Research Paper

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Species Diversity of Lake Hawassa, Ethiopia

Biology

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ABSTRACT

Lake Hawassa is one of the many freshwater shallow lakes found in the central Ethiopian Rift Valley. The sum totalities of aquatic and terrestrial habitats adjoining the lake facilitate for the rich diversity of flora and fauna compared to other Ethiopian Rift valley lakes.

Scores of species with sundry forms of plants, animals and micro-organisms make the lake extremely bio-diverse. The littoral area is covered with emergent and submerged macrophytes those serve as shelter, thrashing and proliferation zones for several benthonic and pelagic zooplanktons such as Protozoans, Rotifers, Crustaceans, and several weed bed fauna like annelids, insects as well as fishes. The littoral and open water of the lake is dominated by wide-ranging delivery of 'qetema' (Cyperaceae), 'fila' (Typha sp.), the floating grass Paspalidium germinatum and hydrophytes such as the Blue water lily (Nymphaea coerulea), water cabbage (Pistia stratiotes) and Wolfia arrhiza, considered to be the smallest flowering plant in the world.(Tilahun et al., 1996, EFASA-2013).

The lake is among one of the biggest bird sanctuaries in the rift and homeland for several hundred species of water birds, including local and palaearctic migrants with large population of Marabou storks. The animal population includes large hippopotamus, otters, monitor lizards, Velvet and Colobus monkeys surviving on flanking lake ecosystem. Six varieties of fishes are abundantly found in the lake of which the native African species Tilapia (Oreochromis niloticus) are dominant. The lake is a major source of income through eco-tourism while the inhabitants depend on the lake for fishing and recreation.

Present investigation is a maiden attempt to bring out first hand information by this visiting investigator who made a general enquiry for a small period of time to understand the ecosystem and species diversity of fresh water lakes of Ethiopia.

Introduction

Among the various African countries, Ethiopia is quite unique for its geo-geographic conditions. The country is blessed with plenty of water resources, long green fields, rich animal husbandry and over all, diverse flora and fauna. The Ethiopian rift valley also known as the Afro-Arabian rift is one of the greatest East African rift valleys that extend from Jordan in the Middle East to Mozambique in west and Kenya in the South up to the northern boarders of Red sea. It divides the Ethiopian highlands in to north and south halves. The volcano-tectonic basin so created as a result of faulting, later modulated in to lakes. There are several fresh water lakes found embedded in this basin, among them the most prominent are e.g., the lake Koka, Beseka, Ziway, Abijata, Abaya and Lake Hawasa.

Lake Hawassa is the most prominent freshwater lakes found in the central Ethiopian Rift Valley located at the highest topographic position. Five independent small and big rivers drain in to the Lake extending the catchment. Runoff from the eastern wall of the caldera feeds another small lake called lake Cheleleka. Overflow from Lake Cheleleka drains into Lake Hawassa through the Tikur Wuha River, which is the only major affluent river.

Area of Investigation

The Hawassa Lake is situated 275 km away from the capital city Addis Ababa of Ethiopia towards the south near the city Hawassa, the capital city of Southern Province (SNNPR). The lake lies in between 6° 33' - 7° 33› N and 38° 22' - 38° 29' E. The Lake stretches 16km from the north east to south west direction and extends 8 km from north-west to south east direction having an approximate water volume 1.3 billion meter cube (45.9 billion ft3). The maximum depth of the Lake is 21.6m (70.9 feet) with mean depth however is 11m (Elias Dadebo, 2000). The catchment has a total area of 1455 km^2 of which 93.6 km^2 is the surface area of Lake that may increase up to 99.3 Km^2 in the rainy season. The annual net groundwater outflow from Lake Hawassa to adjacent basins is estimated at 58 ×106 m3 (Yemane Gegziabiher, 2004, EFASA-2013).

