Chapter 20

The Status of Lake Victoria Environment: Trends and Impacts to Fish Stocks

J. Gichuki  
Kenya Marine and Fisheries Research Institute, Kenya

A. Getabu  
Kenya Marine and Fisheries Research Institute, Kenya

C. Ezekiel  
Tanzania Fisheries Research Institute, Tanzania

O.C. Mkumbo  
Lake Victoria Fisheries Organization, Uganda

ABSTRACT

This chapter discusses the environmental conditions in Lake Victoria and how they impacts on the fish stocks. Results show that in last 4 decades Secchi disc visibility decreased by about 75%. Oxygen depth decreased by 50% indicating that a large body of the lake water in the deeper waters cannot support life. Chlorophyll a has increased three times as compared to historical values. Results show that the redfield ratio has decreased to 8.2:1 (N: P). Low oxygen conditions in the deep water causes rapid denitrification with subsequent loss of nitrogen. Primary productivity has doubled over the period and algal biomass increased by 8-10 folds. The algal biomass is currently dominated by Cyanophyta. Zooplankton communities have changed to smaller sized species and a dominance of rotifers while Caridina nilotica has a higher abundance in inshore waters compared to offshore waters. Environmental changes have influenced changes in herbivorous and Zooplanktovore fish species resulting to increase in “Dagaa” Rastrineobola argentea, and decline of carnivore species. Changes in ecological interactions due to species introduction, predation accelerated by the environmental changes and increased fishing pressure have further complicated the ecosystem dynamics of Lake Victoria and pose serious uncertainties on the lakes future stability and sustainability of the fisheries resources. Lake Victoria’s future sustainability requires effective management of fishing effort and phosphorous loading.

DOI: 10.4018/978-1-61520-907-1.ch020
INTRODUCTION

East Africa has a high diversity of freshwaters bodies that include lakes, rivers and streams. Lake Victoria is the largest tropical lake in the world and is surrounded by Tanzania, Kenya and Uganda. It lies at an altitude of 1134 m above sea level and has a surface area of 68,800 km². The lake is roughly square in shape with its greatest length and width of about 400 m and 320 km respectively. Much of the lake is shallow (≤ 40 m), but deep regions of the lake have maximum depth in the range of 60 m to 92 m. Lake Victoria has a catchments area of about 194, 200 km² (Piper et al. 1986) and is located between latitudes 0° 20' N, 3° 0' S and longitudes 31° 39' E, 34° 53' E. The lake bottom is mainly covered by thick layer of organic mud, but a few areas have patches of hard substrate, sand or rock (Scholtz et al. 1990). The coastline is indented with many bays and gulfs. The Kagera and Nzoia Rivers are the major inflows while the major out flow is via the River Nile.

Lake Victoria, like any other African Great Lakes experienced dramatic changes in the past century. These changes occurred in the drainage basin involving the vegetation, industrialization, agricultural developments, introduction and invasion of alien species and intensive non-selective fishing. These, among other factors, have led to destruction of native and endemic components of the Lake Victoria basin lakes such as decline in fish stocks, reduction in fish species diversity. Lake Victoria lost about 60% of its over 300 cichlid taxa in the last decade (Lowe-McConnell 1993) and faced deterioration in water quality. Other developments were over exploitation of the fishes and human impacts on the ecosystem (Witte et al. 1992; Ochumba et al. 1994; Ogutu-Ohwayo, 1990). Other components of aquatic system that changed included algae, macrophytes, invertebrates, birds, amphibians and reptiles those are important in an ecosystem. This document has synthesized on trends in the major environmental parameters to elaborate the changes in the lake environment and the fisheries.

BACKGROUND

Since the late 1960s disruptions of physical and biogeochemical processes have occurred in the Lake Victoria basin caused by intense human activity in the watershed caused by accelerated population growth, intense cultivation, poor animal husbandry and introduction of exotic fish species (Bugenyi and Balirwa, 1989; Hecky, 1993; Balirwa et al. 2003; Lowe-McConnel, 1997). These disruptions have lead to over fertilization (eutrophication) which affects water quality and aquatic biota including fish in Lake Victoria (Mugidde, 2001; Lungayia et al. 2000; Kolding et al. 2008). The symptoms of eutrophication as characterised by elevated nutrient concentrations; hypoxia; massive fish kills and algal blooms have become a common phenomenon in Lake Victoria in the late 1990’s (Silsbe et al. 2006). The interventions by the respective governments and some development partners have reduced the effects but still this is very far from control.

Changes in the environment involving water quality especially turbidity may have brought about dramatic losses in biodiversity. Increased sediments loads and elevated algal biomass have direct effects on the fish habitat as well as fish production. Fish require good light conditions for visual recognition during mating and territorial defense. The changed light environment in Lake Victoria as indicated by the increased water turbidity has reduced the effectiveness of colour signals between mates leading to the breakdown of the reproductive barriers and consequence erosion of the cichlid species diversity in Lake Victoria (Seehausen et al. 1997; Seehausen et al 2008). This has had direct effect to the other species as the Rasrimeobola argentea which shared the same ecological niche. The introduced species on the other hand also competed with the endemic species.