

Assessment of Fish Seed Potentiality of a Stretch of River Ganga in Bihar

M YUSUF KAMAL, BALBIR SINGH AND P M MATHEW

Central Inland Fisheries Research Institute

Doranda Farm, Ranchi-834 002

The occurrence of spawn and the qualitative as well as quantitative potential of the 370 km stretch of river Ganga (Patna to Rajmahal) in Bihar has been discussed. The entire river stretch was divided into three sections, the upper (Patna to Mokameh, 116 km), the middle (Mokameh to Sultanganj, 100 km) and the lower (Sultanganj to Rajmahal, 160 km) which were systematically investigated during the year 1971-73.

The seasonal indices of spawn quantity and quality at the point of detailed investigations in each section of the river stretch have been evaluated to be 282 ml and 40.37% in the upper stretch at Daryapur, 324.6 ml and 70.28% in the middle stretch at Jahangira and 880 ml and 79.9% in the lower stretch at Sukhsenaghat. The indices of spawn quality and quantity are satisfactory measures of spawn-yielding capacity of a river stretch. Daryapur, Jahangira and Sukhsenaghat are, therefore, valuable additions to the spawn collection centres on river Ganga in Bihar.

Introduction

In spite of spectacular advances in fish seed production through hypophysation and bundh breeding, the natural riverine environment continues to remain the chief source of country's fish seed requirements. Since induced breeding of major carps is yet to gain the desired popularity and has its own limitations, the increasing requirement of fish seed calls for the location of additional high-yielding carp seed collection centres in riverine environments.

Though intensive spawn collection is practiced in certain stretches of many rivers, a systematic comprehensive survey of the spawn resources, except in the case of Mahanadi in Orissa and those carried out by the Central Inland Fisheries Research

Institute (Anon 1965, Malhotra et al. 1966, Shetty et al. 1967 & 1971 a, b, and Khan & Kamal 1972), has not been done. Therefore, investigations under the All-India Coordinated Research Project on Riverine carp spawn prospecting and collection techniques were initiated on river Ganga in Bihar with a view to (i) charting of exploited and likely economic carp spawn collection centres, (ii) assessing the spawn yielding potentialities of selected river stretches in regard to quality as well as quantity, and (iii) evolving suitable nets for operation under various hydrological conditions. The present paper elucidates the results of the systematic attempt at the qualitative and quantitative analysis of fish seed in a

370 km stretch of river Ganga (Patna to Rajmahal) in Bihar, establishing three promising carp seed harvest centres (figure 1).

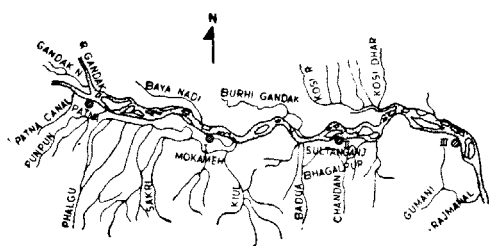


Figure 1 Stretch of River Ganga investigated during 1971-73.

I, Daryapur; II, Jahangira; III, Sukhsenaghat

Material and Method

The 370 km stretch of river Ganga extending from Patna downstream to Rajmahal was investigated during the years 1971 (110 km stretch from Patna to Mokameh—the upper stretch), 1972 (100 km stretch from Mokameh to Sultanganj—the middle stretch) and 1973 (160 km stretch from Sultanganj to Rajmahal—the lower stretch). A thorough premonsoon survey of the stretches preceded the detailed monsoon investigations with a view to chart all suitable sites along both the banks of the river and the best among them was chosen for detailed round the clock observations for assessing qualitative and quantitative spawn-yielding potentiality.

In deciding upon a site as suitable during the course of premonsoon survey, the following factors were taken into consideration: (i) Good accessibility during the monsoon months; (ii) Topography of dry river-beds and the bank features to expect (a) sufficient operational area at each flood level, (b) gently sloping bank along which

subsidiary current of moderate velocity (0.5–3.0 km/hr) flowing parallel to the bank would prevail during monsoon; (iii) Availability of major carps in abundance in the stretch and adjoining water areas; and (iv) Presence of nalas or tributaries in the vicinity which may either constitute the breeding grounds or link the breeding grounds elsewhere with the river stretch.