Sampling

Water samples plankton analysis were collected between November, 2013 to March 2014 by dipping a wide plankton net of mesh size of 45 microns just below the surface of water in open condition. The collected sample was divided generally into three parts. The first part was treated with 5% procaine hydrochloride and then fixed in Schaudinn's fixative. The second part was treated with 5-10% formaldehyde and third part was treated with boiled water and then fixed in formalin. Hot water treatment gives satisfactory results as well as can fix the organism in its natural position which no other relaxing agent can do. A large number of organisms were placed in a Petri dish somewhat less than half full (Edmondson, 1959) to which an equal amount of boiling water was suddenly poured into the middle of the dish. This method worked well basically for free swimming organisms. Then these forms were stained in Haematoxyline or Alum carmine and were mounted in pure glycerin. For the observation of Mastax, Trophi and other chitinious structures, specimens were treated with KOH (or also Sodium hypochlorite) and mounted in glycerin. A mild centrifugation of preserved water sample either cool or gentle hot can also bring good result.

Plankton analysis

For quantitative analysis, of plankton a sub-sample of one ml. was quickly drawn with a wide mouthed pipette resembling that of a stempel pipette and poured into a counting cell similar to that of Sedgwick rafter cell of one ml. capacity and all the organisms of the aliquot were counted. However, when there was a bloom, counting was done only in selected squares in random from which total numbers per liter of water could be calculated. Quantitative data was also taken for other important groups of zooplanktons like *Cladocera, Copepods, Crustacean larvae*, insect larvae etc. The classification and the identification of *Rotifera, Cladocera and Copepoda* was made possible with the help of literature available specifically as given by Edmondson (1959) and that of Koste (1978).

Vegetation around the Lake

The terrestrial ecosystem around the lake consists of Acacia woodlands, wetland vegetation while the bank of the water is covered by lush grasses and sedges. The various Emergent, submerged and floating wetland flora include:

- *Nymphaea caerulea,*
- *Potamogeton schweinfurthii,*
- *Typha angustifolia,*

- *Paspalidium germinatum and*
- *Ludwigia stolonifera.*

Rangelands are rich in grass species including

- *Cynodon dactylon,*
- *Hyparrhenia sp.,*
- *Cenchrus ciliaris,*
- *Heteropogon contortus and*
- *Hypoestes sp.*

Plankton fauna

There are large varieties of phyto as well as zooplankton flora and fauna scattered within the lake respectively.

Phytoplanktons

Cyanophyceae (Cyanobacteria)	*Anabaena circinalis* *Anabaena sp.* *Anabaenopsis sp.* *Aphanizomenon sp.* *Cylindrospermopsis Africana* *C. Curvispora* *Microcystis aeuroginesa* *Nostoc sp* *Planktolyngbya sp.* *Psuedoanabaena sp.* *Raphidiopsis sp.*
Chlorophyceae (Green algae)	*Chlamydomonas reticula* *Coelatrum sp.* *Cosmarium sp.* *Cyclotella sp.* *Pediastrum boryanum* *Pediastrum typicum* *Pediastrum graccilium* *Pediastrum duplex* *Pediastrum biwae* *Pediastrum simplex* *Phacotus lenticularis* *Scenedesmus accuminatus* *S. dimorphus* *S. armatus* *S. quadricauda* *S. acutus*
Bacillariophyceae (Diatoms)	*Cymbella* *Fragillaria* *Mellosira sp.* *N. rostellate* *Navicula cryptocephale* *Navicula sp.* *Nitzschia sp.* *Nitzschia vernicularis* *Surirella* *Synedra* *Thalassiosira sp*
Dinophyceae (Dinoflagellates)	*Peridinium spr*
Cryptophyceae (Cryptophyta)	*Cryptomonas obvata*
Euglenophyceae (Euglinophyta)	*Phacus longicaudar* *Lepocincilis sp.*

Zooplanktons

The lake is basically dominated by large populations of Rotifers, Copepods, Cladocerans and Dipterans (Chioronomous) insects. The Cilliophorans especially the Paramecium was also represented by quite a good number of species.

