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SIZE DISTRIBUTION AND LENGTH WEIGHT RELATIONSHIP IN COMMERCIALLY IMPORTANT FISH *SILLAGO SIHAMA* (FORSSKAL, 1775) (FAMILY: SILLAGINIDAE) FROM KARACHI COAST, PAKISTAN

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ABSTRACT

Length weight relationship and Size distribution are presented for 522 specimens of *Sillago sihama* (Forrskal, 1775) (Family: Sillaginidae) collected fortnightly from commercial landings at Korangi Creek (Ibrahim Hydari) and Karachi Fish Harbor during the period from September 2003 to January 2005. Length weight relationship of males and females computed separately and also pooled. The logarithmic weight and length relationship showed a straight line pattern. A high percentage of length frequency found during the spawning months. Length frequency was most prominent between size ranges from 160-169 mm T.L.

KEYWORDS: Length-weight relationship, Length frequency distribution, *Sillago sihama,* Karachi coast.

INTRODUCTION

Sillago sihama (Forsskal, 1775) commonly known as 'silver whiting' or 'lady fish'. Fish length weight relationships are basic biological parameters which have been use in stock assessment (Garcia-Arteaga *et al*., 1997).

The work on length weight relationship which is an important information for fisheries management, has been reported by Abbas (2000), Ali (1979), Hussain *et al*., (1992), Khan and Hoda (1999), Nehemia (2012), Papageorgious (1979) and Salam and Mahmood (1993).

Length weight relationship provides indication for degrees of stabilization of taxonomic characteristics in fish species and is useful in fish population exploitation and management. Length weight relationship provide a means of converting measurements of length and weight. It can be indication of some important events in the life history of the fishes such as maturity and growth (Khan and Hoda, 1999). Length weight relationship is helpful in assessing experimental improvements of an environment for existing and new stocks of fish.

Size distributions help to work out growth rate of fish. Length frequency distributions with time help to analyze some useful parameters in the study of population dynamics.

This study provides length weight relationship and length frequency distribution data of *Sillago sihama* (Forsskal, 1775) from Karachi coast and it could be helpful in stock management of this palatable specie.

MATERIAL AND METHODS

Random samples of the fish '*Sillago sihama'* drawn fortnightly from the commercial landings at Korangi Creek (Ibrahim Hydari) during the period of September 2003 to January 2005. After sorting, the fish samples were freeze for further detailed study.

The length weight relationship originally described by Meek (1903) was a description of the Cube Law: $W= a L^3$. Where W is the weight, L is the length and a constant. The individual of a species may change shape as they grow and become heavier for a given length is one season then others. Therefore the equation is modified: $W= a L^b$ Where W is weight, L is length and b is an exponent usually ranges between 2.5-4.0; for an ideal fish maintaining the same shape, b =3.0 (Wootton, 1990; Salam & Mahmood, 1993).

Total length of the fish measured up to nearest mm and grouped at 10 mm intervals, with the midpoint representing the particular size group. The data collected were pooled month wise and the size frequency distribution presented in terms of percentage.

Length weight relationship were calculated after LeCren (1951) according to the equation, Log W= log a + b log L (The logarithmic form of $W= a L^b$)

Length frequency studies based on random samples of whiting collected regularly from September 2003 to January 2005. Length frequency data based on total length measurements of almost all the specimens in the catches.

RESULT

A total of 277 male and 245 female fishes ranging 103-271 mm in total length taken for this study. Males, females treated separately, and the relevant details given in Table 1. Male and female did not differ significantly. The entire length weight data pooled into a single equation:

$$\text{Log } W = -5.3799 + 3.1073 \log TL, \; r = 0.966$$

Table 1. Length and weight of *Sillago sihama* from Karachi Coast in different months.

