Environment & Ecology 29 (2) : 623—626, 2011
 ISSN 0970-0420

Influence of Rain Fall on the Seed Production of Indian Major Carps in TB Board Fish Farm

ANANDTEERTH PURANIK[1], V. S. KULKARNI[2], K. V. BASAVAKUMAR[3]* AND A. N. KUMAR[1]

[1]T. B. Board Fish Farm, T. B. Dam, Hospet, Karnataka, India
[1]T. B. Board, T. B. Dam, Hospet, Karnataka, India
[2]Department of Mathematics, NV Degree College, Gulbarga, Karnataka, India
[3]Directorate of Research, University of Agricultural Sciences
Dharwad 580005, Karnataka, India
E-mail : sharathbasu@gmail.com
**Correspondence*

Abstract

A study was conducted to assess the extent of relationship between the pre-monsoon, monsoon and post-monsoon rainfall on the seed production of Indian major carps and exotic carps for a period of 19 years. Pre-monsoon had a positive and highly significant correlation on the seed production of catla and also to the total seed production. The number of rainy days had a significant correlation with seed production of catla followed by rohu and mrigal. A negative relationship was observed in common carp seed production and pre-monsoon rainy days.

Key words : Rain fall, Seed production, Indian major carps.

Breeding in fishes is regulated by environmental factors that trigger internal physiological mechanisms. The final event of the breeding cycle, the release of eggs and milt resulting in spawning, can be controlled by placing the fish in an appropriate environment and by changing its internal regulatory mechanism by injecting hormones or other inducing substances. The internal mechanisms that regulate spawning are similar in most fish (1). The external environmental factors that control reproduction vary considerably among species (2). The availability of seeds of Indian major carps (IMC) comprising catla (*Catla catla*) rohu (*Labeo rohita*) and mrigal (*Cirhinus mrigala*) and common carp (*Cyprinus carpio*) and other exotic carps in fish farm at the right time plays an important role in the development of fisheries of the region in the country. The objectives of the fish farm have been to produce maximum number of good quality seeds of carps to cater to the needs of reservoirs and tank fisheries of the state. But there has been a lacuna in the production and supply of seeds at right time due to climatic and environmental factors operating in the regions. There is always a challenge between demand versus supplies of fish seeds in all the fish farms. Karnataka state is blessed with lot of inland water resources consisting of 2,500 major tanks (approx 1.20 lakh ha), 3,00 minor tanks (approx 1,500 ha) and 20 reservoirs (approx 1.20 lakh ha) based on fisheries department statistics of 2008-09. The present fish seed production of the state is around 20 crores of fry per annum, which is meeting only one third of the total requirement. The TB Board Fish Farm is one of the second largest seed production farm in the state contributing around 10 to 14% of the total seed production (fry) of the state. The rain fall plays an important role in breeding response and seed production of IMC and other carps. The amount of rain fall and the frequency of rain fall (number of rainy days) have a role to play as natural stimuli in changing physico-chemical characteristics of not only pond water but also the climatic conditions which facilitate gonadal development and breeding process of IMC. Hence, current study is aimed at knowing the influence of rain fall on seed production of IMC and common carp over a period of two decades from 1991-92 to 2009-10 years since the reports on such works are scanty.

Methods

During the period of study in TB Board Fish Farm,

Table 1. Influence of monsoon on the seed production of Indian major and exotic carps.

Year	Pre-monsoon (Feb—May) Rainfall in mm	Pre-monsoon (Feb—May) No. of rainy days	Monsoon (Jun—Sep) Rainfall in mm	Monsoon (Jun—Sep) No. of rainy days	Post-monsoon (Oct—Dec) Rainfall (mm)	Post-monsoon (Oct—Dec) No. of rainy days	Production (in lakhs) Catla	Rohu	Mrigal	Common carp	Total seed production (in lakhs)
1991-92	19.8	15	348	47	16	5	527.68	251.1	59.8	12	850.58
1992-93	53	3	296	23	386	11	431.4	254.25	134.55	31.5	851.7
1993-94	41	7	572	47	269	20	312	245.25	179.75	104	841
1994-95	46	4	338	24	168	17	280.73	326.95	107.32	90	805
1995-96	7.6	1	10.2	4	140	7	120.65	191.4	49.95	77.43	439.43
1996-97	17	7	806	37	181	12	140.10	260.11	90.0	40.20	530.41
1997-98	22	3	190	26	222	13	45.5	298.25	117.8	14	475.55
1998-99	14.5	3	569	46	195.2	13	145.4	296	27.3	4.5	473.2
1999-00	145	12	354	43	240	18	256.2	204.7	152.7	11.2	624.8
2000-01	54	6	447	55	101	13	160.3	270.2	74.5	75.5	580.5
2001-02	19	3	454	41	225	14	133	133	28	67	361
2002-03	44	9	252	35	119	10	172	96	55	27	350
2003-04	0	0	238	40	131	11	160.3	101.5	40.2	55	357
2004-05	124	10	409	48	131.6	10	216.8	163.1	62.1	32	474
2005-06	36.2	8	681	64	142	15	142.9	138.9	120	30	431.8
2006-07	76	14	250.3	45	38.7	6	124	220.5	81.54	18	444.04
2007-08	62	3	451	47	87.3	6	105.9	183.9	150.5	37	477.3
2008-09	174.7	13	356	40	126	12	117.85	103	90	5	315.85
2009-10	201	18	273	44	268	13	177	257.9	92	0	526.9

