



Length-Weight Relationship and Condition Factor of *Notopterus notopterus* (Pallas, 1769) from Manchar Lake Sindh, Pakistan

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Received 29th April 2014 and Revised 24th July 2015

Abstract: *Notopterus notopterus* is commercially important fish and having enormous potential for its nutritive and therapeutic qualities. No attempt has yet been made to determine length-weight relationships in Pakistan. Present study describes the length-weight relationships (LWRs) for *N. notopterus* from Manchar Lake Sindh, Pakistan for the first time. Fish samples were collected from August 2011 to July 2013 at Manchar Lake District Jamshoro Sindh, Pakistan. A total of 309 specimens (162 males and 147 females) were collected randomly which ranged between 10-30 cm in Total Length (TL) and weight 16.5- 290 g. Length-weight relationship equation was calculated as $\text{Log } W = 0.0101L^{3.0069}$ (combined population) $\text{Log } W = 0.0100L^{3.0069}$ (male population) and $\text{Log } W = 0.0101L^{3.0066}$ (female population). The relative condition factor (Kn) values ranged for combined population 0.86 -1.31 (Mean 1.0101 ± 0.15), for male 0.87- 1.29 (Mean 1.0100 ± 0.15) and females 0.85 - 1.33 (Mean 1.0100 ± 0.15). The Length-weight relationship and condition factor shows that the growth of *N. notopterus* is isometric and satisfactory. This is the first report on length-weight relationships and condition factor of *N. notopterus* from Pakistan.

Keywords: *Notopterus Notopterus*, Manchar Lake, Condition factor, Pakistan

1. INTRODUCTION

Notopterus notopterus (Osteoglossiformes, Notopteridae) commonly known as bronze featherback, found in clear streams and enters in brackish waters (Talwar and Jhingran, 1991) and floodplains (Rainboth, 1996). It feeds on insects, fish, crustaceans and some young roots of aquatic plants (Rainboth, 1996; Ukkatawewat, 1984). This fish is eaten both fresh and dried form. It is of high economic importance food fish in South and Southeast Asia, Borneo and Sumatra. This fish has enormous potential for high productivity and is important for its nutritive and therapeutic qualities. No study on length-weight relationship and condition factor of *N. notopterus* in Pakistan is so far available.

The length-weight relationship is essential to establish growth equation in production and to know if the fishes maintain a constant body shape throughout their lifespan. Length-weight relationship is helpful in conversion of growth in weight and growth in length equation to determine the estimation of biomass from length observations and stock assessment models (Weatherley and Gill, 1987; Wootton, 1990; Moutopoulos and Stergiou, 2002).

The aim of present study is to investigate the length-weight relationship of *Notopterus notopterus* from Manchar Lake Sindh, Pakistan.

2. MATERIALS AND METHODS

Collection: Fish samples were collected monthly from August 2011 to July 2013 from the catch of fishermen at Manchar Lake (District Jamshoro).

Number, size and weight: The fish sample comprised of a total number of 309 specimens (162 male and 147 female), ranging in size from 10-29 cm (males) and 10-30 cm (females). The weight ranged 16.5-280 g and 16.9-290 g in males and females, respectively were used for the analysis.

Weight and Measurement: Fish were blotted dry on paper towels and weigh to the nearest 0.01 g on an electronic digital balance (Chyo MP-3000). Body length measurements were made to the nearest 0.1 cm using a Perspex measuring tray.

LWRs and Kn factor: The length weight relationship was calculated from the LW equation given by Le Cren (1951) $W = a L^b$, where W indicates weight of fish (g), whereas L shows total length of fish (cm), body form coefficient is *a* while exponent *b* is an indicator of isometric growth when 3.0. The values *a* and *b* are calculated through a log transformed equation, $\text{Log } W = \log a + b \log L$. The weight W, was calculated as per equation given above for each length group. Relative condition factor (Kn) was estimated according to Le Cren (1951) $\text{Kn} = W/a L^b$ which can also be expressed

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as $K_n = W/\hat{W}$, where W is observed weight and \hat{W} is calculated weight. Relative condition factor (K_n) calculated separately for males, females and combined population for each 2 cm length intervals.

