

ON THE GROWTH OF *PENAEUS INDICUS* EXPERIMENTED IN CAGES AT DIFFERENT DENSITIES IN A SELECTED NURSERY GROUND

ABSTRACT

Effect of different densities on the growth of *Penaeus indicus* was studied in a highly productive nursery ground located at Ramanthuruth Island (lat. 9°58'50"N, long. 76°15'40"E) using cages. Eight cages of the same size were placed with prawns in sets of 5, 10, 20, and 40 of the nearest size range (between 30 and 35 mm) and their growth was recorded once in every fortnight for six months. The average growth in length in the first month in different densities were 28.1, 22.00, 18.6 and 10.4 mm respectively which progressively decreased in subsequent months. The relevance of the present experiment in the culture of *P. indicus* is discussed.

A KNOWLEDGE of the growth pattern of the commercially important species of prawn and the factors that govern their growth rate are essential for their successful cultivation. Fairly large number of literature on the various aspects of the biology and fishery of the common penaeid prawns of India are available although information on their growth is much restricted and is based mostly on length frequency studies. Most of the penaeid prawns have extended spawning period which makes the growth studies on length frequency more difficult and less reliable. Although *Penaeus indicus* is a commercially important species, highly preferred for its size, information on the dynamics of growth is still not extensive. This information is particularly relevant in the present context of large scale efforts to culture this species in the Cochin Backwater. The present study was therefore taken up to collect more information on the growth pattern of the species in different densities.

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Materials and Methods

The experiment was conducted in January-July 1979, using cages in a fairly large and highly productive tidal pond having an area

of nearly thirty acres located in Ramanthuruth Island (lat. 9°58'50"N, long. 76°15'40"E) near the Cochin Harbour entrance. The study formed part of a project to understand optimum environmental conditions for large-scale culture of prawns. The data collected on the physico-chemical and biological aspects of the environment in the area selected for this study are being published separately.

Juveniles of *P. indicus* were collected using small meshed cast net and kept in cages for a few days for getting acclimatised to the cages. They were then measured from the base of the rostrum to the tip of the telson and the smallest prawns of the same size available in sufficient numbers were selected and transferred to the cages immersed in the pond at a depth of about 1 m at low tide. The experiment was conducted in replicates in densities of 5, 10, 20 and 40. The initial size of the experimental prawns ranged from 30.0 to 35.4 mm. Length measurements were taken once in every fortnight. In order to maintain the same density, cages were checked twice a week to replace any loss due to escape or mortality, taking care to see that they were of the same size as those in the cages at the time of replacement.

The cages were of the size 50 × 50 × 30 cm (Fig. 1). A frame was first made using a 1.27 cm diameter PVC pipe and was covered

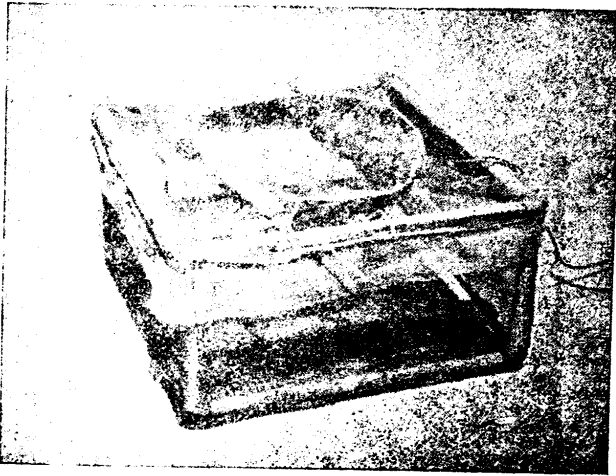


Fig. 1. Cage used for the experiment.

