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FISHING GEAR AND FISH CATCH ASSESSMENT ALONG THE OTI RIVER AT AGBASAKOPE IN KRACHI EAST DISTRICT OF VOLTA REGION, GHANA

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Abstract

Rivers are a great source of fish and contribute significantly to the fish consumed by many Ghanaians. However, catches from rivers have declined over the past few decades partly due to various illegal fishing activities. The study was conducted on the Oti River at Agbasakope in Krachi East District in the Volta Region of Ghana from December, 2013 to March, 2014 to assess gears used and fish catches in order to provide technical information for sustainable exploitation of fish. Fishing gears were identified through personal observation. Fish catch data was obtained from randomly selected commercial fishermen once in a month. The results revealed that fishing gears such as atidza net, beach seine net, bamboo traps and gillnets were used. Gillnet was the most dominant fishing gear (47%) and the least used gear was atidza net (8%). The total average monthly fish catch was estimated as 10,027.9 kg during the period of study. Forty-six (46) fish species belonging to twelve (12) families were identified. Ten (10) species were caught from the family Cichlidae. Claroteidae was the most relatively abundant family (49.1%) with Chrysichthys auratus (20.1%) registering the highest percentage abundance in terms of number. Most fishing gears used by the fishermen did not conform to those legally allowed by the Fisheries Directorate for inland capture fisheries. Ban on use of unauthorised fishing gears should be enforced to increase fish production on a sustainable basis from the River Oti.

Keywords: **Fish, Fishing gears, Catch, Fishermen and Oti River**

Introduction

Ghana's fishing industry has made tremendous strides over the years, developing from a predominantly traditional canoe fleet to a mix of traditional and modern fleet. According to Seini *et al*. (2003), Ghana has a system of rivers, lagoons and lakes that form the basis of an inland fisheries industry. The fisheries sub-sector has for a long time provided a source of employment for Ghanaians. Fish supplies naturally augment food availability. Fish is an important source of animal protein for human consumption (Delgado *et al*., 2003), and features prominently in the diet of many people in most parts of Africa. When per capita fish consumption is low, small quantities of fish can have a significant positive nutritional impact by providing essential amino acids, fats, and micronutrients that are scarce in

vegetable-based diets (FAO, 2012).

Fishing gear refers to the physical equipment that is used when fishing; some examples of fishing gear are hook and line, nets, traps and spears (Gabriel *et al.,* 2005). Fishing gears are an intrinsic part of the fishing process. Without these tools we would be very ineffective predators in the river environment. Therefore, any assessment of the impacts of fishing on river environments requires, at a minimum, a time series of fisheries catches related to the gear that caught them is important (Watson *et al*., 2006).

Despite the importance of fisheries and other freshwater aquatic resources for large numbers of people in Ghana, national policies relating to such central issues as economic development, poverty alleviation, food security, conservation and sustainability often fail to recognize their role. This has contributed to a widespread failure to establish effective management systems. As a consequence, it seems likely that these resources and the benefits that they provide will become increasingly overexploited and degraded in the near future. This pattern of decline, which clearly has already started to take hold, will lead to severe competition and conflict between resource users, and may lead to a gradual lowering of socioeconomic conditions and increased poverty (Neiland and Béné, 2008). Fishing effort in Ghana has largely been unregulated and poorly managed, resulting in intensive exploitation and severe depletion of fishery resources (Ofori-Danson, *et al.,* 2012). Over the past decade, catches in local Ghanaian waters have declined by over 50% (Directorate of Fisheries, 2011). Fishermen at Agbasakope depend heavily on the Oti River for their livelihood. However, fishers in the area use different type of gears including unauthorized ones in order to get catch that will meet their intended market demand. It is feared that this can lead to over-exploitation and decline of catches in the Oti River hence the need for this study. The main objective of the study was to assess gears used and fish catch in the Oti River, in order to provide more technical information for sustainable exploitation of fish.

