Ghana Journal of Science, Technology and Development
Vol. 6, Issue 1. May 2019
available online at www.gjstd.org
ISSN: 2343-6727

Traditional Fisheries Management of Lake Bosomtwe, a Sacred Lake in Ghana: Past, Present and Future

Mark OWUSU-FRIMPONG[1], *Gifty ABACHE[1], Prince Emmanuel OPPONG[2], Randy Kwadwo AGYEIBI[2] and Akwasi AMPOFO-YEBOAH[3]

[1]CARMEL, P.O. Box TL 1410, Tamale, N/R, Ghana
[2]Department of Applied Biology, University for Development Studies, P.O. Box NV 24, Navrongo, Ghana
[3]Department of Fisheries & Aquatic Resources Management, University for Development Studies, Box TL1882, Tamale

**Corresponding author: giftyabache@yahoo.com*

Abstract

Lake Bosomtwe is an ancient meteoritic impact crater lake, situated near Kumasi in the Ashanti Region of Ghana. The lake is highly prized as a major source of freshwater fish supply, livelihoods, and a resort attraction. The lake is held sacred because of the legend surrounding its discovery. Its predominantly cichlid fishery has been managed for many centuries only by laws that were shrouded in taboos or traditional religious prohibitions. Human activities with the tendency to upset the spirits believed to be dwelling in the lake, such as excessive agitation of the water, noise-making, fishing on a sacred day and the use of conventional nets were prohibited and outlawed. The chiefs, at the instance of the priests of the local shrines, demanded ritual (animal and drink) sacrifices from offenders in cases of non-observance of the taboos to pacify and avert the wrath of the spirits. Although, the laws were essentially traditional religious commandments they were not without connotations for conventional fisheries management. Currently, however, virtually all the traditional fisheries rules and regulations appear to have broken down, as modernity seems to have eroded their relevance, with the result that there is a serious overfishing and depletion of the fish stocks. Nevertheless, recovery of the dwindled fisheries is possible by blending conventional management practices and the traditional laws that are still deemed relevant.

Keywords:*Lake Bosomtwe, closed lake, traditional fisheries laws, fisheries conservation, cichlid fishes*

INTRODUCTION

Lake Bosomtwe is situated within an ancient, circular meteorite impact crater near Kumasi in the Ashanti Region of Ghana. It is the only important, natural freshwater lake in the country. The up to 81 m deep and 49 km^2 lake was formed as the crater was gradually filled with water (Moon and Manson, 1935; Welcomme, 1972; Turner *et al*., 1996a). The rim of the crater consisting of hills rising up to 400 m high separates the lake basin from the general drainage system of the country (Turner *et al*., 1996b). Lake Bosomtwe is thus a closed lake, receiving rain as its primary source and small streams flowing down the steep, forested hills but has no outflows. There are over 24 villages dotted within the lake basin, each

village having a shrine which the inhabitants consult for help in times of trouble, such as a poor harvest. The name "Bosomtwe" literally means "fetish antelope" and it was given by a hunter who chased a wounded antelope he shot in the woods at dawn until the game jumped into the lake and disappeared. The hunter believing that the antelope was the incarnate spirit of the lake regarded the lake sacred. The lake is highly prized as a major source of livelihood, freshwater fish supply and a resort attraction.

Recorded information on the fisheries of Lake Bosomtwe is scanty. The species composition and ecology of the endemic fish fauna had been studied over a century ago by Gunther (1902). Later, Lelek (1968) and Whyte (1975) studied some aspects of the distribution, trophic relationships and breeding habits of the fish species. Quite recently, Post *et al*. (2008) studied the food web structure of the fishes, which revealed that the fish diversity has declined over the years.

The present study was conducted to document especially the traditional knowledge on the fisheries management and the socio-economic importance of the lake.

