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Frame survey and fish catch assessment of the bontanga reservoir in Northern Ghana

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Key words: frame survey; fish catch; fishing gears; reservoir and management.

Abstract

Reservoir fisheries play a vital role in the provision of fish protein to the people of northern Ghana. However, for 20 years, dwindling catches from these resources have become a common knowledge. The study was conducted in the Bontanga Reservoir, in the Northern Region of Ghana to mainly assess fish catches and management practices in the reservoir. The catch assessment was done by purposively selecting two canoes each from the eight landing sites. A frame survey with complete census method was carried out to identify management practices. The total catch recorded during the period of study was 779.9 kg and the Catch per Unit Effort (CPUE) was estimated to be 2.7 kg/canoe/day. The study revealed eighteen fish species belonging to nine families in the reservoir. Catches were dominated by the family Cichlidae (70%) with *Sarotherodon galilaeus* being the predominant species (32%) while the least recorded species was *Malapterurus electricus* (0.2%). Management practices identified included ban on the use of drag nets and poisonous chemicals in the reservoir. It was concluded that fish catches were generally poor as a result of increasing number of fishers therefore closed season of fishing should be considered to promote spawning and growth of fish.

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Introduction

Inland fisheries are important source of revenue including foreign exchange for many countries through the sale of fish. It is also a source of food for poor people which play an important role in improving Africa's food security (Bene and Heck, 2005). Fish constitutes about 60% of animal protein component of the diets in the majority of Ghanaian communities (FAO, 2008). Although fish forms an important component of the diet of many people in Ghana, farther away from the coast, fish becomes relatively scarce and expensive. This situation is worse within the rural settlements of the Northern Region of Ghana. This can be attributed to poor management practices and use of inappropriate fishing gears and methods (Quarcoopme *et al.*, 2008). According to FAO (2003), it is also important to avoid wasting fish through spoilage to ensure sustainability of catch. Improved fish processing methods preserves fish for future use thereby reducing the frequency of fishing and improving the quality of fish harvested. Therefore, there is a strong need of current information on fishery activities and management practices of the Bontanga reservoir. In the light of this, the study primarily sought to assess fish catches; obtain background information of fishers and fishery activities for deeper knowledge on management strategies of the reservoir.

Materials and methods

Study Area

The Bontanga reservoir which was constructed in 1986 is situated between latitudes 9° 30´ and 9° 35´ N and longitudes 1° 01´ and 1° 03´ W (Fig. 1).

