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The impact of stunt growth of fish in ponds on fish supply in Chipata city, case study of selected markets in Chipata, Zambia

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Abstract
Climate variability has been one of the major issues of the 21st century. In fact, its importance keeps on increasing with the realization that its impacts cut across all sectors of a country's economy. Hence it should not only be looked at just as an environmental issue but also a developmental issue.
Drylands and the plateau areas of sub-Saharan Africa, southern and central Africa, are homes to nearly 50 percent of its populations, who depend on agriculture including livestock, crops and fisheries, as their main livelihood strategy (FAO, 2016). Sporadic and irregular rainfall patterns are the most important environmental driver for these regions and water, in particular surface water, is the primary element of scarcity in drylands (FAO, 2016). Generally, drylands and the plateau areas water bodies are unstable and strongly pulsed ecosystems owing to intermittent and largely unpredictable precipitation (FAO, 2016).
As a result of this productivity, they can sustain very high yields in years of good rains, but being largely short-lived as they also respond rapidly to environmental changes in hydrological regimes, which means that alternating periods of low productivity are inevitable (FAO, 2016).
Particularly, in protracted crisis situations and to enhance the potential supply of fish from dryland areas through improved use of the available water bodies, and in particular small reservoirs (FAO, 2016). The important role that small water bodies play in supplying essential micronutrients and protein to the communities has largely been overlooked since the termination of the FAO (Food Agriculture Organisation/ALCOM (Aquaculture for Local Community Development) programmes (FAO, 2016).
Most of the fish production, however, is consumed locally and goes unrecorded in official catch statistics (Kolding, *et al*. 2016). By refocusing attention on the fish productivity of small water bodies and reservoirs in drylands and plateau areas, in particular by integrating fisheries with developments in water harvesting, irrigation and improved water storage facilities, the potential to increase the role played by fish in the diets of dryland and plateau people, and to provide improved livelihood opportunities is great (FAO, 2016). Therefore, the general and increased unpredictability of the rainfall required to sustain surface water bodies creates uncertainties in annual production (FAO, 2016).
These are the prevailing conditions that are commonly affecting the district of Chipata. As a district, it is known to be a plateau type where water bodies are less, therefore, affecting fish growth and the supply to the city of Chipata.

Keywords: drylands, ponds, fish supply, Chipata city

1. Introduction
The role and importance of fish in securing food and nutrition for humans, particularly in developing countries, has frequently been overlooked. Fisheries and aquaculture are often arbitrarily separated from other parts of the food and agricultural system in food security studies, debates and policy-making (HLPE, 2014) [7]. In this regard, the importance of fish, and in particular small fish, for sustainable and healthy livelihoods in Africa, as well as their strong relationship with climate-driven water dynamics and their role during times of crisis and disasters, are generally undervalued and little understood (FAO, 2016). This is because most small fish are consumed locally and, as such, go unrecorded in catch statistics (Kolding *et al*., 2016) [10].
However, given the widespread distribution of drylands in Southern and Central Africa, and the extent of fish production and regional trade on the continent, all fisheries do, or have the potential to contribute to the livelihoods of people in the drylands, either directly to those fishers and fish farmers working in dryland areas, or as a vital source of food for drylands populations (FAO, 2016).

1.1 Statement of the Problem
Although the issue of fishing and aquaculture have been under discussion and extensively researched for some time, it was not known which factor is a clear or major cause of less fish supply in Chipata town, Mudenda, (2009) [13] says fish is the major source of protein and food security.
It is against this background that this research was conducted to assess the impact of stunt growth of fish in ponds on fish supply in selected markets of Chipata city. The current situation is that fish supply is low and expensive to fetch in Chipata city. If this situation is not treated with importance it deserves, then chances of having inadequate fish resources and supply in the city will keep on decreasing.

1.2 Purpose of the study
Was to assess the impact of stunt growth of fish in ponds on fish supply in selected markets of Chipata city.

1.3 General objective
To find out the impact of the stunt growth of fish in ponds on fish supply in selected markets of Chipata city.