MATERIALS AND METHODS

Study locations and data collection

Abono and Ankaase were purposively selected for this study from the over 24 villages dotted within the lake basin on the basis of their historical and commercial importance. The lake is situated 30 km south-east of Kumasi in the Ashanti Region of Ghana. Annual precipitation within the lake basin is high, varying from 1,136-1,520 mm, with monthly maxima occurring between March and June (Puchniak *et al*., 2009; Whyte, 1975; Turner *et al*., 1996a). Traditional information on the fisheries and socio-economic importance of the lake was gathered by interviewing at random one hundred inhabitants from each village using a structured questionnaire. To ensure that the responses were reliable, the questionnaire was pre-tested twice at an interval of two weeks (Abache, 2014), and the questions were asked in the vernacular, and in the same way and order as much as possible, to be consistent (Evans *et al*., 1997). Personal observations were made to refute or confirm doubtful responses where applicable (Abache, 2014). Secondary data were retrieved from available journal publications.

RESULTS AND DISCUSSION

Fisheries management

Fishing usually begins at dawn (around 5:00 AM) and ends at dusk (around 6:00 PM). The main fishing season starts in August and ends in December with a peak in September. The fisheries of Lake Bosomtwe have witnessed a paradigm shift from an ancient management system based on traditional beliefs and ritual prohibitions to virtually no regulation at all. For several centuries the lake has been regarded sacred because of the belief that it was the resting place for ancestral spirits and the spirit of the lake. For this reason, the ancient chiefs and elders enacted laws and craftily shrouded them in taboos to compel the people to render homage to the lake and at the same time regulate and conserve the fishery. In this sense, a taboo is a traditional religious commandment pronounced by an accredited priest of a local shrine to protect and enforce the belief of a people in a deity or ancestral spirit dwelling in a sacred place, often a natural resource such as a river, lake or grove. It also serves to conserve the resource through access prohibition or extraction restriction. The principal traditional laws or taboos are discussed below.

In general, it was prohibited to upset the ancestral spirits and the spirit of the lake by any

activity that could vigorously agitate the water. Thus, it was a taboo to use dugout canoes or boats propelled by oars or outboard motors. The fishers sat on 45 cm long, light wood planks locally called "Padua" and used their bare hands to navigate to the fishing grounds. The use of the "padua" produces less splashing noise. Furthermore, it is unstable on the water, and requires considerable skills to operate effectively. It is therefore highly risky to operate it in deep, turbulent waters especially in a stormy weather. Hence, the "padua" fishery technically and conveniently allows for only inshore fishing, setting apart a greater portion of the lake as a "closed area" required for natural recruitment of the fish stocks. Some fishers, particularly the poor, still use the "padua" fishery today, not because they respect the traditional laws but because it is cheap. The use of conventional fishing gears including gill nets, seine nets and cast nets was forbidden apparently because of their high catch per unit effort (CPUE). The prescribed fishing gear was the underwater trap designed and woven from strips of the oil palm (*Eleias guineensis*) and raffia palm (*Raffia pedunculata*) fronds. The trap is dropped on the floor of the lake at the littoral zone and baited. The location is marked with a long pole carrying an identification flag. The trap fishery ensures minimal disturbance to the lake and has low average catch per unit effort of about 10-35 fish fisher^{-1} day^{-1}, depending on the number of traps set. However, the method requires considerable diving skills which the fishers acquire through rigorous training from infancy. The method is used today by poor fishers who cannot afford the more effective conventional fishing gears.

