Report Of The Auditor General On Sustainable Management Of Fish Resources In Natural Waters

JUNE, 2015

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ACRONYMS

CCRF	:	Code of Conduct for Responsible Fisheries
CpUE	:	Catch per Unit of Effort
DoF	:	Department of Fisheries
FAO	:	Food Agriculture Organisation
FMP	:	Fisheries Management Plan
INTOSAI	:	International Organisation of Supreme Audit Institutions
MAL	:	Ministry of Agriculture and Livestock
OAG	:	Office of the Auditor General
PLARD	:	Programme for Luapula Agriculture and Rural Development
RSNDP	:	Revised Sixth National Development Plan
VMC	:	Village Management Committee

EXECUTIVE SUMMARY

i. Background to the Audit

Fisheries are an important source of food, social and cultural benefits and contribute to rural development through employment, income generation and poverty reduction.

However, the fisheries sub-sector faces challenges such as overfishing, degradation of fish habitats and the use of destructive and unsustainable fishing methods such as the use of poisons, explosives and mosquito nets among others which have contributed to the depletion of fish stocks. It is for this reason that the Auditor General considered conducting a performance audit on sustainable management of fish resources in natural waters.

The objective of the audit was to assess whether the Ministry of Agriculture and Livestock (MAL) had implemented effective measures to promote sustainable management of fish resources.

ii. Major Findings

The following observations were made:

- The Department of Fisheries (DoF) did not have knowledge of the biomass[1] of fish species in natural waters except for kapenta and buka-buka. Consequently, the DoF was unable to institute technical measures to control the harvest of fish from the natural waters for demersal or inshore fish species as there was no determination or estimation of the limit of how much fishers could take out as well as how much was to be left for regeneration.
- Fisheries Management Plans (FMPs) in fishery areas were not in place. The result of not having the plans in place hindered DoF's intention of managing fish resources on a co-management basis with the community.
- Control measures in place were not effectively implemented. Fishers continued to fish without licences and were not adhering to the fishing ban. Use of illegal methods such as mosquito nets, potato sacks (commonly called sefa-sefa or chikukula), weirs, explosives and poisons were reported. These methods impact negatively on the fish as they disturb breeding sites, migration routes and indiscriminately kill fish.
- Although breeding sites had been identified and gazetted, a review of documents revealed that fishers had settled in some identified breeding areas and were actually undertaking fishing activities in those areas. The DoF was not regulating landing sites. As a result, fishers landed fish anywhere making it difficult for the DoF to collect statistics on fish catches.

[1]In ecology, is the mass of living biological organisms in a given area or ecosystem at a given time.

- Monitoring, Control and Surveillance (MCS) was carried out to check whether fishing activities are in accordance with the regulations. However, the DoF was not able to achieve targets set. Factors that were attributed to the DoF not achieving the set targets included low staffing levels, inadequate land and water transport, and untimely and inadequate funding.

iii. Conclusion

The Ministry of Agriculture and Livestock (MAL) and the Department of Fisheries (DoF) have not implemented effective measures to promote sustainable management of fish resources.

iv. Recommendations

- The DoF should determine the fish biomass which will enable them to estimate how much fish can be harvested and how much can remain for regeneration.
- DoF should ensure that FMPs are drawn and implemented for all fishery areas in order to improve management of fisheries resources in the country.
- The DoF should strengthen participation of key stakeholders such as the VMCs, ZMC, FMC and support progressive fisheries management initiatives and programmes that will address issues of overfishing and use of illegal gear and fishing methods. It is important to get communities involved in the management of fisheries as it creates a sense of ownership of the resources.
- The DoF should improve resource allocation for fisheries management and community level sensitization programmes.

1. INTRODUCTION

a) Background

The Agricultural sector which encompasses crops, livestock and fisheries sub-sectors is one of the Revised Sixth National Development Plan (SNDP) priority sectors in achieving sustainable economic growth and reducing poverty in Zambia. While agriculture is the most important source of livelihood, Zambia has 15 million hectares of water in the form of rivers, lakes and swamps which provide the basis for extensive freshwater fisheries[2].

Fisheries are an important source of food, social and cultural benefits and contribute to rural development through employment, income generation and poverty reduction. The fisheries sector contributes 3% to the agriculture GDP which currently stands at 18%[3]. The fisheries sector provides employment through fishing, processing, trading and boat building. There are also some seasonal jobs that are created when the fishing activities are at their peak as well as various jobs in fisheries research and extension. As of December 2014, the number of fishers in the country was estimated at 72,053 while the number of fish farmers was estimated at 12,500[4]. The DoF in the Ministry of Agriculture and Livestock is responsible for execution of the Ministry's mandate on fisheries in Zambia.

b) Motivation

The performance audit on the management of fish resources was carried out following concerns raised by MPs in the House and media reports on overfishing, degradation of fish habitats and the use of destructive and unsustainable fishing methods such as the use of poisons, explosives and mosquito nets among others which have contributed to the depletion of fish stocks.

Further, the development of the fisheries sector was identified by Government in its budget for 2014 as one of the policies and strategies for consolidating growth and job creation and that the Government intended to reposition Zambia as a net exporter of fish by promoting aquaculture development and improving infrastructure for fisheries research and marketing.

In a preliminary study carried out by the Office of the Auditor General (OAG), it was found that the DoF faced challenges in carrying out surveillance and enforcement resulting in non-adherence to the fishing ban and the continued use of illegal fishing methods by fishers.

[2]FAO Fisheries Country Profile – The Republic of Zambia

[3]ZDA Zambia Agriculture, Livestock and Fisheries Sector Profile 2011

[4]Source: Department of Fisheries

2. AUDIT DESIGN

a) Audit Objective

The objective of the audit was to assess whether the Ministry of Agriculture and Livestock (MAL) had implemented effective measures to promote sustainable management of fish resources.

b) Audit scope

The audit focused on the measures put in place by the MAL through the DoF to achieve its overall objective of promoting sustainable management of fish resources in natural waters (capture fisheries). The audit covered operations relating to the period 2011 to 2014.

c) Audit Questions and Sub-Questions

The audit was designed to answer the following questions and sub-questions;

i. To What Extent has the MAL through the DoF been Effective in Promoting Sustainable Management of Fish Resources?

- Is there knowledge of fish biomass in natural waters to use as determination of levels of exploitation by DOF?
- Has the DoF put in place effective measures to promote sustainable management of fish resources?
  - Have the management plans for the development of fisheries sub-sector been implemented?
  - What control measures have been put in place to ensure sustainable management of fish resources?

ii. To What Extent has the DoF Implemented Monitoring, Control and Enforcement Measures in Order to Achieve Sustainable Use of Fish Resources?

- Are inspections planned for, executed and reported?
- Has DoF carried out surveillance and enforcement of the Fisheries legislation to promote sustainable fisheries resources?
- Does the DoF have adequate manpower and financial resources to manage fish resources?

d) Methodology

The audit was conducted in accordance with the International Standards for Supreme Audit Institutions (ISSAIs) and audit policies and procedures established by the OAG which conform to the international standards.

In gathering audit evidence, the following techniques were used:

i. Document Review

A review of documents was conducted to obtain an understanding of the mandate of the DoF. Documents reviewed included among others, the Fisheries Act No. 22 of 2011, the Fisheries Regulations, the Strategic Plan for the years 2014-2016, the National Agriculture Policy and the RSNDP. Annual reports, budgets and work plans were also reviewed to ascertain to what extent the DoF had implemented planned activities and whether inspections and surveillance carried out by the DoF were effective.

ii. Interviews

Interviews were conducted with key personnel to gain understanding of the operations of the DoF, to confirm the information obtained from document review, to gather information that could not be obtained through the document review and to obtain different perspectives from relevant stakeholders.

Structured staff interviews were held with at least twenty three (23) members of the Department staff and in some instances, questionnaires were provided. All interviews were minuted. *See Appendix 2*.

iii. Physical Inspections

Physical inspections were carried out to reconfirm evidence collected from document review and interviews. Fisheries areas were visited and observations carried out on the type of fishing gear and methods used, the landing of fish and recording of catches. Photographs were taken during the physical inspections as part of audit evidence.

iv. Focus Group Discussions

Focus group discussions were also carried out with fishers and were used as a way of capturing data from fishers. This method was chosen as most fishers were already organised into fishing villages. The focus groups intention was to collect data from the fishers that included their experiences of fishing - challenges and recommendations. Minutes were written up from focus group discussions and in some instances, videos were captured. Seven (7) focus group discussions were carried out with a total number of 162 participants. **Appendix 3.**

e) Sampling

Zambia has fourteen (14) fishery areas namely; Mweru-Luapula, Mweru-Wantipa, Bangweulu, Lusiwashi, Kariba, Itezhi-tezhi, Lukanga Swamps, Upper Zambezi, Lower Zambezi, Super-Upper Zambezi, Tanganyika, Chambeshi, Kafue Flats and Upper Kafue. **Appendix 4** describes some of the fishery areas in terms of size and species found there as well as other characteristics. In order for all activities that take place in the DoF to be included, the sampling design was based on fishery areas which had research/extension activities and capture/aquaculture activities. **Accordingly, a total of six (6) fishery areas were visited namely Mweru-Luapula,** Bangweulu**, Lusiwasi, Kariba, Lukanga Swamps and Itezhi-tezhi using this criteria.**

3. AUDIT CRITERIA

The performance of the DoF was assessed against criteria drawn from the;

i. Fisheries Act No. 22 of 2011,
ii. The Fisheries Regulations, 2012,
iii. SNDP 2011-2016,
iv. National Agriculture Policy 2004 - 2015,
v. Strategic Plan 2014-2016
vi. Code of Conduct for Responsible Fisheries (CCRF).
vii. Best practice from the Food Agricultural Organization (FAO) on management of fish resources.