During the course of monsoon investigations, 1–5 standard spawn nets (1/8" meshed Midnapur type spawn nets) were operated round the clock and their catches analyzed for ascertaining the spawn availability and deriving the indices of spawn quality and quantity. A trial net was operated at two or three spots round the clock throughout the season. The moment their spawn catch indicated bulk spawn availability (i.e., 1ml/hr/net), the spot of maximum spawn availability was determined and a battery of five standard nets put into operation. When spawn density fell below the index of availability, trial net operation was restored.

After removing the floating debris from the *gamcha*, the spawn collected were scooped out to a container half-filled with river water. They were then sieved through round meshed mosquito netting cloth on to a muslin cloth kept half-immersed in water and measured in spawn-measuring brass cups of 5–200 ml capacity before being released inside hapas for awaiting transshipment.

The quality of spawn was determined through microscopical examination of two-hourly spawn samples as well as by their spurt-wise rearing in nurseries, plastic pools, dugout pits or chetty pots up to identifiable fry stage. Any catch of spawn having 10% or more of major carps, as revealed by microscopical examination, was considered as desirable. The total catch of

Table 1 Spawn occurrence in relation to flood phase in the stretch of river Ganga (Patna to Rajmahal) in Bihar during the years 1971-73

No.	Flood details		Peak date/Flood levels (in m ⁺)	Spawn spurt No.	Spurt duration		Spawn desir-ability (D/UD)**	Total spawn catch in ml.
	Phase	Duration from/No. of days			From date/hour	Period (in hr)		
UPPER STRETCH (DARYAPUR 1971)								
I	Receding	24.6.71/3	—	1	26.6.71/6.00	10	UD	47
II	Rising	27.6.71/12	8.7.71/2.90	2	30.6.71/18.00	8	D	25
	Vascillation	9.7.71/7	—	3	2.7.71/2.00	80	D	747
	"	16.7.71/3	—	4	10.7.71/18.00	24	D	153
	Receding	19.7.71/4	—	5	13.7.71/16.00	22	D	338
III	Vascillation	23.7.71/5	22.7.71/4.66	—	—	—	—	—
	"	28.7.71/4	—	6	24.7.71/22.00	14	D	83
	Vascillation	1.8.71/3	31.7.71/5.30	7	25.7.71/20.00	14	D	64
IV	Rising	4.8.71/3	—	—	—	—	—	—
	Receding	7.8.71/12	6.8.71/5.66	—	—	—	—	—
V	Rising	19.8.71/4	22.8.71/5.39	—	—	—	—	—
	Total					172		1,457
MIDDLE STRETCH (JAHANGIRA 1972)								
I	Rising	22.6.72/7	28.6.72/1.41	1	29.6.72/8.00	10	D	48
	Receding	29.6.72/4	—	2	10.7.72/16.00	4	D	15
II	Rising	3.7.72/22	24.7.72/6.21	3	16.7.72/22.00	8	D	34
	"	25.7.72/5	—	4	21.7.72/6.00	12	D	81
	Receding	30.7.72/5	3.8.72/5.52	5	22.7.72/10.00	6	D	45
III	Rising	4.8.72/5	—	6	23.7.72/14.00	78 (10)***	D	647
	Receding	9.8.72/10	18.8.72/6.75	7	1.8.72/14.00	40 (10)***	D	168
IV	Rising	19.8.72/8	—	8	13.8.72/22.00	34 (8)***	D	270
	Receding	27.8.72/-	—	9 & 10	20.8.72/14.00	30	D	320
V	Rising	—	—	—	—	—	—	—
	Total					222		1,628

LOWER STRETCH (SUKHSEENAGHAT, 1973)

I	Rising	21.6.73/8	4.7.73/1.42	1	21.6.73/18.00	10	D	50			
	Receding	5.7.73/4									
II	Rising	9.7.73/2	10.7.73/1.07	2	11.7.73/06.00	12 (4)***	D	300			
	Receding	10.7.73/10		3					16.7.73/04.00		
				4						18.7.73/06.00	
				5							18.7.73/20.00
				6							
III	Rising	21.7.73/12	1.8.73/4.00	6	22.7.73/12.00	18	D	685			
	Receding	2.8.73/10		7					23.7.73/20.00		
IV	Rising	12.8.73/11	22.8.73/4.08	—	—	—	—	—			
	Receding	23.8.73		—							
Total								6,150			

* Above initial level

** D, Desirable; UD, undesirable

***Number of hours net operation was suspended due to rough weather

desirable spawn taken by one standard net in the course of the entire season, generally based on the average of five standard nets, was taken as the *seasonal index of spawn quantity*. The percentage of major carps in the season's total catch of desirable spawn, as revealed by rearing, was taken to be the *seasonal index of spawn quality*.