1.4 Specific Objectives
1. To establish the impact of stunt growth of fish in ponds on fish supply to selected markets of Chipata city.
2. To assess the species of fish commonly found on the selected markets of Chipata city.
3. To identify the sources of fish supply to the selected markets of Chipata city.

1.5 Research questions
1. What is the impact of stunt growth of fish in ponds on fish supply to selected markets of Chipata city?
2. What are the common species of fish found on the selected markets of Chipata city?
3. Which of these identified sources are the main sources of fish supply to the selected markets of Chipata city?

1.6 Research Variables

Scarcity of fish supply	On the markets of Chipata city.
Common species of fish	On the markets of Chipata city.
Common sources of fish	On the markets of Chipata city.

1.7 Significance of the Study
In-depth studies should be undertaken with a view of developing an administrative structure that could facilitate aquaculture development in the country (Mudenda, 2009) [13]. Therefore, the findings of the study might also inevitably contribute to the knowledge in the field of aquaculture in general, in the country**.** In addition, it will also contribute to the increase in supply of fish in the city based on the recommendations by the researcher.

2. Literature review
Objective of this literature review is to present evidence that reinforces this conclusion and supports a portion of other previous studies regarding this study.

2.1 Continental Perspectives
Fish provides the main source of animal protein for some 200 million people on the African continent (Heck *et al*., 2007) [6]. Reduced annual and dry season, rainfall, and changes in the duration of the growing season, is likely to have implications for aquaculture and create greater potential for conflict with other agricultural, industrial and domestic users in areas where water is scares (FAO, 2016). These impacts are likely to be felt most strongly by the poorest aqua-culturists, whose typically smaller ponds retain less water, dry up faster, and are, therefore, more likely to suffer shortened growing seasons, reduced harvests and a narrower choice of species for culture (FAO, 2016).

2.2 Zambian perspectives
Drylands and plateaus are subject to large year-to-year variations in precipitation, with prolonged dry periods interspersed with wetter years (FAO, 2016). Chipata district major water bodies are such as; Lutembwe, Chingoma, Rukuzye, Musandire and Lunkhuswe streams which are not perennial, and dams. The general drying out of the climate in the district has increased abstraction of water for fishing means that many notable hydrological features are disappearing Welcomme and Lymer (2012) these are similar conditions of Chipata district.
This is most clearly observed in the desiccation of some ponds, Tim and Chiparamba dams which have contracted by 80 percent in the last 48 years relating to the decreased rainfall in the lower lands of the district over the past four decades, and its effect on the major water bodies of the district, which is directly reflected in the fisheries yields, (Lemoalle *et al*., 2012) [12] as they have caused stunt growth of fish in some ponds.

2.3 Comparatives
Zambia as a whole is well endowed with fisheries resources from the rivers, streams and inland waters such as floodplains, lakes and other reservoirs (Mudenda, 2009) [13]. Many of the countries in Africa with large dryland areas, such as Kenya and Uganda, also produce large quantities of fish which are traded locally, and transported to regional and international markets (FAO, 2016).
For Zambia as a country, much has to be done. Instead, much fish is being imported from some neighbouring countries.

3. Methodology
This was presenting the research design, the target population, the sample size, sampling and data collection procedures and analysis and the instruments that were used.

3.1 Research design
The qualitative method allowed the researcher to obtain in-depth information about the phenomenon under investigation while the quantitative method ensured high levels of reliability of the gathered data. Therefore, the researcher conducted a case study as White (2013), indicates that in order to get in depth understanding of the phenomenon under study.

3.2 Target population
"A population is a collection of objects, events or individuals having some common characteristic that the researcher is interested in studying", (Ng'andu, 2013) [15]
In this study, the target population will comprise of one hundred (100) fish traders and none fish traders in selected city markets and ten (10) officials in the department of fisheries at district levels in Chipata district, in Zambia.