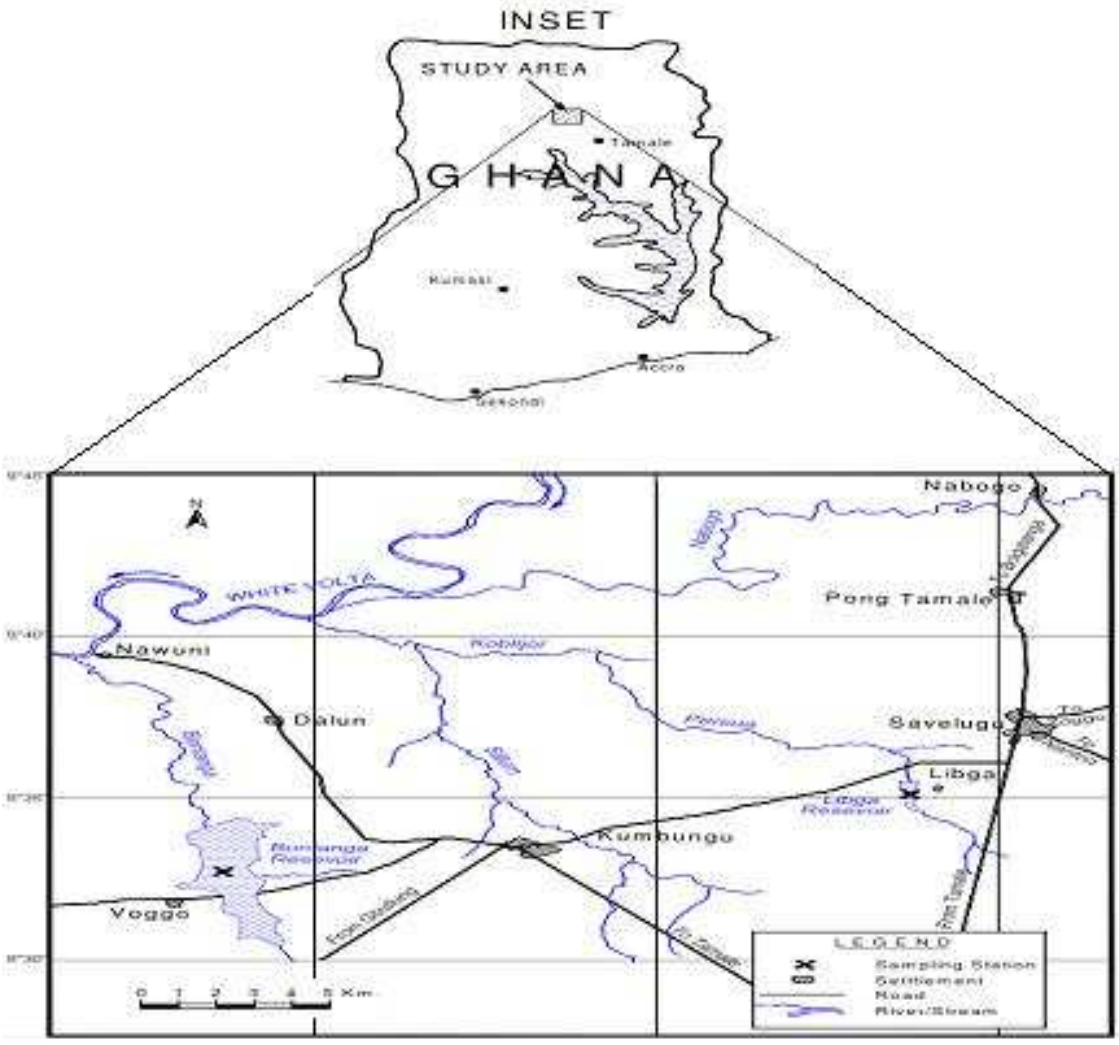

Fig. 1. Map of Ghana showing Bontanga (sampling station) in northern Ghana

It has a surface area of 770 ha with an average depth of 8 m and 12 m at its deepest portion. The mean annual rainfall for the area is 1100 mm with relative humidity of 75%. Temperature is between 15 °C and 42 °C with mean annual temperature of 28.3 °C. The wet season begins from April/May through to September/ October with peak season in July/August and dry season starts from November to March. It is the largest reservoir in the Northern region of Ghana. The reservoir serves two purposes; irrigation for crop production (Up to 490 ha of land) and as water body for inland capture fisheries for migrant fishermen (Obodai and Kwofie, 2001). It is within the centre of three traditional zones namely Zongbalund, Kumbungu and Gbulung. The main occupations of the people in the area are fishing and subsistence farming.

Data Collection

Frame Survey

A complete census method of frame survey (Ekwemalor, 1977) was carried out from December, 2009 to February, 2010. During the survey, the existing fish landing sites along the entire length of the reservoir were identified and counted. The number of fishermen, canoes and fishing gears were also counted.

Purposive Sampling

Fishermen and fishmongers in the study area were purposively sampled and questionnaire administered to obtain data on the number of fishermen and the number of canoes along the landing sites, identified the fish processing methods and determined the management practices in the reservoir for the three month period.

Semi-Structured Questionnaire

Eighteen fishermen and fishmongers were randomly selected after a number of visits to the community specifically once every month and a semi-structured questionnaireadministered tothem. This questionnaire solicited data on types of fishing gears, fish processing methods as well as management practices being undertaken in the area.