Observations

The Upper Stretch (Patna to Mokameh)

Spawn occurrence: The flood pattern of river Ganga in this stretch is heavily influenced by the three tributaries viz. the Son, the Gandak and the Punpun. During the course of investigations (24.6.71–22.8.71), six floods were encountered at Daryapur—the spot of detailed investigations—yielding seven spawn spurts. The days of floods, dates of flood peaks, number of spawn spurts and their spawn yield are delineated in table 1.

The desirable spawn's (1410 ml)—96.7% of total spawn catch (1457 ml)—availability period was spread over 162 hr between 30th June to 26th July, 1971. The peak spawn availability period was observed to be from 2.7.71 to 14.7.71 when 87.7% of the season's spawn catch could be obtained in three spawn spurts (III, IV and V) in 124 hr.

Spawn quality: The qualitative composition of the spawn catches is depicted in table 2, Mrigal spawn dominated the major carps during spurts III and VI (27.09% and 35.26%) whereas rohu spawn dominated the catches of spurt II and IV (9.7% and 42.2%). Catla having a comparatively lean proportion amongst the major carp spawn dominated the spurt V with rohu (14.2% each). Mrigal, rohu and calbasu were present in all the spurts, while catla was available in spurts II, III and V only. Amongst the major carps, calbasu's contribution was the poorest in this stretch.

The indices of quality and quantity were estimated as 40.37% and 282 ml respectively. Daryapur, on the south bank of river Ganga in Patna district, is a promising site for riverine spawn collection.

The Middle Stretch (Mokameh to Sultan-ganj)

Spawn occurrence: Jahangira site, the point of detailed investigations, too is situated on the south bank of river Ganga. The observations at Jahangira were initiated on June 20, 1972 when typical summer conditions were prevalent, and were continued till August 31, 1972.

During the course of investigations, the river experienced four floods, yielding ten spawn spurts.

Out of the total spawn catch of 1963 ml, 1,628 ml was available in five standard nets whereas 98 ml was collected during occasional testing of 12 research nets and the rest 232 ml of spawn represented the catch of one trial net during the periods when spawn catch remained lower than the availability criterion.

Of the total spawn catch of 5 standard nets (1628 ml), 62.40% was the yield during the receding phases while 27.60% represented the catch of rising phases of the various floods.

Spawn quality (table 2): Spawn spurt VI was the richest, contributing as high a percentage of major carps as 94.94–95.99% initially and for the greater period of its occurrence but subsequently its desirability fell to 49.2% during its last phase on account of heavy spawning of *Barilius* sp. Season's poorest desirability, recorded during spawn spurt II, was 47.21%. *Cirrhina mrigala* was present in all the spawn spurts, dominating most of them, closely followed by *Labeo rohita*. *Catla catla* was available only once and *Labeo calbasu* was totally absent.

Table 2 Spawn quality (spurt-wise) in the stretch of river Ganga (Patna to Rajmahal) during the years 1971-73

