Short Communication

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Body Length Versus Skeleton, Otolith and Body Weight Relationships of a Soleid Fish, *Euryglossa Orientalis* (BL. & SCHN.) from Karachi Coast

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Skeleton constitutes the framework for the support of the body and attachment of muscles providing leverage for locomotory forces. Lee *et al.* [1] determined the difference of the skeleton-body weight relationships between terrestrial and aquatic animals to be due to buoyancy and specific gravity of the water. Thompson [2] and Reynolds and Karlotski [3] found that the skeleton weight of terrestrial vertebrates comprised increasing proportion of body weight with size, while those of aquatic vertebrates comprised a constant proportion of body weight regardless of size. If the value of the slope in the allometric relationship is 1, the skeleton weight will be a constantly increasing proportion of the body weight, which could be hardly moved by muscles on land.

Wyllie [4] and Gamboa [5] studied otolith size versus body weight and length relationships of 30 and 11 fish species respectively and concluded that the otolith-fish size or weight relationships could be useful in determining prey size and weight in feeding habit studies.Lenght weight relationships of some marine fishes of Pakistan except *E. orientalis*, were determined for knowing the weight from the length of the fish and vice versa [6-9]. In view of the paucity of such data for flat-fishes of Pakistan, this study has been undertaken to establish the regression equations for (a) skeleton weight-body weight and length, (b) otolith weight-body length and (c) length-weight relationships in *E. orientalis.*

A total of 638 samples of *E. orientalis* was taken fortnightly during January-December, 1992 from fish landings at West Wharf, Karachi. The fish measuring 87-350 mm and weighing 84-900 g were used for estimating the length-weight relationship. 3-4 fish of different sizes in each month totalling 46 were boiled, muscles removed manually and washed with 5-10% ammonia with fins intact. The skeletons thus prepared were oven-dried at 40°C and weighed. Otolith weighing 6-60 mg taken from the dorsal side of 201 fish (males 100, females 101) of different sizes (150-350 mm) and seasons (January-December, 1992), were studied for estimating the allometric relationships with fish lengths.

The regression equations were determined by the least square method: Y = a + b X or log Y = log a + b log X (a, intercept; b, slope). The significance of variation in the estimate of slope 'b' from the estimated value B (=3) for an ideal fish was tested by t-test at 0.05 confidence limit (CL) [10].

$$'t' = \frac{b - B}{SE\ 'b'}$$ (B=hypothetical 'b' ($\in$ 3) and SE = standard error)

The regression equation of Ws (skeleton weight) -Wf (fish weight) was computed for *E. orientalis* (Fig.1) to be

log Ws = -1.094+0.901 log Wf ....(A)

SE 'a' = 0.923, SE -b' = 0.0404

Ws/Wf=2.1-6.57 %

The regression coefficient 'b' (=0.901) in *E. orientalis* being less than 1 agrees well with that of Nimi [11] for *Salmo gairdneri* (i.e., log Ws=-1.4454 +1.0554 log Wf) and Reynolds and Kaelotski [3] for 11 fish species (log Ws=-1.4794 +1.0297 log Wf) and the constant proportion 2.1-6.7 % appears consonant with 2.3-5.1% in other fishes [3], whereas the terrestrial vertebrates have slope values more than 1 (Ws = -1.5059+1.1230 of a mammal) [3] and increasing proportion 12.2% in *Felis pardus* [12], 13.1% in *Homo sapiens* [13] and 20% in *Loxodonta africana* [14]. However, Hill [15] found stranded whales break bones and are suffocated by their own weight. It is also on record that no terrestrial animal, even the large dinosaurs reached the size of an adult blue whale [16].

