

## Distribution and abundance of prawns in the freshwater habitats of Bangalore, South India

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**Abstract.** Fifty three freshwater habitats located in and around Bangalore (South India) were surveyed for studying the distribution and abundance of prawns. The survey indicated that, the habitats were rich in prawn fauna, harbouring one species of Palaemonid, *Macrobrachium lanchesteri* (de Man) and 3 species of Atyids, *Caridina nilotica* (Roux) var *bengalensis*, *Caridina rajadhari* (Bouvier) and *Caridina weberi* var *sumatrensis* (de Man). *Macrobrachium lanchesteri* and *Caridina nilotica* were more widely distributed than *Caridina rajadhari* and *Caridina weberi*. The results throw light on the pattern of distribution and species composition of these prawns in relation to the nature of the habitats.

**Keywords.** Prawns; distribution; abundance.

### 1. Introduction

In an earlier report, Anantha Raman *et al* (1978) have described the occurrence of one species of palaemonid and 3 species of Atyid prawns in the freshwater habitats of Bangalore. All these prawns are either important commercially (Johnson 1968; Guerrero and Guerrero 1979) or have ecological significance (Hart 1980) in freshwater habitats. The present paper describes the distribution of these prawns in the lentic and lotic habitats of Bangalore.

### 2. Materials and methods

During the early part of 1978, 53 freshwater habitats located in and around the North and South taluks of Bangalore (figure 1) were surveyed for the occurrence and distribution of freshwater prawns. The nature of each habitat was noted. From each habitat, prawns were collected using a plough net (mesh size: 0.75 × 0.75 cms), specially designed for the purpose. This facilitated the capture of prawns above the size of 10 mm in total length and ensured that all available species were represented. In each habitat, the net was operated randomly 5 times for a total distance of 20 m and using the dimensions of the net and the distance ploughed, the average number of prawns collected per 20 m<sup>2</sup> was determined. After collection, the prawns were preserved in ice and transported to the laboratory. In the laboratory, the samples of prawns collected were identified using standard keys (Tiwari 1947; Holthuis 1950, 1965, 1978) and the distribution patterns of these prawns in the different habitats were recorded.

