

On the Intensity of Exploitation of Berried Females of *Macrobrachium rosenbergii* (de Man) in the Vembanad Lake

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The annual exploited stock of *Macrobrachium rosenbergii* during 1994-95 from Vembanad lake is computed at 112.35 tons of which 66.22 tons was constituted by the female population. Contribution of berried and spent females were in the order of 23.43 tons and 5.02 tons respectively. Highest exploitation of berried (13.24 tons) and spent (3.39 tons) females were noticed in October while zone 11 accounted for maximum landings of berried prawns (3.6 tons). More than 50% of the berried females were found to be exploited from upstream part of the lake during september and October. In zone 4, 49.59% of the total spawner was comprised of spent females in the month of October. Among the various type of fishing gears and methods, "Pongu Veechal" accounted for exploitation of 75 and 79% of berried and spent females respectively. Temporal and spatial variations in the intensity of exploitation of ovigerous females and spent females are given. Intensity of recruitment over fishing being exercised on the stock of *M. rosenbergii* of Vembanad lake is brought out and the methods by which conservation measures can easily be imposed for replenishment of stock is also highlighted.

Key words : Berried females, exploitation *Macrobrachium rosenbergii*, Vembanad lake, Kerala.

Macrobrachium rosenbergii (de Man) of the Vembanad lake is reported to have dwindled over the past three decades from 400 tons in sixties (Raman, 1967) to a mere 39 tons in 1988-89 (Kurup *et al.*, 1992). Enroute the breeding migration of berried population from upstream to downstream region of the lake, the female spawners are subjected to indiscriminate exploitation and this is attributed to be one of the reasons for the alarming depletion of its stock (Kurup *et al.*, 1992). However, there is no authentic information on the spatial and temporal variations in the intensity of exploitation of ovigerous females of the lake and therefore an attempt is being made to collect data on these lines which will be

useful for the conservation and management measures for the revival of fishery. The fishery, spawning migration and temporal and spatial availability of berried populations of *M. rosenbergii* in Vembanad lake were studied by Raman (1967), Kurup *et al.* (1992) and Harkrishnan & Kurup (1995).

Materials and Methods

The entire stretch of Vembanad lake extending from Cochin bar mouth to Alleppey was apportioned to ten zones and each of the 5 km stretch of the adjoining rivers such as Muvattupuzha, Meenachil, Pampa, Manimala and Achencoil were taken as three separate zones (Fig. 1). Regular monthly fishery

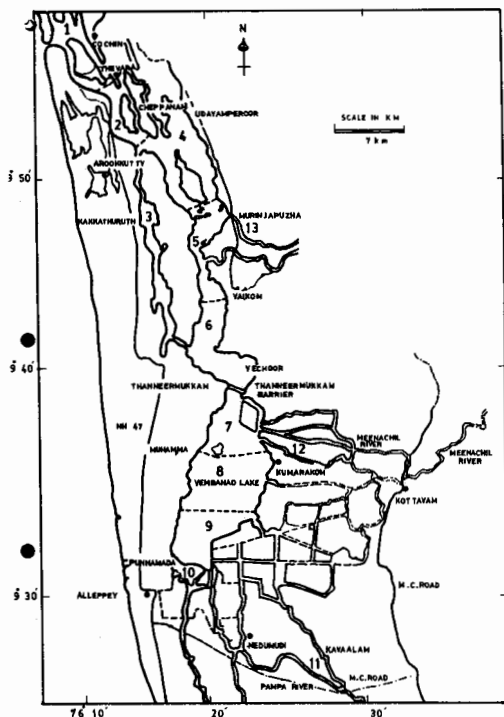


Fig. 1 Vembanad lake showing various zones.

cruise surveys were undertaken in the lake and the confluent riverine zones during March 1994 to February 1995 in order to observe the exploited fishery of *M. rosenbergii* with the help of M.B. Kingfisher. The fishery in each zone was observed for a period of 24 h and catches from not less than 30% of total units engaged in fishing were examined in detail giving special emphasis to total weight, sex, size range, stage of maturity, presence of berry, colour, stage of embryonic development, weight of male, female, berry and spent etc. The ovigerous females were distinguished by the presence of brood chamber holding entire egg mass attached to the hairs on the basipodites of pleopods. Three stages of berried females were observed

such as orange, grey and black, however, such differentiation was not made while quantifying the exploited berry stock. The spent females were distinguished by the empty brood chambers showing remnants of egg membranes. The total landings and contribution of berried and spent females from each zone was computed applying the formula of Kurup *et al.* (1992).

