



Open Access

Research Article

Distribution and Seasonal Availability of Freshwater Prawn *Macrobrachium* Spp. in Kodayar River in Tamil Nadu, India

S. Arumugam

Department of Zoology, Presidency College, Chennai, Tamil Nadu, India.

Corresponding author: s_aru11@yahoo.co.in

Abstract:

Freshwater prawn culture has attracted more attention in the recent years due to its export potential and increasing demand as luxury protein. India is the second largest contributor of freshwater prawns to the world market. Freshwater prawn culture has undergone a phenomenal growth in the past two decades. Many species are of regional or local fishery important however only half a dozen species of genus *Macrobrachium* spp. are of major economic value in India. The river basins of Tamil Nadu contains some species of freshwater prawn. The prawn fishery of the river Kodayar in Tamil Nadu, India indicates that there are some major commercial species which support local fisheries. Kodayar river basin lies at the southern most tip of Indian peninsula. This is a small basin having an area of 1533 Sq. Km. with hilly area of 607 Sq. Km. which is more than one third of basin area. Kodayar river has two major tributaries in the upper reaches of its starting point. There are four stations fixed in Kodayar river basin for prawn collection. Temperature and rainfall play an important role in the breeding season of freshwater prawns. The basin rainfall highly recorded is 512.2mm during the north-east monsoon in October 2008. The average minimum and maximum temperature is found to be 23.36°C and 33.50°C respectively. The availability of prawns dependant in only monsoon periods and post monsoon periods. Totally 9 *Macrobrachium* species were collected in this river basin. The present paper deals with the distribution and the seasonal availability of the freshwater prawns for establishing culture farms in Kodayar river basin.

Key words: Aquaculture, Freshwater prawn, *Macrobrachium* spp., Distribution, Kodayar river.

1.0 Introduction:

Freshwater prawns are important in the capture and culture fisheries scene and are extensively distributed in freshwater and estuaries of the world mostly in tropical and subtropical belt. Freshwater prawn culture is an aquaculture business designed to raise and produce freshwater prawn for human consumption. The main freshwater prawn producers are China, India, Vietnam, Thailand, Taiwan and Bangladesh. Production of this prawn in Thailand is starting to raise again (New, 2005). The global annual production of freshwater prawns in 2003 was about 280,000 tonnes, of which China produced some 180,000 tonnes followed by India and Thailand with some 35,000 tonnes each (Vijayan, 2008). Species of the freshwater prawns genus *Macrobrachium* are distributed throughout the tropical and subtropical zones of the world. They are found in most inland freshwater areas like lakes, rivers, swamps, irrigation channels, canals and ponds as well as estuarine areas. Most species required brackishwater in the initial stages of their life cycle although some complete their cycle in inland, saline and freshwater lakes

(Banerjee, 2003). Freshwater prawn farming is popular in South East Asian countries but it has not gained much progress in India until recently although freshwater prawns are a high priced product and have a high market demand in both domestic and export markets (Radheyshyam, 2009). *Macrobrachium* culture is gaining momentum since it is less likely to have a detrimental impact because these prawns cannot be reared at densities as high as the marine shrimp. Indeed while its productivity is generally lower, management is less labour intensive and the potential pollution of water sources are minimal (Balamurugan et al., 2004). There are more than 25 species under the former family is commercially important whereas the latter with 20 species judicious utilization of these resources is of prime importance (Jayachandran and Indira, 2010). *M. rosenbergii* and *M. malcolmsonii* are the few freshwater prawn species utilized to establish freshwater prawn farms presently. India, one of the richest countries in the world in Inland water wealth and there is considerable scope for achieving significant increase of human food production through inland aquaculture (Pandian,

1993; Mary, 2003). In Tamil Nadu, the availability of culturable freshwater resources such as ponds and tanks contribute 158100 ha. of which large, medium and small reservoirs occupy 52000 ha. Thus, there is a vast scope for freshwater prawn culture possibility in Tamil Nadu, but only in certain pockets where freshwater prawn culture is practicing and only few farmers are concentrating regularly (Mary, 2003).

