Feed Formulation and Optimization of Fish Feed for Different Developmental Stages of Indian Major Carps from Spawn to Marketable Size Fish Stage

[1]Udaybhanu Pandharinath Sirdeshmukh , [2]Dr.Vishwas S. Shembekar
[1]Research Scholar, [2]Professor and Head
Department of Zoology and Fishery Science
Rajarshi Shahu Mahavidyalaya (Autonomous), Latur, INDIA.

Abstract
Fish feed formulation is one of the most important area to work in aquaculture. Fish feed have the huge demand all over the world. But fishes having different life stages and needs different feed formulations. Fishes having four prominent life stages spawn, fry, fingerling and young fish and other life stages. In each life stage food and feeding habit is variable. Food and feeding behavior of usually different in different life stages in Indian Major Carps. Information on larval, fry and fingerling stages nutrition is less available and yet to optimize. Indian major carps, *Catla*, *Rohu* and *Mrigal*, all require a micro zooplankton diet initially, feed on progressively larger items as they grow in size and make a gradual transition to the appropriate adult feeding habit as fingerlings. A common feature of all the early life stages of all cultured carps is their rapidity of growth and development from small hatchling to large active post larval stage and fry stage. Carps fry feed on both living as well as nonliving food includes food supplements those provide additional nutritional demand of nutrition for rapid and healthy growth in fishes.. In addition to the provision of live food organisms, supplemental feeds such as the microencapsulated egg diet, yeasts and proteinaceous flours have also seen some use. So current study deal with a study of life stage specific feed formulations.

Key Words: Indian Major Carps, Fish feed formulation, fry, fingerlings, supplementary diet.

1. Introduction:

Fish feed formulation is one of the most important area to work in aquaculture. Fish feed have the huge demand all over the world. But fishes having different life stages and needs different feed formulations. Fishes having four prominent life stages spawn, fry, fingerling and young fish and other life stages. In each life stage food and feeding habit is variable. Food and feeding behavior of usually different in different life stages in Indian Major Carps. Information on larval, fry and fingerling stages nutrition is less available and yet to optimize. Much more research concentrated on fish feed requirements from young stage to adult stage. In Indian Major Carps hatchling do not eat any exogenous food but carrying its own yolk sac and generally performing only the vertical movements. Larvae after absorption of yolk sac, eating exogenous food and swimming in all directions. Indian major carps, *Catla*, *Rohu* and *Mrigal*, all require a micro zooplankton diet initially, feed on progressively larger items as they grow in size and make a gradual transition to the appropriate adult feeding habit as fingerlings. A common feature of all the early life stages of all cultured carps is their rapidity of growth and development from small hatchling to large active post larval stage and fry stage. Carps fry feed on both living as well as nonliving food includes food supplements those provide additional nutritional demand of nutrition for rapid and healthy growth in fishes. Live food includes zoo plankton like brine shrimp (Artemia), nauplii, rotifers and cladocerans etc. So there is a need for formulation of fish feed for early and later stages of life stages for Indian Major Carps. In addition to the provision of live food organisms, supplemental feeds such as the microencapsulated egg diet, yeasts and proteinaceous flours have also seen some use. So current study deal with a study of life stage specific feed formulations.

Carp culture has been practiced in India for the past 3-4 decades, particularly in east, west and southern states of India. More than 60 percent of farmers use farm-made feeds consisting of an oilseed cake and rice bran mixture (Mohanty, 2006). The most commonly used farm-made supplemental feed is mixture of rice bran and groundnut oil cake (50:50 ratio) with the average proximate composition of crude protein 24 percent, crude lipid 9 percent, ash 9-10 and digestible carbohydrate 45-48 percent.

The proximate composition of commercially available feeds is reported to be 20-30 percent protein, 2-4 percent lipid, 10-15 percent fiber, 30-40 percent carbohydrate and 8-10 percent ash and often are claimed to have been enriched with lysine, methionine, vitamins and minerals (Nandeeshsa, 1993) but because of price commercial feeds are not commonly used for carp culture in India. The major problems with the use of commercial feeds also relate to pellet stability and proper assessments of the impact of low cost feeds on growth and economics of production.

