

OBSERVATIONS ON BREEDING OF MAJOR CARPS
IN THE TILAIYA AND PANCHET RESERVOIRS



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PANCHET RESERVOIRS

by

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INTRODUCTION

The question as to whether the major carps breed at the head-water* regions of the Damodar Valley Corporation reservoirs and the significance of this in relation to the management programmes concerning the respective areas have been engaging the attention of the authorities for some time now, but since no proper investigations in this direction have earlier been attempted definite information on the subject has been lacking. It is well known that rivers are the main natural sources of seed required for fish cultural practices in the country and that intensive spawn collections are regularly made from sections of different rivers (David, 1959). After the commissioning of the D.V.C. dams across the Damodar, Konar and Barakar rivers, regular stocking of the reservoirs with major carps has been undertaken by the fisheries department of the Corporation, except in Panchet reservoir, where it appears that the same was done during one year only. Although, mass migration of mature Catla catla, Labeo rohita, Cirrhina mrigala and Labeo calbasu during the monsoon seasons has been reported in recent years at the head-water areas of these reservoirs, only unconnected and hearsay evidence regarding the actual spawning of these fishes were available till now and that too only from the reported presence of fish eggs at some places.

It is possible that most species of fish may be able to adapt themselves to different spawning conditions and those which normally breed in rivers may be able to do so in lakes also under certain circumstances (Hora, 1945). Conditions in the D.V.C. reservoirs are specially interesting as riverine characteristics prevail at the head-water regions for some part of the monsoon season and major carp breeders are known to move up in these areas in large groups during such periods. These considerations led to the initiation of the present investigations, which were primarily aimed at finding out whether the major carps actually breed in these reservoirs and if so, whether there are sufficient seed resources.

LOCATION OF THE FIELD STATIONS

In view of the limited staff available for these studies, only two reservoirs, viz. Tilaiya and Panchet, which appeared to offer better conditions for the major carps to breed, were taken up. A preliminary survey was conducted during early June 1964, by one of the authors (V.G.) along with the Fisheries Officer, D.V.C., to select suitable centres for conducting these investigations. On the basis of the preliminary observations made, the base camp for studies in Tilaiya reservoir was set up at Puhara (Fig.1) and for Panchet reservoir at Kargali (Fig. 2). The different centres of observations are indicated on the respective maps.

* The term 'head-water region' is used here to denote the area where the river meets the reservoir.

METHODS

Midnapore type spawn collection nets, made to the following specifications, were used for these studies :

Type I : Length : 3.2 metres
 Width at mouth : 3.124 metres
 Height at mouth : 0.61 metres
 Ring diameter : 0.229 metres
 Mesh size : 3.2 mm

Type II : All dimensions same as above, but
 with mesh size - 1.6 mm

The number of nets operated at a time and the mode of fixing them in relation to the bank had to be varied at the different collection centres, according to the prevailing conditions.

Direction of current was observed by releasing on the water surface, a small sponge float tied to a fine thread, care being taken to see that there was no effect of waves. From the alignment of the thread, the direction of flow was recorded with the aid of a pocket compass.

Velocity of current was calculated by measuring the time taken by a thin float to cover a measured distance on the water surface. However, the values obtained are to be treated as approximates only, as on occasions wind and surface waves were found to affect the measurements substantially.

Flood level readings at the centres were taken with the aid of vertically fixed bamboo-poles. For Panchet reservoir, corresponding gauge levels were available from the Sindri Pump House. For Tilaiya, data obtained at the Dam only are given (Appendix Table I) as no gauge readings were available in the vicinity of Purhara.

Temperature of the water was recorded at site by taking the reading in bucketful of water drawn from the place of operation of the nets. Air temperature was recorded in shade above the water surface and with the sun at the back of the observer.

Turbidity readings were taken with Secchi disc and pH with the aid of B.D.H. narrow range indicator papers. Dissolved oxygen content was estimated by Winkler's Method (Standard methods, 1955).

Plankton collections were made by filtering 50 litres of water through a 21XXX Bolting silk-plankton net. Samples were always taken from very near the mouth of the anterior net. The plankton thus obtained was immediately fixed in 5% formalin. After making the volume of the preserved sample to 50 cc, 1 cc of the same was drawn in a Sedgwick-Rafter cell for examination and counting.

Collections from the tail pieces of the spawn collection nets were generally made once in every two hours at the Panchet reservoir and in every three hours at the Tilaiya reservoir. However, more frequent collections were made on the days of heavy catches. The daily duration of observations was normally from 6 A.M. to 6 P.M. except on the days when eggs appeared in large quantities, when the operations were continued upto 9 P.M. More night collections were not possible due to want of facilities and also due to the fact that in the areas under study, sudden rises in water level were very frequent.

By sieving the collections obtained in the tail pieces of the spawn collection nets through two pieces of fry-net cloth of different mesh sizes, the associates were separated. Samples of the carp spawn were kept in earthen 'gamlas' and also preserved in 5% formalin. In the case of eggs obtained at Puhara, after retaining sample lots in earthen 'gamlas' and troughs, the rest were mostly released back into the river. A few, however, were taken to the Bachai Fish Farm. Samples were preserved in 5% formalin for laboratory studies. The associates were also preserved for further laboratory observations.

