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Research Article

COMPARATIVE ANALYSIS OF AGE AND GROWTH OF FRESH WATER FISHES (*LABEO ROHITA*, *CIRRHINU MRIGALA* AND *PUNTIUS TICTO*)

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ABSTRACT

Age and growth study provide detail information on the life history, ecology of fish and habitat which is important to manage the water body for fish production and optimize of harvestable size. Scale based age and growth of Indian major crap (*Labeo rohita*, *Cirrhinus mrigala and Puntius ticto*) was studied. There is no significance occurs in between the species. Such study is helpful in describing the present status of fish population along with the future course of the fishery**.**

Keywords: Scale, Age determination, *Labeo rohita, Cirrhinus mrigala, Puntius ticto.*

INTRODUCTION

Age and growth are closely linked. Determination of age is an age old practice. It is a rational part of the work direct to the exploitation of fish stock. (Bagenal, 1974; Mills & Beamish, 1980; Panfili & Panfili, 2002). Knowing the age of the fish provides clue to its longevity, age of first maturity, age recruitment and growth (Fowler, 2009). Age and growth studies are important for the problem associated with management of fisheries. Age determination of fish from scale, otolith, vertebrate fins, spines, fin rays and other structure are usually performed. Monitoring of fish population of known age and require for long time and is quite expensive method. Hence the best appropriate method for age determination is to study of annulus formation of fish (Secor *et al*., 1996). The age of fish can be estimated indirectly the length frequency distribution. From which it can obtain the mean length of each age group or directly by counting and analysis of the annual growth marks in calcified structure such as scale, otolith, opercular bone and fin rays of each specimen (Bhatt & Jahan, 2015).

Age determination in fishes can be carried out using anatomical method, length frequency analysis or direct measurement. The study of weight length has the great value in fisheries and significantly is to access the growth of fish in different environment. Some authors describe the length weight relationship in various fish scale and age. Age determination in fish is fundamental for the management of fisheries (Hilborn & Walters, 2013). Age determination of fish is useful for understanding fish life history and their population dynamics (Beddington & Kirkwood, 2005).The many body parts of fish that is scales, opercula, vertebra spines, fin rays and otoliths (Casselman, 1983) are available for ageing fish. These structure are used for comparative purposes (Khan & Khan, 2009; Vilizzi & Walker, 1999).

In India 31 species of *Labeo rohita* were found (Talwar & Jhingran, 1991). *L. rohita* (Hamilton,1882) commonly known as Rohu is the one of the most commercially important fresh water fishes. It belongs to the family Cyprinidae and order Cypriniformes. It is found in all tanks and ponds. It occurs widely in the Northeast, Northern ans central India: Nepal and Pakistan(Talwar & Jhingran, 1991). *L. rohita* are typically full scaled and silvery, black grey, olive green or yellow-brownish coloured (Balon, 1995; Lintermans, 2007). The fish is covered with cyclod scale (Hamilton, 1882). *Cirrhinus mrigala* (Hamilton, 1882)commonly known as Mrigala is a carp native to the river of Indo-Gangetic plains of India and Pakistan. It belongs to the family Cyprinidae and order Cypriniforms (Hamilton, 1882). Mrigala is typically full scaled and silvery grey or yellow brown in their backs, pale yellow or white on their bellies (Balon, 1995; Kirpichnikov *et al*., 1993; Linterman & Browne, 2007). In natural

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environment it grows in 99 cm and weight is 12.7 kg. It is a detritus and bottom feeder (Talwar & Jhingran, 1991).The body is covered with cyclod scale (Hamilton, 1882). *Puntius ticto* (Hamilton, 1882) is a small indigenous fresh water and brackish water fish species. It is commonly known as 'ticto' and 'two-spot barb'. It is silvery in colour and two black spots are found on the lateral line and depth of body less than one-third of standard length (Guldi *et al*., 2005; Joshi *et al*., 2007).The body is covered with cyclod scale (Hamilton, 1882).

