GROWTH STUDY OF AN EXOTIC FISH, RED PIRANHA (*Pygocentrus nattereri)* IN POLYCULTURE POND, BANGLADESH

M. M. RAHMAN[1], A. T. ABU AHMED[1], M. M. MAHMUD[1] AND M. A. HOSSAIN[2]

[1]Department of Zoology, University of Dhaka-1000, Dhaka, [2]Fisheries and Marine Resource Technology Discipline, Khulna University, Khulna-9208, Bangladesh

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ABSTRACT

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The growth in terms of length and weight of Red Piranha, *Pygocentrus nattereri* Kner**,** 1858 was studied in a polyculture pond at the Khaza Matshya Hatchery, Valuka, Mymensingh where the fish were cultured with different fish species, for a period of one year (August 2005 to July 2006). In the observed pond, the final overage weight and length of Piranha was 1102g and 39.1 cm respectively and the growth rate varied from 9.89% to 188.89%. Growth rate in terms of length and weight showed an increasing trend in February. The logarithmic from of equation obtained for the length weight relationship was represented by log W= -3.302+4.122 log (TL) 00 W= 0.00019889 (TL) $^{4.122}$. The regression Co-efficient (b) and correlation co-efficient (r) was calculated as 4.122 and 0.985060 respectively. The values of relative condition factor (Kn) ranged from 0.60 to 1.70 with an average of 1.05. It was lowest in July and highest in January. The drop in the Kn value from April to July might be due to maturity of the fish. From the growth of the study, the growth rate of *P. nattereri* was found to be closely nearer (or higher in some case) to that of the other exotic species of fish.

Key words*:* Growth, Red Piranha, polyculture

INTRODUCTION

In Bangladesh, about 16 species of feed fish have been introduced for increasing the overall production of food fishes, utilizing a vacant niche by appropriate species, controlling insect pests, and decorating aquarium by ornamental varieties (Rahman 2005).The Red Piranha, *Pygocentrus nattereri* belongs to the family Characidae of order, Characiformes, is one of the exotic species in Bangladesh. *P. nattereri* also called Red Bellied Piranha originally a resident of Amazon Basin in South America. They are normally about 15 to 25 cm long (6 to 10 inches), although reportedly individuals have been found up to 60 cm in length (Source: Wikipedia).This species was earlier introduced in Thailand, China, Singapore and the Philippines. The fish traders imported this fish in Bangladesh in 2001 from Thailand and China for culture and marketing. A number of people reportedly are involved in the culture of the species in Tongi areas in Dhaka, Trishal, Valuka in Mymensingh, Daudkandi in Comilla and Chandpur, Khulna and Satkhira areas (Rahman, 2005) for the commercially viable growth rate of Piranha. The induced spawning is being practiced at different hatcheries in Mymenshingh area. Already it has been possible to produce fingerlings by artificial breeding through stripping of mature females and mixed with milt obtained from mature males with hormonal treatment. This species at the early stages resembles the Rupchanda and sold in market as Thai Rupchanda. It is anticipated that the fish may accidentally escape the culture system and come in competition with native species for establishment in open water. But it is informed through personal communication with fish farmers that Piranha has a fanning potential in Bangladesh as a high yielding variety and its respective size, shape and colour.

The knowledge of age and growth of a fish is extremely useful in management and great biological interest (Lager, 1965). Growth may be simply defined as an increase in size, considering both length and weight (Rounsefell and Everhart, 1962). Several researchers like Vietmeyer (1976), Mehta *et al.* (1976), Shireman *et al.* (1980) and

Prabhavathy and Sreenivasan (1977) have studied the growth rate in terms of weight and length of Red Bellied Piranha. Length, weight and age are mainly considered to be the growing factors for life, so also in case of fishes. Fishes are known to be poikilothermic animals living in an aquatic media. The growth of fishes in terms of length and weight is a continuous process with some exceptions due to fluctuating velocity. To establish length-weight relationship of particular fish there lying two objectives (Le Cren, 1951): (a) to ascertain measurement of individuals, as indications of fatness, general well- being etc., (b) to convert logarithmic growth rate for weights may also give indications of taxonomic difference and events in the life history. Knowledge of length-weight relationship is a must to establish growth equations in production computation (Rao, 1974). Due to scarcity of data on growth rate of Red Bellied Piranha in Bangladesh, the present study was felt necessary.So the present study was undertaken to explore the growth of Red Bellied piranha, *P. nattereri* that will be a key element for culture and management of this fish in Bangladesh.