Month	Sex	N	T.L(mm) Range (Min-Max)	Mean T.L (mm)	Wt.(g) Range (Min-Max)	Mean Wt (g)
Sep. 03	M	4	165-225	189.25	34-64	44.00
	F	29	171-256	208.24	38-134	70.13
Oct. 03	M	3	150-170	161.66	24-38	30.66
	F	29	162-249	191.51	24-104	49.48
Nov. 03	M	15	112-198	141.26	09-64	22.93
	F	6	139-185	170.00	18-45	35.66
Dec. 03	M	14	153-182	162.07	26-46	32.28
	F	17	157-186	166.52	28-54	34.29
Jan. 04	M	16	156-178	165.43	28-46	35.25
	F	15	167-187	176.00	34-56	43.73
Feb. 04	M	12	160-238	209.25	30-87	71.25
	F	17	163-249	211.76	30-124	78.70
Mar. 04	M	18	105-192	140.22	07-46	21.88
	F	8	135-175	160.37	18-45	33.25
Apr. 04	M	19	103-190	142.31	06-46	21.05
	F	15	141-250	198.73	20-122	62.13
May. 04	M	12	141-175	156.50	22-36	28.83
	F	19	150-208	178.21	24-74	43.73
Jun. 04	M	17	145-191	165.76	20-50	32.70
	F	13	149-173	161.38	24-40	30.92
Aug. 04	M	18	152-230	194.66	24-79	52.16
	F	14	169-241	203.07	32-100	59.00
Sep. 04	M	13	143-195	169.92	20-54	34.30
	F	24	177-271	210.29	36-168	71.08
Oct. 04	M	37	110-173	147.89	8-36	22.81
	F	9	138-187	176.33	19-52	41.44
Nov. 04	M	19	156-208	186.78	26-76	50.63
	F	10	179-210	194.20	42-76	57.20
Dec. 04	M	42	140-217	174.83	20-79	40.64
	F	8	157-210	178.62	28-70	46.50
Jan. 05	M	18	157-219	174.55	28-80	41.00
	F	12	154-209	181.66	28-64	46.16
Total	M	277	103-238	167.64	6-87	36.39
	F	245	135-271	185.43	18-168	50.21

Table 2. Length-weight relationships in *Sillago sihama.*

Sex	N	T.L(mm) range	Wt.(g) range	a	b	S.E (a)	S.E (b)	r^2
Male	277	103-238	6-89	-5.34176	3.08953	0.00413	0.0130	0.966
Female	245	135-271	18-168	-5.38084	3.10844	0.00367	0.0117	0.944
Pooled	522	103-271	6-168	-5.37979	3.10731	0.00308	0.0097	0.966

Analysis of covariance patterned after Snedecor (1955) showed in Table 2 representing Total Length range and Body Weight range. Value of b is 3.089 for male and 3.108 for female, which shows male were more significant than female (Table 2).

When the average weight of different size groups of fishes plotted against the average length of corresponding size groups a parabolic curve obtained. It is because weight increase as a power of length, the graph assumes a parabolic curve.

The logarithms of the grouped lengths and weights of the female, male and combined or pooled were plotted a graph and it was seen that the points for all of the three groups lay on the same straight line (Fig. 1). There was no noticeable change in slope beyond any point leading to the conclusion that there was no marked difference in the length weight relationship of the fish in three groups. There is no sexual dimorphism in the length weight relationship of the species and the relationship does not change perceptibility during the growth of the fish.