2. Methodology

To study different physico-chemical parameters of water, following methods are used.

2.1 PH and Temperature

Pre calibrated Digital Multi parameter device (Eutech Thermo Fischer scientific) is used to record PH and Temperature simultaneously.

2.2 Dissolved oxygen (D.O.)

Winkler's titrimetric method is used to measure dissolved oxygen from different aquarium water samples those are used for rearing different life stages of Indian major carps. Monitoring dissolved oxygen is required after regular time intervals. It help in maintaining required concentration of D.O.in water. Andalso indicates need of fresh water to be added in aquarium in proper proportion. Due to accumulated food and its degradation water oxygen level get affected after certain time period, so monitoring is required. Less oxygen conditions may suffocate fishes and causes mortality in fishes.

2.3 Hardness and Alkalinity

Titrimetric methods are used in monitoring these parameters. These parameters are also impacts on fish physiology and also effects on other waters physico-chemical parameters. Maintaining these parameters is also one of the prominent requirement of fish culture

2.4 Feeding practices for Indian Major carps

The size of the fish feed granules should commensurate with mouth aperture of fish. Dust or fine particles of feed may clog gills causing their damage. Feeding of formulated diets as per feeding schedule followed in different phases of carp culture practices

a) Spawn to fry (culture period 25 days):4 times of initial body weight during first week and 8 times of initial body weight during second week. Feeding is provided twice a day.

b) Fry to fingerlings (culture period 40 days): 6-8% of biomass during first month, 5-6% of biomass during second month and 3-4% of biomass during third month and feeds are provided twice a day.

Finely powdered feed is broadcast in ponds for spawn and fry rearing. The feed is provided in the morning after sunrise and before sunset in the afternoon. For feeding fingerlings, feed dough or dry pellets are provided. Several feed formulations have been developed for different life history stages of Indian major carps, the composition of which are listed in **Table I**.

Fish life Stage	**Fish Feed Formulation Name**	**Composition of feed type**	Proportion in %
Fry	Sample A	Boiled fine granules of chick egg yolk	100
Fingerling	Sample B	soybean meal + groundnut oil cake	25:75

Fingerling	Sample C	soybean meal + groundnut oil cake	50:50
Fingerling	Sample D	(soybean meal + groundnut oil cake	75:25
Fingerling	Sample E	soybean meal	100
Fingerling	Sample F	groundnut oil cake	100

Table I: Above chart shows different Fish formulation, their composition and proportion.

Experiment executed in Three Replicates for each fish feed type in a different aquarium. Each aquarium contains 10 fingerlings, hence 30 fingerlings reared in three aquarium for each fish feed type from sample B to sample Observe the growth and development in fingerlings , those are kept with same physico-chemical parameters ,but feeding with different composition of feed type. Measure the length from tip of snout to end of tail fin.after every five days intervals.

2.5 Statistical and Graphical Analysis

Application of MATLAB 7 and Microsoft excel software for data analysis includes average mean, standard deviation and graphical representation.