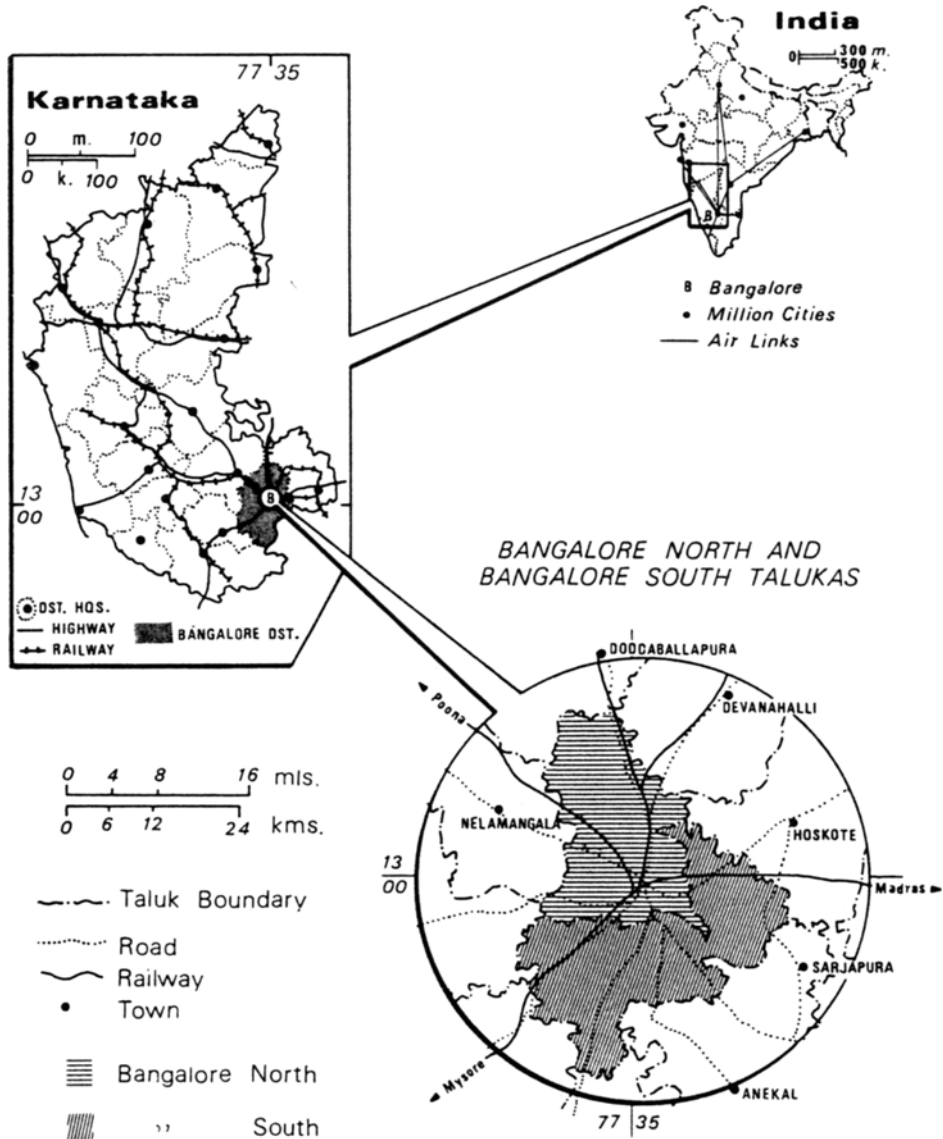


Figure 1. Topographic location of taluks of Bangalore District.

### 3. Observations and results

Except for one lotic habitat represented by the Vrishabhavathi rivulet, the inland habitats in and around Bangalore are mostly represented by perennial or seasonal lentic habitats which include pools/ponds/tanks/reservoirs/lakes. Most of the habitats are rainfed and the water is regularly used for purposes of irrigation. In many of the habitats, human activities have been considerable, leading to the drainage of domestic/industrial wastes.