2.0 Materials and Method:

Freshwater prawns are found in most inland freshwater areas as well as in estuarine areas. Most species require brackish water in the initial stages of their life cycle (and therefore they are found in water that is directly or indirectly connected with the sea) although some complete their cycle in inland saline and freshwater lakes.

2.1 Stations of Sample Collection:

The stations of Kodayar River Basin have been fixed for sample collections for the study period Pechiparai Dam, Chittar Dam, Aruvikkarai Anicut and Nanchil Nadu Puthanar Channel.

2.2. Mode of Sample Collection:

The samples for the present study were collected using Scoop net and Hand net. The *Macrobrachium* prawns inhabit the bottom of the rocks and boulders at the center. These prawns were collected by turning the stones with care and then hand picked. For the estimation of population size and relative abundance of species, collections were carried out throughout the study period at regular intervals of 6.30 a.m. to 7.30 a.m. The prawns collected in this river basins were killed and fixed using 1-2% formalin in the collection spot. Then they were taken to the laboratory and preserved in 5-10% formalin. Later they were examined, identified and counted.

Representative sample specimens from each collection were preserved separately for identification. The species were identified using relevant literatures and the original description (Henderson and Matthai, 1910; Holthuis, 1950; Charles, 1984, 1996; Jalihal et al., 1988; Jayachandran and Joseph, 1986; Jayachandran, 2001; Mariappan and Jasmine, 2006; Valarmathi, 2009).

2.3. Collection of Environmental Factor:

In the present work, the seasonal abundance of all the *Macrobrachium* prawn species collected

regularly from Kodayar river basin influenced by the main environmental factors such as rainfall, temperature and relative humidity were studied. These environmental factors were collected from PWD, Water Resources Organization in Taramani, Government of Tamil Nadu, India.

2.4. Statistical Analysis:

The differences between species of study areas were analyzed by analysis of variance (one-way ANOVA) and if significant differences were found ($P < 0.01$) the least significant differences, Duncan Multiple Range Test was applied (SPSS Software).

3.0 Results and Discussions:

Kodayar river basin lies at the southern most tip of Indian peninsula. This basin is a small basin having an area of 1533 Sq. Km. with hilly area of 607 Sq. Km. which is more than one third of basin area. It is surrounded by Thamiraparani basin in the north and Nambiar basin in the east and Neyyar basin of Kerala State in the west. The Kodayar system comprises of two major rivers namely Pazhayar and Paralayar along with Thamiraparani or Kuzhithuraiyar in which Kodayar itself is a major tributary (Anonymous, 2001) (Map. 1). Kodayar river basin has spread over in only one district Kanyakumari. The Kodayar river basin is highly recorded in Thuckalay raingauge station 512.2mm during the north-east monsoon in October 2008. The average monsoon rainfall maximum and minimum is found to be 337.37mm and 47.44 mm respectively. The average monsoon rainfall of maximum and minimum is found to be 337.37mm and 47.44 mm respectively (Table 1 and Figure 1).

The basin receives most of the rainfall from the south-west monsoon and the north-east monsoon from June to December is considered as monsoon period and January to May as non-monsoon period. During the south-west monsoon Boothapandi, Kuzhithurai, Pechiparai, Surulacode, Thirupparappu, Thuckalay and Keeripparai raingauge stations gets more amount of rainfall. The average minimum and maximum temperature is found to be 23.36°C and 33.50°C respectively (Table 1 and Figure 2). Generally the temperature was low during January and February and high during April to June. The relative humidity minimum and maximum is found to be 60.28% and 75.02% respectively (Table 1 and Figure 2). The relative humidity was low during May to July and high during October to December.

