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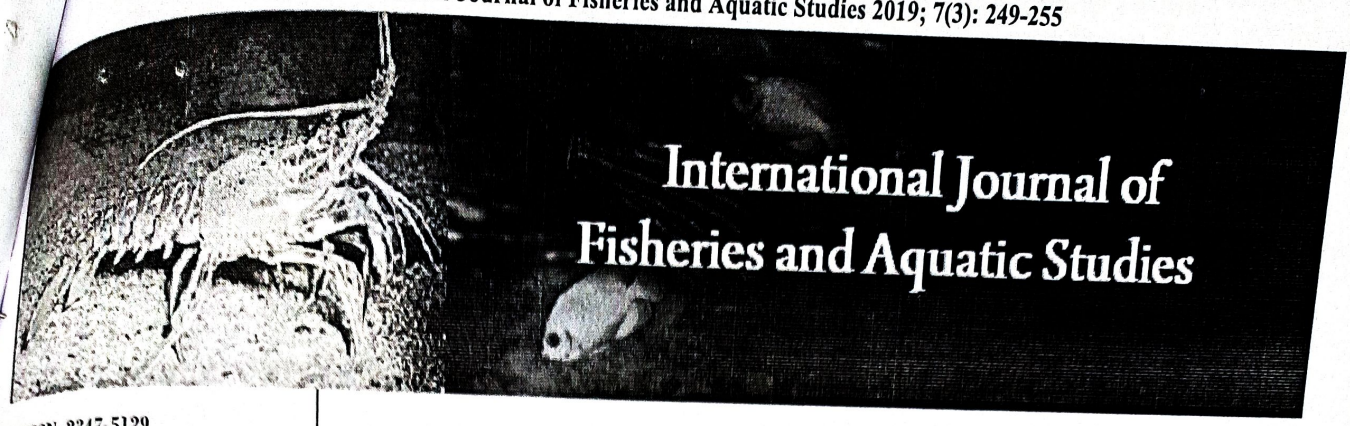

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Suitability of *Labeo rohita* for cage culture in Godavari River, Marathwada region, Maharashtra (India)

Jayvardhan V Balkhande and Arvind Kulkarni

Abstract
This was the first trial of cage culture of *Labeo rohita* in back waters of Godavari River in Marathwada. This experiment was basically tried for the suitability of the species for Cage culture. Final weight of the *Labeo rohita* in natural feeding cage was 5.96±0.71, 8.41±1.17, 22.03±4.73, 34.67±5.15, 58.25±12.31 and 92.15±12.10 gm for I, II, III, IV, V and VI th months respectively. Another set the cage was provided with supplementary food during the experiment. In this cage final weight of *Labeo rohita* was 7.09±0.66, 13.73±3.75, 41.97±9.80, 75.73±20.93, 160.95±34.28 and 244.88±22.11 gm for the six month study. The total fish production of *Labeo rohita* in 180 days in cage culture with natural feeding was 5.5 kg, whereas it was 17.6 kg in a supplementary feeding cage. It was first ever study in this area and result was encouraging in the field of cage culture. It was concluded that *Labeo rohita* is a suitable species for cage culture in back waters of Godavari River.

Keywords: Daily growth rate, specific growth rate, weight gain percentage, supplementary feeding

1. Introduction
The cage aquaculture is one of the method of aquaculture has grown very rapidly during the past 20 years and presently undergoing rapid changes in response to pressure from globalization and growing demand for aquatic products. Particularly the need for suitable sites resulted in the sector accessing and expanding into new untapped open water culture areas such as reservoirs, rivers, coastal brackish and marine offshore waters. The origin of cage culture is a little vague. It can be assumed that at the beginning fishermen may have used the cages as holding structures to store the captured fish until they are sent to the market. The first cage which was used for producing fish was developed in Southeast Asia at the end of the 19th century. Wood or bamboos were used to construct these cages and the fish were fed by trash fish and food scraps. In 1950s modern cage culture began with the initiation of production of synthetic materials for cage construction. Cage culture is common in central and South East Asian countries such as China, Philippines, Indonesia and Thailand (Beveridge, 1983, Beveridge, 1987, Beveridge, 1996, Beveridge and Stewart, 1998) [2-5].

