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Age and growth patterns in *Channa marulius* from Harike Wetland (A Ramsar site), Punjab, India.

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Abstract: *Scale samples of Channa marulius were collected and studied for age determination and calculation of growth parameters. The fish were sampled from Harike Wetland during 1998 to 1999. Linear relationship with a high degree of correlation was observed between total fish length and the lateral scale radius. Age determination studies revealed 5 age groups. The harvestable size falls just below the 2nd year. The regression equation is given. Various growth parameters indicate a hardy nature of the fish and the suitability of habitat ecology for its optimum growth.*

Key words: *Channa marulius, Growth & age, Harike wetland.*

Introduction

Channa marulius (Hamilton-Buchanan), locally known as '*Sol*' is the largest among the murrel species and is an inhabitant of larger rivers, canals, lakes and other aquatic habitats along with other species of same genus (Wee,1982). The fish belonging to genus *Channa* contribute a lot to the commercial fishery of inland waters of northern India. High market price, tolerance to a variety of habitats and carnivorous food habit make them an important element of fish farming which demands an understanding of their biology and ecological requirements (Wee, 1982; Kilambi, 1986). The perusal of literature indicate that lots of work has been done on *Channa striatus* and *C. punctatus* with respect to their spawning frequency, parental care, fecundity (Qasim and Qayyum, 1961) and their biology (Alikunhi, 1953; Bhatt, 1969,1970; Reddy, 1981; Abbas and Siddiqui, 1987). However, little is known about the age and growth history of *C. marulius*.

The present study has been undertaken to describe age related growth patterns for this fish from Harike Wetland (31^0 10' 15" N, 74^0 57' E). This site is a Ramsar sites in India situated in the state of Punjab. Age structure of the population, growth parameters, survival and mortality rates have been deduced using scales from the fishes sampled from Harike Wetland.

Materials and Methods

The samples were collected from commercial catches (using primarily hooks and occasionally gill nets). The weight and total fish lengths were recorded. Scales of this fish were found to be suitable for age & growth determination and the results obtained are in accordance with already established standards in this field. The data is based on a study of scales from 100 fish samples (mixed) collected from the commercial catches.

The methods used for the collection of scales, the measurements and the methodology for back calculated lengths and calculations for various growth parameters are based on the methodology recommended by Tandon and Johal, (1996). The "key scales" were removed from the samples and cleaned with 1% KOH. These were then studied under scale reader with a magnification of 21x. Lateral scale radii; the number of annuli and annulur radii with respect to the focus were measured. The regenerated scales having disorganized focus, and the ones having irregular circuli and annular pattern were not included in the study.

Results and Discussion

The length-weight relationship was calculated using the following equation:

Log W = Log a + n Log L (LeCren, 1951)

where 'n' represents the slope of line and 'Log a' its position. Curvilinear relationship was observed when original total lengths and weights were plotted and linear relationship was observed after logarithmic transformation of these parameters (Fig. 1).

The length - weight relationship of *C. marulius* as derived by LeCren's formula is

Log W = -1.677 + 2.7469 Log L

$W = .021037784\ L^{2.7469}$

Where N = 100

Linear relationship (Fig. 2) has been observed between total fish length and lateral scale radius, which reflects the high degree of correlation between these two parameters. The regression equation is given in Table 1.

The formula suggested by Bagenal and Tesch (1978) has been used for the back calculation of lengths. Based on this formula, the average back calculated lengths of the pooled data at different age classes have been calculated as given in Table 2.

Annulus formation has been attributed to variation in temperature and spawning and since these factors are influenced by the southwest monsoon, its onset may be one of the major factors in annulus formation as suggested by the earlier workers (Johal and Tandon, 1992).