MATERIALS AND METHODS

The present study was conducted from August, 2005 to July, 2006 at the Khaza Matshya Hatchery, Valuka, Mymensingh and at the Fisheries Laboratory of Department of Zoology, University of Dhaka. In the present investigation, a pond situated at hatchery area was used which was cultivated under culturable conditions in polyculture. To study the growth of *P. nattereri* monthly sampling was done with the help of small seine net (mesh size 8 mm). At least 10% of the catch representing at least one from each size group was collected for this purpose. The study of the growth of fish fry and fingerlings were done just after washing in the laboratory to avoid shrinkage or weight loss by the preservatives. In every month from August 2005 to July 2006, at least ten fishes were caught and measured for weight and lengths to monitor their growth with the help of centimeter scale to the nearest cm and "Triple beam balance" to the nearest gm and then were put back into the pond. The length and weights were recorded at 30 days interval of each month on a particular date.

The mathematical function suggested by Le Cren (1951) was used in estimating length – weight relationship

$$W = a L^n$$

Where,

W = weight,
L = Length,
a = constant and
n = an exponential usually lying between 2.5 and 4.0

The above formula suggested by Le Cren is originated from the following power function:

$y = ax^b$, which is not linear but parabolic in nature.

The exponential from the above relationship can be expressed as follows:

$\text{Log}y = \text{Log}\, a + b \,\text{Log}\, x$, which is linear.

The value of 'a' and 'b' was estimated by means of the regression analysis using least squares method from the original data.

The relative condition factor (Kn) calculated by the formula:

$$Kn = W/\hat{W}$$

Where,

W= observed log weight and
$\hat{W}$= calculated log value

RESULTS AND DISCUSSION

During the period of investigation, growth in terms of length and weight of Red Bellied Piranha *(Pygocentrus nattereri)* was observed. Continuous growth of the fish was observed throughout the year. The estimated monthly average total length (cm), average standard length (cm), average weight (g) and the growth rate of *P. nattereri* in pond are shown in Table 1. In the observed pond the final average weight and length of Piranha was 1102 g and 39.1 cm, respectively and the growth rate varied from 9.89% to 188.89 %.The graphical presentation of monthly average growth of Piranha are shown in Figure 1. The growth of fishes at the early stage was rapid. Growth rate in terms of length and weight showed an increasing trend in February. This might be due to the change of season, start of rainfall and availability of more food items in the pond. Growth of Piranha can be highly variable due to different culture conditions.

Table 1. Estimation of monthly recoded average total length, average standard length, average weight, growth rate and gain in weight of *P. nattereri.*

Month	Total length (cm)	Standard length (cm)	Weight (g)	Growth rate (%)	Gain in weight (g)
Aug.'05	15.6	13.1	27		
Sep.'05	19.6	14.9	78	188.89	51
Oct.'05	22.0	17.4	160	105.13	82
Nov.'05	23.0	18.5	285	78.13	125
Dec.'05	24.0	19.6	362	27.02	77
Jan.'06	24.8	20.7	452	24.86	90
Feb.'06	28.5	23.6	594	31.42	142
March'06	30.1	25.0	683	14.98	89
April 06	31.0	26.1	789	15.52	106
May 06	33.8	28.1	889	12.67	100
June06	36.1	31.2	1011	13.72	122
July06	39.1	34.3	1102	9.89	91

