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Length-Weight Relationship of Asian Seabass (*Lates calcarifer* Bloch, 1790) from Pichavaram Mangrove Waters, South East Coast of India

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Abstract

The length-weight relationship of Asian seabass (*Lates calcarifer* Bloch, Centropomidae) was estimated for the first time based on a wild population; specimens were collected from Pichavaram mangrove waters during October 2003 to September 2004. A highly significant correlation between length and weight, as a relative condition changing in the course of the year, were particularly observed. These data will be certainly useful for the Asian seabass aquaculture development and fisheries.

Introduction

The carnivorous Asian seabass, *Lates calcarifer* also called giant seaperch or barramundi in Australia, is an economically important food fish and sport fish in the tropical and subtropical areas of the Western Pacific and Indian Ocean (Greenwood 1976). Seabass is an euryhaline (Lim et al. 1986), protandric hermaphrodite (Grey 1987) with a cannibalistic character. The reported maximum size of this fish in wild was 2000 mm (Fischer and Whitehead 1974). The species is catadromous but widely distributed in the tropical Indo-Pacific region (Greenwood 1976).

It is a good candidate species for aquaculture and a production close to 20,000 tons per annum with a value of >65 million dollars has been reported (Tucker et al. 2002). The potential for *L. calcarifer* farming has been considerably increased to many fields in India after successful induced breeding of this fish at the Central Institute of Brackishwater Aquaculture (CIBA), Chennai, India (Thirunavukkarasu et al. 2001) following the commercial production of seabass young ones at the Rajiv Gandhi Centre for Aquaculture (RGCA), India (Thampi Sam Raj et al. 2003). Furthermore, the availability of vast extent of suitable land, with favour-

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able hydrological and climatic conditions and ready marketability of seabass are expected to boost entrepreneurs to explore this field.

Seabass inhabits coastal, estuarine and freshwater areas from the Arabian Gulf through Southeast Asia to northern Australia. The species supports important commercial and recreational fisheries throughout this area, and established considerable scope for the development of aquaculture industries in Asia and Australia (Copland and Grey 1987; Pearson 1987; Southgate et al. 1994).

Culture of brackishwater finfishes has assumed global significance in recent years. The environmental issues coupled with disease outbreaks in shrimp farming have forced aquaculture sector to look for an alternate species for diversification (David Kingston and Manikandavelu 1996). Among various species of finfishes, Asian seabass, *L. calcarifer* is highly suitable for aquaculture from the production point of view with better survival rate during the growth period from fry to marketable size in ponds and cages (Barlow et al. 1996).

Length-weight relationship (LWR) of fish is of great importance to fisheries (Pauly 1993; Entsua-Mensah et al. 1995; Vazzoler 1996; King 1996) in recent years in order to find out the possible mathematical relationship between the variables length and weight of the fishes. It also plays a significant role in studying the growth, rate of feeding, metamorphosis, fatness, onset of maturity and spawning gonadal development and general well being of the fish population (Le Cren 1951; Pauly 1993) and comparing the life history of fishes of different localities (Petrakis and Stergion 1995). Besides this, the length-weight relationship can also be used in setting yield equations for estimating the number of fish landed and in comparing the population in space and time (Beverton and Holt 1957). Furthermore, length-weight relationships allow inter alia; i) estimation of average weight of the fish of a given length group (Beyer 1987); ii) Conversion of length-growth equations to weight-growth equivalents (i.e., length-at-age to weight-at-age) in yield-per-recruit and related models; iii) interspecific and inter populational morphometric comparison of fish species; and iv) assessing the relative well-being of fish populations (Bolger and Connolly 1989; Kulbicki et al. 1993; King 1996). In tropical and subtropical waters, the growth fluctuation is more frequent in fishes due to variations in seasons, multiple spawning and food composition (Das et al. 1997). The knowledge of length weight relationship has a vital role in aquaculture also. It helps in establishing the biomass and also in converting one variable to another as is often required during regular samplings. Several reports are available on length-weight relationship of marine fishes from various parts of the world but only one such published information is available on seabass that too under captivity, reared in a closed recirculating system. Perhaps the present investigation would be the first report in the world based on wild catch. Since the knowledge on length-weight parameters will help in mass culture of *L. calcarifer* the present observation from Pichavaram mangrove waters was selected for the present study.