MAP-1. KODAYAR RIVER BASIN

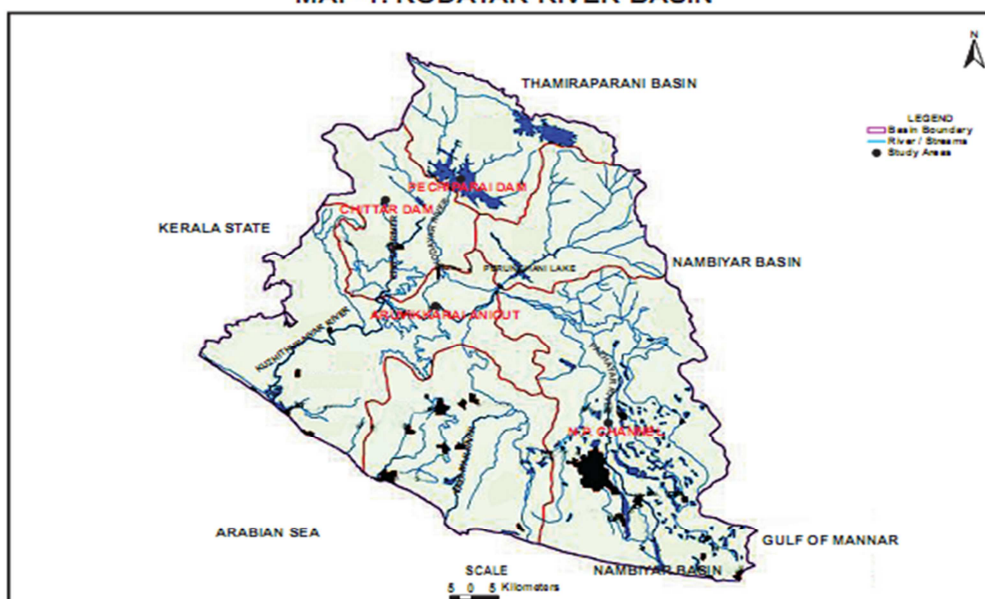
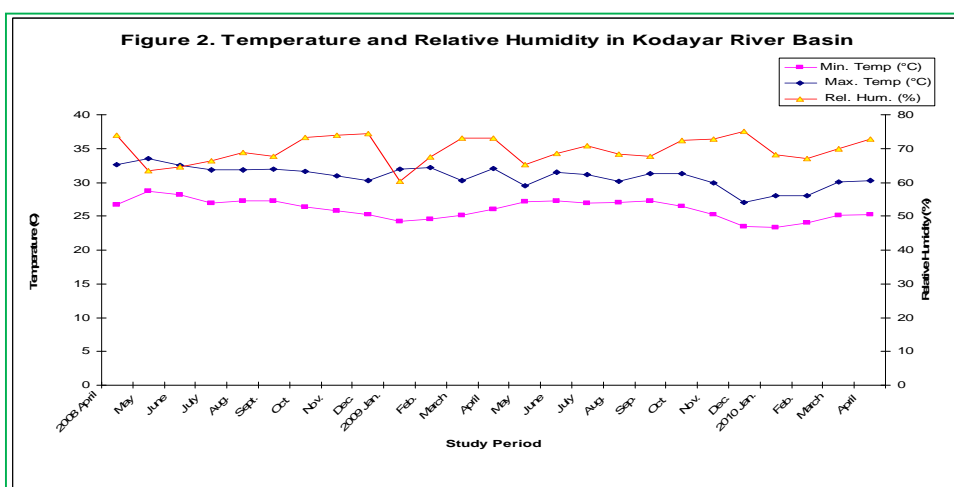
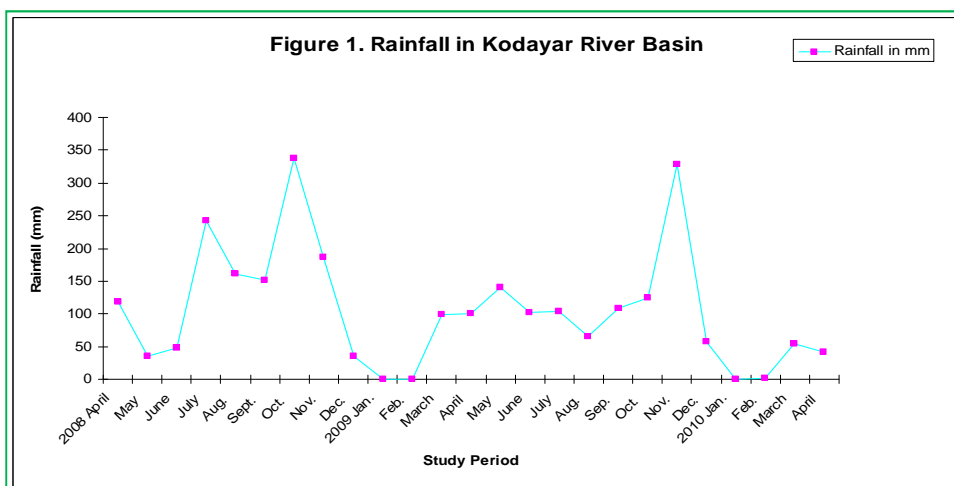