Catch Assessment

Two canoes were selected using stratified random sampling as in (Ekwemalor, 1977) in each of the eight landing sites identified for the three months period. Fish landed were identified using identification keys provided by Holden and Reed (1972) and Dankwa *et al.* (1999). They were later sorted into species and weighed. The weight taken aided in the calculation of the Catch per Unit Effort (CPUE) to determine the fish catch of each fisherman in each of the landing site. The total catch was estimated using Catch, C (kg) = CPUE x Fishing days (Fd).

Focus Group Discussion

A focus group discussion of mainly five fishermen and five fishmongers were organised. Using a checklist, data collected on types and number of fishing gears, fish processing methods and management practices in the area was validated.

Results

Background Information on Fishermen and Fishmongers at the Bontanga Reservoir

The results obtained indicated that, majority of both fishermen and fishmongers fell within the age brackets 36 - 45 years (Table 1). Most of the fishermen and fishmongers had primary education (Figs. 2 and 3 respectively). Majority of the fishermen and fishmongers were Dagombas (natives) with the Fantes and Ewes as the minority tribes (migrants) (Fig. 4). A greater number of the fishermen and fishmongers were part time workers while the minority was into full-time fishing (Fig. 5).

Table 1. Age distribution of fishermen and fishmongers at the Bontanga Reservoir

Age (Years)	Fishermen		Fishmongers	
	Number of people	% Frequency	Number of people	% Frequency
10-25	5	11	2	12
26-35	13	30	5	29
36-45	23	52	7	41
46-55	3	7	3	18
Above 55	0	0	0	0

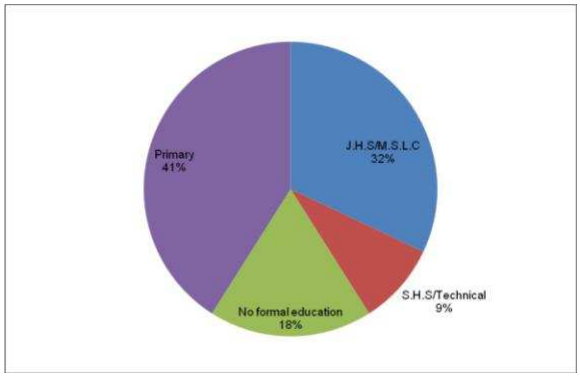

Fig. 2. Educational status of fishermen at the Bontanga Reservoir

* Junior High School (JHS), Senior High School (S.H.S), Middle School Leaving Certificate (M.S.L.C)

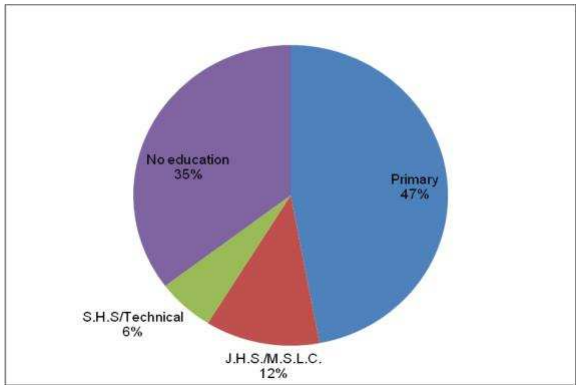

Fig. 3. Educational status of fishmongers at the Bontanga Reservoir

Landing Sites and Fishing Gears at Bontanga Reservoir

The results showed that there were 8 landing sites with 30 non-motorized canoes at the Bontanga reservoir. Simons landing site had the highest number of canoes (8) representing 27% while Aflo, Koufie and Kushibo landing sites recorded the least with 2 canoes (7%) each (Table 2). A total of 71 fishing gears of all types were recorded in all the landing sites. These included gill nets (62), cast nets (5) and hook and line (4) (Table 3).

Fresh Fish Catches, Processing Methods and Management practices at the Bontanga Reservoir

The total fish catch during the period of survey was 779.9 kg with January recording the highest (311 kg), followed by February (254.9 kg) while December recorded the least with 214 kg. The estimated catch per unit effort (CPUE) was 2.7 kg/fisherman/day.