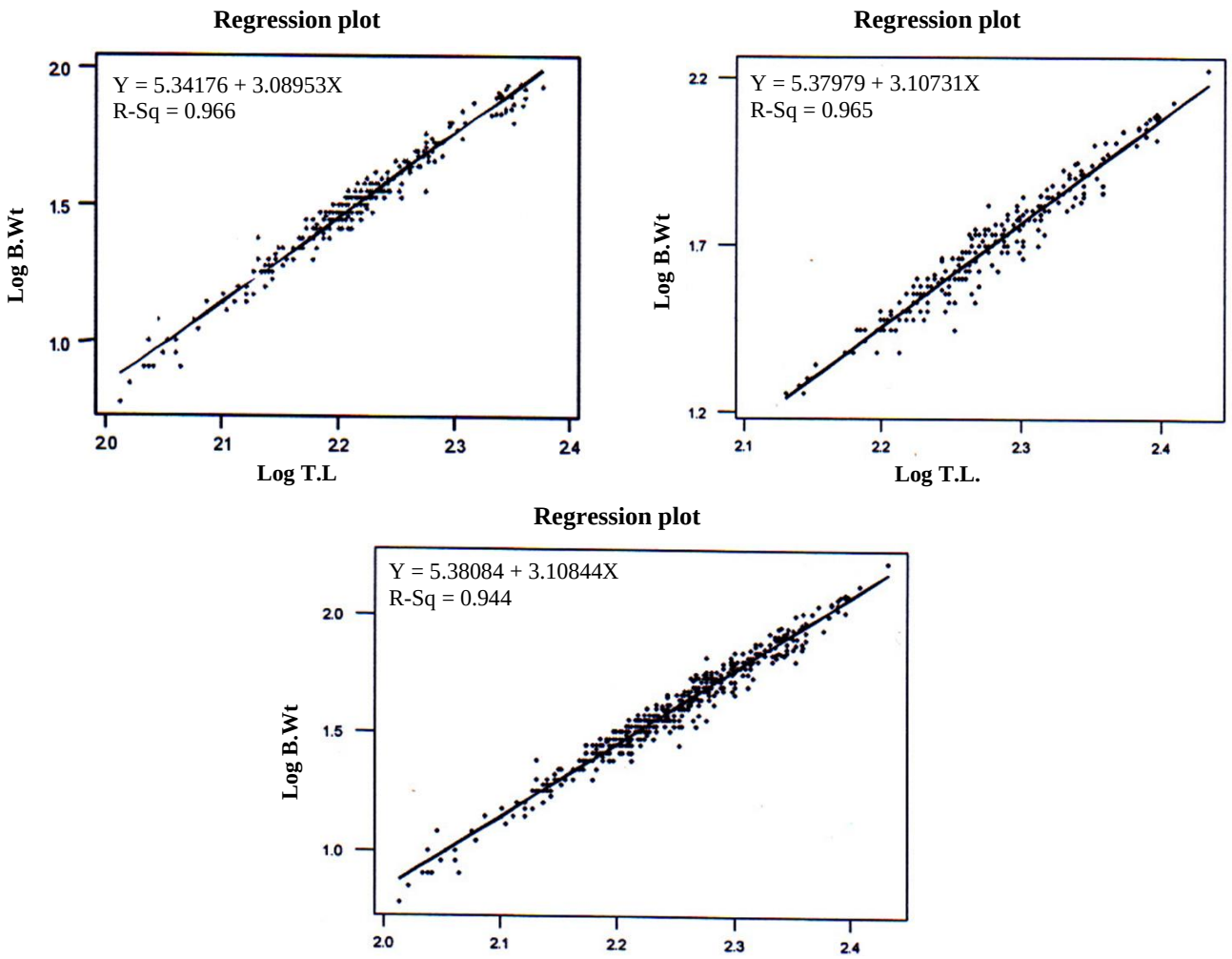

Fig. 1. Log-log length weight relationship (a) male; (b) female and (c) combine.

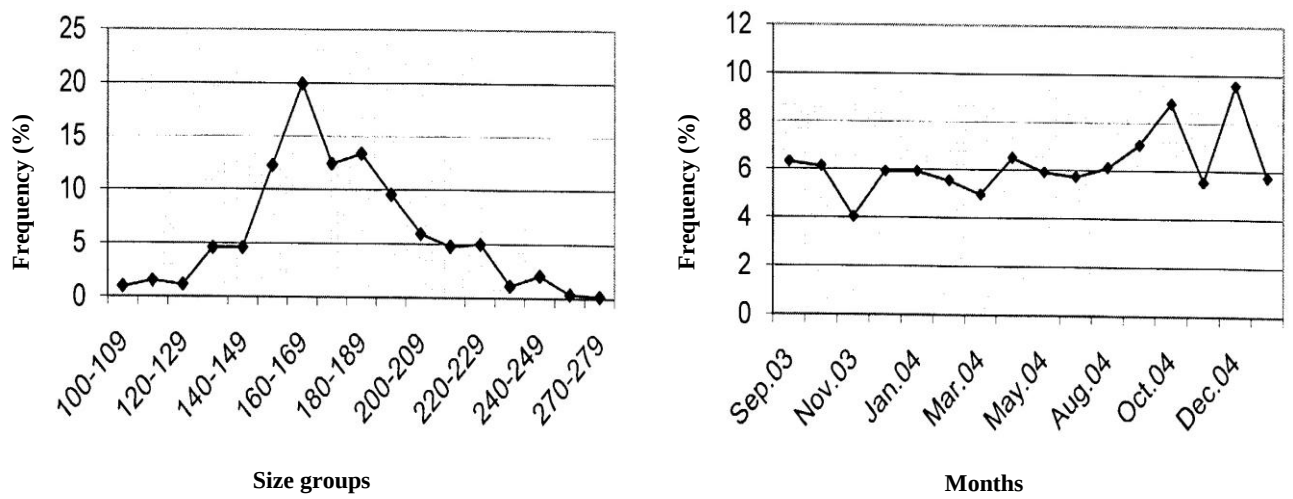

Fig. 2. (a) Frequency distribution of Length of *Sillago sihama* in different size groups of 522 specimens collected during Sept 2003 to Dec 2004. (b) Frequency distribution of Length of *Sillago sihama* in different months.