Materials and Methods

Study Area

The study was conducted on the Oti River at Agbasakope in Krachi East district in the Volta Region of Ghana (Figure 1). It is about 50 km south west to the district capital. It lies between latitude 7^{o} 40' N and 8^{o}15' N and longitude 0^{o} 6' E and 0^{o} 20' E (Cheke, 2001). The community share boundary with Ayidafie Battor to the south, Tokuroano to the east, Afadakope to the north and to the west is Oti River. Oti River forms one of the principal tributaries of Volta Lake in the north east part of Ghana with drainage area of 72,778 km^2 and derives its source from Pendjari National Park in Benin. It experiences annual flooding of its banks between August and November. The water level remains stable within part of November to December, recede in part of December to June and furthermore remain stable again in July. The people of Agbasakope are predominantly fishers from the southern part of Ghana, but few including Chokorsis and Konkombas, and Krachis who are natives of the land engage in farming. The vegetation of the area is moist semi-deciduous forest type. The following trees are commonly found around and within the community: Dadwadawa (*Parkia biglobosa*), Neem tree (*Azadirachta indica*), Silk cotton (*Ceiba pandra*), Sheanut tree (*Vitellaria paradoxa*).

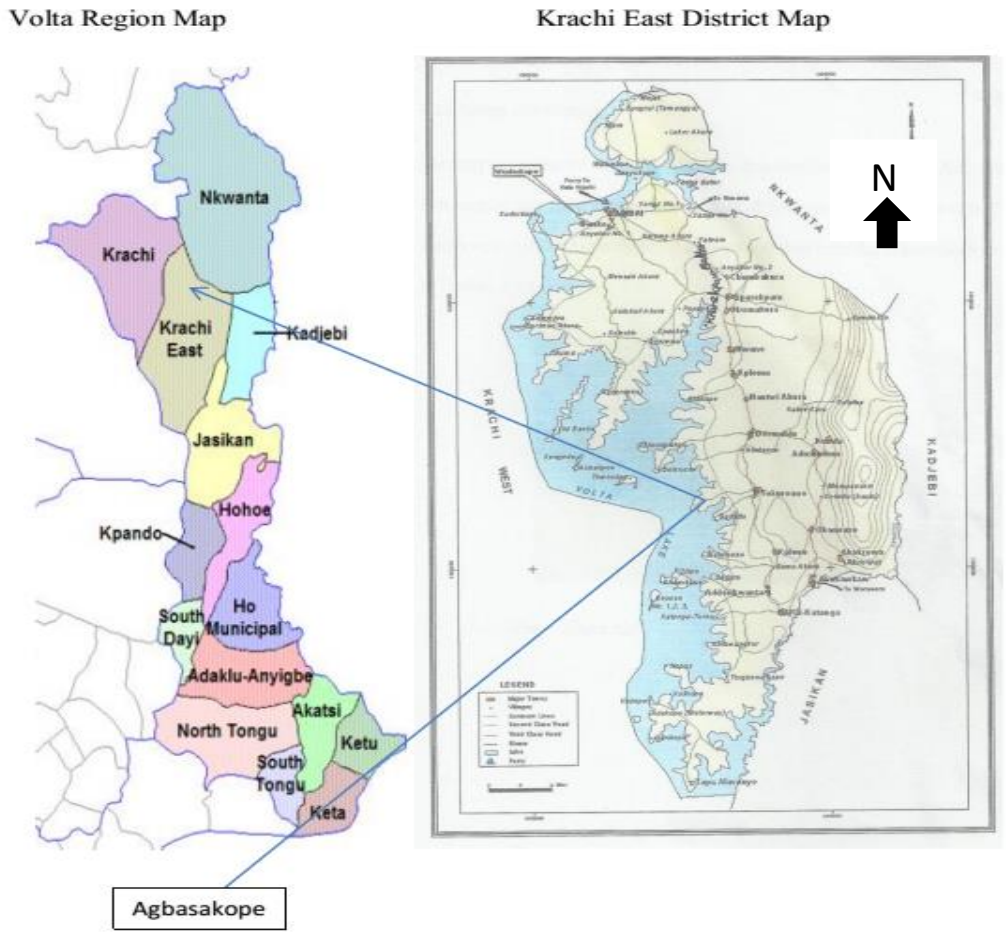

Figure 1: Map of Volta region and Krachi East district showing the study area

Sampling design

In order to cover different gears and fishes caught by fishers, traditional fishing landing sites in the community were grouped into two, namely; landing sites A and B. The two landing sites were visited once in every month from December, 2013 to March, 2014 to observe and identify type of gear and fishes caught from Oti River.