Materials and Methods

Pichavaram mangroves is located about 250 km south of Chennai City and 10km south of Parangipettai in the Tamil Nadu along the southeast coast of India (Lat. 11° 27' N: Long. 79° 47' E) (Fig. 1). Pichavaram mangroves consist of 51 small and large islets covering an area of 1,100ha (Muniyandi 1986). Of the total area, 50% is covered by the mangrove forest, 40% by the waterways and the remaining 10% by the sand and mud flats

(Krishnamurthy and Jeyaseelan 1983; Kathiresan 1987), which are meandered by numerous creeks, gullies, rivulets, channels and canals.

The specimens of *L. calcarifer* were collected from the northern side of the mangroves. Influence of adjacent neritic water was greater in this region due to a narrow gulley (or) inlet from the sea resembling a small mouth of an estuary, locally called 'Chinnavaikkal'. The depth of the water column was about 2 m.

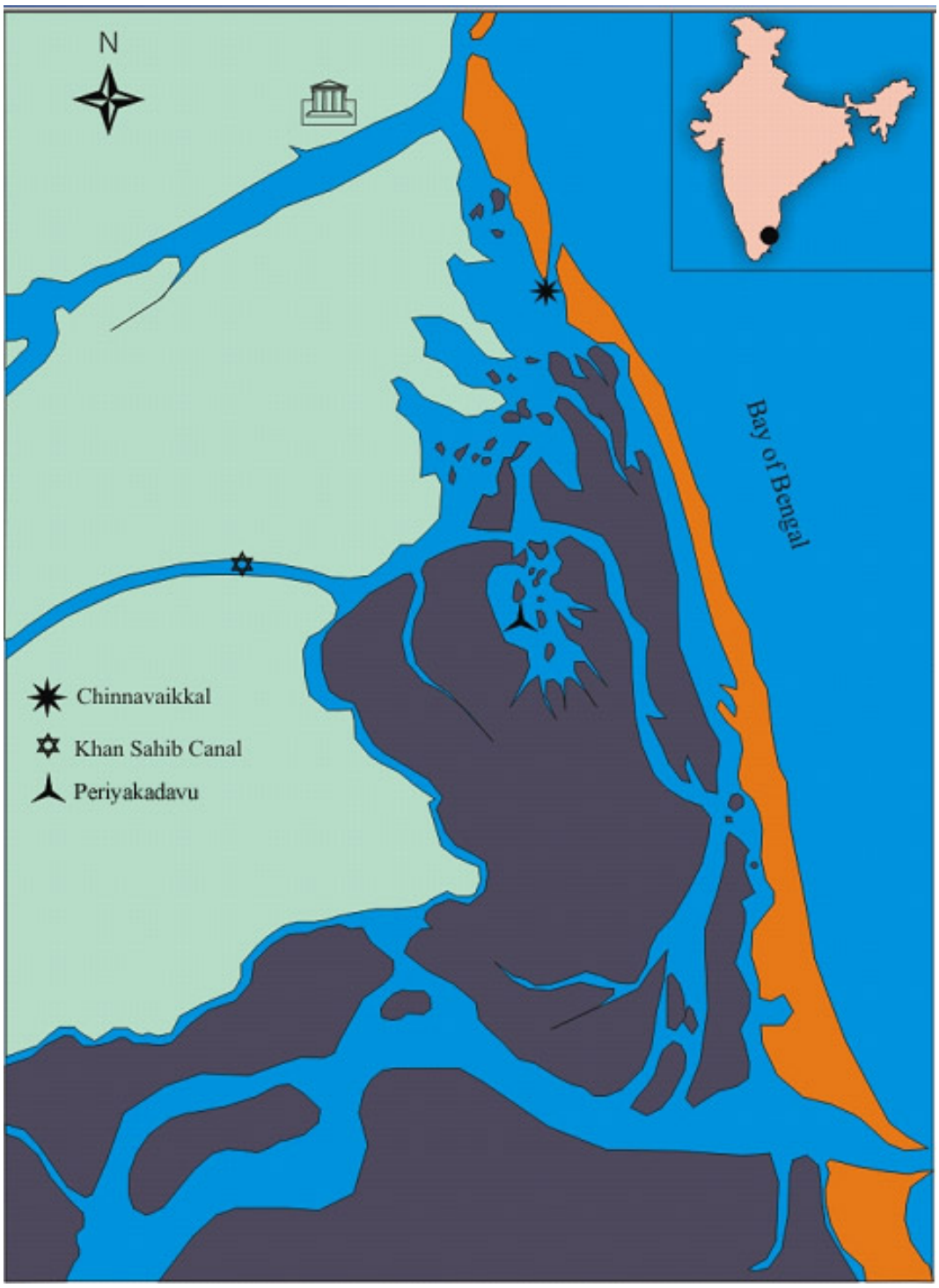

Fig. 1. Map showing the study area

Specimens were sampled during the period from October 2003 to September 2004, from the catches of bottom gill nets, hook and lines and also traditional valved basket traps. Specimens were identified and the total length (from tip of the snout up to the end of caudal fin) was measured in 'mm' and each fish was weighed in a spring balance in 'kg'. Nomenclature of the fish taxa conforms to FAO sheets (Fischer and Whitehead 1974). A total of 130 specimens of *L. calcarifer*, were measured. The length and weight of the fishes ranged from 284 to 1807 mm and from 1.5 to 110 kg respectively. The observations on length and weight from all these fishes were subjected to statistical analysis. The mathematical relationship between length and weight was calculated using the conventional formula $W= aL^b$ (Pauly, 1984) and using the logarithmic transformation log W= log a + b log L, where W = is the weight of the fish in kilograms, L = is the total length of the fish measured in centimeters and the parameters 'a' and 'b' are proportionality and regression coefficient. The seasonal mean relative condition factor (Kn) of samples was calculated using the equation $Kn = W_0/W$, Where Kn = Fulton's condition factor, W_0 = observed weight and W = expected weight.

Results

From these a length-weight relationship of *L. calcarifer* was found to be

Log W = − 3.8918 + 2.6633* log L
$r^2 = 0.9366$
Corresponding to
$W = 0.0001\ L^{2.6633}$

The logarithmic values and the observed length-weight were plotted in Figs. 2 and 3. These equations may also be used to convert length-frequency data to catch-at-length data.

The relative condition found ranged from 0.89 to 0.9811. The values showed an increasing trend from monsoon to summer and a sudden decrease in pre-monsoon (Fig. 4).

