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Note

Daily growth and length-weight relationship of *Lates calcarifer* (Bloch) larvae during hatchery rearing

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ABSTRACT

Daily growth and length-weight relationship of Asian seabass *Lates calcarifer* was studied in the hatchery reared larvae. Larvae attained mean total length, standard length and total wet weight of 10.96±0.49mm, 8.97±0.47mm and 31.93±3.63mg respectively at the age of 21 days of post hatching. Growth rate was higher when the feed was changed from rotifer (*Brachionus plicatilis*) to *Artemia* nauplii and *Artemia* biomass with increased size variation among the larvae. The correlation coefficient of total length with total weight and standard length with total weight were highly significant. Log transformed regression were used to study the length-weight relationship. Total length- weight and standard-length weight relationship indicated the allometric growth in seabass larvae during hatchery rearing phase.

Information on the length-weight relationship of the larvae will be useful to understand the quality and health of the larvae reared in the hatchery. Studies on length weight relationship of brackishwater finfishes during hatchery rearing are scanty. In order to draw the production estimate in the fish hatcheries, it is important to study the length weight relationship of juvenile fishes, while rearing them in the hatcheries. This study also helps to determine the mathematical relationship between the two variables and to calculate the variation from the expected weight for length of individual or group of fishes (Le Cren 1951).

Asian Seabass *Lates calcarifer*, an important brackishwater finfish belonging the family Centropomidae is suitable for culture which is constrained by the availability of seed. Induced breeding and seed production of seabass under captive condition has been achieved in India (Thirunavukkarsu *et al* 2002; Kailasam *et al* 2002). Studies on growth parameters and their relationship during hatchery rearing are very important in order to achieve large scale production. Therefore, the present investigation was taken up to study the length weight relationship of seabass

larvae and fry from day one to twenty after post hatching.

Newly hatched seabass larvae were obtained from the fish hatchery, Muttukkadu experimental station of Central Institute of Brackishwater Aquaculture, Chennai. Larvae were reared in indoor tanks of two ton capacity FRP tanks at a stocking density of 15 larvae / litre for up to 21 days. Rotifer *Brachionus plicatilis* was introduced as initial feed on day 2 at the rate of 5 nos/ ml and it was gradually increased to 20 nos /ml on day 8. *Artemia* nauplii were introduced on day 9 at the rate 2 nos/ml and it was gradually increased to 10nos/ ml on day 21. The larvae were fed with *Artemia* nauplii from day 15 to 21. Rotifer density was gradually reduced from day 10 and completely stopped on day 15. Rotifer and *Artemia* density in the larval rearing tanks were monitored daily and the density was adjusted according to the requirement. Water quality parameters were recorded daily. Water exchange was done in the larval rearing tanks at the rate of 20% for five days and thereafter it was increased to 50%. Tanks were mildly aerated during the period of experiment. Twenty larvae were collected from the rearing tanks on daily basis for 21 days. Total length (TL) and standard length (SL, from tip of the snout to the origin of caudal peduncle) of the larvae were measured from day 1 to 21 and wet weight of the larvae was taken from day 9 to 21.

To study the length-weight relationship Total length (TL), Standard length (SL) to nearest millimeter and weight (g) were measured. This data was used to determine the relationship between TL and weight and SL and weight of the seabass larvae.

The functional relationship between body weight (W) and Length (L) given by Le Cren (1951) is an exponential form:

$$W = a L^b \quad (1)$$

Where, W = Weight of fish, L= Length of the fish, a = constant and b= exponential value. When the data is transformed into logarithmic form, a linear relationship is obtained for equation (1) as follows.

$$\text{Log}_{10}(W) = \text{Log}_{10}(a) + b \log_{10}(L) \quad (2)$$

In the present study the TL – weight and SL – weight relationship of the seabass larvae are computed by using Equation (2). The parameters a and b of equation 2 were computed by least squares method.

If fish retains the same shape it grows isometrically and length exponent 'b' has the value b=3.0, a value significantly larger or smaller than b=3.0 shows allometric growth. A value less than 3.0 shows that fish becomes lighter (negative allometric) or greater than three shows that the fish becomes heavier (positive allometric) for a particular length as it increases in size (Wootton, 1998). Linear growth rate was calculated statistically for three different growth phases according to the change of the feed.