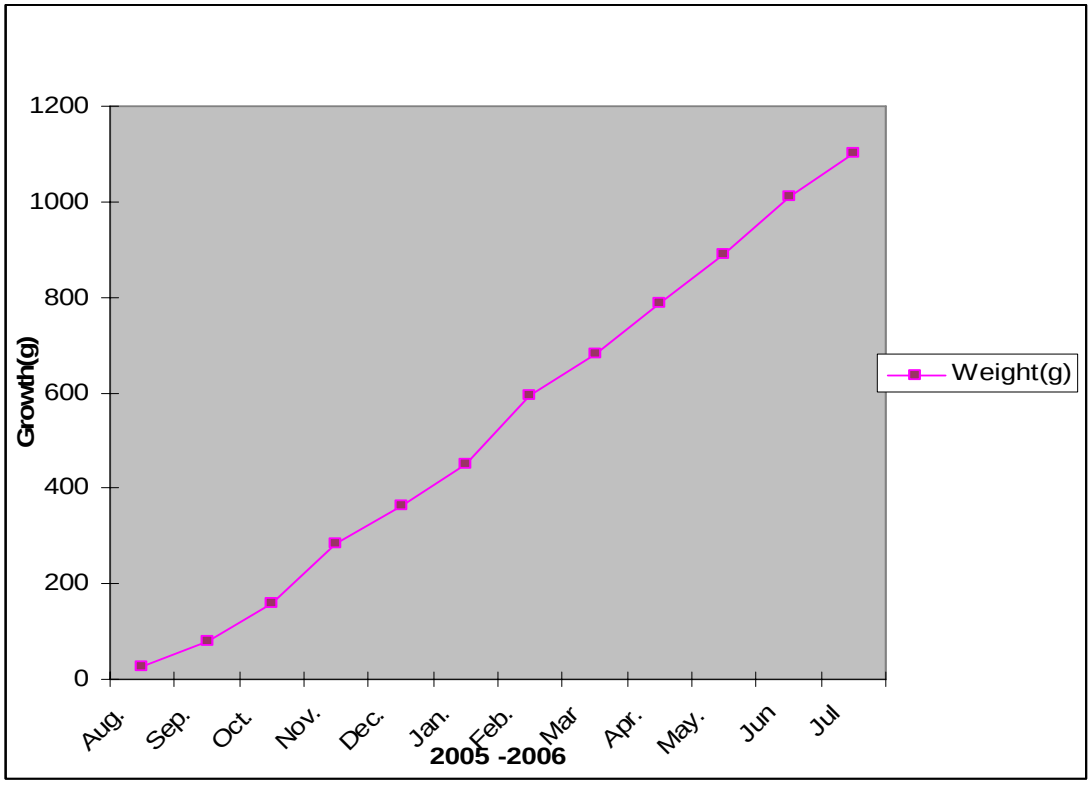

Figure 1. Monthly average growth of red piranha (*P. nattereri)*

The results of length weight relationship of *P. nattereri* are shown in Table 2.The logarithmic form of equation obtained for the length-weight relationship of *P. nattereri* was represented by Log =-3.302+4.122 log(TL) or $W= 0.00049889(TL)^{4.122}$.The computational procedures are shown in Table 2. The regression coefficient (b) and correlation co-efficient (r) was calculated as 4.122 and 0.985060 respectively. The parabolic and logarithmic relationship between the length and weight are given in Figure 2 and 3. Relative condition factor shows cyclical changes in different months. Its values ranged from 0.60 to 1.70 with an average of 1.05. It was lowest in July and highest in January. The drop in the Kn value from April to July might be due to maturity of the fish.

Table 2. Showing the relationship between total length and weight of *P. nattereri*