Specifically, the audit criteria as related to the audit questions were as follows:

a) Promotion of Sustainable Management and Development of Fish Resources

i. According to the Fisheries Act, the Department is required to promote the sustainable development of fisheries and a precautionary approach in fisheries management, conservation, utilisation and development; establish fisheries management areas and fisheries management committees; provide for the regulation of commercial fishing and aquaculture.

ii. The mission of DoF is to ensure sustainable exploitation of capture fisheries and development of aquaculture in Zambia. The overall objective of the Department is to promote sustainable utilisation of fisheries resources in Zambia. The objective includes among others:

- To promote the development of appropriate fishing gears in order to ensure sustainable utilisation of the natural fisheries resource base.
- To promote fisheries and aquaculture diversification in order to ensure availability of a wide range of fisheries commodities.

iii. According to the RSNDP, DoF is required to provide technical information necessary for sustainable exploitation and production of fish.

b) Knowledge of Fish Biomass in Zambian Waters to Use as Determination of Levels of Exploitation by the DoF

i. According to the Fisheries Act No. 22 of 2011 Part II (4) (3) (f), the functions of the Director are to assess fish stocks and collect statistics including details of catches.

ii. According to the FAO Code of Conduct for Responsible Fisheries, States should recognize that responsible fisheries require the availability of a sound scientific basis to assist fisheries managers and other interested parties in making decisions. Therefore, States should ensure that appropriate research is conducted into all aspects of fisheries including biology, ecology, technology, environmental science, economics, social science, aquaculture and nutritional science.

iii. According to the RSNDP 2013-2016, enhance management of capture fisheries statistics and conduct research on the status of fish in all natural water bodies.

c) Implementation and Follow up of Management Plans for the Development of Fisheries Sub-sector

According to Fisheries Act No. 22 of 2011, the DoF is required to establish fisheries management areas and fisheries management committees. In addition fisheries management plans should;

- Identify the fishery to which it relates and state its characteristics and its current state of exploitation
- Determine fishing quotas, the amount of fish which may be harvested and number of fishing licences which may be issued in respect of the fishery in any fishing season.

d) Measures to Promote Sustainable Management of Fish Resources

i. According to the Fisheries Act No. 22 of 2011 (13), the Director is required in cooperation with other appropriate agencies and other departments of Government, promote the development of fisheries, fish culture and related industries through providing-

- Extension and training services
- Conducting research and surveys
- Promoting co-operation among fishermen
- Providing infrastructure facilities

In addition, the Director is required to;

- Facilitate and simplify the issuance of licences and permits to those who are entitled to them.
- Maintain a record of fishing boats and people working on them.

Further, the Minister may, by notice in the gazette, impose any of the following measures

- Closed seasons for designated areas, species of fish or method of fishing.
- Prohibited fishing areas for all or designated species of fish or method of fishing.
- Limitations on the method or fishing gear including mesh size of nets that may be used for fishing. ***See Appendix 5***.
- Limitation on the amount, the size, age and other characteristics and species or composition of species of fish that may be caught, landed or traded.
- Regulate the landing of fish and provide for the management of fish landing areas.[5]

ii. According to the National Agriculture Policy Implementation Plan, the DoF will promote sustainable fishing methods.

iii. According to the MAL Strategic Plan 2014-2016, one of the functions of DoF is to establish and implement mechanisms for determining optimal maximum sustainable yields per natural resource unit (fish).

[5]Fisheries Act No.22 of 2011

iv. According to FAO Code of Conduct for Responsible Fisheries Article, States should take measures to prevent or eliminate excess fishing capacity and should ensure that levels of fishing efforts are commensurate with the sustainable use of fishery resources as a means of ensuring the effectiveness of conservation and management measures.

v. According to the Fisheries Act, a boat registered under the provision of this Act, shall be allocated a number or identification mark corresponding to the number of the identification mark entered in the register. The number or identification mark of a boat shall be clearly painted on the hull of such a boat in such a manner as the Minister may prescribe.

vi. According to the Fisheries Act, the Minister may, in consultation with the Director, a committee, a local authority and the Chief, by notice in the Gazette, declare any area of a commercial fishing area as a fisheries reserve if the Minister considers it necessary.

vii. According to the Fisheries Act, a person shall not engage in any fishing activity in a fisheries reserve declared under subsection (1), without the written permission of the Director.

e) Implementation of Monitoring, Control and Enforcement Measures in Order to Achieve Sustainable Use of Fish Resources.

According to the Fisheries Act No. 22 of 2011, the Director is required to monitor and control fishing operations as well as carry out surveillance activities.[5]

f) Inspections Planned for, Executed and Reported

According to the Fisheries Act of 2011, an authorised officer may:

- At any reasonable time, enter upon and inspect any land, tent, conveyance, fish processing establishment, aquaculture facility, building or premises where any fish or fish product may be found or processed, or where any traps, weirs, stakes, fences or other contrivances may be found for inspection and data collection.
- Require any person to produce for inspection any fish, fish product, net, trap, line, poison, document, explosive, appliance or anything in relation to or in connection with which, the authorized officer has reason to believe, an offence has been committed or is likely to be committed.

g) Enforcement of the Fisheries Legislation to Promote Sustainable Fisheries Resources

According to the Fisheries Act No. 22 of 2011, the functions of the Department are to issue, vary, suspend and revoke any permits and licences for fishing, equipment used for fishing and other activities for which permits or licences are required.

In addition, the Act also requires that no person should carry out any commercial fishing activities in a fishing area using Kutumpula[6] or any prohibited fishing methods specified under the Act.

[6]Fishing method whereby fish are driven into a stationary net or monofilament net or trap

h) Manpower and Financial Resources

According to FAO Code of conduct for responsible fisheries, Authority or Authorities representing the fisheries sector in the coastal management process should have the appropriate technical capacities and financial resources.

In addition, the Code requires States to ensure the availability of research facilities and provide appropriate training, staffing and institution building to conduct the research, taking into account the special needs of developing countries.

4. DESCRIPTION OF THE AUDIT AREA

a) Statutory Mandate and Role of the Department of Fisheries

The department is responsible for the enforcement and regulation of the Fisheries Act No. 22 of 2011 of the laws of Zambia. The DoF oversees the implementation of the national fisheries programmes in capture fisheries and aquaculture development. It also carries out research in fisheries and aquaculture, in order to achieve a sustainable fishing industry and economic benefits.

b) Mission

The mission of the DoF is to ensure sustainable exploitation of capture fisheries and development of aquaculture in Zambia.

c) Strategic Objectives

The overall objective of the Department is to promote sustainable utilisation of fisheries resources in Zambia. The objective is to be achieved by employing responsive research, extension strategies, training programmes and promoting public/private partnerships at all levels of development and management of the fisheries sub-sector.

d) Funding (in Kwacha)

Table 1: Fisheries Department Annual Budget 2011-2014

Activity	2011	2012	2013	2014
Capture Fisheries Research	110,372	188,641	482,963	364,895
Capture Fisheries Mgt & Dev	224,500	463,423	514,156	**350,759**
Fisheries Development	294,500	71,829	-	-
Fisheries Statistics Mgt	44,000	78,963	239,100	53,528
Database Management	59,000	310,255	1,234,199	657,966
Total	**732,372**	**1,113,111**	**2,470,418**	**1,427,148**

Source: The Estimates of Income and Expenditure

e) Organization Structure

The DoF is headed by a Director who is responsible for the administration of the Act and is assisted by two Deputy Directors, one responsible for Capture Fisheries Management and Development and the other for Aquaculture Development. The two branches each have two (2) wings namely Extension Services and Research which are spread throughout the provinces and districts of the country. ***See Appendix 1***

f) Staff Establishment

As of November 2014, the DoF had an approved establishment of 2,347 positions of which 430 were filled resulting in a shortfall of 1,917 staff.

g) Division of Responsibilities

i. Capture Fisheries Section

The functions of the unit include:

- Coordination of research and management of capture fisheries resources.
- Administration of fisheries legislation in relation to fisheries resources in natural lakes, rivers, swamps and flood plains.
- Coordinating aquaculture research and development with respect to the development systems for best aquacultural practices for fish and other aquatic organisms in dams, ponds, weirs and cages.
- Building capacities for fisheries training institutions, departmental staff, fish farmers, private and local communities in order to improve the performance of the sub-sector.
- Development of a comprehensive fisheries and aquaculture information management system that enhances the storage, retrieval and dissemination of information for the benefit of all stakeholders in the fisheries sub-sector.

ii. Aquaculture Section

- The function of the unit includes:
- Development of aquaculture extension services,
- Regular research in order to generate information for aquaculture development,
- Regular development and implementation of relevant technologies to increase production, and
- Monitoring and evaluation of fisheries and aquaculture programmes in order to facilitate implementation of appropriate interventions.

h) Other Key Players

i. Fishers

Fish production in natural waters is carried out by two distinct groups namely:

- Industrial Fishers – these are fishers that operate big fishing vessels on natural waters and in Zambia are mostly found on the lakes Tanganyika and Kariba.
- Artisanal Fishers – also known as traditional or small scale fishers constitute the largest type of fishers in the country estimated at 72,053 as of December 2014. These use smaller vessels such canoes to catch fish.

ii. Aquaculture Farmers

These are fish farmers who can be small scale, middle or commercial farmers. Fish farming in Zambia is done in dams, earthen or concrete ponds or most recently in cages.

iii. Food and Agriculture Organisation (FAO):

An organ of the United Nations, FAO is an intergovernmental organization with a vision of conserving biodiversity for food and agriculture and promoting its use in support of global food security and sustainable development, for present and future generations. Among its key priorities is making fisheries more productive and

sustainable. FAO achieves this by dissemination of information (statistics) as well as sharing their policy expertise with governments.

iv. Programme for Luapula Agriculture and Rural Development (PLARD)

The overall objective of PLARD II (2011 to 2015) is to achieve an efficient, competitive and sustainable agricultural and fisheries sector, ensuring increased income and security for the people of Luapula province. PLARD offers the following support to the DoF:

- Considerable financial and technical support,
- Assist the DoF to establish a series of community and regional organizations as part of the support to enable communities to manage their resources,
- Provision of funds, consultants and technical assistance to develop the Fisheries Management Plans,
- Promoting cage culture and supporting the development of aquaculture.

i) Systems Description

i. Registration of Fishers and Fishing Vessels

The registration of fishers is done through licensing. Artisanal fishers are registered at fishery level in the district. These are either licensed by officers in the field or can obtain licenses at the fisheries offices. The industrial fishers acquire their licenses at the fisheries offices in Chilanga. The processes of acquiring the fishing license include application for the license, advertising intent to apply for the license in the press, appraisal of applications by the licensing committee and issuance of the license by the DoF. The licensing committee is composed of staff from the DoF, Maritime Department, Office of the President, and any other member of the private sector. The chairperson of the licensing committee is appointed by the Permanent Secretary of the Ministry in charge of fisheries.

There is the registration of all fishing vessels which is mandatory for all fishers. The institutions involved in the registration of fishing vessels are the DoF and the Maritime Department, which verifies the vessels' water worthiness. Each fishing vessel is given a number. The definition of a boat according to the Fisheries Act No. 22 of 2011 means any water craft, whether powered or unpowered, used for, or in connection with, commercial fishing, but does not include a canoe.

ii. Registration of Fish Farmers

An application for a licence to engage in aquaculture shall be made to the Director or such other officer designated for that purpose by the Director and shall be accompanied by a prescribed fee, an Environmental Impact Assessment report and such other information as may be prescribed.

The Director is supposed to issue a licence within thirty (30) days of receiving an application for a licence.