the induced breeding trials have been conducted in 4 to 6 number of cement breeding tanks of size 3.5 × 6.2 × 1.2 m which had proper flowing water conditions. A cooling tower erected on one of the breeding tank is used to reduce air and water temperatures by 2 to 3 C during hot climatic conditions in pre-monsoon and monsoon period to facilitate breeding.

On an average 45 to 55 kg of total female brooders per day were injected with reproductive hormones and released in 3 to 4 breeding tanks. A ratio of 1:1 between female and male is maintained for each pond. The dose of pituitary gland extract given to females and males was 10 to 12 mg/kg and 4 to 6 mg/kg of body weight of fish respectively. The dose of ovaprim, ovatide and ova- FSH injected for females and males were 0.4 to 0.5 ml/kg and 0.1 to 0.2 ml/kg of body weight of fish respectively. Chinese and glass jar hatcheries are used for hatching the eggs.

All the brood stock and nursery management practices of fish farm regarding manuring, feeding is based on the standard norms set by the Department of Fisheries, Government of Karnataka. Feed consisting of rice bran, ground nut oil cake, powdered mixture of broken rice, maize, horse gram, soybean and fish meal in different combinations at 2% of body weight of brood stock have been tried over the years. Combination of organic and inorganic manures is practiced to get desired plankton production. The data were statistically analyzed using correlation coefficient for three different periods of monsoon viz., pre-monsoon (March to May), monsoon (June to September) and post-monsoon (October to December) on the Indian major carps and exotic carp. Later correlation coefficient was tested for its significance by using *t*-test.

Results and Discussion

During the present study, the air temperature, water temperature, and pH of water were found to vary between 24 to 34, 24 to 32 C and 7.8 to 8.3 respectively during the successful breeding trials conducted in fish farm during 1991-92 to 2009-10. The most favorable conditions were found in peak period of breeding season in June to July when the air and water temperatures were 29 to 30 and 26 to 28 C respectively. In spite of these variations of air and water temperatures, the IMC have been successfully bred

Table 2. Relationship between various parameters of seed production. **Correlation is significant at 0.01 level (2 tailed). *Correlation is significant at 0.05 level (2 tailed). Values in parentheses indicate the probability of significance.

	Pre-monsoon (Feb—May)	No. of rainy days	Monsoon (Jun—Sep)	No. of rainy days	Post-monsoon (Oct—Dec)	No. of rainy days	Catla	Rohu	Mrigal	Common carp	Total seed production (in lakhs)
Pre-monsoon (Feb—May)	1										
No. of rainy days	0.716** (0.001)	1.00									
Monsoon (Jun—Sep)	-0.113 (0.646)	0.031 (0.901)	1.00								
No. of rainy days	0.216 (0.374)	0.410 (0.082)	0.628 (0.004)	1.00							
Post-monsoon (Oct—Dec)	0.139 (0.570)	-0.214 (0.379)	0.064 (0.795)	-0.281 (0.244)	1.00						
No. of rainy days	0.139 (0.569)	-0.080 (0.744)	0.374 (0.115)	0.153 (0.532)	0.597 (0.007)	1.00					
Catla	0.977 (0.000)	0.664** (0.003)	-0.118 (0.642)	0.242 (0.334)	0.079 (0.756)	0.120 (0.636)	1.00				
Rohu	0.407 (0.094)	0.204 (0.416)	-0.174 (0.490)	-0.004 (0.987)	0.230 (0.359)	0.364 (0.137)	0.489** (0.039)	1.00			
Mrigal	0.268 (0.283)	0.105 (0.678)	0.241 (0.335)	0.097 (0.702)	0.382 (0.118)	0.414 (0.088)	0.203 (0.434)	0.469 (0.058)	1.00		
Common carp	-0.459 (0.000)	-0.536* (0.022)	0.056 (0.825)	-0.223 (0.373)	0.075 (0.767)	0.324 (0.190)	-0.426 (0.088)	0.236 (0.361)	0.106 (0.675)	1.00	
Total seed production (in lakhs)	0.827 0.000	0.484* (0.049)	0.016 (0.952)	0.161 (0.537)	0.231 (0.372)	0.346 (0.173)	0.874** 0.000	0.789** 0.000	0.532* (0.028)	-0.064 (0.808)	1.00

in TB Dam from April to September over two decades. Similar observations are made by many people (3—6) have tried to breed these fish in the months other than May to August months. The controlled climatic conditions in pre-monsoon period and continued monsoon for longer period might be responsible for early or late breeding of these carps respectively as reported in their study.