The significance of the expected "Cube Law" was tested by't' Test ($t= 3\text{-}b / SE^b$). The value for male and female are 6.886 and 9.268 respectively, which are significant ($p<0.05$). The t value in combination with length weight relationship is 11.062 which is also significantly different from 3 ($p<0.01$) showing that the cube law does not hold for *Sillago sihama.*

Length frequency distribution in different months given in Table 3. Figure 2 shows that percentage of length frequency is higher during the months from August to December which shows the spawning season as the larger fish attain sexual maturity. The dominant size groups seemed to be 150–159 mm T.L to 210–219 mm T.L.

Table 3. Frequency (%) distribution of Length (mm) of *Sillago sihama* in different size groups of monthly collections.

Size range (mm)	Sep. 03	Oct. 03	Nov. 03	Dec. 03	Jan. 04	Feb. 04	Mar. 04	Apr. 04	May 04	Jun. 04	Aug. 04	Sep. 04	Oct. 04	Nov. 04	Dec. 04	Jan. 05
100-109							11.5	5.88								
110-119			19.0				3.84	2.94					4.34			
120-129			9.52				3.84	5.88					2.17			
130-139			14.2				23.0	20.5					17.3			
140-149			14.2				11.5	8.82	12.9	6.66		5.40	13.0		2.0	
150-159		3.12	4.76	35.4	6.45		11.5	5.88	25.8	30.0	9.37		32.6	3.44	10.0	10.0
160-169	3.03	9.37	9.52	41.9	54.8	13.7	19.2	2.94	19.3	33.3	12.5	13.5	10.8	3.44	28.0	43.3
170-179	9.09	21.8	9.52	12.9	19.3	3.44	7.69	5.88	9.67	23.3	9.37	8.10	8.69	10.3	24.0	10.0
180-189	15.1	15.6	14.2	9.67	19.3	17.2	3.84	8.82	12.9	3.33	3.12	10.8	10.8	34.4	22.0	10.0
190-199	15.1	31.2	4.76			6.89	3.84	8.82	9.67	3.33	6.25	16.2		34.4	8.00	6.66
200-209	3.03	9.37						8.82	9.67		15.6	21.6		10.3	2.00	13.3
210-219	27.2	3.12				10.3		2.94			15.6	2.70		3.44	4.00	6.66
220-229	21.2	3.12				13.7		5.88			21.8	13.5				
230-239						6.89		2.94			3.12	5.40				
240-249	3.03	3.12				27.5					3.12					
250-259	3.03							2.94								
260-269																
270-279												2.70				

DISCUSSION

Allen (1938) recorded that for all ideal fish which maintain the same shape, the value for the exponent has been found to be 3 (Table 2). Fishes up to 6cm in length increase in weight at a lesser rate than the subsequent size group. Values of increasing weight are uniform up to 12 cm length above which there is a noticeable variation. In fish, the weight considered to be a function of length. According to Wootton (1990) if the fish retains the same shape and its specific gravity remains unchanged during its life time, it is growing isometrically and the value of the length exponent b would be exactly 3.0. A value less than 3.0 shows that the fish becomes heavier for its length as it increases in size (Salam and Mahmood, 1993). Significant departure of the exponent of length weight relationship from 3.0 may be attribute to the peculiar shape and the asymmetrical nature of the body of the fish. Ahmed *et al*. (2015), Khan and Hoda (1999) and Soni, and Kumari (1979) also observed such deviations in different groups of fish.

In the length frequency data the length range of the collected specimens was from 100-279 mm T.L. Figure 2(a) shows most prominent mode at 160-169mm T.L. Figure 2(b) shows that large number of fish length 150-200 mm T.L from greater percentage of occurrence during October to January which suggests that *Sillago sihama* might spawn in October to January and in the following months February to June juveniles are present which are the outcome of previous spawning during October to January. In the present collection, largest specimen of male was 238 mm in Total Length and 87g in Weight and female 271 mm in Total Length along with 168g in Weight. This shows that the females grew to a bigger size than the males (Pajuelo & Lorenzo, 2000).

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