The equation describing the skeleton weight-body length (SL) relationship in *E.orientalis* is as follows (Fig.2)

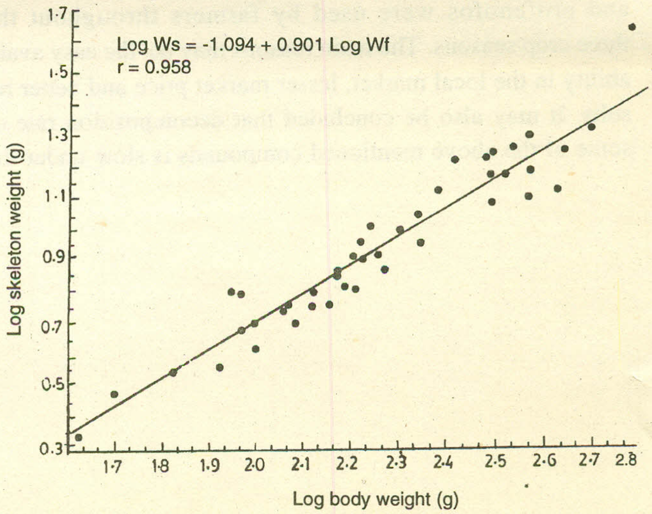

Fig. 1.

log Ws = -5.535 +2.843 log SL ....(B)

(SE 'a' = 3.6608,SE 'b' = 0.1342, r = 0.955)

The 't' test value 1.1699 is not significant which indicates that the skeleton weight of *E. orientalis* has a reduced growth function which limits its maximum size.

The allometric relationship between otolith weight (Wot) and fish length (TL) for male and female *E. orientalis* are given below (Fig.3)

Males: Wot (mg) = -39.1413+0.2895 (mm)..................(C)

(SE 'a' = 3.358, SE 'b' = 0.0154 , r = 0.884)

Females: Wot (mg) = -36.8042 +0.2635 TL (mm)....(D)

(SE 'a' = 3.8010, SE 'b' = 0.0157, r = 0.86)

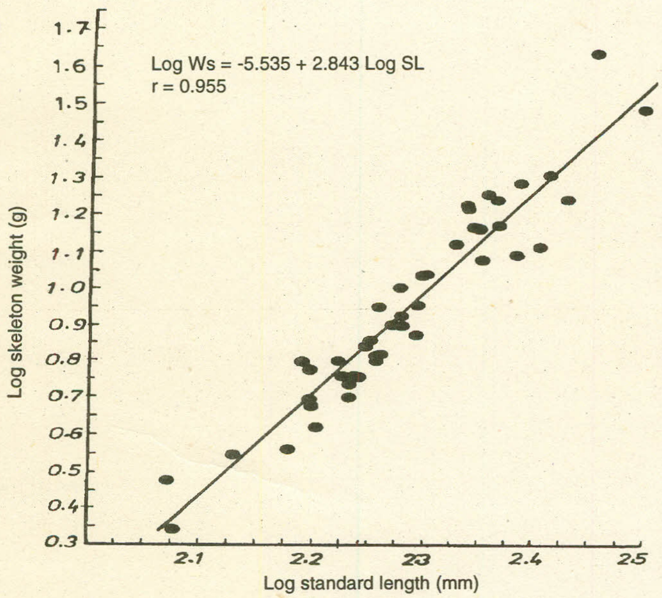

Fig. 2.

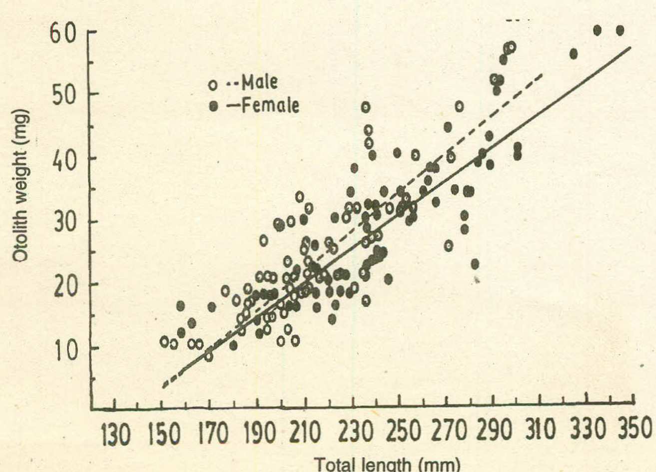

Fig. 3.

The otolith weights of males increase slightly more than those of females from 180 mm TL onward. The weight or size of prey-fish can be extrapolated from the weight (or size) of the otoliths taken from the stomachs of the predator in feeding habit studies.