An aquaculture licence confers on the holder thereof exclusive rights to harvest the products of the aquaculture facility named in the licence within the area specified in the licence. A holder of an aquiculture licence may, at least three (3) months before its expiry, apply for the renewal of the licence.

iii. Demarcation of Fisheries Management Areas and Development of Fisheries Management Plans

The main processes in the management of fisheries resources include the demarcation of a fisheries management area, development of a fisheries management plan and implementation of the management plan. Various stakeholders are involved in the different stages of the management process. The identification of a fishery management area is done by the Department of fisheries in collaboration with the communities, with the traditional leadership as the main custodians of the resources.

The demarcation of the fishery management area is a consultative process among the traditional leadership, the Ministry of Lands, Natural Resources and Environmental Protection and the Ministry of Local Government and Housing. The final declaration of the fishery management area is done through a Statutory Instrument that is passed through Cabinet and thus involves the consultation of all line ministries.

During the development of the Fisheries Management Plan, all identified stakeholders in a fishery area are consulted. The key stakeholders include the traditional leaders, fishers, and other members of the community, line ministries and non-governmental organisations (NGOs).

5. AUDIT FINDINGS AND OBSERVATIONS ON SUSTAINABLE MANAGEMENT OF FISH RESOURCES

a) Lack of knowledge of Biomass in Fisheries

According to the Fisheries Act, DoF should assess fish stocks and collect statistics including details of catches. Fisheries management should be based on scientific evidence available in order to determine allowable catch and optimum utilisation.

Zambia's fish resources are multispecies and they are estimated at 400 species of which only fifteen (15) are commercially exploited. According to the DoF, most of the other species are of ecological importance to maintain biodiversity and clean the environment. Some of the commercially exploited species are shown below.

Table 2 - Showing Some of the Commercially Exploited Fish Species

No.	Scientific Name	Common Name/English Name
1	Oreochromis Andersonii	Three Spotted Bream
2	Oreochromis Machrochir	Green Headed Bream
3	Oreochromis Niloticus	Nile Tilapia
4	Oreochromis Tanganicae	Tanganica Bream
5	Tilapia Rendalli	Red Breasted Bream
6	Lates Stapersii	Buka buka
7	Hydrocynus Vitaltus	Tiger fish
8	Clarias Gariepinus Clarias Ngamensis	Catfish
9	Serranochromis Robustus	Yellow belly
10	Brycinus Lateralis	
11	Petrocephalus Catastoma	
12	Stolothrissa Tanganicae Limnothrissa Miodon	Lake sardine (Kapenta)

The DOF carried out various surveys that assisted with understanding of what was obtaining in the waters and around the fishery areas such as frame surveys which were conducted to collect statistics of fishing effort while Catch Assessment Surveys were carried out to collect data on fish production. Gillnet surveys and Limnology surveys were carried out to assess stock and water conditions respectively. Hydro acoustic surveys were also carried out to determine the biomass of certain species in the waters.

However, with the exception of Kapenta and Buka Buka, the DoF did not have knowledge of the standing biomass of all the other fish species in the waters. The DoF had not determined the biomass for the other fish species because the methods that existed to estimate biomass for demersal or the inshore fish species was environmentally unfriendly and had serious limitations when applied on large open lakes. These species especially the commercially exploited faced a risk of being depleted putting the sustainability of fish resources under question.

The knowledge of Kapenta biomass was outdated as the last conclusive study done for kapenta; a hydro acoustic study was done on the Lake Kariba in 1997[7] which determined the Kapenta biomass between 20,000 to 30,000mt whilst the biomass for Kapenta on Lakes Itezhi tezhi and Tanganyika had not been determined. Although a hydro acoustic survey was conducted in 2014, the analysis of the data collected had not been concluded as of March 2015.

Consequently, the DOF was unable to institute technical measures to control the harvest of fish from the natural waters for demersal or inshore fish species as there was no determination or estimation of the limit of how much fishers could take out as well as how much was to be left for regeneration.

b) Fishing Effort in the Fishery Areas - No Quota System in Place

According to DoF, there was no limitation of fishing effort in any of the fishery areas in Zambia. It was observed that fishing effort had been on the increase in fishery areas. Zambia practiced 'open access' on its waters which is a system that gives access to anyone to fish with no limit on the number/ length of nets or other types of gear to use and boats they can own.

[7] In 2014, a hydro acoustic survey was conducted but is not yet conclusive.

Table 3: Fishing Effort in Fishery Areas

Mweru Luapula	1997	2013	Increase/Decrease	
			Count	%
Boats	8,662	13,977	5,315	61
Fishers	12,047	20,936	8,889	74
Gear	97,303	263,630	166,327	171
Comparison: gear & fishers	8	13		
Bangweulu	**2007**	**2012**	**Increase/Decrease**	
			Count	%
Boats	11,281	12,103	822	7
Fishers	15,113	18,150	3,037	20
Gear	56,296	59,663	3,367	6
Comparison: gear & fishers	4	3		
Lusiwashi	**2006**	**2014**	**Increase/Decrease**	
			Count	%
Boats	164	240	76	46
Fishers	365	431	66	18
Gear	856	2,387	1,531	179
Comparison: gear & fishers	2	6		
Kariba	**2006**	**2011**	**Increase/Decrease**	
			Count	%
Boats	2,431	2,451	20	1
Fishers	2,804	4,653	1,849	66
Gear	17,102	26,769	9,667	57
Comparison: gear & fishers	6	6		
Mweru wantipa	**2004**	**2013**	**Increase/Decrease**	
			Count	%
Boats	1,798	3,535	1,737	97
Fishers	2,337	4,929	2,592	111
Gear	73,367	20,854	(52,513)	(72)
Comparison: gear & fishers	31	4		
Super Upper Zambezi	**1996**	**2013**	**Increase/Decrease**	
			Count	%
Boats	499	1,492	993	199
Fishers	847	2,324	1,477	174
Gear	7,813	9,215	1,402	18
Comparison: gear & fishers	9	4		

The table shows that there has been an increase in the number of boats and fishers over the years in question. The activity has in general also been intensified with more gear in use. The table above also shows that the number of gear in a fishery compared to the numbers of fishers indicated that the number of gear was at least twice the number of fishers.

The open access meant that the Quota system of managing fish resources was not practiced in Zambia. According to the DoF, the quota system was not practiced because the system would be information intensive as daily data on location and fish caught by all fishers would be needed. Further, there would be a challenge of who to apportion a quota to a n d the basis to use to do so. According to PLARD in Luapula Province, quotas raised issues of equity in fisheries resource exploitation and utilization that may not be easily addressed because of the social-political organization among individuals, communities and traditional leaders.

The failure to limit the fishing effort resulted in overfishing in fishery areas. Information gathered from the fishery areas indicated that stock overfishing which relates to a particular species, environmental relating to overfishing of all fish species and recruitment type of overfishing which involves catching of fish even before it breeds took place. The following was said on the types of overfishing on particular fishery areas for demersal species.

Table 4: Types of Overfishing Per Fishery Area

	Stock Overfishing	Environmental Overfishing	Recruitment Overfishing
Lake Kariba			√
Lake Lusiwashi	√		
Lukanga swamp	√		
Lake Bangweulu	√	√	√
Lake Mweru Luapula	√	√	√

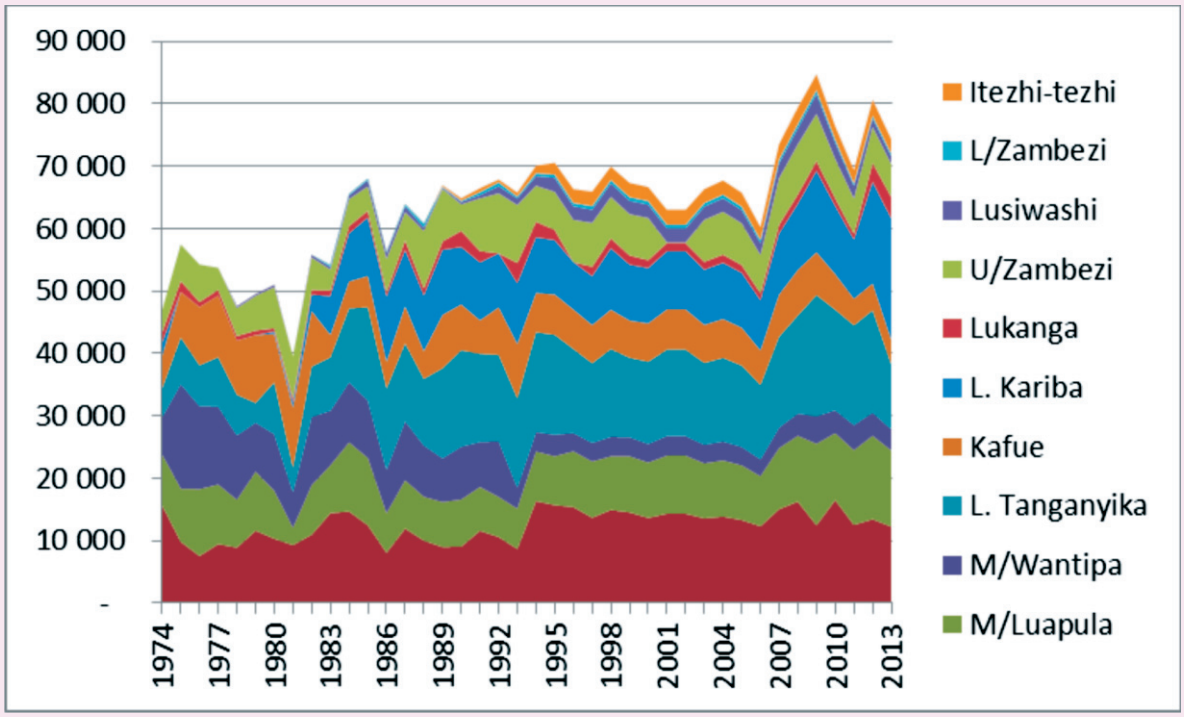
Source: DoF

In particular, the following was observed:

i. Production against Fishing Effort.

An analysis of fish production and fishing effort was carried out. Historical production of fish in Zambia from 1974 to date showed a steady increase and so was the production per fishery. However, in the case of Mweru Wantipa, production reduced drastically in the early 1990s as shown in the Figure below:

Figure 2: Showing Annual Fish Production 1974-2013



Effort that was applied to harvest fish in the years where frame surveys were carried out for six (6) fishery areas is shown in the Table 5 below.