Status of cage culture in India
according to (James *et al.* 1986) [8] in India freshwater fishes raised in cages are essentially from family cyprinids comprising Indian major carps (*Catla catla, Labeo rohita* and *Cirrhinus mrigala*), exotic common carp (*Cyprinus carpio*) and silver carp (*Hypophthalmichthys molitrix*). Catfishes of the families Bogridae (*Mystus Seenghala*), Siluridae (*Ompok bimaculatus*), Anabantidae. (*Anabas testudineus*) and Heteropneustidae (*Heteropneustes fossilis*) have also given encouraging results when cultured in cages, especially the last 3 air breathing species. Cage culture of murrels (Channidae), viz. *Channa punctatus, Channa marulius* and *Channa striatus,* has also been occasionally tried.
In India cage culture was attempted for the first time in cage of air breathing fishes like *Heteropneustes fossilis, Anabas testudineus* in swamps (Dahadrai *et al.* 1974). [7]. At Powai Lake, Mumbai shows that, *Labeo rohita* grew from 3.24 gm to 54.72 gm within 43 days with survival of 50.72%. Whereas during the same period *Cyprinus carpio* with a density 50 No/m^3 grew from 0.293 gm to 31.34 gm with a survival of 75.26% (Kohli *et al.* 2002) [9].

Status & resources for cage culture in Marathwada

Marathwada is one of the most important region in the Maharashtra state. This area has many freshwater resources in the form of rivers, reservoirs, ponds, lakes, etc. Godavari is the important river and many projects were constructed on the basin of this river and its tributaries. Jayakwadi (Aurangabad), Mazalgaon (Beed), Purna Yeldari (Parbhani), Lower Terna (Beed), Purna Siddheshwar (Hingoli), Manar (Nanded) and Manjra (Latur) were some important projects which fulfill the demand of water in this area.

Labeo rohita fish is consumed in large scale along with *Catla catla* by the people from this area. Hence we selected this species for this experiment. The fishermen of this region generally performing capture fisheries, our main objectives was to popularization and implementation of this culture system among the fishermen, so they can turn from capture fisheries to culture fisheries. If the culture of fishes in cages becomes successful then this will be a boon for fishermen and will open a new chapter in fisheries development of Maharashtra. Hence this study was undertaken which will lead to "Blue" revolution.

2. Materials and Methods

2.1 Study area

The back water of the Shankar Sagar Reservoir was spread up to 40 (km) the place Dhangar Takli 19°7'12"N 77°3'28"E was selected as a study area.

2.2 Site selection

Site selection is the most important part of the cage culture. According to ecological niches and transport facility we have selected this place.

2.3 Criteria for site selection

Back water of Godavari river is the potential site provided that it has adequate water with sufficient depth, so that cage can be arranged in this sediment free water.

Good water exchange is also an important factor to replenish oxygen and flush away wastes. Considering these factors we surveyed 40 km back water area for selection. We found that all that criteria at Dhangar Takli; hence a small village situated on the bank of Godavari river was selected as a site for cage culture. It is about 8 km from Purna (Dist. Parbhani) on Nanded – Purna road.

2.4 Fabrication of cages

Experimental cages were fabricated from strong, durable, and non-toxic iron material with suitable size mesh. The cage mesh should allow maximum flow of water through it and adequate flowing of oxygenated water is good for health of the fish and removes wastes from the cage.

2.5 Cage materials

Normally cage components consist of a fra netting, feeding ring, lid, and floats. Cage ma square, or rectangular and all the materials which fabricate according to the type of cage. The experimental cages was 6' X 4' X 4' and it was submerged condition. The frame of the cages was mad iron square pipes by doing gas welding. The size of the net was 1.8 cm and it was so small that it allows wate enter in the cages and prevents escape of fishes from cage An opening was kept at the top for handling the fishes an also to provide food to them.

All sides of cages were covered with mesh except bottom. The galvanized sheet was fixed at the bottom by using nut and bolt. After fabrication cages were painted by using red oxide and sky blue oil paint, the mesh sheet was fixed to the frame with the help of binding wire. Feeding ring was fitted at the upper side of cage.

2.6 Selection of fish species

According to ecological niches and economic importance *Labeo rohita* was selected for culture in cages.