MATERIALS AND METHODS

The fresh water fishes *Labeo rohita*, *Cirrihinus mrigala* and *Puntius ticto* were purchased from local fish market (Jagatsinghpur) Odisha and total length of each fish was measured. The fish scale was scrubbed from the lateral side of the fish in the region directly below the dorsal fin and above the lateral line. Ten and twelve scales were taken from each fish and kept separated. Isolated scale were first washed in water and the scrubbed gently between finger tips to remove the mucus and other extraneous matter attached to the scale then they were cleared with tissue paper. To make scale more clear and soft, they were dipped in weak 1% of KOH solution for about 5 min then washed with tap water and dried in air .The scale were place in 30%, 50% and 70% alcohol respectively for about 5min to dehydrate. Then they were stained with Eosin and washed with 70% alcohol. Again the scale was dehydrated with 90% alcohol for 5 minute. Finally the scale was placed over the slide. Covered with cover slips and observed under trinocular microscope (10x) and taken the photo of scale using both 10x and 5x lens .The number of complete annuli and rings were counted and noted down properly.

RESULTS AND DISCUSSION

L. rohita, *C. mrigala* and *P. ticto* (n=5) were collected from the local areas of Jagatsinghpur, Odisha. ***Labeo rohita:*** Their measurements were taken in cm, then mean and standard deviation of each species parameter were calculated and noted in the form of table (1). There is no significance in between the species of *L. rohita*. In, ANOVA table of *L. rohita* between the group, sum of square is 160.213, df is 4, mean square is 40.0532, F is 0.338 and $p<1$. Within the group sum of square is 8887.65, df is 75, mean square is 118.502 and $p<1$. The total of sum of square is 9047.86 and df is 79. The mean of weight of 5 species of *L. rohita* is 644 where the age consisting of 1 and below 1 year.

Table 1. Calculated length, mean and standard deviation of *L .rohita.*

Measurement	*Labeo rohita*-1 (in cm)	*Labeo rohita*-2 (in cm)	*Labeo rohita*-3 (in cm)	*Labeo rohita*-4 (in cm)	*Labeo rohita*-5 (in cm)	Mean	Standard deviation
Total length	38.1	40.2	30.1	42.2	35.2	37.16	± 4.224
Standard length	30.5	32.4	24.3	34.0	28.3	29.9	±3.386
Fork length	32.8	35.2	25.9	36.3	30.3	32.1	±3.726
Head length	7.8	8.23	6.16	8.64	7.21	7.60	±0.865
Pre-pelvic length	15	15.8	11.8	16.6	13.8	14.6	±1.678
Pre-dorsal length	14	14.7	11.0	15.5	12.9	13.6	±1.563
Dorsal fin base length	6	6.33	4.74	6.64	5.54	5.85	±0.664
Caudal depth	9	9.50	7.11	9.97	8.32	8.78	±0.998
Body depth	10	10.55	7.9	11.07	9.23	9.73	±1.107
Peduncle length	4	4.22	3.16	4.43	3.69	3.9	±0.443
Pre orbital length	2.5	2.64	1.97	2.74	2.30	2.43	±0.273
Eye diameter	10.1	10.6	7.98	11.19	9.46	9.8	±1.101
Post orbital length	6	6.33	4.74	6.64	5.54	5.85	±0.664
Pectoral length	5.8	6.12	4.58	6.43	5.36	5.6	±1.317
Pelvic fin base length	6	6.33	4.74	6.64	5.54	5.85	±0.664
Anal fin base length	5.8	6.12	4.58	6.43	5.36	5.6	±0.645

Table 2. Age and weight relationship.

Species	Weight(gm)	Age
Labeo rohita -1	650	1
Labeo rohita -2	700	1
Labeo rohita-3	500	Below 1
Labeo rohita-4	750	Below 1
Labeo rohita-5	620	Below 1
Mean	644	-

Table 3. Correlation of *L.rohita.*

	L. rohita-1	*L. rohita-2*	*L. rohita-3*	*L. rohita-4*	*L. rohita-5*
Labeo rohita -1					
Labeo rohita-2	0.99994				
Labeo rohita-3	0.99998	0.99993			
Labeo rohita-4	0.99999	0.99993	1		
Labeo rohita-5	0.99999	0.99993	0.99999	0.99999	