Table 5: Production and Effort Applied per Fishery

	Mweru Luapula		Bangweulu		Itezhi tezhi		Lusiwasi		Kariba		Tanganyika		Mweru wantipa	
	1997	2013	2007	2012	2006	2014	2006	2014	2006	2011	2004	2011	2004	2013
Production (Metric tonnes)	8,964	12,187	15,098	13,573	2,007	2,033	1,933	1,200	8,008	9,454	13364	15,953	3,064	3,416
Level of Effort (by Count)														
Boats	8,662	13,977	11,281	12,103	1,129	520	164	240	2,431	2,451		2,320	1,798	3,535
Fishers	12,047	20,936	15,113	18,150	1,172	1,065	365	431	2,804	4,653		8,420	2,337	4,929
Gear	97,303	263,630	56,296	59,663	11,541	8,297	856	2,387	17,102	26,769		16,160	73,367	20,854

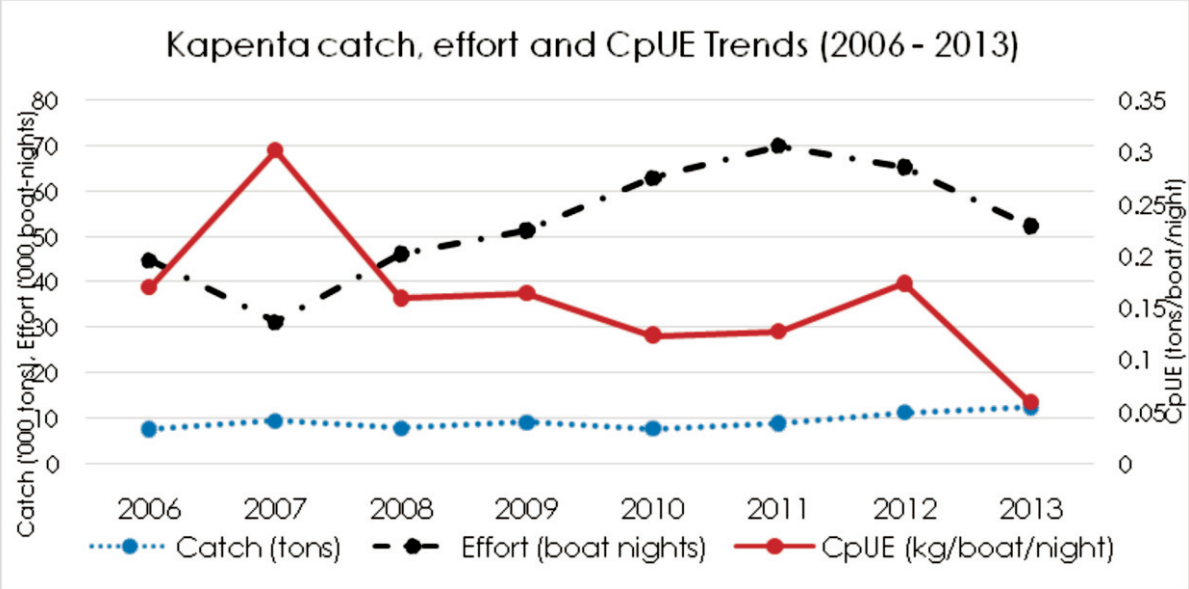
Source: DOF

Fish production and fishing effort above compared the levels of fishing effort that was applied to harvest fish in the relevant years. However, change in fish production was lower than the increase in the effort that had been applied. Although fishing effort (boats-822, fishers-3037 and gear-3367) increased for Lake Bangweulu recorded in 2007 and 2012, a reduction of 1,525 mt of fish was recorded in 2007 and 2012. In addition, the fishing effort (boats-76, fishers-66, fishing gear-1531) increased for Lake Lusiwashi recorded in 2006 and 2014, a reduction of 733mt was recorded in 2006 and 2014.

The proportional relationship of production (fish mortality) and fishing effort could further be explained by the fact that, generally, Catch per Unit of Effort (CpUE) in the fishery areas was falling. The national average CpUE showed this reduction for the years 2011 to 2013. In 2011, it was at 0.128 ton/boatnight, 0.174ton/ boatnight in 2012 and 0.076 ton/boatnight in 2013.

An analysis of the Kapenta production and effort was carried out. Data from the DoF showed that the CpUE for Kapenta has been dropping showing that it was becoming more and more difficult to catch Kapenta even though total production levels were static. See figure below.

Fig 3: Kapenta Production Trends from 2006 to 2013 - Lake Kariba



Source: DoF 2013 Annual Report

According to the results of the frame survey done in 2011, the ideal number of rigs to fish on the Zambian side of Lake Kariba was determined at 240 rigs. However, a review of documents revealed that as of 2013, the number of rigs fishing on the lake was 962 rigs thus exceeding the recommended number by 722 rigs resulting in overfishing.

ii. Frame Surveys Per Fishery

According to the DoF, the frame survey should be done once after five (5) years. The significance of the survey is to determine the number of fishers, vessels and fishing gear (number and types), population and number of fishing villages.

An analysis of the information on frame surveys revealed that surveys were not being conducted according to best practice of carrying out a survey every after five (5) years.

There were delays in some cases of up to seventeen (17) years as was the case in Super Upper Zambezi where there was an interval of seventeen (17) years between the two frame surveys. Tanganyika had an interval of seven (7) years, Mweru wantipa had nine (9) years, Lusiwashi had eight (8) years while Itezhi tezhi, Kafue flats, Lower Zambezi and Upper Kafue which were last done in 2007, 2006, 2007 respectively were due in 2012/13. A complete frame survey for Lukanga was last done in 1994 as shown below.

Table 6: Frame Surveys Conducted Per Fishery Area

Fishery	Year carried out/supposed			
Mweru Luapula	1997	2003	2008	2013
Bangweulu	2007	2012		
Itezhi tezhi	2006	2012	2014	
Lusiwashi	2006	2012	2014	
Kariba	2006	2011		
Tanganyika	2004	2010	2011	
Mweru wantipa	2004	2010	2013	
Kafue flats	2007	2013		
L/Zambezi	2006	2012		
U/kafue	2007	2013		
Upper Zambezi	2007	2013		
Super upper Zambezi	1996	2002	2008	2013
Chambeshi	2007	2013		
Lukanga	1994			
	Key			
		Not Done but due		
		Done		

This resulted in the DOF not having up to date data on fishery areas or not having data at all that could be used in managements decision making.

c) Ineffectiveness in Implementing Measures in Place

During the period under review, the DoF had developed measures to prevent and reduce the non-sustainable use of fish resources such as licencing, fishing ban, restrictions on fishing gear and restrictions on fishing methods among others. The DoF also introduced aquaculture to mitigate reduced productivity in the conventional fisheries sectors. Even though the DoF had these measures in place, they continued to face challenges in promoting sustainable management of fish resources as shown below.

i. Fisheries Management Plans (FMPs)

According to the Fisheries Act, the DoF should have an FMP for the conservation and management of fish and development of the fisheries management area. However, a review of documents revealed that none of the fourteen (14) fishery areas had FMPs in place though three (3) areas namely Mweru-Luapula, Bangweulu and Kafue flats had draft plans which remained unapproved since 2013.

The eleven (11) fisheries management areas that did not have a FMP were Lusiwasi, Tangayika, Mweru-Wantipa, Lukanga, Kariba, Upper Zambezi, Lower Zambezi, Upper Kafue, Itezhi-tezhi, chambeshi and Super Upper Zambezi.

The result of not having the plans in place hindered DoF's intention of managing fish resources on a co-management basis with the community.

ii. Control Measures

In order to control the fishing activities in Zambia, the DoF uses the following measures:

- **Licencing of Fishers**

  Licencing of fishers was one of the control measures used by the DoF to regulate fishing activities in the fishery areas. The legal requirement in fishery areas is that every person who intends to engage in fishing should obtain a licence. There is however no limitation on the number of licenses available; anyone who wants to engage in commercial fishing can obtain a license from the DoF. The Table below shows the total number of traditional or small scale fishers licenced in the fishery areas visited.

Table 7: Licenced Traditional/Small Scale Fishers 2011-2014

Fishery Area	No. of Licences Issued				Total Licences Issued
	2011	2012	2013	2014	
Mwense (Mweru Luapula Fishery)	4	7	0	0	11
Samfya (Bangweulu Fishery)	4	2	4	25	35
Lusiwasi	41	39	39	47	166
Lukanga Swamps	20	0	0	0	20
Itezhi-tezhi	147	197	177	21	542
Siavonga (Lake Kariba Fishery)	398	243	82	16	739
Sinazongwe (Lake Kariba Fishery)	164	466	187	103	920
Total	**778**	**954**	**489**	**212**	**2433**

Source: Department of Fisheries Annual Reports

As shown in the table above, for the period 2011 to 2014, a total of 2,433 fishers were licenced. Mwense district, Samfya district and Lukanga in Kapiri Mposhi district recorded the lowest number of licenced fishers. There was also a reduction in number of licenced fishers from 954 in 2012 to 212 in 2014.

Licencing of industrial fishers is also carried out by the DoF. However, the DoF's Annual Report for 2013 showed that there were 135 rigs illegally operating on the Zambian side of Lake Kariba as they were not licenced.

Focus group discussions held with Village Management Committees (VMCs) and fishers revealed that the DoF was not strictly enforcing the requirement that fishers obtain licences before commencing fishing. Consequently, some fishers were not motivated to pay for the licences because other fishers were operating without licences and continued to fish.

Physical inspections carried out at landing sites to ascertain whether the boats were inscripted with the receipt number of the fish licence revealed that some boats were not inscripted with the numbers as required by regulations. The DoF stated that failure to enforce the Fisheries Regulations was attributed to the dual roles extension staffs have to play which includes extension services and enforcement of Fisheries Regulations.

- **Fishing Ban**

  One of the measures the DoF has put in place is an annual fishing ban which coincides with the peak breeding period for most fish species in Zambia. However, a review of documents revealed that despite extensive sensitisation on the importance of the fishing ban, fishers were not observing the ban. See table below.

Table 8: Fishing Ban Statistics

Period	Arrests	Confiscated fish (kgs)	Convicted	Items Confiscated/Impounded			
				Boats	Nets	Vehicles	Bicycles
2011	413						
2012	295	21,818.5	46	58	965	2	32
2013	242	37,629.0	98	63	617	6	32
2014	405	34,303.5	199	151	1193	1	58
Total	**1355**	**93,751.0**	**343**	**272**	**2775**	**9**	**122**

Source: DoF

During the period from 2011 to 2014, a total of 1,355 fishers were arrested and 343 fishers convicted whilst a total of 93,751kgs of fish was confiscated. Although there was a decrease in the number of arrests from 295 in 2012 to 242 in 2013, the amount of fish confiscated was more by 15,811kgs. There was also an increase in number of convicted fishers from 46 in 2012 to 199 in 2014. Items confiscated during the 2013 fish ban included boats, nets, vehicles and bicycles.