Results and Discussion

During the period from March 1994 to February, 1995 the exploited stock of *M. rosenbergii* from Vembanad lake was computed at 112.35 tons of which the contribution of males and females were in the order of 46.13 tons and 66.22 tons respectively. The fishery was exclusively constituted by males during March to May (Fig. 2a) and their dominance

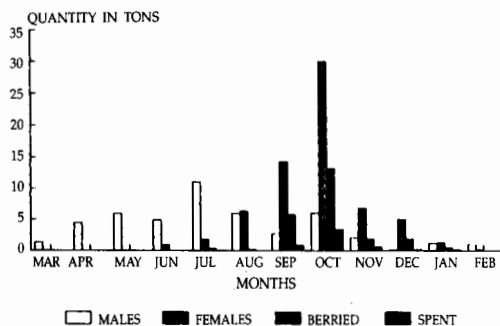
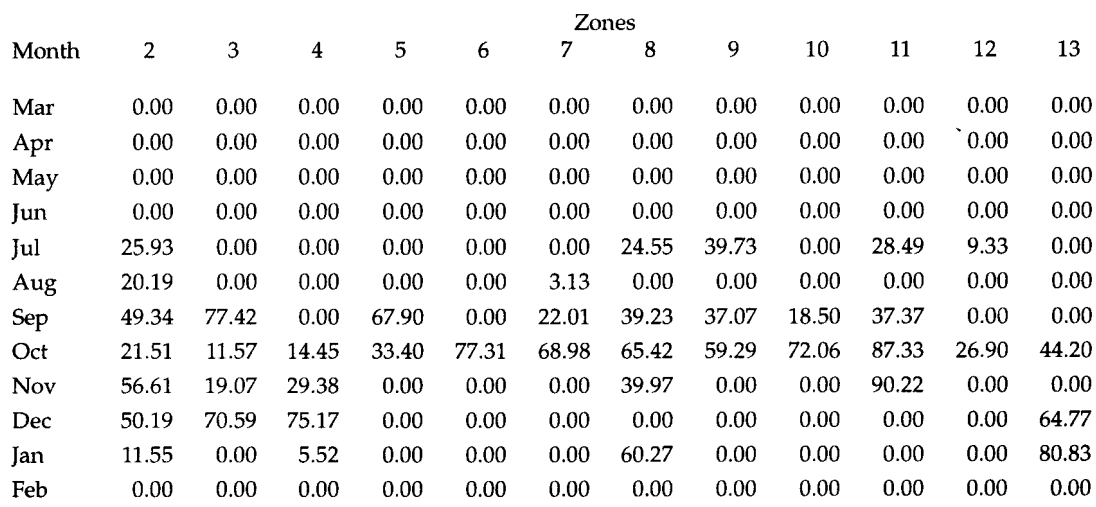


Fig. 2a Monthwise landings of males, females, berried and spent females from Vembanad lake during 1994-95.

continued during June and July. About 72% of the total males exploited from the lake was landed during this period. Highest landings of males were observed in July (11.06 tons) and males were found to be exploited heavily from zones 8 to 11 (Fig. 2b) with peak landings from zone 8 (10.54 tons). On the contrary, the females



Percentage exploitation of berried females from various zones of the Vembanad lake during March 94 to February 95 is given in Table 2. 41.49% of the ovigerous females was found to be exploited from the downstream part of the lake (zones 1-6) while from upstream and confluent rivers, it was in the order of 27.18% and 31.33% respectively. Highest quantities of berried prawns were caught from downstream region of river Pampa (Fig. 2b Zone 11), Kumarakom region (Zone 9) and Shertalai canal (Zone 3) while in zones 10, 2 and 4 moderate exploitation could be noticed (Table 2). It could be seen that only 30.2% of the total berried population was caught in zones 2-4 while 69.8% were being caught at different zones either at its home ground or during its downward migration. Invariably in all zones, exploitation of berried prawns became intensified during September-November and highest landings were observed in October. An exception to this situation

was noticed in zones 3 and 13 where peak landings were encountered in September (2.02 tons) and December (0.45 tons) respectively.

