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Alteration in stocking composition and species diversification in composite fish farming of Howrah District, West Bengal

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Abstract

Species diversification and stocking composition by the composite fish farmers of the Howrah District, West Bengal was investigated. The perception towards the Indian and exotic carps in composite culture revealed that rohu (*Labeo rohita*) and silver carp (*Hypophthalmichthys molitrix*), respectively, was the most favoured species of culture. Majority of the surveyed fish farmers (58%) produced between 7.5-9 tonne /ha/yr. as they stocked upto eight species incorporating minor carp (*Labeobata*) and giant fresh water prawns in their composite farming system. It was found that even more number of species could be accommodated as per the fitted relationship between production and number of stocked species were concerned ($y = -0.012x^2 + 0.787x + 2.510$, $R^2 = 0.747$).

Keywords: species diversification, composite farming, exotic carps, West Bengal.

Introduction

India is the second largest producer in inland finfish and farmed food fish production in the world with a share of 10% and 6.5% of the global total production, respectively [1]. Sustainability of aquaculture depends on proper feeding and farm management practices [2]. Increase in fish production rely on expansion of the area under aquaculture, diversification of technologies and cultivable species and information transfer from the research centers to the farming households. Polyculture of compatible fish species facilitates efficient utilization of all ecological zones within the pond environment enhancing the maximum standing crop [3]. Composite culture of Indian and exotic carps together was developed during the mid-sixties and the ICAR was involved in testing its feasibility and economic viability through All India Coordinated Research Project which was initiated far back in 1971 [4].

Carp culture with three Indian major carp species, viz., catla (*Labeo catla*), rohu (*Labeo rohita*) and mrigal (*Cirrhinus mrigala*) or in combination with exotic carp species viz. silver carp (*Hypophthalmichthys molitrix*), grass carp (*Ctenopharyngodon idella*) and common carp (*Cyprinus carpio*) stocked at different densities and species combinations recorded production levels ranging from 1000 to 10,673 kg/ha/year [5]. The research and development efforts during the last five decades have greatly enhanced average fish yields in the country making carp culture an important economic enterprise [6, 7]. Developmental strategies need attention towards diversification of aquaculture through locally available fish species [8]. In India, village level ponds are the mainstay of aquaculture which is managed by the people from the lowest strata of the rural community [9].

With this above background the present study has been designed to to assess the deviation/alteration from the standard package of practice of composite fish particularly with respect to species diversification and stocking composition in composite farming of carps in Howrah District, West Bengal.

Materials and Methods

The present study on was conducted in the purposively selected Howrah district, West Bengal (22° 48' N and 22° 12' N latitudes and between 87° 23' E and 87° 50' E longitudes) as it has diverse inland fishery resources of immense potentialities and 14th fish producing district in West Bengal. Moreover, the study area was easily accessible for collection of data through

personal interview with the farmers. Among 14 development blocks in Howrah district, five blocks namely Uluberia-I, Uluberia-II, Bagnan- I, Bagnan-II and Amta- I were purposively selected in consideration of the intensity of aquaculture and preponderance of fish farmers among the population.

Sampling and data collection

From each of the five selected blocks, twenty farmers were randomly selected for interviewing and primary data collection. Therefore, a total of 100 fish farmers from the selected five blocks constituted the respondents for the present study. Primary data were collected with the help of structured and pre tested interview schedule from the respondents on spot through personal interview. The schedule was finalized following a pilot study in the selected study area.

Analyses of data

The data were analyzed in terms of percentage and frequency against each variable. Appropriate statistical relationship in between two variables was fitted for prediction of degree of relationship between them with R^2 values.

Results and Discussion

Stocking composition

The most conspicuous deviation from the standard practice as emerged from the present study was related with stocking composition, density and ratio. The six species combination of IMC and exotic carps were not being followed by more than sixty percent of the farmers in the surveyed area (Fig.1). This was in conformity with earlier studies of [10] in North 24 Parganas and Burdwan district. This was because the surveyed farmers reported that fish production through the classical method with combination of classical six species gave low yield and resorted to multiple species composition with introduction of several other species including minor carps and freshwater prawns. If several species were stocked together in proper proportion in the same pond so that all the available ecological niches were exploited, the production increased several times [11]

