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Length-Weight Relationship and Seasonal Distribution of *Magalaspis cordyla* (Linnaeus 1758) fish Size Frequency Variation from Karachi Coast

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Abstract:
The study of seasonal variation in distribution of 167 fishes of *magalaspis cordyla* from the Karachi fish harbour collected seasonally (pre-monsoon, mon-soon, post-monsoon) between September 2011-August 2012. The highest catch of fish (68) was recorded in pre-monsoon season and the lowest catch of fish (47) was recorded in monsoon season. The highest mean length (38.6± 0.746) and weight (288± 21.90) was measured during pre-monsoon season and lowest mean length (22.5± 0.671) and weight (120.5± 2.73) was measured during mon-soon season. The highest mean condition factor (1.192± 0.817) and minimum (0.500± 0.038) was recorded in pre-monsoon season. Fish estimated negative and positive allometric growth because b values larger and less then 3 in pre-monsoon and monsoon season but post-monsoon season showed positive allometric growth because b value larger then 3 in all size classes.
Keywords: *Magalaspis cordyla*, Length-Weight Relationship, Karachi Coast

INTRODUCTION

The fishes of the family Carangidae are one of the important resources from Indian waters as they constitute nearly 5% of the annual marine fish landings of 3.21 million tones and 9% of total pelagic fish landing during 2008 (Anon, 2009). The family Carangidae comprises of jacks, cavallas, crevalles, pompanos, queen fishes, runners, scads and travellies. *Megalaspis cordyla* is a hardtail scad, locally known as *kauwa machh.* They have commercial importance but are exploited as bycatch or as incidental catches in gillnet, bottom trawl and shrimp trawl. They inhabit coastal waters upto 60 m depths. The fish feeds on small crustaceans and fishes (Quddus and Shafi, 1983).

Length and weight data are useful standard results of fish sampling programs (Morato *et al.,* 2001). In fish, size is generally more biologically relevant than age, mainly because several ecological and physiological factors are more size-dependent than age-dependent. Consequently, variability in size has important implications for diverse aspects of fisheries science and population dynamics (Erzini, 1994). Length-weight regressions have been used frequently to estimate weight from length because direct weight measurements can be time-consuming in the field (Sinovcic *et al.*, 2004). One of the most commonly used analyses of fisheries data is lengthweight relationship (Mendes *et al*., 2004).

Length-weight relationship (LWR) is of great importance in fishery assessments (Garcia *et al.,* 1998; Haimovici and Velasco, 2000). Length and weight measurements in conjunction with age data can give information on the stock composition, age at maturity, life span, mortality, growth and production (Beyer, 1987; Bolger and Connoly, 1989; King, 1996a and b; Diaz *et.al*., 2000).

Length and weight data of fish are very important parameters in the estimation of the length and age structures, population dynamic (Krause *et al.,* 1998), growth and mortality rates, and well-being of the fish (Kohlers *et al*. 1995). They are also used to obtain information such as biomass from length frequency distribution (Anderson and Gutreuter 1983, Gayanilo *et al*. 1997) and fish condition (Petrakis and Stergiou 1995, Abowei *et al*. 2009) for stock assessment and management of the population of fish (Garcia *et al*. 1989, Sparre and Venema 1998, Blackwell *et al*. 2000, Haimovici and Velasco 2000).

