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Standardising stocking density for freshwater prawn *Macrobrachium rosenbergii* (De Man, 1879) farming in coconut garden channels

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Abstract

The effect of stocking density on the population structure, growth characteristics and production of freshwater prawn *Macrobrachium rosenbergii* in coconut garden channels was studied. A randomised block design of four treatments and four replicates was used and the only difference being the stocking densities which ranged from 5000 ha^{-1} to 25,000 ha^{-1}. The mean weight and survival at the time of harvest varied from 55.5 g to 101.7 g and 28.21% to 69.44% respectively. At lower densities the proportion of undersized non-marketable prawns was relatively low. However, net production increased with stocking density from 90.1 (TC-1) to 199.7 kg·ha^{-1}· 8 months^{-1} (TC-4). Final marketable yield structure and economics revealed that the stocking density of 15,000 ha^{-1} was optimum for coconut garden channels in Kuttanad. Present study suggests that the profit incurred from freshwater prawn farming is directly related with production of larger orange-clawed and blue-clawed morphotypes. Hence stocking density was found as an essential component for ensuring better marketable yield and improving the economic returns. This study provides significant information since most coconut garden channels are abandoned water areas which when utilised properly can be an additional source of income especially to agriculture farmers in India and other Asian countries.

Introduction

Aquaculture production systems used across the world differ widely depending on the species being cultured and on the geographical location and socio-economic context. The pursuit for an alternate eco-friendly and sustainable aquaculture has led to the recognition of giant freshwater prawn, *Macrobrachium rosenbergii* (De Man, 1879), with the trade name ‘scampi’, as the prime candidate species for freshwater grow-outs. Kuttanad, the rice bowl of Kerala (South India), is traditionally known as the home ground of this species. Traditionally, prawn farming is carried out in polders developed from paddy cultivation (Kurup et al. 2002). Being a low-lying wetland, Kuttanad is governed by a wide array of physico-chemical parameters characterised by low water and soil pH. Since this area is also frequently flooded, a round the year culture of scampi is not feasible. Moreover, paddy being given prime importance, scampi culture is only practiced as part of a crop rotation process. Hence, the duration of culture cannot be extended beyond 5-6 months. Also due to water logging, pre-stocking management practices like drying, raking and liming of the soil cannot be done effectively. Hence, a wide fluctuation in

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the net production from these polders (95 to 1,297 kg·ha^{-1}) was discernible (Kurup and Ranjeet, 2002).

Another limiting factor for the profitability of freshwater prawn farming is the size disparity seen among adult prawns (Ranjeet and Kurup, 2002). The differential growth pattern of various male and female morphotypes of *M. rosenbergii* has been well characterised in grow-out population under different levels of stocking density and management strategies (Brody et al. 1980; Cohen et al. 1981; Karplus et al. 1987). As stocking density increases, an increase in yield can also normally be expected; however, a corresponding increase of non-marketable prawns in the harvested population due to the decrease in mean weight is commercially most disadvantageous to this species (Cohen et al. 1981; Montanez et al. 1992; Kurup, 1996). Hence the economic success of prawn culture in any locality is governed by the proper selection of stocking density and stocking size (D'Abramo et al. 1989).

In Kuttanad, area under coconut cultivation is nearly 871,000 ha and intricate coconut garden channels are available that provide a conducive grow-out environment for successful farming operations. These channels usually have a water-spread area ranging from 0.2 to 7 ha, hence providing a vast span of untapped resource for freshwater prawn farming. The farming of this species has been carried out in the past without adhering to a strict protocol. No attempts have so far been made to optimise the stocking density in these channels for improving survival rate, growth performance, marketable yield and profitability. In the present study, an attempt is made to investigate the optimum stocking density for freshwater prawn farming in coconut garden channels of Kuttanad. Kuttanad shares a geographical and agro-climatic environment similar to many South Asian countries. Sound knowledge on the farming of freshwater prawn in the interstitial channels formed during agriculture can be effectively utilised as a means of additional income to farmers.