3.3 Research tools
The main research tools to be used in the study were questionnaires. Research instruments include questionnaires, interview schedules and observations, (Orodho and Kombo (2006, 2009).
Therefore, the questionnaires were used to gather data over a large sample and had both open-ended and closed questions.
Semi-structured questionnaires were used in the study to

capture information from the fish and none fish traders and the fisheries officials concerning the exploration of fish supply in the city of Chipata.
The questionnaires are of two types, one targeted directly to fish and none fish traders, and the other type targeting the district fisheries officials.

3.4 Data analysis
The researcher started the process of data analysis as soon as the research was accomplished. In this study both cases, that is, qualitative and quantitative data analysis were used, respectively.
In line with qualitative data analysis, Kombo and Tromp, (2006, 2009), urge that, 'the responses were categorized into various classes which are called categorical variables,' and added that, 'in qualitative research, data was also analysed mathematically. Qualitative data was analysed by content analysis. The data was analysed using the pie-charts, tables, graphs and statistical measures such as percentages.

3.5 Quantitative Data Analysis
In this particular study, quantitative data was analysed using the statistical package for social sciences (SPSS) and STATA to generate descriptive statistical information in form of frequencies, variables, tables, graphs, pie-charts and percentages. 'Statistics are a set of mathematical methods used to extract and clarify information from observable data. Statistics generate simple numbers to describe distributions' (Kombo and Tromp, (2006, 2009, and 2011). Besides, Gall *et al*, (2014, 2016), explains that mathematical technique is appropriate for organizing, summarizing as well as displaying a set of numerical data.

3.6 Ethical Consideration
Ethics as defined by (Strydom, 2013) are a set of moral principles suggested by an individual or group, is widely accepted and which offers rules and behavioural expectations towards respondents and other stakeholders in research.
During the study, the researcher observed the ethical considerations by respecting the rights and views of the participants. White (2014) cites the relevance of the information to the participants' decision as one of the most important elements in informed consent.
Confidentiality, respect, information and permission during data collection from participants were followed appropriately.

3.7 Scope of the study
It specifically looked at the exploration scarcity of fish supply on the markets of Chipata city as the targeted area, that is, fish traders, and none fish traders and fisheries officials by looking at the time frame and the level of funds of the researcher.

3.8 Limitation of study
In the pursuit of this study, several limitations were experienced. Such as the following;
- Cost in terms of time, effort and finances to carry out an extensive and exhaustive research.
- Obtaining accurate data because of fear of appraising and victimization on the part of respondents.
- The study will be qualitative in nature, therefore, it relied on respondent perceptions and views and quality of data depended on them.
- Since the study focused in the Eastern province, Chipata district, and some randomly selected fish and none fish traders on the city markets of Chipata, the findings of the study may not be generalized to all the Republic of Zambia.
- The purposive sampling procedures were used, therefore, decreased the generalization of the findings.
- In the qualitative study, the findings could not be subjected to other interpretations.

4. In these presentations showed the background characteristics of the respondents
Respondents' background characteristics

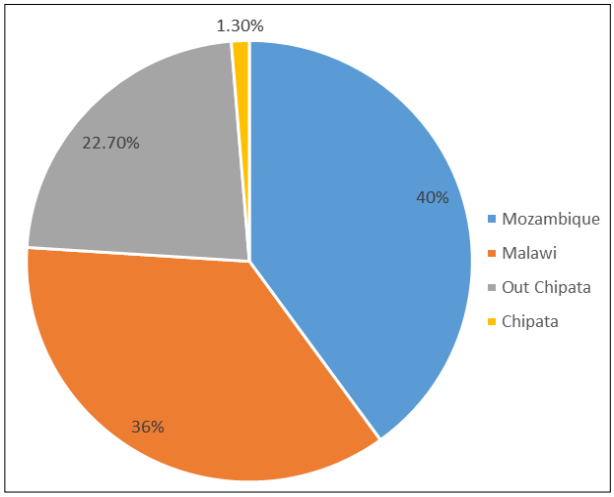
Table 1: Respondents from different markets in Chipata city and Fisheries Department

Name of markets	Frequency	Percentage
Kapata	69	% 62.7%
Saturday	24	21.8%
Nabvutika	06	5.5%
Kamanda	01	0.9%
Chipata District Senior staff fisheries	10	9.1
Total	110	100%

***Source*:** Field data, 2018

Explanation
These respondents were readily available to be interviewed. Therefore, 69(62.7%) were respondents from Kapata market, 24(21.8%) were respondents from Saturday market, 06(5.5%) were respondents from Nabvutika market, 01(0.9%) were respondents from Kamanda, and 10(9.1%) were respondents finally from Chipata district fisheries department senior staff, respectively.