Though the DoF stated that fish catches in experimental fishing and figures from market statistics were higher after the fishing ban period, the ban was not effectively implemented due to high costs such as transport and inadequate human resource.

During focus group discussions, it was established that fishers were not complying with the fishing ban because it was a challenge for most of them as they did not have alternative livelihoods.

- **Restrictions on Gear and Fishing Methods**

  One of the control measures the DoF has put in place is the restriction on the fishing methods fishers are allowed to use and to this effect, sensitization of the fishers was carried out. However, despite efforts by the DoF to sensitise the fishers on the damage caused by the restricted methods, fishers still continued to use the prohibited methods. The DoF was particularly concerned with the use of mosquito nets, potato sacks (commonly called sefa-sefa or chikukula), weirs, explosives and poisons. These methods impact negatively on the fish as they disturb breeding sites, migration routes and indiscriminately kill fish. ***See Appendix 5.***

A review of the Annual Reports from the Provincial and District fisheries offices however revealed that fishers were still using the prohibited methods of fishing in areas such as Lealui, Kalabo, Chambeshi, Bangweulu swamps, Chirundu/Chiawa and Shibuyunji, Mongu, Sinazongwe, Ithezhi-thezi, Namwala, Samfya and Siavonga. In the period under review, the DoF confiscated a total of 1,112 nets (comprising 494 seine nets, sixty-six (66) mosquito nets, 399 gill nets and 153 mono nets), twenty-two (22) kutumpula sticks, fifty-two (52) hooks, eleven (11) spears, four (4) slap sacks, sixty-two (62) tilly lamps and 136 potato sacks. In the pictures below are examples of some of the illegal gear confiscated in Luangwa and Samfya.

Nets with small mesh sizes confiscated in Samfya **Weir traps Baskets confiscated in Luangwa**

Site visits carried out in seven (7) fishery areas namely; Mweru-Luapula, Bangweulu, Lusiwashi, Lukanga, Itezhi-tezhi, Kafue Flats and Kariba revealed that generally, fishers were not adhering to the controls set by the DoF with the exception of Itezhi-tezhi where there was some measure of adherence. However, the fishers in Itezhi-tezhi mentioned that the sizes of the fish caught was reducing and they were now having to use 76 mm net as they could no longer use the 152 mm nets as before. In Lusiwashi, fishers were observed using drag nets while in Kafue flats, fishers were observed using the potato sacks.

Fishers using a drag (l) and their catch after 7 hours of setting the net ®

The impact of irregular activities of the fishers in the various fishery areas is that the fish caught is reducing in size as the fish is caught before it matures. Gillnet surveys conducted in Mweru Luapula, Bangweulu and Kariba and frame survey in Mweru wantipa revealed that more fish in number was caught the smaller the mesh size. *See Appendix 6.*

- **Breeding Sites**

  As part of its efforts to manage the fish resource, the DoF has identified certain areas as breeding sites were fishers are not allowed to undertake any fishing activities or to settle. The DoF is required to legalise the identified areas by way of issuing a Statutory Instrument which should be gazetted in the Government gazette.

  However, a review of documents revealed that fishers had settled in some identified breeding areas and were actually undertaking fishing activities in those areas. A case in hand is Mifimbo in Nchelenge which is a gazzetted breeding site where about 2,000 people had settled. Other breeding areas namely Kansungwa, Mwatishi, Mulundu, Luche, Nkomba and Lukwesa on Mweru-Luapula and Chipepo Lagoon and small Kariba on lake Kariba among others had been identified but they had not been gazetted making it difficult for the DoF to enforce any restrictions.

- **Regulation of Landing Sites**

  Although the Act requires landing site to be gazetted, none had been gazetted as of June 2015, consequently, fishers were operating from informal landing sites

  Informal landing sites were observed in the fishery areas that were visited. In Samfya, although they had four (4) recognized landing sites namely Mwafuli, Katansha, Kapundu and Kapalala, it was stated that fishers landed anywhere on the lake making it difficult to collect accurate data.

  In Kafue, landing sites were no longer managed by the DoF as it was in the old system where fish would be weighed upon landing by fisheries staff. The department had a landing site at the habour which was put up for fishers to land and sell fish but it was not in use as some fishers opted to land in small habours for fear of being apprehended for using illegal gears such as potato sacks.

The recording of fish catches was also a challenge for the DoF. Low staffing levels were identified as one of the causes of not being able to collect data from fishers because the DoF could not be at every landing site where fishers land their catches. Water transport was also a challenge as they did not have reliable motorized boats to conduct patrols.

Efforts to have artisanal fishers submitting returns had also not worked largely because of lack of compliance and also because of low literacy levels in fishing communities. Although VMC structures were in place, there were no extension officers at VMC level. It was stated that in order to do this, the staff strength needed to be strengthened and FMCs needed to be gazetted to provide for increased monitoring and enforcement. The current status was that fish happened to be landed at any time anywhere.

- **Aquaculture**

  According to the DoF, the intent of introducing aquaculture as an alternative livelihood in fishery was to reduce fishing pressure off the natural waters.

Table 9: Showing Aquaculture Production Trends in the Last 10 Years

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Quantity (tons)	4,500	5,125	5,125	5,210	5,876	5,640	9,535	10,291	12,988	20,271

Source: DoF 2013 Annual Report

Aquaculture production had increased from 12,988 metric tons in 2012 to 20,271 in 2013.

There was a major increase of 7,283 from 12,988 tons in 2012 to 20,271 tons in 2013 and the DoF revealed that this was because of more players (mainly commercial) joining the aquaculture industry, cage culture to be specific with huge production capacities.

The DoF offered technical support to individuals who wanted to engage in fish farming such as site selection, pond construction and pond management and also provided fingerlings to farmers that were vulnerable in an effort to promote aquaculture. However, the DoF faced challenges that included inadequate capacity to offer fish farmers extension services due to low staffing levels. Non-availability of transport was also highlighted as one of the major causes for the DoF not being able to carry out monitoring visits.

There was an increase in number of unstocked ponds which was attributed to the following factors; fish farmers had newly constructed ponds, harvested their fish or in some cases had recorded high numbers of unstocked ponds due to distances from sources where they could buy fingerlings. For instance, Mansa, Samfya and Mwense recorded a total of 1,397 ponds of which 872 were stocked and 525 were unstocked.

It was also observed that fish farmers were not issued with licences contrary to the Fisheries Act which states that persons engaging in aquaculture should be issued with a licence. Licences were not issued by the DoF because the aquaculture regulations were not in place to guide the issuance of licences. Fish farmers did not maintain records of production levels. This was as a result of not having scales to weigh the production. It was difficult to keep track of production levels because aquaculture was still in its infant stage so most fish farmers did it on a subsistence basis and did not keep records of the production levels.

Aquaculture research was also hampered by the lack of equipment.

Physical inspections carried out at Fiyongoli research unit showed that the unit did not have a laboratory to carry out research. The unit also lacked equipment required to carry out aquaculture research such microscopes, water checkers, plankton nets among others.

a) Inadequate Monitoring Control and Surveillance

The DoF on an annual basis planned to carry out Monitoring, Control and Surveillance (MCS) to check whether fishing activities are in accordance with the regulations. It is through these MCS activities that the DoF has been able to discover the fishers who are using various prohibited methods of fishing. However, a review of records showed that, the DoF was unable to achieve the targets it had set for MCS activities. See table 10 below.

Table 10: MCS Performance Targets/Achieved

Fishery Area	2011	2012	2013	2014
Mwense (Mweru Luapula Fishery)	Enforcement and surveillance, Target:300 Achieved:104	Licensing of artisanal fishers and insuance of certificates of origin, Target:900 Achieved:20	Fishing ban activities, Target:30 Achieved:10	Local surveillance operations/Co-managenment, Target:15 Achieved:10
Samfya (Bangweulu Fishery)	19 Patrols were undertaken. No targets indicated	Surveillance and enforcement was not undertaked during this period due to inadequate funds	Patrols were conducted and Zone fisheries management committee were formed. No targets were set	Surveillance and enforcement ,Target:12 Achieved:15
Lusiwasi	No activities undertaken due to lack of funds	Two road blocks were conducted and no target was set	Surveillance and enforcement :Target 3 Achieved 3	Surveillance and enforcement ,Target:12 Achieved:12
Lukanga Swamps	Enforcemnt and surveillance, Target:300 Achieved:104	Surveillance and enforcement,Target 20 road blocks, Achieved:3	Issuance of fish licenses and certificate of origin,Target:600 Achieved:0	Extension visits,Target:4 Achieved:2
Itezhi-tezhi	Enforcement and surveillance, Target:12 Achieved:9	12 Water patrols were conducted and 13 land patrols.No target was set.	8 Patrols were conducted and no target was set.	Registration and licensing of Boats and Fishers,Target:125 Achieved:35
Siavonga (Lake Kariba Fishery)	Enforcement and surveillance, Target:300 Achieved:104	Fishing licensing and registration,Target: 150 Achievd:53	Lake patrols,Target:16 Achieved:8	Fisheries licensing and registration,Target :100 Achieved:8
Sinazongwe (Lake Kariba Fishery)	Licensing and registration of boats and fishers,Target: 500 Achieved:164	Strengthening Co-management structures, Target:8 Achieved0	Lake patrols: Target:16 Achieved4	Lake patrols,Target:16 Achieved:9

Factors that were attributed to the DoF not achieving the set targets included low staffing levels, inadequate land and water transport, and untimely and inadequate funding as detailed below.

i. Staffing

According to the 2014 Departmental staff establishment, the DoF has an establishment of 2,347 staff comprising 1,468 professional and technical staff and 879 support staff. As of November 2014, DoF had 430 employees against the approved establishment of 2,347 employees resulting in understaffing of 1,917 thus operating at 18.3% staffing capacity as shown below.

Table 11: Staff Status per Section

Staff Status Per Section				
SECTION/ POSITION	**No. ESTABLISHMENT**	**TOTAL IN PLACE**	**VACANCIES**	**% STAFFING**
Director	1	1	0	100
Deputy Directors	2	2	0	100
Capture Fisheries Research	182	29	154	15.8
Capture Fisheries Extension	650	125	525	19.2
Aquaculture Research	79	33	47	41.3
Aquaculture Extension	493	41	452	8.3
Fisheries Statistics & Management	16	4	12	25
Fisheries Training Unit	24	7	17	29.2
Kasaka Training Institute	21	9	12	42.9
Administration and Non-civil servants	879	181	698	20.6
OVERALL STATUS	**2,347**	**432**	**1,917**	**18.41**

Source: DoF

ii. Transport

Inadequate land and water transport was another challenge that the DoF faced. The DoF at the district level falls under the District Agriculture Coordinating Office (DACO) and as such, the control of resources such as motor vehicles were directly under the DACO. A visit to the districts revealed that DACOs only had one (1) vehicle that would have to be shared among the departments under the DACO. This had an impact on the implementation of planned MCS in the districts. For instance, a total of eight vehicles were available for Luapula province. Only two (2) vehicles were in good condition. Mwense only had one (1) vehicle shared with the Ministry. This resulted in the DoF not being able to carry out extension visits and delays in conducting activities.

