Pakistan Journal of Marine Sciences, Vol. 22(1&2), 15-21, 2013.

SEASONAL VARIATION IN LENGTH-WEIGHT RELATIONSHIP AND RELATIVE CONDITION OF *SARDINELLA GIBBOSA* OF BALOCHISTAN COAST

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ABSTRACT: The present study describes the length-weight relationships (LWR) as well as the condition factor of Sardine fish *Sardinella gibbosa* from the Balochistan Coast. The fishes were procured from fisherman during the months of August, 2009 to July, 2010. Log transformed regression was used to determine the growth of specimens (n=351). The regression coefficient 'b' of the relationship has a value b=3 which are when compared with an isometric slop b=3 show that growth of *Sardinella* is positively allometric. It was concluded that body proportion changes as fish grew in size. Results showed highest mean length of fish of 19.5±0.68 cm in winter season and lowest of 14.5±0.95 cm in spring. The highest and mean weight of 80±4.266 cm and 45.5±2.65 respectively, were recorded in spring. The condition factor (k) average to 1.29 ±0.18. The mean condition factor was highest in summer (mid May to mid September) 1.49±0.078 and lowest in summer (mid May to mid September) 1.05±0.007. The relationships between condition factor and log weight and condition factor and total length were highly significant.

KEYWORDS: Length-weight relationship, condition factor, *Sardinella gibbosa*, Balochistan Coast.

INTRODUCTION

Clupeidae is the family of the herrings, shads, sardines, hilsa and menhadens. It includes many of the most important food fishes in the world, belonging to 5 subfamilies, 64 genera and 745 species and constitute a very rich aquatic bio-diversity along the coast of Pakistan. (Froese and Pauly, 2006). The Sardines occur widely throughout the Indian subcontinent including Bangladesh, India and Pakistan (Froese and Pauly, 2008). They are also important commercial fishery all over the world which provides sufficient protein food for human beings in the form of fresh and canned products, for livestock and poultry as meal and the body oil for commercial industrial purposes (Froese and Pauly, 2006).

The relationship between body length and weight is useful in assessing the well – being of the individuals and in determining possible differences among different stocks of the same species (King, 2007). Condition factor compares the well being of a fish and is based on the hypothesis that heavier fish of a given length are better conditioned (Bagenal and Tesch, 1978). Therefore, condition factor has been used as an index of growth and feeding intensity (Fagade, 1979). It decreases with increase in length (Bakare, 1970) and also influences the reproductive cycle in fish (Welcome, 1979).

The length weight relationship of fish is an important fishery management tool. Its importance is pronounced in estimating the average weight at a given length group and in assessing the relative well being of a fish population (Beyer, 1987; Bolger and Connoly, 1989).

In the present study, an attempt has been made to estimate the length–weight relationship and condition factor (k value) of *Sardinella* from Balochistan Coast.

MATERIALS & METHODS

The present study was conducted in the water of Gawadar, Balochistan Coast .The sampling was carried out by Gill net (length- 19m, width- 3m and mesh size- 33mm) during August, 2009 to July, 2010. The Gill- net was operated once a month from a boat each haul was of 40-60 min. All the fish sample of *S. gibbosa* from the station were weighed separately. A total of 351 samples were collected during the study period. The total length of the fishes was measured to the nearest cm, from the tip of the snout to the tip of the caudal fin. The fishes were identified with the help of FAO identification sheets (Fischer and Bianchi, 1984) and the condition factor was calculated by the following formula

$K = 100W/L^3$

Where,

K =is condition factor

W=is body weight

L=is total length of the fish

The length-weight relationship was estimated by using the following allometric growth equation

$W = aL^b$

Where,

W= Weight of fish in (g)

L= Total Length (TL) of fish in (cm)

a= Constant (intercept)

b= The Length exponent (slope).

RESULTS & DISCUSSION

Length-weight relationship:

The length-weight relationship was calculated by the equation ($W=aL^b$). The calculated weight for the length groups according to equation demonstrated that the correlation (r) between length-weight relationships generally high in the each sample and in all season indicate strong connection between length-weight relationship. Although there were some differences between the mean weights that were calculated which were in the fishes of same length. From the statistical point of view, it was discovered the weight differences were insignificant between the fishes in all seasons and they displayed

a more or less similar growing pattern (Figure 1). As shown in Figure 1, the highest length was 20.5 cm and weight recorded was 87 gm, the lowest length was 13.5 cm and the lowest weight was 35 gm (Table 1). Length-weight relationships give information on the condition and growth patterns of fish (Bagenal and Tesch, 1978). Fish are said to exhibit isometric growth when length increases in equal proportions with body weight for constant specific gravity. The regression co-efficient for isometric growth is '3' and values greater or lesser than '3' indicate allometric growth (Gayanilo, F.C and D. Pauly, 1997).