Data sampling

Five fishermen were randomly selected from each landing site. From each fisherman, total fish caught was weighed in kilogram using a balance scale and about 2.5 to 10 kg of fish was sampled and the following information was collected: (i) Fish species identification was done using freshwater fish identification guide (Dankwa *et al.*, 1999). This involved examining the colour pattern, morphology, lateral lines, fins and mouth, and character of the teeth, and scales. (ii) Total body length (from snout to tip of anal fin) using fish measuring board, and weight of fish in gram (iii) name of gear and its mesh size was measured in centimeter with the aid of a ruler.

Data analysis

Monthly fish catches (C) were estimated using C = Catch per unit effort (CPUE) × Number of fishing days (Fd). The CPUE was estimated as catch per canoe per day (kg/canoe/day).
The percentage Relative Abundance (RA) in terms of numbers was determined as follows:
RA =
Number of fish species/Total number of fishes × 100.

Data collected was processed using Microsoft Excel 2010 and results presented in tables, pie chart and bar graphs. The data on fishing gear identification and mesh sizes of nets was analysed in percentage frequency and class boundaries. The results were presented in a pie chart and table. Data on monthly fish catch estimation was calculated and the results were presented in bar graphs. Fish species composition was calculated in percentages and represented in tables and pie chart.

Fishing Gear Identification and Mesh Sizes of Net

Four main types of fishing gears were used by fishers in the Oti River as shown in Figure 2. The results indicated that the commonest gears were *atidza* net, bamboo trap, beach seine net and gillnet. Gillnet dominated (47%) all the gears used in the Oti River whereas '*atidza*' net (8%) was the least used. Figure 3 shows the photographs of major fishing gears identified during the study.

Results

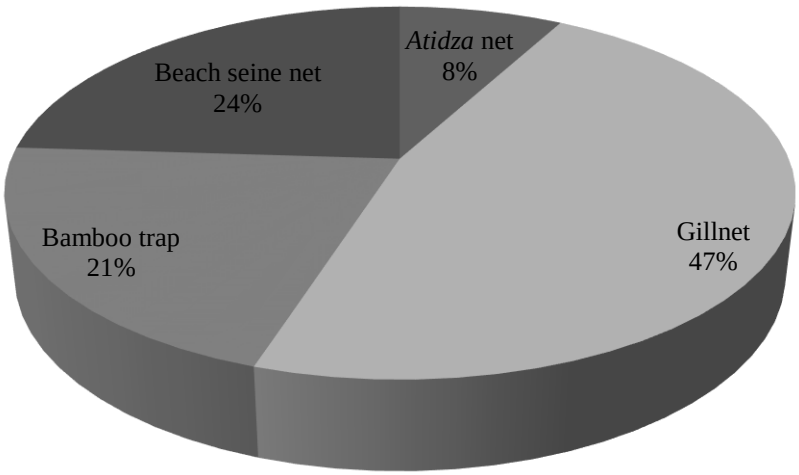

Figure 2: Types of major fishing gears identified from Oti River at Agbasakope.

Figure 3: Photographs of major fishing gears identified on Oti River at Agbasakope

The result in (Table 1) revealed that all the *atidza* net, beach seine net and some gillnet (7) have mesh sizes less than 5.0 cm. With the rest of gillnet assessed eleven (11) had mesh sizes between 5.0 cm to 15.0 cm.