For separation of hatchlings of carps from those of non-carps, the standard considerations viz. shape of yolk sac, segmentation, oil globules in yolk, barbels and position of fins were taken into account. In distinguishing major and minor carp hatchlings of 6 mm and more in length, characters like posteriorly elongated oval yolk sac, persistence of yolk sac, development of dorsal fin and presence of more than 11 undivided rays in dorsal fins, were taken into consideration. Bigger fry could be identified following in general the descriptions given by Mookerjee et al (1944).

In addition to the spawn collection nets, fry drag nets made of 1.6 mm mesh size were operated in shallow inundated areas. Tow-nets of half-metre diameter mouth, made from organdie cloth, were also operated at different regions as indicated in Figs. 1 and 2.

OBSERVATIONS IN TILAIYA RESERVOIR

The Tilaiya Dam is on the Barakar river, about 208 km above its confluence with the Damodar. The spawn collection nets were operated at points near about Puhara (Fig.1), the salient features of the location being presence of sand banks, shallow and sandy margins of the original river and the confluence of the tributaries Burhi and Nunhi. Regular observations in the reservoir were made for a period of 42 days, from 30th June 1964 to 10th August 1964, and a summary of the data collected is presented in Table 1. In view of the particular nature and slope of the substratum of the river at Puhara, the spawn collection nets were fixed one behind the other, the front one always of 3.2 mm mesh size and others of 1.6 mm.

The first breeding of major carps was observed during the night of 11th July 1964, when the breeders were found to congregate in large numbers on the bank opposite Puhara, i.e., left side of the river, in the shallow and sandy marginal zone at the bend (Figs. 1). There were heavy rains in the locality from 8th July 1964 resulting in floods in the river. This was in fact the second flood of

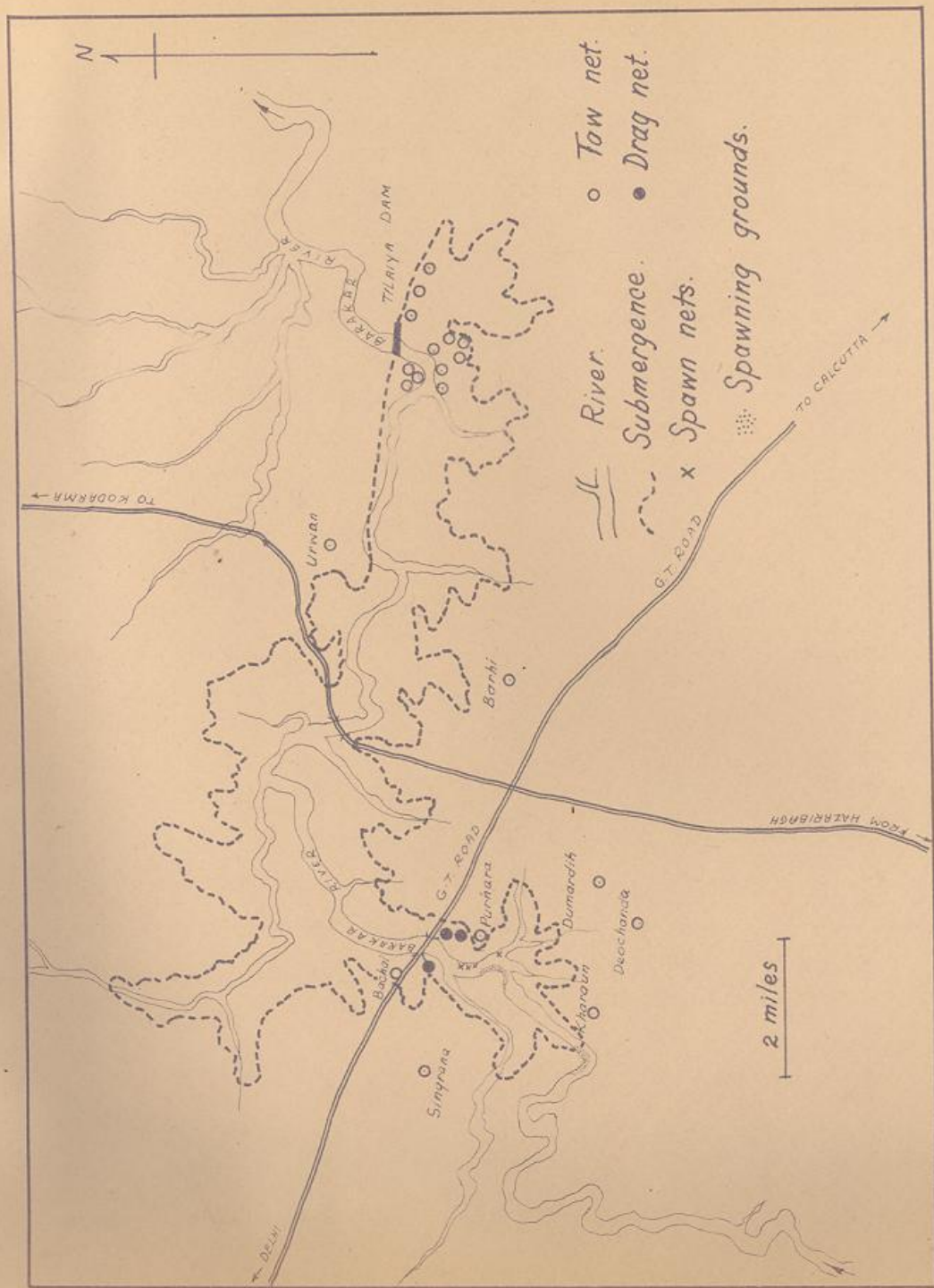


FIG. 1 — TILAIYA RESERVOIR SHOWING THE COLLECTION CENTRES AND SPAWNING GROUNDS.

