. A folded paper at a time was picked at random without replacement and this was included in a sample till the required number was obtained.

Purposive sampling

Purposive sampling was used in respondents of this study involving selection of 10 marine officials, 10 Puntland authorities and 10 Puntland fisheries ministry officials.

3.5 Data Collection methods and Instruments

The study used an interview guide for data collection as well as document review checklist. The researcher ensured that both qualitative and quantitative data was collected using survey method. For the qualitative data, the collection methods involved mainly interviews while for the quantitative data, documentary reviews and records on fisheries statistics were used.

3.5.1 Interviewing

In this method the researcher interviewed respondents (key informants) face to face to obtain in depth information on foreign fishing vessels and the commercial fish stocks. The interviews were structured to comprise a set of question items on which the researcher wished to draw data from the respondents. Their responses were analyzed for content related to the study objectives and written verbatim.

Interviews with the target respondents were conducted using the interview guide by meeting the respondents and asking them questions of which the researcher recorded all the responses by himself verbatim (Airat, 2014).

3.5.2 Secondary Data

A list of books and reports on foreign fishing in Somalia were used to come up with the statistics related to the commercial catches, fishing capacity and fishing stocks.

A list of documents were reviewed was drawn up by the researcher and these were used to come up with the statistics as well as the discussion and analysis of the findings. Permission to conduct the study was sought from authorities to the study.

3.6 Quality Assurance

3.6.1 Validity

Amin (2005) states that validity is the appropriateness of the instrument, validity of an instrument is the ability of that instrument to collect justifiable and truthful data; that is, measuring what it is developed to measure. The instruments were given to ratters who rated the relevancy of each item and a Content Validity Index (CVI) was computed using the following formula:

$$CVI=\frac{R}{R+N+IR} \quad \text{.....(iii)}$$

Where

CVI = content validity index; R= Total number of items rated as relevantly N = Total number of items rated as Neutral; and IR= Total number of questions rated as irrelevant

Twelve items were considered in determining the validity of the research instrument for each element of the independent variable. Then the researcher calculated the content validity index and the results are shown in Table 3.2.

Table 3. 2: Showing the Content Validity Index of the study variables

Variable	Number of items judged relevant	Number of Neutral items	Number of irrelevant Items	CVI
Commercial fish stocks	8	2	2	0.67
Fishing Capacity of foreign fish vessels	11	1	-	0.92
Commercial fish catches of foreign fish vessels	7	3	2	0.58
Average				**0.72**

Source: Primary data

The computed CVIs were above the 0.5 or 50% threshold as postulated by Amin (2005) and an average of 0.72 is also above 0.5 and this implies that the tools that were used in data collection were valid.

3.6.2 Reliability

Reliability of an instrument refers to the ability of that instrument to give uniform responses/answers each time it was used on the same phenomenon. Results realized were discussed with the supervisor for reliability and to make sure that, the instruments were acceptable. The reliability of the interview guide and documentary review was assessed using Cronbach's Alpha at 0.05 level of significance. According to Amin (2005). Cronbach's alpha coefficient was used to test for internal consistency of the research variables to test for the reliability of the interview guide. The following formula was used;

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum \sigma_k^2}{\sigma^2}\right) \quad \text{.....(iv)}$$

Where

$\sum \sigma^2_k$ = the sum of the variances of the k parts (usually items) of the test.

σ = standard deviation of the test (items in the instrument).

α = reliability coefficient.

The results obtained were as follows;

Table 3. 3: Reliability analysis

Variable	**Number of items**	**Cronbach's alpha coefficient**
Commercial fish stocks	5	0.96
Fishing Capacity of foreign fish vessels	20	0.76
Commercial fish catches of foreign fish vessels	6	0.95

Sources: from primary data reliability test

Table 3.2 shows the alpha values of 0.96 for service tangibility, 0.76 for service reliability and 0.95 for service responsiveness which were higher than 0.60 recommended for social research by Amin (2005), thus suggesting that all the items used to measure each variable were consistent in measuring the reliability. Table 3.3 reveals that, all the variables have Alpha Values which are above 0.6 marks, and therefore all the variables in the instrument are deemed reliable. Additionally, errors that had been left out unidentified were detected and removed through pre-testing of instrument by undergoing a pilot study.

3.7 Data Analysis

3.7.1 Quantitative Analysis

Quantitative data was analyzed from the documents using descriptive, frequencies and graphs in relation to the required information.

3.7.2 Qualitative Analysis

The researcher analyzed the data basing on descriptions made by the respondents. Qualitative data analysis was presented in a narrative form on the different questions paused to the respondents. For qualitative analysis, the researcher organized statements and responses to generate useful conclusions and interpretations on the research objectives (Sekaran, 2003).

3.8 Ethical Consideration

Ethical issues were taken into consideration; the permission of respondents was first sought, confidentiality, community norms and values were respected. A rapport was created as a building block for openness and respondents' participation.

3.9 Limitations

In undertaking the study, the research encountered some challenges which were however addressed with time and these were:

3.9.1. Financial constraints

The study was costly in terms of expenses i.e. one position all the time without moving to the next chapters of the dissertation. But some relatives supported me financially. The researcher did not find it easy to get funds to meet the involved costs. However, in one way or the other the

researcher managed to secure a loan which he later paid back. The arrangement was costly as it had financial and time spending implications on the side of the researcher.

3.9.2. Reference Materials

Limited access to recent reports, environment reports, rigidity in accessing the relevant reports from the field were among other challenges faced while conducting the research. It was difficult in finding the relevant books in the university library with which to use related to the selected topic for research study. However, the researcher visited Uganda Management institute library and other Libraries in different Universities which had relevant textbooks for reference purposes.

The study area was perceived as sensitive by many respondents because it involved matters of secret information that could not be revealed. This was overcome by assuring the respondents of their anonymity and proving to them that the study is strictly for academic purposes.

CHAPTER FOUR

ANALYSIS, PRESENTATION AND INTERPRETATION OF RESULTS

4.0 Introduction

This chapter presents data analysis, presentation and interpretation of results: questionnaire rate return, demographic characteristics, respondents' age, gender, questions related to the foreign fishing vessels and the commercial fish stocks.

4.1 Response rate

Out of the 144 expected interviewees, 140 participated in the study. This represents 97.2% response rate, which was considered very good to make conclusions for the study. This high response rate is attributed to the ease with which the interview questions provided to the respondents. A 50% response rate is adequate, 60% good and above 70% rated very well. This implies that basing on this assertion; the response rate in this case of 97.2% was very good as per Kothari, 2004).