2.7 Stocking of fish

Fingerling of the *Labeo rohita* was brought from Barul Govt. Fish seed farm. Tq. Kandhar Dist. Nanded. Fingerlings was conditioned and brought in oxygenated polythene bags. The length and weight of individual fish was measured before stocking, and they are kept in different sets, one set with supplementary food and second set was without artificial food i.e. with natural food. The stocking density was 100 fingerling/72 cubic foot. (Table No.2)

2.8 Feeding

After stocking fishes were fed with commercial pelleted feed brought from Krishi Vigyan Kendra, Karda Tq. Risod Dist. Washim, as per their body weight i. e. 5% of their body weight, in the morning hours at 7:00 am every day. Table No.1 shows the ingredients and formulation of artificial feed to fishes in cages.

Table 1: Shows the ingredients and formulation of artificial feed to fishes in cages.

S. No	Ingredients	Inclusion level (%)
1	Ground nut oil cake + Rice bran	25
2	Soya bean cake	25
3	Maize powder	40
4	Fish powder/ Trash fish powder	09
5	Mineral mixture	01

Table 2: Shows stocking density and doses of feed.

Particular	Cage I		Cage II	
Stocking density	100 Fingerlings/72 cubic feet. Average length: 2 cm	1.3 fingerling/ cubic foot	100 Fingerlings/72 cubic feet. Average length: 2 cm	1.3 fingerling/ cubic foot
Feeding	Once in a day 5% body weight		No artificial feeding	
Feed ingredients	Pellet feed		Natural food	

2.9 Cage management

After installation cage management is very important parameter in cage culture. For that purpose cages were cleaned regularly before feeding, to remove dead fishes, uneaten food etc. to keep the environment good for fish. The cages were lifted partially from water weekly before feeding, to check the damage and for removal of algal blooms on the surface of the cage.

Checking and measurement of fishes

Fishes were checked at regular interval of 15 days; fishes were taken alone and handled carefully to avoid injury by a hand net from the cage to record length and body weight in cm and gm respectively.

2.12 Culture period

Fingerlings were cultured in cages for 180 days from October 2010 to April 2011.

2.12 Water quality parameters

During the study important immunological parameters such as Temperature, pH, Transparency, Total alkalinity, Dissolved Oxygen (DO), Free Carbon dioxide (CO_2), Chloride, Hardness, Calcium, Magnesium, and Productivity were analyzed by using standard method as suggested in APHA (2000) [1].

2.13 Statistical analysis

The data were expressed in terms of mean± standard error. All data were subjected to one-way ANOVA. This analysis was done by using Graph pad Prism Software 6.

Popularization of cage culture in Marathwada by organizing workshop on cage culture

Cage culture is one of the most recent techniques of fish culture in Marathwada; this was the first work of cage culture in this area. Hence the one day workshop on "Cage culture" was organized on dated 06/09/2013 with collaboration with College of Fishery Science, Tq. Udgir Dist. Latur. (MAFSU, Nagpur) to introduce the idea of fish culture in cages among the fish farmers, businessman, teacher's researchers and students so that activity of fish culture will spread.

3. Results

Growth and production performance of *Labeo rohita* in cage culture

The growth performance of *Labeo rohita*, in natural and supplementary feeding cages in terms of final length and weight, weight gain percentage, specific growth rate (SGR %), daily growth rate (DGR), survival rate and total production are shown in and table 3 and 4.

3.1 Mean weight

The mean initial length of *Labeo rohita* for I, II, III, IV, V and VI th months was 1.8, 6.4, 8.3, 13.2, 16.2 and18.4cm respectively. Their mean final length was 6.4±0.63, 8.3±0.50, 13.2±0.73, 16.2±0.67, 18.4±1.00 and 22.3±1.06 cm for six months respectively. The mean final weight of natural feed cage was 5.96±0.71, 8.41±1.17, 22.03±4.73, 34.67±5.15, 58.25±12.31 and 92.15±12.10 gm for I, II, III, IV, V and VI th months respectively.

In supplementary feeding cage, the mean initial length was 2, 7.2, 9.5, 14.2, 19.7 and 23.1cm, their mean final length was 7.2±0.45, 9.5±1.05, 14.2±1.16, 19.7±1.11, 23.1±1.61 and27.6±1.31 cm in I, II, III, IV, V and VI th months respectively. Their final weight was 7.09±0.66, 13.73±3.75, 41.97±9.80, 75.73±20.93, 160.95±34.28 and 244.88±22.11gm recorded in I, II, III, IV, V and VI th months respectively. The mean weight of natural feeding cage was 92.15± 12.10 gm and in supplementary feeding cage, *Labeo rohita* attained 244.88±22.11gm.

