

Study on the mixed culture of *Liza tade* (Forsk.) and *Liza parsia* in brackish water with reference to pond ecology- A review report

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ABSTRACT

Mixed culture of different fishes (mulletts) according to their different ecological niches, but in a same habitat, of a selected brackish water pond always results in better economic returns and sustainable utilization than any of the pond's natural productivity. In this context of heavy public demand as a palatable bengali dish but gradually decrease of the selected fish populations, these two different mullets i.e., *Liza tade* and *Liza parsia* are taken into consideration in this present study. For the particular aquaculture experiment of mullets namely, *L.tade* and *L.parsia* were conducted in four identical ponds (0.06 ha) at Kakdwip Research Centre of CIFRI, Kakdwip, situated 38 km. away from the Bay of Bengal for a period of 18 months. Uniform stocking density was maintained in all the sets. In one set of species ratio of *L.tade* : *L.parsia* was 1:2 and in second set the ratio was 1:4. *L.tade* was selected from nursery reared stock whereas *L.parsia* was directly collected from estuarine water. The present study also give some references regarding their positive role in bioremediation and reversing effect in eutrophication in the studied brackish water ponds as they consumed as food the different selected suspended particles and benthic detritus.

Key Words - Mixed culture, brackish water pond, mullets, bioremediation, eutrophication.

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INTRODUCTION

In India, at the moment, about 1.42 m ha of saline tract is available for development of brackish water aquaculture. Only about 45,000 ha area is under real utilization. There is, thus, ample scope for the development of brackish water aquaculture on commercial scale. The existing practice of fish culture in deltaic areas of West Bengal is part of a slow process of reclamation of the land for conversion into rice field. However, this industry is still backward and much research work is needed to make fullest use of these water bodies.

Extensive work pertaining to brackish water fish culture, especially with respect to the milk fish,

Chanos chanos (Forsk.) and *Liza tade* (Forsk.), the grey mullet is in vogue at Jaua, Philippines Tiwan and Hong Kong for more than three decades (Hora and Pillay, 1962; Lin, 1954). Ronquillo and Jesus (1957); Djajadiredja and Poernomo (1970); Dolmendo *et al.* (1970); Balanco (1970); Chen (1970, 1970 a) and Oren (1975) also presented valuable information on the subject. In India too, some information is available on culture of brackish water fishes and prawns (Hora & Nair, 1944; Pillay, 1948, 1954; Pillay and Bose, 1957 Jhingran, 1969; Pakrasi, 1965, 1979; George and Sebastian, 1970). The main focus of these literatures centered round

either to the salt water bheries of West Bengal or Paddy-cum-fish culture practices of Kerala State, resulting lack of comprehensive data on pond culture practices of brackish water fishes, particularly of mullets.

On the other hand, Ghosh *et al.* (1971, 1975); Rao *et al.* (1975); Roy (1980); Roy and Chakraborty (1983); Roy *et al.* (1970, 1986) worked on culture of mullets mostly pertaining to fry rearing and requirement of supplementary feeding and other conditions in brackish water ponds. Only during the launching of the All India Co-ordinated Research Project on brackish water fish farming a package of practices for increasing production of brackish water fishes & shrimps has been developed (Ghosh, *et al.*, 1985). In the present contribution an attempt has been made to study the growth survival, & production of mullets *Liza tade* (Forsk.) and *L. parsia* (Ham) in brackish water ponds under mixed culture with special reference to the ecology of culture system.

MATERIALS & METHODS

The materials are procured from the mixed culture experiments of mullets, *Liza tade* and *Liza parsia* conducted in four identical ponds (0.06 ha) at the Kakdwip Research Centre of CIFRI, Kakdwip situated 38 km. away from Bay of Bengal for a period of 18 months commencing February 1984, Initial temperature of the ponds were dewatering, limiting at 250.0 kg/ha and subsequent fertilization with organic manure (poultry droppings) at 500.5 kg/ha. After fertilization and intaking of tidal water a fortnights time was allowed for development of a thick matrix at the bottom of the ponds as well as rich growth of periphytons on the leaves of the marginal grasses which forms the main bulk of natural food for the fishes.

