J. Indian Inst. Sci., 65 (C), Sept. 1984, pp. 109-114


Short Communication

# Moult production and food conversion in two freshwater prawns in relation to body size

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**Abstract**

Effects of different body sizes on the moult production, food intake, growth, conversion and yield efficiency of two freshwater prawns, *Macrobrachium lanchesteri* and *Caridina weberi* are described. With increase in size, the per moult weight decreases in both the species. Body size also profoundly influences the physiological energetics of feeding and growth of either species.

**Key words:** Freshwater prawns, moult production, physiological energetics.

## 1. Introduction

The culture potential of freshwater prawns is well known. However, basic information on the physiological energetics of feeding and growth of Indian freshwater prawns is scarce[1]. Under conditions of unlimited availability of food sources, one factor that is important in governing the rate of growth of prawns is the body size[2]. Prediction of growth rate of prawns of different sizes is particularly required to construct life history tables of species as well as to plan the feeding schedules during their intensive culture practices. Most studies have demonstrated that with increase in size, there is a gradual decrease in the growth rate of animals[3-4], experimental evidences for which are extensively and conclusively drawn from fishes[5]. Unlike fishes, considerable food energy ingested by prawns is periodically lost as exuviae; since this moult production is also an energy-expanding phenomenon[6], size-related variations in growth rates may be further complicated, relative to the moulting frequencies. In the current study, the relationships between the body size and rates of moult production and growth of two freshwater prawns are examined.

## 2. Materials and methods

Individuals of *Macrobrachium lanchesteri* (de Man) and *Caridina weberi* (de Man) were collected from the Hulimavu tank (near Bangalore) and maintained in aquaria containing fresh water. Experimental individuals were segregated, based on the body lengths and body weights. Five different size classes were selected for *M. lanchesteri* and three for *C. weberi*, as shown overleaf.



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| Group No. | *Macrobrachium lanchesteri* | | *Caridina weberi* | |
|---|---|---|---|---|
| | Length (mm) | Weight (mg) | Length (mm) | Weight (mg) |
| 1 | 10 - 20 (15.0) | 22 - 40 (26.83) | 10 - 15 (12.1) | 40 - 80 (54.33) |
| 2. | 21 - 30 (25.5) | 41 - 160 (150.83) | 16 - 20 (18.0) | 81 - 110 (104.50) |
| 3. | 31 - 40 (34.6) | 161 - 300 (281.17) | 21 - 25 (22.8) | 111 - 160 (143.50) |
| 4. | 41 - 25 (43.0) | 301 - 800 (623.83) | | |
| 5. | 46 - 50 (48.3) | 801 - 1200 (1010.00) | | |

Values in parentheses represent the means.

Both the species of prawns were maintained at the respective ideal conspecific population densities of 4 and 8 prawns per 15 litres of fresh water respectively[1]. The prawns were fed daily *ad libitum* with *Tubiflex tubiflex* worms for 60 days. Water in the aquaria was aerated continuously and temperature was maintained at 23 ± 2°C. Data on moult production, moulting frequency (number of days between two successive moults), per moult weight (dry weight of a single exuvium expressed as percentage of the initial dry body weight of the prawn) and a total moult weight (pooled dry weight of all the exuviae produced per prawn during the entire experimental period) were recorded. The data on assimilation, growth, food intake, conversion and yield of prawns during the experimental period were determined as described earlier[7]. During the experimental duration of 60 days, water of the experimental aquaria was filtered through a Whatman No. 1 filter paper, once in 20 days, to collect the faecal matter. From the estimated faecal loss (and not accounting for the urinary loss), food assimilation values were calculated.

## 3. Results and discussion

*Moult production and moulting frequency:* The data on the influence of body size on the moulting frequency and moult weight of *M. lanchesteri* and *C. weberi* are given in Table I. Considerable variations were observed in the number of moults produced, total moult weight and moulting frequency in relation to the body size of *M. lanchesteri*. However, the per moult weight decreased with increase in size. The average per moult weight of *M. lanchesteri* (14.1 ± 4.33%) is comparable to that reported for *Palaemon lamarrei* (14.4 ± 6.32%)[2]. The present value is also comparable to the average value obtained for *M. lanchesteri* reared at different population density levels[1].