3.2 Weight gain %

The percentage of weight gain was 198, 41.10, 161.9, 57.37, 68.01, and 58.19%in natural feeding cage. In supplementary feeding cage the weight gain percentage was 254.5, 93.65, 205.6, 80.43, 112.5 and 52.14% in I, II, III, IV, V and VI th months respectively.

3.3 Specific growth rates (SGR)

The specific growth rates (SGR) with treatments are given in Table 3 and 4. The treatments in natural feeding attained the least mean SGR13.2%/day/fish, 8.16 %/day/fish, 45.4%/day/fish, 42.1%/day/fish, 78.6%/day/fish and 113%/day/fish, respectively.

In supplementary feeding cage mean SGR 16.96%/day/fish, 22.13 %/day/fish, 94.13 %/day/fish, 112.5%/day/fish, 284%/day/fish and 279%/day/fish.

The fish attained the maximum mean SGR284 %/day/fish and the minimum mean SGR 16.96%/day/fish among the supplementary feeding cage.

3.4 Daily growth rates (DGR)

Mean daily growth rate of *Labeo rohita* was calculated between natural feeding cage and supplementary cage. The mean daily growth rate of 0.13 g / day, 0.08 g / day, 0.45 g / day, 0.42 g / day, 0.78 g / day and 1.13 g / day was recorded in natural feeding cage.

A mean daily growth rate of 0.16g / day, 0.22g / day, 0.94g / day, 1.1g / day, 2.8g/ day and 2.7g / day was recorded in the feeding cage. In supplementary feeding cage daily growth rate was higher than natural feeding.

3.5 Mortality %

In supplementary feeding cage 28 fishes died in first week of stocking of fish fingerling. Afterwards there was no mortality. High mortality was recorded in natural feeding cage. 40 fishes were died during the experiment, these fishes died during the first 15 days of experiment.

3.6 Survival %

Survival rate was 60% in natural feeding cage, whereas it was 72% in Supplementary feeding cage. Most of the deaths were encountered in the first fifteen days of the experiment period.

3.7 Yield/ total production

The total weight gained (yield) for each treatment per cage is presented in Table 3 and 4. The weight increase was significantly different with feeding and natural feeding experiments. The total fish production of *Labeo rohita* in 180 days in cage culture with natural feeding was 5.5 kg, whereas it was 17.6 kg recorded in supplementary feeding cage.

One way ANOVA was analyzed for average final length of *Labeo rohita* from natural feed caged fishes and artificial feed caged fishes and are shown in Fig. 1. The mean final length of individual *Labeo rohita* in artificial cage was significantly higher i.e. $P < 0.05$ than the natural feeding cage. The one way ANOVA described the significant difference among the two cages. The 95% confidence interval was calculated in between 7.088 to 11.09.

The One way ANOVA was analyzed for average final weight of *Labeo rohita* and is depicted in Fig. 2. The Welch's corrected t test was t =9.046 and degree of freedom was i.e. df= 74.45. The p value was significantly different i.e. $P < 0.05$

and the P value was calculated as 0.0012. According to One way ANOVA of Welch's correction the study of *Labeo rohita* in cage culture is significant.

3.8 Water quality parameters

Water quality parameters were analyzed in this experiment to observe any appreciable changes that might have occurred in response to cage culture. Physical parameters like temperature, pH and transparency and chemical parameters such as dissolved oxygen (DO), Free Carbon dioxide (CO_2), Chloride, Alkalinity, Hardness, Calcium and Magnesium were measured for monthly interval throughout the study period. All the parameters were more or less within the acceptable range for fish culture. Mean values (±SD) of water quality parameters of different treatments are shown in Table 5.