4.2: Demographics of the respondents of the study

4.2.1 Gender of respondents

Table 4.2. 1: Gender of respondents

Gender		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	75	52	52	52
	Female	69	48	48	100.0
	Total	144	100.0	100.0	

Source: primary data, 2017

Table 4.2.1 shows the gender of all the respondents. Majority 52% of the respondents were male while 48% were females. This implies that the majority of the respondents were males compared to females in the study. Males dominated the fishing industry because they were majorly responsible for taking care of their families while the women might have been involved in the fishing industry in activities like preparing, cleaning the fish, selling, and preserving the fish. The women were also fishmongers who sold fish to other buyers.

4.2.2 Age of Respondents

Table 4.2. 2: Age of respondents

Age of respondents		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18 – 25 years	30	20.0	20.0	20.0
	26 – 30 years	92	64	64	84
	31 – 35 years	11	7.3	7.3	91.3
	44 – 50 years	4	2.7	2.7	94
	Above 50 years	7	6	6	100.0
	Total	144	100.0	100.0	

Source: primary data, 2017

Table 4.2.2 represents the age of the respondents for the study. Out of a total of 150 sets of questionnaire the researcher returned, a total most of 64% of all the respondents had age ranging between 26 – 30 years and above in a frequency of 92 times. The second largest group of the respondents, a total of 20.0% was those aged 18 – 25years. The third group, a total of 7.3% was those aged between 31-35 years. The respondents aged above 50 were only 6% while the other 2.7% were those aged 44-50 years. The majority were aged 26 to 30 years.

4.3 Commercial fish stocks in the waters of Somalia

The study assessed the commercial fish stocks in the waters of Somalia and results from the literature are analyzed in the table presented below.

Table 4.3. 1: List of commercial fish catches in the waters of Somalia and Punt land (Metric tones, 2014)

English Name	Somali Name	Somalia (000, metric tones)	Puntland (000, metric tones)
Indian thread fin	Leered	54.44	0
Emperor	Gacash	192.46	11.24
Indian halibut	Shirwa	44.44	3.89
Yellow fin tuna	Tabadin	49.17	8.78
Anchovy	Saynug	40.28	5
Shark	Libaax	8.33	4.32
Grouper	Faras	143.61	4.56
Mackerel	Taraaqued	27.78	2.78
Anchovy	Gaguado	38.33	2.56
Grouper	Sumaan	150.89	5.67
Indian halibut	Ascebe	70.39	2.67
Snapper	Qandabo	102.78	5.33
Red snapper	Silgo	0	1.44
Skipjack tuna	Jeader	0	0.56
Skipjack tuna	Yunbi	0	0
Swordfish	Dambiri	0	0
		922.9	**58.8**

(Adopted from FAO, 2015)

The findings by FAO, 2015 indicated that the combined commercial fish stocks in the catches in the waters of Somalia are the emperors (Lethrinidae), groupers (Serranidae), snappers (Lutjanidae), grunts (Pomadasyidae) and threadfin breams (Nemipteridae), lizard fishes (Synodontidae) and goatfishes (Mullidae). The findings showed that fishing is based from some 25 fish landing sites scattered along the north and east coasts. Between the landing sites, the population densities are very low, hence, these fishing grounds. All the views from fishermen's interviews showed that indeed they were overfishing and this influenced negatively on the commercial fish stock they extended to markets. In one of the discussion one fisherman expressed his concern as follows:

> *"The Somali law does prohibit foreign ships from fishing within 15 miles of the coast, with the aim of protecting small-scale fishers. The country has also banned other destructive fishing methods, such as bottom trawling a practice where the ship drags a fishing net across the seafloor, catching everything in its path. Still, the lack of a regulatory maritime entity in the country has enabled the continuation of illegal fishing in the region" (*Fisherman participant from Eyl Puntland).

Catches total landings reported by FAO on behalf of Somalia were 922,930 tones (944,999 tones before adjustment) from 1950-2010, with catches varying between 5,000-15,000 tones for years from 1950 to the early 1980s, before increasing rapidly to around 25,000 tones year by the early 1990s. Following a decline in landings during the 1990s, reported landings increased again to 30,000 tones in the early 2000s and have been fixed at this amount since. Here, we split these data into assumed industrial and small-scale components of reported landings, and added unreported catches as well as discarding to both components.

The reconstructed total catch was around 1.8 million from 1950-2010, which was 98% larger than the adjusted landings of 922,930 reported to FAO on behalf of Somalia for the same period. For the first 20 years (1950-1969), total reconstructed catches averaged around 18,600 t·year-1. During the 1970s and the 1980s, catches increased to around 22,000 t·year-1 and 28,000 t·year, respectively. After the government systems collapsed in 1991, total catches stabilized at 28,000 t·year until 1995, before rapidly increasing to 41,000 t·year-1 by the end of the decade. This increase continued into the 21st century and level led out at almost 65,000 t· year-1 after 2016 (FAO, 2015.

4.4 Fishing capacity of foreign fishing vessels in the waters of Eyl Puntland Somalia.

The research sought to identify the fishing capacity of foreign fishing vessels in the waters of Eyl Puntland Somalia so as to have a comparison with the local fishing capacity. Results are analyzed in the presentation below.

Table 4.4. 1: Types of fishing vessels used and a brief definition.

Local Boat Name	Definition
Saximaad/ Baaraforde/ Faara boota	Fiberglass skiff with outboard
Volvo/Laash	Fiberglass with inboard
Houri	Wooden boat with outboard
Saab	N/A
Shuraac	Sail
Sweden	Made in Sweden
Dhow	Dhow motorized
Sambuk	Wooden boat with inboard engine

Source: primary data(2017)

The boats used in most sites were fiberglass skiffs with an outboard engine. For landing sites along an open coastline, fiberglass skiffs allow easy beaching and landing from a sandy beach. Fiberglass is popular because wood is not always available and fiberglass does not rot. Boats with inboard engines often moor at sea and therefore usually require protected harbors. Dhows and sail vessels are found only in the south under the Swahili influence of Somalia's southern neighbors. There is clearly variability among the sites, but the fiberglass boats are most common and there are very few examples of other boat types.

Plate 2: Longliners fishing vessels used in Somalia (Indian Ocean Tuna, 2013)

Vessel length varied among sites, with the most frequently found sizes between 3 and 6 meters. Vessels of 10 meters or longer were found mainly in Somaliland. The reason for this difference may be due to a preference for smaller boats as they are easier to launch and beach along the open and exposed Indian Ocean coastline. As Table **4.4.2** shows, variation among locations with regard to vessel size is quite high and statistically significant. This indicates that most vessels in the sample are motorized (c. 90 percent), with the largest in Puntland and the smallest in "other" states. The differences are statistically significant ($p<0.01$).