Pie Chart (figure 1)



***Source*:** Field data 2018

Fig 1: Sources of fish in Chipata city

Explanation
- **Blue** stands for Mozambique which shows 40% of fish coming into Chipata city, Zambia.

- **Brown** stands for Malawi which shows 36% of fish coming into Chipata city, Zambia.
- **Grey** stands for outside Chipata shows 22.7% of fish coming into Chipata city, Zambia.
- **Yellow** stands for Chipata shows 1.3% of fish coming from within the district Chipata, Zambia.

Table 2: Respondents interviewed from different markets in Chipata city –fish traders and none-fish traders

S. No.	Responses from Markets	Percentage		Respondents Interviewed	
		Fish Traders	None-Fish Traders	Fish Traders	None-Fish Traders
1	Kapata	50.9%	11.8%	56	13
2	Saturday	21.8%	00.0%	24	00
3	Nabvutika	04.55%	00.9%	05	01
4	Kamanda	00.0%	00.9%	00	01
5	Chipata District Fisheries Senior Staff	00.0%	09.1%	00	10
	Total	77.3%	22.7%	85	25

***Source*:** field data 2018

Explanation

The respondents who accepted to be interviewed are as follows; 69(62.7%) but 56(50.9%) were fish traders and 13(11.8%) none-fish traders respondents from Kapata market, 24(21.8%) all were fish traders respondents from Saturday market, 06(5.5%) but 05(4.55%) were fish traders and 01(0.9%) was none-fish trader of the respondents from Nabvutika market, 01(0.9%) was none-fish trader respondent from Kamanda, and 10(9.1%) were respondents finally from Chipata district fisheries department senior staff, respectively.

Table 3: Respondents from different markets explaining the cause of scarcity of fish supply in the city of Chipata

Reason	No. of Respondents	Percentages
A	11	11%
B	08	08%
C	81	81%
Total	100	100%

***Source*:** field data 2018

Note

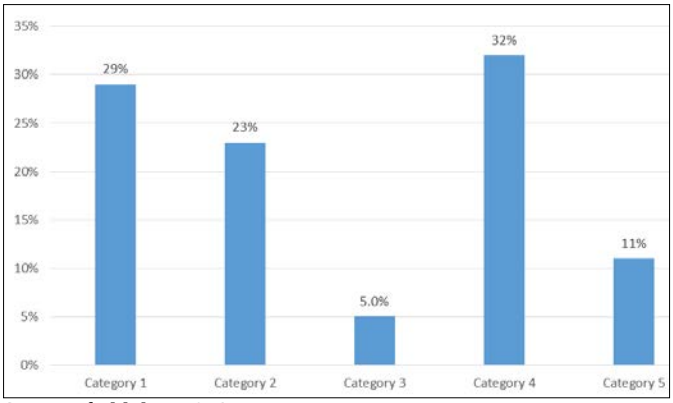
- **Reason** (A)-Long distance from the sources of fish.
- **Reason** (B)-Less sources of water bodies in the district.
- **Reason** (C)-Both A and B, and stunt growth of fish in some ponds.

Explanation

Eleven (11) respondents, that are 11%, explained that it was due to reason A as to why there is scarcity of fish supply in the city of Chipata.

Eight (08) respondents, that are 08%, explained that it was due to reason B as to why there is scarcity of fish supply in the city of Chipata.

Eighty-one (81) respondents, that are 81%, explained that it was due to reason C as to why there is scarcity of fish supply in the city of Chipata.