Materials and Methods

A randomised complete block design method was used to select the channels. All the 16 coconut garden channels selected for the study had an equal water spread area of 1 ha each. These channels were cleared of all predatory fishes by netting, drying and applying deoiled cake of mahua @ 5 kg·ha^{-1}. Lime @ 50 kg·ha^{-1}was added to bring pH to neutrality. Having considerable natural deposits of lime in these areas, liming @ 50 kg·ha^{-1} was found to be enough to maintain the soil and water pH under control throughout the culture period. Farmyard manure @ 1,000 kg·ha^{-1} was applied in equal monthly installments during the culture period. The channels were stocked with post larvae procured from a local hatchery. The performance of post larvae stocked under four separate stocking densities (treatments) in these channels was assessed. Each set of treatment represents data collected from four separate channels (quadruplicates). In the first set of treatments (TC-1) the initial stocking density was kept @ 5,000 ha^{-1} and in subsequent treatments the initial stocking density was @ 10,000 ha^{-1} (TC-2), 15,000 ha^{-1} (TC-3) and 25,000 ha^{-1} (TC-4) respectively. The prawns were fed initially with a commercial feed (Charoen Pokphand (CP–scampi) starter feed) @ 20% of the prawn biomass for 3 months and later they were fed with a diet mixture of groundnut oil cake, rice bran and boiled meat of edible clam in equal proportion @ 10% of the prawn biomass. Water in the coconut garden channels was exchanged twice every week. Water quality parameters such as temperature, dissolved oxygen, transparency, water and soil pH were monitored on a monthly basis following AOAC (1985), while levels of total ammonia-nitrogen (TAN), nitrite-nitrogen and hydrogen sulphide in water samples collected during morning hours from each treatment were determined at fortnightly intervals using Aquakit (MERCK).

At the end of 8 months of culture, water from the channels was pumped out and the prawns were harvested by handpicking. Random samples of 500-1,000 prawns from each grow out were examined on the day of harvest. All the prawns were sorted according to their sex and morphotypes (Kurup et al. 1998). The males were then classified into three morphotypes such as small males (SM), strong orange-clawed males (SOC) and strong blue-clawed males (SBC) and four of their transitional stages viz. weak orange-clawed males (WOC), transforming strong orange-clawed males (t-SOC), weak blue-clawed males (WBC) and old blue-clawed males (OBC). Similarly, females were also sorted into three main morphotypes such as small females (SF), strong orange-clawed females (SOF) and strong blue-clawed females (SBF) and three transitional stages viz. weak orange-clawed females (WOF), transforming strong orange-clawed females (TOF) and weak blue-clawed females (WBF) (Harikrishnan and Kurup, 1997). All the prawns were measured up to the nearest mm and weighed up to the nearest g. In order to assess the effect of stocking density on population characteristics and yield structure the cumulative mean values of each treatment among channels (TC-1 to 4) were compared. The variations in the mean weight, survival rate and net production among the four treatments were tested employing Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1984).

Results

Water quality parameters among the treatments did not show any significant difference (P>0.05). Table 1 shows the mean values calculated for different water quality parameters observed during the present study. All the water quality parameters determined were well within the optimum ranges.

Population structure

The details of population density at harvesting on mean weight of prawns, percentage survival and contribution of male and female in the harvested population of the four treatments (TC-1 to TC-4) are given in Table 2. The final densities of *M. rosenbergii* at the time of harvest in treatments 1 to 4 were in the order of 0.35, 0.54, 0.57 and 0.70 m^{-2} respectively. Survival in the various treatments showed a remarkable decline from 69.4% in TC-1 to 28.2% in TC-4. A similar declining trend in the mean weight also was noticed with increase in final density among the treatments. Male: female ratio was dissimilar at all the four densities. Highest production was encountered in TC-4 (199.7 $kg{\cdot}ha^{-1}$), while the least was seen in TC-1 (90.1 $kg{\cdot}ha^{-1}$). The percentage by weight of undersized non-marketable prawns (SM and WOC) increased remarkably with an increase in the stocking density (Table 3). Proportion of SM and WOC was least in TC-1 (10.32%), whereas it showed significant increase to 36.33% in TC-4. On the contrary, percentage of BC males in the final population followed an inverse trend, which showed a decrease at significant levels from 34.71% in TC-1 to 14.11% in TC-4. Among the female morphotypes, only SF showed a direct relationship with stocking density as its proportion increased from 5.33 in TC-1 to 12.89% in TC-4. The most significant among them were the individual weight of OBC, which showed reduction from 147.9 to 103.45 g in TC-1 and TC-4 respectively.

