LENGTH-WEIGHT RELATIONSHIPS IN THREE MARKETABLE SIZED MACKEREL FISH SPECIES COLLECTED FROM KARACHI FISH HARBOUR, PAKISTAN.

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Abstract

Fish is a source of highly nutritive protein and play an important role in food chain. Total 177 specimen of *Rastrelliger kanagurta*, 119 specimen of *Scomberomorus commerson*, and 108 specimen of *Scomberomorus guttatus* were collected from Karachi fish harbour during August, 2006 to December, 2008. The maximum mean length (24.17+0.28 cm) and mean weight (134.6±2.583 g) of *Rastrelliger kanagurta* were recorded during spring 2007-2008. In *Scomberomorus commerson* highest mean length (48.8±0.22 cm) and weight mean (726.15 +8.48 g) were measured during winter 2006-2007 and 2007-2008 respectively. The highest mean length of *Scomberomorus guttatus* (51.22±0.11 cm) and weight mean (701.9 ± 10.09) were recorded in during spring (2006-2007). Our result showed that *Rastrelliger kanagurta* fish estimated negative allometric growth because b values less then 3. Fish *Scomberomorus commerson*, *Scomberomorus guttatus*, showed positive and negative allometric growth because b value shows were larger b<3 or smaller b>3.

Introduction

The family Scombridae, the mackerels, tunas, and bonitos, some of the world's most popular food fishes. Scombrids are pelagic fishes living in tropical and subtropical seas however, some species move seasonally into temperate or cold waters. This family is also known as the fastest-swimming fishes in the world. Some, especially the smaller mackerels, remain near coastlines, while many others roam deeper waters. Mackerels are rounded and torpedo-shaped, with a slender, keeled tail base, a forked tail, and a row of small finlets behind the dorsal and anal fins. They are carnivorous fishes and feed on plankton, crustaceans, mollusks, fish eggs, and small fish. They remain in schools and swim actively in the upper 25–30 fathoms of the water in the warmer months and then descend to as deep as 100 fathoms during the winter. They spawn during the spring and early summer along coastlines. Mackerels are mostly caught by nets, rather than by angling.

Length-weight relationship (LWR) takes great importance in fishery assessments (Garcia *et al.,* 1998; Haimovici and Velasco, 2000). The length-weight relationship is very important for proper management and conservation of fish species (Anene, 2005). Measurement of the relationship between total length and body weight is also very much essential for taxonomic point of view (Pervin and Mortuza, 2008). The data also provideds help to estimate growth rates, age and other components of fish population dynamics (Kolher *et al.,* 1995). Length weight relationship allows fisheries researchers to develop stock assessment models (Morato *et al.,* 2001), to estimate biomass (Petrakis and Stergiou, 1995; Dulcic and Kraljevic, 1996), to compare life history and morphological aspects of populations inhabiting different regions ((Beyer, 1987; Bolger and Connoly, 1989; King, 1996a and b; Diaz *et.al.,* 2000; Stergiou and Moutopoulos, 2001) and to calculate fish condition (Petrakis and Stergiou, 1995).

The objective of this study was to calculate the length-weight relationship and frequency distribution of three mackerel species, i.e. *Rastrelliger kanagurta*, *Scomberomorus commerson*, and *Scomberomorus guttatus* collected from Karachi fish harbour during August, 2006 to December, 2008.

Materials and Methods

Sample collection: Three fish species *R. kanagurta*, *S. commerson*, and *S. guttatus* of various length (cm) and weight (g) were collected during August, 2006 to December, 2008 from the Karachi fish harbour. The fishe samples were collected seasonally and identified with the help of FAO guidelines (Fischer and Whitehead, 1974).

Length (cm) and Weight (g) measurement:
The length of the fish was measured from the tip of the anterior part of the mouth to the caudal fin in (cm). Fish weight was measured after blot drying with a piece of clean towel. Total length (TL) and body weight (W) in fresh samples were measured to the nearest 0.1 cm and 0.01 g, respectively.
The LWR was estimated following Ricker, (1973) equation,

$\mathbf{W= aL^b}$

Where, W=weight, L=Length, a= a constant equivalent to c, b= a constant to be determined empirically. The values of constant a and b were estimated from the log transformed data of length and weight i.e. log W = log a + b log L. Length and weight frequency distribution were plotted on individual fish length (cm) and weight (g). All data on LWR of different fish species were subjected to t-test analysis at P<0.001. The sample size, minimum and maximum lengths and weights, length-weight relationships, coefficient of determination (r^2), and growth type (isometric or allometric) were analyzed following.

Results and Discussion

A total 177 (43.81%) samples of *Rastrelliger kanagurta, 119* (29.45%) samples of *Scomberomorus commerson*, and 108 (26.73%) of *Scomberomorus guttatus* samples were collected from Karachi fish harbour during August, 2006 to December, 2008 (Table 1). This shows that *R.Kanagurta* was the most abundant species and ranked first while S.commerson and S. guttatus ranked second and third respectively.

Table 1. Yearly distribution of collection and relative frequency of Karachi fishes during 2006 to 2008 from Karachi fish harbour.