Table Analyzed	One-way ANOVA data
Column B vs. Column A	Artificial Feed vs. Natural Feed
Unpaired t test with Welch's correction	
P value	< 0.0001
P value summary	****
Significantly different? (P < 0.05)	Yes
One- or two-tailed P value?	Two-tailed
Welch-corrected t, df	t=9.046 df=74.45
How big is the difference?	
Mean ± SEM of column A	18.58 ± 0.9930, n=72
Mean ± SEM of column B	27.67 ± 0.1547, n=72
Difference between means	9.090 ± 1.005
95% confidence interval	7.088 to 11.09
R squared	0.5236
F test to compare variances	
F,DFn, Dfd	41.19, 71, 71
P value	< 0.0001
P value summary	****
Significantly different? (P < 0.05)	Yes

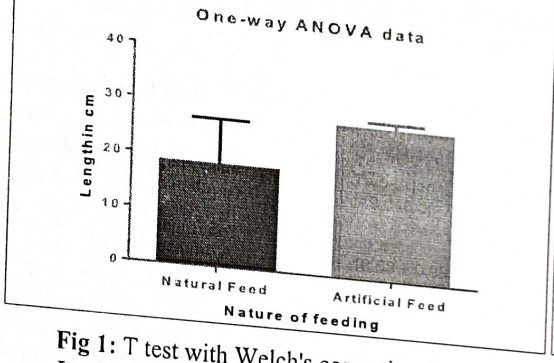

Fig 1: T test with Welch's correction for Length of *Labeo rohita* in Cage culture.

Table Analyzed	One-way ANOVA data
Column B vs. Column A	Artificial Feed vs. Natural Feed
Unpaired t test with Welch's correction	
P value	< 0.0001
P value summary	****
Significantly different? (P < 0.05)	Yes
One- or two-tailed P value?	Two-tailed
Welch-corrected t, df	t=50.04 df=114.3
How big is the difference?	
Mean ± SEM of column A	92.11 ± 1.589, n=59
Mean ± SEM of column B	244.9 ± 2.607, n=72
Difference between means	152.8 ± 3.053
95% confidence interval	146.7 to 158.8
R squared	0.9564
F test to compare variances	
F,DFn, Dfd	3.282, 71, 58
P value	< 0.0001
P value summary	****
Significantly different? (P < 0.05)	Yes

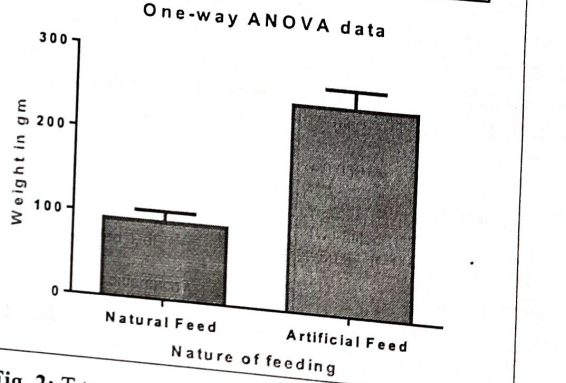

Fig. 2: T test with Welch's correction for Weight of *Labeo rohita* in Cage culture.

Table 3: Depicts the Growth analysis of 100 fingerling of *Labeo rohita* in natural feeding from October 2010 to April 2011 at Dhangar Takli (180 days).

Months	Initial length (cm)	Final length (cm)	Initial weight (gm)	Final Weight (gm)	WG %	SGR	DGR	Mortality	Survival %
Oct- 2010	1.8		2						
Nov- 2010	1.8	6.4±0.63	2	5.96±0.71	198	13.2	0.13	39	61
Dec- 2010	6.4	8.3±0.50	5.96	8.41±1.17	41.10	8.16	0.08	00	61
Jan- 2011	8.3	13.2±0.73	8.41	22.03±4.73	161.9	45.4	0.45	01	60
Feb- 2011	13.2	16.2±0.67	22.03	34.67±5.15	57.37	42.1	0.42	00	60
Mar- 2011	16.2	18.4±1.00	34.67	58.25±12.31	68.01	78.6	0.78	00	60
Apr- 2011	18.4	22.3±1.06	58.25	92.15±12.10	58.19	113	1.13	00	60
Total fish production(kg) = 5.5 kg									60

[1]WG %- Weight gain percentage, [2]SGR- Specific growth rate, [3]DGR- Daily growth rate

Table 4: Depicts the Growth analysis of 100 fingerling of *Labeo rohita* in natural feeding from October 2010 to April 2011 at Dhangar Takli (180 days).