Results of Duncan's Multiple Range test (DMRT) employed to compare mean weight, survival rate and net production indicate that all the above production parameters were significantly ($P<0.01$) different among the four treatments (Table 4). On further investigation it was noticed that mean weight and survival rate among all the four treatments varied significantly (Table 5). However regarding the net production the performance of TC-1 and TC-2 did not differ significantly. Similarly, there was no difference in the net production between TC-3 and TC-4. The structure of male and female populations from four treatments is depicted in Fig. 1. It could be seen that SM and WOC showed a direct proportion with the increasing density. The proportion of SM was appreciably high in stocking density of @ 25,000 ha^{-1} (14.2%) while it was least at a density of 5,000 ha^{-1} (7.8%). Similarly, high proportions of t-SOC and OBC were observed at lower density of 5,000 ha^{-1} (26.8% and 15.1% respectively) while their percentage showed reduction considerably at stocking density 25,000 ha^{-1} (16.3% and 12.8% respectively). The population structure of female morphotypes at the final harvest also showed significant variations ($P<0.05$) in the different treatments (Fig. 1). The percentage of undersized SF increased from 10.1 to 15.3% as the stocking density increased from TC-1 to TC-4. The percentage of orange-clawed (OC) and blue-clawed (BC) females did not follow any particular pattern among the treatments, but their adequate representation in TC-2 (39.8 and 49.7%) and TC-3 (41.2 and 45.2%), were worth noticing.

Table 1. Water quality parameters from the four treatments 1-4 (Coconut garden channels).

Parameters	**Treatment 1 (TC-1)**	**Treatment 2 (TC-2)**	**Treatment 3 (TC-3)**	**Treatment 4 (TC-4)**
Temperature (^oC)	28.4 ± 2.35	29.3 ± 2.77	31.4 ± 1.52	30.4 ± 2.12
Dissolved Oxygen ($mg \cdot L^{-1}$)	4.62 ± 1.62	5.50 ± 0.84	5.06 ± 0.91	4.94 ± 1.02
pH range	7.8 ± 0.46	7.7 ± 0.52	7.4 ± 0.64	7.5 ± 0.55
Soil pH range	6.3 ± 0.34	6.0 ± 0.25	6.2 ± 0.28	6.3 ± 0.40
Transparency (cm)	35.1 ± 12.41	28.8 ± 18.65	26.2 ± 11.30	28.4 ± 13.88
Total alkalinity ($mg \cdot L^{-1}$)	68.4 ± 14.42	52.1 ± 13.15	66.7 ± 18.99	64.3 ± 15.38
Nitrite-N ($mg \cdot L^{-1}$)	0.11 ± 0.05	0.14 ± 0.03	0.12 ± 0.04	0.11 ± 0.03
Total ammoniacal-N ($mg \cdot L^{-1}$)	0.14 ± 0.01	0.17 ± 0.03	0.13 ± 0.05	0.09 ± 0.03

Mean water quality parameters +/- standard error from four treatments in quadruplicate (N=128)

Table 2. Stocking details and yield characteristics of *M. rosenbergii* reared under stocking density in coconut garden channels.

	TREATMENTS			
	TC-1	**TC-2**	**TC-3**	**TC-4**
Stocking Particulars				
Number per ha.	5,000	10,000	15,000	25,000
Mean weight (g)	0.2	0.2	0.2	0.2
Biomass per ha.	1.0	2.0	3.0	5.0
Harvest Details				
Number per square meter	0.35	0.54	0.57	0.70
Number per ha.	3560	5380	5690	7020
Mean weight (g)	101.65	87.73	69.11	55.48
Gross production ($kg \cdot ha^{-1}$)	92.10	110.10	188.30	219.10
Net production ($kg \cdot ha^{-1}$)	90.10	103.16	173.50	199.72
Survival (%)	69.44	54.52	42.69	28.21
Mean male weight (g)	128.6	105.2	101.8	85.3
Mean female weight (g)	68.2	52.5	50.1	42.8
Sex ratio	2.05:1	1.15:1	1.11:1	0.77:1