Uniform stocking density of 25,000 fingerlings/ ha was maintained. In two of the four ponds, species ratio of *L.tade*: *L.parsia* was 1:2 and in other two ponds it was 1:4. At the time of stocking all possible care was taken to minimize the initial size variations of the stocking materials. *L.tade* was selected from nursery reared stock whereas *L. Parsia* was directly collected from pits in the inter-tidal zone and

stocked in the prepared experimental ponds. Supplementary feeding with a mixture of rice polish and fish meal (2:1) at 2-3% of the biomass was resorted to during the entire period of culture duration. Monthly sample netting was undertaken for assessment of growth of the fishes and estimating the quantity of supplemental feed to be applied. Physio chemical and biological characteristics of the pond water were analyzed fortnightly following standard Methods. Planktons and bottom biota were collected fortnightly ponds was flushed fortnightly with tidal water. Final harvesting was done by complete dewatering of the ponds. Besides initial fertilization the ponds were uniformly fertilized at 100.00 kg/ha of poultry dropping on monthly basis to maintain a good standing crop of plankton and benthos. Since the aim experiments was to raise marketable mullets, culture was continued for 18 months.

RESULTS & DISCUSSION

Results of the culture experiments with respect to initial size, final size attained during harvest, survival, gain in weight per day and net production in different sets are presented in Table 1. Physicochemical & biological characteristics of experimental ponds during the tenure of the culture operation are shown in Table 2.

The normal plankton production in brackish water system is poor. Common genera of phytoplankton were represented by *Oscillatoria* sp., *Lyngbya* sp., *Gyrosigma* sp., *Navicula* sp. *Synedra* sp. *Microcystis* sp. and *Nostoc* sp., whereas, *Diaptomus* sp., *Cyclops* sp. *Naupli* of copepods & *Mysids* were frequently encountered among the Zooplanktons.

Salinity showed some relationship between the growth of the fishes during the tenure of the experiment. Fishes showed maximum growth potential during the increasing phase of salinity. On the other hand, temperature though showed some influence but it was not uniform throughout. High temperature during summer months was accompanied by higher rate of growth of the fishes while the growth rate during monsoon or post monsoon months was poor in spite of high-water temperature. The reason may be attributed to the

poor standing crop of plankton & benthic organizing during the season. The present experiment revealed that the growth of fishes was steady during the period of increasing phase of salinity and temperature. Secondly it was further revealed that weight increment of *L. tade* and *L. parsia* was more during second year.

Roy *et al.* (1986) observed growth increment of *L. tade* upto 30 gm and above after a rearing period of 120 days at a stocking density of 5,000 to 12,000/ha from the initial size of 9.0 gm. Further they have observed that weight of *L. tade* decreased by 51 and 4 percent respectively. When increased the stocking density by 70 and 140% over 5000/ha. Roy *et al.* (1970) observed average gain in weight in percentage per day as 6.45 and Roy *et al.*, (1986) observed average gain in weight in percentage per day as 5.25 even when stocked at an increased rearing density by 37%. Chakraborty *et al.* (1980) obtained 0.325 gm to 0.498 gm/day for *L. tade* and 0.081 - 0.130 gm/day for *L. parsia* in 210 days culture duration in tri-culture of mullets with *P.monodon* at a combined density of 25,000/ha.

In the present studies daily increment in weight of *L.tade* varied from 0.25-0.27 gm and *L.parsia* varied from 0.09 to 0.11 gm when stocked at 1:2 species ratio. On the other hand, *L.tade* increased between 0.33 and 0.36 gm/day and *L.parsia* at 0.12 gm/day. When species ratio was 1:4 keeping uniform total stocking density of 25000/ha.

