COMPARATIVE ECOLOGICAL STUDIES ON SOUTH-EASTERN AREA OF LAKE MANZALA AND WATER OF BAHR EL-BAQUR DRAIN BEFORE AND AFTER TREATMENT OF WASTEWATER BY ENGINEERED WETLAND

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A thesis submitted in Partial Fulfillment
Of
The Requirement for the Doctor of Philosophy Degree
In
Environmental Sciences

Department of Environmental Basic Sciences
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APPROVAL SHEET

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ABSTRACT

Lake Manzala is one of the most important Delta wetlands in Egypt, because it is the largest one and due to its high productivity. The southern region of the Lake receives agriculture, industrial and sewage wastewaters without treatment from several drains; the most polluted one is Bahr El-Baqar drain. Pollution in the southern part of the Lake led to high levels of contamination and high organic load affecting consequently all aquatic organisms including fishes.

Therefore, a five-year Global Environmental Facility (GEF) project was implemented last decade by United Nations Development Program (UNDP) and Ministry of water Resources Irrigation to tackle the problem of polluted drainage water that enters the Lake from Bahr El-Baqar drain, using Engineered wetland for biological treatment.

Physico-chemical parameters have been analyzed in water samples collected seasonally along to lake, drain; before and after Engineered Wetland station during the period from winter 2012 to autumn 2013.

Also, some heavy metals were measured in the water and Nile Tilapia organs (gills and muscles). The total and fecal coliforms were also studied. Water quality index (WQI) was used as a useful tool to assess the quality of water in both Lake Manzala and Bahr El-Baqar drain. Results showed that the concentrations of some water quality parameters exceeded the permissible limits of Low 48/1982, Ministerial decision 92/ 2013**.** The heavy metals Al and Ni levels in water were higher than the international permissible limits of Australia and New Zealand. The levels of the heavy metals in gills and muscles of the Nile Tilapia also exceeded the maximum permissible limits in all fish muscles. So, it can be conclude that the southern area of Lake Manzala is contaminated by high levels of heavy metals and the consumption of its fish not save and could cause health hazard to the local inhabitants as their diet depends mainly of fish.

In conclusion, the quality of Bahr El Baqar drain is the main factor controlling the pollutants in Lake Manzala, and the main solution is the reduction of pollutants discharging by using different treatment techniques, such as Constructed wetland in large scales which considered the most economically treatment and alternative compared with other ways of improvement of water quality.

List of Contents

List of Tables

List of Figures

CHAPTER I

INTRODUCTION

1.1 BACKGROUND

Lake Manzala is situated in the north-eastern extremity of the Nile Delta. It lies between 31˚45', 32˚15'E and 31˚00', 31˚35'N. It involves an area of about 52,611hectares. The lake is bounded by the Mediterranean Sea to the North, Suez Canal to the East, and Damietta Branch to the West. The southern shores of the lake form the north boundary of Dakahiliya and Sharkiya Governorates. It is the largest and one of natural the essential sources of fisheries in Egypt **(Zahran *et al.*, 2015).**

It was contributed about 50 % of the total country yield during early 1970 and about 35 % during 1980 **(Khalil and Salib, 1986)**, and now only 3% of total yield **(GAFRD, 2014)**.

The lake is considered as one of the most important wintering and nesting sites for many species of the migratory birds. About 2785 fishing boats and 15975 fishermen are licensed in the lake water. Cattle raising are present in lake islands, but no agricultural production can be considered **(Shehata, 1982 ; El-Bokhty, 1996 ; El- Enany, 2004)**.

The lake is connected with the Mediterranean Sea by a narrow sandy fringes **(Fishar *el al,* 2015**) namely; El-Gamil, New El-Gamil, El - Boughdady and New Damietta Boughases. The lake is also connected with Suez Canal at El-Kabouti; few kilometers to the South of Port Said. The north-western side of the lake is connected with Damietta Branch of the River Nile by El- Souffra and El-Ratma Canals, North Damitta City. The lake is presumed to have resulted from the accumulation of the Nile flood water into the low lying lands where it now occupies. The Nile water then becomes mixed with the sea water, which was entering into the lake after the effect of prevailing northerly winds. This confirmed by brackishness of the lake water and the lake deposits, which formed mainly of mud mixed with sands **(Shehata 1982; El-Mansy and Shalloof 2015)**

Concerning water quality, the Lake can be divided into two regions: The southern eastern region which receives mainly drainage water through different drains and the second region at the north eastern region affected by sea water (**Ali, 2008).**

The lake is subjected to continuous and steadily flows of pollutants through numerous drains; (as drainage water contributes about 98% of the