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A Comparative Study of Potential Fish Yields and Productivity Levels of Devalahandiya and Wijayakatupotha Reservoirs in Puttalam District.

by

Egodagae Asha Probodanie Perera.

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Declaration.

The work described in this thesis carried out by me under the supervision of Prof. J. Jinadasa and a report on this has not been submitted in whole or in part to any university for another Degree / Diploma.

Signature of the Candidate: .....

Signature of the Supervisor: .....

Signature of the Course Coordinator: .....

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ABSTRACT.

The fish yields of most of the perennial reservoirs are lower than the potential fish yields and fish yields are mainly affected by the productivity of the reservoir. The productivity levels are different in reservoirs even with similar morphometric characteristics. Therefore it is important to know the productivity and the potential fish yields of reservoirs in order to maximize the inland fish production of Sri Lanka.

In this study the comparison of the nutritional status, present fish yields and potential fish yields of Devalahandiya and Wijayakatupotha reservoirs in Puttalam district were calculated. These reservoirs are primarily built for irrigational purposes and fisheries are developed secondarily.

These two reservoirs are similar in size. However they have different mean depths, slope gradients and shoreline characteristics. During the studied period from April 2003 to December 2003 some limnological properties and morphological differences were determined. Morphological features such as surface area, capacity, mean depth, maximum depth, full supply level, and slope gradient of the two reservoirs were studied.The limnological properties of water such as surface temperature of water, pH, sechi disc visibility, conductivity, alkalinity, hardness surface and bottom dissolved oxygen levels, primary production levels, zooplankton and phytoplankton densities, detritus matter in the bottom sediment were compared. Commercial fish catch by species were taken from July 2003 to December 2003,twotimes weekly. Thereby the present fish yield was calculated. By conductivity and mean depth data morpho-edaphic indices and the maximum sustainable yields were obtained for the two reservoirs. *Oreochromis niloticus* is the main contributer to the yield of both reservoirs. In addition to that *Channa sp.*, *Etropus sp.*,*Danio sp.*, and sometimes Indian major carps *Labeo rohita* and

Catla catla were present in the catch. The present commercial commercial fish catch of Devalahandiya and Wijayakatupotha reservoirs are 102.5 Kg/ha/Yr and 31.9 Kg/ha/yr. respectively. The potential fish yields of these reservoirs are well above the present yield. The potential fish yield of Devalahandiya and and Wijayakatupotha reservoirs are 270.0 Kg/ha/Yr and 199.6 Kg/ha/Yr respectively. The great difference in present fish yield and potential fish yield is due to the low abundance of fish stocks. Stocking of fish fingerlings would be a correct measure to increase the fish yields of these two reservoirs.

1. Introduction

1.1 Fresh Water Resources in Sri Lanka.

Although Sri Lanka has no natural lakes, it has an ancient heritage of man made reservoirs, built primarily for irrigation of rice fields in the dry zone. These water bodies cover 2-3 % of total land area and their extend dominates all other freshwater resources combined. Although figures vary, there are estimated to be at least 10,000 such reservoirs in abundant and operational conditions. Ten are of greater size of than 5000 ha. 67 are over 500 ha. and 287 are over 100 ha. (Wijesuriya and Kamaladass 1997), Great majority are rain fed seasonal village tanks which are less than 20 ha. in extent, holding water for 3 - 12 months of the year. All these reservoirs are never impounded for fishery development but fisheries are beginning to be recognized as an important secondary measure of reservoir water resources. In certain instances , it is reported that the income from the fishery exceeds that from the intended primary function of the reservoir (De Silva 1988).

Inland fisheries are important in the developing countries in the tropics specially due to that the inland fish do not require complex and expensive infrastructure for harvesting, processing, marketing and transportation. With the increasing human population, reservoirs are becoming increasingly important in the current millennium as an important provider of animal protein and employment opportunities, particularly to rural poor people. Sri Lanka used to obtain about 20 % of its national fish production from man made inland water bodies (De Silva and Amarasinghe 1996).