Table 1: Mesh size ranges for various netting gears identified in Oti River at Agbasakope

Gear	**Mesh sizes(cm)**			**Total**
	0 - 4.9	5.0 - 9.9	10.0 - 14.9	
***Atidza* net**	3	_	_	**3**
Beach seine net	9	_	_	**9**
Gillnet	7	8	3	**18**
Total	**19**	**8**	**3**	**30**

Estimation of fish catch

Figure 4 below indicates estimated monthly catch of fishes from Oti River between December, 2013 and March, 2014. Total fish catch recorded for the four gears was 40,111.4 kg. March recorded the highest (15,912.3 kg) fish landed and February recorded the lowest (3,610.3 kg) fish.

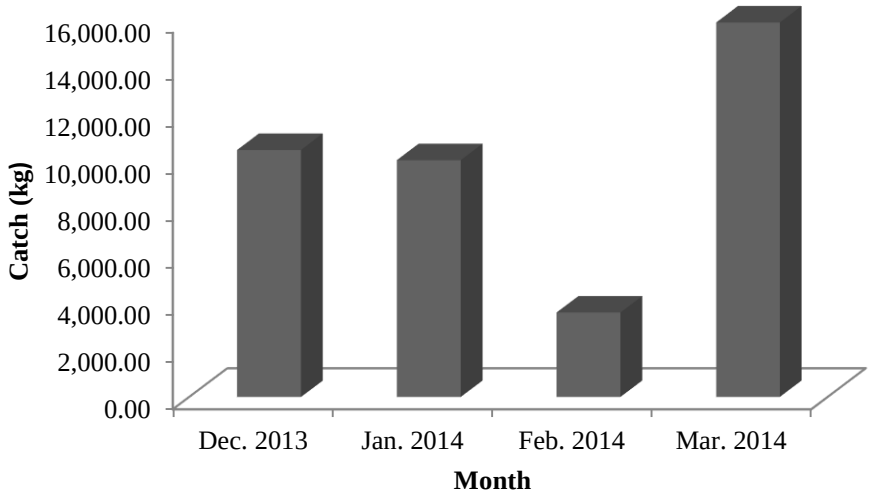

Figure 4: Monthly fish catch from Oti River at Agbasakope by all gears.

Catches from individual gears

Bamboo trap scored the greatest fish catch in December (4,267.0 kg) and March (9,284.0 kg), and Beach seine net in January (2,728.3 kg) and February (1,282.6 Kg). Gillnet recorded the least fish catch from December to March. The fish caught by gillnet ranged between 1,077.2 kg to 2,263.2 kg

(Figure 5).

