GROWTH, SURVIVAL AND PRODUCTION OF *LATES CALCARIFER* IN SEASONAL, RAIN-FED COASTAL POND OF THE KONKAN REGION

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Experiments were conducted for four years in the rain-fed pond (0.2 ha) to evaluate the growth, survival and production of *Lates calcarifer*. The seed of *L. calcarifer* was collected from nearby creeks and stocked at varying densities with *Oreochromis mossambicus* as a forage fish that were available abundantly in the paddy plots of the farm. The fry (*L. calcarifer*) of variable numbers and sizes (750 of 75 mm, 450 of 73 mm, 1125 of 25 mm and 1125 of 45 mm) were stocked over four consecutive years. The survival percentage was between 76.40 to 86.66. Maximum weight attained by *L. calcarifer* was 2500 g in about 6 to 7.5 months while average growth was in the range of 196 to 668 g during four years of culture. The highest production of *L. calcarifer* was observed to be 740 kg/ha/yr besides an additional contribution of 900 kg/ha/yr of tilapia, *O. mossambicus*.

INTRODUCTION

Jitada or *Lates calcarifer* (Bloch) is an esteemed fish inhabiting the estuarine and freshwater zones of the Konkan region. It tolerates wide salinity changes and fetches high price in the market due to its good taste. The seed of the fish is collected from nearby estuaries and stocked in the freshwater as well as coastal brackishwater ponds by the farmers. A survey conducted to determine culture status of this fish in north Konkan region revealed that it is being cultured along with the Indian major carps in freshwater ponds under traditional culture system without scientific management.

Investigations on the pond culture of *L. calcarifer* have been conducted by Danakusumah and Ismail (1986) in Indonesia, Khamis and Hanafi (1986) in Malaysia and Genodepa (1986) in Philippines. However, information is limited on its culture in India except few studies on its distribution and fishery (Kasim and James, 1986), influence of salinity on food intake and growth (Mukhopadhaya and Karmarkar, 1981) and certain aspects of its biology (Patnaik and Jena, 1976). James and Marichamy (1986) have reviewed the status of seabass culture in India. However, the above studies are mainly from eastern and southeastern region of India. The work in the Konkan region, where its fishery is significant, is limited to that of traditional culture of Jitada (Belsare *et al.*, 1987), prospects and status of Jitada culture in Maharashtra (Singh *et al.*, 1990a),
comparative growth of the fry under provision of cultured zooplankton and different organic substances (Singh et al., 1990b) and fry resources in the nature (Singh and Mehta, 1997). Hence, a preliminary study was conducted to determine the growth, survival and production potentials of *L. calcarifer* under varying conditions such as seed, stocking densities, size and in single or combination with tilapia (*Oreochromis mossambicus*) as forage fish in a seasonal, rain-fed coastal pond.

**MATERIAL AND METHODS**

A 0.2 ha rain-fed pond with water depth of 2.5 m, located at Kharland Research Station of Konkan Agriculture University at Panvel in coastal Raigad district of Maharashtra state was used for an experiment successively for four years from 1993-94 to 1996-97. The seed of *L. calcarifer* was collected from natural habitats in the vicinity of the agricultural farm where the fry were abundantly available from June to September (Singh and Mehta, 1997). After collection, the fry were graded and acclimatized before stocking in the pond. Tilapia, *O. mossambicus* used as forage, were also collected from paddy plots of the farm and stocked normally in advance of the Jitada seed so as to make tilapia fry available as food for the fry of *L. calcarifer*. The length and weight of the fry of *L. calcarifer* were recorded before releasing them into the pond. The tilapia were reared mainly on natural food but in case of its deficiency, oilcake and rice bran were used as feed as well as for enhancing the productivity through fertilization by left-over feed (Khaylov and Yerokhin, 1971). The density of forage tilapia varied from 2.33-8.80 times that of *L. calcarifer* seed from 1993-94 to 1996-97.

The water quality parameters viz., pH, dissolved oxygen, water transparency, salinity and zooplankton biomass were recorded weekly throughout the year from 1993 to 1997 to observe their variations. These parameters were observed over whole year despite the fact that culture period was 6-7.5 months. The pond was dewatered every year before the onset of monsoon. Each year had been divided into two period’s viz. June to December, which is primarily rainy season, and January to May, the post monsoon period. The climatic condition of both periods are quite distinct. The total fish production was calculated at the end of the experiment taking into account of all partial harvesting done which was necessitated due to reduction of the water level, although about 70 to 75 cm water level was available throughout the year. The average growth was determined by dividing total catch of the fish by total number of fish collected during harvesting.

**RESULTS AND DISCUSSION**

The seed of *L. calcarifer* (25-75 mm) was stocked at 425 to 1125 fry/ha while that of tilapia varied from 1600 to 10,000/ha. The culture period was determined by the
water level and restricted till such time that it was at least one meter in the pond. The pH of water exhibited marked variations in both rainy and post-monsoon periods. In 1993-94 the same was observed to be the highest up to 10 while in subsequent years there was a gradual decrease. Further, in each year the pH was comparatively low during June to December which may be attributed to cloudy season that inhibited photosynthesis leaving carbon dioxide unutilized which in chemical process formed acid and reduced pH of the water. The decrease in pH may also probably be due to excess leaching of gases from soil in the monsoon period. In post-monsoon period the same was found to be increased.