A wide array of indigenous fishing gear and methods were employed for the exploitation of *M. rosenbergii* in Vembanad lake, among which three varieties of cast net operations locally known as "Pongu Veechal", "Koti Kuthi Veechal" and "Thady Veechal" (Raman, 1967; 1975; Kurup *et al.*, 1992 and Harikrishnan & Kurup, 1995) are the most extensively practised. During March 1994 to February 1995, cast net operations accounted for the exploitation of 19.22 tons of berried females. The "Pongu Veechal" alone contributed to 17.8 tons while gill nets (1.46 tons), Stake nets (1.62 tons), Choonda (0.32 tons) and Chinese nets (0.52 tons) were also involved in the exploitation of berried females. The gear wise landings of berried females is depicted in Fig. 3a. A zone wise analysis

Table 2. Percentage exploitation of berried females of *Macrobrachium rosenbergii* from different zones of Vembanad Lake during March 1994 to February 1995

Month	Zones												Total
	2	3	4	5	6	7	8	9	10	11	12	13	
Mar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Apr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
May	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jun	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jul	19.27	0.00	11.66	0.00	0.00	0.00	52.07	2.25	0.00	12.96	1.80	0.00	100.00
Aug	85.92	0.00	0.00	0.00	0.00	14.08	0.00	0.00	0.00	0.00	0.00	0.00	100.00
Sep	2.56	35.25	0.00	1.65	0.00	1.79	13.48	28.64	9.57	7.09	0.00	0.00	100.00
Oct	5.26	1.22	8.28	5.35	13.90	5.27	6.20	13.40	14.37	22.37	3.10	1.10	100.00
Nov	25.31	9.93	38.23	0.00	0.00	0.00	16.98	0.00	0.00	9.55	0.00	0.00	100.00
Dec	31.78	29.86	13.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.58	100.00
Jan	3.91	0.00	3.70	0.00	0.00	0.00	21.67	0.00	0.00	0.00	0.00	70.72	100.00
Feb	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	8.81	12.43	8.96	3.43	7.86	3.50	9.06	14.62	10.47	15.38	1.77	3.71	100.00

(data not shown) showed that the cast net operations were dominant in zones 8 to 11 in upstream part of the lake. In zone 9, "Pongu Veechal" landing was to the tune of 3.47 tons, while in zone 11 the landings from "Koti Kuthi Veechal" was 1.1 tons of berried females. Cast net operations by "Thady Veechal" prevalent in zone 4 accounted for 0.35 tons of berried females.

Spent females were exploited to the tune of 5.02 tons which formed 7.57% of the females exploited from the lake (Table 3). Highest landings of spent females was noticed in October (3.39 tons) (Fig. 2a) similar to berried females. The landings of this group was invariably high during September to November in all the zones except in zone 13, where it constituted a small fishery only during December and January. In October, during the peak breeding period, the highest landing of spent animals was encountered from zone 4 (1.058 tons) which formed 49.13% of the total female spawners exploited. However, their

highest percentage exploitation with respect to total exploited females was registered in zone 8 (60%) (Table 2). In November "Pongu Veechal" landed about 79.2% of the total spent females exploited from the lake, while Choonda (8.42%), Gill net (5.36%) and Stake net (1.84%) (Fig. 3b) landed negligible quantities. In zone 4, 0.21 tons of spent females were landed by "Thady Veechal".

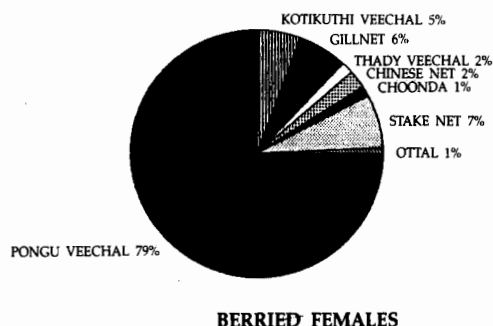
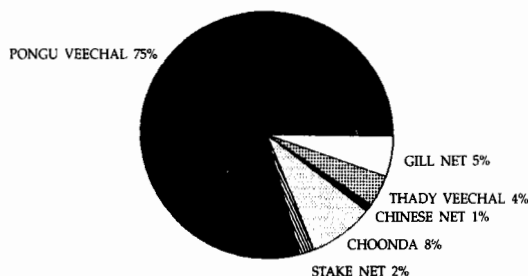


Fig. 3a Percentage exploitation of berried females by various gear in Vembanad lake during 1994-95.