Table 4.4. 2 The foreign fishing boat types, gears and average catch capacity

Fishing Nation	Boat types	Fishing gear	Average catch 2016 (tones)	Estimation Method
Iran	Motorized Boats	Gill net fleet	1800	Reconstruction
Yemen	Freezer Trawlers	Trawlers, Long Liners	3, 000	Reconstruction
Egypt	Fishing fleets	Long liners, motorized boats	3,000	Reconstruction
Seychelles	Fishing fleets	Long liners	1,200	IOTC
Korea	Fishing fleets	Long liners	2,270	IOTC
Taiwan	Fishing fleets	Long liners	2,900	IOTC
Italy	Freezer Trawlers, Fishing fleets	Trawlers, Purse seiners	3,450	Reconstruction
Pakistan	Fishing fleets	Long liners	3,080	Allocation
Japan	Freezer Trawlers, Fishing fleet	Trawlers, Purse seiners	3,120	IOTC
Thailand	Freezer Trawlers, Fishing fleet	Trawlers, Purse seiners	4,200	Reconstruction ,
China	Fishing fleets	Trawlers, Long liners	2,900	IOTC
Kenya	Motorised Boats	Gill net fleet	1,080	Reconstruction
Total			**32,000**	

Source: FAO, 2016

The findings in table 4.4.2 indicate that most of the foreign fishing vessels were a combination of Freezer Trawlers and Fishing fleets from countries such as Italy, Japan and Thailand capable of catching on average 4590 mt (4450+4120+5200)/3 mt while fishing fleets belonging to countries such as Egypt, Seychelles, Korea, Taiwan, Pakistan, and China were capable of catching on average 3092 mt (3,000 + 2400+ 2270+ 2900+3080+4900)/6 mt. However, Kenya and Iran had motorized boats with a capacity of catching on average of 1440 mt. On average the foreign

vessels fishing capacity was 32000 mt after reconstruction and after accounting for the discards in line with IOTC and FAO (2016)

Table 4.4. 3: Artisanal fishing gear used in the Puntland waters and average catch capacity (Metric Tonnes)

Fishing gear	Catch (Mt) (2010-2016)	Operating depth	Operated by	Fishery type
Gill net	1.0	Bottom	Foot fishermen	Lobster
Gill net	1.3	Bottom	Foot fishermen Embarked fishermen	Lobster Fish (demersal)
Gill net	1.4	Bottom	Foot fishermen Embarked fishermen	Lobster Fish (demersal)
Gill net	1.7	Bottom	Embarked fishermen	Fish (demersal) Shark
Drift net	1.1	Surface	Embarked fishermen	Fish (pelagic) Shark
Traps	1.3	Bottom	Foot fishermen Embarked fishermen	Lobster
Hook & Line	2.1	Bottom	Embarked fishermen	Fish (demersal)
Long line	2.3	Surface	Embarked fishermen	Fish (pelagic mostly tuna) Shark
Total	**12.2**			

Source: **Ministry of Fisheries and Marine Resources, 2016**

The findings in table 4.4.3 indicate that the fishing gears used by artisanal fisheries in the waters of Somalia as well as Puntland were mostly gill nets and these were capable of catching the Lobsters, Fish (demersals), and Sharks.

Table 4.4.: Percent distribution of frequency of foreign vessel sightings at 2011

Frequency	Somaliland	Puntland	Other	Total
Never	16.07	1.14	1.89	3.86
Rarely	10.71	5.14	12.26	8.31
Some of the time	10.71	6.86	30.19	14.84
Frequently	23.21	20.00	27.36	22.85
All the time	39.29	66.86	28.30	50.15
N	**56**	**175**	**106**	

Source: FAO, 2015

The findings point out that it would seem the problem is more severe now, as more than twice as many people stated “all the time” for the current period (Table 4.4.4 and figure 4.1) compared to five years ago.

Table 4.4. 4: Percent distribution of frequency of foreign vessel sightings at the current time

Frequency	Somaliland	Puntland	Other	Total
Never	11.43	8.94	5.50	8.38
Rarely	5.71	18.99	11.93	14.25
Some of the time	31.43	25.14	35.78	29.61
Frequently	21.43	24.58	25.69	24.30
All the time	30.00	22.35	21.10	23.46
N	**70**	**179**	**109**	
Kruskal-Wallis Test Statistic: 1.76, $p<0.01$				

Source: FAO, 2015

The findings indicate that sightings have reportedly increased since five years ago (Table 4.4.5) when only 23 percent of the surveyed fishermen reported seeing foreign vessels off their shoreline all the time. Inter-port variation was not statistically significant ($p>0.05$) five years ago.

In an interview with a group of 68 fisherman from Eyl, they expressed their concern aggregatively as this:

> *Most fishing boats used in Somalia are wooden outboard motor Boats and rowboats. These boats catch most of fish with gill nets, lines & hooks, trolling lines, short pelagic longlines, and hand lines, drift nets, purse seine. They are owned by individual fishing families. There are about 1,000 in the country. Somalis are proficient in their manufacture and maintenance. These boats are rowed while some are outboard motors. There are also about 400 small fiberglass boats 6-10 meters long. These boats are mechanized; however, the motors and other equipment for these boats are old and debilitated. It is difficult to find spare parts for them. Some of these boats were manufactured in the country by a project funded by FAO, but was its infancy when the civil war broke out. On gear and*

*spare parts, there is very little or almost no place to buy. (*68 Fisherman participants from Eyl Puntland), 6 of the 10 Marine officials aggregatively remarked thus:

*The most active fishing in Somalia (excluding illegal fishing from foreign trawls) is being carried out along coastal waters. Over all 866 functional motorized GRP vessels are observed actively engaged in fishing. Similarly, the largest number of traditional fishing boats (i.e. the canoe-like Houris and the larger wind powered Mashuas and Bedens) were counted in Somalia. The numbers of fishermen who are actively engaged in the sector of fishing and make a living out of it are estimated 4500 fishermen, although varying considerably in the coastal regions of the country. However, the greater majority of these unaccounted fishermen are not working in the field either because of they are lacking fishing equipment and/or boats or because local or export markets outlet are not available.*6 Marine officialsfrom Eyl Puntland.

In addition to violations by foreign vessels, instances of corruption on the Somali side have also contributed to the depletion of fish stocks in the region. Reports state that Puntland's government has sold $10 million worth of fishing licenses to China, going against the Somali law, which states that fishing permits must be purchased from the central Somali government. In addition to illegal fishing and corruption, other factors behind the resurgence of piracy in the region.

As attacks on ships increased, the waters off Somalia became a no-go zone. At its peak, 47 merchant vessels were hijacked, from a total of more than 200 attempts. It was costing the global shipping industry in excess of $6-billion a year in added security costs and inflated insurance premiums. A global naval flotilla was put together to protect ships and combat the pirates.

In 2009, a *Time* magazine article highlighted the transformation of Somali waters into a "free-for-all" fishing site where international fleets illegally collected more than $300 million worth of

seafood. Foreign vessels have been increasingly present in Somali waters, with seafood captures doubling or even tripling those of Somali fishermen.