3. RESULTS

Length-weight relationship:

The length frequency distribution (males) ranged between 10-29 cm. The male length-weight relationship is expressed (Table 1, 2) by the regression equation $\text{Log } W = 0.0100L^{3.0069}$. Female length frequency distribution on the other hand ranged between 10-30 cm. The female length-weight relationship is expressed by the regression equation

$\text{Log } W = 0.0101 L^{3.0066}$. The combined Length-weight relationship is expressed by the equation $\text{Log } W = 0.0101L^{3.0069}$.

Relative condition factor:

The formula given by Le Cren (1951) was used to calculate the relative condition factor (K_n).

$$K_n = W / a L^b$$

This can be expressed as $K_n = W/\hat{W}$

Where,

W = observed weight

\hat{W} = calculated weight as determined from length-weight equations

The relative condition factor (K_n) was computed for males, females and combined (Table 3). It ranged from 0.87- 1.29 (Mean 1.0100 ± 0.15) in males, 0.85 – 1.33 (Mean 1.0100 ± 0.15) in females and 0.86-1.31 (SD± 0.15 Mean 1.0101) in combined population. The graphical presentation of LWRs is shown in (Fig. 1, 2 and 3).

4. DISCUSSION

The Length-weight relationship of *N. notopterus* for male, female and combined sexes are presented in tables 1, 2 and 3. In present study the values b were computed 3.0069 for males, 3.0066 for females and 3.0069 for combined population. These results show isometric

growth in both sexes of *N. notopterus*. Similar findings were reported by Kalita and Rath (1996) in male *N. notopterus* also showed isometric growth ($b= 3.0$) from India.

The fish grows isometrically, when the specific gravity of a fish remains unchanged and holds the same form during its life time and the value of b , would be exactly 3 (Wootton,1990). Our results show isometric growth in *N. notopterus*. In Manchar Lake growth in *Wallago attu* and *Oreochromis mossambicus* was also found isometric (Achakzai et al., 2013a, b) also reported. On contrary slightly different results were achieved by Kiran et al., (2004) reported positive allometric growth in male *N. notopterus* ($b= 3.2721$) while negative allometric growth in female *N. notopterus* ($b= 2.8483$) from Janna pur India. Sani et al., (2010) reported negative allometric in *N. notopterus* ($b=2.99$) for both sexes. Parameswaran and Sinha (1966) recorded maximum length of 40 cm in *N. notopterus* whereas in the present study the maximum length recorded for female *N. notopterus* was 30 cm. Hamza (1980) reported linear relationship in *N. notopterus* with length ranging from 13-35 weight 14-400 g. In present study, the LWRs ranged from log 1.00 to 1.47cm while weight ranged from log W 1.21 to 2.46 g, showed linear relationship indicating that when length increases the corresponding weight also increases proportionally.

The relative condition factor (K_n) showed variations in all 10 size groups. The lowest K_n values were recorded in large fish groups while highest K_n values in smaller fish. Similar results were achieved by Shafi and Quddus (1974) in *Catla catla* from Bangladesh and Achakzai et al., (2013b) in *Oreochromis mossambicus* from Manchar Lake Pakistan. This is first study conducted on length-weight relationships and condition factor of *N. notopterus* from Manchar Lake, Sindh, Pakistan.

Table 1. Descriptive statistics and estimated parameters of length-weight relationships (LWRs) of *N. notopterus* Male (M), Female (F) and Combined sexes (C) during August 2011 to July 2013.

Sex	<i>n</i>	Length range (cm)	Weight range (g)	<i>a</i>	95% CL	<i>b</i>	95% CL	<i>r</i> ²		
M	162	10-29	16.5-280	0.0100	0.0104	0.0173	3.0085	2.8042	2.9851	0.962
F	147	10-30	16.9-290	0.0101	0.0099	0.0178	3.0067	2.7933	3.0004	0.955
C	309	10-30	16.5 -290	0.0101	0.0110	0.0162	3.0070	2.8278	2.9637	0.958

Table 2. Length-weight relationship of *N. notopterus* in different size groups during August 2011 to July 2013.