Several authors have reported both isometric and allometric growth for different fish species from various water bodies. King, 1991 reported allometric growth patterns for *Tilapia* spp from Umuoseriche Lake, Nigeria. (King, R.P., 1996) reported isometric growth for *Pseudotolithus elongatus* from Qua Iboe Estuary. (Ekeng ., 1990 also found an isometric growth pattern for *Etmalosa fimbriata* from Cross River Estuary in Cross River State, Nigeria. (Marcus, 1984) obtained an isometric growth patterns for *E. fimbriata* from coastal and brackish water of Akwa Ibom State, Nigeria. (Shenouda *et al.*,1994) also observed an isometric growth pattern for *Chysichthys auratus* from the southern most parts of River Nile, Egypt. The log transformed length fitted over weight gave linear growth indicating the three dimensional growth structures of most fish species (Lagler *et al.*, 1977).

Table 1. Mean ±SD of Length- weight and condition factor of *Sardinella gibbosa* (n=351) collected from Balochistan coast during August 2009 to July 2010.

Size of classes (cm)	N	L (cm)	W(g)	K
13.5-16	146	15± 0.90451	50±7.534	1.476±0.075
16.5-18	95	17.5±0.6181	61±4.4777	1.221±0.0607
18.5-20.5	110	19.5±0.676	80±4.232	1.078±0.064
Total	351	16.5±2.143	60±14.52	1.2911±0.1893

The condition factor values which were calculated according to the length in the seasonal samples of *Sardinella gibbosa* are given in Tables 2-4. The mean condition factors (1.2911) and monthly condition factor ranged from 0.1893 obtained in this study varied slightly with the results earlier reported. As shown in Fig 2, the log transformed weight fitted over condition factor gave linear growth. (Ajayi, 1982) reported K=0.77 – 0.81 for *Clarotes filamentosus* in lake Oguta, Nigeria. Nwadiaro and Okorie, (1985) obtained K = 0.49-1.48 in Andoni River, Nigeria. The value recorded during the present study showed that all the species studied were in good condition. Gayanilo and Pauly, (1997) reported that certain factors often affect the well-being of a fish. These include data sorting into classes, sex, stages of maturity and contents of the stomach. The condition factor (K) reflects, through its variations, the physiological state of the fish in relation to its welfare, accumulation of fat and gonad development (Le cren, 1951). K also provides information for comparing different populations of fishes living in certain

feeding, density, climate, and other conditions. It also helps in determining the period of gonad maturation and also assessing the feeding activity of a species to verify whether it is making good use of its feeding source (Weatherley, 1972).

Table 2: Mean ±SD of Length- weight and condition factor of *Sardinella gibbosa* (n=351) collected from Balochistan coast in summer season during August 2009 to July 2010.

Size of classes (cm)	N	L (cm)	W(g)	K
13.5-16	40	15± 0.89	51±8.06	1.49±0.078
16.5-18	25	17.5±0.63	61±4.84	1.24±0.059
18.5-20.5	30	19.5±0.68	80±3.811	1.05±0.07
Total	95	16.5±2.16	60±14.55	1.29±0.19

Table 3: Mean ±SD of Length- weight and condition factor of *Sardinella gibbosa* (n=351) collected from Balochistan coast in spring season during August 2009 to July 2010.

Size of classes (cm)	N	L (cm)	W(g)	K
13.5-16	30	14.5± 0.953	45.5±2.657	1.48±0.0852
16.5-18	20	17.5±0.617	61±4.242	1.217±0.0619
18.5-20.5	25	19±0.743	80±4.829	1.121±0.079
Total	75	17±2.197	61±14.99	1.2416±0.1966

Table 4: Mean ±SD of Length- weight and condition factor of *Sardinella gibbosa* (n=351) collected from Balochistan coast in winter season during August 2009 to July 2010.

Size of classes (cm)	N	L (cm)	W(g)	K
13.5-16	36	14.75± 0.908	48±7.910	1.48±0.070
16.5-18	18	17±0.676	60±4.768	1.24±0.057
18.5-20.5	30	19.5±0.657	80±4.266	1.078±0.059
Total	84	16±2.25	58±15.3229	1.29±0.196

Table 5: Mean ±SD of Length- weight and condition factor of *Sardinella gibbosa* (n=351) collected from Balochistan coast in autumn season during August 2009 to July 2010.