For all but the bravest illegal fishermen, fishing off Somalia became more trouble than it was worth and it was simply too dangerous. And without the illegal fishermen, fish stocks began to recover. "Pirates may also be inadvertently playing the role of marine conservationists by preventing commercial over-fishing,"

These findings are in agreement with those of Carvalho *et al.* (2011) who argued that the bottom longline fisheries directly employed in 2005 about 350 crew members while the handline fishing about 930 fishermen, representing about 60% of all professional fishermen in the Ely. The average price per kilo of demersal species remained stable for the whole period at about 5.3 Euros. Although bottom longline and handline catch represented on average 42% of all landed weight their landed value for this period averaged 76% of all landed value in the region.

4.5 Commercial fish catches of foreign fishing vessels in the waters of Eyl Puntland Somalia

The research sought to assess the commercial fish catches of foreign fishing vessels in the waters of Eyl Puntland Somalia. The researcher enquired from the respondents' feelings towards the effect of foreign fishing vessels on the commercial fish stocks. Results are analyzed and presentation below.

The study findings showed that total longline catches (in metric tons, MT) of bluefin, Pacific bluefin, southern bluefin, bigeye, albacore and yellowfin tunas (Miyake, in press), Eyl Puntland and country. The catches were separated into large-scale, small-scale longliners, and by-catch of swordfish longliners, using the general knowledge on longline fisheries. Since the catches by small-scale longliners are often reported as by unclassified gears (artisanal), and since the size of

small-scale longline fleet is not known, it was very difficult to split the catches. Therefore, the results should be considered as a rough estimation.

The various tuna species (including bonito) skipjack and mackerel, of which Spanish and king mackerel is one of the most highly priced species. The traditional fishing grounds for these species are found along the Northern coast (especially the North-eastern) mostly halfway from Mait and usually inshore. It is also known that there are good fishing opportunities in the Gulf of Aden for tuna and skipjack during the Southwest monsoon in the deeper water. The stocks were estimated, at the time of the research, to have an annual catch potential of 2,000/4,000 metric tons (MT), in some extreme cases even reaching 8,000 MT. Species occurring along the Somali coast are, in the mainly, sardines, round, scad, anchovies, and small mackerel and herring type of fish. These are largely restricted to shallow water, and their movements depend very much upon water temperature and currents. The most abundant species are the sardines, and they are found more along the Northeast coast (Indian Ocean) than the North coast. The seasonal abundance of these species (particularly sardines, scads and herring types) is estimated to vary between 120,000 and 370,000 MT, of which about 70,000 to 100,000 metric tones could be caught annually without endangering stocks. Off the North coast, during fishing season, catches of up to 30 MT per night have been taken by purse seining. Catches included sardines, anchovies, small horse mackerel and Indian mackerel. Extensive coastal migration among these small pelagic species, however, makes their availability at North Eastern area seasonal.

The results show that for 2001, approximately 390,000 MT of tunas of these species were caught by large-scale longliners, and 200,000 MT were caught by other longliners (small scale and/or longliners targeting swordfish).

Table 4.5 1: Commercial fish catches of foreign fishing vessels in the waters of Eyl Puntland Somalia (metric tons)

Species caught in Somalia's "EEZ"	Annual landings (average 2007-2016)	Value per ton (average 2007-2016)	Total Annual Value (average 2007-2016)
Yellow fin Tuna	2,168	$2,333	$5,707,851
Bigeye Tuna	1,485	$2,913	$5,044,167
Skipjack Tuna	1,417	$1,035	$1,471,568
Albacore	90	$2,516	$263,354
Tropical Spiny Lobster	453	$9,959	$4,390,080
Swordfish	393	$2,639	$1,245,157
Mixed Group	26,413	$1,051	$27,770,359
Total	**32,419**	**$1,416**	**$45,892,437**

Source: Ministry of Fisheries and Marine Resources, 2016

The findings indicate that the total foreign landings according to the Ministry of Fisheries and Marine Resources, 2016 averaged 32, 419 over for a nine year period (2007-2016).

Table 4.5 2:Summary of foreign catch (in metric tons) in Somali waters, 1981–2013. The decadal columns give the average catch in one year for that decade (not the total catch over ten years).

Fishing Nation	1980s	1990s	2000s	2010s	Total 1981–2013	Estimation Method
Iran	9,444	31,874	44,853	44,853	1,031,673	Reconstruction
Yemen	4,635	15,644	26,537	28,970	579,404	Reconstruction
Spain	1,995	14,803	16,178	8,884	363,296	IOTC
Egypt	3,240	8,370	12,420	12,240	286,020	Reconstruction
France	4,369	6,345	8,335	7,352	215,529	IOTC
Seychelles	13	650	7,407	6,315	105,948	IOTC
Other	694	4,912	4,440	0	99,756	IOTC
Korea	3,172	1,361	2,654	5,495	90,680	IOTC
Taiwan	387	2,481	5,066	2,360	88,393	IOTC
Italy	1,758	3,440	2,408	0	74,306	Reconstruction
Pakistan	0	792	6,595	0	73,878	Allocation
Japan	840	507	1,809	158	31,348	IOTC
Thailand	0	0	2,818	9	28,215	Reconstruction,
China	0	0	922	239	10,174	IOTC
Ex-Soviet	6	148	653	0	8,067	IOTC
Kenya	0	0	4,800	3,200	8,000	Reconstruction
Greece	447	0	0	447	2,235	Reconstruction
Portugal	0	0	208	0	2,080	IOTC
Mauritius	0	138	1	0	1,390	IOTC
Rèunion	0	35	0	0	348	IOTC
Total	**31,000**	**91,500**	**148,104**	**120,522**	**3,100,740**	

Total Catch landed (FAO, 2016)

The findings in table 4.5.2 indicate that the total fish catch by foreign ships as at 2013 was at 3,100 mt as compared to 31 mt in the 1980s. This is an increase by 100,000% in 50 years implying that fisheries production potential had risen.

Table 4.5 3: Fishery Production Potential (FPP) compared to current catch in Somali waters.

Fishery Category	FPP in Somali LME	FPP in Arabian Sea LME	Area-Weighted FPP, Somali LME	Area-Weighted FPP, Arabian Sea LME	Total FPP in Somali Waters	Total Catch in Somali Waters (2013)
Piscivores	215,000	323,000	119,000	17,000	836,000	138,400
Planktvores	542,000	646,000	301,000	34,000	535,000	386,310
Benthivores	597,000	633,000	331,000	33,000	464,000	398,220
Total	**1,354,000**	**1,603,000**	**751,000**	**84,000**	**1,835,000**	**922,930**

Source: FAO, 2015

The results in table 4.5.3 show the fishery production potential (FPP). Catch is from foreign and domestic fishing combined. The area-weighted FPP columns give estimates of FPP in the LMEs that overlap Somali waters as defined by the Somali EEZ. All units are mt.