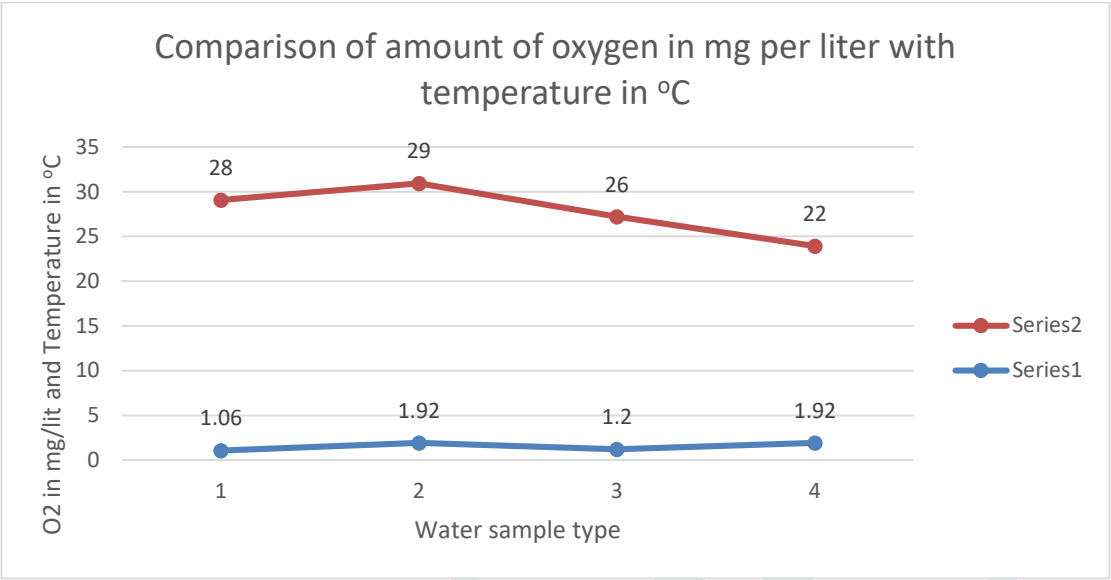
3. Results and Discussions

Optimization and a study of water physico-chemical parameters in laboratory which is used for rearing spawn, fry and fingerling stage of Indian Major Carps for Laboratory conditions is required process before setting experiments for the study of effect of different feed formulations and their effect on growth of fry, fingerling and other stages of fish development.

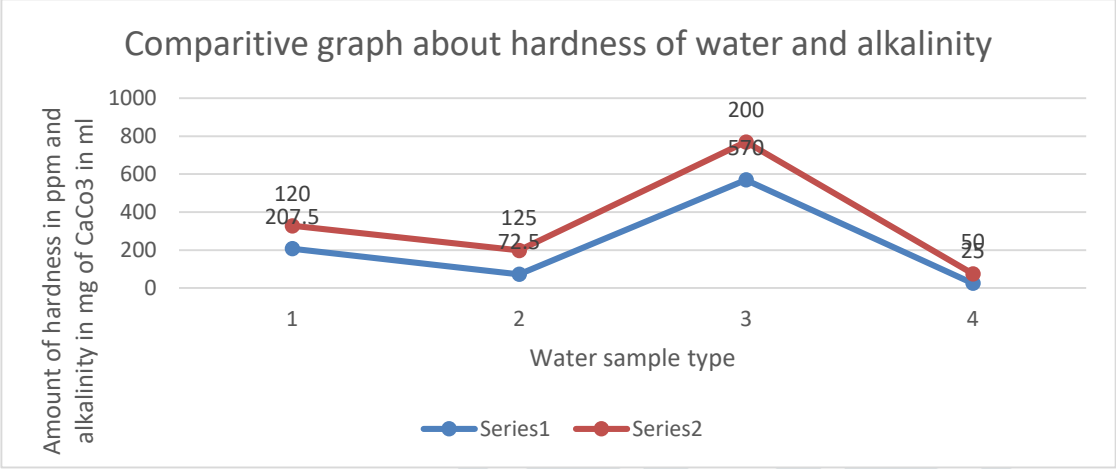
Waters environment is the major issue to optimize because fish growth is not only dependent on fish feed, it also prominently effected by waters environment. So, initially there is need of optimization of water conditions in laboratory and then experiment with different fish feed formulations and their effect on fish growth.

Table II: Comparative Data of Dissolved oxygen, Hardness of water, Alkalinity, PH and Temperature of water

Sr. no.	Water Sample Type	Dissolved oxygen in ml M.B.R. with Standard deviation	Dissolved oxygen in mg per litre	Hardness of water M.B.R. With Standard deviation	Hardness of water in mg CaCo3 equivalent, ppm	Alkalinity in mg CaCo3 per ml	PH	Temperature In degree Celsius
1	Bore well water	0.53 +/- 0.05773	1.06	4.15 +/- 0.0707	207.5	120	7.7	28
2	Municipal Water	0.96 +/- 0.10327	1.92	1.45 +/- 0.2121	72.5	125	8.4	29
3	Bore well + Municipal water	0.6 +/- 0.15773	1.2	11.4 +/- 0.1414	570	200	8.4	26
4	Distilled water	0.96 +/- 0.05773	1.92	0.5 +/- 0.0000	25	50	7.1	22



Graph I – Shows when temperature in between range of 22°C to 29°c ,Dissolved oxygen concentration in bore well, Municipal and aquarium water is 1.06, 1.92 and 1.2 respectively.