Months	Initial length (cm)	Final length (cm)	Initial weight (gm)	Final Weight (gm)	WG %	SGR	DGR	Mortality	Survival %
Oct- 2010	2		2						
Nov- 2010	2	7.2±0.45	2	7.09±0.66	254.5	16.96	0.16	28	72
								00	72

7.2	9.5±1.05	7.09	13.73±3.75	93.65	22.13	0.22	00	72
9.5	14.2±1.16	13.73	41.97±9.80	205.6	94.13	0.94	00	72
14.2	19.7±1.11	41.97	75.73±20.93	80.43	112.5	1.1	00	72
19.7	23.1±1.61	75.73	160.95±34.28	112.5	284	2.8	00	72
23.1	27.6±1.31	160.95	244.88±22.11	52.14	279	2.7	00	72

duction(kg) = 17.6 kg

eight gain percentage, [2]SGR- Specific growth rate, [3]DGR- Daily growth rate

Table 5: Physico chemical parameters of river Godavari at Takli from July 2010- June 2011.

Months	pH	Temperature (°C)		Transparency (cm)	DO mg/L	CO_2 mg/L	Chloride mg/L	Alkalinity mg/L	Hardness mg/L	Calcium mg/L	Magnesium mg/L
		Air	Water								
July	7	29	26	6.5	14.28	7	32.66	530	208.6	16.83	2.40
August	8	28	27	5.5	9.18	5.2	28.4	390	217.2	33.66	5.36
September	7.5	30	29	17.5	9.3	6.8	31.4	480	188	38.47	6.33
October	7.5	28	26	19.5	8.36	0.8	29.82	260	194	30.46	28.75
November	7.4	28	27	29.5	8.9	1.4	36.92	260	98	18.43	12.66
December	7.5	24	21	35.5	7.75	Nil	32.66	280	102	20.84	12.18
January	7.1	26	26	39.5	8.36	Nil	34.08	240	100	22.44	13.62
February	6.9	27	26	37.5	6.32	Nil	36.92	160	96	24.84	9.74
March	7.5	31	28	40.5	7.3	Nil	41.18	260	100.6	24.28	10.72
April	7.5	32	28	39.5	5.91	Nil	42.6	240	70	25.65	32.45
May	7.5	33	29	35.5	6.93	2.2	46.86	270	90	27.25	40.59
June	7.5	32	29	37.5	7.14	1.4	58.22	450	106	32.06	31.82
SD	±0.29	± 2.69	±2.20	± 13.00	±2.17	±2.70	±8.49	±114.71	±53.71	±6.44	±12.65

4. Discussion

Our main objective was to find out the suitability of *Labeo rohita* for cage culture in Marathwada with reference to their growth performances with natural and supplementary feed. We found that *Labeo rohita* was suitable fish for cage culture in Marathwada.

Many researchers performed cage culture activity and our study found the similar results when we correlate our work with other workers. According to Natarajan *et al.* (1983) [14] in India *Catla catla, Labeo rohita, Cirrhina mrigala,* Ctenopharyngodon *idella, Hypophthalmichthys molitrix, Cyprinus carpio* and *Channa Sps* were important particularly for freshwaters. Lipton (1983) [11] fed the cage reared *Heteropneustes fossilis* regularly with artificial pelleted feed at the rate of 3% body weight. Murugesan and Paramarivam (1983) [13] reported that the quantity of the feed given to the stock depends on the utilization and it works to 3 to 5% body eight of the cage reared air breathing fishes. We also feed to the *Labeo rohita* as per their body weight i.e. 5% during the experiment. Luchini and Quiros (1990) [12] conducted the first experimental cage culture of South American catfish (*Rhamdia sapo*) in the Salto Grande Reservoir Entre Ríos. Argentina from January to May 1985 using eight cages. The individual weights in each cage showed considerable differences. Same results were also found in our study.

Some previous studies have suggested that higher levels of protein are required for optimal growth of freshwater fish in cages compared to ponds, possibly due to supplementation of essential amino acids by selective foraging of free-ranging fish in ponds (Tucker & Robinson, 1990 [16], Webster *et al.* 1992, 1994) [17, 18]. Hence we have given the pelleted food to the fishes for the better growth. Kumaraiah and Rao (2002) [10] studied the effects of stocking density of advanced fingerlings (46 g) of *Labeo rohita* in grow out culture for 89 days in circular floating cages (1 m2 area). They concluded that the optimum stocking density could be between 30 and 50 fish/m^2, without considering the profitability under different stocking densities.