The regression equations of otoliths with fish weight (or size) are genus and species specific [17,18].

The length-weight relationship of *E.orientalis* was calculated and plotted (Fig. 4):

log W = -5.127 +3.1506 log TL ....(E)

(SE 'a' = 0.608 SE 'b' = 0.261 r = 0.975).

The values of regression coefficients 'b' lie between 2.5 and 4.0 as determined by Hile [19] for all ideal fishes. The 't' test value 0.577 is not significant at 0.05 C.L. suggesting that the

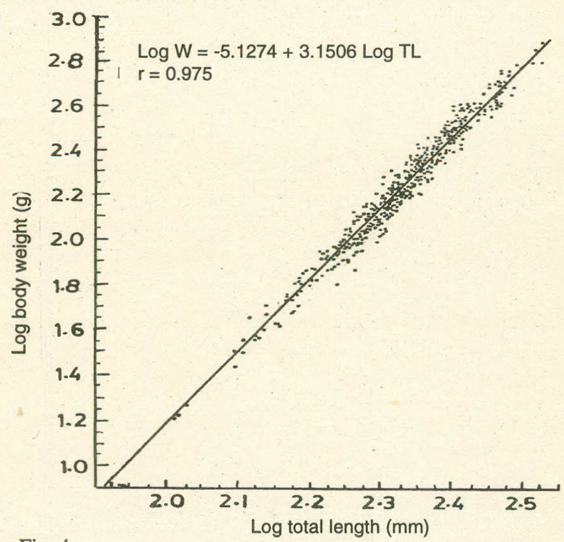

Fig. 4.

cube law for *E. orientalis* holds good. Departure from cube law is rare. Martin [20] opined that as the fish grow they lose their shapes and cube law relationship breaks down. In the fish under study measuring 350 mm TL, the estimated weight of the otolith will be about 62 mg in males and 55 mg in females from equations (C) and (D) respectively. Hence otolith-size-fish size relationships if computed would be very useful in prey-predator studies in feeding ecology. *E.orientalis* measuring 350 mm TL might have an expected body weight of 772 g according to the equation (E) and shows a potential to derive estimates of weight from the length or vice versa,

Key words: Euryglossa orientalis, Skeleton, Otolith, Length-weight relationships.

References

1. R.F. Lee, C.F. Phleger and M.H. Horn, Comp. Biochem. Physiol., **50B**, 13 (1975).

2 W.Thompson, *On Growth and Form* (Cambridge Univ. Press, 1942).
3. W.W. Reynolds and W.J. Karlotski, Copeia, 160 (1977).
4. E. Wyllie, Fish, Bull., **85**, 383 (1987).
5. D.A. Gamboa, Fish. Bull., **89**,701 (1991).
6. S.M.S. Hoda, India J. Fish, **34** (1), 120 (1983).
7. S.M.S. Hoda and S. Ajazuddin, Pak. J. Mar. Sci., **2** (1), 41 (1993).
8. S.M.S. Hoda and Bushra Khalil, Pak. U.S. Conference on Arabian Sea Living Marine Resources and Environment, Karachi University (1993).
9. N. Qureshi and S. M. S. Hoda, Karachi Univ. J. Sci., 25 (1995).
10. H. T. Zar, Biostatistical Analysis, 620 (1974).
11. A. J. Nimi, Copeia, 791 (1974).
12. B. D. Davis, Evolution, **16**, 505 (1962).
13. F. D. Moore, J. Lister, C. M. Boyden, M. R. Ball, N. Sullivan and F.J. Dagher, Human Biol., **40,** 135 (1968).
14. C. Kayser and A. Hewsner, J. Physiol., **56**, 489 (1964).
15. A.V. Hill, Science Progr., **38**, 207 (1950)
16. W.R. Stahl and J. V. Gummerson, Growth, **31**, 21 (1967)
17. R.W. Gasteel, Copeia, **2,** 305 (1974).
18. A.Passoupathy and V. Anandan, J. Mar. Biol. Ass. India, **35**, 216 (1993)
19. R. Hile, Bull. U.S. Bur. Fish, **45,** 209 (1936).
20. W.R. Martin, Ontario Fish. Res. Lab., **70**, 1 (1945).