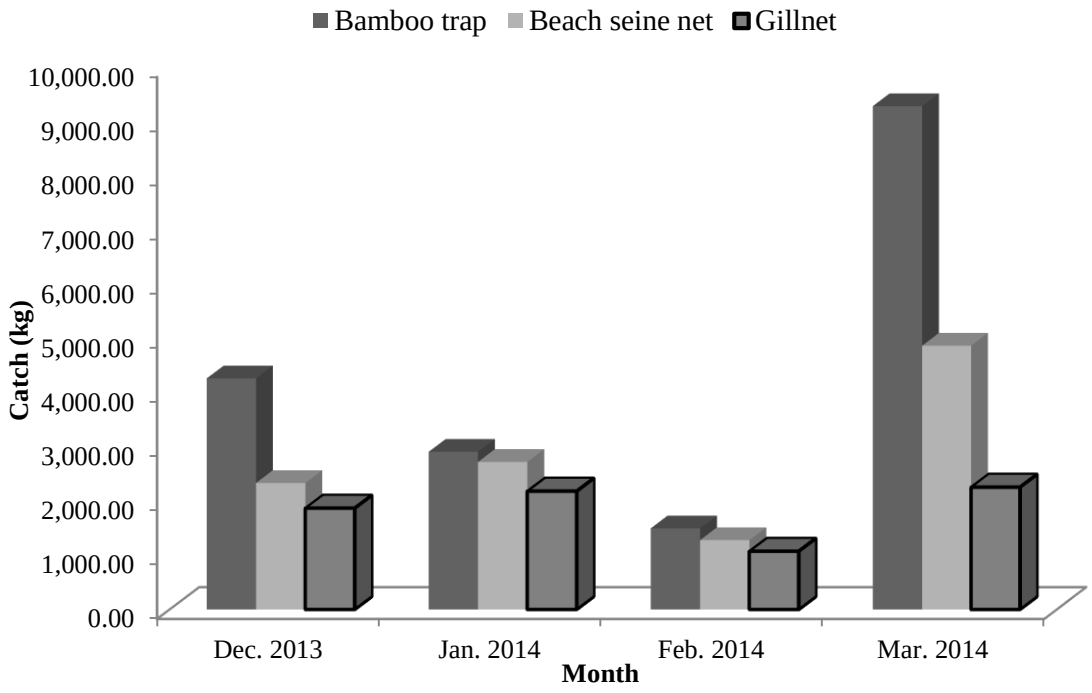

Figure 5: Fish catches from the main gears used in River Oti at Agbasakope

Number of fish caught per gear by family

Table 2 indicates that gillnet caught the highest (449) fish sampled followed by beach seines net (225), bamboo trap (201) and *atidza* net (75). With exception of *atidza* net the family of claroteidae dominated fish species caught by bamboo trap (193), gillnets (133), and beach seines net (132). Gillnet registered 10 families followed by beach seine net (9 families), *atidza* net (8 families) and bamboo trap (4 families).

Table 2: Fish family caught per gear in Oti River at Agbasakope

Families	Fishing Gears				Total
	AN	BT	BSN	G	
Bagridae	3	0	11	49	**63**
Distichodontidae	3	0	0	1	**4**
Characidae	0	0	21	62	**83**
Cichlidae	50	0	50	141	**241**
Clariidae	1	0	1	0	**2**
Claroteidae	7	193	132	133	**465**
Clupeidae	0	0	0	4	**4**
Malapteruridae	0	1	4	0	**5**
Mochokidae	4	5	4	43	**56**
Mormyridae	2	1	1	8	**12**
Schilbeidae	0	0	0	6	**6**
Tetraodontidae	5	0	2	2	**9**
Number of fishes	75	201	225	449	**950**
Number of family	8	4	9	31	

(AN: *Atidza* Net, BT: Bamboo Trap, BSN: Beach Seine Net and G: Gillnet)

Number of fish caught per gear by species

The result in (Table 3) revealed that most of the fish species (39) identified were caught by gillnet, followed by beach seine net (20), *atidza* Net (13) and bamboo trap recorded the least species.

Table 3: Fish species caught per gear in Oti River at Agbasakope

Family	Fishing Gear				Total
	AN	BT	BSN	G	
Bagridae	1	0	2	2	**5**
Distichodontidae	1	0	0	1	**2**
Characidae	0	0	2	4	**6**
Cichlidae	4	0	6	9	**19**
Clariidae	1	0	1	0	**2**
Claroteidae	2	6	4	5	**17**
Clupeidae	0	0	0	1	**1**
Malapteruridae	0	1	1	0	**2**
Mochokidae	2	1	2	8	**13**
Mormyridae	1	1	1	6	**9**
Schilbeidae	0	0	0	2	**2**
Tetraodontidae	1	0	1	1	**3**
Number of species	13	9	20	39	**81**

(AN: *Atidza* Net, BT: Bamboo Trap, BSN: Beach Seine Net and G: Gillnet)

Fish species diversity

Table 4 below shows lists of both the family and scientific names of fishes with their mean weight and mean standard length with standard error (S.E) caught from Oti River. A total of forty six (46) fish species belonging to twelve (12) families were identified. The family with the highest number of species (10) was Cichlidae, followed by Mochokidae with (9); Characidae and Mormyridae were represented by (6) species each. Three families, namely Bagridae, Distichodontidae and Schilbeidae registered (2) species each.