Month	TL (x)	Log x	$(Logx)^2$	Weight (y)	Log y	$(Logy)^2$	Log x X Logy	Calculated Wt.(W)	Calculated Wt (LogW)	Kn
Aug.	15.6	1.193	1.423	27	1.43	2.048	1.707	41.303	1.616	0.654
Sep.	19.6	1.292	1.669	78	1.89	3.58	2.44	105.829	2.025	0.737
Oct.	22	1.342	1.801	160	2.2	4.85	2.958	170.370	2.231	0.939
Nov.	23	1.362	1.855	285	2.46	6.027	3.344	204.630	2.311	1.393
Dec	24	1.38	1.904	362	2.56	6.548	3.531	243.869	2.387	1.484
Jan.	24.8	1.394	1.943	452	2.66	7.049	3.701	265.503	2.424	1.702
Feb.	28.5	1.455	2.117	594	2.77	7.695	4.036	295.21	2.695	1.199
March	30.1	1.479	2.187	683	2.83	8.032	4.191	602.265	2.793	1.101
April	31	1.491	2.223	789	2.9	8.393	4.319	700.357	2.845	1.127
May	33.8	1.529	2.338	889	2.95	8.697	4.509	1000.279	3.00	0.889
Jun.	36.1	1.558	2.427	1011	3.01	9.03	4.682	1312.113	3.118	0.771
July	39.1	1.592	2.534	1102	3.04	9.254	4.843	1823.388	3.261	0.604

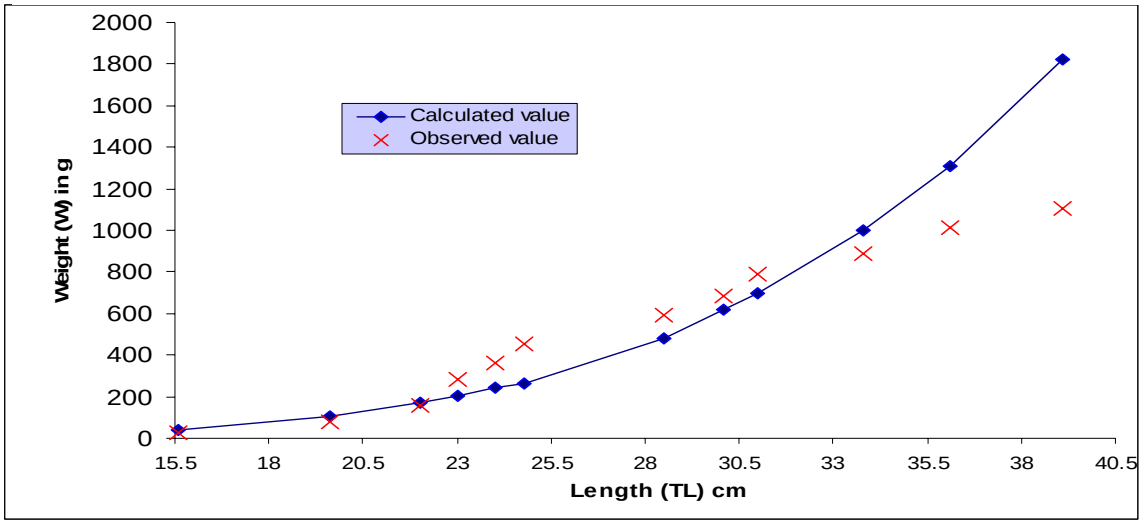

Figure 2. Showing the relationship between total length and weight of *P. nattereri*