Mean daily increment on total length, standard length and wet weight of seabass larvae are shown in Fig 1 & 2. Logarithmic relationship of length and weight relationship of free embryo stage of larvae are shown in figures 3 & 4. Mean total length and mean standard length of the larvae on day one was measured as 1.48±0.1mm and 1.29±0.11 mm respectively. On day 21, the larvae attained mean total length and mean standard length of 10.96±0.49mm and 8.97±0.47mm respectively. Nine day old seabass larvae had mean weight of 1.44±0.11mg and further attained the

Fig.1

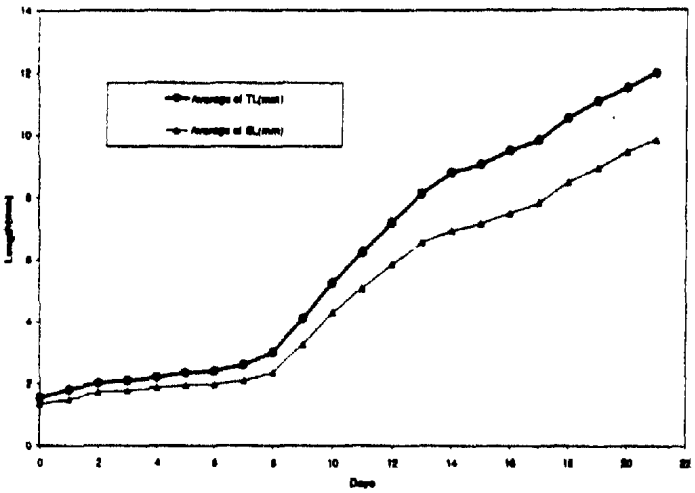

Fig.2

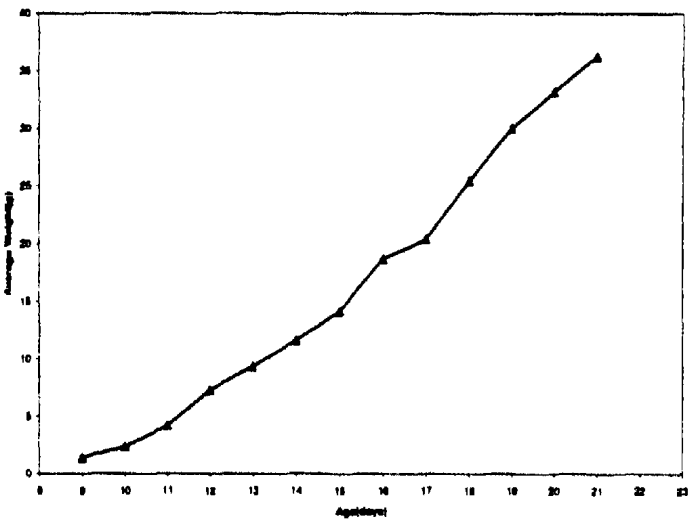

Fig. 1&2 Total length, standard length and weight of seabass larvae from 1 to 21 days after post hatching

weight of 31.93±3.63 mg on day 21. There are two peak growth periods observed from 9th to 14th day and 15th to 21 days were observed. The larvae showed sudden increase in both length and weight on day 9 onwards which was due to ingestion of *Artemia* nauplii feed. This may be because of increase in mouth size of the larvae enabling to feed *Artemia* nauplii. Like wise, the growth trend showed another peak from day 15th to 21 days, mainly due to ability of the fry to feed on *Artemia* nauplii voraciously. Growth and survival of the fish larvae can be enhanced significantly with an increase in *Artemia* feeding level (Duray *et al.*,1997). Kim *et al.* (1996) have reported higher growth rate in Coho Salmon fry, while feeding with *Artemia* biomass than other feeds. Dhert *et al.*, (1990) have reported that the quality of the seabass fry production is good in terms of stress resistance, pigmentation especially, while feeding with (n-3) HUFA enriched *Artemia* nauplii. This is in agreement with the present study also where larvae showed faster growth after feeding with *Artemia* nauplii. Water quality parameters in the tanks were monitored daily. Mean value of temperature, salinity, dissolved oxygen, pH, turbidity, nitrite and ammonia were recorded : 29.5 ± 0.5°C, 31.0 ± 1.0 ppt, 6.5 ± 0.4 ppm, 7.86 ± 0.1, 1.2 ± 0.15 NTU, 0.06 ± 0.01 ppm and 0.05 ± 0.01 ppm respectively.

