

SEDIMENTATION

Effects of siltation on some aquatic animals communities in a man-made lake in Ilorin, Nigeria

Chioma G. Nzeh and I. Bello
Department of Zoology
University of Ilorin
Nigeria
234-803-7261108
E-mail: cgnzeh@yahoo.com

ABSTRACT

The effects of siltation on aquatic animals communities in a man-made lake in Ilorin, Nigeria were investigated. Samples of the sediments were collected using Ekman's grab. The sediments were sieved through various mesh sizes until fine silt were obtained. The silt were air-dried to a constant weight in the laboratory and measurement of the final weight of the silt were taken. Macro-invertebrates were collected using scoop nets and identified. The fishes were collected using cast and gill nets. The water temperature, pH, dissolved oxygen content and transparency were measured. Results indicate that the surface water temperature ranged from 23 to 27°C. Dissolved oxygen content of the lake varied from 3.6 to 4.4 mg O₂/l. The water transparency fluctuated between 88.75cm to 153cm while the silt content of the lake was 11.27% to 24.6%. The invertebrates collected were gastropods and bivalves. The fishes in the lake were family Cichlidae which was the most abundant, other families were Bagridae and Anabantidae. Silt was gradually being deposited in the lake and the volume of water in the lake was gradually being reduced especially during the dry season when there is little or no rainfall. Some portions of the lake dried up during the dry season due to accumulation of silt and the invertebrates living in the affected area of the lake were exposed to dessication resulting in decrease in population of invertebrates. This fresh water lake is gradually being degraded and factors such as construction of residential houses around the lake and agricultural practices were identified as the major causes of siltation of the lake.

Keywords: Siltation, Degradation and freshwater

Introduction

Silt is part of the soil with a diameter of 0.02 to 0.05mm and it contains silicate mineral. The pore space between silt particles are smaller than sand. Silt has the ability to retain water and nutrients between particles for plant use. Silt is the ideal soil for growing crop.

(Bogg 1995). Clay is less than 0.002mm in diameter. The pore is too small therefore clay is sticky. Sand is above 0.05mm and less than 2.00mm in diameter. Sandy soil is limited in nutrient because the large pore spaces between sand grains allow nutrients to leach out. Silt is transported into lakes via water which is an effective means of moving

earth mineral. This occurs over time as the speed of the water transporting the material changes. Sedimentation of lakes is higher than marine environment. This is because Lakes are smaller and are nearly closed systems. Silt is deposited in deeper water areas of the lake.

Some researchers have investigated the effects of moving earth's materials into water bodies. Gliwicz (1989) showed that suspended clay in the lake water may be an important factor limiting primary production by decreasing availability of light and nutrient. Lind and Davalos-Lind (1999) showed that clay competes with plankton for ions such as phosphorus. Owen and Lind (2003) demonstrated that suspended

SEDIMENTATION

clay competes with autotrophs for nutrients and it is the principal cause of light attenuation in many waters. Thus it governs plankton, benthic and macrophyte production. There is little or no work reported on siltation in Agba lake, the objective of this research is to investigate the effects of siltation on aquatic animal communities in a man-made (Agba) lake in Ilorin, Nigeria.

Study Site

Agba lake is located in Ilorin, Kwara state, Nigeria (fig. 1) it was constructed by damming Agba river. It lies between latitude $8^{\circ}30'N$ and longitude $4^{\circ}35'E$. The lake was commissioned in 1956. The depth measured between 14 to 17 meters. The lake has a storage capacity of 50 million liters during rainy season and 30 million liters during the dry season. The lake was constructed primarily to supply water for domestic and industrial usage in Ilorin township.

Materials and Methods

Collection of sediment

Ekman's grab was used to collect sediment from the bottom of the lake. The sediment was sieved through various mesh sizes of sieves. The sediment that was retained in the sieve measuring 0.02 to 0.05 mm in diameter was collected as silt. The sediment was air dried and weighed. Sampling was carried out in a stratified random manner from various sections of the lake.

Physical Condition of the lake

The physical condition measured in the lake was surface water temperature and transparency. The surface water temperature was measured using mercury in glass thermometer. The thermometer was lowered to a depth of about 15 mm and the temperature was recorded.