The following (4) families were each represented by one species. These were Clupeidae, Malapteruridae, Tetraodontidae and Clariidae. *Chrysichthys johnelsi* recorded both the highest mean weight 1032.3 g ± 93.5 and mean standard length of 36.5 cm ± 0.3 and *Odaxothrissa mento* recorded the least mean weight 14.5 ± 0.6 g mean standard length 10.3 ± 0.3 cm.

Table 4: Fish species mean weight and standard length with standard error (S.E)

Family	Species		Mean ± S.E weight(g)	Mean ± S.E length(cm)
Cichlidae	*Tilapia*	*zillii*	92.0 ± 4.7	13.6 ± 4.7
	Tilapia	*dageti*	137.0 ± 12.8	15.8 ± 0.9
	Tilapia	*discolor*	244.5 ± 17.3	31.8 ± 0.7
	Hemichromics	*fasciatus*	100.5 ± 5.0	22.3 ± 0.3
	Streatocranus	*irvinea*	98.0 ± 4.0	18.8 ± 0.3
	Sarotherodon	*galilaeus*	298.6 ± 11.7	20.9 ± 0.9
	Tilapia	*guineensis*	51.5 ± 12.2	10.0 ± 1.5
	Tilapia	*maries*	153.0 ± 30.5	16.8 ± 2.7
	Limochromics	*robertsi*	73.5 ± 6.4	10.3 ± 0.2
	Oreochromis	*niloticus*	388.3 ± 62.21	26.8 ± 0.8
Characidae	*Alestes*	*baramoze*	173.3±2.3	29.1 ± 0.1
	Alestes	*dentex*	224.2 ± 4.8	28.8 ± 0.8
	Brycinus	*leuciscus*	59.5 ± 1.7	17.2 ± 0.2
	Brycinus	*nurse*	274. 0 ± 24.8	27.5 ± 4.4
	Hydrocynus	*forskalii*	145.6 ± 26.3	24.3 ± 1.1
Bagridae	*Bagrus*	*bajad*	220.0 ± 22.2	28.0 ± 0.7
	Bagrus	*domack*	259.2 ± 21.1	25.9 ± 1.3
Claroteidae	*Chrysichthys*	*auratus*	111.3 ± 4.9	17.7 ± 0.7
	Clarotes	*laticeps*	591.1 ± 139.3	31.5 ± 3.6
	Chrysichthys	*johnelsi*	1032.3 ± 93.5	36.5 ± 0.3
	Chrysichthys	*maurus*	116.0 ± 29.0	19.3 ± 7.4
	Chrysichthys	*nigrodigitatus*	263.0 ± 47.2	23.7 ± 0.9
	Chrysichthys	*walkeri*	127.3 ± 38.1	19.5±1.5

Mochokidae	*Synodontis*	*clarias*	88.6 ± 1.4	17.7 ± 0.5
	Synodontis	*macropthalmus*	127.5±7.4	17.1 ± 0.1
	Synodontis	*arnoulti*	97.9 ± 11.1	16.4 ± 0.5
	Synodontis	*schall*	229.7 ± 34.2	20.7 ± 1.2
	Synodontis	*sorex*	162.2±21.3	17.3 ± 0.7
	Synod ontis	*ocellifer*	195.5 ± 24.5	19.4 ± 0.8
	Synodontis	*eupterus*	102 ± 20.4	14.6 ± 2.4
	Synodontis	*bastiani*	124.0 ± 24.8	16.9 ± 2.8
	Synodontis	*filamentous*	119.5 ± 9.8	22.4 ± 0.8
Mormyridae	*Mormyrop*	*breviceps*	140.5 ± 39.2	17.0 ± 2.0
	Marcusenuis	*abadii*	75.0 ± 1.4	15.7 ± 0.3
	Brienomyrus	*breachyistius*	101.0 ± 20.1	25.2 ± 4.5
	Mormyrop	*anguilloides*	365.0 ± 2.7	45.1 ± 0.6
	Marcusenius	*ussheri*	73.5 ± 17.0	14.9 ± 0.7
	Marcusenuis	*senegalensis*	67.0 ± 13.40	16.9 ± 0.9
Schilbeidae	*Parailia*	*pellucida*	9 ± 1.8	7.4 ± 1.3
	Schilbe	*mystus*	53.4 ± 4.8	16.0 ± 0.4
Distichodontidae	*Distichodus*	*engycephalus*	291.7 ± 55.5	18.7 ± 0.9
	Distichodus	*rostratus*	218 ± 43.6	26.5 ± 4.5
Tetraodontidae	*Tetraodon*	*lineatus*	139.9 ± 4.5	15.4 ± 0.3
Malapteruridae	*Malapterurus*	*electricus*	399.3 ± 27.6	32.4 ± 0.9
Clupeidae	*Odaxothrissa*	*mento*	14.5 ± 0.7	10.3 ± 0.3
Clariidae	*Clarias*	*gaeriepinus*	419.5 ± 44.3	30.4 ± 0.8