Mwense also did not have water transport and relied on water transport donated to the VMCs by PLARD.

Table 12: Showing Ideal and Actual Number of Water Transport

District	Purpose	Number	Ideal Number	Impact
Sinazongwe	Research Activities	1	3	Water transport enhanced
	Fish disease monitoring and suiveillance	2	4	Water transport enhanced
Choma	Research Activities	1	3	Water transport enhanced
	Fish disease monitoring and suiveillance	2	4	poor enforcements of fisheries regulations
	Fisheries Enforcements	3	9	poor enforcements of fisheries regulations
Samfya	Extension research and law enforcement	2	3	Poor service delivery and lawlessness
Mwense	Fisheries Enforcements	4	5	Water transport enhanced

iii. Funding

MCS activities were not achieved as per target due to inadequate and untimely funding. Activities such as the fishing ban were also affected due to late disbursement of funds.

The DoF was not funded fully for capture research and capture extension services. Interviews **conducted** revealed that surveillance and enforcement were not achieved as per target due to inadequate funding. Surveillance and enforcement goes on throughout the year to curb all illegal fishing activities. The table below shows percentages of funds received of the total budget for capture fisheries management.

Table 13: Funding Received (%) Capture Fisheries Management

	2011	2012	2013
Kapiri Mposhi	62%	55%	53%
Serenje	46%	63%	55%
Southern Province	47%	63%	22%
Luapula Province	28%	67%	20%

6. CONCLUSION

The Department of Fisheries (DOF) has an important role to play in in the management of fish resources in natural waters through the promotion of sustainable utilisation of the resource. However, the DoF has not implemented effective measures to promote sustainable management of fish resources. The DoF does not have technical measures in place which restrict the harvest of fish from the natural waters as it has no up to date information on fish biomass for it to be able to determine how much fish can be harvested and how much can be left for regeneration.

The lack of knowledge of fish biomass per specie per water body renders the use of the quota system redundant thus open access is practiced which allows anyone willing to fish to do so. The DoF did not impose any restrictions on the number of fishing gear and vessels and the quantity of fish they can harvest in any given period which may result in the depletion of fish resources.

Co-management of fish resources is one of the measures the DoF intends to implement to enable communities better manage the fish resources. Co-management is to be achieved through formation of fishery management areas and in turn fishery management plans. This however has not been the case as FMPs are either still in draft form or have not been developed at all.

Monitoring, control and surveillance has not been effectively carried out. This has been as a result of factors which include inadequate staffing to monitor illegal fishers, lack of transport to carry out monitoring as well as inadequate funding among others.

Although some fishers are licensed, licensing has not worked as a control measure other than raising revenue. Compliance levels pertaining to licensing are very low and more common with artisanal fishers yet they constitute a larger portion of fishers. This has resulted in unregulated fishing where most fishing activities on the natural waters are not even known by the DoF thus increasing the threat of overfishing.

Lack of MCSs has resulted in the fishing ban not strictly being adhered to as reflected in the increase in the number of fishers and fish traders being apprehended for illegal fishing or trading during the closed period. In addition, to fish ban, protection of breeding areas is another way the DoF uses to allow fish to replenish. However, the settlement of people in these areas and the failure to gazette these areas has resulted in the measure not being effective.

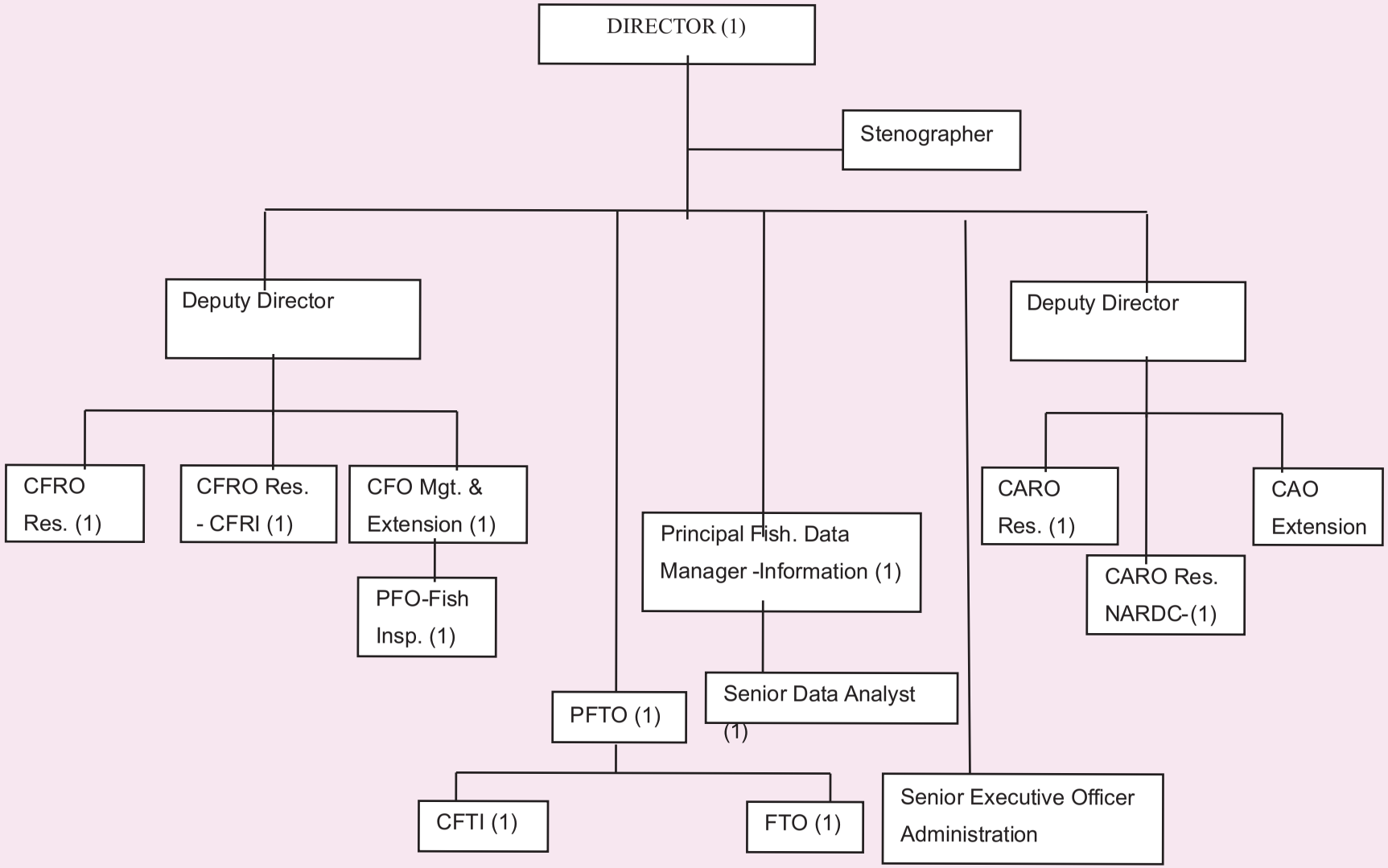
The DoF has tried to implement measures to control the gear and methods fishers use, but this has also not been effective as fishers have continued to use gears and methods that have been declared illegal such as the use of mosquito nets, poisons, explosives and kutumpula among others. Surveys by the DoF indicate that smaller mesh sizes are being used by fishers as well as wrong methods of fishing. Use of small mesh sizes does not discriminate which fish is caught in terms of size and this only worsens the situation further since even juvenile fish is caught including other species which are of ecological importance to maintain bio-diversity and clean the environment.

7. RECOMMENDATIONS

Based on the findings, the following is recommended:

- The DoF should determine the fish biomass in each fishery area which will enable them to estimate how much fish can be harvested and how much can remain for regeneration.
- The DoF should ensure that FMPs are drawn and implemented for all fishery areas in order to improve management of fisheries resources in the country.
- The DoF should strengthen participation of key stakeholders such as the VMCs, ZMC, FMC and support progressive fisheries management initiatives and programmes that will address issues of overfishing and use of illegal gear and fishing methods. It is important to get communities involved in the management of fisheries as it creates a sense of ownership of the resources.
- The DoF should provide better data, other information and technical support to fishers, communities and others on how to manage their stocks, so improving productivity.
- The DoF should intensify sensitizations on the importance of fish farming so that people can be engaged in fish farming as an alternative source of livelihood and emphasis should be on fingerling production so as to increase fish production.
- The DoF should continue to push for the recruitment of staff to fill existing vacancies at various levels of the departmental structure.
- The DoF should also improve resource allocation for fisheries management and community level sensitization programmes.

APPENDIX 1: ORGANISATION STRUCTURE (EXTRACT)



APPENDIX 2: PLACES VISITED AND INTERVIEWEES

Location	Name	Interviewees
1. Lusaka Province	Department of Fisheries HQ	1. Director
		2. Assistant Director - Capture Fisheries
		3. Assistant Director - Aquaculture Fisheries
		4. Chief Aquaculture Officer
		5. Chief Fisheries Research Officer
		6. Data Manager
		7. Provincial Fisheries Officer
2. Southern Province	Choma	8. Provincial Fisheries Officer
	Siavonga	9. District Fisheries Officer - Aquaculture
	Sinazongwe	10. District Fisheries Technical Officer
		11. Senior Fisheries Research Officer
3. Luapula Province	Mansa	12. Provioncial Fisheries Officer
		13. Fisherires Technician
		14. Aquaculturist
		15. PLARD

			Representative (2)
			16. Fisheries Research Officer
		Samfya	17. District Fisheries Officer
			18. District Fisheries Officer
		Mwense	
4.	Central Province	Kabwe	19. Principal Fisheries Officer
		Itezhi - tezhi	20. Senior Fisheries Research Officer
			21. Fisheries Assistant
			22. Fisheries Assistant Extension Officer
		Serenje - Lusiwashi	23. Fisheries Assistant
		Kapiri Mposhi - Likanga	

APPENDIX 3: FOCUS GROUPS

Fishery Area	No# of Attendants
Mwense	11
Samfya	9
Lusiwashi	27
Lukanga	24
Itezhi-tezhi	37
Sinazongwe	45
Siavonga	9