Length Groups (cm)	Male			Female			Combined sexes		
	n	Length (cm)Mean±SD	Mean weigh (g)	n	Length (cm)Mean±SD	Mean weigh (g)	n	Length (cm)Mean±SD	Mean weigh (g)
10.1-12	19	10.9±0.71	17.7	17	10.9±0.66	18.1	36	10.9±0.68	17.1
12.1-14	33	13.3±0.57	22.8	36	13.3±0.58	22.6	69	13.3±0.57	22.7
14.1-16	31	15.1±0.58	31.1	24	15.1±0.56	30.3	55	15.1±0.57	30.8
16.1-18	31	17.1±0.53	49.5	26	17.2±0.62	49	57	17.1±0.57	49.3
18.1-20	8	19.0±0.71	62.4	10	19.2±0.75	63.4	18	19.1±0.72	62.9
20.1-22	14	21.4±0.51	88.2	12	21.5±0.50	97.9	26	21.4±0.50	91.3
22.1-24	5	23.7±0.43	124.2	4	23.7±0.48	127	9	23.7±0.43	125.4
24.1-26	10	25.3±0.58	172.9	8	25.5±0.54	175	18	25.4±0.56	174
26.1-28	7	27.2±0.57	255.1	6	27.2±0.52	253	13	27.2±0.52	254.1
28.1-30	4	28.8±0.28	279	4	29.1±0.62	284	8	29.0±0.50	282
Total	162			147			309		

Table 3. Relative condition factor (Kn) for male, female and combined sexes in *N. notopterus* at different size groups during August 2011 to July 2013.

Length groups (cm)	Male			Female			Combined sexes		
	Observed weight(g)	Calculated weight(g)	Kn	Observed weight(g)	Calculated weight(g)	Kn	Observed weight(g)	Calculated weight(g)	Kn
10.1-12	17.7	13.63	1.29	18.1	13.62	1.33	17.9	13.63	1.31
12.1-14	22.8	24.18	0.94	22.6	24.29	0.93	22.7	24.24	0.93
14.1-16	31.1	35.52	0.87	30.3	35.39	0.85	30.8	35.46	0.86
16.1-18	49.5	51.71	0.95	49	52.4	0.93	49.3	52.02	0.94
18.1-20	62.4	71.24	0.87	63.4	73.4	0.86	62.9	72.42	0.86
20.1-22	88.2	101.29	0.87	97.9	102.98	0.92	91.3	102.04	0.89
22.1-24	124.2	138.83	0.89	127	137.83	0.92	125	138.33	0.9
24.1-26	172.9	167.28	1.03	175.2	171.98	1.01	174	169.29	1.02
26.1-28	255.1	209.65	1.21	253	209.04	1.21	254	209.27	1.21
28.1-30	279	247.19	1.12	283	255.34	1.11	282	252.02	1.11
Mean Kn			1.0100			1.0102			1.0100

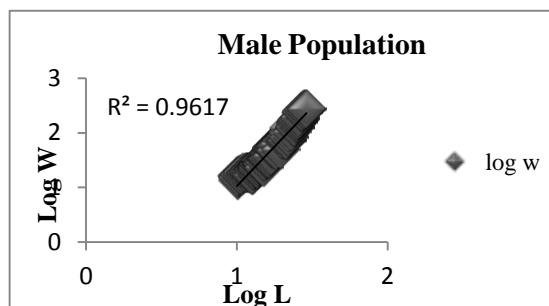


Fig. 1. Plot of values of logarithmic LWR of male *N. notopterus* .

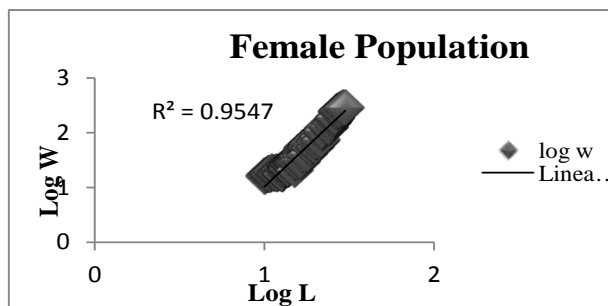


Figure 2. Plot of values of logarithmic LWR of female *N. notopterus*.

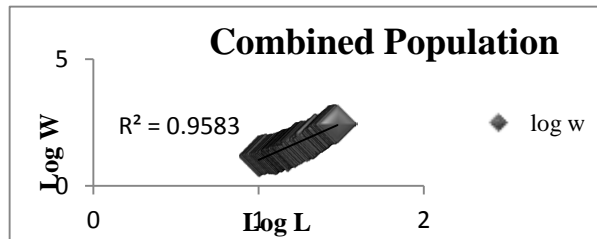


Fig. 3. Plot of values of logarithmic LWR of Mixed Population of *N. notopterus*.

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