Fish catch in Somali waters by the foreign fleets (Table 4.5.2) and fish catch from the Somali domestic fleet (Table 4.5.1) are aggregated into categories of piscivores, planktivores, or benthivores and compared to the total FPP in Somali waters (Table 4.5.3). Somali waters have a FPP of 1,835,000 mt per year (Table 4.5.3). By comparison, an estimate of only 992,000 mt of fish were caught in Somali waters in 2013. However, the harvest of these fish is severely unbalanced with respect to categories of fish. The FAO model estimates Somali waters can sustainably produce 136,000 mt of piscivores each year. This category includes tuna, billfishes, sharks, and predatory coastal fishes such as snappers. In 2013, an estimate 139,000 mt of

piscivores were harvested from Somali waters. Consequently, this category of fishes appears to be fished at maximum capacity. It is conclude fishing fleets in Somali waters cannot increase the amount of piscivores caught without implicating the sustainability of these commercially valuable fisheries.

On the other hand, planktivores (such as sardines) and benthivores (such as flatfishes) are fished far less than their estimated FPP (Table 4.3.3); 335,000 mt of planktivores could be harvested from Somali waters each year but only 26,000 mt were harvested in 2013. Likewise, 364,000 mt of benthivores could be harvested from Somali waters each year but only 28,000 mt were harvested. In order to protect the long-term sustainability of Somali's fisheries, development of fisheries for planktivores and benthivores may be most profitable and ecologically sound.

According to one of the Puntland authorities states that:

> *Total landings of the bottom longline and handline components of the commercial fisheries averaged 4.2 thousand tonnes . This value has a high uncertainty not because of high discards rates but because of the difficulty to correct assign landings to fishing gears. The bottom longline and handline fishery contributes from 20% to 60% of all landed weight in the Ely. These fluctuations are related with fluctuations in the tuna landings and thus the total landings in the Ely. Catches from demersal fisheries usually include more than 20 species with economic value. Some of the most important species for the period 2000-2010 are the blackspot seabream with average annual landings of 1,000 t, the conger eel (Conger conger) with average landings of about 400 t, the squid (Loligo forbesi) with about 400 t, the wreck fish (Polyprion americanus) with about 350 t, bluemouth rockfish (Helicolenus dactylopterus) with about 280 tones, the two species of alfonsinos with about 210 t, the*

forkbeard (Phycis phycis) with about 190 t, and the common red porgy (Pagrus pagrus) with annual landings reached 100t.

The findings showed that the estimation of unreported catch in the bottom longline and handline fisheries has been recently made (Christopher Pham et al., unpub. data). From 2000 to 2010, yearly discards averaged about 14% of the reported landings. Total unreported catches from the bottom longline fishery averaged 600 tonnes per year. For this period, deep-water sharks were represented by at least 10 species and accounted for 16% of the discarded organisms. These species are never landed and accounted in average for 135 tonnes of total discarded amount per year. Other species with high discard amounts per year included the bluemouth rockfish and alfonsinos especially for years when the TAC has been exceeded and discards reached more than 40% of the reported catch.

4.6 Summary

The commercial fish stocks

Based on the information and data available from FAO, and the assumptions outlined in the methods used for estimating fish catches both foreign and local catches, 1950-2010 catch data were reconstructed in an attempt to gain a better understanding of likely total Somali domestic catches.

A significant amount of the planktivore biomass is composed of small mesopelagic fishes (myctophids or lantern fishes) that are not currently harvested at expected scales. Myctophids are not likely to be sold for direct human consumption, but they could contribute to fishmeal production in the future.

Fishing capacity of foreign fishing vessels

The fishing capacity of the local fishermen is limited by the types of gears which are not standardized basing on the existing environmental laws of Puntland and this has had an impact

on the capacity because the fishermen with resources are capable of achieving certain level of fish catches while those without resources have to also cater for their subsistence as well

Commercial fish catches of foreign fishing vessels

The commercial fish catches of foreign fishing vessels averaged to 32,000 mt annually over a seven year period (2010-2016) and this was attributed to the level of technology used by their fishing fleets and trawlers.

If the ratio is greater than 1.0, the biomass of a fish stock is higher than that needed to produce MSY for the fishery. Sustainability in this case is based on the ratio of current levels of fish biomass to the biomass needed to produce maximum sustainable yield, or MSY (B/BMSY).

The effect of foreign fishing vessels on the commercial fish stock in Eyl, Puntland Somalia should sustainable commercial fish stock limit is 58.800 metric tones and the foreign commercial catches were 32,000 metric tonnes while the local commercial catches are 12,000 mt, this presents a situation where the foreign fishing vessels have over fished because the foreign commercial catches of 32,000 metric tones are way above half the sustainable fishing limit. This indicates that there is extreme overfishing in the waters of Somalia and at large in Puntland.

CHAPTER FIVE

DISCUSSION OF FINDINGS

5.0 Introduction

This chapter presents the discussion of the findings and these are presented according to the objectives of the study.

5.1 The commercial fish stocks

The total Fisheries Production Potential estimated for Somali waters at 835,000 mt per year, is only achievable if significant increases in catch are made for benthivores and planktivores. A significant amount of the planktivore biomass is composed of small mesopelagic fishes (myctophids or lantern fishes) that are not currently harvested at expected scales. Myctophids are not likely to be sold for direct human consumption, but they could contribute to fishmeal producton in the future. The large imbalance in harvest between piscivores on the one hand and planktvores and benthivores on the other hand is illustrative of a global pattern: top predators have been highly desired for human consumption for many decades and their harvest levels are likely at (or in excess of) levels that are sustainable. The findings in the study are in line with Nincic (2008) who notable points out that for humans to increase fish catch in a sustainable manner, a more balanced approach to harvesting should increase catch of benthivores and planktvores. In this regard, Somali waters are no different from those in the rest of the world's oceans.

Based on the information and data available from FAO, and the assumptions outlined in the methods used for estimating fish catches both foreign and local catches, 1950-2010 catch data

were reconstructed in an attempt to gain a better understanding of likely total Somali domestic catches. The reconstructed total catch estimates are nearly two times the data reported by FAO on behalf of Somalia, with reconstructed small-scale catches as the major contributor to the difference.

It is interesting to note that the commercial catches showed an increase during the initial phase of the civil war instead of the expected decline. This data reflects the loss of monitoring and enforcement capacity of Somalia during that time, which seems to have been taken advantage of by foreign vessels engaging in illegal fishing. Unlike commercial catches, the reconstructed small-scale catches are thought to better reflect the unstable situation in Somalia. However the researcher expected the late 1980s to be connected with a rapid decline after the collapse of the legitimate government in 1991. After this initial decline, small-scale catches were expected to increase substantially after 1995 due to the increased involvement and private investments in the domestic artisanal fisheries sector was the main reason for the observed increase in catches which also was supported by Lovatelli (1996).