Transparency was measured using a secchi disc the diameter was 20.20 cm. The disc was lowered into the lake until the first point of disappearance.



Figure 1. Agba Lake, Ilorin, Nigeria.

Dissolved Oxygen

The dissolved oxygen content of the water was measured by titrimetric method and the pH values of the lake were determined using pH meter.

Sampling of Macroinvertebrates

A qualitative sampling of macroinvertebrates was carried out using scoop nets. The content of the scoop net were sorted out and identified.

Table 1. Monthly mean variation in Temperature transparency dissolved oxygen pH and silt content of Agba Lake Ilorin, Nigeria.

Parameter	Jan	Feb	March	April	May	June	July	Aug	Sept
Temperature (°C)	26.7	26.5	27.0	27.2	26.6	24.0	24.8	24.4	25.0
Transparency (cm)	120.0	121.2	124.0	120.2	107.0	89.1	130.3	112.0	117.8
Dissolved O ₂ (mg/l)	4.95	4.0	4.84	4.70	4.50	4.55	4.20	4.0	4.05
pH	6.86	6.90	6.85	7.0	6.78	6.91	7.17	7.4	7.38
Silt (%)	22.47	25.50	26.83	27.10	27.6	20.4	15.8	15.2	19.5

Sampling of the fishes

The fishes were sampled using cast net and gill nets and they were identified to species

Results

The surface water temperature in Agba lake varied from 23°C to 27°C. The water transparency range observed in the lake was 89.10cm to 130cm mean values (Table1). The pH fluctuated from 6.9 to 7.4. The dissolved oxygen content of the water approximately 4.0mg/L to 5.0mg/L (Table 1).

The silt content of the lake was about 15% to 28% as shown in table 1. The lowest values of silt were obtained during the month of August while the highest values were obtained in April and May.

The macroinvertebrates collected from the lake were mollusca and the two classes represented were gastropoda and bivalvia. The gastropods were *Biomphalaria* and *Lymnae*. *Lymnae* were more abundant constituting about 80% of the invertebrates. While *Biomphalaria* formed about 15%. The bivalvia represented by *Aspitharia* species constituted about 5% of the invertebrates.

The fisheries composition of the lake showed that four families were represented: Cichlidae, bagridae, claridae and anabantidae. The family cichlidae represented by *Hemichromis fasciatus*, *Tilapia zillii*, *Sarotherodon galilaeus* and *Oreochromis niloticus* (Table 2) were the most abundant species and they formed about 85% of the catch. The bagri-

dae represented *Auchenoglanis occidentalis* and *chrysichthys nigrodigitatus* formed 10% while claridae represented by *Clarias anguillaris* and anabantidae represented by *Ctenopoma kinsleye* constituted about 2.5% of the catch respectively.

Discussion

The transparency values obtained in this present work indicate that enough light penetrate the water for photosynthetic activities by the autotrophic plankton in the lake. Kemdirim (1990) obtained higher values for a man-made lake in Jos Plateau State, Nigeria. The presence of suspended matter may be responsible for the scattering of solar radiation in Agba Lake resulting in low Sechi disc transparency value. The temperature and pH values observed in this present work were within tolerable range for aquatic organisms (Boyd 1978). The oxygen content of Agba lake was within the range recommended for aquatic organisms (Boyd 1978).

Silt is gradually being deposited in the lake with a portion of the lake drying up (Plate 1) during the months of January to April representing the period of little or no rainfall in Ilorin. The implication is that the gastropods: *Biomphalaria*, *lymnae* and Bivalve represented by *Aspitharia* are exposed to dessication resulting in decrease in the population of the invertebrates. Similar observation was made by Kreutzweiser et. al. (2005), their results showed a decline in the aquatic insect communities as a result of fine sediment inputs.

In Agba lake, the major factor identified to be responsible for the deposition of silt in the lake is construction (Plate

Table 2. Macroinvertebrates and fish species composition of Agba Lake, Ilorin, Nigeria.