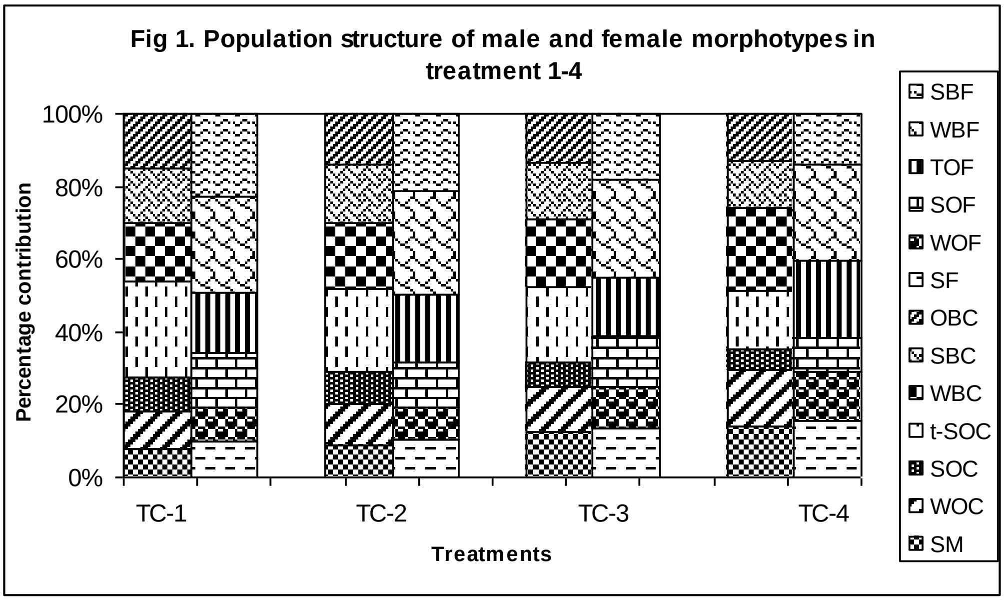

Fig. 1. Population structure of male and female morphotypes in treatment 1-4.

Table 3. Percentage contribution and mean weight of male and female morphotypes among the four treatments (channels).

Treatment		Male morphotypes							Female morphotypes					
		SM	WOC	SOC	t-SOC	WBC	SBC	OBC	SF	WOF	SOF	TOF	WBF	SBF
TC-1	Sample size (*n*)	65	25	6	72	41	22	24	29	34	15	26	51	50
	Contribution by weight (%)	6.28	4.04	4.56	28.45	5.00	8.37	21.37	5.33	1.16	0.10	7.34	4.76	3.24
	Mean weight (g)	18.41	42.53	93.33	103.62	97.78	129.40	147.91	12.05	34.64	51.50	52.14	54.59	76.80
TC-2	Sample size (*n*)	24	14	17	45	48	35	52	24	48	4	15	24	24
	Contribution by weight (%)	15.79	11.28	3.77	20.12	6.22	6.20	15.09	7.37	0.81	0.42	3.55	4.47	4.91
	Mean weight (g)	25.60	32.20	87.50	108.70	82.80	120.53	121.30	12.26	37.92	50.45	58.17	51.18	65.41
TC-3	Sample size (*n*)	13	24	15	35	31	20	35	24	42	15	12	16	62
	Contribution by weight (%)	20.21	15.92	2.66	11.58	8.02	4.20	10.62	9.33	0.52	0.14	7.87	3.55	3.38
	Mean weight (g)	18.23	36.43	68.50	76.37	78.12	102.45	111.45	16.04	31.50	60.63	71.99	60.95	70.00
TC-4	Sample size (*n*)	29	29	13	30	51	33	40	33	38	18	29	17	32
	Contribution by weight (%)	23.66	12.67	3.73	14.29	4.42	2.00	7.69	12.89	1.72	1.56	5.88	6.34	2.15
	Mean weight (g)	15.57	32.47	45.61	61.57	61.00	95.34	103.45	13.50	41.20	64.40	58.40	61.14	86.02

Table 4. Comparison of means for mean weight of prawn, survival rate and net production among the four treatments.

Variable	Source	df	Sum of Squares	Mean Square	F	Sig.
Mean weight	Between Treatments	3	4956.183	1652.061	30.773	0.001
	Within Treatments	12	644.234	53.686		
	Total	15	5600.416			
Survival	Between Treatments	3	3680.498	1226.833	47.036	0.001
	Within Treatments	12	312.993	26.083		
	Total	15	3993.491			
Net production	Between Treatments	3	34100.544	11366.848	16.502	0.001
	Within Treatments	12	8265.883	688.824		
	Total	15	42366.427			

Table 5. DMRT results for mean weight, survival rate and net production among the four treatments.