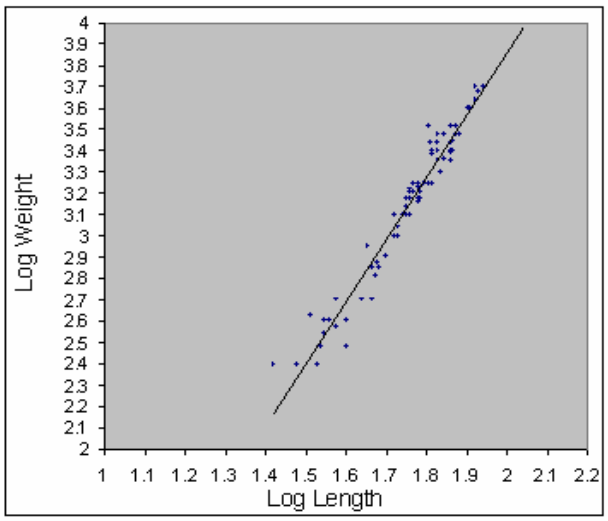

Fig.1: Linear relationship between log length and log weight in *C. marulius.*

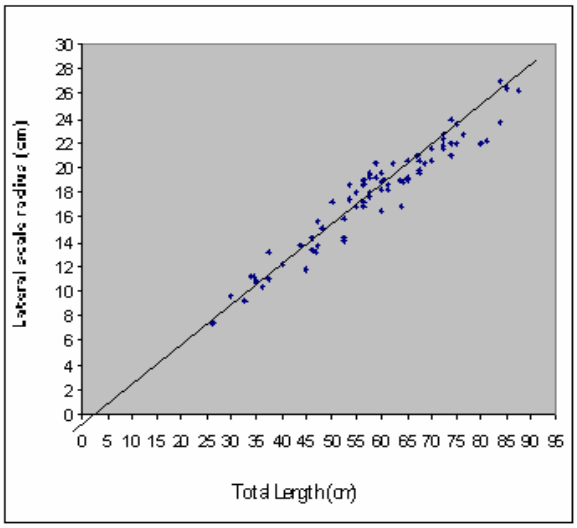

Fig.2: Linear relationship between total length and lateral scale radius.

Table – 1: Correlation between total fish length and lateral scale radius.

Locality	Number of specimens	Regression equation Y = a + bX	Correlation coefficient	Correction factor
Harike, India	100	Y= +2.15+0.269X	0.9308	2.1 mm

Table – 2: Back-calculated lengths (in cm) of *C. marulius* during 1998-99.

Age classes	No. of specimens	Average total length (cm) at the time of capture	L_1	L_2	L_3	L_4	L_5
1	18	37.69	28.02				
2	29	54.14	29.58	41.95			
3	39	64.11	28.78	40.95	53.36		
4	11	75.11	30.66	44.09	53.69	62.89	
5	3	85.41	28.09	38.51	48.65	60.38	73.52
	100	63.208	29.02	41.37	51.9	61.63	73.52
	h		29.02	12.35	10.53	9.73	11.89

L_1, L_2, L_3, L_4 and L_5 represent the back-calculated lengths.

Table – 3: Summary of growth data of *C. marulius* from Harike using scales during Aug.'98 – Feb.'99.

Growth Parameters	Years of life				
	1	2	3	4	5
L(cm)	29.02	41.37	51.9	61.63	73.52
h (cm)	29.02	12.35	10.53	9.73	11.89
Ø h(cm)			14.70		
C_l	42.55	25.45	18.74	19.29	
C_{th}	10.28	9.38	8.91	10.87	
C_{lt}	0.53	0.34	0.25	0.26	
W(gm)	441.17	1164.65	2070	3359.09	4916.66
w(gm)	441.17	723.48	905.35	1289.09	1557.57
C_w	163.99	77.73	62.27	46.37	
Ø C_w			87.59		
Mortality rate M=1-S			1 - 0.84 = 0.16		

L = length; h = increase in average length; Øh = index of species average size; C_l = specific rate of linear growth; C_{th} = growth characteristic; C_{lt} = growth constant; W = weight;
w = weight increase; C_w = specific rate of weight increase; ØC_w = index of population weight growth intensity; M = mortality rate; S = survival rate