Table 4. Test for equal means (ANOVA) of *L. rohita.*

	Sum of square	df	Mean square	F	p (same)
Between groups	160.213	4	40.0532	0.338	0.8515
Within groups	8887.65	75	118.502		Permutation p (n=99999) 0.8543
Total	9047.86	79			

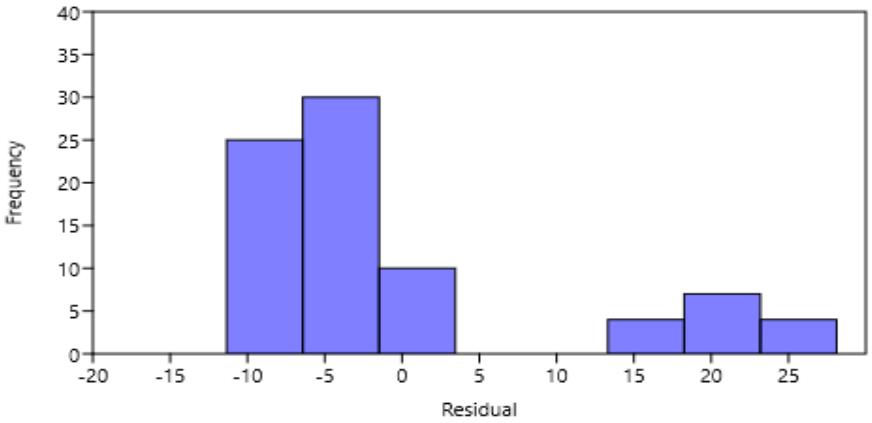

Figure 1. Histogram of residuals of *Labeo rohita.*

Table 5. Calculated length mean and standard deviation of *C.mrigala.*

Measurements	*Cirrhinus mrigala*-1 (in cm)	*Cirrhinus mrigala*-2 (in cm)	*Cirrhinus mrigala*-3 (in cm)	*Cirrhinus mrigala*-4 (in cm)	*Cirrhinus mrigala*-5 (in cm)	Mean	SD
Total length	48	43	46.2	32.1	30.5	39.96	±7.267
Standard length	41	36.7	39.4	27.4	26.0	34.1	±6.212
Fork length	41.2	31.6	39.8	27.6	26.2	33.28	±0.746
Head length	8.8	7.88	8.47	5.88	5.59	7.3	±1.333
Pre-pelvic length	22	19.7	21.1	14.7	13.9	18.28	±3.340
Pre-dorsal length	19.3	17.3	18.6	12.9	12.2	16.06	±2.945
Dorsal fin base length	8	7.16	7.7	5.35	5.08	6.65	±1.211
Caudal depth	5	4.47	4.81	3.34	2.10	3.94	±1.086
Body depth	11.6	10.4	11.1	7.77	7.38	9.65	±1.740
Peduncle length	5.3	4.75	5.10	3.54	3.55	4.44	±0.758
Pre orbital length	4	3.58	3.85	2.67	2.54	3.32	±0.606
Eye diameter	1	0	0.9	0.6	0.6	0.62	±0.348
Post orbital length	5	4.47	4.81	3.34	3.17	4.15	±0.758
Pectoral length	7.6	6.81	7.32	5.08	4.83	6.32	±1.152
Pelvic fin base length	1.5	1.34	1.29	1.0	0.9	1.2	±0.222
Anal fin base lengths	3.3	2.9	3.18	2.21	2.10	2.73	±0.494

Cirrhinus mrigala: The measurement of *C. mrigala* were taken in cm, then mean and standard deviation of each species parameter were calculated and noted in the form of table(5).There is no significance in between the species of *C.mrigala* .In ANOVA table between the group the sum of square is 383.827,df is 4,mean square is 95.9567 and f is 0.5665 and p<1.In within the group sum of square is 12703.8, df is 75 ,mean square is 169.383 and p<1.The mean of weight of 5 species is 980 having age below 1 year.