The use of metal containers on the lake to hold the catch during fishing expeditions was prohibited, because any noise from the metal was considered a nuisance to the resting spirits in the lake. In place of metals, the fishers used baskets (woven from the back of palm fronds), clay pots or large calabash containers ("apakyie") from *Crescentia cujete*, all with lids to prevent the fish from jumping back into the lake. The significance of the law on noise-making in fisheries regulation could not be explained by the fishers. However, the first author has observed some fish farmers in Ghana clap hands, blow a whistle or ring a bell to attract fish to aggregate at selected spots in a pond to facilitate feeding, sampling or partial harvesting. Apparently, noise-making on the lake was prohibited to restrict harvesting. In Nigeria, a local shrine prohibits cast net fishery on Lake Ndakolowu because of the splashing noise associated with it (Chukwugozie, personal communication). Conservation of coastal fisheries resources in Ghana through imposition and observance of taboos is a common practice (Koranteng *et al*., 1998). Fishing or navigation on the lake on a sacred day was prohibited. Sunday was strictly observed as the day of rest ("Sabbath") for the lake. According to legend, the first name of Lake Bosomtwe is "Akwasi" (the name Asantes give to a Sunday-born male child) because the lake was discovered on a Sunday. Observance of this law implied a mandatory ban on fishing for at least 52 days in a calendar year to further restrict fishing. The fishers themselves also took advantage of the holiday to rest from fishing and mend their fishing gears.

In the event of non-observance of any of the traditional laws (taboos), rituals in the form of animal sacrifices and pouring of libations were performed by the local priests to pacify and avert the wrath of the spirits dwelling in the lake. Offenders were made to buy the prescribed animal or drink for the ritual sacrifice. Failure to pacify the spirits in this manner could invite a bad omen like poor fish harvest season, strange diseases and even unexplained deaths. Dread of the scary consequences actually compelled the ancient inhabitants to observe the taboos. Thus, the traditional management laws were quite

effective and ensured sustained catches of big fish in the past. Even in the late 1970s, the first author commonly encountered women selling smoked tilapia as big as 150 g from the lake, suggesting a positive impact of the taboos.

Presently however, as a result of modernity and population pressure, the traditional laws have become obsolete and allowed to break down. Fishing is done every day of the week in the lake without regard for the law prohibiting fishing on a sacred day. Motorized canoes and small speed boats are used on the lake to ferry people and goods from one village to another to promote lake transportation, eco-tourism and recreation, disregarding the ban on noise making and excessive agitation of the water. Fishing with prohibited conventional gears including monofilament gill nets and cast nets of unrestricted mesh sizes and underwater metal wire traps is also common. The result of the apparent breakdown of the traditional belief systems enshrined in the taboos is that, current catches show drastically reduced fish sizes averaging 50 g or less. This is alarming and indicates a serious over-exploitation of the fisheries. Often, progressive reduction of fish size in the harvest signals overfishing (von Sarnowski, 2004). Fisheries overexploitation in Africa has often been blamed on the breakdown of traditional management systems and barriers to entry (Brainerd, 1995).

Fish stocks and catch statistics

The species of commercial fishery importance in Lake Bosomtwe are all cichlids. They include *Sarotherodon multifasciatus* ("Apatrefufuo"), *Hemichromis fasciatus* ("Komfo"), *Tilapia busumana* ("Papari"), *T. discolour*("Kaabre"), and *Oreochromis niloticus*. The respective proportions observed in the fishers' landings in the present study were 6.5%, 7.3%, 8.1%, 77.7% and 0.4%. Another cichlid *Chromidotilapia guntheri* ("Yenkonwhia") has been reported to occur naturally in the lake (Dankwa *et al*, 1999), but not a single specimen was encountered in this study. This suggests that the species is endangered or has probably suffered local extinction. The fishers reported the occurrence of seasonal variations in species dominance, but could not give details as to which species is dominant in what season. However, in November 1979 and January 1980, casual observations by the first author on trap fishery landings at Abono showed *S. multifasciatus* as the dominant cichlid, while *T. discolour w*as the least. It will be worthwhile to investigate the factors that trigger and control the apparent succession of species dominance in the lake for fisheries management and biodiversity conservation purposes.