With regards to species combination, only 10% of farmers followed the classical six species combination for their composite fish farming while 6% of fish farmers cultured only IMC species. 25% fish farmers cultured bata (*Labeo bata*) and black carp (*Mylopharyngodon piceus*) with IMC and exotic carp. 12% fish farmers cultured bata and rupchanda (*Pygocentrus nattereri*) with IMC and exotic carp, 16% fish farmers cultured IMC with grass carp, less number of common carp (*Cyprinus carpio*) and black carp (*Mylopharyngodon piceus*) but they did not use silver carp (*Hypophthalmichthys molitrix*). 8% fish farmers cultured japani punti (*Puntius japonicas*) with IMC and exotic carp, 11% fish farmers cultured bata (*Labeo bata*) and tilapia (*Oreochromis niloticus*) with IMC, grass carp (*Ctenopharyngodon idella*), less amount of common carp (*Cyprinus carpio*) and black carp (*Mylopharyngodon piceus*). 3% fish farmers cultured mullet (*Liza parsia*) and prawn (*Macrobrachium rosenbergii*)

with IMC and exotic carp, 4% fish farmers cultured koi (*Anabas testudineus*) with IMC, grass carp (*Ctenopharyngodon idella*) and less amount of common carp (*Cyprinus carpio*), 2% fish farmers cultured bhetki (*Lates calcarifer*) with advanced fingerling of IMC and fry of bata (*Labeo bata*), 3% fish farmers commercially cultured prawn (*Macrobrachium rosenbergii*) with IMC and combination with silver carp (*Hypophthalmichthys molitrix*) and grass carp (*Ctenopharyngodon idella*) (Fig. 1).

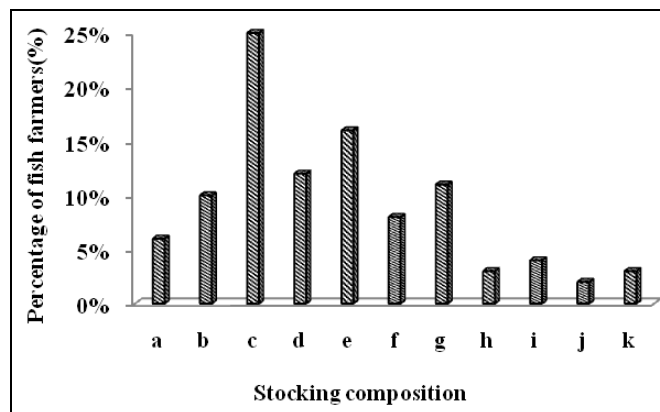


Fig 1: Stocking compositions (a: only IMC, b: IMC + exotic carps, c: IMC+ exotic carps+ black carp + bata, d: IMC+ exotic carps + rupchanda + bata, e: IMC + grass carp+ common carp + black carp, f: IMC +exotic carps + Japani punti, g: IMC + grass carp+ common carp+ black carp+ bata+ tilapia, h: IMC + exotic carp + mullet + fresh water prawn, i: IMC + grass carp + common carp + koi, j: bhetki + IMC+ bata, k: IMC + prawn + silver carp + grass carp)

Farmers' perception about the six species under composite culture

Farmers' perception about IMC

Among the Indian species of carps, rohu was most preferred followed by mrigal and catla (Fig.2). Accordingly, most of the surveyed farmers have given more importance to rohu and mrigal in composing their stocking combinations as 56% of the farmers opined that consumer preference of mrigal was better than catla in the study area. Among the exotic carps, grass carp was given less importance compared to silver carp and common carp in species combination. Though catla used to face competition from the most preferred exotic silver carp by the farmers, almost all the farmers stocked silver carp because it was a fast growing and very efficient filter-feeder [12]. Moreover, consumer preference was good because it is a relatively cheap fish that the farmers' family can afford to eat [13]. Therefore, farmer's perception towards the fast growing Indian species, catla as bad to average was because of the imbalanced stocking ratio of catla and silver carp which needs to be scientifically addressed to the farmers. The stocking density of silver carp should be less as it was effectively grazing even the nano-phytoplankton at the surface layer which resulted in negative impact on the zooplankton abundance and ultimately growth rate of catla. As a result, most of the farmers remarked that, silver carp should be stocked one month after stocking of catla in the pond.