Table 6. Age and weight relationship of *Cirrhinus mrigala.*

S.No	Species	Weight(g)	Age
1	*Cirrhinus mrigala*-1	1300	Below 1 year
2	*Cirrhinnus mrigala*-2	1100	Below 1 year
3	*Cirrhiinus mrihgala*-3	1150	Below 1 year
4	*Cirrhinus mrigala*-4	750	Below 1 year
5	*Cirrihinus mrigala* -5	600	Below 1 year
	mean	890	

Table 7. Correlation of *Cirrhinus mrigala.*

	Cirrhinus mrigala-1	*Cirrhinus mrigala*-2	*Cirrhinus mrigala*-3	*Cirrhinus mrigala*-4	*Cirrhinus mrigala*-5
Cirrhinus mrigala-1					
Cirrhinus mrigala-2	0.99592				
Cirrhinus mrigala-3	0.99999	0.9957			
Cirrhinus mrigala-4	1	0.99584	0.99999		
Cirrhinus mrigala-5	0.99962	0.99543	0.99961	0.99962	

Table 8. Test for equal means (ANOVA) of *Cirrhinus mrigala.*

	Sum of square	df	Mean square	F	p (same)
Between groups	383.827	4	95.9567	0.5665	0.6877
Within groups	12703.8	75	169.383		Permutation p (n=99999) 0.6951
Total:	13087.6	79			

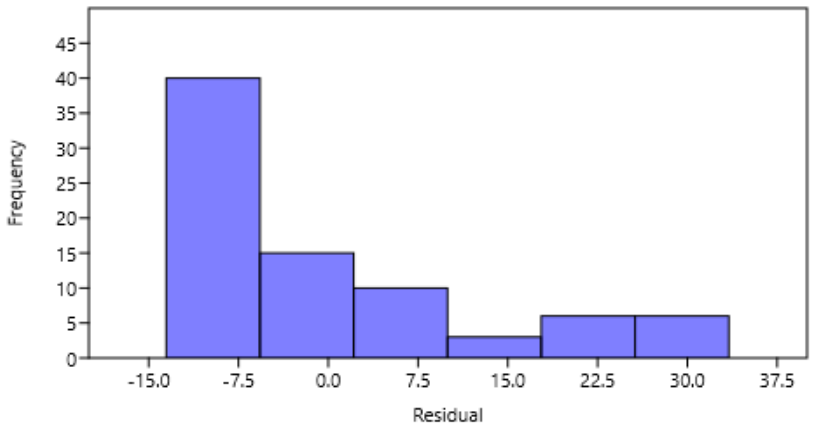

Figure 2. Histogram of residuals of *Cirrhinus mrigala.*

***Puntius ticto*:** The measurement of *P. ticto* were taken in cm, the mean and standard deviation of each parameter were calculated and noted in the form of table (9). There is no significance in between the species of *P. ticto*. In ANOVA table, between the group, the sum of square is 1.89825, df is 4, mean square is 0.474562 and F is 0.1236 and P<1. In within the group sum of square is 287.981, df is 75, mean square is 3.83975 and P<1. The mean of weight of 5 species is 3.12 having age below 1 year**.**

Table 9. Calculated length, mean and standard deviation of *Puntius ticto.*

Measurements	*Puntius ticto*-1 (in cm)	*Puntius ticto*-2 (in cm)	*Puntius ticto*-3 (in cm)	*Puntius ticto*-4 (in cm)	*Puntius ticto*-5 (in cm)	Mean	SD
Total length	6.6	5.2	5.9	6.2	5.0	5.78	±0.601
Standard length	6	4.7	5.3	5.6	4.5	5.22	±0.556
Fork length	5.3	4.1	5.0	5.1	4.1	4.72	±0.515
Head length	1.2	0.9	1.0	1.1	0.9	1.02	±0.116
Pre-pelvic length	2.7	2.1	2.4	2.5	2.0	2.34	±0.257
Pre-dorsal length	2.7	2.1	2.4	2.5	2.0	2.34	±0.257
Dorsal fin base length	0.5	0.3	0.4	0.4	0.3	0.38	±0.074
Caudal depth	0.7	0.5	0.6	1.6	0.5	0.78	±0.416
Body depth	1.7	1.3	1.5	1.5	1.3	1.46	±0.149
Peduncle length	0.5	0.3	0.4	0.4	0.3	0.38	±0.074
Pre orbital length	0.2	0.1	0.1	0.1	0.1	0.18	±0.046
Eye diameter	0.2	0.1	0.1	0.1	3.8	0.86	±1.470
Post orbital length	0.5	0.3	0.2	0.4	0.3	0.34	±0.101
Pectoral length	0.7	0.5	0.4	0.6	0.5	0.54	±0.101
Pelvic fin base length	0.3	0.2	0.1	0.2	0.2	0.2	±0.063
Anal fin base length	0.5	0.3	0.2	0.1	0.3	0.28	±0.132

