

Morphometric and Meristic Differences Between Two Types of Palla, *Tenualosa ilisha* (Hamilton) from River Indus, Pakistan

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Abstract.- The comparative study of two types of palla, *Tenualosa ilisha* was based on 280 specimens (out of which 160 belonged to type A and 120 to type B) collected from river Indus from October 2004 to September 2005. The study revealed significant intertype differences in six morphometric measurements (total length, standard length, fork length, head length, eye diameter and girth) and seven meristic characters (total number of scutes, pre pelvic scutes, post pelvic scutes, dorsal fin rays, pectoral fin rays, pelvic fin rays and anal fin rays). Length-weight relationship, condition factor values and GSI values were also different in summer and winter types of *T. ilisha*.

Key words: Anadramous, Morphometrics, River Indus, *Tenualosa ilisha*.

INTRODUCTION

Tenualosa ilisha, locally known, as "palla" is a species of a lucrative commercial fishery in Pakistan. Moreover, it is also an important fishery in India, Bangladesh Myanmar, Malaysia and Vietnam and also Iran, Kuwait and Iraq in the Middle East (FAO, 1974).

The majority of Indian workers (Hora, 1941; Hora and Nair, 1940; Jones and Menon, 1951; Pillay, 1957; Chandra, 1962; Mathur, 1964) are of opinion that this fish has two distinct migrations and breeding seasons in a year, one during monsoon and other in late winter. Shafi *et al.* (1978) reported two separate breeding seasons of this fish. Quddus *et al.* (1984a,b) described meristic and morphometric differences and age and growth of two types of *T. ilisha* from Bangladesh. The possibility of having different races in Indian water was first suggested by Day (1889), Naidu (1939) and Jenkins (1940). A detailed study of this problem was conducted by Pillay (1952, 1954, 1957) and Pillay *et al.* (1962) concluded that two or three different races of *T. ilisha* exists in the Gangetic river system.

There is no published information regarding the racial differences of *T. ilisha* in Pakistan waters nor different spawning season whether the same fish breeds twice in different seasons or otherwise.

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Hence, it was felt desirable to perform detailed study on their comparative population biology to identify the different stocks and breeding seasons based on the materials from Pakistan waters. In this paper, the differences between the types were examined through the analysis of morphometric and meristic characters, length-weight relationship and GSI values.

MATERIALS AND METHODS

The comparative study of two types of palla, *Tenualosa ilisha* was based on the examination and analysis of 280 specimens (out of which 160 size ranged from 19.5 to 48.0 cm belonged to type A and 120 size ranged from 18.5 to 33.4 cm to type B) collected from Kotri Barrage and ketti bund of river Indus from October 2004 to September 2005. The sex and condition of gonads were determined by dissecting the abdomen. Fishes were measure for morphometric and meristic counts in the laboratory. In total six morphometric, measurements (total length, standard length, fork length, head length, eye diameter and girth) and seven meristic characters (total number of scutes, pre pelvic scutes, post pelvic scutes, dorsal fin rays, pectoral fin rays, pelvic fin rays and anal fin rays) were selected for comparison. All the characters were measured to the nearest millimeters and weighed on an electronic

balance to the nearest gram. All meristic counts and morphometric measurements were made in accordance as suggested by Pillay (1957). The statistical analysis, viz. mean standard deviation, t-test, regression analysis and analysis of covariance were employed in all the data for high precision interpretation. The length-weight relationship and relative condition factor (Kn) was determined by least square methods as given by LeCren (1951).

RESULTS

Morphometric measurements

During the year round sampling, it was noticed that two separate populations of palla, *T. ilisha* exist. To examine the differences of types A and B in River Indus, five combinations were designed such as between male and female within type A and B, between male of types A and B, between female of types A and B and between types A and B (combined). There were no significant differences between male and female. Accordingly, all six morphometric characters (total length, standard length, fork length, head length, eye diameter and girth) were tested on total length and observed that there was significant difference at 5% level between the types A and B. The type A fish were found larger in size than that of type B. The comparisons of the various morphometric measurements are shown in Table I for type A and B.

Meristic counts

For meristic counts seven meristic, characters (total number of scutes, pre pelvic scutes, post pelvic scutes, dorsal fin rays, pectoral fin rays, pelvic fin rays and anal fin rays) were studied. It was observed that the total number of scutes, pre-pelvic and post-pelvic scutes, dorsal fin ray, pectoral fin ray, pelvic fin ray and anal fin ray count of type B were higher than those of type A. The comparisons showed that all seven meristic characters were found to be different significantly at 5% level (Table II). There were no differences in any of the meristic characters observed between male and female of the same type. It was also noticed that type B was smaller and broader than that of type A of *T. ilisha*. Thus, quite clear differences were evidenced between the two types of *Tenuulosa ilisha* of River Indus as shown by the analysis of morphometric and meristic characters.