Treatment	Mean weight		Survival		Net production	
	Mean	SD	Mean	SD	Mean	SD
TC-1	101.650[a]	7.5067	69.440[a]	6.6525	90.100[b]	7.4891
TC-2	87.730[b]	8.1917	54.533[b]	3.8724	103.160[b]	15.0562
TC-3	69.113[c]	8.6865	42.690[c]	6.3707	173.500[a]	28.4177
TC-4	55.483[d]	3.9793	28.210[d]	2.1198	199.718[a]	40.8038

Means with same letter as superscript are homogeneous

Yield Characteristics

Variations in the mean weight of population corresponding with final density were observed among the four treatments. Highest mean weight for prawns was recorded in TC-1 (101.6 g) against 55.5 g registered in TC-4 (Table 2). Invariably, the mean weight of male and female morphotypes was highest in TC-1 with 128.6 g and 68.2 g respectively in TC-1 and 85.3 and 42.8 g respectively in TC-4. Commensurating with the variations in mean weights, the net production also showed differences among the treatments. The lowest mean net production was recorded in treatments with stocking density @ 0.5 m^{-2} (90.1 $kg \cdot ha^{-1}$), while the highest production was registered in channels stocked @ 2.5 m^{-2} (199.7 $kg \cdot ha^{-1}$). The results of DMRT (Table 5) showed variations in net production were insignificant among TC-1 and TC-2 and between TC-3 and TC-4. Hence, there was no significant increase in the net production beyond an initial stocking density of 15,000 ha^{-1} in these coconut garden channels. It may, therefore, be inferred that a further increase in the stocking density from 1.5 to 2.5m^{-2} will not have any significant effect in improving the net production.

The weight distribution patterns of prawns in the four treatments at different levels of stocking density are depicted in Fig. 2. Preponderance of males in the final harvest in TC-1 seems to have influenced the marketable weight structure which is evident from the dominance of weight group >120 g (44%). Moreover, it may also be noted that the percentage of undersized non-marketable prawns (<50 g), such as SM, WOC and undersized female morphotypes were appreciably low (6%) in this treatment. In contrast, the percentage of non-marketable prawns showed an increase to 22% in TC-4, which was characterized with highest stocking density. Furthermore, the weight class >120 g was only moderately represented (29%) in TC-3 and TC-4. In these treatments, the weight distribution of the total population was found to be much influenced by the female morphotypes since the weight group 50–80 g (40%) showed predominance. It would thus appear that of the total biomass produced from each of the four treatments, 94% of the yield from TC-1 was constituted by prawns of >50 g size group and therefore, were marketable whereas in TC-4 only 78% were marketable. While working out the total revenue by taking into consideration the price packages offered by the seafood processing plants located at Cochin for *M. rosenbergii* per kg, total income would work out to be Rs. 25,032/- in TC-1, Rs. 32,312/- in TC-2, Rs. 47,528/- in TC-3 and Rs. 60,120/- in TC-4. It may therefore be seen that though the yield from TC-1 formed only 35.7% of TC-4, income wise it fetches 43.3% of the latter because of large size of prawns as well as reduction in the percentage of undersized prawns. However, analysis of cost and return per ha showed beyond a stocking density of 15,000 ha^{-1} the profit incurred from farming reduced considerably (Table 6). As the stocking density increased in subsequent treatments the gap between the percentage contribution of yield and income reduces significantly. Hence, beyond a stocking density of 15,000 ha^{-1}, the farming of freshwater prawn becomes less economical.