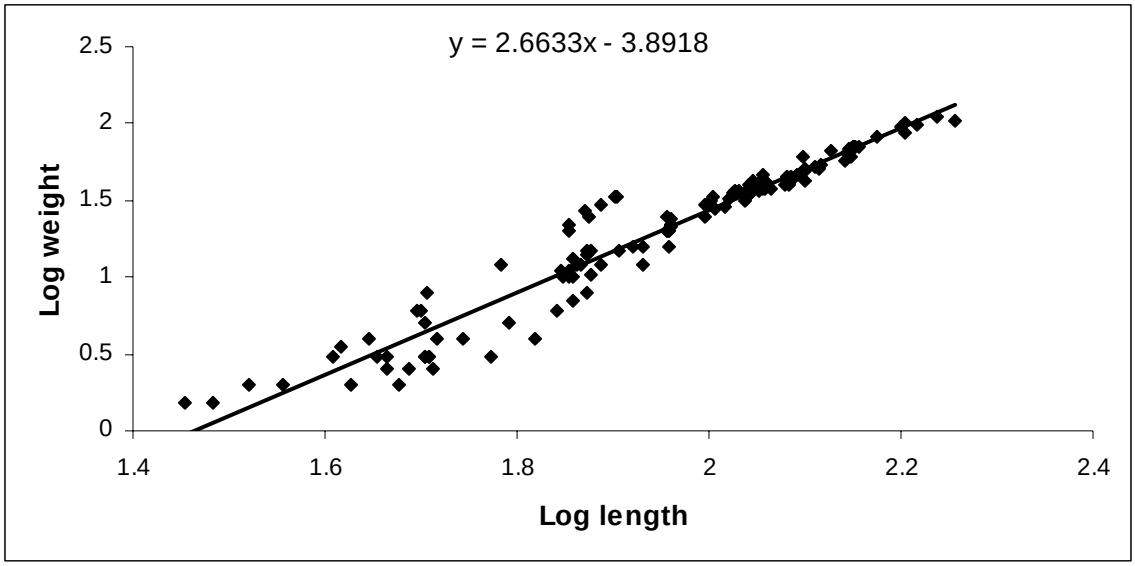

Fig. 2. Logarithmic relation between length and weight of Asian seabass, *Lates calcarifer*

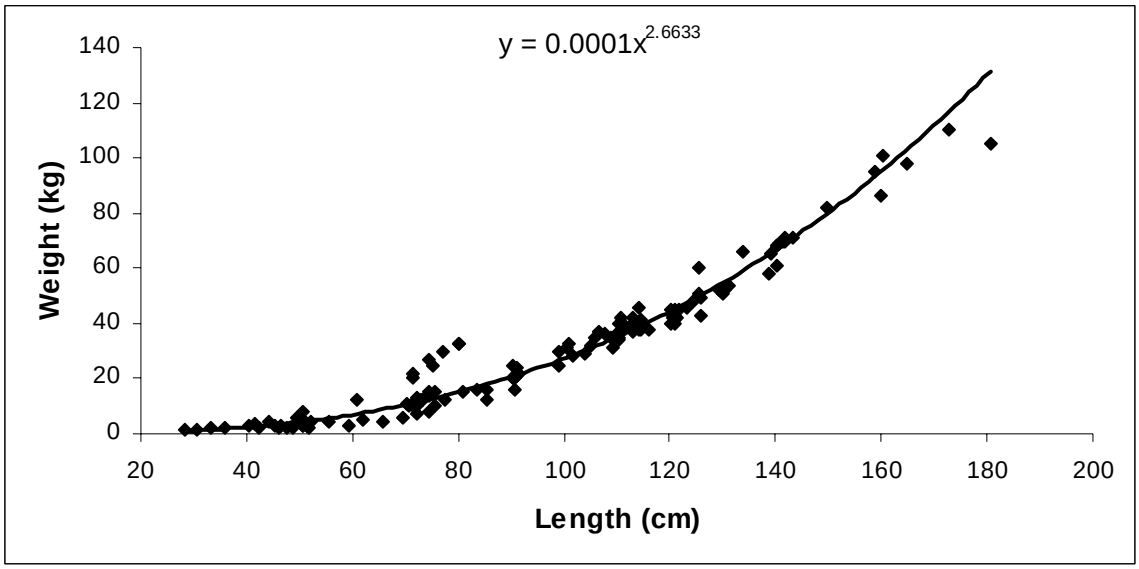

Fig. 3. Parabolic relationship between length and weight of Asian seabass, *Lates calcarifer*