Table 1. Conspectus of data obtained from Tilaiya Reservoir (at Parhara)

Date	No. of nets	No. of eggs collected	Air Temp. in °C	Water Temp. in °C	Flood* level (in m.)	Current velocity (km/hr)	Weather condition	+Turbidity opm	+pH	+Dissolved Oxygen ppm
June 30 '64	1	Few	27.5	29.0	1.22	5.0	F	500	7.0	7.52
July 1, '64	3	Few	28.5-31.5	26.5-30.5	0.43	3.3	F	330-500	5.7	4.7-3.8
2	2	Nil	26.5-31.0	26.5-32.5	0.30-0.33	3.6	F	158-310	6.7-7.0	4.9-6.8
3	2	Nil	26.5-31.5	27.0-33.0	0.30	2.5-3.3	F	<100-158	7.3	4.7-7.1
9	4	Nil	24.5-29.2	24.7-27.3	0.91-1.04	3.0	C,R	360-550	6.7-7.0	7.5-8.3
10	3	Nil	24.3-25.3	24.8-28.3	1.14-1.37	4.5-6.0	R	440-650	6.7	6.8-8.3
11	4	Nil	24.3-28.3	24.1-29.7	1.68-2.13	4.5	R	550-900	6.7	8.0-8.3
12	4	103 lakhs	24.5-29.8	25.5-30.5	1.22-1.97	3.0-4.5	F,C,R	360-500	6.7	8.7-8.3
13	4	22,000	25.2-28.0	25.0-30.8	0.76-1.52	2.3-5.0	F,C,R	180-650	7.0	7.5-8.3
14	1	Nil	25.0-25.2	25.5-25.8	1.83-2.13	4.5	R	650	7.0	7.5
15	1	Nil	25.7-28.5	26.7-30.5	1.22	2.25	F	158-180	7.0	7.5
16	1	Nil	25.8-26.0	25.8-27.0	1.21-1.04		C	310-440	6.7-7.0	5.0-7.5
17	1	Nil	25.6-26.0	25.0-28.5	0.91-1.04	2.25	F	158-440	7.0-7.3	5.0
18	1	Nil	25.8-26.8	25.8-26.0	0.91-2.13	2.25-4.5	F	158-350	7.0	7.5-7.9
19	4	83,000	25.3-28.3	25.5-30.2	1.52-1.68	1.5-2.25	R	290-400	6.9-7.0	7.5-8.3 p.t.o.

5 Table 1 (cont'd.)

1	2	3	4	5	6	7	8	9	10
20	3	M11	25.5-	25.5-	1.22-	F	180-	6.7-	5.7-
21	3	M11	33.5	33.5	1.37	F	215	7.0	7.5
22	3	M11	26.0-	26.8-	1.22	F	180	7.0	5.7
23	3	M11	33.0	33.0	1.22	F	180	6.9-	5.7
24	3	M11	26.5-	27.2-	1.22	F	180	7.0	7.1
25	3	M11	32.5	32.0	1.22	F	180	7.0	7.1
26	3	M11	27.0	26.7	1.22	F	500	7.0	7.1
27	3	M11	25.3-	26.3-	1.37	F, C	270-	6.7-	8.1
28	3	M11	28.5	30.7	1.37	F	310	7.0	7.1
29	3	M11	25.0-	25.5-	1.37	F	168-	6.8-	7.1
30	3	M11	29.0	32.0	1.30	F	190	6.9	7.1
31	3	M11	25.0	25.0	1.30	F	112	6.9	7.1
August 1	3	M11	28.0	28.0	1.22	F	< 100	7.3	7.5
August 2	4	M11	27.0-	26.0-	-	F	195-	5.8-	7.5-
3	4	M11	31.0	34.5	-	F	230	7.0	8.1
4	3	M11	26.0-	26.0-	-	F	145-	6.8-	7.5
5	3	M11	31.0	32.0	-	F	180	6.9	7.5
6	2	M11	26.0-	23.0-	-	C	120	6.9-	8.1-
7	2	M11	28.5	30.0	-	C	112	7.0	8.3
8	2	M11	26.0	26.0	-	C	112	5.9	7.9
9	2	M11	27.5-	25.5-	-	F	< 100	6.9-	7.5
10	2	M11	31.0	33.0	-	F	< 100	7.0	7.5
11	2	M11	27.0-	27.0-	-	F	< 100	5.9-	7.5
12	2	M11	30.5	33.5	-	F	< 100	7.0	7.5

* Flood level as related to a fixed point
 --Very little current or still water
 @ Morning observations only
 F Fair C Cloudy + Range R Rainy

the season. The breeders engaged in the spawning activity were mostly catla and mrigal, as could be seen from the catches made by local fishermen. These fishes were mostly in oozing or spent condition and the available data on such catches are given in Appendix Table I. Incidentally, it may be mentioned that a large number of these breeders were being caught by local fishermen.