Eighteen species of fish belonging to nine families were encountered. Cichlidae recorded the highest in terms of weight (545.8 kg) constituting 70% and the least was the family Malapteruridae (1.8 kg) forming 0.2%. *Sarotherodon galilaeus* was the highest fish species recorded (32%) while *Malapterurus electricus* was the least (0.2%) by weight during the study period (Tables 4, 5 and Fig. 6).

Three fish processing methods were identified at the reservoir during the survey period namely Frying (53%), Smoking (29.4%) and Salting (17.6%), (Table 6).

Management practices included ban on the use of dragnets, poisonous chemicals and disturbances of the water body in any form for fishing purposes.

Table 2. Number of Canoes of each landing site at Bontanga reservoir

Name of Landing Site	Number of Canoes	% Frequency
Aflo	2	6.7
Simons	8	26.6
Koufie	2	6.7
Vorgu	6	20.0
Gingaani	4	13.3
Kpurih	3	10
Kushibo	2	6.7
Biegu	3	10
Total	**30**	**100**

Table 3. Types of fishing gears used at the Bontanga Reservoir

Type of gears	Number	Type of fish caught	Reasons for use
Cast net	5	Tilapia	Can be used throughout the day.
Gillnet (2.5 cm - 6.1 cm)	62	The species in these families - Bagridae, Characidae, Cichlidae, Clariidae, Malapteruridae, Polypteridae, Schilbedae, Mochokidae and Mormyridae	Catches different type of fish due to different mesh sizes.
Hook and Line	4	*Clarias sp*. and *Bagrus sp.*	Purposely designed to catch these types of fish.
Total	71		

Table 4. Fish species identified at the Bontanga reservoir

Family/Fish species	Common Name
Bagridae	
Auchenoglanis occidentalis	Gear box
Bagrus bayad	Bagrid
Cichlidae	
Hemichromis fasciatus	Tilapia
Oreochromis niloticus	Nile Tilapia
Sarotherodon galilaeus	White Tilapia
Tilapia zillii	Red belly Tilapia
Clariidae	
Clarias gariepinus	Mudfish
Clarias anguillaris	Mudfish
Alestidae	
Brycinus nurse	Red tail fish
Malapteruridae	
Malapterurus electricus	Electric fish
Mochokidae	
Synodontis velifer	Lizard fish
Mormyridae	
Hyperopisus bebe	Elephant snout fish
Mormyrus rume	Elephant snout fish
Marcusenius abadii	Elephant snout fish
Marcusenius senegalensis	Elephant snout fish
Marcusenius cyprinoides	Elephant snout fish
Polypteridae	
Polypterus senegalus	Sail fins
Schilbeidae	
Schilbe mystus	Butter fish

Table 5. Fish catches by weight (kg) during the survey period

Fish species	Aflo	Simons	Koufie	Vorgu	Gingaani	Kpurih	Kushibo	Biegu	Total
Auchenoglanis occidentalis	0.5	11.9	4.5	5.5	5.5	6.5	7.4	4.3	46.1
Bagrus bayad	1.0	4.9	1.1	1.8	0.7	1.0	2.9	0.3	13.7
Brycinus nurse	6.9	15.7	7.5	9.6	11.9	12	10.7	10	84.3
Clarias anguillaris	0.8	1.0	0.5	0.4	1.2	1.6	0.2	2.1	7.8
Clarias gariepinus	0	1.5	0.2	0	0.4	0	2.8	2.0	6.9
Hemichromis fasciatus	5.3	14.2	7.1	6.8	3.5	2.4	7.6	5.7	52.6
Hyperopisus bebe	0	1.5	1.2	0.4	0.1	0	0.3	1.0	4.5
Malapterurus electricus	0	1.5	0.3	0	0	0	0	0	1.8
Marcusenius abadii	0.9	4.5	1.6	2.8	2.6	3.5	4.9	2.2	23.0
Marcusenius cyprinoides	1	0.9	0.2	1.2	0	0	2.0	1.3	6.6
Marcusenius senegalensis	0.8	3.6	1.0	1.5	3.1	2.3	2.8	1.8	16.9
Mormyrus rume	0.5	1.7	1.3	2.0	1.1	0.9	1.8	0	9.3
Oreochromis niloticus	13.1	23.4	14.5	14.4	13.6	14.1	14.2	12.8	120.1
Polypterus senegalus	0.1	1.3	0.2	1.0	0.4	0.5	0	1.6	5.1
Sarotherodon galilaeus	36.4	37.8	30.6	27.9	25.8	32.4	24.1	32.9	247.9
Schilbe mystus	0.4	0.6	1.5	0	0.2	0.1	0	0.3	3.1
Synodontis velifer	1.2	2.9	0.3	0.1	0	0.3	0.2	0	5.0
Tilapia zillii	17.1	22.5	14.5	15.1	8.3	13.5	17.3	16.9	125.2
Total	**86.0**	**151.4**	**88.1**	**90.5**	**78.4**	**91.1**	**99.2**	**95.2**	**779.9**