Table 1: Temperature, Rainfall and Humidity of Kodayar River Basin

| Year and Month | Temperature | | Rainfall (mm) | Rel. Hum. (%) |
|----------------|----------------|----------------|---------------|---------------|
| | Min. Temp (°C) | Max. Temp (°C) | | |
| 2008 April | 26.69 | 32.63 | 73.74 | 73.90 |
| May | 28.77 | 33.50 | 4.06 | 63.56 |
| June | 28.16 | 32.50 | 2.78 | 64.48 |
| July | 26.91 | 31.84 | 6.26 | 66.48 |
| August | 27.27 | 31.80 | 58.33 | 68.84 |
| September | 27.27 | 31.96 | 17.60 | 67.60 |
| October | 26.42 | 31.64 | 324.88 | 73.34 |
| November | 25.84 | 30.97 | 210.08 | 73.87 |
| December | 25.21 | 30.30 | 82.98 | 74.52 |
| 2009 January | 24.21 | 32.00 | 5.29 | 60.28 |
| February | 24.53 | 32.17 | 0.0 | 67.50 |
| March | 25.14 | 30.25 | 25.83 | 73.01 |
| April | 26.00 | 32.10 | 121.66 | 72.99 |
| May | 27.18 | 29.50 | 19.39 | 65.20 |
| June | 27.27 | 31.56 | 3.65 | 68.52 |
| July | 26.95 | 31.18 | 8.31 | 70.87 |
| August | 27.00 | 30.20 | 11.54 | 68.35 |
| September | 27.24 | 31.25 | 26.30 | 67.60 |
| October | 26.48 | 31.25 | 54.18 | 72.30 |
| November | 25.20 | 29.99 | 434.33 | 72.85 |
| December | 23.41 | 27.00 | 112.09 | 75.02 |
| 2010 January | 23.36 | 28.02 | 1.92 | 68.20 |
| February | 24.00 | 28.02 | 3.45 | 67.02 |
| March | 25.10 | 30.02 | 14.73 | 70.00 |
| April | 25.30 | 30.28 | 45.28 | 72.89 |



This river basin contains some freshwater prawn. They are *Macrobrachium malcolmsonii*, *M. lamarrei*, *M. rude*, *M. canarae*, *M. idae*, *M. indicum*, *M. idella*, *M. rosenbergii* and *M. nobilii*. Pechiparai Dam, Chittar Dam, Aruvikkarai Anicut and N.P. Channel are fixed in Kodayar river basin for sample collection. In the first station Pechiparai Dam *M. malcolmsonii*, *M. lamarrei*, *M. canarae* and *M. rude* are available. In Chittar Dam the second station *M. malcolmsonii*, *M. lamarrei*, *M. idae* and *M. indicum* are collected. *M. lamarrei*, *M. idella*, *M. idae* and *M. rosenbergii* are available in the third station called Aruvikkarai Anicut. *M. lamarrei*, *M. rude*, *M. nobilii* and *M. indicum* are available in N.P. Channel in Kodayar River Basin (Table 2). Environmental factors

rainfall, temperature and relative humidity show a positive and negative correlation (significant at 1, 5% level) in some species with different study areas (Table 3). There are 9 species collected in this basin. Since P value less than 0.01 there is significant between species in all study areas at 1% level Duncan Multiple Range Test. The species population ANOVA in Table 4. In Kodayar river basin a moderate number of prawns are collected during this study period. The maximum number of prawns of this basin are collected in Pechiparai Dam study area. Nine species are collected in Kodayar river basin. In this basin the maximum number of prawns are recorded in North-east and post monsoon periods.