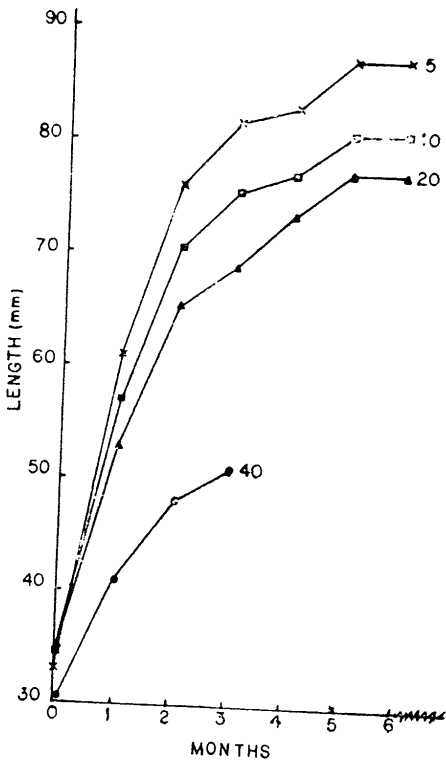


Fig. 2. Growth curve of *P. indicus* at different densities.

with a wire meshed net (mesh size 3 mm) except at the top where nylon nettings of nearly the same mesh size was used to permit closing and opening of the cage (Fig. 1). The wire was coated thrice with M. Seal Anticorrosive Epoxy compound to prevent rusting.

Results and Discussion

The growth curve of *P. indicus* in different densities is given in Fig. 2 and the Ford-Walford plot in Fig. 3. The Bertalanffy growth equation

$$l_t = l_\infty [1 - e^{-k(t-t_0)}] \quad (1)$$

where

l_t = length at time t

l_∞ = asymptotic length

k = rate of attaining the asymptotic length

and t_0 = the age at which the length is zero had the growth been throughout according to the Von Bertalanffy growth equation

is fitted to the growth data with the constraint that $t_0 = 0$ since the actual age of the prawn at the start of the experiment is not known. The fitted equations to the data in order of density are

$$l_t = 87.7 (1 - e^{-0.834t})$$

$$l_t = 80.8 (1 - e^{-0.718t})$$

$$l_t = 78.9 (1 - e^{-0.555t}) \text{ and}$$

$$l_t = 55.6 (1 - e^{-0.559t})$$

As expected from the Walford plot (Fig. 3) all the growth curves have been described by the Bertalanffy equation reasonably well. Banerji and George (1967) also found that the Bertalanffy equation gave a good fit to modal size groups of *Metapenaeus dobsoni*. However, the value of k in the present study is much higher than their estimate and may be largely due to the sharp decline in the growth with time under the experimental conditions.

Asymptotic length, l_{∞} and k were also found to vary with density. Bayerton and Holt (1957) have pointed out that if the Bertalanffy equation truly represents the growth pattern, changes in growth due to changes in density

for descriptive purposes since growth is a highly complex process and hence models are often not realistic in terms of the underlying mechanisms involved. Kurata (1962) based on an extensive study of the crustacean growth

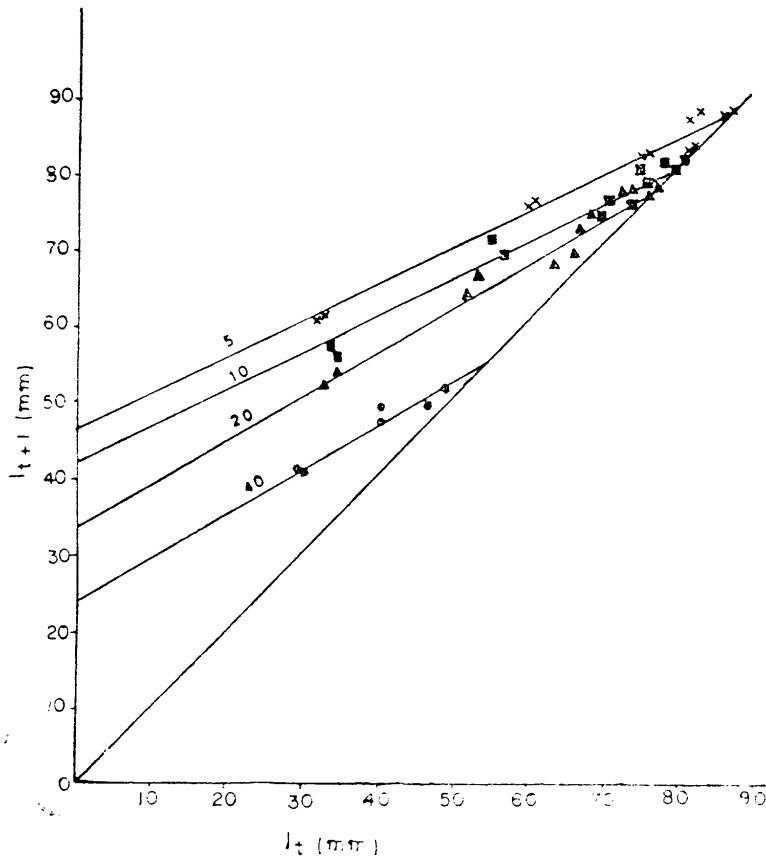


Fig. 3. Ford-Walford plots of the growth in length of *P. indicus* at densities 5, 10, 20 and 40.