Threats to the lake's fisheries

The fundamental threat to the life of Lake Bosomtwe and its fisheries is the fact that it is a closed lake (Turner *et al*., 1996b), because closed lakes are potentially unstable (Wetzel, 1983). The following factors were also recognized as potential sources of threat; uncontrolled relaxation or virtual breakdown of the once effective traditional fishing laws (taboos), overfishing driven by increased population and demand for fish, climate change effects brought about by extensive clearance of the rainforest that once covered the chain of hills ringing the lake, habitat degradation resulting from siltation, and wind-induced cyclical overturn of the lake which results in mass fish kills, usually in August and September. Beadle (1974) reported that the overturn phenomenon releases toxic hydrogen sulphide (H_2S) from the putrefied bottom to the surface which actually kills the fish. However, the traditional rendering says the spirits dwelling in the lake explode gunpowder ("atudro") which has the characteristic smell of hydrogen sulphide to kill the fish when the people commit offenses against them. Agriculture, especially cultivation of vegetables, involving the use of considerable

amounts of agrochemicals including pesticides and fertilizers to increase crop health and yield is common within the lake basin. This is worrying as some amounts of the chemicals will ultimately find their way via run-off and accumulate in the closed lake. This can eventually result in fish kills directly from chemical toxicity or indirectly from anoxic effect of eutrophication. No sewage treatment plant of any sort has been built anywhere within the lake basin. The discharge of untreated sewage from the homes and resort facilities can therefore pollute the water and increase eutrophication, which is a potential threat to the survival of the endemic fish species.

According to the older fishers, fish catches began to dip seriously some 3-4 decades ago, and the situation gets worse year after year. They also believe some of the fish species in the lake have disappeared over the years as they are not caught anymore. This has been confirmed by scientific reports (Whyte, 1975; Post *et al*., 2008).

Nile tilapia *Oreochromis niloticus* is not an endemic fish in Lake Bosomtwe, but it was encountered in the fishers' catches during the study, though at a much lower incidence. The alien cichlid found its way into the lake recently, probably through accidental releases from cage culture installations at Abono and pond culture operations at Amakom. The presence of Nile tilapia poses a potential threat to the lake's endemic fish (ichthyofuanal) diversity, on account of its general hardiness, relatively faster growth rate, male's polygamous mating behaviour and efficient maternal mouth-brooding habit. According to Trewavas (1983), maternal mouth-brooding is the most successfully evolved parental care strategy among the cichlid fishes. The different life history stages of Nile tilapia encountered in the fishers' catches suggests that the species is thriving very well in the lake. To prevent further contamination of the endemic fish diversity, cage and pond aquaculture of alien fish species in the lake basin should be outlawed and rigidly enforced, except for the culture of certified sterile (triploid) populations that cannot breed, since it is extremely difficult to prevent accidental releases or escapees from fish culture facilities, either on land or on the lake.

Recent prospecting for minerals in the Lake basin has revealed rich gold deposits (Koeberl *et al*., 2007). Future commercial mining operations would destroy the beautiful landscape, damage both the aquatic and terrestrial ecosystems and jeopardize the existing rich biodiversity through chemical pollution and siltation, and subsequently deprive the local inhabitants of their traditional livelihoods. The prospecting killed a lot of fish (Personal communication).

CONCLUSION

The observed decline in the lake's current fisheries production would continue, if efforts in regulating fishing are not intensified by dealing sternly with the violation or breakdown of the traditional laws (taboos). A blend of appropriate conventional fishery management practices and traditional laws (taboos) that are still deemed relevant is needed to save the fisheries of Lake Bosomtwe from possible collapse in the near future.

ACKNOWLEDGEMENT

This study was conducted with funds from Community Aquatic Resources Management for Enhanced Livelihoods (CARMEL)

REFERENCES

Abache, G. (2014). The contribution of Tono reservoir fisheries to household livelihoods in selected communities in the KassenaNankana Municipality of the Upper East Region of

Ghana. M. Phil. thesis, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana. 137 pp.

Beadle, L.C. (1974). The Inland Waters of Tropical Africa. An Introduction to Tropical Limnology. Longman Group Ltd. London

Brainerd, T. R. (1995). Fishery Co-management: A discussion paper. Charleston, S.C: South Atlantic Fishery Management Council.