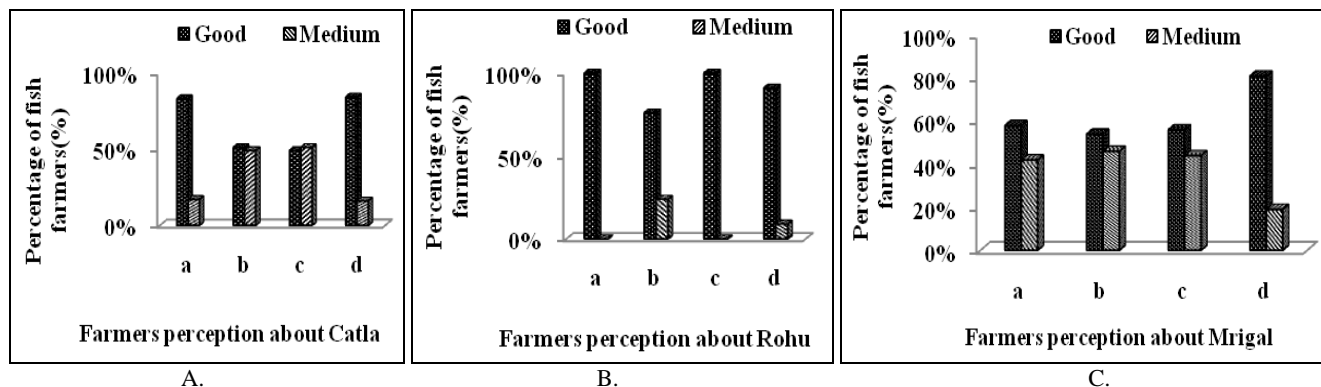


Fig 2: Farmers’ perception towards catla (A), rohu (B) and mrigal (C) (a: growth rate, b: disease resistance, c: consumer preference and d: preferable culture environment of the species).

Farmers’ perception about exotic carps

With regards to exotic carps, 69% fish farmers remarked silver carp as a good species while 31% opined the species as satisfactory (Fig.3). So far grass carp was concerned, 60% of

surveyed fish farmers remarked the species as good. Likewise, 63% farmers remarked common carp as a good species in composite farming (Fig. 3).

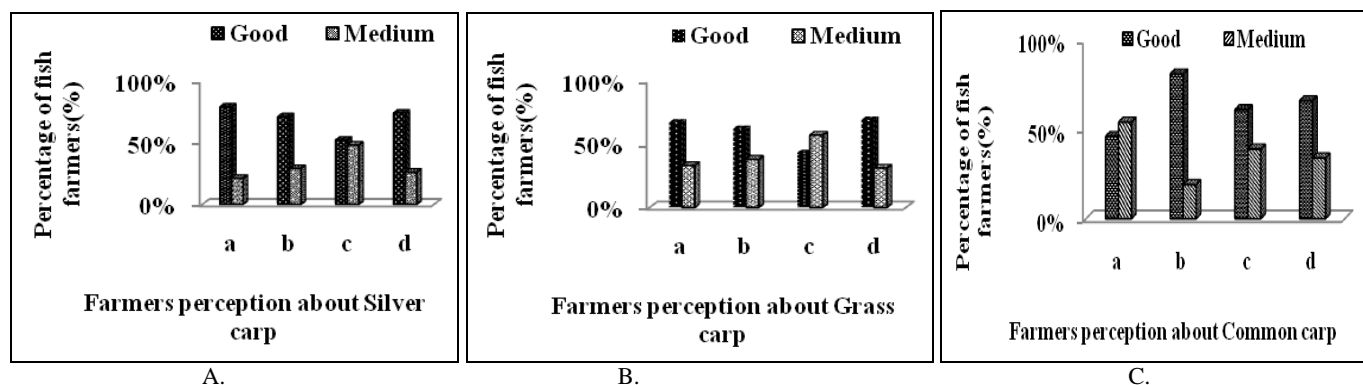


Fig 3: Farmers’ perception about Silver Carp (A), Grass Carp (B) And Common Carp (C) (a: growth rate, b: disease resistance power, c: consumer preference and d: preferable culture environment of the species)

However, higher stocking density of silver carp indirectly affected the growth rate as well as production of rohu and mrigal also as reported by the farmers in general. This was supported by the earlier findings of [14] who reported that lower ratio of rohu resulted in higher production of silver carp and higher ratio of silver carp resulted in lower production of mrigal.