The researcher figures out that other contributing factors to this state of affairs could have been the change in seafood consumption habits among the Somalis, the relocation of displaced people due to war, and the increased use of motorized boats by artisanal fishers as supported by Anon. (2001).

The aspect of foreign illegal and semi-illegal fishing has an impact on the commercial fish stocks and this is because since Siad Barre's regime collapsed in 1991 (and possibly even before that), Somalia has not been able to comprehensively patrol and protect its waters. Numerous vessels from various countries are thought to have exploited the situation by fishing illegally in Somali waters (e.g. Qayad 1997; Jennings 2001; Mwangura 2006b; Schofield 2008). There are

contradictory reports about the number of illegal fishing vessels operating off the Somali coastline. Some of the more recent numbers suggest a decline from 500 foreign fishing vessels in 2006 (Mwangura, 2006a) to 200 fishing vessels in 2009 (Anon, 2009c). However, exact numbers are not known due to the absence of monitoring and enforcement capacity within Somali waters. Furthermore, the number of foreign fishing vessels operating in Somali waters is also difficult to monitor due to the lack of transparency in data sharing among international monitoring agencies working in the Indian Ocean.

As a matter of fact, misleading the public seems commonplace, as many fishing vessels, even while being attacked by Somali pirates, systematically withheld accurate position reports from relevant agencies, such as the International Maritime Bureau and International Maritime Organization, and these agencies avoid reporting positions in favour of likely dubious self-reporting by vessels (Hansen, 2009). In contrast, the commercial MaRisk system, using position data collected via satellites and remote sensors from the military coalition fleet, showed that fishing vessels were deep within Somalia's EEZ when captured by pirates (Hansen 2009).

The autonomous, but unrecognized territories of Somaliland and Puntland had some limited success in controlling illegal fishing for short periods. i.e. the Puntland administration assigned responsibility for controlling coastal resources to private security companies such as Hart Security (British) for 2000-2001, SOMCAN (United Arab Emirates) from 2001-2006, and Al Hababi Marine Services (Saudi Arabia) in 2006 (Hansen, 2008). However, these initiatives met with limited success as most foreign vessels escaped into international waters whenever the private security vessels approached. Thus, for example, only four fishing vessels were arrested by Hart Security. None of the private security arrangements survived the interplay of local clan politics and changing political equations in these territories (Hansen, 2008; Kinsey, 2009).

It has been suggested that illegal foreign fishing in Somali waters has been the social reason for the resurgence of piracy in the region during the 2000s (Jennings, 2001; Lehr and Lehmann, 2007; Menkhaus, 2009). The catch reconstruction illustrates that domestic artisanal catches did decline after the start of the civil war and the collapse of central governance control. At the same time, foreign fishing fleets started to substantially increase their illegal fishing activities in Somali waters.

5.2 Fishing capacity of foreign fishing vessels

The initial decline of artisanal catches was most likely caused by the lack of gear and boats, as well as the increased risk due to civil war, but might also have been impacted by the illegal foreign fleets. It has been reported that foreign vessels fished very close inshore and destroyed local fishing gears. These findings are in line with Lehr and Lehmann (2007) who points out that the loss of their fishing boats and gear would have fuelled anger towards foreign fishers. Irrespective of the initial reasons and drivers for the resurgence of violence, the fishing capacity of the foreign fishing vessels was far more advanced compared to the local artisanal fisheries though it is the lack of fishing licenses that allows fishing in the state in case one has the fishing license of Somalia, they may not be allowed to fish in Puntland waters which requires one to have a license from Puntland as well.

The fishing capacity of the local fishermen is limited by the types of gears which are not standardized basing on the existing environmental laws of Puntland and this has had an impact on the capacity because the fishermen with resources are capable of achieving certain level of fish catches while those without resources have to also cater for their subsistence as well. These findings are in line with studies carried out by Menkhaus (2009). The traditional boats are

thought to have had a much higher fraction that were operational, due to lower mechanization and easier, more traditional maintenance requirements. Therefore, the fraction of operating traditional boats is in line with Thurow and Kroll (1962)

Somali fishers are limited by the small size of their boats and lack of access to fish-finding technologies. Larger boats, navigatonal equipment (e.g., GPS and navigaton charts), and fish-finding sonar systems would increase the ability of Somali fishers to compete with industrial and foreign vessels. Most Somali vessels catch fish using gillnets; this precludes catching large, highly migratory (and highly profitable) tuna such as yellowfin, and gillnets create unwanted bycatch. It is believed, there is great potental in an artisanal pole-and-line yellowfin tuna fishery.

For example, the Maldives have leveraged their artisanal tuna fishing practices onto a larger scale, and they market their products accordingly: pole-and-line caught tuna from the Maldives is highly desired and commands above-market prices because it is certified sustainable by the Marine Stewardship Council. Somalia has similar potential. Targeted investment into pole-and-line gear or longlines equipped with catch prevention measures could create a niche market for Somali tuna. The findings show catch of highly migratory tuna in Somali waters is approaching the limits of sustainability, so increases in domestic harvest must be reconciled with the large amounts of tuna caught by foreign vessels. Somalis would earn greater income from a profitable artisanal tuna fishery than from licensing foreign vessels to land the same fish, but development of such a fishery will take time. However, there may be even greater potential for catch of the coastal species of tuna (e.g., frigate tuna, bullet tuna, or kawakawa). Depending on the statistics by the IOTC does not yet perform sustainability analyses for these species, but Somali-led data collection initiatives could help fill this gap. This is also supported by other observations (Gulaid 2004; Mohamed and Herzi, 2005; Sabriye, 2005). Also the increasing piracy activities in the

2000s may have reduced illegal foreign fishing in coastal waters, permitting and enabling an increase in domestic artisanal sector to re-emerge.

5.3 Commercial fish catches of foreign fishing vessels

The commercial fish catches of foreign fishing vessels averaged to 32,000 mt annually over a seven year period (2010-2016) and this was attributed to the level of technology used by their fishing fleets and trawlers. Irrespective of the issue of piracy, the problem of foreign fishing fleets illegally exploiting Somali waters illustrates a severe failure of flag-state control, and further illustrates that illegal fishing is a matter of international, trans-boundary criminal activity rather than a fisheries management failure (Österblom *et al.* 2011; UNODC, 2011). The value of illegal catches taken out of Somali waters in 2005 was estimated as being at least US$300 million (Lehr and Lehmann, 2007). This lucrative illegal business is thought to have contributed to the prolongation of instability in the country, since neither foreign fishing interests or local authorities (warlords) would have benefited as much from properly controlled legal operations (Coffen-Smout, 1998; Jennings, 2001). Importantly, the value taken out of Somali waters by the illegal foreign fleets would not be available to the Somali people and society. In contrast, with fully transparent and legal licensing through foreign fishing access agreements, a functional national government would have been able to derive benefits for all of Somali society from one of their largest natural resources. Such controlled access would be an important source of foreign exchange income for legal national authorities, and might contributed to the stability of the country (UNEP, 2005).