APPENDIX 4: DESCRIPTION OF FISHERY AREAS

Fisheries	Description
Lake Kariba	Lake Kariba fishery, situated in southern province of Zambia and shared with Zimbabwe is a creation through damming of the Zambezi River for the purpose of hydro-electricity power generation. The general features of the topography and hydro biography of the lake can be summarized as follows: • Length: 280 kilometers (total) • Width at greatest: 19.4 km • Total area of Lake: 5,364 sq km • Depth at greatest: 93 m While management of the in-shore fishery (breams, characids, cat fish etc) is per country-basis, because the mixing of fish species in this category is very minimal, management of the pelagic species (Limnothrissa miodon) has to be jointly done because fishing units catch the same stock as it moves to any or all parts of the lake.
Lake Tanganyika	Lake Tanganyika is one of the major fisheries in Zambia. It is the longest lake in the world and the second deepest after Lake Baikal in Russia. Its depth is due to the fact that it lies in the Great Rift Valley which was formed as a result of the tectonic movements in the earth's crust. At its deepest point, Lake Tanganyika reaches 1,433m which is about 642m below sea level. The lake is 677km long and 50km at its widest point. About a sixth of the world's fresh water species are found in this lake, with around 350 species of fish. Although the abundance of fish species vary according to seasons, overall the most common fish species on Lake Tanganyika are Kapenta, Buka Buka and Breams. Furthermore, Lake Tanganyika is one of the few fresh water bodies that is known for its unique and famous ornamental fish which is exported to many countries around the world. In Zambia, Lake Tanganyika is located on the northern tip of the country and wholly lies in Northern Province of Zambia. It is shared by Zambia, Tanzania, Burundi and Democratic Republic of Congo and only about 7 percent of the lake lies in Zambia. Mpulungu is the only port on the Zambian side. Its inflow sources are Ruzizi, Malambo and Maragarasi rivers while its outflow is Lukuga River.

Mweru Luapula	• Surface area 4650 km^2 (Lake), 1500-2400 km^2 (Flood plain) • Depth 27 m (max), 10 m (mean north basin), 3 m (mean south basin) • Max length 124 km (lake), 160 km (flood plain) • Width 51 km (max lake), 5-18 km (flood plain) • Shoreline Lake 350 km (210 km Zambia) • Actual 5.5 m (max), 1.5-2 m (mean) The Mweru Luapula Fishery includes Lake Mweru, its islands, the Luapula River with its lagoons, swamps and flood plains from Mambilima falls south of Mwense up to Lupiya at the Lunchinda River. Both the river and Lake Mweru are shared almost equally by the Zambia and the Democratic Republic of Congo (DRC) (52% and 48% respectively). Apart from the Luapula River in the south, the lake has another main effluent river the Kalungwishi from the East. Its outflow is the Luvua River to the north into DRC and the Congo basin. Mweru Luapula harbours about 100 fish species, of which about 17 are commercially important.
Lake Mweru Wantipa	Mweru Wantipa fishery is entirely situated in Kaputa district in the Northern Province of Zambia. It is 73.5 km in length and 43.3 km in width. The fishery includes lakes Mweru-wa-Ntipa and Chishi, a small lake that adjoins it. Mweru-wa-Ntipa meaning "Lake of Mud,"is surrounded by a marsh and lies wholly within Zambia. It is located between grids 29 00 and 30 00 east and 8 10 and 9 10 south and drains a catchment's basin which has no exit although in times of very heavy rainfall there can be a connection from Kalungwishi river overflowing into Mofwe dambo.
Lake Itezhi Tezhi	Lake Itezhi tezhi is situated in Itezhi tezhi district in the central province of Zambia. It is a manmade lake covering an estimated 370 Km^2. The dam wall is an earth wall constructed in 1977 as an added reservoir for electricity generation downstream at Kafue Gorge. The eastern part of the lake is hilly with dotted fishing camps and villages. The western and southern parts of the lake are surrounded by the Kafue national park. The Kafue River which feeds its waters into this reservoir enters from the northern part. The lake is also feed by Musa River which flows from the south- western direction on the southern tip of the lake, while Lwabeza, mungoshiyachibila and malala rivers join in from the mid western direction of the lake.

Lake Bangweulu	Lake Bangweulu (lakes, rivers and swamps) complex is found in the northern part of Zambia. Lake Bangweulu fishery is an inter-connection of lacustrine and riverine systems. The lacustrine system is composed of five inter-connected Lakes Chifunabuli, Walilupe, Kampolombo, Kangwena and Bangweulu proper. Lake Bangweulu proper is separated in the west from Lake Chifunabuli by the sandy Ifunge Peninsula and in the east from Lake Walilupe by the swampy Mbabala Island. In the south, Lakes Kampolombo and Kangwena are separated but inter-connected by man-made channels and by rivers. The riverine system is composed of Chambeshi River which enters the swamps through Chief Nsamba area from the north-eastern direction and Luapula River that outflows from the southern direction through Tuta bridge. The swamp area covers over 5, 000 km^2 making up to 16% of the complex which reduces to 10% in the dry season (Mattwell, 1998).
Chambeshi River	Chambeshi River, also spelled Chambezi, river is located in northeastern Zambia. It rises in hills on the Tanzanian border at an elevation of 1,760 meters above sea level and flows 300 miles (480 km) southwest to the Bangweulu Swamps.The Bangweulu Swamps are part of Lake Bangweulu, and by the end of the rainy season in May, it delivers a flood which recharges the swamps and inundates a vast floodplain to the southeast, supporting the Bangweulu Wetlands ecosystem. The swamps act as a check to the annual flooding, releasing the flood waters slowly through a myriad of channels and lagoons, to issue as the Luapula River where the slope increases once more. The Chambeshi River is the most remote headstream of the Congo River (in terms of length) and therefore considered its source. (However, in terms of volume of water, the Lualaba River is the greater "source" of the Congo.) For more than 100 km of its length as it flows to the east of Kasama the river consists of a maze of channels in swamps about 2 km wide, in a floodplain up to 25 km wide. Further downstream, where it is bridged by the Kasama-Mpika road and the TAZARA Railway, the permanent main channel is about 100 m wide, and up to 400 m wide in flood.

Lukanga Swamp	The Lukanga swamp is located at 14° 08' - 14° 40'S, 27° 10' - 28° 05'E in Central Province of Zambia and has an altitude of 1090m above sea level. The area is found about 60 km west of Kabwe town and then on the east bank of the Kafue River along the stretch between Machiya Ferry at Mswebi and Mongo. The Lukanga with its estimated 2,600 km^2 is the largest permanent water body in the Kafue basin and is one of the key wetlands in Zambia. The swamp is generally shallow and does not exceed 6 m in depth, even at the height of the rainy season. The swamp is a suitable or ideal habitat for birds and wildlife as well as breeding ground for fish. The Lukanga basin is 58, 909 km^2 and covers an area stretching from the Copperbelt of Zambia down to the Central province, where the Lukanga swamps are found. It is part of the upper catchment of the Kafue Basin excluding the Lunga river catchment which joins the river after Lukanga. The swamp includes two substantial islands, Chiposha and Chilwa Islands, the latter measuring some 14.5 × 6 km, and several semi-permanent lagoons andchannels. The largest lagoon, adjacent to Chilwa Island, has maximum dimensions of 17 × 11km.