Experiments on nursery rearing of *L.parsia* at a stocking density of 12500/ha fertilization & supplementary feeding at 16% of body weight demonstrated an increment of 65 mg/day and survival of 82% (Anon 1972). Chakraborty *et al.* (1980) observed in on rearing experiment with

L.parsia at a stocking density of 1.0 Lakh/ha a growth increment of 105 mg/day with a survival of 83.67% while fed with a supplementary feed (prawn meal & rice polish at 1:2) at 10% of body weight. Chakraborty and Halder (1985) further observed the growth increment of 99.22 mg/day of *L.parsia* and a survival of 44.49% when fed with wheat flour and fish meal (1:1) at 5% of body weight at the same stocking density.

In the light of the above information the growth increment of *L.tade* and *L.parsia* under mixed culture over a period of 540 days observed in present investigation was comparatively better spite of a low rate of feeding (2-3%). The survival of *L.parsia* in the present investigation was low.

Result obtained in the present investigation revealed that the growth of *L.tade* was better in 1:4 ratio of *L.tade* and *L.parsia* than in the ratio of 1:2. The individual stocking density of *L.tade* at 1:4 was 5000/ha while at 1:2 ratio it was 8.333. Better growth of *L.tade* in low stocking density may be easily explained as getting more feed and space in a unit time.

It was widely accepted among the animal ecologists that some form of regulation existed in population at least in extreme densities and this involved some kind of density dependent mortality (Solomon, 1944; Lack, 1954). The effect of individual stocking densities of *L.tade* of 5000 to 8333 experimented in the present contribution was found to be non-significant although highest survival of 95.33 to 96% were obtained in lower stocking density of 5000/ha. On the other hand, growth performance as well as survival of *L.parsia* were better in higher individual stocking density of 20.000 than that of 16,667 requires further studies.

Table 1: Summary of experimental observations showing initial average size final size attained, survival & net production obtained under mixed cultured of mullets at Kakdwip

Expt. Set %	Pond	Area	Species	Density (Nos/ha)	Species ratio	Average initial size (mm/g)	Average final size	Nos. stocked	Nos. harvested	Culture duration (months)	Survival (%)	Total quantity harvested (Kg)	Net production (Kg/ha/yr)	Increment of weight day (g)
I	A	0.06	<i>L. tade</i>	25,000	1	55.8/5.0	215.8/142.0	500	427	18	85.4	79.54	836.6	0.25
			<i>L. parsia</i>		2	32.7/1.75	165.4/58.2	1000	325	18	32.5			0.11
	B	0.06	<i>L. tade</i>	25,000	1	64.2/5.2	225.3/150	500	400	18	80	80	862.7	0.27
			<i>L. parsia</i>		2	30.9/1.7	155.2/52.41	1000	400	18	40			0.09
II	A	0.06	<i>L. tade</i>	25,000	1	65.6/5.2	255.0/185.0	300	286	18	95.33	82.35	1014.9	0.33
			<i>L. parsia</i>		4	35.0/1.9	167.0/65.0	1200	650	18	54.16			0.12
	B	0.06	<i>L. tade</i>	25,000	1	61.8/5.0	265.0/201.0	300	288	18	96	85.12	1051.6	0.36
			<i>L. parsia</i>		4	33.8/1.8	171.5/66.1	1200	612	18	51			0.12

Table 2: Physico-chemical condition of mullet culture ponds at Kakdwip during February 1984 - July 1985.