Graph -II –shows comparative graph about hardness of water and alkalinity.

Above water parameters are nearly maintained in optimum level throughout the experimental time intervals. Above tabulated and graphical data representation shows physico-chemical characters of aquarium waters ,which is maintained during experiments.

Temperature of water maintained in the range of 22 – 29 ^{0}C and oxygen level is maintained in between 1.06 to 1.92 mg/lit.Hardness and alkalinity also ranges from 25 -207.5 mg/lit and 50 – 200 mg Caco3 per ml.PH also maintained in optimum range 7.1 to 8.4.

During rearing of spawn and further stages of fish during development, laboratory water conditions are optimized to natural conditions of water for in vitro development of Indian Major Carps from spawn to fingerling stage. Transport of spawn carried out in a polythene bag containing water of same natural source and saturated with oxygen. After carrying the spawn to laboratory, spawns are released in plastic pools containing water bore wells partially mixed with municipal water.

Chicken Egg yolk is boiled and fine granular egg yolk given as a primary diet for spawn for on 5-7 days. After 10 days different combinations of nutritional supplements are tried .Initially density of spawn population is 2500 per tank. After one week developing Frys reared in aquariums. It helps in thinning of the fry population density to get required/ adequate environment to all fry and fingerlings for their growth and development.

Fish Species	Life History Stage	Average Mean range Growth in c.m.	No. of Days Required
Catla catla	Spawn to Fry	0.5 - 1.0	25
Labeo rohita	Spawn to Fry	0.6 – 1.2	25
Catla catla	Fry to Fingerling	1.0 - 2.0	30
Labeo rohita	Fry to Fingerling	1.3 – 2.2	30
Catla catla	Fingerling	2.0 – 2.5	40
Labeo rohita	Fingerling	2.2 – 2.7	40

Table III – Data showing average fish life stage growth and number of days required.

Prominent growth of fingerlings happen after 25, 30 and 40 days. Which ranges from 1c.m. to 2.5 c.m. in *Catla catla* and 1.3 to 2.7 in Labeo rohita.

Fish Species	Life History Stage	Average Mean Growth in c.m.	Standard deviation
Catla catla	Spawn	0.69	0.69+/-0.15
Labeo rohita	Spawn	0.85	0.85+/-0.22
Catla catla	Fry	1.47	1.47+/-0.27
Labeo rohita	Fry	1.74	1.74+/-0.30
Catla catla	Fingerling	2.31	2.31+/-0.16
Labeo rohita	Fingerling	2.43	2.43+/-0.14

Table IV – shows Average mean and standard deviations of dfferent life stages of *Catla catla* and *Labeo rohita.*

Average growth in spawn condition of *Catla catla* and *Labeorohita* is 0.69 c.m.and 0.85 c.m.with standard deviation +/- 0.15 and +/- 0.22 respectively from spawn stage to fry stage. Average growth in Fry life stage of *Catla catla* and *Labeo rohita* is 1.47 c.m.and 1.74 c.m.with standard deviation +/-0.27 and +/- 0.30 respectively from fry stage to fingerling stage.Average growth in Fingerling life stage of *Catla catla* and *Labeo rohita* is 2.31 c.m.and 2.43 c.m.with standard deviation +/-0.16 and +/- 0.14 respectively from fry stage to fingerling stage.

Observations shows that ‘sample C’ with composition soybean meal and groundnut oil cake in 50:50 proportion and sample ‘Sample D’ with composition soybean meal and groundnut oil cake in 75:25 proportion is prominently useful in increasing growth in fry to fingerlings. And this composition maybe also useful in large scale applications in pisciculture in rearing different life stages of Indian Major Carps.

