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ORIGINAL ARTICLE

Fecundity observation of exotic *Oreochromis niloticus* (L) invaded into the Ganga River system, India.

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ABSTRACT

Fecundity of exotic O.niloticus was measured by counting the ripe eggs in ovaries and relation between fecundity/weight, fecundity/length and fecundity/ovary weight was investigated. R^2 was calculated through regression analysis. There was a positive correlation (r) between fecundity/weight and fecundity/length of O.niloticus captured from the Ganga River and from the Yamuna River. Degree of correlation between fecundity/ovary weight was lower than the fecundity/weight and fecundity/length correlation. Observed high fecundity and better correlation advocates advance reproductive strategy of O.niloticus which may support the invasion success in both the Rivers. Although calculated value of R^2 and correlation was slightly maximum in the Yamuna River than the Ganga River, it indicates high invasion rate of O.niloticus in the Yamuna River. Increased invasive rate of exotic O.niloticus may create negative impacts on indigenous fishes.
Keywords: Oreochromis niloticus, fecundity/weight, fecundity/length

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INTRODUCTION

O. niloticus is native to central and North Africa and the Middle East [4]. Now it has been introduced into Ganga and Yamuna River and successfully invade in it. Although the negative effects of introduced species are widely recognized [6,7,8,9] many of them are still being released into the aquatic ecosystems of India for production enhancement, without consideration of their potential impact on native fish and fisheries [5]. Among other factors, the success of *O. niloticus* has been attributed to its mouth brooding habits, feeding flexibility and its tolerance to a wide range of physico-chemical variables [20]. On the basis of reproductive strategy, high fecundity rate of *O.niloticus* also facilitates its invasion success. The knowledge of fecundity of fish from a specific aquatic body is extremely important [18]. Fecundity is important parameter to define the biology, population dynamics and reproductive potential of individual fish species [1,2]. It has direct bearing on fish production, stock recruitment and stock management. Estimation of fecundity is not only important for these parameters but it is equally important for acquiring knowledge about different races ,as different races have characteristic fecundities and egg diameter, which in turn is helpful in recognizing the population whether it is a homogenous population (with a single species) or a heterogenous type of population [3]. Recent studies and use of generalized linear models to hindcast fecundity variations demonstrate that stock reproductive potential estimated by the total egg production can lead to different perceptions of the state and productivity of the stock. The recent development of cost-effective methods to count egg numbers of fish now makes it practical to routinely determine potential fecundity. Seasonal fecundity varies in relation to parental quality (e.g., size, condition), resource availability (e.g., food abundance and quality), environmental (e.g., temperature) and evolutionary factors e.g. stock biomass, fishing pressure [17]. Greater insight into the environmental factors that regulate reproductive activity may be gained by determining the relative reproductive investment allocated at each spawning event. The ability to estimate annual fecundity for more multiple-spawning species will facilitate examination of the effects of fishing on the reproductive characteristics [19]. The goal of this study was to investigate the relation between fecundity to fish weight, fish length and ovary weight *O. niloticus* in Ganga River system. Assessment of all these relations may provide the information about the reproductive strategies of *O. niloticus* invading in the Ganga as well as in the Yamuna River.

MATERIALS AND METHODS

Present study was carried out between Jan-2013 to Dec- 2013 and fish samples was collected monthly basis by using gill net from fish landing areas i.e Etawah, Kalpi and Allahabad of Yamuna region and confluence region of Allahabad, Varanasi and Ballia of the Ganga region (Fig.1). Total length (cm) of each fish was calculated and it was measured from the tip of the snout (mouth closed) upto the tip of the caudal with the help of measuring board. Body weight was measured to the nearest gram using a portable digital balance [10]. Ovary was removed from dissected fish and ovary weight was measured by a digital balance. We measured the ripe eggs in the Ovary and followed the methodology which has already been used by [1]. To obtain representative samples of the whole gonads, small portions were taken from the posterior, middle and anterior regions of both lobes of the ovary. These samples were weighed and the numbers of ripe eggs were counted. The total number of ripe eggs in the ovary was estimated by multiplying the number of ripe eggs in the sample by the ratio of the ovary weight to the sample weight. For statistical analysis, experimental data were subjected to linear regression analysis by log-log data application.

Fig 1. Map Showing sampling locations of the Ganga River and the Yamuna River.