From Table 1, it will be seen that about 103 lakhs eggs were collected in the four nets operated from 06 hours to 21 hours on 12th July 1964. This was actually only a small fraction of the total quantity of eggs liberated.

The next breeding activity of major carps was observed in the same area between 14 to 19 hours on 12th July 1964. The breeding continued throughout the day of 13th July also, but only about 20,000 eggs were collected, as the nets got disrupted in strong current.

Next spawning of major carps was observed during the later part of the night of 18th July 1964, when the third flood of the season occurred. Since the current was very strong, the nets could be fixed only from the morning of 19th and a total of about 83,000 eggs were collected. No further spawning was observed in this region.

During the period of spawning of the major carps, violent splashing resulting in considerable noise was always a characteristic phenomenon and the movements of the breeders were always found to produce spurting fountains of water all over the region. Presence of human beings at the spot did not appear to have any effect on the behaviour of the fishes and in fact, many of the breeders were being caught easily with bare hands or by beating them with sticks.

No significant differences between the catches in 3.2 mm and 1.6 mm mesh size nets were observed.

Breeding activities of Rhinomugil corsula and Oxygaster bacaila were also observed at the sand banks at the place of confluence of Burhi and Nunhi with the Barakar. The eggs collected on 2nd July 1964 were the result of such an observed breeding of these fishes.

Tow-nets were operated in the main reservoir from 30th July to 3rd August 1964 (see Fig. 1 and Table - 1a). No hatchlings or fry of carps could be collected in these areas.

Fry drag nets were operated at the shallow submerged areas near the bridge on Grand Trunk Road, but no carp eggs or spawn were obtained in these collections.

Samples of carp eggs obtained in Puhara were kept for observation in troughs and earthen gamlas and it was noticed that the average percentage of fertilization was about 98% in samples collected on 12th July 1964 and 90% in those of 19th July 1964. Most of the embryos hatched out and they were released into the reservoir.

Table 1a

Data obtained from Tilaiya Reservoir near the Dam

Date	Type of net	No. of fish larvae collected	+ Temp. °C		Weather condition	Turbidity ppm	+ pH	+Dissolved oxygen
			Air	Water				
July '64								
30	Townet	73	27.0- 29.0	29.0	C	<100	6.8- 7.0	7.5
31	"	62	27.0	29.0	C	<100	6.8- 6.9	7.5- 8.3
August '64								
1	"	4	28.2- 29.0	29.0- 29.5	F	<100	7.0	7.9- 8.3
2	"	56	28.0- 29.0	28.5- 29.0	F	<100	7.0	7.5- 7.9
3	"	16	29.0- 31.0	28.0	F,C	<100	7.0	8.3
+ Range		F Fair	C Cloudy					

Associates :

Although the collection of carp eggs in the nets was restricted to a few days, data on the fishes obtained from the tail pieces of the spawn collection nets were regularly recorded and a summary of the same is given in Appendix Table III. The more common of these, which were almost always present, were Oxygaster bacaila and Ambassis nama, followed by Amblypharyngodon mola. Data for 13th and 14th July have not been included as the collections got mixed up. On 16th, 21st, 22nd and 23rd July 1964 no fish were caught in the nets. The quality and quantity of these associates did not appear to show any regular relationship with the floods.

The plankton content at the head portion of the reservoir was found to be poor, the average count being only about 3.8 per litre. The organisms recorded were rotifers, Diaptomus sp., nauplii, Diphanosoma sp., Moine sp., insect larvae and nematodes. Near the dam, the average plankton count was 19 per litre, the organisms present being Anabaena sp., Microcystis sp., Brachionus sp., Keratella sp., Cyclops sp., Diaptomus sp., nauplii, Diphanosoma sp. and Moine sp.

OBSERVATIONS IN PANCHET RESERVOIR

Preliminary observations made at Panchet Dam from 23rd June to 28th June 1964 indicated that from the onset of monsoon by about the 21st June 1964 the fishes started moving within the main reservoir. From the catches brought to the Fisheries Department it was evident that mature major carps started moving towards the head end of the reservoir after 3/4 days. This period denoted that first flood in this area. Detailed data on the catches from the head region of the reservoir could not be recorded as the local fishermen, mostly poachers, did not allow the fishes to be handled. However, as much data that could be gathered are presented in Appendix Table IV. Almost all specimens of Catla catla and Cirrhina mrigala in the catches were observed to be in fully mature and oozing condition.