Table 6. Fish Processing Methods at Bontanga reservoir

Processing Methods	Number of fishmongers	% Frequency
Salting	3	17.6
Smoking	5	29.4
Frying	9	53.0
Total	17	100

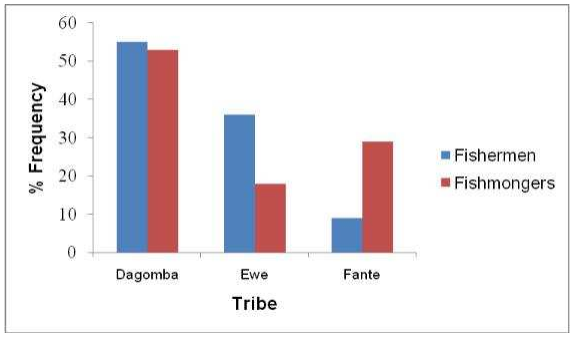

Fig. 4. Tribes of fishermen at the Bontanga Reservoir

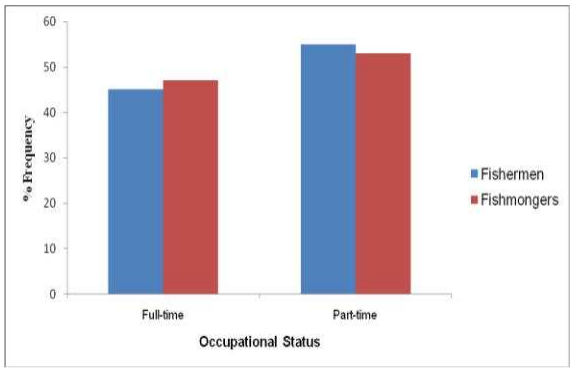

Fig. 5. Occupational status of fishermen and fishmongers at the Bontanga Reservoir

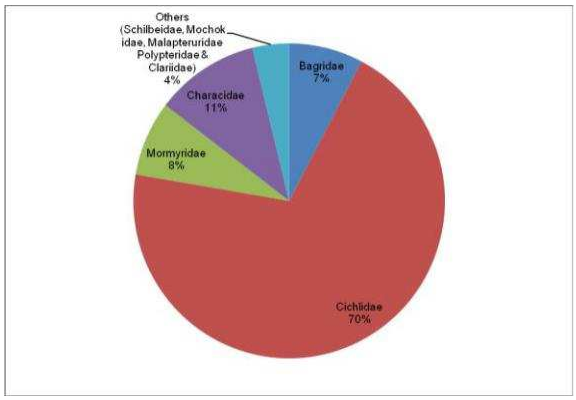

Fig. 6. Percentage weight of fish family at Bontanga reservoir

Discussion

The age distribution of the fisher folks revealed that most of them were within the working age class (26-45) forming 56% of the total. This means that fishing activities in the reservoir can go on for a long time as most of the fisher folks were still young and active.