Although stock assessment methods and abundance indices show somehow healthy stocks of demersal deep water species in the Ely, there's a common perception among fishermen that some

stock may be facing serious problems. Additionally, local fishers fear that open access regime under the current CFP reforms will allow foreign vessels to decimate their fish stocks (Carvalho *et al.,* 2011). They argue that they are an ultra-remote island community, with fragile resources and economies and many rural communities heavily dependent on the fishing sector for their economic wellbeing (Carvalho *et al.,* 2011). They need special recognition and special protection from the threats of open access and free-for-all fishing, which would encourage over-exploitation of fish stocks. Additionally, there are some concerns on the potential exploitation of demersal fish stocks outside the Eyl by international trawlers.

Sustainability in this case is based on the ratio of current levels of fish biomass to the biomass needed to produce maximum sustainable yield, or MSY (B/BMSY). This ratio is a common metric of sustainability used by the Indian Ocean Tuna Commission (IOTC), among others. If the ratio is greater than 1.0, the biomass of a fish stock is higher than that needed to produce MSY for the fishery. Theoretically, then, the fishery could support a higher level of fishing. If the rato is less than 1.0, the biomass of a fish stock is below that needed to produce MSY for the fishery, and fishing levels should be reduced to improve sustainability.

In systems such as Somalia's, which lack regular scientific surveys of marine resources, it is nearly impossible. Costello *et al.,* (2012) developed an approach for estimating B/BMSY when only catch and basic biological information are available. The analysis to Somalia's waters is limited to the catch from those species groups that (a) had sufficient data for analysis and (b) were not highly migratory species (HMS). HMS stocks undergo more rigorous sustainability analysis by the IOTC. Using a combined catch from both the foreign and domestic catch estimates for dolphin fish, emperors, goatish, jacks, clupeids, snappers, sharks, rays, groupers,

and grunts. Uncertainty in catch reconstructions at the species level and limitations with the sustainability model precluded analysis of individual species.

At least 8 of the 17 fish groups analyzed are currently fished at unsustainable levels. These include swordfish, striped marlin emperors (including the commercially important spangled emperor, Lethrinus nebulosus), goatfish, snappers, sharks, groupers, and grunts (including the commercially important painted sweetlips, Diagramma pictum).

Analysis on categories of catch that range from species (e.g., yellowfin tuna) to groups of families (e.g., sharks), results found for aggregated categories do not translate to the species that make up that group, and variation between species will occur.

Increased foreign fishing may be due to a recent weakening of deterrence factors that include patrolling shores and apprehending or sanctioning violators. While it is difficult to show actual cause, in some of the following sections, anti-piracy patrols are blamed for making illegal fishing easier (there is less likelihood of pirate attacks to deter foreign fishing vessels), so recent success in anti-piracy campaigns may be unintentionally making illegal fishing by foreign vessels easier. Distribution of these species is also strongly influenced by environmental changes and therefore the availability and abundance would vary from year to year depending on currents and upon the onset of monsoon winds.

5.4 Implications of foreign fishing

Foreign fishing will deplete fish stocks as well as have a negative impact on the livelihoods of the local fishermen whereby the local catches will reduce drastically

Pollution of the waters due to their advanced ship types that dump hazardous and domestic wastes into the water body and thus these results into eutriphication and also temperature increase of the water which leads to suffocation of fish and this ultimately death of the fishes.

Foreign fishing will increase piracy that is intended to limit foreign fishing and this may overlap thus causing a loss to the economies of both Somalia and Puntland because Somali waters is a path of international commercial ships which are going to gulf states and the rest of the world thus this leads to economic implications

Also some fishes will extinct because the trawlers normally destroys the breeding areas of the fish and this leads to reduction of fish species thus reduces the annual catch landings.

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.0 Introduction

This chapter presents a summary of findings, conclusion derived from the study and makes recommendation, and suggestions for further studies.

6.1 Summary of Finding

6.1.1 The commercial fish stocks

In Somalia, the study found out that the total Fisheries Production Potential estimated for Somali waters is 835,000 mt per year which is only achievable if significant increases in catch are made for benthivores and planktivores because these fishes acts as predators to other smaller fishes although these are commercially viable fishes. the combined Commercial fish stocks in the catches in the waters of Somalia are the emperors (Lethrinidae), groupers (Serranidae), snappers (Lutjanidae), grunts (Pomadasyidae) and threadfin breams (Nemipteridae), lizard fishes (Synodontidae) and goatfishes (Mullidae). The findings showed that fishing is based from some 25 landing sites scattered along the north and east coasts. Between the landing sites the population densities are very low, hence, these grounds are only lightly fished.

6.1.2 Fishing capacity of foreign fishing vessels in the waters of Eyl Puntland Somalia

The fishing capacity of the foreign fishing vessels were found to possess a combination of Freezer Trawlers and Fishing fleets from countries such as Italy, Japan and Thailand capable of catching on average 4,590 mt while fishing fleets belonging to countries such as Egypt, Seychelles, Korea, Taiwan, Pakistan, and China were capable of catching on average 3,092 mt

However, Kenya and Iran had motorized boats with a capacity of catching on average 1,440 mt. on average. The foreign vessels fishing capacity was 32,000 mt after reconstruction and after accounting for the discards in line with IOTC and FAO (2016). In relation to the artisanal fisheries, the fishing gear used in the waters of Somalia as well as Puntland were mostly gill nets and these were capable of catching the Lobsters, Fish (demersals), and Sharks. The boats used in this case were mostly fiberglass skiffs with an outboard engine which allowed easy beaching and landing from a sandy beach on an open coastline. The local fishermen used boats with inboard engines which often moor at sea and therefore usually require protected harbors. Dhows and sail vessels were found only in the south under the Swahili influence of Somalia's southern neighbors. The findings revealed that much of the fish caught by local fishermen was sold at-sea and never brought to shore, and is therefore not recorded as caught or landed in Somalia by Somali fishermen, even if data was recorded at local landing sites. Since most of these fish are reportedly bought by Yemeni traders, it is considered to have neither landed in Yemen nor been caught in Somalia waters. It is unclear whether selling fish at sea is illegal in Somalia or Puntland. Such transshipment is banned in many countries to ensure such catches pass through local landing sites and processing facilities. It also confounds data collection systems in terms of volume of landings and source of catches even though it may be profitable to both fishermen and traders. It can clearly be principally seen as unreported and unregulated catch, so another aspect of IUU fishing that requires closer investigation and action. There is clearly much work to be done to understand the extent and magnitude of the problem and to build more robust fish catch-reporting systems with local fisheries authorities in Somalia.