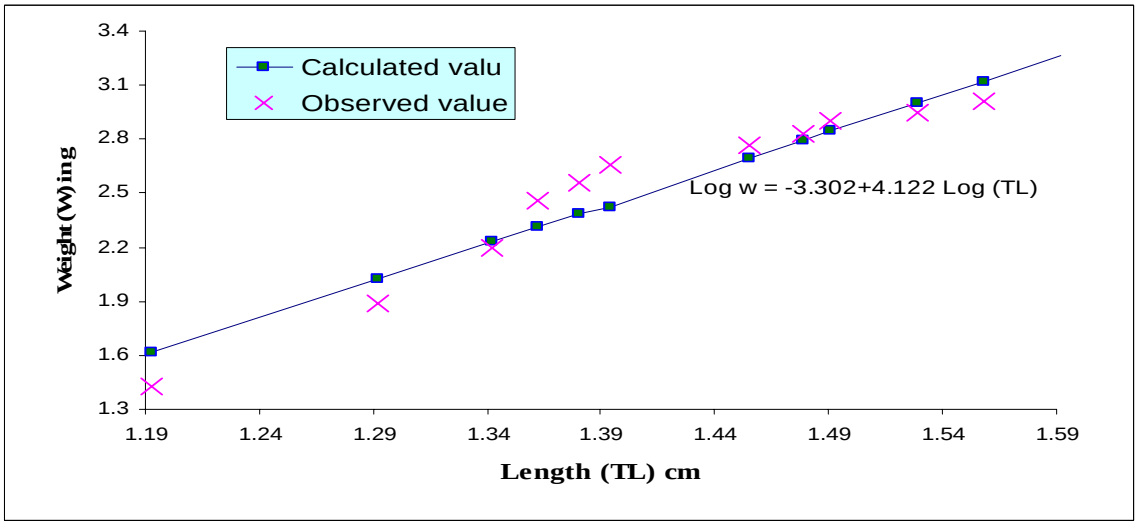

Figure 3. Showing the least square regression of Log weight on Log length of *P. nattere*

In the study of growth, various authors considered either length or weight of the samples. However, in the present study both length and weight were considered. In the observed pond the final average weight and length of piranha was 1102 g and 39.1 cm respectively and the growth rate varied from 9.89% to 188.89%. This result shows that the increase of weight of *P. nattereri* according to their length is nearer to exotic carp fishes of our country, like silver carp (*Hypophthamichthys molitrix)*, common carp (*Cyprinus carpio)*, grass carp(*Ctenopharyngodon idellus*) etc. From the personal communication with the fish farmers, it was known that the growth rate of *P. nattereri* is higher than the native carps like, *Catla catla, Labeo rohita* etc. They have also informed that in optimum condition where supplementary feeds are provided properly, the growth rate of *P. nattereri* exceeds the growth rate of all other exotic species of fish. Merona (1984) reported that growth rate of *P. nattereri* remains high until the fish reach a 19-22 cm, when the fish are about 9 to 12 months old. Almost same trend of growth was observed in the present study.

The length-weight relationship for grass carp (*H. molitrix*) usually does not differ significantly from the standard cubic growth equation. The logarithmic form of equation obtained for the length -weight relationship of *P. nattereri* was presented by log W = -3.302+4.122 log (TL) or W= 0.00049889 (TL) $^{4.122}$. This relationship is more or less similar to the length-weight relationship of *H. molitrix.* He determined the relationship of silver carp of 27-66 cm (TL) in a culture pond to be W=0.0005953 (TL) $^{3.991}$. The length-weight relationship in parabolic equation usually lies between 2.5 and 4.2 (Hile, 1936). In a typical fish that maintain constant shape "b" will be 3.0, i.e. growth is isometric (Andrade and Campos 2002) The value of the regression co-efficient "b" recorded in the present study was 4.122. However the condition of fish is subject to variations with a number of factors including reproductive cycles and availability of foods (Thomson 1943, Rounsefell and Everhart 1953, Morato *et al*. 2001) such variation may also be related to the environmental factors and the age and the physiological state of the fish (Brown 1957).The value of the correlation co-efficient `r' recorded in the present study was 0.985 which indicates strong and highly correlated relationship between length and weight of the fish. The relative condition factor (Kn) ranged between 0.60 to 1.70 with an average of 1.05. The Kn values recorded for the fish indicate good condition of the fish. Kn values were found to show an increasing trend with higher age groups but decreasing trend was observed with further increases in age.

The present study has demonstrated the growth of pond reared red piranha which is one of the important aspects of biology of a fish. From the growth of the study, it is clear that the growth rate of *P. nattereri* is closely nearer (or higher in some case) to that of the other exotic species. As a result, a number of people have engaged themselves commercially in the culture of this species. From this point of view, it is a commercially viable species of exotic fish in Bangladesh. But it has been known from the other study on food and feeding behaviour of *P. nattereri*, the fries are mainly `planktivores'; the fingerlings are "omnivores". The adult is also found to be "omnivores" but the highly carnivorous characters are dominant over the herbivorous characters. This is a negative impact of piranha culture in our country. However, it is highly recommended that the advance research on the biology of the *P. nattereri* should be carried out further for the culture and management of fish and fisheries resources in Bangladesh.

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