Table 2: Macrobrachium Prawns Available in Kodayar River Basin

| Sr. No. | Kodayar River System | Freshwater Prawns |
|---------|-------------------------------|----------------------------------------------------------------------------------|
| 1. | Pechiparai Dam | <i>M. lamarrei</i> , <i>M. rude</i> , <i>M. malcolmsonii</i> , <i>M. canarae</i> |
| 2. | Chittar Dam | <i>M. malcolmsonii</i> , <i>M. lamarrei</i> , <i>M. idae</i> , <i>M. indicum</i> |
| 3. | Aruvikkarai Anicut | <i>M. lamarrei</i> , <i>M. Idella</i> , <i>M. Idae</i> , <i>M. rosenbergii</i> |
| 4. | Nanchil Nadu Puthanar Channel | <i>M. lamarrei</i> , <i>M. rude</i> , <i>M. nobilii</i> , <i>M. indicum</i> |

Table 3: Correlation co-efficient of species between the Environmental factors in Kodayar River Basin

| Study Area | Species | Minimum Temp. | Maximum Temp. | Relative Humidity | Rainfall |
|--------------------|------------------------|---------------|---------------|-------------------|----------|
| Pechiparai Dam | <i>M. lamarrei</i> | 0.062 | -0.086 | 0.329 | 0.593** |
| | <i>M. rude</i> | 0.347 | 0.028 | 0.217 | 0.687** |
| | <i>M. canarae</i> | 0.048 | -0.005 | 0.409* | 0.531** |
| | <i>M. malcolmsonii</i> | 0.090 | 0.035 | 0.248 | 0.401 |
| Chittar Dam | <i>M. malcolmsonii</i> | -0.059 | -0.008 | 0.156 | 0.112 |
| | <i>M. lamarrei</i> | -0.102 | -0.137 | 0.127 | 0.345 |
| | <i>M. idae</i> | -0.401 | -0.140 | 0.436* | 0.173 |
| | <i>M. indicum</i> | -0.222 | -0.194 | 0.255 | 0.239 |
| Aruvikkarai Anicut | <i>M. lamarrei</i> | -0.726** | -0.645** | 0.310 | 0.006 |
| | <i>M. idella</i> | -0.623** | -0.454* | 0.301 | 0.098 |
| | <i>M. idae</i> | -0.733** | -0.321 | 0.146 | -0.137 |
| | <i>M. rosenbergii</i> | -0.307 | -0.097 | 0.523* | 0.422 |
| N.P. Channel | <i>M. lamarrei</i> | 0.124 | 0.010 | 0.620** | 0.640** |
| | <i>M. nobilii</i> | 0.010 | 0.059 | 0.425 | 0.422 |
| | <i>M. rude</i> | -0.260 | -0.129 | 0.539* | 0.553* |
| | <i>M. indicum</i> | -0.032 | -0.014 | 0.365 | 0.525* |

Table 4: ANOVA in Significance difference between species of study areas in Kodayar River Basin

| Species | Study Area | | | |
|------------------------|----------------|--------------------------|---------------------------|--------------|
| | Pechiparai Dam | Chittar Dam | Aruvikkarai Anicut | N.P. Channel |
| <i>M. malcolmsonii</i> | 13.90 ±6.92 | 10.10 ^a ±5.27 | - | - |
| <i>M. nobilii</i> | - | - | - | 11.18 ±5.21 |
| <i>M. lamarrei</i> | 17.00 ±7.38 | 14.38 ^b ±4.92 | 13.96 ^c ±4.61 | 14.42 ±5.80 |
| <i>M. rude</i> | 13.58 ±6.34 | - | - | 13.44 ±3.78 |
| <i>M. idella</i> | - | - | 12.26 ^{bc} ±5.30 | - |
| <i>M. rosenbergii</i> | - | - | 2.47 ^a ±1.92 | - |
| <i>M. idae</i> | - | 13.10 ^b ±4.55 | 10.08 ^b ±5.40 | - |
| <i>M. indicum</i> | - | 13.52 ^b ±4.28 | - | 12.20 ±3.87 |
| <i>M. canarae</i> | 13.54 ±6.21 | - | - | - |
| F Value | 1.513 | 3.359 | 20.091 | 1.628 |
| P Value | 0.217 | 0.022* | 0.000** | 0.191* |

** denotes significance at 1% level, * denotes significance at 5% level, Different alphabets between species denote significance at 5% level using Duncan Multiple Range Test, ± - Standard Deviation.