Length-weight relationship

Length-weight relationship for males and females size ranged from 101 to 500 mm and 101 to 350 mm in total length for type A (n=160) and B (n=120), respectively, was calculated by least square methods (LeCren, 1951). The equations for both the types of *T. ilisha* are as under:

Log W = -2.13 + 3.03 Log L (males type A)	during summer
Log W = -2.16 + 3.08 Log L (females type A)	during summer
Log W = -3.08 + 3.81 Log L (male type B)	during winter
Log W = -3.05 + 3.83 Log L (female type B)	during winter

Table I.- Comparison of morphometric measurements of various body parts of Type A and B of *Tenuulosa ilisha* (Hamilton) from River Indus (during summer and winter) (n=160 and 120, respectively).

Length groups (cm)	Mean TL (cm)		Mean SL (cm)		Mean FL (cm)		HL / TL (cm)		ED / HL (cm)		Girth (cm)	
	Type A	Type B	Type A	Type B	Type A	Type B	Type A	Type B	Type A	Type B	Type A	Type B
15.1-20.0	19.5± 1.55	18.5± 0.88	15.5± 1.22	14.5± 0.45	16.5± 0.66	15.0± 0.15	4.3± 0.44	4.0± 0.12	0.98± 0.33	0.80± 0.11	12.0± 1.22	13.0± 1.85
20.1-25.0	22.4± 2.05	21.3± 1.8	18.1± 1.55	17.1± 1.25	19.0± 1.00	18.0± 0.88	5.0± 0.55	5.1± 0.25	1.0± 0.22	0.90± 0.11	14.6± 1.66	15.3± 1.55
25.1-30.0	28.0± 1.90	27.0± 1.55	22.2± 1.33	21.5± 1.20	23.5± 1.88	23.0± 1.22	6.1± 0.80	5.3± 0.60	1.1± 0.55	1.0± 0.25	18.0± 1.88	19.5± 1.90
30.1-35.0	32.1± 2.10	33.4± 1.55	26.0± 1.88	27.0± 1.55	27.5± 1.33	28.5± 1.15	7.3± 0.65	5.5± 0.33	1.2± 0.44	1.0± 0.22	19.2± 1.89	20.4± 1.88
35.1-40.0	38.1± 1.90	-	31.3± 1.55	-	33.5± 1.34	-	9.0± 0.44	-	2.0± 0.45	-	26.5± 1.55	-
40.1-45.0	41.3± 2.10	-	34.0± 1.88	-	35.5± 1.20	-	10.0± 0.33	-	2.0± 0.45	-	28.5± 1.90	-

45.1-50.0	48.0± 1.89	-	38.0± 1.33	-	40.0± 1.35	-	10.5± 0.45	-	2.0± 0.35	-	31.5± 1.66	-
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Abbreviations used: ED, eye diameter; FL, fork length; HL, head length; SL, standard length; TL, total length.

Table II.- Comparison of meristic counts of two types A and B of *Tenualosa ilisha* (Hamilton) from River Indus (during summer and winter).

Meristic characters	Type A		Type B	
	Range	Mean	Range	Mean
Total number of scutes	30-32	31±0.50	31-33	32±2.0
Pre-pelvic scutes	16-17	16.5±0.25	17-19	18±1.0
Post-pelvic scutes	14-15	14.5±0.25	15-17	16±1.0
Dorsal fin rays	17-19	18±1.0	18-20	19±1.0
Pectoral fin rays	15-16	14±1.0	14-15	13±1.0
Pelvic rays	7-9	8±1.0	8-10	9±1.0
Anal fin rays	18-22	20±2.0	19-23	21±1.0

Table III.- Comparative data on length-weight relationship of two types A and B of *Tenualosa ilisha* (Hamilton) from River Indus.

Length groups (mm)	Male Type A		Female Type A		Male Type B		Female Type B	
	Mean length (mm)	Mean weight (g)	Mean length (mm)	Mean weight (g)	Mean length (mm)	Mean weight (g)	Mean length (mm)	Mean weight (g)
101-150	140	45.0	142	50.0	147	32.5	--	--
151-200	197	132.1	193	139.2	179	55.1	190	85.1
201-250	234	209.2	241	265.0	234	138.2	232	160.6
251-300	292	387.0	275	416.3	275	204.6	271	228.6
301-350	317	535.4	345	786.0	310	266.9	340	365.2
351-400	370	875.1	371	975.5	--	--	--	--
401-450	426	1356.0	433	1587.0	--	-	--	--
451-500	-	-	469	1970.2	--	-	--	--

The values of regression coefficient "b" for both males and females were significantly ($p < 0.05$) different from each other during summer and winter and in type A and B. These values also indicated that the growth of *T. ilisha* during different seasons from River Indus were of isometric type. Data on length and weight of both types (A and B) of *T. ilisha* from River Indus is presented in Table III.

Condition factor

Relative condition factor Kn (Ponderal Index) was calculated for males and females of both types (Table IV). Relative condition factor was calculated with the help of calculated weight and empirical weights for both the types of *T. ilisha*. The mean values of Kn were 1.01 and 1.0 for male and female respectively in type A while 1.06 and 1.02 for males and females, respectively in type B. On average, the

males of both the types are slightly in a better (Mean Kn = 1.01 and 1.06 for type A and B) condition than female (Mean Kn = 1.0 and 1.02 for type A and B).

