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## Ecological study of exotic fishes in Govindgarh reservoir

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### Abstract

The present investigation has been carried out in Govindgarh reservoir located in Rewa district, Madhya Pradesh, during the period Nov. 2012 to Oct. 2013. *Common carp*, *Silver carp*, *Grass carp* and *Tilapia* were the most dominant species among all exotic fishes. Attempts were made to estimate the diversity of exotic fishes and their role in the ecology of the water bodies as a means of successful aquaculture practices. During the present investigation water bodies of Govindgarh reservoir has been selected to study the Length-weight relationship and Ponderal Index along with their ecological condition. Monthly and seasonal variations of different factors were regularly recorded, the findings of the study will help to estimate the general analysis of different size of the fishes.

**Keywords:** physico-chemical, water, ponderal index and govindgarh reservoir

### 1. Introduction

The functioning of an aquatic ecosystem and its suitability to support life forms depend, to a great extent, on the physico-chemical characteristics of its water. The key feature of an ecosystem is the interaction among the biotic and abiotic components. The external controls and internal interactions combine to produce a certain ecosystem structure and the species develop certain patterns of abundance, seasonality, biomass and stratification. Any change in the abiotic components will be reflected in the biotic life.

Consideration of water quality is important in wetland habitat evaluation because a host of interacting physical and chemical factors can influence the levels of the primary productivity and thus influence trophic structure and total biomass throughout the aquatic food web (Wetzel, 1975) [8].

The cultivation of fishes is very profitable area and has ecological importance too, and these variations from the basic law are measured by a unit, the condition factor (also known as Ponderal index, k-factor or coefficient of condition) and serves as a useful index of the nutritional biological cycle of the species (Jhingran, 1972) [3]. Thus condition factor also is a medium to know the relationship between length and weight of a particular fish.

This study period exotic fishes were selected for the study of Length-Weight Relationship and Ponderal Index. An exotic species is one of that is not active to the ecosystem it inhabits because it is not its native ecosystem such a species in often without natural population controls. An exotic species proliferating out of control is often responsible for a wide range of impacts on its adopted habitat and other species. These effects may be direct or indirect, positive or negative, temporary or permanent.

Keeping this view in the present study some important physico-chemical parameters were incorporated along with length weight relationship and condition factor with many ecological views of particular three water bodies conducted and found the idea how to enhance the value of productivity in present time and what about future prospective of fish production in Rewa district. Hence the present study will be mile stone to know the ecology of exotic fishes of Rewa region.

### 2. Materials and Methods

Govindgarh reservoir is situated about 20 km from Rewa city in Rewa district of Madhya Pradesh. Its geographical location being 81°15'20" E longitude and 24°24' N latitude. It is an artificial lake; its construction was started in 1856 and completed in 1916. The present area of lake is 307 hectares

The fish Reservoir has been selected on random basis for the study which are under exotic fish practices.

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Monthly sampling was done from Nov. 2012 to Oct. 2013 in all the reservoir for finding out the various abiotic (temperature, transparency, pH, dissolve oxygen, free CO<sub>2</sub>, total alkalinity, Biological oxygen demand (BOD) and biotic parameters. The physico-chemical analyses of the water samples were done according to APHA (1998) [9].

The study exotic fishes like common carp (*Cyprinus carpio*), silver carp (*Hypophthalmichthys molitrix*), *Tilapia mossambica* and Grass carp (*Ctenopharyngodon idella*) etc. were selected for the study of length weight relationship formula proposed by Huxley (1924) [2] and Le Cren (1951) [4] was used. The primary objective of this study to evaluate the ecology and determine the water quality and secondary aim of the study is the identification of length weight of these species of fishes.