Spawn collection nets were operated regularly at the head-water region of the reservoir from the 28th June 1964. The shore near Kargali Ghat was found to be the best suited for operating the nets in this area. However, trials were made also at other centres like Shetpalas, Sindri Ghat (Sarisakundi), Kudanjhor nullah, Gowai nullah, opposite bank of Tasra, Ichhar, Murabag and Sindri Pump House, Dumat (Bundlajhor) and Hurara (Utle nullah) (Fig. 2). Considerable difficulty was often encountered in the fixing and operation of the nets as a result of sudden changes in water level. Due to this reason, the base camp at Kargali itself had to be set up at an elevated position about 1 km from the shore. The maximum number of nets that could be operated at a time was three, one 3.2 mm mesh size net being in front and two 1.6 mm mesh size nets behind but side by side. At some of the centres only one net (1.6 mm mesh size) was operated as the equipment had to be carried on foot over long distances.

From the data obtained (Table 2) it will be seen that a small quantity of carp spawn could be collected from the Panchet reservoir. Most of these were obtained on 30th June 1964, while a few more appeared during 1st to 4th July 1964. Samples from these collections were reared in earthen gamlas and the species composition of these, as recorded on 31st July 1964, is presented in Appendix Table V.

A significant observation made in the Panchet reservoir was that during the early part of the monsoon season almost all the brood fish moving up the narrow portion of the reservoir were being caught by local fishermen and villagers. Several teams of fishermen were found to make heavy catches, especially during nights. At the shallow and narrow portion of the reservoir near Ichhar Ghat, the water used to be clearer and the villagers could easily catch the migrating breeders using encircling nets and also by beating with sticks. Spears and rakes used for catching fish were also seen with some villagers. It was only natural that with such large scale destruction of the breeders, only small quantities of spawn could be collected. The silted shallow marginal region at Ichhar, with several inundated water pools, looked like a potential breeding ground of the major carps, but no spawning activity was noticed. In fact, none of the brood fish had even a chance to reach this area as those moving towards this direction were being removed almost en masse.

While the effect of pollution on the fisheries of Panchet reservoir does not come under the scope of the present account, it may be mentioned that at the centres above Sindri Ghat, no damage to fish larvae was apparent. The chief sources of pollution here were the effluents from the coal washeries and even when appreciable quantities of coal dust and allied wastes were observed at the sites, no mortality of fish or fish larvae occurred as observed in the collections. However, the flow from the Sindri nullah, into which effluents from the Sindri Fertiliser Factory are discharged, appeared to have adverse effect on fish spawn, particularly in the area surrounding the mouth of the nullah. Several dead fish larvae were observed in the collections made in this area on 2nd and 3rd July 1964.

No significant differences were observed in the catches obtained in nets of 3.2 mm and 1.6 mm mesh sizes.

A half-metre organdie tow-net was operated in different regions of the head-water portion of the reservoir (Fig. 2) from a boat belonging to the D. V. C. Fisheries Department but no fish larvae were found in the collections.

A fry drag-net was operated on different days during the earlier part of the monsoon season at the shallow inundated areas near the mouth of the Kudanjhor nullah on Kargali side, as it was thought that some carp breeders might have got in there during the floods. But no spawning activity was observed here and the collections also did not contain any fish eggs or larvae.