The fishery of *M. rosenbergii* in the downstream part of the lake is seasonal

Table 3. Percentage of spent females in total female population of *Macrobrachium rosenbergii* exploited from different zones of Vembanad lake during March 1994 to February 1995

[illegible]



SPENT FEMALES

Fig. 3b Percentage exploitation of spent females by various gear in Vembanad lake during 1994-95.

and therefore it could be inferred that the migratory stock descending from the upstream part of the lake and confluent rivers constitute the fishery. Similar condition was reported in Bolgoda lake in Sri Lanka (Jinadasa, 1985). The preponderance of males and females during February to July and August to December respectively in the lake support previous findings (Raman, 1967; Rao, 1967; Wanninayake & Costa 1987; Kurup *et al.*, 1992) that *M. rosenbergii* performs differential migration in the estuaries of India and Sri Lanka. Based on the pattern of exploitation trend presently noticed from the lake, it is apparent that males are predominantly prone to exploitation in the upstream part of the lake and confluent rivers, and on the contrary, females are heavily exploited from the downstream part of the lake. In consonance with this, the percentage of berried population exploited from the downstream part of the lake is remarkably high. Females of *M. rosenbergii* exhibits breeding behaviour and the period of incubation varies from 18-20 days (New & Singholka, 1985). Commensurating with the progress of embryonic development it undertakes breeding migration

to saline regions of the lake where salinity varies from 10-15 ppt (Sebastian, 1990).

Prior to the construction of Thanneermukkam salinity barrier, Kumarakom and adjacent regions of the upstream part of the lake offered ideal brackishwater conditions for hatching and completion of larval metamorphosis. Therefore, the fishery was well restricted in the upper reaches of the lake (Raman, 1967), as the stock need not perform downward migration for the purpose of breeding. However, in recent years, with the commissioning of the barrier, a shift in breeding ground was found effected to 40 km downward (Kurup *et al.*, 1992) and consequently the berried females are compelled to undertake lengthy spawning migration in order to reach the breeding ground. With the intensification of fishing activity in the lake for freshwater prawn during July to December, the slow moving ovigerous females are most vulnerable to heavy fishing pressure and this may be the reason for their heavy exploitation in the downstream part of the lake.

The females in advanced stages of maturation such as grey and black berries have predominated in the downstream part of the lake where salinity varied from 6-22 ppt (Harikrishnan & Kurup, 1996). In the present study, the fishery of berried females was mainly found restricted in downstream areas during November to February. It may, therefore, be inferred that breeding of *M. rosenbergii* may be taking place in zones 2, 3 and 4 where the salinity is quite congenial for the completion of larval metamorphosis, as

reported previous (Kurup *et al.*, 1992). In zone 13 (Muvattupuzha river which drains out at downstream part of the lake), the existence of a late fishery comprising of berried and spent females during December and January could be noticed. The appearance of berried females in this zone may be related to the breeding migration of late maturing females to downstream areas. On the contrary, the occurrence of spent females in the catches may be due to the bypass return migration of the same to freshwater habitats consequent to the closure of Thanneermukkam salinity barrier during December to April.

The results of the present study revealed that on an annual basis 23.4 tons of berried females are exploited from Vembanad lake which form 20.86% of the total exploited stock of *M. rosenbergii*. As zones 2, 3 and 4 of the lake are suitable habitats for completion of larval metamorphosis of *M. rosenbergii*, it can reasonably be inferred that the spawner stock which reach these zones are only fortunate to successfully complete larval history and contribute to the stock replenishment. Of the total stock quantified from the lake, the contribution of berried population from these breeding grounds accounts for only 30.2% while the remaining 69.8% is vulnerable to fishing pressures at various zones in upstream part of the lake. Based on the distribution and exploitation of berried population in the lake, it may be inferred that only one third of the spawner stock gets a chance to reach its breeding ground where hatching and larval metamorphosis conditions are suitable while remaining part of the stock is destined to be caught at different regions of the lake during the process of

maturation of berries and also downward migration. This finding would suggest the possibility of recruitment over-fishing as defined by Pauly (1980), which can be one of the reasons for the alarming depletion of the stock observed during the past decade. The methods generally recommended for the conservation of the stock are: a) imposing a ban on fishing during the peak period of occurrence of spawner stock, b) reduction in fishing pressure at the breeding ground during the breeding period, c) regulation of fishing effort of the gear which is primarily responsible for the exploitation of major part of spawner stock (Gulland, 1984). By examining the results of the present study, it could be seen that 56.56% of the ovigerous females were exploited from the lake during October, while zones 2, 3 and 4 form the breeding ground of *M. rosenbergii* in the lake where the hatching and larval metamorphosis take place during September to January whereas 75% of berried females are found to be caught by cast net (Pongu Veechal). It would thus appear that the conservation of the stock of *M. rosenbergii* in lake would be possible by imposing regulatory measures in any one of the above forms.

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