The coefficient of correlation ‘r’ can be calculated using the following.

$$r = \frac{\sum xy - n \bar{x} \bar{y}}{\sqrt{[(\sum x^2 - n \bar{x}^2)(\sum y^2 - n \bar{y}^2)]}} r$$

Individual variations from general length-weight relationship have been studied under the general name condition factor (Le Cren 1951) [4]. Such change in “condition” have usually been analyzed by name of condition factor as k- factor as ponderal index. Which has been calculated by using different

formula by various workers. Hile (1936) [1] proposed the following formula to determine the condition factor as k-factor:

$$K = \frac{W \times 10^5}{L^3}$$

Where,

- K = condition factor
- W = weight of the fish
- L = Length of the fish (in mm)

### 3. Results and Discussion

In recent year, the emphasis in fisheries research is to find out the possible mathematical relationship between length and weight of fishes with a view to study the growth, gonadal development and management of the fish population and compare the life history at localities. The Govindgarh lake is a reservoir where lentic and lotic ecosystem co-exists. In the study period during the collection of data, the sexes were not differentiated due to practical field problems. Though it was known that they generally might have different relationships. During the monthly collection, the number of fishes collected for the study of Ponderal index was totally based on the availability of specimens at that time. On the basis of collected data following monthly and seasonal fluctuation were observed.

**Table 1:** Correlation Matrix of Physico-chemical parameters.

	Air Temp.	Water temp.	Secchi Trans	Conductivity	TDS	pH	CO <sub>2</sub>	Total Alk.	Dissolved O <sub>2</sub>	Chloride	Total Hard.	Ca Hard.	Sodium	Potassium	Nitrates	Phosphate	Sulphate	Relative Silica	
Air Temp.	1.00																		
Water Temp.	0.88	1.00																	
Secchi Trans	-0.38	-0.35	1.00																
Conductivity	-0.17	-0.39	-0.16	1.00															
TDS	-0.02	-0.27	-0.21	0.97	1.00														
pH	0.16	0.02	0.11	-0.21	-0.16	1.00													
CO <sub>2</sub>	0.15	0.01	0.49	-0.29	-0.28	0.66	1.00												
Total Alk.	-0.11	-0.24	0.47	0.62	0.58	-0.01	0.15	1.00											
Dissolved O <sub>2</sub>	-0.68	-0.80	0.11	0.29	0.22	-0.23	-0.32	0.05	1.00										
Chloride	0.08	-0.06	-0.12	0.80	0.78	-0.37	-0.32	0.64	0.15	1.00									
Total Hard.	-0.67	-0.68	-0.05	0.70	0.58	-0.11	-0.31	0.33	0.45	0.35	1.00								
Ca Hard.	-0.43	-0.58	0.02	0.78	0.68	0.11	-0.08	0.50	0.30	0.44	0.90	1.00							
Sodium	0.30	0.01	-0.06	0.71	0.72	-0.28	-0.08	0.59	0.11	0.87	0.12	0.36	1.00						
Potassium	0.27	0.11	0.33	0.33	0.27	0.17	0.45	0.65	-0.38	0.33	0.10	0.44	0.53	1.00					
Nitrates	0.50	0.38	-0.46	0.19	0.25	0.22	0.19	-0.07	-0.31	0.15	0.03	0.19	0.23	0.32	1.00				
Phosphate	0.36	0.16	-0.53	-0.01	0.05	-0.06	-0.16	-0.21	0.19	0.13	-0.33	-0.29	0.31	-0.24	-0.03	1.00			
Sulphate	-0.14	-0.46	0.40	0.70	0.67	0.09	0.23	0.84	0.32	0.53	0.36	0.58	0.64	0.56	0.10	-0.11	1.00		
Relative Silica	-0.27	-0.30	0.76	-0.50	-0.55	0.19	0.63	0.06	0.17	0.52	-0.29	-0.25	-0.28	0.15	-0.37	-0.11	0.14	1.00	

**Table 2:** Co-efficient of correlation (r) between Physico-chemical features of water and Ponderal index at Govindgarh.

	Common carp	Grass carp	Silver carp	Tilapia
Air Temp.	0.46	-0.65	0.56	-0.07
Water Temp.	0.23	-0.71	0.69	-0.06
Secchi Trans	-0.24	0.75	-0.46	0.08
Conductivity	0.64	0.14	-0.65	0.17
TDS	0.71	0.07	-0.58	0.05
pH	-0.15	0.08	-0.38	-0.50
CO <sub>2</sub>	-0.08	0.42	-0.18	0.03

Total Alk.	0.40	0.44	-0.69	0.09
Dissolved O <sub>2</sub>	-0.08	0.53	-0.46	-0.20
Chloride	0.83	0.04	-0.47	0.13
Total Hard.	0.08	0.28	-0.63	0.16
Ca Hard.	0.29	0.25	-0.63	0.18
Sodium	0.89	0.02	-0.41	0.27
Potassium	0.39	0.09	-0.33	0.46
Nitrates	0.45	-0.23	0.02	-0.10
Phosphate	0.25	-0.39	0.28	-0.06
Sulphate	0.41	0.57	-0.76	0.00
Relative Silica	-0.49	0.61	-0.21	0.13