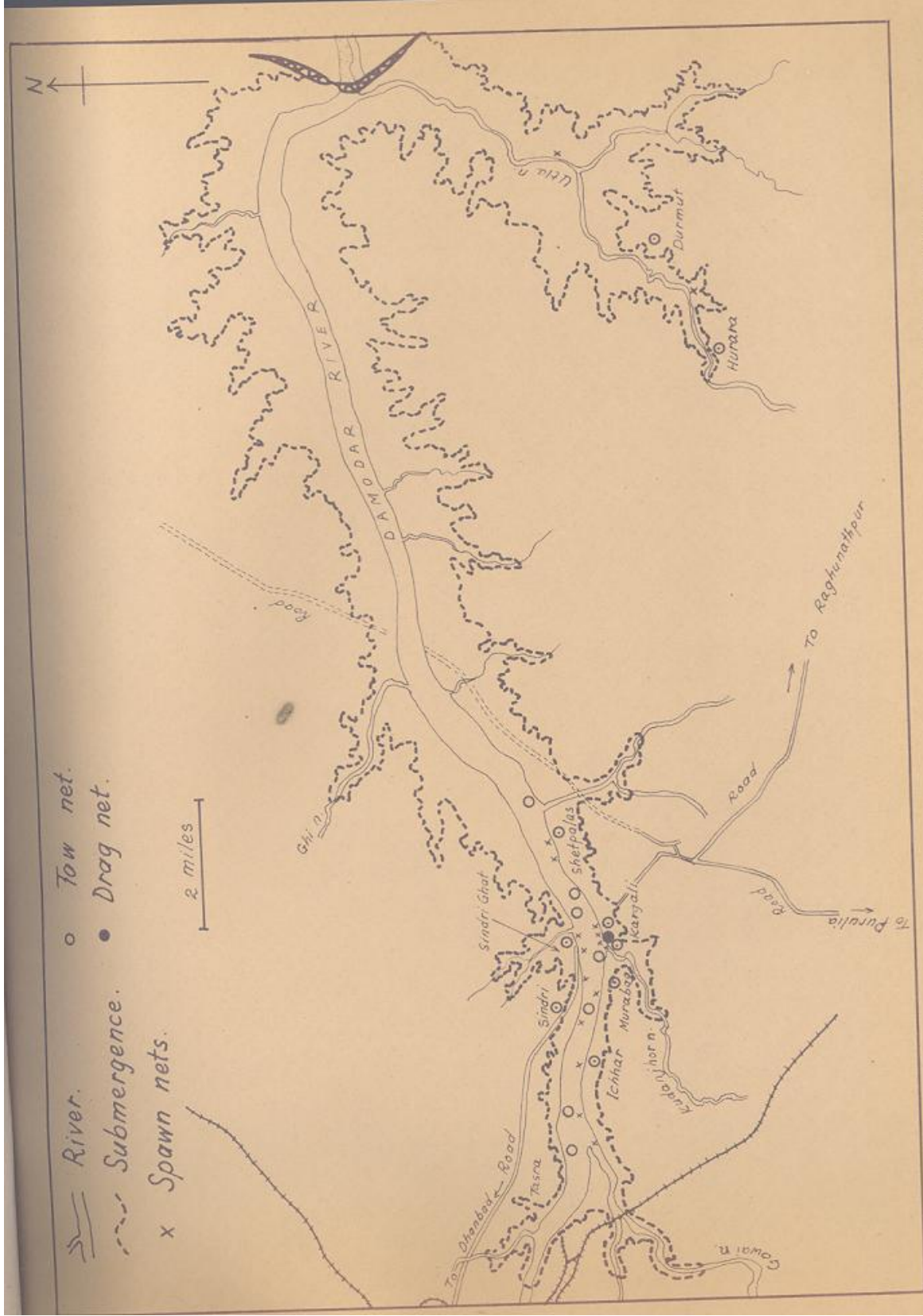


FIG. 2 — PANCHET RESERVOIR SHOWING THE COLLECTION CENTRES.

Table 2. Conspectus of data obtained from Parchet Reservoir.

Date	No. of nets collected	No. of carp spawn collected	Temp. in °C.		* Flood level (ft. & in.)	+ Current velocity km/hr	Weather condition	+ Turbidity p.p.m.	+ pH	Dissolved Oxygen ppm	Centre of collection
			Air	Water							
June '64											
29 ^c	1	150	29.0	28.5-30.0	409-2--409-7	0.32-0.51	F, C	1200	6.4	4.89	Kargali
"	1	30	29.0	28.5	"	0.76	C	1200	6.4	4.89	Shetralas
30	3	28,000	27.0-30.7	29.0	409-0--410-4	0.38-0.45	C, R	500	6.4	6.02	Kargali
July '64											
1	3	215	29.0-33.0	28.0-31.0	410-0--410-2	0.30-0.57	F	750-1200	6.4	5.64	Kargali
2	3	2,339	31.0-33.0	30.7-33.7	409-11--410-1	0.29	C	550	6.4	5.64	Sindri Ghat
3	3	75	32.0-34.0	32.7-34.0	409-10	0.14-0.27	F, C, R	360	6.55	5.26	" "
4	2	45	29.0-31.5	31.0-32.0	409-5--409-6	0.54	F, C, R	155-172	6.5	4.89	Kadanjhor nullah
5 ³	1	Nil	31.0	30.2	411-4	1.01	R	172	6.6	4.89	Gowai nullah
" ³	1	Nil	31.0	30.2	"	1.01	R	172	6.6	4.89	Ichhar Ghat
6	1	1	28.75-33.0	29.5-32.4	407-11--408-4	0.33-0.42	F, C, R	205-240	6.5-6.85	4.89	Sindri
7	3	2	31.0-32.5	30.5-33.0	-	0.29	C	360	6.5-6.8	4.89	Kargali
8	3	1	32.0-33.0	32.0-33.0	403-9--407-0	0.28	C	440	6.4	4.89	Kargali
9	3	Nil	27.7-32.0	27.5-31.0	407-2--408-10	0.30	F, C, R	360	6.8	6.01	Kargali
10	3	Nil	28.0-32.0	27.0-30.5	410-3--414-0	0.78-0.94	C	240-400	6.4-6.7	5.82	Kargali

p.t.o.