Dankwa, H, R., Abban, E. k. and Tuegnels, G.G. (1999). Freshwater fishes of Ghana: Identification, distribution, ecology and economic. Royal museum for Central Africa, leuvensesteen weg 13, B-3080, Tervusen volume 283, pp 44. A publication of Water Research Institute of Ghana.

Evans, S.M., Gill, M.E., Retraubun, A.S.W., Abrahamz, J. and Dangeubun, J. (1997). Traditional management practices and the conservation of the gastropod (*Trochus niloticus*) and fish stocks in the Maluku Province (Eastern Indonesia). *Fisheries Research*, 31: 83-91.

Gunther. A. (1902). Last account of fishes collected by Mr. R.B.N. Walker. C.M.Z.S. On the Gold Coast. Proceedings of the Geological Society. London: 330-339.

Koeberl, C., Milkereit, B., Overpeck, J.T. Scholz, C.A., Amoako, P.Y.O., Boamah, D., Danuor, S., Karp, R., Kueck, J., Hecky, R.E., Kling, J.W. Peck, J.A. (2007). An internationall and multidisciplinary drilling project into a young complex impact structure: the 2004 ICDP Bosomtwe impact crater, Ghana drilling project: an overview. *Meteoritics & Planetary Science*, 42:483-511.

Koranteng, K.A., Ofori-Danson, P.K. and Entsua-Mensah, M. (1998). Comparitive Study of the Fish and Fisheries of Three Coastal Lagoons in West Africa. *International Journal of Ecology and Environmental Sciences*. 24: 371-382.

Lelek, A. (1968). The vertical distribution of fishes in the Ebo stream and notes on fish occurrence in Lake Bosomtwe, Ashanti, Ghana. *Zool. Listy*, 17:245-252.

Moon, P.A. and Manson, D. (1967). Geology of Field Sheets Nos. 129 and 131, Bompata S.W. and N.W. *Ghana Geological Survey Bulletin*, 31:1-51.

Post, A.E., Hecky, R.E. and Muir, D. (2008). Biomagnifications of mercury in a West African crater lake (Lake Bosomtwe, Ghana). *Verh. Internt. Verein. Limnol*. 30: 647-650.

Puchniak, M.K., Awortwi, F.E., Sanful, P.O., Frempong, E., Hall, R.I. and Hecky, R.E. (2009). Effects of phytoplankton dynamics on water column structure of Lake Bosomtwe, Ghana (West Africa). *Verhandlungen der Internationale Vereiniggung fur Theoretsciche und AngewandteLimnologie*, 30:1077-1081.

Trewavas, E. (1983). Tilapias: taxonomy and speciation, p. 3-13. In R.S.V. Pullin and R.H. Lowe-McConnell (eds.) The biology and culture of tilapias. ICLARM Conference Proceedings 7, 432 p. International Center for Living Aquatic Resources Management, Manila, Philippines.

Turner, B.F., Gardener, L.R. and Sharp, W.E. (1996 a). The Hydrology of Lake Bosomtwe, Climate-Sensitive Lake in Ghana, West Africa. *J. Hydrol*., 183:243-261.

Turner, B.F., Gardener, L.R., Sharp, W.E. and Blood, E.R. (1996 b). The Geochemistry of Lake Bosomtwe, a Hydrobiologically Closed Basin in the Humid Zone of Tropical Ghana. *Limnology and Oceanography*, 41:1415-1424.

von Sarnowski, A. (2004). The artisanal fisheries of Lake Albert and the problem of overfishing. Johannes Gutenberg Universiteit, Mainz Germany.

Welcomme, R.L. (1972). The Inland Waters of Africa. Committee for Inland Fisheries of Africa (CIFA) Technical Paper I. 117 pp.

Wetzel, R. G. (1983). Limnology. Second Edition. CBS College Publishing, USA. 767 pp.

Whyte, S.A. (1975). Distribution, Trophic Relationship and Breeding Habits of the Fish Populations in a Tropical Lake Basin (Lake Bosomtwe – Ghana). *J. Zool*. 177:25-26.