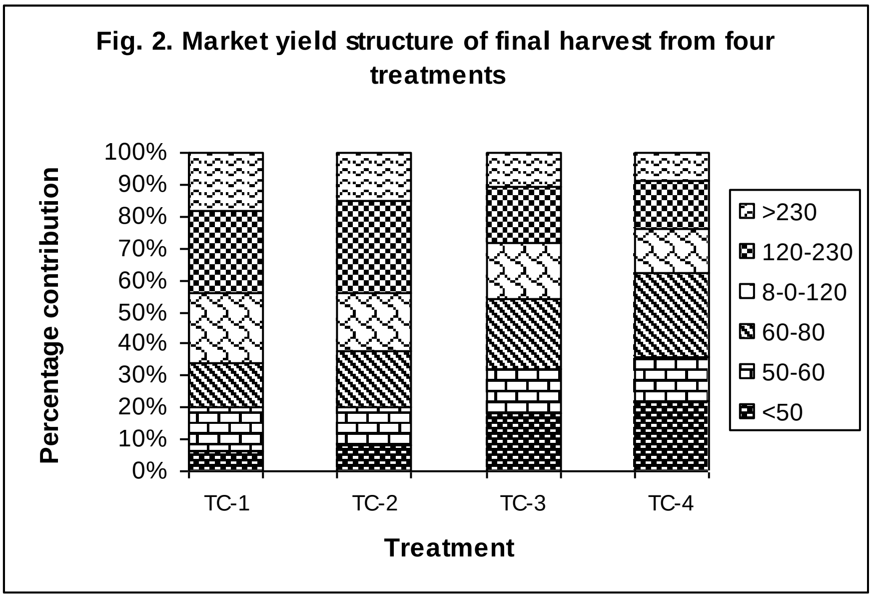

Fig. 2. Market yield structure of final harvest from four treatments.

Table 6. Cost and returns per hectare from *M. rosenbergii* farming under separate stocking densities in coconut garden channels.

Particulars	TC-1	TC-2	TC-3	TC-4
I. COSTS (Rs.)				
A. Variable Cost				
Pond preparation	2520	2850	3500	5000
Fertilizer	520	520	800	1000
Feed	3500	3500	6500	9000
Seed	3000	6000	9000	15000
Power	1200	1025	1230	2210
Labor	1800	2900	5000	7800
Fuel	850	850	1250	2000
Total Variable Cost	13390		27280	42010
B. Fixed Costs (Rs.)				
Pond Construction (apportioned)	7500	7500	7500	7500
Depreciation (5%)	375	375	375	375
Salary Wages^{-1}	1500	1500	1500	1500
Interest on Fixed capitals (18%)	1773	1773	1773	1773
Total Fixed Costs	11148	11148	11148	11148
C. Total Costs (A+B) (Rs.)	24538	28793	38428	53158
II. RETURNS				
Total cost of production (Rs.)	24538	28793	38428	53158
Total Yield (kg)	89.4	115.4	182.8	250.5
Gross Return (Rs.)	25032	32312	47528	60120
Net Return (Rs.)	494	3519	9100	6962

*1 Rs= 0.22 US$

Discussion

A remarkable difference in growth and the consequent weight attained by the morphotypes at the four levels of final density in coconut garden channels could be discernible and their variations were well reflected in the population structure. The available reports suggest that females invariably dominate in grow-outs of *M. rosenbergii* (Smith et al. 1978). However, in the present study, a similar trend was noticed only at higher final population density levels in coconut garden channels, while at low stocking densities, males showed their dominance. The growth rate of female is slow when compared to their male counterparts and therefore the chances of their vulnerability to predation are high in higher density, especially during early phase of culture (Peebles, 1979). Adult male prawns at a greater stocking density are prone to face competition for food and space. Owing to greater struggle and due to its highly cannibalistic nature, the proportion of male population gets considerably reduced (Kurupet al. 1998). Retrieval percentage registered in the coconut garden channels in the present study was found to be high when compared to earlier reports (Padmakumar et al. 1992; Mathew et al. 1993). Mean weight of dominant male morphotypes in the highly stocked grow-outs increased with reduction in survival rate and this may be due to the complex social hierarchy prevailing in the grow-out, while the undersized SM and WOC were deprived of food and space. This in turn reduced their average weight at higher densities.