The culture of *Macrobrachium* Spp. is gaining momentum since it is more eco-friendly than Penaeid prawn culture. More than 100 species of *Macrobrachium* have been described worldwide of which those attain a body weight of >15g are economically important as luxury protein in domestic and international markets (Balamurugan et al., 2004). Freshwater prawn farming, under monoculture and polyculture systems, has assumed greater significant, as the induction of prawn into freshwater aquaculture system has given fillip to substantial improvement in the profitability of aquaculture, triggering its expansion and elevation into an industry (Uptal, 2001). The biology and fishery of prawns has gained considerable attention, due to their great economic importance, prawns are caught round of

the year. However the peak catch shows a definite seasonal trend in commercially important prawn landing areas (Dutta, 2001). The farming of freshwater prawn is growing rapidly day by day in India due to its risk-free culture operations backed up by a good and steady international price which tend to prevail all along (Saravanan, 2003).

Totally 9 species are collected in Kodayar river basin. *M. lamarrei*, *M. indicum*, *M. rude*, *M. malcolmsonii*, *M. idae*, *M. idella*, *M. nobilii*, *M. canarae* and *M. rosenbergii* are the prawns collected in this river basin. *M. lamarrei* is abundantly available in all the study areas. *M. malcolmsonii* is available in Chittar Dam and Pechiparai Dam but not available in other two study areas. *M. indicum* is available in Chittar Dam

and N.P. Channel but not available in other two study areas. *M. idae* is available in Chittar Dam and Aruvikkarai Anicut but not available in other two study area. *M. rude* is available in Pechiparai Dam and N.P. Channel not available in other two study areas. *M. canarae* is only available in Pechiparai Dam but not available in other three study areas. *M. idella* and *M. rosenbergii* are available in Aruvikkarai Anicut but not available in other study areas. A very low number of *M. rosenbergii* is collected in comparatively other species. *M. nobilii* is only collected in N.P. Channel but not available in other study areas. In comparatively a large number of prawns are collected in Pechiparai Dam and next in line are Chittar Dam, N.P. Channel and Aruvikkarai Anicut. Kodayar river basin is received most of the rainfall from the southwest monsoon and the northeast monsoon periods. The northeast monsoon rainfall is higher than the southwest monsoon. The availability of prawn is dependant in both monsoon period. A maximum number of prawns are collected in Chittar Dam study area in Kodayar river basin.

During the study period of the present investigation the availability of prawn varied in species to species because most *Macrobrachium* prawns show seasonal reproductive patterns with respect to environmental factors such as rainfall, temperature and relative humidity. Studies of crustacean populations provide an important information on species dynamics, as well as for protection of natural biodiversity, and the population studies of freshwater prawn. Environmental factors rainfall, temperature and relative humidity show a positive and negative correlation (significant at 1, 5% level) in some species with different study areas. The result of this study clearly shows that freshwater prawn potentials availability in the river Kodayar basin and water bodies. Hence it is recommended that as the freshwater prawn resources are available throughout the year in river Kodayar, freshwater prawn farms may be actively promoted to encourage intensive prawn culture in these stations of the southern landscape of India.

4.0 Conclusions:

The river basins of Tamil Nadu contains some species of freshwater prawn. The prawn fishery of the river Kodayar in Tamil Nadu, India indicates that there are some major commercial species which support local fisheries. There are four stations fixed in Kodayar river basin for prawn collection. Temperature and rainfall play an

important role in the breeding season of freshwater prawns. The maximum number of prawns are recorded in north east and post monsoon periods. Totally 9 *Macrobrachium* species were collected in this river basin. The freshwater prawn resources are available throughout the year in river Kodayar. So, this basin is suitable for establish to freshwater prawn farm.