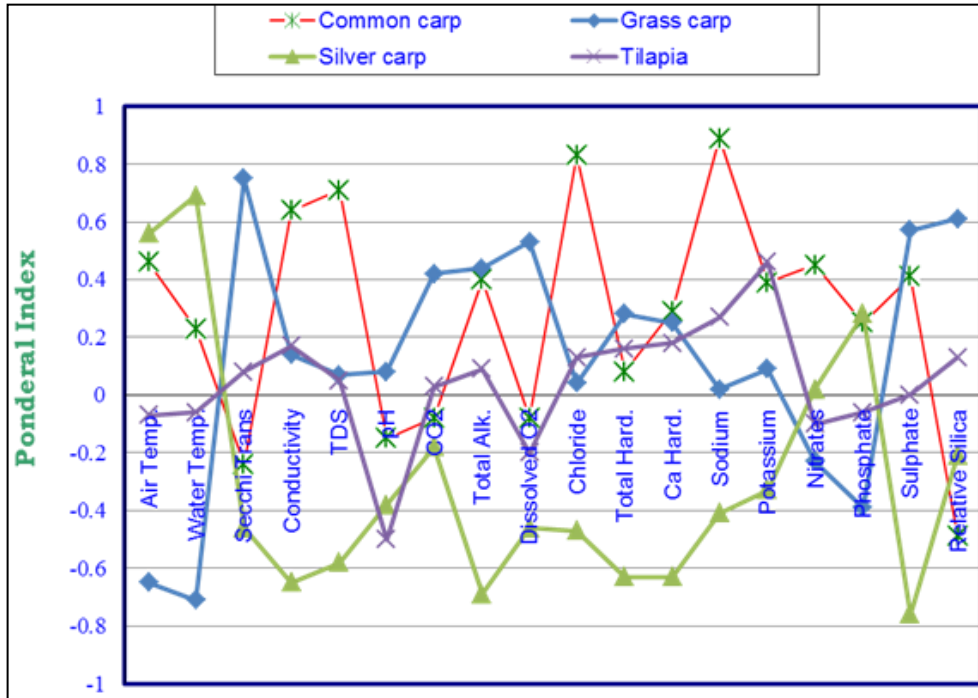


Fig 1: Co-efficient of correlation (r) between physico-chemical features of water and ponderal index at Govindgarh.

During the observation it was found that generally two peaks of 'K' value for exotic carps were registered. The first peak during early summer which was higher than second peaks recorded during the months of October and November. More or less similar findings were also reported by Jhingran (1972) [3].

In the present study marked seasonal variations were observed in the case of *Common carp*, *Silver carp*, *Grass carp* and *Tilapia* all the three water bodies. Generally maximum value of Ponderal index were found during summer season. The high value during summer season may be attributed due to active metabolic activities, sufficient availability of food, maturity time of gonads and preparatory period of pre-spawning. Jhingran (1972) [3], Singh (1991) [7], Mitra (2001) [5], Mortuza (2006) [6] etc. were also reported more or less similar seasonal fluctuation in their studies.

The relation of Ponderal index (K) with physicochemical features of water are evident from the value of coefficient of correlation (r) given in table 2. Significant positive correlation was found by Grass carp for all the physicochemical parameters which indicate that production of grass carp in Govindgarh lake was maximum and due to heavy weight, a very good spawner with weed feeder grass carp may be a best exotic carp which can be cultivated with scientific approach in Govindgarh lake, while common carp ranking second and silver carp and Tilapia and next, and because grass carp not as harmful as tilapia which show most negative correlation in

Govindgarh it can be more useful. It also not very much competitor as silver which have competition with catla and other major carp.

So according to co-efficient correlation between physicochemical features the result shows vast quantity of common carp it because it shows a positive correlation with water temperature, transparency, conductivity, TDS, alkalinity, DO, chloride, Total hardness, Ca hardness, Potassium, Nitrate and sulphate.

**4. Acknowledgement**

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