Rotifera

Asplanchana seiboldii
Asplanchna sp.
Brachionus calyciflorus
B. caudatus
B. fulcatus
B.bidentata
Brachionus quadridentata
Cephalodella gibba
Filinia longiseta
Fillinia sp.
Keratella cochlearis
K. tropica
K. valga
Lecane luna
Polyarthra sp.
Testudinella sp.
Trichocera elongate

Copepoda

Thermocyclops consimili
Mesocyclops aequatorialis
Mesocyclops sp.
Phyllodiaptomous

Cladocera

Diaphanosoma excisum
Moina micrura
Ceriodaphnia sp.

Ostracoda

Heterocypris sp
Strandesia sp.

Diptera (Chironomidae)

Chironomous larva

Fish fauna

The fish fauna of Lake Hawasa consists of only six species. A lake of such a dimension with wonderful chemical composition having tiny amount of fish diversity was a matter of concern that needs attention. The wild culture of Tilapia and overproduction of eggs may inhibit the growth and reproduction of other cultivable fishes. Moreover the fish (Tilapia) itself probably prevents the growth of several phytoplankton and macrophytes due to its voracious feeding and anti predation features. The fish fauna of the lake was:

1. *Oreochromis niloticus*
2. *Labeobarbus intermidius*
3. *Barbus paludinosus*
4. *Aplochelichthys antinorii*
5. *Clarias gariepinus*
6. *Garra sp.*

Tilapia constitutes about 90% of the total production, while Barbus and Catfish contribute only about 2-3% and 7-8% respectively. Tilapia and Barbus are caught exclusively by gill nets while Catfish is caught both by gill nets and long lines. Overfishing of Tilapia had resulted in to a recent ecological imbalance which again a matter of great concern that needs immediate attention.

No amphibian fauna was reported from and around the lake while the reptilians are represented by a skimpy number of monitor lizards.

Avian fauna

About 80 wetland birds and 24 are Palearctic migrants are almost reported by several workers in and around the lake. Of these birds four are purely endemic recorded from the woodlands nearby. They are-

1. Yellow-fronted Parrot *Poicephalus flavifrons*,
2. Black-winged Lovebird *Agapornis taranta,*
3. Banded Barbet *Lybius undatus and*
4. Forest Oriole, *Oriolus monacha.*

Wetland migrant birds including the following are frequently ob-

served in the lake.

1. Egyptian Goose, *Alopochen aegyptiacus*
2. Cotton Pygmy Goose, *Nettapus coromandelianus*
3. White-faced Wistling Duck, *Dendrocygna viduata*
4. Spur-winged Goose, *Dendrocygna viduata*
5. Knob-billed Duck
6. Red-knobbed Coot, *Sarkidiornis melanotos*
7. African Fish Eagle, *Haliaeetus vocifer*

Conclusion

The present investigation has enabled us to understand the fact that the lake is a living one still in its full swing of limnological conditions and not at all in the way of dieing. The lake cannot be perfectly assumed as a Eutrophic lake as presumed by several early workers. The lake of course needs proper conservation and rejuvenation. More over the domestic, municipal and industrial depositions should be well treated before dumping into the lake.

Another significant move will be linking the Lake Hawassa with other nearby lakes (lake Shallo, lake Tilo, lake Shalla, Abayya etc.) to safe guard the freshness of water and continuity of aquatic diversity. More over it will solve the problem of domestic supply of drinking water, irrigation and fish culture for improving socio-economic conditions of people.

Presence of large populations of phytoplankton in the lake indicates the change of hinterlands for several types of zooplanktons, nektons and macro predators. This change in habitats leads to adaptation and succession of more vulnerable species causing destruction of existing flora and fauna. Earlier workers reported the dominance of Copepods and Cladocerans which now overtaken by Rotifers as found in present investigation. The abundance, species composition and population of Rotifers clearly designate the dominance of Rotifers over other zooplanktons. Simple presence of such new faunal diversity and floral attributes does not exhibit the lake going to be eutrophic rather semi saprobic or leading towards oligo-saprobic condition. The additional water affluent from tributaries and over down pour changes the hydro-biology of lake within span of time. But it seems hurry to pronounce accordingly for a visitor without un-

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