6.1.3 Commercial fish catches of foreign fishing vessels in the waters of Eyl Puntland Somalia

The catches by small-scale longliners are often reported as by unclassified gears (artisanal), and since the size of small-scale longline fleet is not known, it was very difficult to split the catches. These include the various tuna species (including bonito) skipjack and mackerel, of which Spanish and king mackerel is one of the most highly priced species. The traditional fishing grounds for these species are found along the Northern coast (especially the North-eastern) mostly halfway from Mait and usually inshore. It is also known that there are good fishing opportunities in the Gulf of Aden for tuna and skipjack during the Southwest monsoon in the deeper water. The stocks were estimated, at the time of the research, to have an annual catch potential of 2,000/4,000 metric tons (MT), in some extreme cases even reaching 8,000 MT. Distribution of these species is also strongly influenced by environmental changes and therefore the availability and abundance would vary from year to year depending on currents and upon the onset of monsoon winds.

Species occurring along the Somali coast are, in the main, sardines, round, scad, anchovies, and small mackerel and herring type fish. These are largely restricted to shallow water, and their movements depend very much upon water temperature and currents. The most abundant species are the sardines, and they are found more along the Northeast coast (Indian Ocean) than the North coast. The seasonal abundance of these species (particularly sardines, scads and herring types) is estimated to vary between 120,000 and 370,000 MT, of which about 70,000 to 100,000 mt.

6.2 Conclusion

6.2.1 The commercial fish stocks

In Somalia, the total Fisheries Production Potential estimated for Somali waters is 835,000 mt per year only achievable if significant increases in catch are made for benthivores and planktivores which are predators to other smaller fishes although the combined commercial fish stocks in the catches in the waters of Somalia are the emperors (Lethrinidae), groupers (Serranidae), snappers (Lutjanidae), grunts (Pomadasyidae) and threadfin breams (Nemipteridae), lizard fishes (Synodontidae) and goatfishes (Mullidae).

6.2.2 Fishing capacity of foreign fishing vessels in the waters of Eyl Puntland Somalia

The fishing capacity of the foreign fishing vessels are combinations of Freezer Trawlers and Fishing fleets capable of catching on average 4,590 mt while fishing fleets are capable of catching on average 3,092 mt and the motorized boats having a capacity of catching on average 1,440 mt.

6.2.3 Commercial fish catches of foreign fishing vessels in the waters of Eyl Puntland Somalia

The Commercial fish catches of foreign fishing vessels account for 32,000 mt on average and these catches are composed of various tuna species (including bonito) skipjack and mackerel, of which Spanish and king mackerel is one of the most highly priced species. The major species occurring along the Somali coast are mainly sardines, Scad, anchovies, and small mackerel and herring type of fish. These are largely restricted to shallow waters, and their movements depend very much upon water temperature and currents. The most abundant species are the sardines, and they are found more along the Northeast coast (Indian Ocean) than the North coast.

The effect of foreign fishing vessels on the commercial fish stock in Eyl, Puntland Somalia have shown that since the sustainable commercial fish stock limit is 58,800 metric tones and the foreign commercial catches are 32,000 metric tones while the local commercial catches are 12,000 mt, this presents a situation where the foreign fishing vessels have over fished because the foreign commercial catches of 32,000 metric tones are way above half the sustainable fishing limit. This indicates that there is extreme overfishing in the waters of Somalia and specifically in Puntland.

6.3 Recommendation and area for further study

a) Based on the findings, in order to improve on the commercial fish stocks, there is a need for the Somalia and Puntland Ministries of Fisheries and marine to set standards and catch limits which in the long term will limit fishing of near extinct specifies and increase in their production.

b) The government of Somalia and that of Puntland should put together joint monitoring programmes of the implementation of their fisheries laws and policies so as to evaluate the status of the marine resources. This will provide a basis for issuing licenses to actors and promote coordination which will improve overall fisheries management.

c) In order to improve on the fishing capacity, the is a need for the governments of both states to implement use of standard fishing gear for certain fish types so as to reduce on fishing of premature fish. The governments should also demarcate areas where certain fishing gears can be used so as to reduce on the destruction of the environment caused by these fishing gears.

d) Stock assessment survey should be undertaken by the Ministry of Fisheries and Marine Resources on specific commercial and high value species on finfish such as shark and tuna so to establish their business and ensure they do not go below the required numbers or business. Based on stock assessed studies species specific licensing could be promoted.

e) The data collection system of fisheries should be improved through training the fisheries ministry official and staff from the line ministries and the organizations so that real up to date data can be used for estimating, modeling and making best fisheries management decisions.

f) Fisheries enforcement needs more involvement of fishermen, particularly in community - based surveillance and reporting. This could be accomplished in part by using SMS and cell phone technologies to report infractions, and via community radio call-ins.

g) Somalia needs to sign or ratify the Port State Measures Agreement. This will provide minimum standards for the conduct of dockside inspections and training of inspectors and requires parties to restrict port entry and port services for foreign fishing vessels.

h) Research should be undertaken by both Somalia and Puntland so as to establish best practices in fishing and regulating overfishing which will in turn increase and improve the commercial fishing industry in both states.

i) The researcher recommends that, further research should be conducted on mechanisms to enhance the effectiveness of commercial fish stocks in sustainable development in Somalia.

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Appendix I: Interview guide

What is your age?

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Where do you live?

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Where do you originate from?

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What is your position on the vessel?

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Are you self employed?

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……

Where do you land your catch?

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……

How long have you been working in the fishing industry?

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……

What type of registered vessel do you mainly work on?

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……

What kind of techniques/gear(s) do you normally use during fishing activities?

……

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……

……

What are your main target species and associated by catch species?

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……

Please estimate your total annual landing size

……

……

Where is your main ground located?

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……

What is the commercial fish stock in the waters of Eyl Puntland Somali?

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What is the fishing capacity of foreign fishing vessels in the waters of Eyl Puntland Somalia?

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What is the commercial fish catches of foreign fishing vessels in the waters of Eyl Puntland Somalia?

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Appendix II: Secondary Data Checklists

DOCUMENTS	SEEN	NOT SEEN	REMARKS
Puntland Ministry of fisheries reports 2015/16			
Previous reports on foreign fishing vessels by ADESO			
FAO reports on status of fisheries, Somalia			
UNDP report on status of artisanal fisheries in puntland			
ADESO IUU final report of 2015			
UNDP feasibility report on the fisheries sector of puntland			
Shuraako report on foreign vessels in puntland and Somaliland			

Appendix III: Table for determining sample size

N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Source: Krejcie and Morgan, 1970, Note:—*N* is population size. *S* is sample size.