The salinity is the prime characteristic feature of coastal soils and water, also observed to vary during the study. The highest salinity (13-15%) was recorded in 1993-94 when the pond was excavated, while it was nil from 1995-96 onwards. The low salinity during June-December of the same year may be due to high rainfall in the region. The dissolved oxygen levels were within the conducive range while water transparency ranged between 10 to 46 cm.

The pH was recorded between 8.3 to 10 in 1993-94, 8.4 to 9.4 in 1994-95 and 7.8 to 8.9 in 1995-96 and 1996-97. The high pH is reported to have an adverse impact on the fish growth and survival (Huet, 1979). This is evident in 1993-94 when pH was as high as 10 and average weight of the fish as well as the weight range was also comparatively much low. The pH between 9.3 - 10 in 1993-94 was noted for longer duration from December to April-May or till end of the period. The high pH of soil, in general, is due to the calcareous nature of the coastal soils.

The survival percentage of *L. calcarifer* ranged between 76.40 to 86.66. As regards the average growth, the highest (668 g) was recorded in 1994-95 and lowest (196 g) in 1993-94 while the individual growth was maximum (2500 g) in 1995-96. The ratio of seed of *L. calcarifer* to tilapia varied from 1:2.33 to 1:8.8 during the different years and was observed to have a direct influence on the total *L. calcarifer* production. The pond being rain-fed had only freshwater. The soil of the farm being saline in nature, the salts are leached into the water, turning it to saline in the first two years. Subsequently, water remained freshwater throughout the year. The water level was observed to be receding after December compelling partial harvesting of the fishes. Growth of *L. calcarifer* is highly variable among the individuals, water bodies, river and seasons (Davis, 1986). This was evident in present study also where individual growth ranging between 110-2500 g was recorded during the different years (Table 1).

The survival rate (76.40-86.66%) registered in the present experiment was higher than obtained by Khamis and Hanafi (1986) in Malaysia where it ranged between 30.4-76.4% in a similar culture period despite an added facility of exchange of water at 30%
Table 1. Particulars of stocking and harvesting of *Lates calcarifer* and *Oreochromis mossambicus*

<table>
<thead>
<tr>
<th>Year</th>
<th>Seed stocking</th>
<th>Culture period</th>
<th>Harvest of <em>O. mossambicus</em></th>
<th>Harvest of <em>L. calcarifer</em></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>L. calcarifer</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nos/ha</td>
<td>Av. size (mm)</td>
<td>(months)</td>
<td>(kg/ha/yr)</td>
</tr>
<tr>
<td>1993-94</td>
<td>750</td>
<td>75</td>
<td>7.5</td>
<td>Nil</td>
</tr>
<tr>
<td>1994-95</td>
<td>425</td>
<td>73</td>
<td>6.0</td>
<td>200</td>
</tr>
<tr>
<td>1995-96</td>
<td>1125</td>
<td>25</td>
<td>6.0</td>
<td>85</td>
</tr>
<tr>
<td>1996-97</td>
<td>1125</td>
<td>45</td>
<td>6.0</td>
<td>900</td>
</tr>
</tbody>
</table>
per day and maintenance of water level. They attributed low survival rate to high seed stocking density, which varied between 3000 to 4500 nos/ha. Survival of 50 to 55% in a period of fourteen months was recorded in a pen near Pulicat lake (Anon, 1984). Similarly the survival percentage in the ponds of Tuticorin was reported to vary between 45.5 to 77% in a culture period of 15-17 months at a low stocking rate of the seed (21-28 mm) (James and Marichamy, 1986).

James and Marichamy (1986) and Khamis and Hanafi (1986) have also made observations with weight variation ranging between 65-1350 g at Tuticorin and 13.1-960 g in Malaysia. It appeared that presence of larger individuals prevented smaller ones from feeding satisfactorily and the competition for dominance, feed and space by a few larger individuals in a restricted culture area resulted in starvation as well as death to others (Teng and Chua, 1978). Hence, regular harvesting of larger ones is desirable.

There is a significant increase in total \textit{L. calcarifer} production per ha with the increase of forage fish tilapia from 184 kg/ha/yr 1993-94 to 740 kg/ha/yr in 1996-97 (Table 1). The ratio of \textit{L. calcarifer} seed to tilapia was 1:2.33, 1:3.7, 1:4 and 1:8.8 during 1993-94, 1994-95, 1995-96 and 1996-97, respectively. Gonodepa (1986) had also reported higher total fish production when ratio of \textit{L. calcarifer}-tilapia fry was high and concluded that 1:15 \textit{L. calcarifer}-tilapia ratio is very promising. An increase in total production was observed in the present experiment with increase in forage tilapia numbers. However, in rain-fed ponds without facility for exchange of water or replenishment of water, it is suggested that \textit{L. calcarifer}-tilapia ratio between 1:8 - 1:10 would be more appropriate in order to avoid overcrowding and ecological imbalance.

ACKNOWLEDGEMENTS

The author is thankful to Research Officer, Taraporevala Marine Biological Research Station, Mumbai for technical guidance and Khar Land Scientist, Kharland Research Station, Panvel for providing necessary facilities. Thanks are also due to the S.S.O and the Associate Dean, Faculty of Fisheries, Konkan Agricultural University, Dapoli for entrusting the project, time to time guidance, review, scrutiny and encouragement.

REFERENCES