Earlier works to optimise stocking density in polders (Kurup et al. 2002), river pens (Son et al. 2005), cages (Cuvin-Aralar et al. 2007) and in polyculture ponds (Hossain and Islam 2006; Marques et al. 2010) suggest that the most important factor for viable freshwater prawn culture is stocking density. A dynamic shift in the proportion of male morphotype with density was also discernible in the present study. At higher density, the proportion of SM was relatively high while OC males and its transitional stages showed next hierarchical dominance. Interestingly in the channels having low density, the percentage of BC males was distinctly high but the weight attained by them were comparatively lesser than that of t-SOC. This may be because with an ambient environment to thrive, the undersized male prawns instead of passing through the transformation pathway skipped the intermediary stages to attain the terminal growth by leapfrog transformation (Harikrishnan and Kurup, 1997). Moreover, in higher densities because of the urge for faster transformation from SOC to t-SOC and to subsequent BC, the relative size and weight of these males became comparatively less. So even though the prawns could attain the terminal stage of their growth, the weight gained was pertinently less when compared to morphotypes from lower densities. The shift observed in the frequency of male morphotypes may be due to the complex social organisational hierarchy in *M. rosenbergii.* At high density, the percentage of SM and WOC were high and this would suggest the chances of inhibition of growth of SM by BC due to the proximity of the latter. It may therefore be inferred that the rate of transformation of male morphotype to its successive stages was very rapid in low density grow outs, on account of less competition and fast growth rate and this can well be attributed as the reason for the presence of OBC in appreciably high proportions. Selective stocking and harvesting hence of late have received much attention among researchers as a mode to reduce this size disparity (Mohanty, 2009; Preto et al. 2010).

The inverse relationship between the prawn density and mean size of different morphotypes in this study fully agrees with the earlier findings (Cohen et al. 1981; Karplus et al. 1986b). The reduction in prawn growth with increasing density may be attributed to a variety of reasons such as competition for food, early sexual maturity, hyperactivity of subordinate individual, loss of exuvia and aggressive and social hierarchy (Karplus et al. 1986a). The results from the present study suggest the relative proportion of OC and BC in the population and the marketable size structure of the yields profoundly influence the economic viability of ‘scampi’ farming, rather than the total biomass produced. Therefore, information on the effect of various stocking densities, management measures and dynamics of male morphotypes and their interaction are very much required for improvement in the economic yield of *M. rosenbergii* for sustainable aquaculture. While working out the marketable yield structure and profit incurred from the culture under varied stocking densities, it could be seen that an increase in stocking density beyond a particular level was not helpful in the reciprocal improvement of the profit due to the dominance of undersized prawns in the final harvest. Although the significance of formulating different feeding strategy for diverse stocking rates has been advocated recently (Asaduzzaman, 2009), optimisation of stocking density is still considered the pivotal point in developing a threshold grow-out strategy for *M. rosenbergii* in many Asian countries (Schwantes et al. 2009; Nazim et al. 2010). Optimisation of stocking density also holds good since the reduction of the stocking rate below a particular level, though helpful in increasing the mean weight of prawns, would result in poor yield and thus farming becoming economically unviable.

Ranjeet and Kurup (2008) has shown that under similar culture period, the mean weight of prawn from polders and coconut garden channels differ greatly hence emphasising the need for adopting suitable grading system for marketing and increasing economic profitability from *M. rosenbergii* farming.

Farming in coconut garden channels was found to have some advantages like (1) Longer duration of culture than polders, as a result the mean weight of prawns gets increased (2) Better monitoring of feed input and hence wastage of feed can be considerably reduced (3) An elaborate network of coconut roots available on the banks on the channel act as artificial substrate or shelters for prawn hence reducing cannibalism (4) The shade cover of coconut palm avoids any thermal stratification in channels, (5) Harvesting is less labour intensive and can be done through draining or pumping out the water and (6) Since channels can be individually harvested, the farmer can sell the catch depending on the market demand.

Conclusion

In Kuttanad, a scientific culture practice for *M. rosenbergii* in coconut garden channels is lacking and most of the farmers are complying with a rather traditional type of farming which leads to reduced profit. Since stocking density has been a deciding factor that determines the profitability and economic sustainability of prawn farming, any information on standardising stocking densities for these grow-outs warrants much importance. The present study suggests that the relative proportion of larger OC and BC morphotypes in the final population profoundly influences the economic viability of 'scampi' farming in coconut garden channels. In order to ensure the availability of desired morphotypes in the harvested population in appreciable quantities, optimisation of stocking density is a prerequisite. While maintaining an initial stocking density at 1.5 m^{-2} in coconut garden channels, a linear relationship between the economic returns and corresponding profit could be established and similar relationship could not be arrived at other stocking densities studied. Therefore, a stocking density of 15,000 ha^{-1} would be ideal in the coconut garden channels of Kuttanad for the farming of *M. rosenbergii* in a more economically viable level.

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