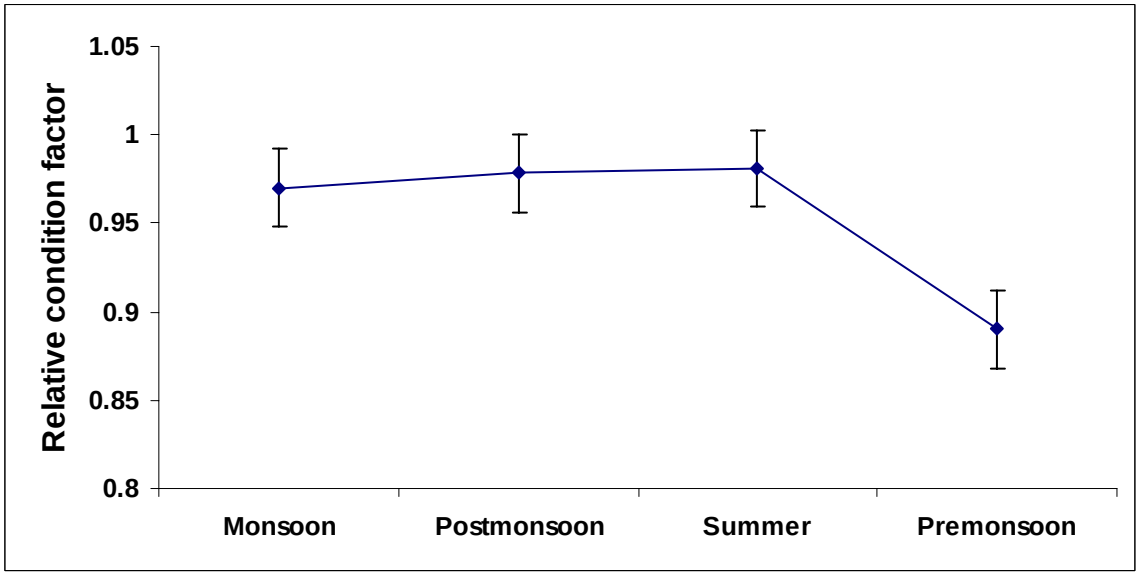

Fig. 4. Fluctuations in relative condition (Kn) in different seasons of *Lates calcarifer*

Discussion

The regression value (b = 2.6633) obtained in the present study is found to be lesser than that of the previous report for *L. calcarifer* reared seabass in the laboratory (b = 3.0347) (Volvich and Appelbaum, 2001). The variation may be attributed to non-availability of food, competition and poor water quality in the wild than under captivity. The trend of increase in relative condition factor during summer and sudden decrease during pre-monsoon might be related to the maturation of these fishes, the spawning of this species generally occurs during summer (Mohsin and Ambak 1996; Pillay 1999).

Condition factor is used to compare the 'condition', 'fatness' or 'well being' of fish and are based on the hypothesis that the heavier fish of a given length are in better condition.

During the peak spawning period breeding stock should be protected, in such a way that the rules and legislations should be imposed in order to maintain sustainable exploitation of this species. Considering the compatibility and prospective of this species for aquaculture, the present findings will give a substantial information for the aquaculturists and researchers. In a long-term basis, the above measures along with further studies on breeding biology, nutritional studies, feeding biology and age and growth will lead to a successful sustainable management of *L. calcarifer*.

The recent December 26th Tsunami has destructed the entire coastline of Southeast Asian countries. Many of the shrimp hatcheries and farms collapsed and it will take long time to reestablish these hatcheries and to produce shrimp seeds. The crafts and gears were also damaged due to the Tsunami that caused the reduction of wild finfish catches. In such a situation the culture of Asian seabass gains a good potential in order to fill this demand of salt water finfishes.

Conclusion

Studies on the length-weight relationship have a fundamental role in fishery biology and aquaculture of any species. Asian seabass is a candidate species for brackish water aquaculture, knowledge on its length-weight relationship parameters sound importance. From the regression value (b=2.6633) obtained in the present study it can be concluded that the weight of *L. calcarifer* increases proportionally to the cube of the length as the exponent value was observed to be almost close to 3. The equations derived assume importance in view of the fact that no attempt has so far been made to elucidate the relationship in this species in the world.

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