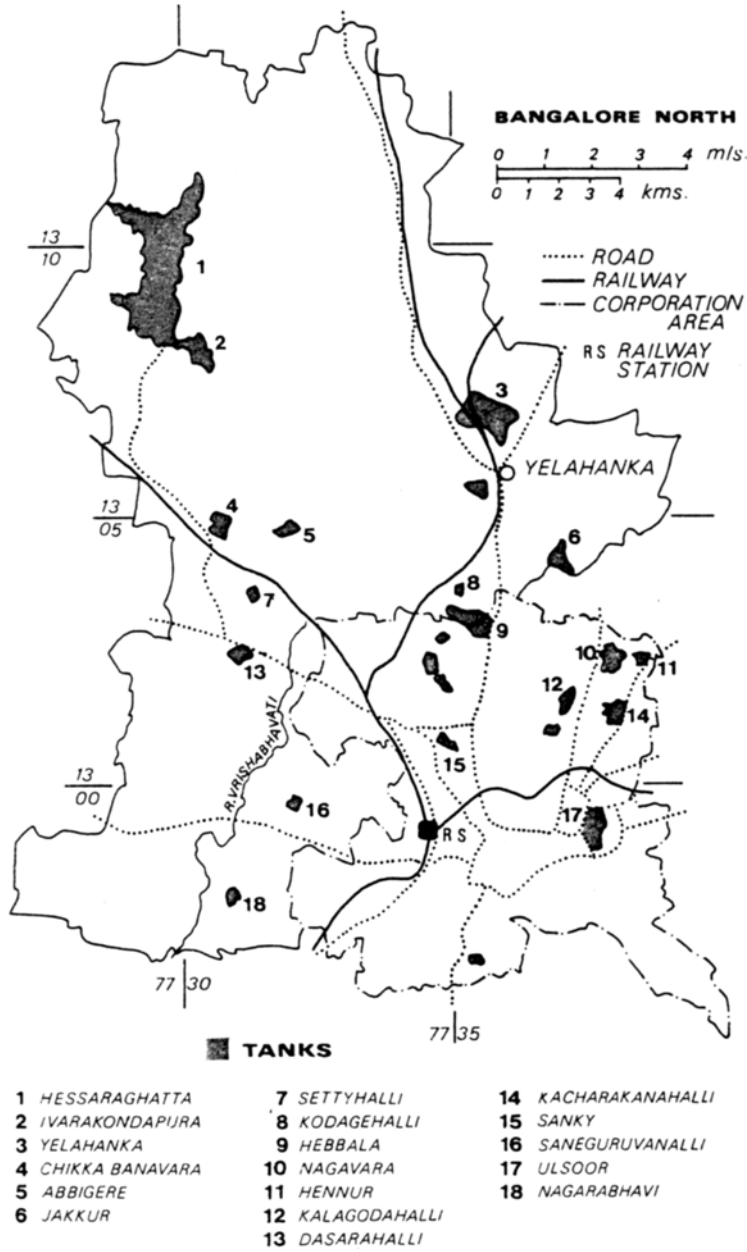


Figure 2. Freshwater habitats located in the North taluk of Bangalore.

During the survey, 4 species of prawns, one belonging to the family Palaemonidae (*Macrobrachium lanchesteri* (de Man); size range: 10–56 mm total length) and 3 species belonging to the family Atyidae (i. *Caridina rajadhari* (Bouvier); size range: 10–32 mm TL; ii. *C. nilotica* Roux var *bengalensis*; size range: 10–34 mm TL and iii. *C. weberi* var *sumatrensis* (de Man); size range: 10–30 mm TL) were collected.

Figure 2 represents the location of the freshwater habitats in the Bangalore North

**Table 1.** Distribution and abundance of prawns in the freshwater habitats of Bangalore North taluk. The numbers indicated in column 2 correspond to the habitats denoted in figure 2. In columns 3 and 4, only the ranges are represented.

Nature of the habitat	Habitat number	Density of prawns (Number/20 m <sup>2</sup> )	Distribution (%)			
			M.I.	C.n.	C.r.	C.w.
<b>A. Perennial habitats</b>						
i. Rainfed; fairly deep in the centre; grassy vegetation at the shallow margins; open waters devoid of weeds; bottom sediment mostly made up of clay and sand	1, 9 and 15	45-333	47-82	18-51	0-18	<1-3
ii. As above but infested with <i>Eichhornia</i> sp.	3	273	<1	78	19	2
iii. As in i. but with rocky bottom	18	5	100	—	—	—
iv. As in i. or ii. but with considerable drainage of domestic/industrial effluents	17	—	—	—	—	—
<b>B. Seasonal habitats</b>						
i. Rainfed; grassy vegetation at the margins open waters devoid of weeds; bottom sediment made up of clay & sand	2, 5, 7, 8	15-483	8-100	0-44	0-27	0-35
ii. Rainfed; fairly deep with slushy bottom; with <i>Eichhornia</i> sp.	10	531	4	58	37	1
iii. Rainfed; shallow with slushy/rocky bottom; no aquatic vegetation in the margins	4, 6 and 11	—	—	—	—	—
iv. Shallow with considerable drainage of domestic sewage/industrial effluents	12, 13, 14 and 16	—	—	—	—	—

M.I.: *M. lanchesteri* (de Man); C.n.: *C. nilotica* (Roux) var *bengalensis*; C.r.: *C. rajadhari* (Bouvier); C.w.: *C. weberi* var *sumatrensis* (de Man).