11 Table 2 (contd.)

1	2	3	4	5	6	7	8	9	10	11
11	3	M11	28.0-27.0- 32.5 31.0	411-8-- 412-5	0.5	F	255	6.5	5.82	Kargall
12	3	30	26.0-25.0- 32.0 30.5	411-8-- 413-3	1.20	F,C,R	215- 310	3.4- 6.5	4.39	Kargall
13	3	52	29.0-29.0- 31.0 31.0	410-3-- 413-3	0.86	F	400	6.6	4.89	Kargall
14	3	4	30.0-29.0- 32.0 31.0	409-0-- 410-2	0.25- nil	F,C,R	230	5.4	4.89	Kargall
15	3	M11	30.0-28.0- 33.0 31.5	409-4	0.20	F	215	5.1	4.89	Kargall
16	3	M11	27.0-28.0- 31.0 30.0	411-0-- 411-2	0.51	F,C,R	240	6.35	5.07	Kargall
17	3	M11	30.0-28.0- 33.0 32.0	412-3-- 412-4	0.25- 0.67	F,C,R	215	6.4	4.89	Kargall
18	3	M11	29.0-27.0- 32.0 31.5	411-11-- 412-4	0.3	F,C,R	240	5.5	5.26	Kargall
19	3	M11	29.0-28.5- 33.0 32.0	411-10-- 412-2	0.31	F,C,R	215	5.5	5.64	Kargall
20	3	M11	30.0-31.5- 34.0 34.5	411-7-- 411-9	0.4	F	172	6.8	5.32	Kargall
21	3	M11	30.0-31.0- 33.7 32.0	410-2-- 410-5	0.19- nil	F,F	168	6.7	5.25	Kargall
22	3	M11	32.0-32.0- 34.5 35.0	409-11-- 410-0	0.3	F	135	5.8	4.89	Kargall
23	3	M11	30.0-30.5- 33.5 33.0	409-10-- 410-0	0.24	F,C,R	140	6.8	4.89	Kargall
24	3	M11	27.0-26.7- 32.0 31.5	410-0	0.13	F,C,R	130	5.7	5.08	Kargall
25	3	M11	30.0-29.0- 33.7 33.0	410-1	nil	F	195	3.7	4.39	Kargall
26	3	M11	31.0-30.0- 34.5 34.0	409-9-- 410-0	0.15	F	195	6.6	4.89	Kargall

contd.....

Table 2 (contd.)

	1	2	3	4	5	6	7	8	9	10	11
27		3	Nil	31.0-31.5- 34.5 33.0	409-7-- 409-8	nil	F,R	135	5.7	4.89	Kargali
28		3	12	27.5-30.0- 32.5 31.5	409-5-- 409-6	0.15- 0.25	F,C,R	138	6.7	4.89	Kargali
29		3	17	25.5-28.5- 28.5 29.5	409-0-- 409-3	0.10- 0.22	R	-	5.8- 7.0	4.51	Kargali
"		1	Nil	28.5-30.0- 30.0 31.0	-	1.05	F,R	<100	5.9	-	Durmut
30		3	65	25.7-28.0- 32.5 28.7	409-1-- 409-6	0.40- 0.55	C,R	-	6.9	6.39	Kargali
"		1	Nil	31.0-32.0- 33.7 33.0	-	1.28	F,R	<100	6.85	-	Hurara
31		3	102	26.5-28.0- 30.5 30.2	410-5-- 410-8	0.31- 0.64	C,R	-	6.9	4.7	Kargali
August '54											
1		3	Nil	28.0-29.5- 32.0 31.0	410-3-- 410-5	0.19	F,R	215	6.7	5.26	Kargali
2		3	Nil	29.0-30.0- 33.5 32.5	410-0-- 410-2	0.20	F,R	195	6.7	5.26	Kargali
3		3	Nil	31.0-30.0- 35.2 34.5	409-10-- 410-0	0.21	F	215	6.4	4.89	Kargali
4		3	Nil	29.0-30.0- 34.5 33.0	409-10	0.24	F,C	195	6.4	4.89	Kargali
5		3	Nil	30.0-31.0- 33.2 32.0	410-0	0.25	F,R	240	6.7	5.08	Kargali
6		3	Nil	30.0-29.7- 33.0 33.0	410-1-- 410-3	0.31	F,C,R	140	6.8	5.26	Kargali
7		3	Nil	29.7-29.0- 33.5 33.0	410-0-- 410-1	0.50	F,C,R	330	6.4	4.89	Kargali
8		3	Nil	28.5-28.5- 31.0 30.5	409-8-- 409-10	0.37	F,R	440	6.4	4.89	Kargali

+ Range * Data from Sindri Pump House

@ Morning observations only

E Afternoon observations only

C Cloudy

R Rainy

As mentioned elsewhere, the occurrence of floods did not appear to have much significance in this reservoir also. In fact, water level and current depended on the control exercised at the Dam also. The data on the organisms other than carp spawn collected in the sampling nets are given in Appendix Table VI. Frog eggs and tadpoles used to appear in large numbers after heavy rains in the locality. The common small fishes observed were Oxygaster bacaila, Puntius sophore, Osteobrama cotio, Ambassis nama and Glossogobius giuris. Insect larvae and prawn larvae were also encountered on several days.

No evidence of major carp spawning was observed in the Utlā nullah.

REMARKS

The observations described above clearly indicate that the major carps do spawn at the head-water region of the Tilaiya reservoir. The actual spawning ground has also been located. From the nature of the catches obtained during the period, it is possible to infer that the eggs collected should have belonged mostly to the major carps Cirrhina mrigala and Catla catla. The proximity of the spawning grounds to the centres of collection made it possible for only the eggs to be obtained and spawn collection nets could not be operated anywhere below Puhara due to lack of sufficient water current.

The first flood in the Barakar river occurred by about the 29th/30th June 1964 and the major carps started migrating up from the reservoir proper from then on, as could be deduced from the fish catches brought to the local D.V.C. Fisheries Office. The maximum spawning activity of major carps was observed during the second flood in the river, (11th to 13th July 1964). During the third flood, which occurred between 18th and 19th July 1964 similar breeding was observed, though the number of brood fish assembled was less than during the second flood.

