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Growth pattern of concertina fish, *Drepane longimana* (Perciformes: Drepaneidae) from Clifton beach, Pakistan

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Abstract
This study carried out to find the growth pattern in juvenile fishes of *Drepane longimana* along the Clifton beach, Pakistan. The total of 128 small fishes were collected to evaluate the size frequency distribution, length-weight relationship (LWR), condition factor (K) and relative condition factor (Kn). The size frequency distribution shows the dominance of the smallest size class *i.e*., 3.6-4.0cm. The value of coefficient *b* obtained from the regression analysis of length-weight data, shows the negative allometric growth (b<3) in juveniles of *Drepane longimana.* The condition factor and relative condition factor were estimated ranging from 2.14-3.53 and 0.83-1.34 respectively. Results of present investigations confirms that environmental conditions of Clifton beach were favorable for the growth of juveniles of *Drepane longimana.* This is for the first time that, this sort of study is carried out for juvenile fishes of *Drepane longimana* from Clifton beach, Pakistan.

Keywords: Concertina fish, *Drepane longimana*, growth pattern, Clifton beach.

1. Introduction
Concertina fish, *Drepane longimana* belongs to the order Perciformes, family Drepaneidae and locally known as Sarando or Phanna. This family contains only 1 genera and 3 species. They are good edible fishes and can grow up to 50cm, commonly 23cm. They are inshore fishes and found at a depth <50m. They have been reported from Indo-West Pacific; Red Sea and East Africa to Indonesia; New Guinea and Philippines; North to Taiwan and Japan and South to Northern Australia. They have VIII spines and 19-23 soft rays in their dorsal fin and III spines and 17-19 soft rays in their anal fin [1, 2, 3].
In fisheries sciences, length-weight relationship is widely investigated to estimate weight when length of fish is available [4]. Length-weight relationship helps to understand the seasonal differences on fish growth and helps to study the morphological differences among populations living in different regions [5]. In regression analysis of length-weight relationship, the *b*-value shows the growth of fish. If *b* is equal to 3, the growth is called isometric; if *b* is less than 3, the growth is known as negative allometric growth; however, if the value of *b* in regression equation is greater than 3, the growth is termed as the positive allometric growth [6, 7].
To the best of author's knowledge, there is no published literature is available on length-weight relationship and other aspects of biology of juveniles of *D. longimana* from Clifton beach. Therefore, this study provides a baseline information on growth pattern and condition of *D. longimana* in their early stages of life at Clifton beach. There is still a need for further studies on various aspects of biology and growth in different life stages of *D. longimana* from Clifton beach and from other coasts of Pakistan.

2. Materials and methods
2.1. Sample collection and measurements
A total of 128 specimens of concertina fish (*Drepane longimana*) were collected from artisanal fishermen at Clifton beach during the months of May and June 2015. Samples were immediately transferred to the laboratory. Length and weight of fresh specimens were measured in centimeter (cm) and gram (g) respectively.

2.2. Size frequency distribution
Length of juvenile fishes were measured in cm and data was classified into 4 size classes *i.e.*, 3.6-4.0cm, 4.1-4.5cm, 4.6-5.0cm and 5.1-5.5cm.

2.3. Length-weight relationship (LWR)
Length-weight relationship of juveniles of *Drepane longimana* was estimated with the linear regression equation as proposed by [8];

$W = aL^b$

Where, W is weight of fish; *a* is intercept; L is length of fish; *b* is regression coefficient.

2.4. Condition factor (K)
The condition factor (K) was assessed by the following equation of [9] to find out the well-being or fitness of juvenile fishes of *Drepane longimana* at Clifton beach.

$K = W \times 100 / L^3$

Where, K is condition factor of fish; W is weight of fish; L is total length of fish.

2.5. Relative condition factor (Kn)
Relative condition factor (Kn) was calculated after [10];

$Kn = Wt / We$

Where, Kn is relative condition factor; Wt is measured weight of fish; We is estimated weight of fish by aL^b.

2.6. Statistical analysis of data
Firstly, all data was entered in MS Excel 2013 and then calculations were done by the help of Minitab statistical software.

3. Results and Discussions
3.1 Size frequency distribution
Results for size frequency distribution of juvenile *Drepane longimana* shows that fishes were more numerous in smallest size class which is 3.6-4.0cm with 34.38% (Table 1). However, 24.22%, 22.66% and 18.75% were recorded for size classes 4.1-4.5cm, 4.6-5.0cm and 5.1-5.5cm respectively. These results shows the abundance of juveniles of *D. longimana* during the study months of May and June along Clifton beach so, these months can be suggested as recruitment season for the population of *D. longimana*.

Table 1: Size frequency distribution of *Drepane longimana* collected from Clifton beach, Pakistan.

	Size classes	No. of Samples	Frequency	
No. of Obs.	**cm.**	**(N)**	**(%)**	**Rank**
1	3.6-4.0	44	34.38	A
2	4.1-4.5	31	24.22	B
3	4.6-5.0	29	22.66	C
4	5.1-5.5	24	18.75	D
	Total	128	100.00	

3.2 Length-weight relationship (LWR)
The descriptive statistics and length-weight parameters of juvenile *Drepane longimana* presented in Table 2. The *b*-value from regression analysis was obtained as 2.46. The coefficient of correlation shows the high correlation ($r>0.95$) furthermore, all results were found highly significant at 5% significance level ($p<0.05$).

Results for Length-weight relationship of *D. longimana* specifies the negative allometric growth ($b<3$) in juvenile fishes however, [11] had been reported positive allometric growth of *D. longimana* from Oman. These changes in growth pattern may be due to several reasons such as, number of specimen, sampling site, temperature, salinity and food availability [12]. According to [13] alterations in growth of fishes may be due to differences in observed length ranges of the sampled specimens.

Table 2: Descriptive statistics and length-weight parameters of *Depane longimana* collected from Clifton beach, Pakistan.

Length (cm)		Weight (gm)		n	a	b	S.E. (b)	r	r2	p-value	G
Max	**Min**	**Max**	**Min**								
5.3	3.6	5.1	1.0	128	-8.049	2.46	0.058	0.993	98.58	0.000*	A-
*significant at $p<0.05$											

3.3 Condition factor (K) and Relative condition factor (Kn)
The results of Condition factor (K) and Relative condition factor (Kn) were presented in Table 3. Maximum, minimum and mean value of condition factor (K) were estimated as 3.53, 2.14 and 2.81 respectively. While, maximum, minimum and mean value of relative condition factor (Kn) were assessed as 1.34, 0.83 and 1.02 respectively. Results of the present study reveals that *Drepane longimana* is in good condition in its juvenile stage at Clifton beach.

Condition factor reflects the degree of well-being or health of a fish [14]. It may affect by water temperature and availability of food [15].

Table 3: Condition factor (K) and Relative condition factor (Kn) values of *Depane longimana* collected from Clifton beach, Pakistan.

					Condition factor (K)		K values	Relative condition factor (Kn)		Kn values
Length (cm)		Weight (gm)		n	Range		Mean	Range		Mean
Max	Min	Max	Min		Max	Min		Max	Min	
5.3	3.6	5.1	1.0	128	3.53	2.14	2.81	1.34	0.83	1.02

4. Conclusions
Present investigations on growth pattern shows that juveniles were in good condition at Clifton beach and environmental conditions were favorable for the healthy growth of *Drepane longimana*. This study provided basic information on growth pattern of juvenile *D. longimana* for the first time from Clifton beach, Pakistan and it will help to facilitate the fisheries biologists and managers to manage the fishing activities along Clifton beach, Pakistan.

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