The minimum, maximum and mean

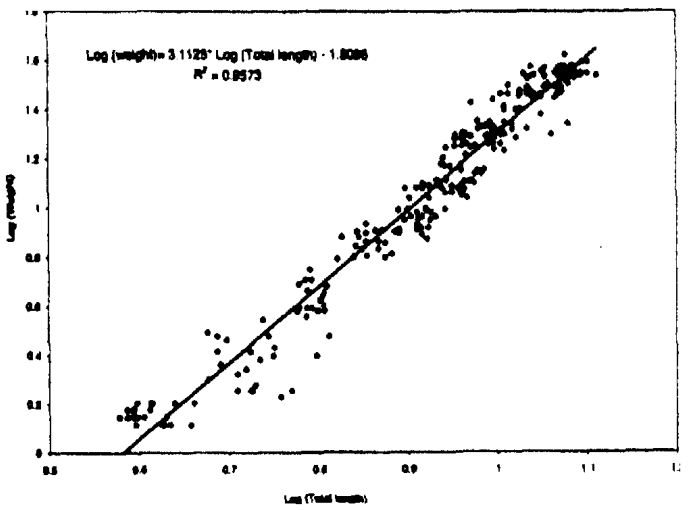

Fig. 3 : Total length and weight relationship of Seabass larvae

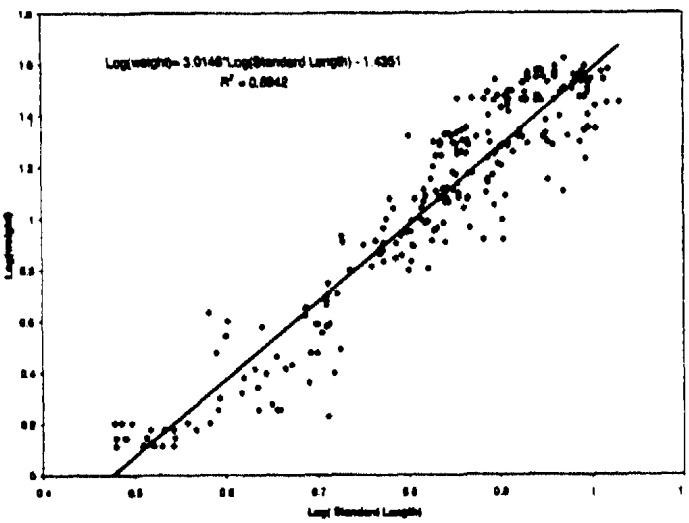

Fig. 4 : Standard length and weight relationship of Seabass larvae

length ± standard error for total length (TL) and standard length (SL), correlation coefficient between TL / SL and weight of the fish were presented in Table 1. The coefficient of correlation between TL and weight is 0.931 and SL and weight is 0.929 which is highly significant ($p < 0.001$) indicating the positive correlation between length and weight.

The estimated parameter 'a' and 'b' values of the length-weight relationship is in the form of logarithmic equations as follows

Log (weight) = 3.1125* Log (Total Length) - 1.8096, $R^2 = 0.96$ (3)

Log (weight) = 3.0146 * Log (Standard Length) - 1.4351, $R^2 = 0.89$ (4)

The standard errors of 'b' values as 0.41 and 0.05 for equations 3 and 4 are highly significant as far their regression values are concerned. The departure of 'b' values from the

TABLE 1: *Correlation coefficient of total length and standard length (minimum, maximum and mean length) with weight of seabass larvae during larval rearing period.*

Growth Parameters	N	Minimum (mm)	Maximum (mm)	Mean (mm)	Correlation coefficient with weight
Total Length	260	3.78	12.90	8.71(0.148)	0.931
Standard Length	260	2.18	10.72	7.00(0.121)	0.929

conventional cube law was significant ($p < 0.001$) for both TL and SL indicating the allometric growth of the seabass larvae in the hatchery rearing phase.

There are three different growth rate based on the feeding protocol, 1st phase from 0 to 8th day 2nd phase from 9th to 14th day and 3rd phase from 15th to 21st day. In each phase, the linear growth rate with the day (X) was calculated statistically for length and weight. The linear regression equation for each phase is given below.

Total length

1st phase TL = 0.1547 X + 1.6128, $R^2 = 0.918$

2nd phase TL = 0.9445 X - 4.2432, $R^2 = 0.9683$

3rd phase TL = 0.5023 X + 1.4529, $R^2 = 0.8012$

Standard length

1st phase SL = 0.1093 X + 1.4093, $R^2 = 0.867$

2nd phase SL = 0.7366 X – 3.1464, $R^2 = 0.9269$

3rd phase SL = 0.4683 X + 0.0099, $R^2 = 0.7907$

Weight

2nd phase Weight = 2.1367 X - 18.5214, $R^2 = 0.9336$

3rd phase Weight = 3.7493 X – 42.0214, $R^2 = 0.9037$

R^2 value revealed that the linearity was more during the second phase of the growth which may be due to change of the feed from rotifer to *Artemia* nauplii.

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