Months	Temp °C	Depth (cm)	Secchi Disk turbidity (cm)	Salinity (ppm)	Water pH	DO (mg/L)	Total Alkalinity (mg/L as CaCO ₃)	Soil					Benthos (u/m ²)
								Soil P.P. (mg C/m ² /hr)	pH	Organic carbon (%)	E.C. (mmhos/cm)	Plankton (U/L)	
Feb-84	23.1	70	27	9.8	8.4	8.3	174	66	8.15	1	3.74	650	950
Mar-84	25.4	74.2	35	12	8.4	7.1	176	107	8.2	0.66	4.7	375	1050
Apr-84	29.7	80	23	14.9	8.42	6.6	237	170	8.15	0.61	4.4	250	1700
May-84	29.2	80	22	20.2	8.52	4.9	210	230	8.2	0.57	8.4	425	4129
Jun-84	28.7	78	24	17.8	8.25	6.1	172	113	8.3	0.54	11.9	680	2980
Jul-84	29.5	86	25	9.7	8.4	7	151	340	8.3	0.49	5.9	100	899
Aug-84	28.9	92	33	4.05	8.05	7.25	136	170	8.2	0.6	5.2	100	145
Sep-84	29.7	80	27	2.5	7.9	7.3	158	180	8.4	0.64	1.7	150	250
Oct-84	29.4	80	20	2.5	8.7	8.7	179	295	8.4	0.51	1.7	175	390
Nov-84	26.3	81	22	3.1	8.1	7.6	189	290	8.3	0.5	1.9	250	425
Dec-84	21.2	84	25	4.8	8.3	7.5	185	240	8.1	0.7	3.3	370	640
Jan-85	20.9	86	21	5.4	8.3	8.6	170	185	8.25	0.55	4	800	680
Feb-85	23.1	79	24	6.7	8.4	7.5	182	160	8.31	0.41	3.9	500	810
Mar-85	27.2	87	18	7.5	8.4	8.2	220	200	8.3	0.43	6.2	650	1540
Apr-85	29.3	102	26	16	8.2	5.4	196	196	8.47	0.55	9	750	2350
May-85	31.5	75	25	19.5	8.1	6.3	210	280	8.4	0.45	10.5	700	2700
Jun-85	30.2	91	43	8.1	8.3	7	165	168	8.1	0.5	11.7	700	3180
Jul-85	30	82	30	15.5	8.4	5.3	160	207	8.2	0.45	6	400	1200

CONCLUSION

Mixed culture experiment of mullets, *L.tade* and *L.parsia* were conducted in four identical ponds (0.06 ha) at Kakdwip Research Centre of CIFRI, Kakdwip situated 38 km. away from the Bay of Bengal for a period of 18 months. Initial treatments of the ponds were dewatering, liming and subsequent fertilization with organic manure. Uniform stocking density was maintained in all the sets. In one set of species. ratio of *L.tade* : *L.parsia* was 1:2 and in second set the ratio was 1:4. *L.tade* was selected from nursery reared stock whereas *L.parsia* was directly collected from estuarine water. Survival of *L.tade* and *L.parsia* varied from 80.0 to 96.0 and 32.5 to 54.16% respectively. Net production varied from 836.6 to 1051.6 kg/ha/yr. An attempt has also been made to correlate the growth of fishes with ecological parameters. The two mullets actively play in biological bioremediation in the selected ponds. By actively feeding on suspended particles and benthic detritus, the two mullets help recycle nutrients through bio-geo-chemical cycle and prevent the buildup of bottom sediments and save the pond from eutrophication.

REFERENCES

- Ahmed, M. 1987. Advances in aquatic biology fisheries. In *Prof. N. B. Nair Felicitation Volume*. University of Kerala, Trivandrum, India, 139.
- Chakraborty, N. M., & Haldar, D. D. 1985. *I. J. Coast Agri. Res.*, 3(1), 55–62.
- Chakraborty, N. M., Karmakar, H. C., & Roy, A. K. 1980. *Proceedings of the Symposium on Coastal Aquaculture*, Cochin, 12–15 January, Abstract.
- Chen, T. P. 1970. *Proceedings of the Indo-Pacific Fisheries Council, 14th Session*, IPFC/C-70 Symposium 5, 8 p.
- Chen, T. P. 1970. *Proceedings of the Indo-Pacific Fisheries Council, 14th Session*, IPFC/C-70 Symposium 2, 6 p.
- Ghosh, A. N., Das, P. R., & Das, L. K. 1971. *Fishing News*.
- Ghosh, A. N., Mukhopadhyay, M. K., & Chatterjee, G. N. 1975. *Journal of the Inland Fisheries Society of India*, 7, 209–211.
- N. O. N. 1975. *Annual Report*. Central Inland Fisheries Research Institute (CIFRI), Barrackpore.
- Blanco, G. J. 1970. *Proceedings of the Indo-Pacific Fisheries Council, 14th Session*, IPFC/C-70 Symposium 10, 24 p.
- Tirmizi. 1988. *American Institute of Biological Science*. Washington, DC, 539.