Relative abundance in terms of numbers

The most dominant fish species were *Chrysichthys auratus* (29%), *Chrysichthys walkeri* (19%), *Sarotherodon galilaeus* (18%), *Tilapia zillii* (12%), *Chrysichthys maurus* (12%) and *Chrysichthys nigrodigitatus* (10%) as shown in Figure 5.

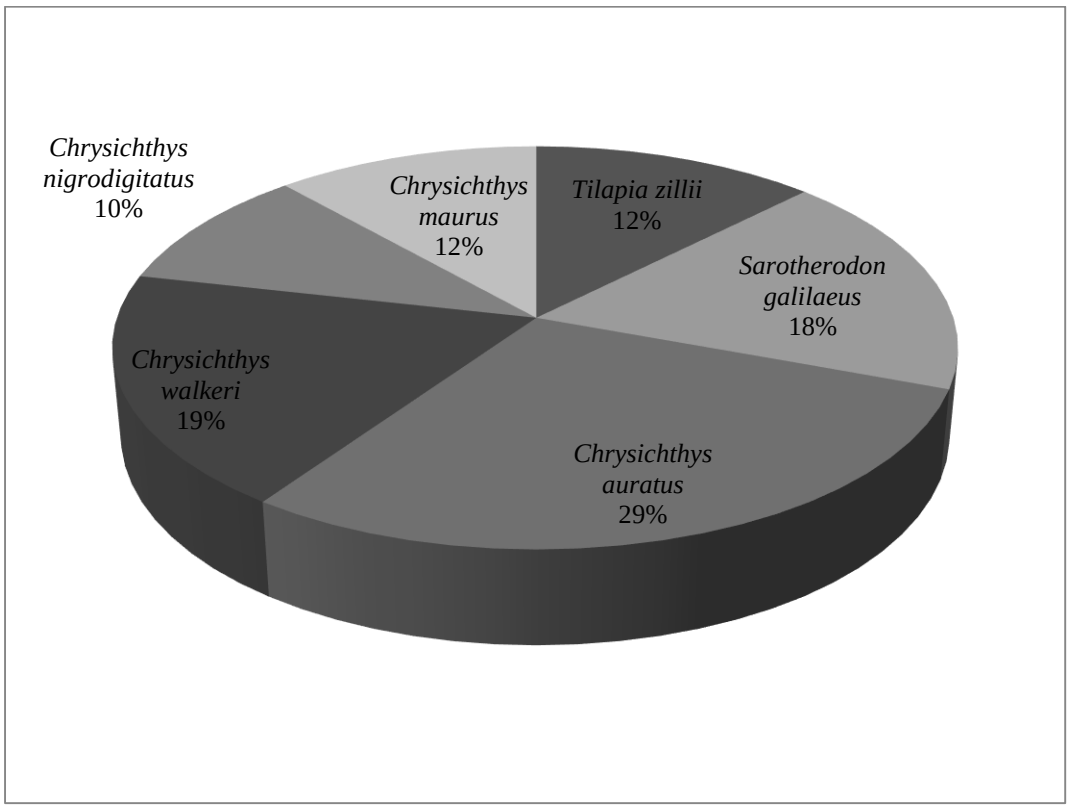

Figure 5: Relative abundance of major fish species in Oti River at Agbasakope

Discussion

Fishing Gear Identification and Mesh Sizes of Nets

Four (4) main types of gears were identified with gillnet being most dominant. According to MoFA (2003) twelve types of fishing gears were identified with gillnet being dominant gear used on the Volta Lake. The dominance of gillnet may be due to its ability to target different fish species with specific sizes which are preferred by the fishermen and less effort required in operating it. Aside those eleven gillnets (Table 1) which had mesh sizes greater than 5.0 cm, the rest of the gears identified were categorized as unauthorized gears (Directorate of Fisheries, 2011) and supposed not to be used in any inland waters in Ghana. Taking into consideration the precautionary approach to fisheries management, the precautionary minimum size of gillnets should be 10 cm bar stretched diagonally. This suggests the need for a review of the Ghana Fisheries Act 625 of 2002 that sets the minimum mesh size of gillnets at 5.0 cm for river fisheries. Enforcing the minimum mesh size of 10 cm would enhance recruitment into the fishery more than the use of the current

minimum legal mesh size of 5 cm of Ghana Fisheries Act 625, 2002.

Estimation of fish catch

March recorded the highest fish caught during the period of study. The high fish caught in March may be due to decreased water level, and availability of food in the river. According to Koeshendrajana and Cacho (2001), fish are more concentrated in low water and tend to be migrationally active during rising and falling water. Hence, they are more susceptible to capture during these times. In this regard, the structure and functional composition, as well as abundance of fish stock, are reflected in the types and intensities of fishing effort operated during this time of the year. Fish stock typically recover from intense low water exploitation during the high water season, when fishing efficiency is low due to dispersion of fish in newly inundated areas.

Total monthly fish catch varied among the major fishing gears identified. Gillnet was the commonest fishing gear used in the Oti River. The monthly fish catch by gillnets were small in weight as compared to bamboo trap and beach seine. The low fish catch recorded by gillnet might be due to high selectivity of species (Akongyuure *et a*l., 2012) caused by the design of the gear.