The study also discovered that most of the fisher folks had their basic education. This may have contributed to the adherence to some management practices in the reservoir.

The survey revealed that majority of the fishermen and fishmongers at the Bontanga Reservoir were natives (Dagombas), because the five native communities around the reservoir had a landing site each for fishing activities as part-time during the dry season. The migrant fisher folks were into fishing as full time job for their livelihood. This implies that fishing pressure in the reservoir is reduced seasonally because majority of the fisher folks focus on farming.

The increase in the number of the landing sites, fisher folks and fishing gears might have occurred because the riparian communities now take part in part-time fishing during the dry season when they have no farming activities. This might have resulted in the low catches during the survey period as stated by Holden and Reed (1997) that over fishing is caused by the increasing of fishing gears and their increasing efficiency in catching fish, particularly the use of fine mesh nets remove all fishes even the young and immature ones thereby, leading to growth over fishing in the area.

It was observed that the gears used at the Bontanga reservoir were mainly cast nets, gill nets and hook and line. These three fishing gears fell under FAO (2010) checklist of 11 fishing gears while it contradicts the research made by Cushing (1975) that the four main methods of catching fish are hook and line, gill net, encircling net and trawl. However, the gill net mesh sizes (2.5 cm - 6.1 cm) fell short of the FAO

(2010) gill net mesh sizes of 3.17 cm - 7.62 cm. This might have contributed to the small size fish caught at the reservoir with its concomitant dwindling catches during the survey period. The small size canoes were the main types of crafts used for fishing in the reservoir as stated by FAO (1984) that, these types have been the traditional fishing craft in Ghana since ancient times.

The total fish catch during the survey period was 779.9 kg with January registering the highest of 311 kg followed by February (254.9 kg) and December recorded the least with 214 kg. The low catch recorded during the survey period could also be attributed to the high water level in the reservoir due to heavy rains prior to the study, making it difficult for fishermen to set their fishing gears. This is because high fish catches usually occur at the reservoir between May and July when the water level is low as reported by Obodai and Kwofie (2001). The increase in the number of native fishermen and fishing gears could also be a contributory factor. The Catch per Unit Effort for the survey period was 2.7 kg/canoe/day which was lower than 9.0 kg/canoe/day as reported by Quarcoopome *et al.* (2008).

Eighteen (18) species of fish belonging to nine (9) families were encountered in the catches of fishermen in the 8 landing sites at the Bontanga reservoir. However, Quarcoopome *et al.* (2008) identified 24 species in the reservoir. This could be attributed to small mesh size nets used by fishermen for maximum harvest of juveniles. It could also be that some of the fish species were in limited number because there was no culture of restocking the reservoir periodically.

The survey indicated that the most predominant family in terms of weight was Cichlidae (70%) while the least was Malypteruridae (0.2%). The high representation of tilapias within the monthly catches could be attributed to their high reproductive potential and worldwide distribution (Hepher and Pruginin, 1981).

The major fish processing methods practised in the reservoir were frying, smoking and salting. Most of the native (Dagomba) fishmongers practiced the frying method because the natives preferred the fried fish for immediate consumption to smoked and salted fish. The migrant fishmongers on the other hand, practised all the three methods because they were commercial fishmongers and that probably, was what the market demanded. Lacking at the reservoir was a cold store to keep the catches before they could be processed or transported fresh to Tamale due to the absence of electricity in the communities. This sometimes leads to post-harvest losses in the area.

The existence of management practices in the reservoir might have been the reason why fishermen still get catches. However, the absence of closed season observance coupled with increasing number of fishermen may lead to the depletion of the fishery resources in the reservoir as fishermen fish all year round as stated by Gulland (1974) that the activities of any individual fisherman affect many others especially if he increases his amount of fishing.

Conclusion

The low catches from the reservoir were attributable to increase in the number of fishermen and continuous fishing. The absence of strict enforcement of the only two fishery management practices might have also contributed to poor catches and species diversity.

Acknowledgement

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