In *C. weberi*, while moulting frequency and number of moults produced did not indicate any specific variation with increase in body size, total moult weight and per moult weight

Table I

**Influence of body size on the moult production and moulting frequency of *M. lanchesteri* and *C. weberi*.**

Each value is the mean of four replicates with four and eight prawns in each replicate, for the two species respectively.

| Length (mm) | Moults produced during 60 days (number) | Moulting frequency (days) | Total moult weight (mg) | Per moult weight (%) |
|---|---|---|---|---|
| *Macrobrachium lanchesteri* | | | | |
| 15.00 | 2.00 | 30.00 | 2.03 | 21.40 |
| 25.50 | 1.50 | 40.00 | 5.97 | 16.12 |
| 33.70 | 0.50 | — | 4.05 | 13.58 |
| 43.00 | 1.00 | — | 12.37 | 9.39 |
| 48.30 | 0.50 | — | 11.10 | 9.80 |
| *Caridina weberi* | | | | |
| 12.10 | 4.20 | 14.30 | 11.11 | 32.16 |
| 18.00 | 3.70 | 16.41 | 13.12 | 16.78 |
| 23.00 | 4.30 | 13.90 | 17.12 | 13.90 |

indicated significant changes (Table I). The average total moult weight per prawn increased with size, while there were decreases in the per moult weight ($p<0.05$). However, the present average value of per moult weight ($20.95 \pm 7.70\%$) is not statistically different from that observed earlier for *C. weberi* maintained at different population levels ($13.60 \pm 0.47\%$, $p<0.10$; Ponnuchamy *et al*[1]).

*Food intake and growth:* Table II represents the changes in the final body weight, food consumed and growth of *M. lanchesteri* and *C. weberi* in relation to body size. In *M. lanchesteri*, while the food consumption increased with the increase in body weight, peak growth was observed for the intermediate size class measuring 25.5 mm in length. The values of growth before and beyond this size were lower, the least being 0.08 mg for the largest size class. From the peak value, with an increase in the length of prawn by 22.2 mm, the growth decreased nearly five times. Though similar observations on the food intake in relation to body size have been reported for *Palaemon lamarrei*[2], growth was observed to be higher for larger individuals. Mauchline[8] has suggested that growth is not constant in many crutsaceans, and generally decreases at successive moults.

In *C. weberi*, while there was a gradual increase in food consumption with increase in size, final body weight and growth indicated peak values for the intermediate size class (18.0 mm). Besides, growth showed the lowest value at the largest size indicating nearly a two-fold decrease from the peak growth value. Hart[9] also reported that in *C. nilotica*, the per moult growth increments were greater in intermediate size classes. The decrease in growth of larger individuals of *M. lanchesteri* and *C. weberi* may be due to the inverse size metabolism relationship and advance in age.

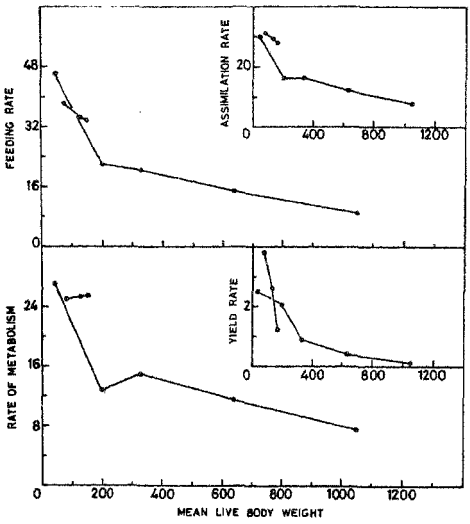


FIG. 1. Influence of body size on the rates of feeding, assimilation, metabolism and yield of *Macrobrachium lanchesteri* (●—●) and *Caridina weberi* (o—o). Values are expressed as mg dry weight/g live prawn/day.