RESULT

We observed the fecundity by counting the ripe eggs in the Ovary. fecundity of *Oreochromis niloticus* was ranged from 930- 2350 in the Yamuna River and from 540- 2162 in the Ganga River. Corresponding weight ranged from 212 g to 455g and length ranged from 21.0 cm - 27.0 cm for Yamuna River and while weight ranged from 187 g- 430 g and length from 19.5 cm- 26.4 cm for the Ganga River. Generally, higher value of fecundity of *Oreochromis niloticus* was observed in the Yamuna River than the Ganga River. R^2 was calculated through Log-log data of regression analysis. Correlation coefficients of fecundity/weight, fecundity/length and fecundity/ovary weight was ranged from 0.9436, 0.9217 and 0.8611 respectively for Yamuna River and 0.9362, 0.9043, 0.8393 for Ganga River.

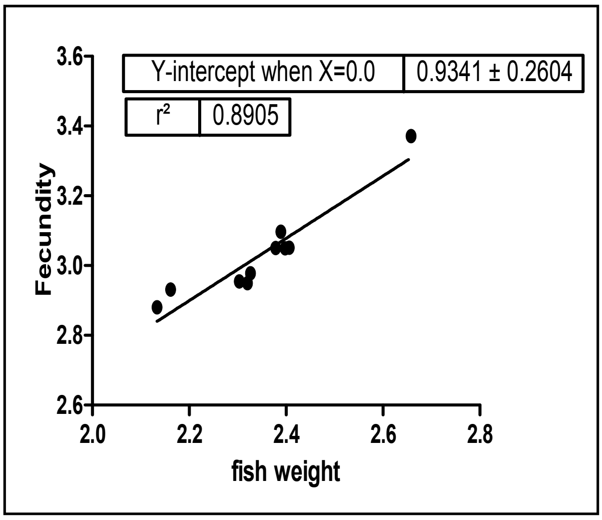

Figure 2. Fish weight and fecundity relation of *O.niloticus* captured from the Yamuna River.

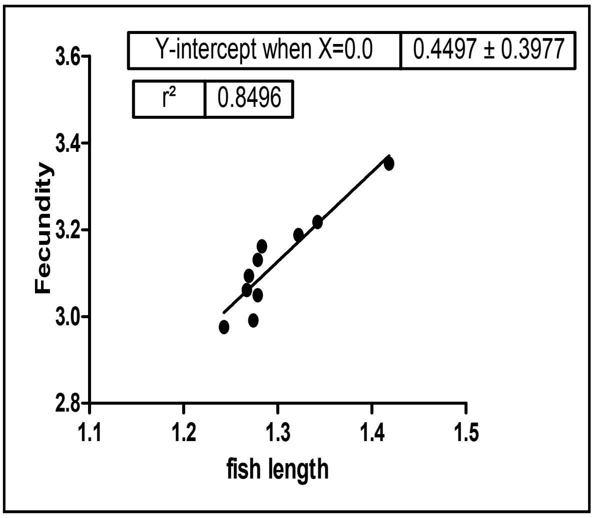

Figure 3. Fish length and fecundity of Relation of *O.niloticus* captured from Yamuna River.

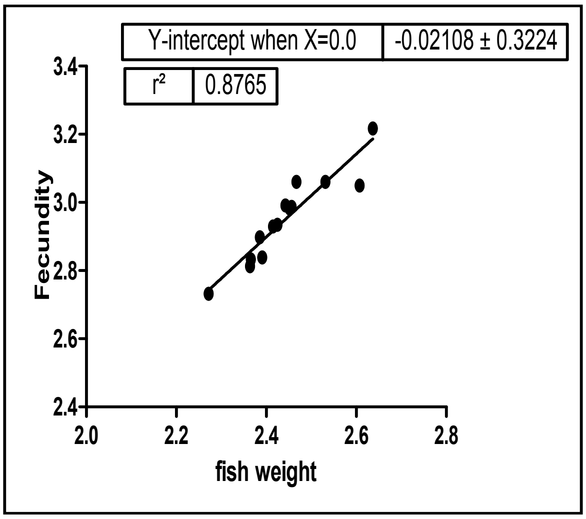

Figure 4. Ovary weight and fecundity *O.niloticus* captured Ganga river

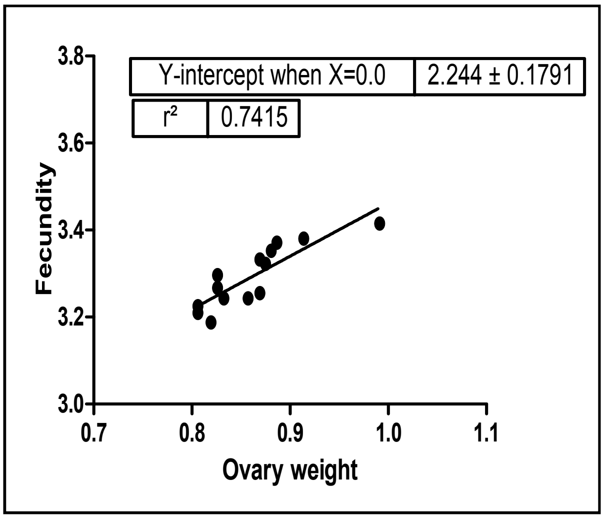

Figure 5. Fish weight and fecundity relation of relation of *O.niloticus* Captured the from the Yamuna River.