Table 10. Age and Weight relationship of *Puntius ticto.*

Species	Weight(g)	Age
Puntius ticto-1	3.75	Below 1 year
Puntius ticto-2	3.60	Below 1 year
Puntius ticto-3	2.70	Below 1 year
Puntius ticto-4	2.00	Below 1 year
Puntius ticto-5	3.55	Below 1 year
Mean	3.12	

Table 11. Correlation of *Puntius ticto.*

	Puntius ticto-1	*Puntius ticto*-2	*Puntius ticto*-3	*Puntius ticto*-4	*Puntius ticto*-5
Puntius ticto-1					
Puntius ticto-2	0.9999				
Puntius ticto-3	0.99879	0.99858			
Puntius ticto-4	0.99155	0.99172	0.99277		
Puntius ticto-5	0.85347	0.85419	0.85613	0.84191	

Table 12. **Test for equal means (ANOVA) of *Puntius ticto.***

	Sum of square	df	Mean square	F	P (same)
Between groups	1.89825	4	0.474562	0.1236	0.9736
Within groups	287.981	75	3.83975		Permutation p (N=99999)0.9744
Total:	289.88	79			

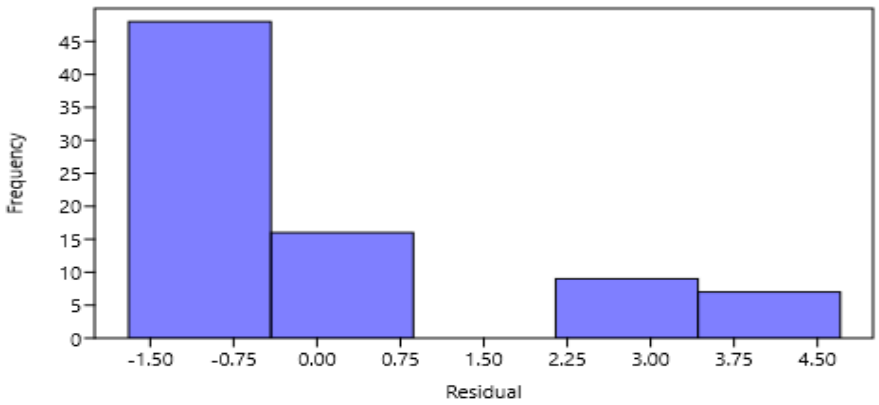

Figure 3. Histogram table of residuals of *Puntius ticto.*

Table 13. Comparative morphometric data of *Labeo rohita, Cirrhinus mrigala and Puntius ticto*.

Measurements	*Labeo rohita*	*Cirrhinus mrigala*	*Puntius ticto*	Mean
Total length	37.16	39.96	5.78	±27.63
Standard length	29.9	34.1	5.22	±23.07
Fork length	32.1	33.28	4.72	±23.36
Head length	7.60	7.3	1.02	±5.30
Pre-pelvic length	14.6	18.28	2.34	±11.74
Pre-dorsal length	13.6	16.06	2.34	±10.66
Dorsal fin base length	5.85	6.65	0.38	±4.29
Caudal depth	8.78	3.94	0.78	±4.5
Body depth	9.73	9.65	1.46	±6.94
Peduncle length	3.9	4.44	0.38	±6.90
Pre orbital length	2.43	3.32	0.18	±1.97
Eye diameter	9.8	0.62	0.86	±3.76
Post orbital length	5.85	4.15	0.34	±3.43
Pectoral length	5.6	6.32	0.54	±4.15
Pelvic fin base length	5.85	1.2	0.2	±2.41
Anal fin base length	5.6	2.73	0.28	±2.87

Table 14. Correlation table of mean of 3 fish species.

	Labeo rohita	*Cirrhinus mrigala*	*Puntius ticto*
Labeo rohita			
Cirrhinus mrigala	0.96924		
Puntius ticto	0.98763	0.98627	

Table 15. Test for equal means (ANOVA) of 3 fish species.