Phylum	Genus	Relative Abundance %
Mollusca	<i>Biomphalaria sp</i>	15
	<i>Lymnae</i>	80
	<i>Asphatharia</i>	5
Fishes		
Family	Species	%
Cichidae	<i>Hemichromis fasciatus</i>	15
	<i>Tilapia zillii</i>	20
	<i>Sarotherodon galilaeus</i>	35
	<i>Oreochromis niloticus</i>	15
Total		85
Baridae	<i>Audenoglanis occidentalis</i>	5
	<i>Chrsichthys nigrodigitatus</i>	5
Total		10
Claridae	<i>Clarias anuillaris</i>	2.5
Anabantidae	<i>Ctenopoma kinsleye</i>	2.5
Total		5

2). When the total ground surface is stripped of vegetation, the upper soils are vulnerable to water erosion. Plate 3 shows a house construction around the river source. This has been identified as a major source of silt into Agba Lake. This observation is in line with the findings of Water (1995), Wood and Armitage (1997), Fossati et. al. (2001), they identified catchment disturbance which could be as a result of agricultural tillage, urbanization, and construction as leading to deposition of sediment in stream bed.

Agba Lake was commissioned in 1956 the town plan-

ning authority should have acquired the land around the Lake so that the environment and the lake will be preserved. However the land was left in the hands of the land owners who sold out their pieces of land and the buyers were constructing houses around the lake. During the rainy season water washes the silt in the soil into the lake thereby filling some portions or areas of the Lake with silt. The deposition of silt in the lake will continue every rainy season into the lake and this has adverse effect on the biodiversity of the lake.

There is a decline in the richness of animal diversity of the lake. The populations of *Biomphalaria*, *Lymnae* and *Asphatharia* have decreased. The fishes in the lake are also affected because the dominant species are the Cichlids. The nest of the guarders are built in the soil where the eggs are deposited during reproduction but where siltation have occurred in the shallow region this may affect the number of eggs that will survive and grow into adult fishes. If siltation continues unchecked in Agba Lake gradually there will be great reduction in the volume of water in the lake and a decrease in the population of aquatic animal communities in the lake. Eventually there will be a change in the structure of the lake making it impossible to serve the function of provision of water for the human community in Ilorin township and there will be loss of the aquatic animal communities in the lake.

References

- Boggs, S., (1995) Principles of sedimentology and stratigraphy, Prentice hall, Englewood Cliffs. N.J.
- Boyd, C.E., (1979) Water quality in warm water fish ponds craftsman printers, Inc. Auburn Alabama, 353pp.
- Fossati O., Wasson J., Hery C., Salinas G. and Marin R. (2001). Impact of sediment releases on water chemistry and macroinvertebrate communities in clear Water Andean streams (Bolivia). Arch Hydrobiologia 151:33-50.
- Gliwicz, M.Z. (1989) suspended clay concentration by filter – feeding zooplankton in A tropical reservoir Nature 323: 330-332.

Kemdirim, E. C (1990) Periodicity succession of phytoplankton in an upland and lowland impoundments in plateau state (Nigeria) in relations to Nutrients Levels and physical characteristics J. Aquatic Sciences 5: 43 –52.

Kreutweiser, D.P. Capell, S.S and Good, K.P. (2005) Effects of fine sediment inputs from a logging road on stream insect communities: A large-scale experimental Approach on a Canadian headwater stream Aquatic Ecol. 39: 55-66.

Lind, O.L. and Davalos-Lind, L. (1999) suspended clay: its role in Reservoir productivity in: Theoretical Reservoir Ecology and its Applications 83-97 Ed. J.G. Tundisi and M.S Traskraba Brazilian Academy of Sciences Publishers.

Owen, O. and Lind, W. (2003) Suspended Clay's effect on lake and reservoir limnology Arch. Hydrobiol. Suppl. 139/3, Stud., p. 327-360.

Waters, T.F. (1995) Sediment in streams, biological effects and control. American fisheries society, Bethesda U.S.A.

Wood, P.J and Armitage, P.D (1997) biological effects of the sediment in the environment. Environmental Manag. 21:P 203-217.