Kohli *et al.* (2004) [9] also conducted experiments on cage aquaculture with *Catla catla, Labeo rohita, Cyprinus carpio, Tor pititora* and *Tor Khudree*. They recommend that the cage culture is viable for raising fingerlings. They feel that cage culture technology for seed rearing should be taken up as a fish enhancement programme in which true economic gains will be reflected only when the production of the reservoir is increased. When it is successful in other countries it cannot be failure in India. Yadav *et al.* (2007) [19] had done research on introduction of Sahar (*Tor putit*ora) in Cage-Cum-Pond Integration system of mixed-sex Nile Tilapia (*Oreochromis niloticus*) at the Institute of Agriculture and Animal Science (IAAS), Rampur, Chitwan, Nepal for 158 days. Our finding is also parallel to the Kohli and their co researchers.

Tamot *et al.* (2008) [15] had done cage culture with *Catla catla* and *Labeo rohita* as a candidate species in Madhya Pradesh. The survival % of *Catla catla* was 58.9% and 78.7% whereas for *Labeo rohita* it was 63.3%, 57.3% and 74.2% in cages culture. These findings were similar with our results. The higher growth rate was achieved in the experiments & may be due to artificial feeding as compared to natural feeding. We have also recorded the higher growth due to the artificial feeding. Chattopadhyay *et al.* (2013) [6] studied effects of stocking density of *Labeo rohita* on survival, growth and production in cages and found that *Labeo rohita* (139.92 ± 0.76 mm/24.33 ± 0.45 g) was reared for 92 days in floating square cages. Our results are also similar with these results.

This was the first attempt for cage culture in Marathwada, Results of the experiments showed that Labeo rohita is suitable for cage culture in back water of river Godavari.

4.1 Extension Programme

Organization of one day workshop on "*Cage culture*"

The rearing and raising of fishes in cages is gaining importance all over the world because of its increasing technical, ecological, social and economic advantages over the capture fisheries and conventional aquaculture.

Hence the workshop was organized to introduce the idea of fish culture in cages among the fish farmers, businessman, teacher's researchers and students so that activity of fish

culture will increase, that would also contribute to countering of the ongoing declining trend in capture fisheries. This will help for addition of another chapter "blue" revolution in Marathwada.

This workshop was organized on 06/09/2013 with collaboration with College of Fishery Science, Tq. Udgir Dist. Latur. (MAFSU, Nagpur). During the workshop Dr. Ajay Kulkarni, Asst. Prof, College of Fishery Science, Tq. Udgir. Dist. Latur, Dr. S. P. Chavan, Asso. Prof. School of Life Sciences, S. R. T. M. University, Nanded and Dr. A. N. Kulkarni, Asst. Prof. & Head Dept of Fishery Science, N. E. S. Science College, Nanded, had delivered their plenary lectures on cage culture and importance of cage culture in this area.

After this a demonstration of cage culture was arranged at college fish tank. After this workshop many fish farmers were interacted with us for cage culture but due to scarcity of rain from last 4 years they couldn't start their cage culture yet.

5. Conclusion and Recommendation

Labeo rohita was suitable fish species for cage culture in Marathwada. Idea of cage culture is unknown to the fishermen and businessman of this region hence more extension programme is required at root level so that people will accept this culture techniques. In view of the relatively wide regional distribution of *Labeo rohita* in India and its acceptability by the consumers, high priority must be placed on the modification and improvements of the techniques for its culture. Thus, under the eco-socio-economical condition of Marathwada, where a large number of freshwater impoundments are available for aquaculture, rearing of *Labeo rohita* through cage culture may be considered as the ideal method of choice for a sustainable fish production. For a country like India with enormous population, cage culture is most needed intensively in order to meet the future food demands and also to improve the aquaculture business.

Raising fry to fingerlings in the cages for stocking in the reservoirs is the need of the day. Therefore this technology is to be demonstrated in large scale.

Training programme, workshops for manufacture of cage material and structure by locally available material can be organized. This will reduce the cost of construction and generate employment opportunities.

All the water bodies of Marathwada can be developed for the promotion of cage culture activity. So the fish farmers of this area may get enough money as well as the fish production is also increases.

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