Spurt No.	Microscopical analysis							Spawn quality in %					Spawn catch in ml.
	Rearing							Rearing					
	Major carp	Minor carp	Others	L. calbasu	L. rohita	C. catla	C. mrigala	Major carp	Minor carp	Others			
UPPER STRETCH (DARYAPUR 1971)													
1.	5.0	34.0	61.0	1.42	4.26	—	4.26	9.94	87.33	2.13	—	47	
2.	24.7	64.7	10.7	0.68	9.60	6.60	5.76	23.88	75.12	—	—	25	
3.	21.0	62.1	16.9	0.43	9.46	0.86	27.09	37.84	61.49	—	—	747	
4.	13.7	38.0	48.3	1.20	42.18	—	8.74	51.82	48.18	—	—	153	
5.	34.7	48.1	17.2	3.55	14.20	14.20	10.65	42.60	49.92	7.10	—	338	
6.	30.0	63.7	6.3	0.82	1.64	—	35.26	37.72	61.52	0.82	—	83	
7.	37.7	52.3	10.7	not reared	—	—	—	—	—	—	—	64	
							Pooled average=40.37						
MIDDLE STRETCH (JAHANGIRA 1972)													
1.	35.6	22.2	42.8	—	35.42	—	19.32	57.74	41.86	3.72	—	48	
2.	59.0	20.3	20.6	—	15.37	—	31.84	47.21	46.11	6.58	—	15	
3.	35.0	35.0	30.0	—	10.40	—	66.40	76.80	15.20	8.00	—	34	
4.	58.4	23.0	18.6	—	—	—	71.50	71.50	26.40	2.20	—	81	
5.	52.5	26.2	21.2	—	—	—	—	—	—	—	—	45	
6.	24/7	59.4	16.0	—	32.43	54.05	8.46	99.94	4.70	—	—	647	
	26/7	—	—	—	1.40	0.47	94.20	95.99	4.20	—	—	—	
	27/7	—	—	—	2.70	1.30	45.20	49.20	50.50	—	—	—	
7.	41.4	29.4	28.8	—	65.19	—	2.87	68.96	24.60	7.38	—	168	
8.	56.1	18.3	23.0	—	57.52	—	16.55	74.07	22.45	3.54	—	270	
9.	52.3	23.4	24.3	—	—	—	—	—	—	—	—	320	
10.	67.5	18.2	14.3	—	—	—	—	—	—	—	—	—	
							Pooled average=70.28						
LOWER STRETCH (SUKHSENAGHAT 1973)													
1.	43.4	26.8	29.8	—	63.0	22.0	—	85.0	14.0	1.0	—	50	
2.	57.0	26.0	17.0	—	67.0	1.0	29.0	97.0	3.0	—	—	300	
3.	25.5	38.5	36.0	—	75.0	10.0	—	85.0	14.0	1.0	—	130	
4.	45.7	32.3	22.0	1.0	69.0	20.0	—	90.0	9.0	1.0	—	60	
5.	42.7	33.0	24.3	—	—	—	—	—	—	—	—	105	
6.	52.0	34.0	14.0	—	62.0	17.0	—	79.0	18.0	3.0	—	685	
7.	23/7	53.0	27.0	—	65.0	6.0	—	71.0	26.0	3.0	—	—	
	24/7	42.0	20.0	—	49.0	16.0	2.0	67.0	28.0	5.0	—	—	
	25/7	50.0	8.0	—	22.0	22.0	9.0	78.0	22.0	—	—	4820	
	26/7	57.0	13.0	—	58.0	15.0	5.0	78.0	22.0	—	—	—	
	27/7	32.3	15.4	—	50.0	17.0	2.0	69.0	28.0	3.0	—	—	
			19.1	—	—	—	Pooled average=79.90						

The indices of quality and quantity were estimated as 70.28% and 324.6 ml respectively. Thus, the Jahangira site is a promising centre for the collection of riverine carp spawn.

The Lower Stretch (Sultanganj to Rajmahal)

The flood load of river Ganga is further influenced in this stretch by the river Kosi and other tributaries in the form of rivulets and nalas. The detailed investigations were undertaken at Sukhsenaghat, 20 km down stream of Sahebganj and 18 km upstream of Rajmahal, on the western bank of river Ganga. The observations initiated on 21.6.73 were continued till 28.8.73.

Spawn occurrence (table 1): The river experienced four floods during the course of investigations. The first three floods yielded seven spawn spurts but no spawn was available during the fourth and the last flood.

A total of 6,150 ml of spawn was collected during the course of investigations at Sukhsenaghat. Out of this 4,400 ml spawn was collected in five standard nets where as 1645 ml and 105 ml represented the catch through 12 cotton and 10 nylon research nets respectively operated for short duration during the course of spawn spurts. All the spurt-wise comparisons are based on the collections of 1 to 5 standard nets only.

The rising phase of flood III was the most productive in that there occurred two (6th and 7th) spawn spurts yielding 5,505 ml of spawn (85.1% of the season's total catch). Only 14.1% spawn could be collected during the receding phase of various floods.

Spawn quality (table 2): Spawn spurt II was the richest comprising of as high a percentage of major carps as 97.0%.

Labeo rohita and *Catla catla* were present in all the spawn spurts while rohu forming the bulk of the collection. *C. mrigala* was poorly represented in only two spurts i.e. 2nd and 7th. Highly negligible percentage of *L. calbasu* could be encountered in only 4th spawn spurt. Most of the spawn spurts were the result of almost simultaneous spawning of rohu and catla.

The indices of quality and quantity were estimated as 79.90% and 880ml respectively. The potentiality of the stretch is pretty rich both in respect of quality as well as quantity. Thus, Sukhsenaghat is found to be a highly promising spawn collection site.