Fish species composition caught per gear

Fishing gears and relevant catch analysis result revealed that all the fishing gears used in the River Oti caught more than four fish species. Gillnet and beach seine registered the high number of species and family. Forty six (46) fish species belonging to twelve families were caught from River Oti. Among the fishes caught was high diversity of genera *Tilapia* and *Synodontis* which belong to the families of Cichlidae and Mochokidae respectively. Studies conducted by Dankwa *et al.* (1999) on Volta system (Ghanaian part) revealed one hundred and twenty one (121) fish species. The low fish diversity obtained from Oti River might be influenced by its smaller drained area of 72,900 km^2 compared to Volta system which had drained area of 390,000 km^2. According to Rosenzweig (2000), the larger the area drained by a water body, the greater the species diversity. Among the species, *Chrysichthys auratus* recorded greater number of fish species followed by *Chrysichthys walkeri*. Work done by Obodai and Laweh (2009) and Marcela and Elmasoeur (2010) showed that Cichlidae dominated fish family caught from other rivers in Ghana contrary to the results in this study. The abundance of Claroteidae in this study was probably due to the recent use and dumping of old bamboo traps into the Oti River by fishermen which serve as additional spawning materials for these species. Generally, most of the fishes caught by fishermen were very small in sizes and quantities.

Conclusion

This study revealed different fishing gears; including non-recommended ones that were used at Oti River fishery. Gillnet was most abundant fishing gear used to harvest fish from Oti River. Bamboo traps and beach seine nets registered the highest monthly fish catch from Oti River during the period of study. Oti River contained rich fish species (46) composition for fishery. High catches of the *Chrysichthys* species by the major fishing gears used in Oti River can cause decline of the fish species in the River. Education and enforcement of fisheries regulations and management practices such as closed seasons, restrictions on fishing gears and net mesh sizes, and registering of fishermen in order to give the fishermen catch quota should be enforced by Ministry of Fisheries and Aquaculture Development in partnership with fishing community leaders.

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