will largely be brought about by changes in the asymptotic size while k remains more or less constant except when temperature is also altered. But the physiological basis of the Von Bertalanffy equation has been questioned by Richards (1959), Taylor (1962), Ricker (1958, 1960), Paloheimo and Dickie (1965) and others. Dickie (1971) points out that most of the growth equations are useful only

has concluded that their growth occurs in two or three phases. Unpublished data on the growth under different levels of feeding (Sreekumaran *et al.* in preparation) indicate that the Bertalanffy equation cannot describe season. Balasubramanian *et al.* (1979) have pointed out that the penacid prawns have a voracious feeding capacity which may be taken advantage of in augmenting their

the early growth of both *P. indicus* and *Metapenaeus dobsoni* in the size range 32.0-101.2 mm and 24.5-70.0 mm respectively since the growth increment did not show any decreasing trend within this size range. Further studies are therefore needed to throw more light on the dynamics of the growth of prawn.

The growth was highly sensitive to change in density and showed a sharp decline with time (Table 1, Fig. 2). Even in the cage with minimum density, the growth was very much retarded with increase in the size of prawn. The growth recorded in all

as 37.5 mm per month. Sreekumaran *et al.* (Per. comm.) have shown that prawns could maintain an uniformly high growth rate under favourable conditions for a few months. These evidences suggest the possibility of rearing *P. indicus* to a large size within a growth. Therefore the effect of physiological aging alone appears to be the main constraint that puts a limit to the maximum size that can be obtained by such means.

Although much effort has been taken to conduct the present study as carefully as possible and has yielded useful and reliable information on the growth of *P. indicus*, it

TABLE 1. Average monthly growth (mm) of *P. indicus* in different densities

Density	Average initial length	Months					
		1	2	3	4	5	6
5	33.0	28.1	15.0	5.5	1.0	4.5	1.0
10	34.7	22.0	13.7	4.9	1.6	3.9	1.0
20	34.6	18.6	12.2	3.4	4.7	3.8	1.0
40	30.5	10.3	7.3	2.5	—	—	—

cages in the first month except those having the highest density of prawns was quite high when compared to published results on *P. indicus* in Cochin Backwater as reviewed by George (1975). He recorded a growth of 14.9 mm/month and pointed out that the earlier estimates were much lower. The highest growth recorded in the present study was 28.1 mm/month. George (1974) observed specimens as large as 165 mm which suggest a fast growth rate at least in certain areas of the backwater. Suseelan (1975 a, 1975 b) has recorded growth rate higher than 30 mm per month in Manakkudy Estuary near Cape Comorin with maximum growth rate as high

has a few limitations which however do not seem to have seriously affected the data. For example, loss due to mortality or possible escape through openings in the top nylon net portion of the cage and even in the wire meshes occasionally caused by the crabs were replaced only twice a week in order to maintain the same density of prawns (Table 2). Such instances were, however, not frequent and only on two occasions the number of prawns replaced in one cage having the highest density exceeded twenty. Whenever a hole was noticed, which except on 2 or 3 occasions were quite small, it was

TABLE 2. Record of prawns introduced during the course of the experiment to replace loss due to escape/mortality

Date of replacement	Density							
	5	5	10	10	20	20	40	40
9-2-1979	—	—	—	2	13	5	4	—
21-2-1979	—	—	—	—	—	—	—	30
6-3-1979	—	—	1	—	1	—	—	—
14-3-1979	—	—	—	—	—	—	5	—
23-3-1979	—	—	—	—	—	—	—	23
12-4-1979	1	—	2	1	3	3	—	—
27-4-1979	1	—	3	2	5	7	—	—
29-5-1979	—	—	—	—	4	—	—	—

immediately repaired or the cage replaced. In addition to biweekly visits by the scientists, a reliable person was also engaged to check

the cages daily and change their position to ensure fresh supply of food as often as possible.

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