References:

- 1) Anonymous. 2001. Tamil Nadu Water Resources Consolidation Project. Water plan for Kodaiyar River Basin. Prepared by TAHAL Consulting Engineers and Associates. Government of Tamil Nadu, Public Works Department, Water Resources Organisation, *Institute for Water Studies, Taramani, Chennai*-113.
- 2) Balamurugan, P., P. Mariappan and C. Balasundaram. 2004. Impacts of Mono-Sex *Macrobrachium* culture on the future of seed availability in India. *Aquaculture Asia*, **2**, 15-16.
- 3) Banerjee, T.K. 2003. *Culture of Freshwater Prawns*. Applied Zoology, Banaras Hindu University, Varanasi. 2003, pp.1-21.
- 4) Charles, P.M. 1996. Effect of temperature on the egg production and the energetics of egg development in *Macrobrachium lamarrei*. *Proceeding of World Aquaculture*. 96. Bangkok, Thailand, January, p. 72.
- 5) Charles, P.M. 1984. Reproductive Physiology of a Freshwater prawn *Macrobrachium lamarrei* (H. Milne Edwards) Ph.D. Thesis, University of Madras, India, p. 106.
- 6) Dutta, N.K. 2001. Studies on the systematics and distribution of prawns in Assam. *Journal of the Bombay Natural History Society*. **1**, 18-25.
- 7) Henderson, J.R. and Matthai. 1910. On a certain species of Palaemon from South India. *Rec. Indian Mus.*, **5**, 277-305.
- 8) Holthuis, L.B. 1950. Subfamily Palaemonidae. The Palaemonidae collected by the Siboga and Snellius Expeditions with Remarks on other species-I. The Decapoda of the Siboga Expedition part-X. *Siboga Exped., Mon.*, **39**, 1-268.
- 9) Jalihal, D.R., S. Shenoy and K.N. Sankolli. 1988. Freshwater prawns of the genus *Macrobrachium* (Bate, 1868) (Crustacea, Decapoda, Palaemonidae) from Karnataka, India. *Rec. Zool. Sur. India, Occ. Paper No.* **112**, p. 1-74.
- 10) Jayachandran, K.V. and B. Indira. 2010. Prawn Fishery Resources of India for Food Security as well as for Rural Employment. *97th Indian Science Congress Symposium*, January 3-7, Thiruvananthapuram.

- 11) Jayachandran, K.V. and N.I. Joseph. 1986. On a few species of *Macrobrachium* (Decapoda : Palaemonidae) from the South-West coast of India. *Crustaceana*, **50**, 217-224.
- 12) Jayachandran, K.V. 2001. *Palaemonid prawns Biodiversity, Taxonomy, Biology and Management*. Oxford and IBH Publishing Company Pvt. Ltd., Calcutta. p. 1-624.
- 13) Mariappan, N. and R. Jasmine. 2006. Studies on freshwater prawns of family Atyidae and Palaemonidae from Kancheepuram and Thiruvallur districts, Tamil Nadu, India including one new species of the genus *Caridina* (H.M. Edwards, 1837). *Rec. Zool. Surv. India. Occ. Paper No.243*, p. 1-80.
- 14) Mary, V.S. 2003. Growth, Survival, Production and Sustainable culture possibilities of freshwater prawn *M. rosenbergii* (De Man) in Tamil Nadu. M. Phil. Dissertation. Presidency College, University of Madras., p. 33.
- 15) New, M.B. 2005. Freshwater prawn farming: global status, recent research and a glance at the future. *Aquaculture Research*, **36**, 210-230.
- 16) Pandian, T.J. 1993. Reproductive Biology of Invertebrates. In: K.G. Adiyodi and R.G. Adiyodi (editor). *Oxford and IBH Publishing Company Pvt. Ltd.*, New Delhi, Pp. 39-166.
- 17) Radheyshyam. 2009. Farming the Freshwater prawn *Macrobrachium malcolmsonii*. *Aquaculture Asia Magazine*, January to March, 29-33.
- 18) Saravanan, S.P. 2003. Mono-Sex Male Culture of Freshwater Prawn (Scampi). *Aqua International*,. September, 15-16.
- 19) Uptal, B. 2001. Status of Freshwater Prawn Farming in West Bengal. *Fishing Chimes*, **21**, 84-87.
- 20) Valarmathi, K. 2009. Studies on the Freshwater Prawns of the Families Atyidae and Palaemonidae (Crustacea, Decapoda:Caridea) from Southern India. Ph.D. Thesis,. University of Madras, p. 146.
- 21) Vijayan, E. 2008. Prawn Potentials of Palar river for Aquaculture. M. Phil. Dissertation, Vinayaka Missions University, p. 76.