## Table II

## Influence of body size on the food consumption and growth of *M. lanchesteri* and *C. weberi*

Each value is the mean of four replicates with four and eight prawns in each replicate for the two species respectively.

| Length (mm) | Initial dry body weight (mg) | Final dry body weight (mg) | Food consumed (mg dry weight/ prawn/day) | Growth (mg dry weight/ prawn/day) |
|---|---|---|---|---|
| *Macrobrachium lanchesteri* | | | | |
| 15.00 | 4.72 | 11.37 | 2.05 | 0.11 |
| 25.50 | 24.69 | 49.27 | 4.28 | 0.41 |
| 33.70 | 59.63 | 76.73 | 6.88 | 0.29 |
| 43.00 | 131.69 | 147.22 | 9.72 | 0.26 |
| 48.30 | 226.54 | 231.23 | 9.29 | 0.08 |
| *Caridina weberi* | | | | |
| 12.10 | 8.27 | 26.88 | 3.10 | 0.31 |
| 18.00 | 21.28 | 40.83 | 4.42 | 0.33 |
| 28.00 | 28.41 | 39.38 | 5.11 | 0.18 |

*Rates of feeding, assimilation, metabolism and yield:* Changes in rates of feeding, assimilation, metabolism and yield in relation to the mean live body weight of *M. lanchesteri* and *C. weberi* are illustrated in fig. 1. An inverse relationship was evident between the mean live body weight of *M. lanchesteri* and most of these parameters. A decrease in the relative growth rate with increase in the body size is also reported for *Palaemon lamarrei*[2]. Rajyalakshmi[10] has also observed that the specific growth rate of *Metapenaeus brevicornis* was highest for the young and decreased with age *i.e.,* increase in size.

In *C. weberi*, similar results were obtained as for *M. lanchesteri* except for the rate of metabolism which did not show much variation in relation to body size (see fig. 1). Hart[9] reported that the metabolic maintenance requirements of *C. nilotica* increased with body size. However, size correlative increases in the rate of metabolism of *C. weberi* were not observed presently.

*Conversion and yield efficiencies:* Table III gives the changes in gross and net conversion /yield efficiencies of *M. lanchesteri* and *C. weberi* in relation to body size. In both the species, net and gross conversion/yield efficiencies decreased with increases in body size. However, in *M. lanchesteri*, peak values were observed in the intermediate size class of 25.5 mm. A similar higher value of gross conversion efficiency of the intermediate size classes has been reported for *Palaemon lamarrei*[2].

**Table III**

**Influence of body size on the conversion and yield efficiencies of *M. lanchesteri* and *C. weberi***

Each value is the mean of four replicates with four and eight prawns in each replicate of the two species of prawns.

| Body length (mm) | Conversion efficiency (%) | | Yield efficiency (%) | |
|---|---|---|---|---|
| | $K_1$ | $K_2$ | $Y_1$ | $Y_2$ |
| *Macrobrachium lanchesteri* | | | | |
| 15.00 | 7.16 | 11.17 | 5.37 | 8.56 |
| 25.50 | 11.90 | 16.50 | 9.58 | 13.26 |
| 33.70 | 5.12 | 6.61 | 4.21 | 5.34 |
| 43.00 | 4.78 | 5.93 | 2.67 | 3.30 |
| 48.30 | 2.83 | 3.23 | 0.86 | 0.96 |
| *Caridina weberi* | | | | |
| 12.10 | 15.99 | 19.75 | 10.00 | 12.37 |
| 18.00 | 12.33 | 14.49 | 7.47 | 8.67 |
| 23.00 | 9.16 | 10.96 | 3.52 | 4.28 |

The present observations indicate that body size has profound influence on the physiological energetics of feeding and growth of these natantians. While the general size-metabolism relationship of animals is also applicable to these natantians, interspecific variations are evident.

**Acknowledgement**

Financial assistance from the University Grants Commission, New Delhi (Project No. F. 23-629/77 (SR-II) is gratefully acknowledged.

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