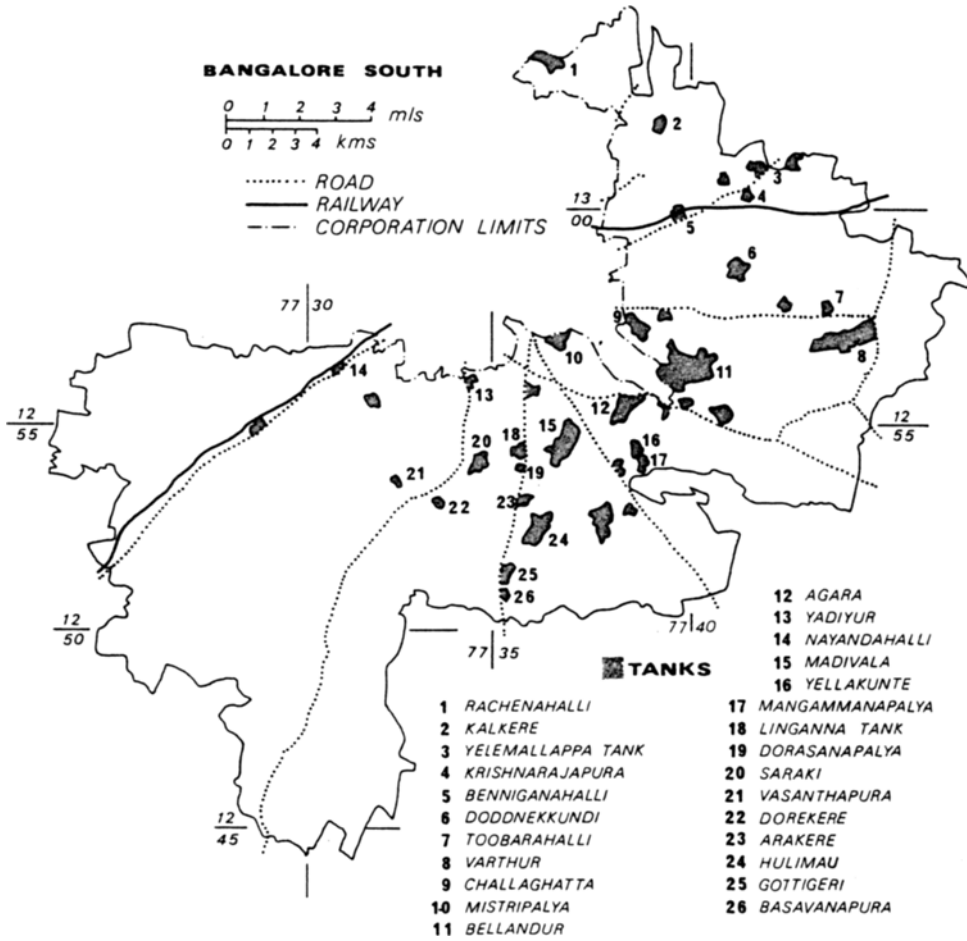


Figure 3. Freshwater habitats located in the South taluk of Bangalore.

taluk and table 1 gives the description of the distribution and abundance of prawns in relation to the nature of these habitats. It is evident that prawns are absent in habitats receiving domestic/industrial effluents and habitats with shallow margins and grassy vegetation appeared to support a rich fauna of these natantians. That the sewage has adverse effects on the survival/physiological energetics of food conversion in *M. lanchesteri* is reported earlier (Ponnuchamy *et al* 1980). It is quite likely that the microdistribution and abundance of both *Macrobrachium* sp. and *Caridina* spp. may be dependent on the nature of bottom sediment and/or aquatic vegetation (see Carpenter 1978).

The location of the freshwater habitats of Bangalore South taluk are represented in figure 3 and the details of the distribution and abundance of the prawn species in relation to the nature of these habitats is represented in table 2. As in the Bangalore North taluk, distribution and abundance of the prawns appear to be dependent on the absence of effluents, the type of bottom sediment and the presence of aquatic vegetation.

**Table 2.** Distribution and abundance of prawns in the freshwater habitats of Bangalore South taluk. The numbers indicated in column 2 correspond to the habitats denoted in figure 3. In columns 3 and 4, the ranges are represented.