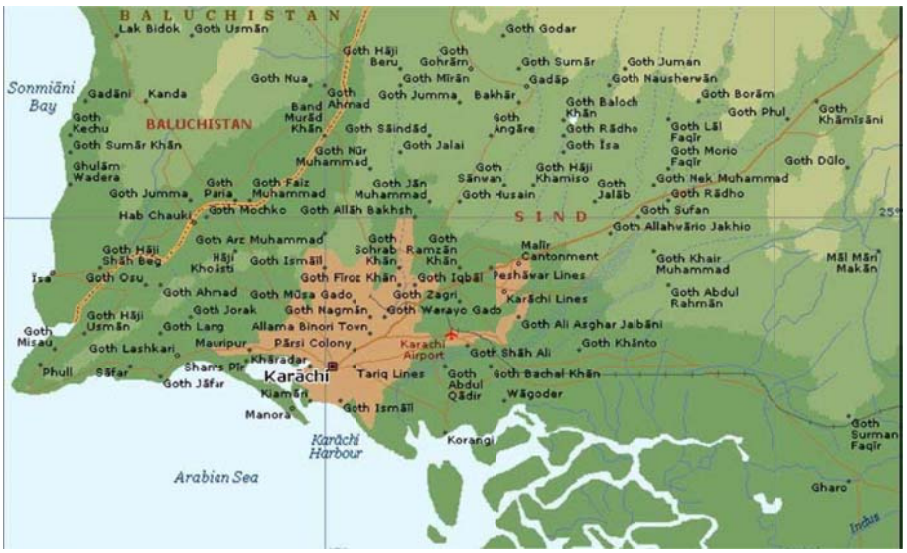

Figure 1. Study area, coast of Karachi and fish harbour

MATERIAL and METHOD

Fish Collection

For the study of seasonal variation in distribution of 167 fishes from the Karachi fish harbour collected seasonally (pre-monsoon, mon-soon, post-monsoon) between September 2011-August 2012. Then samples were transported to the research laboratory in polythene bags for measurement of length and weight, washed samples were keep in frozen.

Length and Weight:

Total length (L) and body weight were measured to the nearest 0.1cm and 0.01g respectively of the fresh samples. All total 86 fish samples were collected and their length frequency measured.

Length-weight relationship

The relationship between the TL and BW of the fish was estimated by fitting the data to a potential relationship in the form of:

$W = aLb$ (Le Cren 1951, Benedict *et al*. 2009)

where W is the BW of fish in grams, L is the TL of fish in centimeters, a is a constant or intercept, and b is the length exponent or slope.

The parabolic equation ($W = aLb$) was then transformed into a linear equation using a logarithmic method:
Ln W = Ln a + b Ln L.
Based on the equation, the estimated values of a and b were obtained using least-squares regression (Zar 1984). The determination coefficient (r2) was used as an indicator of the quality of the linear regression (Zar 1984).

Condition factor (k):

The relative condition factor (Krel) for each individual was calculated according to Le Cren (1951) equation:

$$Krel = \frac{w}{aL^b}$$

where W is the body weight (g),
and L, fork length (cm),
b regression co-efficient (Tudorancea, 1988).

$$K = 100\ \frac{w}{L^3}$$

Length frequency

Percentage length frequencies were plotted against the mid points of 4 cm intervals.

RESULT and DISCUSSION

The Length-weight relationship was measured in magalapis cordyla fish from different season (pre-monsson, mon-soon, and post-monsoon) seasons of the year. Fishes collected from Karachi coast, Karachi fish harbour. Different size classes were taken respectively in studied. The highest mean length (38.6± 0.746) and weight (288± 21.90) was measured during pre-monsoon season and lowest mean length (22.5± 0.671) and weight (120.5± 2.73) was measured during mon-soon season. The highest mean condition factor (1.192± 0.817) and minimum (0.500± 0.038) was recorded in pre-monsoon season. The mean length, weight, condition factor data were showed in (Table 1). Allometric coefficient (b) larger or smaller than 3.0 shows an allometric growth (Bangel and Tesch, 1978). 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 *magalaspis cordyla* fish estimated negative and positive allometric growth because b values larger and less then 3 in pre-monsoon and monsoon season. Post-monsoon season showed positive allometric growth because b value larger then 3 in all size classes (Table 2, 3, 4). Six classes of the fishes were represented in all seasons (pre-monsoon, monsoon, postmonsoon) seasons, (21-24 cm), (24- 27 cm), (27-30 cm), (30-33 cm), (33-36 cm), (36-39 cm) (Table 5).

The condition factor or well-being of fish is crucial in fisheries biology (Weatherly & Gill 1987). This factor is the quantitative parameter that represents the well-being of the fish (Le Cren 1951), which reflects the condition of the fish in its habitat; the heavier the fish species of a given length, the better the physiological condition, indicating the fish feeds more in that area (Bagenal and Tesch 1978). This condition factor is also an index to understand the lifecycle of fish by referring to the coefficient values derived from the length-weight relationship data (Schneider *et al*. 2000). In other words, the condition factor of fish is strongly affected by both biotic and abiotic environmental factors (Saliu 2001). The general expectation is that the weight of fish

increases as the cube (b=3) of length. However, the value of “b” fluctuates between 2.2 to 4.5 (Carlander, 1969). According to Pauly and Gayanilo (1997) it may range from 2.5 to 3.5. Beverton and Holt (1957) in agreement to the existence of cubic relationship between length and weight of fishes, opines that instances of deviation from isometric growth in adult fishes are rare. For a fish having an unchanged body form and specific gravity, the value of “b” is 3, which describes “isometric growth”. Pauly (1984) suggested that “b’ value less than 3 indicated that fish becomes more slender as it increases in length and with a value greater than 3 denotes stoutness indicating allometric growth. Fish are said to exhibit isometric growth when length increases in equal proportions with body weight for constant specific gravity. The regression coefficient for isometric growth is ‘3’ and value greater or lesser than ‘3’ indicate allometric growth.