The perception towards exotic grass carp by the farmers’ was practically sound as supply of appropriate feed to the species throughout the season was a genuine problem to the farmers, though the said species has a good growth rate. As grass carp was a plant feeding organism, all the farmers used this species to control aquatic weeds. [15] reported that it does not harm plants of economic value or create undesirable imbalances in the plant. Grass carp feed voraciously on *Hydrilla*, *Azolla*, *Nechamandra*, *Vallisnaria*, *Lemna* spp. and wide range of submerged and floating weeds and maintain

Fish yield

Regarding annual yield, majority of the surveyed fish farmers (58%) produced between 7.5-9 tonne /ha/yr., 36% produced 5-7.5 tonne /ha/yr and the rest (6%) produced 2.5-5 tonne /ha/yr. (Fig. 4).

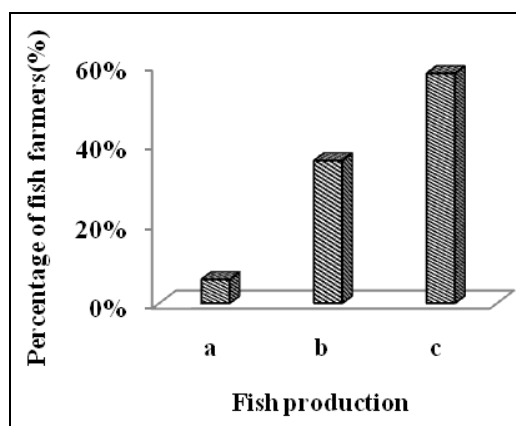


Fig 4: Percentage of fish farmers with their annual yield (a: 2.5-5 tonne /ha/yr , b: 5-7.5 tonne/ha/yr and c: 7.5-9 tonne /ha/yr)

Though the number of species stocked by the farmers was highly variable among the farmers and exceeded upto eight in some cases, it was found that even more number of species could be incorporated as per the fitted relationship between production and number of fish was concerned ($y = -0.012x^2 + 0.787x + 2.510$, $R^2 = 0.747$) (Fig. 5).

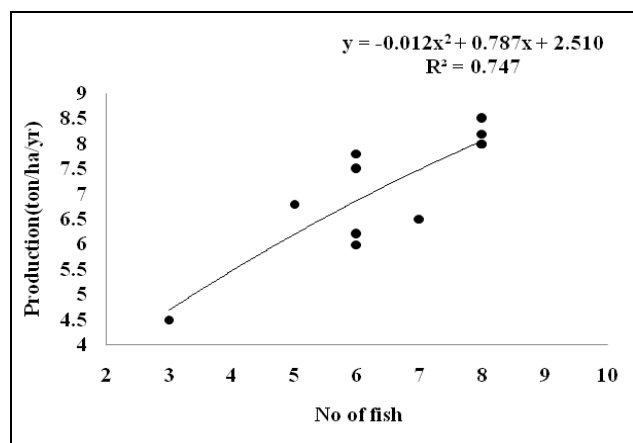


Fig 5: Fitted relationship between numbers of species stocked and production

The farmers surveyed in the present study though were following multiple stocking and multiple harvesting practices, only 12% of the fishermen stocked fish fingerlings @10,000 nos./ha and majority of the fish farmers (46%) stocked in between 10,000- 15,000 nos./ha and the rest (42%) stocked more than 15000 nos./ha. Moreover, most of the farmers achieved more than 7 tonne/ha/yr production with at least two stockings in a year. This indicated that, deviation in stocking management with more stocking and harvesting frequencies was proved beneficial to the farmers' and there is scope of further increase in the productivity level with more number of species introduction. Introduction of bata and freshwater prawn was conspicuous in increasing the total yield.

Conclusion

From the results of the present study, it is concluded that the original package of practice for composite fish farming introduced during the 1970s has been modified by the practitioners on field primarily based on their own practical experiences in the selected study area. Some of these modifications particularly with respect to species selection and composition, diversification of species have been proved to be beneficial in increasing productivity and there is scope of improvements by educating the farmers with advanced training, technical know-how and financial support.

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