	Sum of square	df	Mean square	F	p (same)
Between groups:	1182.24	2	591.118	6.23	0.004087
Within groups:	4269.43	45	94.8763		Permutation p (n=99999) 0.00343
Total:	5451.67	47			

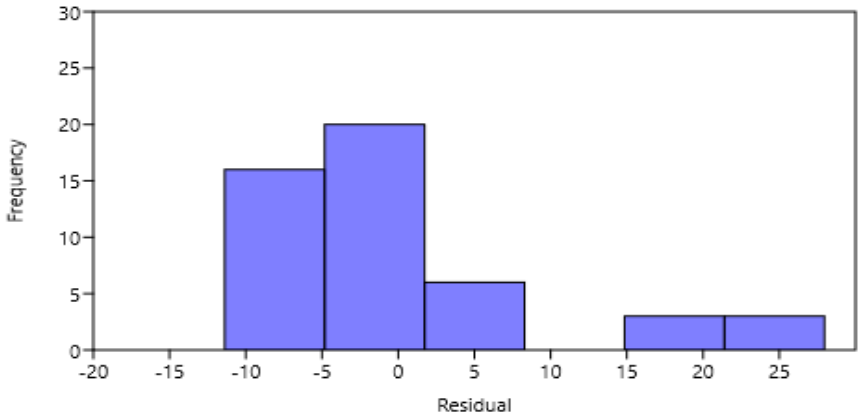

Figure 4.Histogram of residuals of 3 fish species

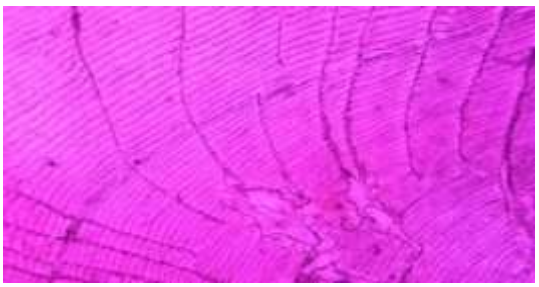

Figure 6. Scale of *Labeo rohita*.

Figure 5. *Labeo rohita* length 38.1 cm; weight 650 gm.

Figure 7. *Puntius ticto* length 6.6 cm; weight 3.75 gm.

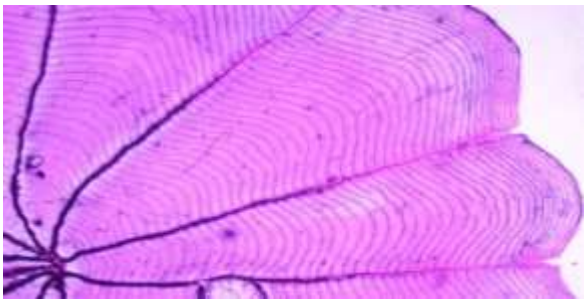

Figure 8. Scale of *Puntius ticto*.

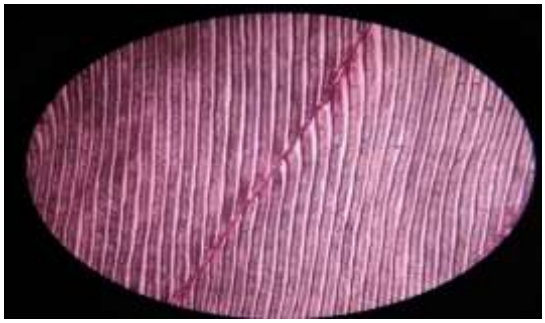

Figure 10. Scale of *Cirrhinus mrigala*.

Figure 9. *Cirrhinus mrigala* length 48 cm; weight 1300 gm.

CONCLUSION

The overall results indicates that *L. rohita, C. mrigala and P. ticto* showed an almost isomeric pattern of growth in the present habitat and condition factor values showed that it is in good condition and economic viable for fisheries. The study will help biologists to know the status of this fish and developed culture technology in natural water and will be useful for the fisheries biologist and conservation biologists for successful development, management, production and ultimate conservation of the most preferred food fishes of the state.

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