This parameter could be used to determine the status of the aquatic ecosystem in which the fish live, whether the ecosystem is in good condition or polluted (Luff and Bailey 2000, Anene 2005). Assessments of fish condition based on weight at a given length are

thought to be reliable indicators of the energetic condition or energy reserves in fish (Lambert and Dutil, 1997). Poor condition is usually associated with poor feeding and/or environmental conditions. Fish in poor condition may suffer increased natural mortality (Lambert and Dutil, 2000). Further, a potential impact of poor condition in spawning fish is that they may be at greater risk of mortality following spawning (Lambert and Dutil, 2000).

Table 1. Mean length (L), mean weight (W), and mean condition (K) values of *Magalaspis cordyla* fishes of four fork length classes during (September 2011-August 2012)

Seasons	Size classes	n	Mean±SD Length (cm)	Mean±SD Weight (gm)	c.f
Pre-monsoon	21-24	18	23.2±0.875	125.5±15.916	0.988±0.034
	24-27	28	26±0.639	174±29.425	1.024±0.120
	27-30	03	27.5±0.894	248±14.56	1.192±0.817
	30-33	13	32±0.933	256±5.852	0.743±0.064
	33-36	-	-	-	-
	36-39	06	38.6±0.746	288±21.90	0.500±0.038
Mon-soon	21-24	06	22.5±0.671	120.5±2.73	1.031±0.071
	24-27	18	25.65±0.875	162±17.78	0.976±0.039
	27-30	09	30.2±1.35	248±4.216	0.924±0.136
	30-33	14	32±0.684	256±5.62	0.781±0.071
	33-36	-	-	-	-
	36-39	-	-	-	-
Post-monsoon	21-24	09	24±0.786	148±6.324	1.072±0.047
	24-27	29	25.8±0.657	168±24.42	1.101±0.100
	27-30	14	28±0.525	251.5±2.99	1.145±0.050
	30-33	-	-	-	-
	33-36	-	-	-	-
	36-39	-	-	-	-

Table2. *Magalaspis cordyla* (TL/TW relationship) during pre-monsoon season from Karachi coast

Size classes	n	a	b	r^2
21-24	18	-2.511	3.373	0.97
24-27	28	-5.622	3.592	0.85
27-30	03	-4.363	2.431	0.91
30-33	13	-1.794	3.146	0.90
33-36	-	-	-	-
36-39	06	-2.436	3.968	0.93

Table 3. *Magalaspis cordyla* (TL/TW relationship) during mon-soon season from Karachi coast

Size classes	n	a	b	r^2
21-24	06	-1.321	3.554	0.91
24-27	18	-2.219	3.146	0.93
27-30	09	-2.069	2.256	0.96
30-33	14	-2.431	2.381	0.97
33-36	-	-	-	-
36-39	-	-	-	-

Table 4. *Magalaspis cordyla* (TL/TW relationship) during post-monsoon season from Karachi coast

Size classes	n	a	b	r^2
21-24	09	-3.136	3.331	0.92
24-27	29	-2.861	3.640	0.90
27-30	14	-1.589	3.563	0.96
30-33	-	-	-	-
33-36	-	-	-	-
36-39	-	-	-	-

Table 5. Seasonal distribution of relative frequency of variously-sized fishes of *Magalaspis cordyla* from Karachi coast

Size classes	Pre-monsoon	Mon-soon	Post-moon
21-24	26.47 (18)	12.76 (06)	17.30 (09)
24-27	41.17 (28)	38.29 (18)	55.76 (29)
27-30	4.41 (03)	19.14 (09)	26.92(14)
30-33	19.11 (13)	29.78 (14)	-
33-36	-	-	-
36-39	8.82 (06)	-	-
N	68	47	52

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