***Source*:** field data 2018

Fig 2: Type of fish on high demand on the markets of Chipata city

Note

- **Category 1:** Siavonga, 29%
- **Category 2:** Usipa, 23%
- **Category 3:** Chisense, 5%
- **Category 4:** Big fish, 32%
- **Category 5:** All types as mentioned above, 11%

Explanation

The 29% of respondents explained that the general population like buying siavonga though being expensive on the markets.

The 23% of respondents explained that the general population like buying usipa though not so expensive, because of its low quality in terms of taste.

The 5% of respondents explained that the general population like buying chisense because of being cheap on the markets.

The 32% of respondents explained that the general population like buying big fish though very expensive on the markets, known to be of good quality and taste.

The 11% of respondents explained that the general population like buying all the type of fish as above mentioned.

5. The presentation is focusing on the discussion and interpretation of the findings of the study

The general picture is that development is about bringing sustainability of the existing natural resources. Therefore, the department of fisheries have to take care of its natural resources to avoid easy and quick depletion of species and other related ecosystems to it.

1. The findings are that from table 1, Kapata market had a higher number of respondents, followed by Saturday, Nabvutika, and Kamanda markets, respectively. Equally, the staff at the department of fisheries at district level overwhelmingly responded to the interviews conducted.
2. 5.2-The Pie chart (figure 1) revealed that much or larger percentage of the fish consumed by the residents of Chipata, is mainly from outside the country. And only a smaller percentage of fish is locally produced or supplied to the city of Chipata. The chart indicates that about 40% of fish has been coming from Mozambique. Then, about 36% of fish equally has been brought into the country from Malawi. This shows that about 76% of fish is clearly from outside the country.

   Besides that, about 24% of fish is from within the country, Zambia. Again, about 22.7% of fish supplied to the city of Chipata has been from outside the district of Chipata, but within Zambia. Within the district, is about 1.3% of fish which is been supplied to the city of Chipata. In total, it is about 98.7% of fish which is been supplied to the city of Chipata is from outside the district.
3. Table 2 revealed that the three groups of respondents accepted to be interviewed were the fish traders' none-fish traders and the senior members' staff from the fisheries department. The table shows that Kapata market, 50.9% were fish trader and 11.8% of them were none-fish traders' respondents, respectively. Respondents from Saturday market, only 21.8% were the fish traders. Then for Nabvutika market respondents, 4.55% were the fish traders and 0.9% none –fish traders. And for Kamanda market respondents, 00% was for fish traders and 0.9% indicates none-fish traders. The neutral respondents of 9.1% were from the department of fisheries.

   The fish traders respondents further explained two major issues which have been affecting them at the border check-points of Mwami (Chipata district) and Chanida (Katete district), respectively. Firstly, is high border levies charged by the Zambia revenue authority (ZRA) causing fish to become more scarce and expensive on the city markets of Chipata. Secondly, there is too much paper work from border check-points clearance given by ZRA and the department of fisheries, which cause further delays of fish supply on the city markets of Chipata. The other reason mentioned was levies charged by city council authorities slumped on fish traders were too high, affecting the fish supply and pricing negatively.
4. Table 3 revealed that the main cause of less fish supply in the district, to be more particular, Chipata city. Some respondents explained clearly that one of the causes of less fish supply in the city of Chipata were long distances from the sources of fish. Secondly, it was also eluded to that the other major cause of less fish supply to the above named city was and is still the existing problem, is having less water bodies in the province as well as in the district. Thirdly, other respondents overwhelmingly expressed their feelings that the current situation is more natural as it is to do with physical geographical features of the province and the district as well.

   Besides, the current streams are not perennials and other water reservoirs easily dry-up due to some droughts during rain seasons in some years. Compounded with the above mentioned factors, and less existing dams in the district have, therefore, resulted into less fish supply in the city.