Gonadosomatic index

Values of gonadosomatic index (GSI) for male and female of two types (A and B) of *T. ilisha* from River Indus were recorded for six months during summer from April to September and in winter from October to March (Table V). It was observed that in the females of both types (A and B) GSI values were higher in July and February 17.33 and 17.30, respectively. In summer an increasing trend in GSI values were recorded in males and females from June to August with a peak in July, while in case of winter *T. ilisha* the GSI values were increasing from January to March with peak in February.

DISCUSSION

The information on morphometric measurements of fishes and the study of statistical

relationship among them are essential for taxonomic work (McConnel, 1978). Moreover, to know the

Table IV.- Comparison of mean values of relative condition factor (Kn) of type A and B of *Tenualosa ilisha* (Hamilton) from River Indus at different size groups.

Length groups (mm)	Male Type A			Female Type A			Male Type B			Female Type B		
	Empi wt.	Calc. wt.	Kn	Empi wt.	Calc. wt.	Kn	Empi wt.	Calc. wt.	Kn	Empi wt.	Calc. wt.	Kn
101-150	45.0	45.0	1.0	50.0	53.0	0.94	32.5	21.3	1.52	--	--	--
151-200	132.1	126	1.05	139.2	135	1.02	55.1	47.8	1.15	85.1	64.5	1.31
201-250	209.2	213	0.99	265.0	265	1.0	138.2	125.9	1.09	160.6	141.2	1.13
251-300	387.0	416	0.94	416.3	396	1.06	204.6	229.0	0.89	228.6	263.0	0.68
301-350	535.4	534	1.0	786.0	788	0.99	266.9	389.0	0.68	365.2	430.2	0.79
351-400	875.1	853	1.03	975.5	982	0.99	--	-	--	--	--	--
401-450	1356	1307	1.04	1587	1570	1.02	-	-	-	-	-	-
451-500	--	--	--	1970	2001	0.99	--	-	--	--	--	--
	Mean Kn = 1.01			Mean Kn = 1.0			Mean Kn = 1.06			Mean Kn = 1.02		

Table V.- Comparison of gonadosomatic index values (GSI) of two types A and B of *Tenualosa ilisha* (Hamilton) from River Indus during summer and winter.

Months	Type A				Months	Type B			
	No. of females	GSI % in female	No. of males	GSI % in male		No. of females	GSI % in female	No. of males	GSI % in male
April	5	2.66	12	0.90	Oct	5	1.89	10	0.90
May	5	6.26	10	1.26	Nov	5	2.30	10	1.0
June	4	11.29	12	1.35	Dec	6	3.44	12	1.12
July	4	17.33	12	1.90	Jan	8	16.52	8	1.80
August	5	16.37	12	1.90	Feb	12	17.30	14	1.90
September	5	1.44	10	0.68	Mar	10	17.0	16	2.0

origin of stock, separation of stocks or identification of commercially important species of fishes, morphometric characters are frequently used (Godsil, 1948; Schaffer, 1948; Pillay, 1957; Royce, 1963; Kramholz and Cavanah, 1968). During the year round sampling in the present study, it was noticed that two separate populations of palla, *T. ilisha* exist one in summer and other during winter. The importance of determining the identity of *Tenualosa ilisha* populations in the investigation had been first emphasized by the Indo-Pacific Fisheries Council (IPFC, 1951). Following that initiative many studies have been done in India and Bangladesh, but so far no report is available on population identity of this species in Pakistan.

Earlier, comparative studies of this population have been carried out by various workers. Pillay (1954) compared populations between the River Hooghly and Chilka Lake. Pillay *et al.* (1962) reported *T. ilisha* population from the important rivers and coastal areas supporting this fishery in India and stated that the River Ganges had at least two populations represented by samples studied from Allahabad and Buxar. Gosh *et al.* (1968) identified three varieties, denoted as sub-populations (slender, broad and broader) from a part of the Gangetic system between Allahabad and Buxar. While Quddus *et al.* (1984a,b) reported meristic and morphometric difference between two types and comparison of age and growth of two types of *T.*

ilisha from Bangladesh waters. The present study from River Indus supports the findings from India and Bangladesh. The values of the length-weight regression co-efficient "b" obtained for male and female (3.03 and 3.08) in summer and (3.81 and 3.83) in winter for type A and B, respectively, in the present study. These values were significantly different in summer and winter season but within the range (2.0 to 4.0) as reported by Tesch (1968). In the present study, it was observed from the GSI values (17.33 and 17.30 in summer and winter respectively) that fish has two different breeding seasons. Similar observations have been reported by Shaft *et al.* (1978) from Bangladesh, Pillay (1958) and Mathur (1964) from India. The observations in the present study agreed with the finding that at least two types are found in Bangladesh and India and confirmed the distinguishable characters such as dorsal, pectoral, pelvic and anal fin ray counts, head length, eye diameter and girth of the body (Quddus *et al.*, 1984a). These two types also differ in spawning season and in length-weight relationship.

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