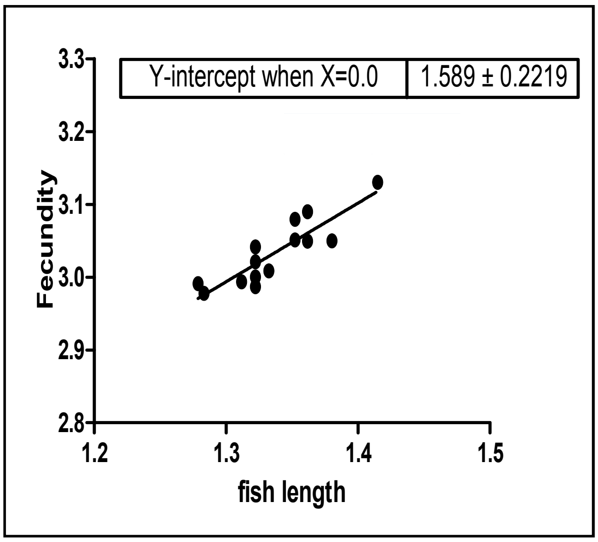

Figure 6. Fish length and fecundity relation of *O.niloticus* captured from the Ganga River

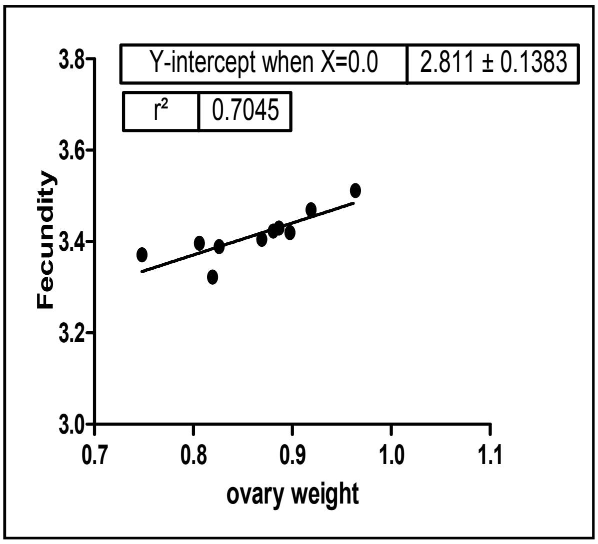

Figure 7. Ovary weight and fecundity of relation of of *O.niloticus* captured from the Ganga River

DISCUSSION

With reproductive strategy of any individual, fecundity also defines fertility. [14] was discussed that species fertility is considered as an indicator of the reproductive strength of any fish species. It is defined as the number of eggs Spawned in a year. This is controlled by several factors, such as Length of the spawning period and its frequency, batch fecundity of individuals, number of females and length or age composition of the females [16]. Study of our result revealed that observed correlation between fecundity/weight, fecundity/length of Yamuna River and fecundity/weight from the Ganga River was almost agrees to the findings of [1]. Although we observed high correlation between fecundity/ovary weight than their findings but trend of correlation between fecundity/weight, fecundity/length and fecundity/ovary weight was similar to their findings. [15] observed positive linear regression found between absolute fecundity length and absolute fecundity-weight in both streams (Gorganroud River Basin, Northern Iran) indicates that larger and older fish produce higher egg number (i.e absolute fecundity), meaning larger specimens are more fecund than small individuals in the studied populations. This view supports our findings related to the fecundity of ripe eggs present in the ovary. We observed slightly higher fecundity in *O.niloticus* invaded into the Yamuna River than the Ganga River. [11] asserted that fish species exhibit wide fluctuations in fecundity among fish of the same species, size and age. Findings of [12] suggested that variation in fecundity may be due to differential abundance of food. In most *Tilapians* fecundity varies considerably even in females of similar sizes especially in large fish classes [13]. High fecundity rate and its better correlation with weight and length of *O.niloticus* may increased spawning potential and invasion of exotic *O.niloticus* in both the rivers, it may create negative impact to our local fisheries.

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