In the current study, the amount of rainfall and the frequency of rainfall (number of rainy days) have varied between nil to 174.7 mm and nil to 18 days in the pre-monsoon period, from 10.2 to 806 mm and 4 to 64 days in monsoon period and between 16 to 386 mm and 5 to 20 days during post-monsoon period respectively over two decades from 1991-92 to 2009-10 years (Table 1). While the contributions of seed productions of pre-monsoon, monsoon and post-monsoon periods to the total annual seed production is found to be 4, 90 and 6% respectively on an average. There is variation of 50 to 60% in the number of brooders chosen for breeding out of total population of brood stock per pond and 80 to 100% in the number of chosen brooders who have responded positively to the trials which is also observed in the current study. These variations could be attributed to the seasonal variations in the climatic and environmental parameters brought about by rain fall in three different phases of monsoon in each year including a little variations in the management practices during the period from 1991-92 to 2009-10 years. Similar observations on the role of water/flood in lowering down the electrolytic level of water causing gonadal hydration for successful spawning has been observed and indicated the prominent role of rainfall in the seasonal variations of seed productions over the years (7, 8).

It is observed that the trends of seed production of mrigal almost followed the trends of pre-monsoon and monsoon rain fall with little variations. The trends of seed production of catla, and common carp followed the number of rainy days of pre-monsoon pe-

riod and the amount of rainfall of post-monsoon period with a little variation respectively. It was observed that pre-monsoon had positive and highly significant correlation with *Catla catla* and total seed production ($P \leq 0.01$) (Table 2). It indicates that as the duration of pre-monsoon increases the production of catla, rohu and also the total seed production increases significantly. Even the number of rainy days during monsoon had significant positive correlation with *Catla catla* ($P \leq 0.01$) and total fish production ($P \leq 0.05$). Further, there was a negative significant relationship with commen carp and number of pre-monsoon rainy days which indicated an inverse relationship between the number of pre-monsoon rainy days and total fish seed production. The monsoon and post-monsoon did not show significant impact on any of the varieties of Indian major or exotic carps. Among the varieties, Catla and Rohu had high significant ($P \leq 0.01$) positive correlation with total fish seed production. Mrigal also had positive relation which was significant ($P \leq 0.05$). But common carp did not have any correlation with total seed production. It may be due to the repeated effective environmental stimuli of rain fall for faster gonadal development in pre-monsoon resulting in successful breeding trials of monsoon period under favorable conditions. It is reported that a significant correlation exists with peak reproductive activity i.e., act of spawning in a study on annual testicular events in free living *Catla catla* and other probable environmental synchronizers (9) and collectively summarized that photo thermal conditions may act as proximate and rain fall may play a role in ultimate environmental factors in regulations of annual testicular events in IMC i.e., *Catla catla.* Hence, it is the frequency of rain fall coupled with amount of rain fall of pre-monsoon period which influence the seed production in the succeeding period of monsoon.

Conclusion

The amount and frequency of rain fall of pre-monsoon and monsoon periods have a definite role to play in the success of the seed production of IMC. It is an important natural environmental stimulus for the successful breeding to enhance seed production of Indian major carps.

References

1. Rottmann R. W., J. V. Shireman and F. A. Chapman. 1991. *Hormonal control of reproduction in fish for induced spawning.* SRAC Publ. No. 424.
2. Mohan D. and D. Choudhary. 2010. Variations in physico-chemical and microbiological characteristics of water during breeding of *Cyprinus carpio* in a closed hatchery system. *J. Environm. Biol.* 31 : 301—306.
3. Alikunhi K. H., K. K. Sukumaran and Parameswaran. 1965. *Observations on growth, maturity and breeding of induced bred, pond reared silver carp, Hypophthalmichthys molitrix and grass carp, Ctenopharyngodon idellus in India during July 1962 to August 1963.* Bull Cen. Inst. Fish. Educ. Bombay, India. 19 pp.
4. Singh S. B. 1979. Observations on prolonged induced breeding of silver carps. *Symp.on Int. Aquacul.* Abstract No. 12.
5. Sen Gupta R., R. N. Ray and S. K. Basak. 1984. Development of carp hatchories in West Bengal. *Proc. Nat. Works. on Fish Seed Production* : 9—20 pp.
6. Sukumaran N. and Md. Kaleemur Rahman. 1984. *Progress report of the Tuticorin sub-center for the period April 1982 to February 1984.* 7th Works. on AICRP on Composite Fish Culture & Fish Seed Production. 144—169 pp.
7. Sinha V. R. P., V. G. Jhingran and S. V. Ganapati. 1974. A review on spawning of the Indian major carps *Arch. Hydrobiol.* 73 : 518—536.
8. Sinha V. R. P. 1980. Hydration of female spawners of carps during hypophysation. *Hydrobiologia* 72 : 193—196.
9. Bhattacharya S. and S. Maitra. 2006. Environmental correlate of the testicular events in major carp *Catla catla* in an annual reproduction cycle. *Biol. Rhythm Res.* 37 : 87—110.