Year	*Rastrelliger kanagurta*	*Scomberomorus commerson*	*Scomberomorus guttatus*
2006 to 2007	86	61	51
2007 to 2008	91	58	57
Total	177 (43.81%)	119 (29.45%)	108 (26.73%)

Table 2 shows the results of ANOVA of three fish species *Rastrelliger kanagurta, Scomberomorus commerson* and *Scomberomorus guttatus*. *R.kanagurta* showed significant higher mean length 24.17± 0.28 and weigth 134.6±2.58 (p>0.01) in spring 2007-2008. However, no significant differences were found in mean length and weight in 2006-2007 among four seasons. In *S.commerson* significantly higher mean length 48.8±0.22 , 48.18±0.29 (p<0.01) and weigth 687.7±11.58 (p<0.05) and 726.15±8.48 (p<0.001) were found in winter 2006-2007 and 2007-2008 respectively while the lowest mean values of length and weight were found in spring. Though the inverse results were obtained in *S.gutatus* where the maximum mean length 51.22±0.16, 50.60±0.16 and weigth 701.9±10.09 and 692± 7.80 (p<0.001) were found significantly higher in spring 2006-2007 and 2007-2008 respectively. However, minimum mean values were recorded in summer.

Our results of length and weight were not similar with other authors may be due to different ecological environment. The mean length (68.9±7.4 cm) and weight (10.39±6.77 g) in *S.commerson*, (18.2±3.4 cm) and (0.20±0.05 g) in *R.kanagurta,* (43.1±6.9 cm) and (0.65±0.11 g) in *S.guttatus*, (54.6±3.4 cm) were reported by Khoshnood, *et al.,(* 2012) which were higher than our findings. While Kamaruzzaman *et al.,* (2010) provided range of length and weight *(*19.50-21.40 cm) and (87.30-106.52 g) in *R.kanagurta* which were slightly lower than our results. Shwafi, (2002) measured length and weight range of (22-30 cm) and (50-65 g) in *R.kanagurta,* (80-100 cm) and (250-500 g) in *S.commerson* from Red Sea of Yemen, (32-37 cm) and (70-65 g) in *R.kanagurta,* (80-90 cm) and (270-450 g) in *S.commerson* from Gulf of Aden. The minimum and maximum length and weight range (14-20 cm) and (50-100 g) in *R.kanagurta*, (30-42 cm) and (200-450 g) in *S.guttatus* fish was reported by (Alina, *et al.,* 2012). This may be due to internal environmental conditions as Blanchard et al., (2005) reported that the size (length and weigth) of fish species are primarily related with the change in the underlying structure of the foodweb.

The relationship between body length and weight (LWR) is of great importance in fishery biology (Gulland, 1983; Sparre *et al.,* 1989). The length-weight parameters of the same species may be different in the population because of feeding, reproduction and fishing activities. Length-weight relationship is important for fish stock assessment and parameters 'a' and 'b' can be used for length weight conversion. Allometric coefficient (b) larger or smaller than 3.0 shows an allometric growth, value b>3 shows a positive allometric growth, while value b<3 indicates a negative allometric growth. It is isometric growth when value b is equal to 3.0 (Bangenal and Tesch, 1978). Our result showed that *Rastrelliger kanagurta* fish estimated negative allometric growth because b values less then 3. Fish *Scomberomorus commerson*, *Scomberomorus guttatus,* showed positive and negative allometric growth both because b value shows b<3 or smaller b>3 during different years (Table 3).

Table 2. Analysis of variance and Duncas's multiple range test of three fish species during different seasons.

Fish Species	*Rastrelliger kanagurta*				*Scomberomorus commerson*				*Scomberomorus guttatus*			
Treatments	2006-2007		2007-2008		2006-2007		2007-2008		2006-2007		2007-2008	
	Length (cm)	Weight (g)	Length (cm)	Weight (g)	Length (cm)	Weight (g)	Length (cm)	Weight (g)	Length (cm)	Weight (g)	Length (cm)	Weight (g)
Autumn	23.83±0.49 a	131.05±6.30a	23.28±0.40 Ab	120.35±4.80 bc	47.93±0.08 b	660.1±14.20 b	47.71±0.17 Ab	691.25±4.89 b	50.46±0.20 a	670.9±9.69 b	49.62±0.12 b	676.1±4.81 a
Winter	23.27±0.30 a	127.3±3.50 a	22.55±0.22 B	115.6±3.03 ab	48.8±0.22 a	687.7±11.58 a	48.18±0.29 A	726.15±8.48 a	49.87±0.16 bc	671.9±5.81 b	49.38±0.14 b	657.1±2.86 b
Spring	23.27±0.40 a	128.8±4.0 a	24.17±0.28 A	134.6±2. 58 a	46.94±0.14 c	640.7±6.45 c	46.78±0.15 C	642.5±4.32 c	51.22±0.16 a	701.9±10.09 a	50.6±0.16 a	692±7.80 a
Summer	22.91±0.25 a	119.25±3.58a	23.90±0.31 A	127.8±2.90 ab	47.11±0.16 c	648.7±11.55 bc	47.46±0.16 B	681.25±5.01 b	49.42±0.10 c	640.6±6.65 c	49.3±0.12 2b	639.6±6.16 c
F – values	1.337ns	1.05ns	5.19**	5.88**	19.60***	12.59***	10.29***	9.12***	10.19***	7.46***	15.57***	13.940***
Lsd	1.06	14.1	0.89	9.69	0.54	16.26	0.51	32.09	0.68	25.80	0.42	17.15

Table 3. Length-weight relationship in fish samples collected from Karachi harbour.

Fish	Year	*n*	*a*	*b*	R^2	*F*
Rastrelliger kanagurta	**2006-2007**	86	-1.176	2.390	0.9676	2512.416
	2007-2008	91	-0.571	1.946	0.9323	1226.377
Scomberomorus commerson	**2006-2007**	61	-4.413	3.423	0.8522	340.316
	2007-2008	58	-0.483	1.967	0.956	1231.20
Scomberomorus guttatus	**2006-2007**	51	-0.969	2.230	0.8105	209.551
	2007-2008	57	-1.774	2.711	0.9219	649.246

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