Ain shams University
Faculty of engineering

Fish passages hydraulics and the restoration of fish production in Nile River

BY
Eng. AmanySaadAly
B.sc. Civil Engineering
Zagazig University
Egypt,2000

A Thesis Submitted In Partial Fulfillment
For The Requirements of the Degree Of
Master of Science(Irrigation and Hydraulics)
in Civil Engineering

Supervised By
Prof. Dr. Mahmoud SamyAbdelsalam
Professor, Irrigation and Hydraulics
Dept., Faculty of Engineering
Ain Shams University, Cairo, Egypt

Dr. Salwa Mohamed Abou El Ella
Assist. Prof.canal maintenance
Research institute

Approval Sheet

Fish passages hydraulics and the restoration of fish production in Nile River

BY
Eng. AmanySaadAly
B.sc. Civil Engineering
Zagazig University
Egypt,2000

This Thesis for M.SC. Degree had been approved by:

Signature

1-Prof. Dr. Anas Mohamed El Molla
Professor, Irrigation and Hydraulics
Civil Dept., Faculty of Engineering
Al Azhr University, Cairo, Egypt

2- Prof. Dr. Ahmed Ali Ali Hassan
Professor, Irrigation and Hydraulics Dept.
Faculty of Engineering
Ain Shams University, Cairo, Egypt

3- **Prof. Dr. Mahmoud SamyAbdelsalam**
Professor, Irrigation and Hydraulics Dept.
Faculty of Engineering
Ain Shams University, Cairo, Egypt

4- **Dr. Salwa Mohamed Abou El Ella**
Assist. Prof.canal Maintenance Research Institute
National Water Research Center
Ministry Of Water Resource & Irrigation
Cairo, Egypt

Date of discussion : 16/11/2013

AKNOWLEDGMENTS

First of all, I wish to give all the thanks to ALLAH for the completion of this work.

I would like to express my deepest gratitude to Prof. Dr. Mahmoud Samy Abdelsalam ,for supervising this work and for his valuable advice, kind encouragement, guidance, and patience throughout this work.

My special thanks to Dr. Salwa Mohamed Abou El Ella who kindly supervised this work and for continuous support and appreciated assistance.

There is no word that can express my deepest gratitude to my husband Mohamed El Masry for his assistance, understanding and encouragement.

At last but not least, deep thanks for my parents who taught me the dignity and value of education and work .

Abstract

In order to increase the Nile river fish productivity after the hydropower station regulators and all dams. It is recommended to restore the fish life cycle. One of the main environmental challenges of small hydropower development is related to fish passage both upstream and downstream. These migrations are ecological imperatives for fish populations creating the need for efficient fish passage systems.

Downstream fish migration at small hydroelectric generating stations is mostly affected by mortality that can occur during fish passage through the turbines, although mortality can also occur upstream or downstream of the power station. The presence of several small generating stations on the same river may also induce cumulative impacts. Four causes of mortality can affect fish passing through a turbine: contact of fish with one of the turbine parts, shear forces associated to variations in velocity, variations in pressure, and cavitations.

The Fish-ways have been developed mainly in the first half of the 20th century, with the development of Denil, pool and weir, and vertical slot.

Monitoring activities are essential to target mortality through turbines, entrainment estimations related to the efficiency of downstream tools, and efficiency of fish-ways. The Nile fish productivity is recommended to be monitored before and after the proposed fish passages along the river Nile.

Key words: hydropower station, Fish migration, fish-ways, downstream devices, monitoring.

LIST OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PHOTOS

ABBRIEVATIONS

MSY	Maximum Sustainable yield
CPUE	Catch per unit effort
WDFW	Washington Department of fish and wild life
NMFS	National Marine Fishery Service
AWS	Auxiliary water system
GAFRD	General Authority for fish resource development

CHAPTER 1
INTRODUCTION

1.1 General

Due to the river Nile nature and the multiplicity of its channels in the most populated areas in Egypt, Nile is one of the most important sources of fish production in Egypt. The production of fish from the river has subjected to many changes that have resulted from mutations of environment that followed the establishment of water conservancy projects such as Aswan reservoir and the High dam.

The development of fishery resources of the River Nile occupies a major concern those involved in the development of fisheries in Egypt. This has been a target of the decision-makers because of its broad social impact on a wide range of citizens.

The Egyptian government has established a series of barrages and hydropower stations which are urgently needed due to rapidly growing population.

The hydropower projects not only create a barrier for upstream movement, they can also induce mortality to fish by passage through turbines.

The statistical data were those published in the statistics year book of GAFRD (general authority for fish resource development) refers to clear reduction in the fish quality and quantity at the governorates which located down stream the Egyptian barrages.

In order to increase the Nile river fish productivity after the hydropower station regulators and all dams. It is recommended to restore the fish life cycle. This may be achieved through fish passages system.

1.2 Objective of the study

- The objective of the study is to investigate a better understanding of fish passages system as a tool for restoring the fish life cycle in the Nile River to increase the fish productivity. In order to achieve this objective the following approaches have been proposed:

  1- Carry out a literature review on recent developments in fish passages (up stream

  and downstream passages.

  2- The effect of turbines types along the River Nile on the fish life cycle.

  3- Investigate the design consideration for fish passages.

  4- Case study for one of the River Nile barrage.

  5- Discuss monitoring activities and its tools where, The River Nile fish productivity is recommended to be monitored before and after the proposed fish passage along the Nile River.

CHAPTER 2
LITERATURE REVIEW

2.1 GENERAL

Impoundment of a river flood has a multiplicity of effects on fish production and fisheries. This has been documented for the Niger River below Kainji dam (Lelek and El-Zarka, 1971[33]; Otobo, 1978[42]; Chude, 1979[11]; Sagua, 1979[48]), the Volta River below Akosombo dam (Moxon, 1969[37]; Obeng-Asamoa, 1979[41]) and the Zambezi River below Cahora Bassa dam (Davies, 1975[16], 1975a[17])

2.2 Overview of Nile River Fishery

The fishery of the Nile River down stream Aswan High Dam is an example studied of any impounded river channel in Africa (Borhan, 1981)[7]. The total surface area of the Nile below Aswan is 1 160 km2. The MSY [Maximum Sustainable yield] is thus 72.5 kg/ha/year. Prior to impoundment by the Aswan High Dam tilapia constituted 35 percent of the catch but this rose to 75 percent afterwards. Borhan suggests that the predominance of tilapia is due to a decrease in current velocity resulting from impoundment. This created a favorable tilapia habitat which is undoubtedly enhanced by the simultaneous increased macrophyte growth [macrophyte is an aquatic plant that grows in or near water and is emergent, submergent, or floating.]. At the same time the loss of floodplain spawning habitat undoubtedly strongly depresses recruitment of migratory taxa [taxa is a group of one (or more) populations of organism(s)] such as mormyrids _sometimes called "elephant