Nature of the habitat	Habitat number	Density of prawns (Number/20 m <sup>2</sup> )	Distribution (%)			
			M.I.	C.n.	C.r.	C.w.
<b>A. Perennial habitats</b>						
i. Rainfed; grassy vegetation in the margins; open waters devoid of weeds; bottom sediment mostly made up of clay and sand	4, 5, 15, 16, 21, 24 and 25	21-409	<1-71	17-42	0-67	0-58
ii. As above but infested with <i>Eichhornia</i> sp.	12	147	11	47	43	—
iii. As in i. but with rocky bottom	18	—	—	—	—	—
iv. As in i. and ii. but with considerable drainage of domestic sewage/industrial effluents	8 and 11	—	—	—	—	—
<b>B. Seasonal habitats</b>						
i. Rainfed; grassy vegetation in the margins; open waters devoid of weeds; bottom sediment mostly made up of clay and sand	1, 2, 6, 10, 14, 17, 19, 22 and 23	3-443	3-100	0-90	0-61	0-40
ii. Rainfed; fairly deep with slushy bottom; infested with <i>Eichhornia/Hydrilla</i> sp.	3 and 20	8-12	0-32	59-69	0-29	2-9
iii. Shallow with slushy/rocky bottom; no aquatic vegetation in the margins	7 and 26	—	—	—	—	—
iv. Shallow with considerable drainage of domestic sewage/industrial effluents	9 and 13	—	—	—	—	—

Table 3 presents the data on the distribution and abundance of prawns in the freshwater habitats around Bangalore North and South taluks. It is again evident that the prawns prefer habitats devoid of effluents but those rich in clay or sandy sediment with grassy vegetation harbour a rich fauna of these prawns. From this it is apparent that the distribution of the freshwater prawns of Bangalore is primarily dependent on the nature of the habitat. While there appears to be not much variation in the distribution patterns of the different species in relation to the perennial or seasonal nature of the habitats, it is largely dependent on the type of bottom sediment, aquatic vegetation as well as the presence or absence of domestic/industrial effluents. That most of the habitats supported a fairly rich fauna of these 4 coexisting species is interesting.

#### 4. Discussion

The genus *Palaemon* (= *Macrobrachium*) belonging to the family palaemonidae is known to be extensively distributed in tropical and sub-tropical regions of the world. While Ortman (1902) opined that the distribution of this genus has no value in the study of ancient geography, Tiwari (1955) has fairly satisfactorily explained certain hypothesis based on the then existing distribution of several members belonging to the genus. According to him, the genus *Palaemon* originated rather late in geographical history, probably in littoral (marine) areas and began migrating to freshwater. In fact, the family palaemonidae as a whole, has been considered to be in the process of migrating from marine to freshwater systems (Emery and Stevenson 1957; John Mary 1957). Based on the above consideration, Tiwari (1955) distinguished the coastal species of the genus from those inhabiting inland freshwater systems of India. However, a large number of species included by him in the latter group are known to be the migratory varieties, still dependent on saline medium, at least for purposes of breeding and completing their larval histories (see Panikkar 1967; Jhingran 1982). While few species have also been indicated to be distributed in ponds/tanks, Tiwari (1955) has mentioned nothing about the distribution of such species in the lentic habitats of the country. Such species complete their entire life-history in totally inland freshwater systems (see also Raman 1976). *M. lanchesteri* (de Man) which is widely distributed in the freshwater habitats in and around Bangalore is one such species which is fully established in closed freshwater systems and thrives in land-locked freshwater habitats (see Johnson 1967; Raman 1976 and present observations). Surprisingly, Tiwari (1955) has not included this species in his discussion on the distribution of the group, despite his own first record of the species from Nagpur and Baroda Aravallis and Gujarat Satpuras as early as 1947. The wide occurrence of this species in the land-locked freshwater systems of Bangalore, suggests that this species is one of the earliest to have migrated, perhaps from coastal waters and is now fully established in totally inland freshwater habitats away from the coast. The ability of *M. lanchesteri* to tolerate saline media to a certain extent, despite its long phylogenetic history in land-locked freshwater systems (see Ponnuchamy 1981), offers further evidence to its probable marine/estuarine ancestry.

*M. lanchesteri* (de Man) is a species of Malayasian origin (Lanchester 1901; Johnson 1967). The record of this Malayan species, from the Satpura trends of mountains (Nagpur and Baroda; Tiwari 1947) and Bangalore (present study) is of special interest. Based on the distribution of hill stream fishes of India, Hora (1944) put forth the hypothesis that, waves of migrations of Malayan fauna passed over the Eastern

Table 3. Distribution and abundance of prawns in the freshwater habitats around Bangalore North and South taluks.