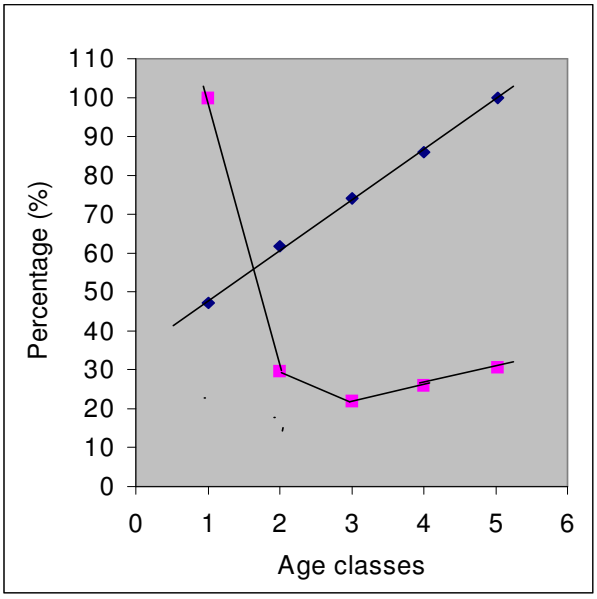

Fig. 3: Harvestable size of *C. marulius* from Harike.

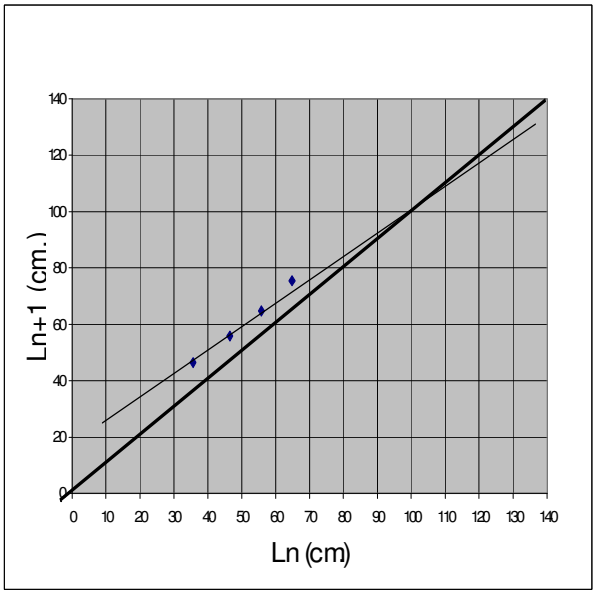

Fig. 4: Ultimate size of *C. marulius* from Harike.

Table – 4: Harvestable size of *C. marulius.*

Age classes	Back-calculated length	Annual increment (h)	A	B
1	29.02	29.02	39.47	100.00
2	41.37	12.35	56.27	42.55
3	51.9	10.53	70.59	36.28
4	61.63	9.73	83.82	33.52
5	73.52	11.89	100.00	40.97

A= %age growth of each age class with respect to the last growth season.
B= %age annual increment in each age class with respect to 1st year growth.

In the present species, 5 age classes were recognized. The maximum annual increment is found to occur in first year of life. In subsequent years decrease in the annual increment (hr) with increase in age has been recorded except in age class fifth, indicating the phenomenon of growth compensation in this age class (Table 3). The specific rate of linear growth (C_l) shows a decline with increase in age except between age class 4th and 5th but contrary to this, the specific rate of weight increase reflects the gradual decreasing trend. Summary of different growth parameters is given in Table-3.

Harvestable size has been determined from the crossing point of the length increments (hr) as percentage of the length of first growth season and average length at each age class as percentage of length of the final growth season (Table 4) against corresponding age classes. The plotting of these two lengths along Y-axis and the age class along X-axis gives the point of intersection, which is considered as the theoretical harvestable size (Fig.3). The harvestable size for this fish lies between age classes 1 and 2 and is found to be 55 cm (Fig.3). This indicates that fish should be harvested before it completes second year of life. Based on the present and earlier investigations from different water bodies on various species, it is confirmed that the harvestable size is directly related with the size and age at first maturity, overall growth rate and other ecological conditions (Tandon and Johal, 1996).

Ultimate size (Fig.4) for *C. marulius* was found to be 99 cm using Walford graph. The lengths of the specimens recorded during the whole period were well below this value. This indicates that the fishing effort should be increased to catch the specimens bigger than the recorded ones as wetland has the potential to sustain the bigger specimens.

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