Sri Lankan lakes and reservoirs are of multiple users, other than for irrigation and fisheries, reservoirs are important in hydroelectricity generation, drinking water supply, fuel wood collection, and recreational purposes (Chandrasoma et al.1996).

In Sri Lanka seasonal hydrological regime of a particular water body reflects the monsoon cycle and the demand of the users or beneficiaries either for irrigation or hydroelectricity generation depending on the type of water body. low land irrigation reservoirs are maintained at high flow through rate from November to April (north monsoon and first inter monsoon) Hydropower generating reservoirs start filling up with the onset of the second inter monsoon and reaches maximum supply level in January. It recedes progressively until the beginning of south west monsoon. All ancient and new upland and lowland reservoirs in Sri Lanka are linked to an aquatic network via irrigation canals (Wijeyaratne et.al 1984). These water bodies fall into two distinct limnological groups.

- New deep hydroelectrically reservoirs located in the highlands.
- Older and new shallow multiple irrigation tanks or storage reservoirs lying in the low land of the dry zone(Fernando 1980).

Potential fish yields vary from system to system and this potential fish yields are the functions of interacting biotic and abiotic factors. Abiotic factors are physio - chemical parameters, lake morphology and hydrology. Hydraulic retention time is reported to be another factor influencing fish yields in tropical reservoirs (Marshall 1984). In irrigation reservoirs of Sri Lanka, management of two crops of rice per year in the dry zone (< 190 cm of rainfall per year) of the country is superimposed

upon climatic patterns. Therefore highly variable retention times and water level fluctuations characteristic almost all irrigation reservoirs in the dry zone of Sri Lanka (Nissanka and Amarasinghe 2001).

Biotic factors are species composition, species interactions and ecology.

1.2 Factors Affecting Fish Production of Lakes and Reservoirs.

1.2.1 Reservoir Morphology and Seasonal Hydrological Regime.

Reservoir productivity is highly variable. Significant variations being observed in reservoirs of comparable size and geology even with the same river basins. It is well known that primary productivity and fish yield are highly related to morphology of lakes (Rawsan 1952). The lakes with more wavy shoreline, low mean depth and low gradient slopes provide ideal nesting habitats for fish species specially *Tilapia* populations and have high fish production than deeper lakes with steep slopes (Wijeyaratne and Amarasinghe 1984). Deeper reservoirs are particularly poor in fish stocks than shallow reservoirs (Fernando 1980). Lakes which are shallower than 60 feats of mean depth, fish production was in between 2.5 to 7.5 pounds per archer while deeper lakes 0.8 to 1.6 pounds per archer and defined shallower lakes as eutrophic and deeper lakes as oligotropic lakes (Rawsan 1952). Also that when depth increases, there is a decrease in bottom fauna and the standing crop of phytoplankton also have negative relationship with depth (Rawsan 1952). Fluctuations in water level in tropical reservoirs have important influences as nutrient dynamics through nutrient release from grass and dung in the submerged peripheral areas (Maclachlan 1971). In Sri Lankan reservoirs the dominant fish species in reservoirs is *Oreschrromic mossambicus*. Fluctuations in the water level in reservoirs therefore have a positive effect on the fish yields, through enhancement of nest site availability in peripheral areas of the reservoirs (De Silva 1988).

Table I .Fish yields of some shallow and deep reservoirs in Sri Lanka.

Name of the Lake	Nature and status	Area	Fish yield Kg/ Ha/ Annum.	Source	Remarks
Parakrama Samudra. Polonaruwa	Shallow	2662	69.4	NAQDA statistics 2003	Mostly *Oreohcromis niloticus*
Udawalawa Reservoir	Deep	3415	98.4	Amarasinghe et al. (2001)	Mostly *Oreohcromis niloticus*
Badagiriya Reservoir Hambantota	Shallow	486	579.6	Amarasinghe et al. (2001)	Mostly *Oreohcromis niloticus*
Muthukandiya Reservoir Moneragala	Shallow	386	240.6	Amarasinghe et al. (2001)	Mostly *Oreohcromis niloticus*
Minneriya Reservoir Polonnaruwa	Shallow	2551	92.9	Amarasinghe et al. (2001)	Mostly *Oreohcromis niloticus*