Nature of the habitat	Name of the habitat	Density of prawns (Number/20 m <sup>2</sup> )	Distribution (%)			
			M.I.	C.n.	C.r.	C.w.
<b>A. Perennial habitats</b>						
i. Rainfed; fairly deep with grassy vegetation in the margins/some aquatic weeds.	Mantapa and Kariyappanapalya	249-286	26-51	41-58	9-16	0-<1
ii. As above but without aquatic vegetation	Hoskere	—	—	—	—	—
<b>B. Seasonal habitats</b>						
i. With grassy vegetation in the margins, open waters devoid of weeds	Dodda Gubbi, Jigani and Koppa	10-148	21-90	10-40	0-46	0-<1
ii. As above but infested with aquatic weeds	Kannur	800	53	22	25	<1
iii. As in i. but with no marginal vegetation	Hoskote	10	29	71	—	—
iv. As in i. and ii. but with considerable drainage of domestic sewage/industrial effluents	Vengaiyah	—	—	—	—	—



Himalaya and then to the Western Ghats and the extreme South of India. From time to time, more evidences have been sighted in support of this hypothesis (Menon 1951; 1977; Silas 1952). The discontinuous distribution of *M. lanchesteri* (de Man) extending from the Satpuras to the South of India (Bangalore) lends further support to this hypothesis.

In regard to systematics, the genus *Caridina* is known to be one of the notoriously difficult genera of Atyidae (Holthuis 1965), which is a major family of decapods largely comprising freshwater prawns of warmer tropics. The probable origin of these primitive caridean prawns is traced to Tethys, a shallow-water tropical sea during the cretaceous (Banarescu 1973) and they are known to be most common in Indo-pacific and Caribbean regions (Johnson 1963). The family is usually described as restricted to freshwaters, although a number of species are known to inhabit 'anchialine'\* pools with a salinity as high as 30% (Holthuis 1973).

Several lines of evidence suggest that unlike the Palaemonidae the Atyidae are ancient inhabitants of freshwater (Roxo 1940; Beurlen 1950). Since salt tolerance or life in proximity to the sea is no criterion of immediate marine ancestry (Ortman 1894; Schminke 1975), especially in a large family like Atyidae, with no present day marine representatives (Fryer 1977), it is probable that the members of the family have a long history in freshwater systems.

From time to time, several species of the genus *Caridina* have been reported from various Indian freshwater habitats (Natarajan 1942; Chinnayya 1968; Tiwari and Pillai 1968; Dutt and Ravindranath 1975; Ravindranath 1977). Of the species so far reported from Indian freshwaters, some are riverine varieties, while others have been recorded from smaller closed water bodies (Ponds and ditches). The 3 species of *Caridina* distributed in and around Bangalore are the confirmed land-locked varieties and appear to be discontinuously distributed in the inland freshwater systems of India. However, since authentic taxonomic identifications of the hitherto recorded varieties of the genus are lacking and the distribution of the different species of the genus, in Indian freshwater habitats is not fully known, a discussion on the distribution pattern of these species has not been attempted presently. The species of *Caridina* recorded presently reproduce in closed freshwater systems and their development is also abbreviated (i.e. eggs hatch into zoea larvae; see Ponnuchamy *et al* 1979; Rao *et al* 1981), provides additional ecological evidences for the hypothesis that the species are ancient inhabitants of freshwater. The occurrence of one or all the species of Atyids in most of the local habitats and their coexistence with a palaemonid (*M. lanchesteri*), suggests that, the genus *Caridina* and the 3 species included under it are advanced and diversified atyids, capable of competing with palaemonids (Walker 1972; Carpenter 1977). The key to their ability to have done so perhaps lies in their extremely specialised and efficient means of food collection (Fryer 1977; Ponnuchamy *et al* 1984), which permits the handling and utilization of minute food particles. However, the irregular pattern of distribution of these atyids as observed presently, as compared to that of *Macrobrachium*, suggests that their microdistribution in the habitats may be regulated either by specific environmental factors, nature of bottom sediment or the distribution of aquatic plant species (see Kemp 1917; Carpenter 1978).

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\*'Anchialine' denotes a freshwater habitat with no surface connection with the seas but which contains saline water fluctuating with the tides.

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