   However, though these challenges, as above mentioned, the population of the of Chipata city is high, as shown by Central statistical office (CSO) 2010, shows that there about 1,592,661 people in eastern province but Chipata district alone has about 455,783 people. This clearly shows that there is high demand of fish, though its scarcity.
5. Because of this scenario, the province, the district and the city of Chipata in particular, as shown from graph 1 (figure 2), this gives a picture that there is high demand of fish though its scarcity. The varieties of kapenta species which appeared from the graph, explains how much the residents of Chipata city favour these species give more to it that there is need to have fish products.

   Siavonga, despite being expensive, it has second highest rate of about 29% demand of being liked by the consumers. Usipa has a third rate of about 23% demands by the Chipata city consumers. Regardless of it having low demand, Chisense, is being consumed at the rate of about 05% by the local consumers of Chipata city. For the big fishes, such as, breams, are most expensive species of fish on the markets of Chipata city. Even though it is expensive, many of the consumers of Chipata city like buying these varieties. So amongst all these varieties, the big fishes are highly consumed by the local residents of Chipata city and have the highest rate of about 32% demand.

   Lastly, about 11% of the respondents indicated that residents of Chipata city like buying all the four varieties which are very common on the markets of the city. This entails that, despite less fish supply in the city of Chipata, there is extremely high demand of the commodity by the residents. During rain and cold seasons, these are known to be the worst hit of having less fish supply on the markets. In rain season, the traders explained that it is due to fish ban and lack of facilities to adequately process and prepare fish for marketing from fishing centres. For cold seasons, it is inclined to weather patterns which do not favour fishing activities at the times of fishing. In view of this, it was reported that fish supply becomes low and resulting into being so expensive. In warm seasons, fish become more plenty and prices are usually fair for consumers to buy fish.

6. The study points out number issues regarding the scarcity of fish supply in the city of Chipata and what it has caused to its communities. However, some recommendations and conclusion have been drawn

6.1 Conclusions

In the mainstream development discourse, agriculture and fisheries departments' growth are considered central to rural poverty reduction. Better water management, including increased construction of small reservoirs, is proposed as one of the solutions to agricultural growth and climate change resilience in many areas of Africa (FAO, 2008a) and while there is general agreement that development in water management should take several forms and benefit many people by better integrating irrigation and other uses (Venot *et al*., 2012), the potential for fisheries and improved nutrition has generally received negligible attention (HLPE, 2014) [7].

Climate change scenarios are primarily predicting increased variability and volatility in the precipitation regimes of drylands, and the impact of these anticipated changes on fish production will be felt primarily in terms of fluctuating supply of water (FAO, 2016).

Freshwater environments are among the most volatile and ephemeral ecosystems that exist and many fish species are highly adapted to fluctuating and variable conditions (FAO, 2016).

In fact, recent research (Kolding and van Zwieten, 2012; Gownaris *et al*., 2016b) [9] shows that the fluctuating nature of most African freshwater systems appears to promote fish production.

The general resilience of many fish resources to climatic variability and the underestimation of fish and fisheries in livelihood importance, but also on enhancing the potential supply of fish from dryland areas through the improved use of the available water bodies, and in particular from small reservoirs by focusing on small, highly productive species (FAO, 2016).

- Most of the fish production, however, is consumed locally and goes unrecorded in official catch statistics (Kolding *et al*., 2016) [10]. By refocusing attention on fish productivity in small water bodies and reservoirs in drylands, and in particular by integrating fisheries with developments in water harvesting, irrigation and improved water storage facilities, the potential to increase the role of fish in the diets of dryland people, and to provide improved livelihood opportunities, is great (FAO, 2016).

6.2 Recommendations

Based on the findings, the following are recommendations emerged from the study:

- Increasing the amount of surface water available from small reservoirs, such as dams and ponds are constructed.
- Putting up factories to manufacture fishing equipment and fish foods in the district.
- Also improving on the roads leading to the fish centres of the province.
- Construction of training institutions in line with fisheries.
- Some research on small, highly productive species of fish that is encouraged in the province.
- To give serious attention to fisheries department in the province by giving much land to use it for ponds and dams in the province.
- To construct storage facilities such as cold rooms in the province.

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