Despite the effort that has been made in the development of formulated starter feeds for larval fish, live food still remains a better option in terms of growth and survival compared to formulated diets (Verreth *et al.*, 1987; Kolkovski *et al.*, 1995; Garcia-Ortega *et al.*, 1998; Mitra *et al.*, 2007).

Mehmood *et al*. (1998) reported that the provision of live food to first feeding rohu larvae enhances growth, health and survival and hence significantly reduces rearing costs. In rohu larviculture, natural live food is provided through pond fertilization schedules. Jana and Chakrabarti (1990) and Chakrabarti and Jana (1998) suggested that exogenous introduction of live zooplankton into larval rearing ponds may be a better approach to rohu and mrigal fry rearing than indirect stimulation of pond plankton production through manuring.

4. Conclusions

Above made supplementary feed for fish farms definitely useful in growth and development in fishes and may increases overall yield of cultured Indian Major Carps. So large scale trials of above supplementary food with natural planktonic foods helpful in fish culture of Indian Major Carps. This kind of supplementation in food

may increases yield in pisciculture.Above study also helps in further optimization of fish ecological parameters. And also helps in knowing need of monitoring water conditions after regular time intervals.

5. References:

[1] APHA. 2005. Standard Methods for Examination of Water and Wastewater, American Public HealthAssociation WWA, Washington, D.C.

[2] Bhatnagar P. R. 2011 "Pisciculture - A revolutionary step in agricultural development", In :CompendiumNational Workshop On "Portable FRP Carp Hatchery Technology", Central Institute of Freshwater Aquaculture, Bhubaneswar, Odisha In collaboration with Central Institute of Post-Harvest Engineering and Technology, Ludhiana, Punjab, India: pp 7-13.

[3] Chondar, S. L. 1994. Induced Carp Breeding. CBS publishers and distributors, India. pp 64-65.

[4] CIFA. 2011. Annual Report 2010-11. Central Institute of Freshwater Aquaculture, Bhubaneswar, India. pp.22

[5] CIFA, 2011. Annual Report 2010-11. Central Institute of Freshwater Aquaculture, Bhubaneswar, India. pp.17.

[6] De, H.K., Saha, G.S., Mahapatra, A.S. and Panda, N. 2012. "Involving women in aquaculture– 25 years of CIFA'S contribution", Central Institute of freshwater Aquaculture, Bhubaneswar, Odisha.

[7] Mohapatra, B.C., Sarkar, B. and Singh, S.K. 2003. Use of plastics in aquaculture. In: Satapathy, K. K. and Ashwani Kumar (Ed.) Pisciculture Intervention for Agriculture Development in North Eastern Region.ICAR Research Complex for NEH Region, Umiam, Meghalaya: pp 290-305.

[8] Mohapatra, B.C., Singh, S.K., Sarkar, B. and Majhi, D. 2004. Portable carp hatchery for carp seed production. In: Technologies on Livestock and Fisheries for Poverty Alleviation in SAARC Countries. SAARC Agricultural Information Centre, Dhaka: pp 132-135.

[9] Mohapatra, B.C., S.K. Singh, B. Sarkar and N. Sarangi, 2005. Portable FRP carp hatchery: An aid for rural aquaculture. Proceedings International Conference on Pisciculture and Precision Farming, November 17-21, 2005, New Delhi, India: pp 515-522.

[10] Mohapatra, B.C., Bikash Sarkar and N. Sarangi, 2008.Portable FRP carp hatchery technology: Successful adoption in India. Fishing Chimes, 28 (4):pp. 48-52.

[11] Mohapatra B. C., Bikash Sarkar, K. K. Sharma and N.Sarangi 2008. "User's manual on portable FRP carp hatchery", Central Institute of Freshwater Aquaculture, Bhubaneswar, and Odisha: pp 1-12.

[12] Tripathi, S. D. 2011. Role of hatcheries in development of sustainable aquaculture. In : Compendium National Workshop On "Portable FRP Carp Hatchery technology", Central Institute of Freshwater Aquaculture, Bhubaneswar, Odisha In collaboration with Central Institute of Post-Harvest Engineering and Technology, Ludhiana, Punjab, India: pp 14-18