Quantitative Potential of the River Stretch

The quantitative potential of the 370 km stretch of river Ganga from Patna down to Rajmahal, during the years 1971 to 1973 is given in table 3.

Table 3 Spawn catches in ml* in the 370 kms stretch of river Ganga (Patna to Rajmahal) during 1971-73

Name of river stretch	Year	Railway bookings by pvt. parties	Spawn purchased by State from pvt. parties	Spawn Collection	
				State	Project
Upper stretch	1971	1,29,500	5,000	3000	1457
Middle stretch	1972	4,18,250	36,700	1000	1963
Lower stretch	1973	37,57,750	83,575	3050	6,150

*1 ml=ca. 500 spawn.

Discussion

The gap between demand and carp seed production was estimated to be 1850 million spawn, 1440 million fry and 73 millions fingerlings in 1964-65 (Govt. of India 1966), and this is continuing to grow at a tremendous rate in view of the increasing energies being diverted towards Composite Fish Culture Technology in different parts of the country. Latest estimate indicate the total requirement of carp fingerlings needed for intensive culture, traditional culture and for reservoirs would be over 2000 million in 1984 (George & Sinha 1975). The Central Inland Fisheries Research Institute undertook an extensive programme of carp seed prospecting from 1964 which was further enlarged through the All-India Coordinated Research Project initiated in 1971. These surveys have not only advanced the techniques of fish spawn collection but have also led to the location of several new potential spawn-bearing centres.

The 370 km, investigated stretch of river Ganga (Patna to Rajmahal) in Bihar is a highly potential source of carp spawn. Spawn prospecting investigations carried out in the three zones of this stretch indicated that each zone has its own characteristic features in terms of spawn quality, quantity and periodicity of spawn availability. The indices of spawn quality and quantity are satisfactory measures of spawn yielding capacity of a river stretch. Based on these observations, it is clearly evident that the spawn-bearing potentiality of the river Ganga increases downstream of Patna and is of highest order in the lower stretch. In the upper and middle stretches of the river the spawning of *Cirrhina mrigala* and *Labeo rohita* was frequent, the former being dominant, but the spawning of *Catla catla* was of limited order and that of *L. calbasu* of very low

magnitude. Whereas in the lower stretch most of the spawn spurts were caused by the simultaneous spawning of *L. rohita* and *C. catla*, the former represented the bulk of the collections. Only two spawning bursts of very low order of *C. mrigala* and a single very poor spawning of the season in case of *L. calbasu* were encountered.

In the upper and middle stretches the spawning of major carps is recorded in the last week of June whereas it commences earlier i.e., in the third week of June in the lower stretch probably being effected by the early flooding of the Kosi. The spawning of major carps appears to be over in July in the upper stretch & lower stretch whereas it continues for a much longer period i.e., up to end of August in the middle stretch. The bulk of spawn is harvested in the first fortnight of July in the upper stretch, last week of July to 3rd week of August in the middle stretch and second to third week of July in the lower stretch. Knowledge of the time of occurrence of the most productive spawn spurts in various sections of the river stretch alongwith an idea of the indices of spawn quality and quantity can be fruitfully utilized for suitably planning the spawn collection programme. Thus, the spawn collection sites of Daryapur, Jahangira and Sukhsenaghat having been established as potential source of quality spawn can be judiciously exploited to meet the additional requirements of fish seed.

The major carp fishery of Ganga river system in the state of U.P. and Bihar does not show any correlation between spawn off take and decrease in catches which has more or less stabilised around 200 t per annum (based on landings at 8 centres during 1961-69) and it needs only 40 t of spawners to produce the present spawn collections from the Ganga river system (Natarajan et al. 1976). Harvesting of spawn crop should, therefore, be taken as a

measure to reduce natural mortality but such cropping should not go beyond a certain level impairing recruit strength. The requirements of fish seed have grown considerably. It is imperative that the riverine collections, being the natural source and the mainstay of the total spawn production in the country, are judiciously exploited and other modes of seed production are intensified. The Ganga river system in U.P. with much higher major carp stock strength calls for more extensive exploitation rather than in Bihar and Bengal. There seems to be good scope for the exploitation of fish seed resources of the economic carps of the Peninsular India. Other methods of fish seed production such as bundh breeding and induced breeding through hypophysation are to be popularised on national

level. In the interest of optimum exploitation of the resources on a continuing basis, conservation and management measures have to be taken care of. Such constant efforts may largely contribute to the regional self sufficiency in terms of fish seed.

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