Size of classes (cm)	N	L (cm)	W(g)	K
13.5-16	40	15± 0.89	50±7.86	1.48±0.069
16.5-18	32	17.5±0.58	61±4.83	1.217±0.659
18.5-20.5	25	19±0.687	80±3.76	1.121±0.076
Total	97	17±2.027	60±13.96	1.268±0.18

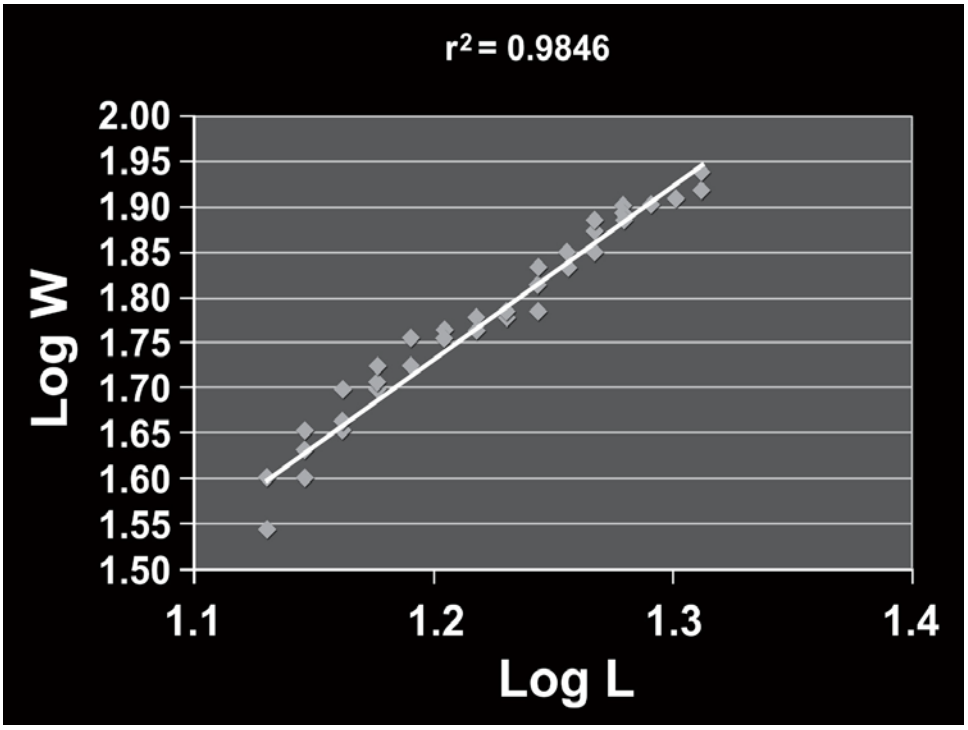

Fig. 1. Length- weight relationship between seasonal variation of TL and BW of *Sardinella gibbosa* fish.

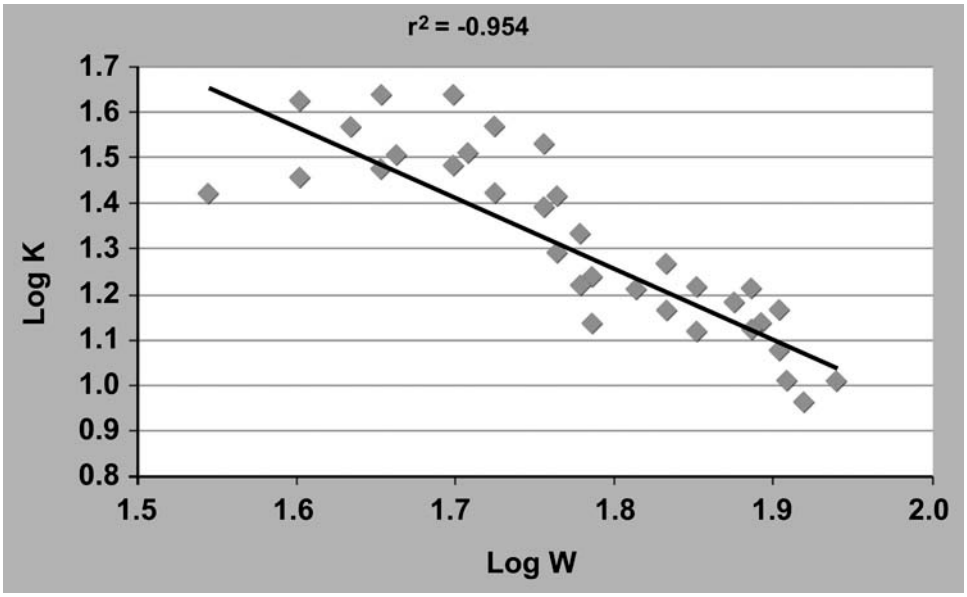

Fig. 2. Relationship between seasonal variation of (BW) and (K) of *Sardinella gibbosa*

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