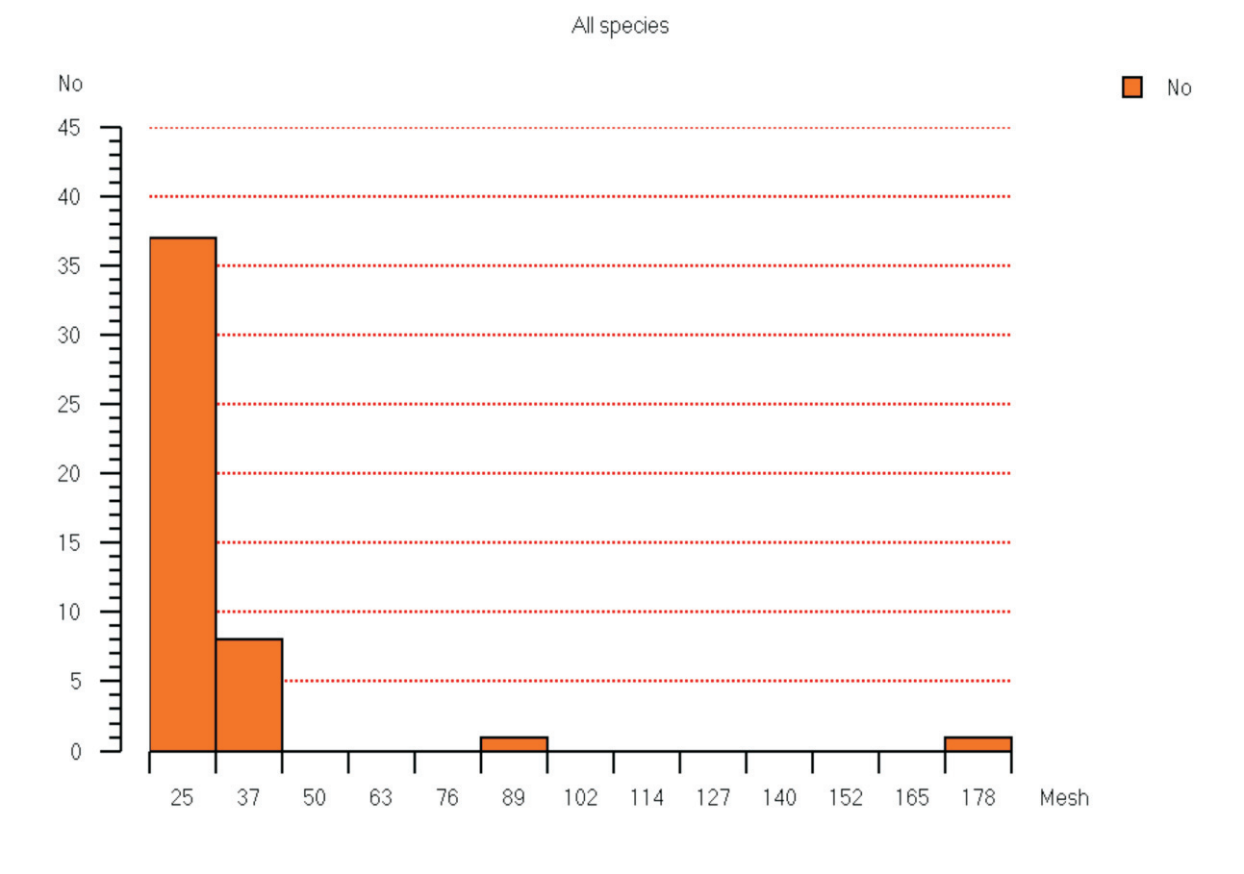
APPENDIX 5

REGULATION OF FISHING IN COMMERCIAL FISHING AREA

COMMERCIAL FISHING AREA	PROHIBITED NETS	PERIOD OF CLOSURE	PROHIBITED FISHING METHODS	PROHIBITED FISHING AREAS
Bangweulu Commercial fishing area. Lower Kafue Commercial Fishing Area Kariba Commercial fishing area Lake Tanganyika Commercial Fishing Area. Lake Lusiwashi Commercial fishing Area Lake Mweru - Luapula Lake Mweru Wantipa Upper Zambezi Supper Upper Zambezi Chambeshi Commercial Fishing Area	➢ Draw/seine net of any mesh size ➢ Draw net of mesh size less than 800 for Bangweulu ➢ Gill nets of mesh size not less than 76mm for Kariba, Lusiwashi, Mweru wantipa, Upper Zambezi, supper upper Zambezi, Luangwa, Lower Zambezi, Lower Kafue ➢ Gillnets of mesh size not less than 63mm for Tanganyika and Mweru-Luapula and Bangweulu ➢ Kapenta nets of mesh not less than 10mm for Tanganyika and	➢ 1st December to the last day of February for Mweru Luapula fisheries for All fisheries.	➢ Use of explosive or firearm ➢ Use trawl net or bottom drag net ➢ Alter natural configuration of the terrain. ➢ Towing through water behind or between boats or by driving or directing fish towards a stationery net. ➢ Setting net across the width of any river,	**Mweru Luapula-** That portion of water of Mweru bound by a straight line drawn from the Northern up of Nkole point in a Northerly direction to the Southern most tip of Kilwa Islands thence in a south easterly direction to the bank of the Chota Channel; thence following the shores of lake Mweru to the right bend of Luapula River thence up this river for a distance approximately 5 kilometres; thence to the nearest boundary between the Democratic Republic of Congo and Zambia opposite; thence in northerly direction along this boundary to the point of starting.

Middle Zambezi commercial Fishing area Lower Zambezi Fishing area Upper Kafue Commercial fishing area Supper Upper Kafue Commercial fishing Area	Kariba ➢ Monofilament nets of mesh size less than 127mm Chisense (P.moeruensis) less than 10mm for Mweru luapula and ➢Mweru-wantipa ➢Gillnets of mesh sizes less than 9mm for Chambeshi ➢Gillnets of mesh sizes less than51mm for Middle Zambezi and Upper Kafue and Supper Upper kafue	bank to bank ➢Use of poison or other noxious substance ➢Use of electrical devic ➢ Use of any equipment for fishing which does not conform to standard prescribed ➢ Use weir or fishing equipment prohibited Use of nets that are of a number and size exceeding that which is permitted	**Kariba** - Namazambwe river estuary, - Mweemba river estuary, - Chimini inlet, Maaze river estuary, - Zongwe river estuary, - Sikalamba river estuary, - Nang'ombe river estuary, - Jongola river estuary, - Chezya river - Lufua River Estaury, - NangandweRiver estuary - Nanhunwe River, - the Lunar period **Lower Luangwa River** **Mweru-wa-ntipa** - Mweru Wa Ntipa National Park **Tanganyika commercial Fishing Area** - Chitili area - Kasakalawe area - Nsumbu National Park - Kapenta fishing during Lunar period i.e. full moon

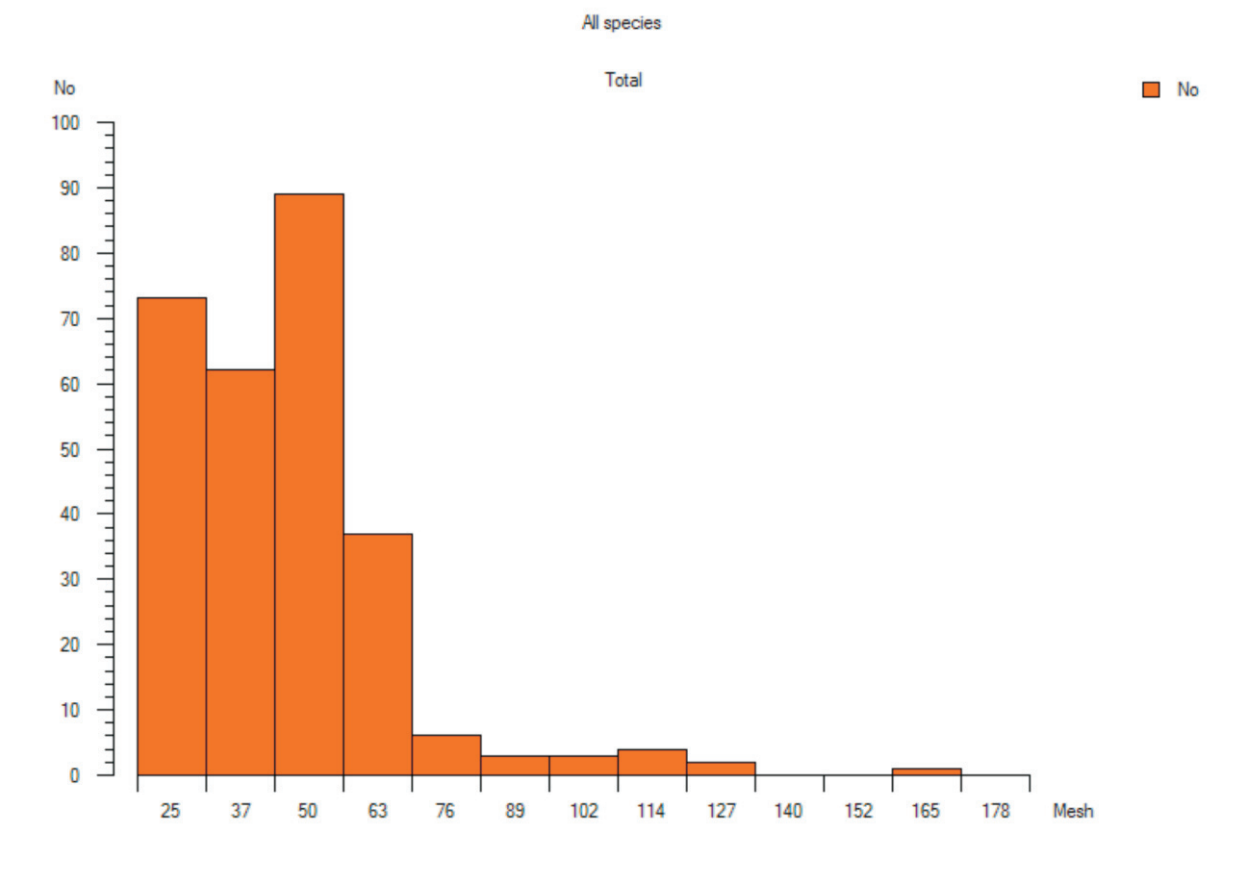
Showing number of fish caught in each mesh size at Kilwa and Mifimbo. Smaller meshes caught more fish than bigger ones.



Source: Mweru-Luapula Fishery 2012 Annual Report

APPENDIX 6

Mesh effectives – Fish species catch per mesh size Lake Kariba



Source: Capture fisheries Report for 2013

7. GLOSSARY OF TERMS

Artisanal Fishers	Also known as traditional or small scale fishers and constitute the largest type of fishers in the country. These use smaller vessels such canoes to catch fish.
Aquaculture Fisheries-	The Fisheries Act, 2011 defines Aquaculture as the cultivation, propagation or farming of fish, aquatic vegetation or other living aquatic resources whether from eggs, spawn, spat or seed or from rearing fish lawfully taken from the wild or lawfully imported into the country, or by other similar process.
Aquaculture Farmers	These are fish farmers and can also be small scale, middle or commercial fishers. Fish farming in Zambia is done in dams, earthen or concrete ponds or most recently in cages. One or more fish species can be stocked with feeding being organic fertlisers and feed depending on whether one is farming on a commercial basis, middle or small scale.
Biomass	In ecology, is the mass of living biological organisms in a given area or ecosystem at a given time. Biomass can refer to species biomass, which is the mass of one or more species, or to community biomass, which is the mass of all species in the community. It can include microorganisms, plants or animals.[4] The mass can be expressed as the average mass per unit area, or as the total mass in the community.
Benthic	Living on or in the sea bed.
Catch Assesment Survey (CAS)	Survey used to determine the fish production per season. The survey is supposed to be carried quarterly in a year.
Capture Fisheries	This is an act of harvesting, killing or taking of fish in natural waters. The Act defines fishery waters as any water in any rivers, stream, watercourse, lake, lagoon, pond and reservoir whether natural or manmade, but does not include water in aquaria or ornamental ponds unconnected to natural waters.

Catch Per Unit of Effort (CpUE)	The amount of fishing effort applied to catch fish per boat per night.
Depleted Catches	Depleted catches are well below historical levels, irrespective of the amount of fishing effort exerted.
Dermasal Fish	Live and feed on or near the bottom of seas or lakes (the demersal zone). They occupy the sea floors and lake beds, which usually consist of mud, sand, gravel or rocks.
Environmental Overfishing	Overfishing of all fish species
Fishing Effort	Fishing vessels, fishers and fishing gear
Frame Survey	The frame survey is used to identify fishing effort such as number fishers, vessels, fishing gear. This type of survey is supposed to be carried out once in 5 years.
Gillnet Survey	Survey determines fish composition, relative abundance, fish reproductive cycle, fish species weight and length (size).
Hydroacoustics	General term for the study and application of sound in water. Hydroacoustics, utilizing sonar technology, is most commonly used for detection, assessment, and monitoring of underwater physical and biological characteristics. Hydroacoustics can be utilized to detect the depth of a water body, as well as the presence or absence, abundance, distribution, size, and behavior of underwater plants and animals.
Maximum Sustainable Yield, MSY	A concept often used in fisheries management describing the theoretical the largest yield (catch) that can be taken from a stock of a species over an indefinite period. In many modern fisheries management models the MSY occurs at 30% of the unexploited population size.
Overfishing	Catching too much fish for the system to support.

Quota	A dedicated portion of a species-specific total allowable catch allocated to a country, fishing-group or an individual fishermen. These are typically given out by weight and for a set time period.
Recruitment Overfishing	The type of overfishing which catches fish even before it breeds. When the mature adults, or spawning biomass, population is depleted to a level where it no longer has the reproductive capacity to replenish itself. There are not enough adults to produce offspring.
Stock Overfishing	The type of overfishing which relates to a particular specie.
Under-exploitation	Underexploited is an undeveloped or new fishery believed to have a significant potential for expansion in total production while fully exploited is a fishery operating at or is close to an optimal yield level, with no expected room for further expansion.