As is generally the case in other major rivers of the region, the floods resulted in increased turbidity at the site of the present investigations also. During the second flood, when spawning of major carps was observed, the turbidity became very high, varying between 500 to 900 ppm. Similarly, during the period of next spawning on 18th/19th July also, the turbidity increased to 650 ppm. The dissolved oxygen content went up to about 8.3 ppm during these floods when spawning occurred. The pH was generally between 6.7 and 7.0 at these periods. These changes in physico-chemical factors were evidently incidental to the freshets (Hora, 1945). The high dissolved oxygen content may not be very essential for the breeding to take place, since these carps have been observed to breed at much lower concentrations of dissolved oxygen (Dubey and Tuli, 1961; Alikunhi *et al.*, 1964). The changes in pH also do not appear to be significant with respect to the spawning activities. The location of the spawning ground at the confluence of the tributaries add further evidence to the importance of the effect of freshets on the spawning activity of the major carps. The availability of spawning

ground has sometimes been thought to be an important factor in inducing natural spawning of carps (Ganapati and Alikunhi, 1950; Ganapati *et al.*, 1951) but this factor was evidently not of much significance in the present instance. The substratum at the spawning ground was sandy and this is specially interesting as most of the earlier records state that grassy beds are pre-requisites for major carp spawning (David, 1959).

Since Puhara is almost at the head-end of the Tilaiya reservoir and there is practically very little current in the lower regions, it is presumed that under normal conditions, the fish eggs are likely to sink in the main reservoir and perish. The tow-net and drag-net collections did not show any carp spawn or fry, which also indicates the doubtful survival of the eggs or even hatchlings.

The fact that only a small quantity of carp spawn could be collected from Panchet reservoir was mainly due to the almost complete removal of the breeders, both legally and illegally, at the time they migrated in groups along the narrow and shallow portion of the Damodar, near Ichhar. Although there are some possible spawning grounds at the head-waters of the reservoir, the breeders got destroyed before they reached this location. The spawn observed was evidently from the spawning of a few fishes at grounds, few kilometres up the river, nearabout Hazaribagh forests. Some of the breeders must have naturally escaped the poachers.

Although there might have been differential mortality amongst the larvae reared in earthen 'gamlas' it is observed that the percentage of major carps in the collections was very high. The analysis of fish catches made at the time when they migrate up also indicated the high percentage of major carps.

The appearance of the spawn, though in small quantities, coincided with the second flood in the Damodar and similar to the conditions found in Tilaiya reservoir, the maximum turbidity values ranging from 500 to 1200 were recorded during this period. The pH was almost always less than 7.0 with a low value of 6.4 when spawn appeared. The oxygen content was lower than in Tilaiya.

The possibility of collecting large quantities of fertilized major carp eggs in the Tilaiya reservoir opens the way for a new venture with very good potentialities and this appears to be worth exploitation by the authorities. The proximity of the spawning grounds to the collection centre make it possible for only fertilized eggs and not spawn to be collected, but since the Damodar Valley Corporation maintains a good fish farm in the neighbouring Bachai village, it will be well worthwhile to operate the maximum possible number of spawn collection nets, say about twenty, during the first half of the monsoon season. Since it may be possible to watch for the actual spawning time of the fish, the operation of all the nets will naturally be necessary on few days only during the above period. One or two experimental nets may have to be operated for daily observations. It may be possible to fix hatching hapas at Puhara itself, in the shallow and grassy submerged areas with constant flow of freshets. The possibility of making hatching pits at Puhara camp is also worth consideration. Even on a moderate estimate 50% hatching and survival up to spawn stage can be expected here as found in some bundhs (Alikunhi *et al.*, 1964).

A large number of major carp breeders are being caught by local fishermen at the spawning grounds. Necessary conservation measures are to be adopted to see that the breeders are not destroyed at least during the short period during which the spawning activities are observed.

Since the Panchet reservoir has mostly been naturally stocked and the present observations have indicated that major carp spawn do come into the main reservoir, though only in small quantities, drastic measures may have to be taken to protect at least part of the major carp breeders which migrate upstream during the earlier part of the monsoon season every year. Unless this is done, it is feared that the fishery potential of the reservoir is likely to be affected seriously during the years to come. Strict conservation measures are necessary at the Ichhar region during this period. It is true that licensed fishermen can expect maximum catches of the year during this season only, but at least a portion of the brood fish should be spared every year in the interest of fishery of the reservoir.

SUMMARY

Investigations conducted during the monsoon season of 1964 revealed that the major carps, mostly Cirrhina mrigala and Catla catla were found to breed near Purhara at the head-end of the reservoir. The actual spawning activities of the fishes could be watched and about 104 lakhs eggs were collected during three days in four experimental spawn-collection nets. The rates of fertilisation of the eggs were about 90 to 98%. Data obtained on the physicochemical factors during the entire period of study are given. The floods in the river appeared to be the chief factor associated with the spawning of the carps. The substratum of the spawning ground was sandy, unlike grassy habitats mentioned in previous reports on the subject.

Simultaneous observations made in Panchet reservoir indicated that only small quantities of carp spawn appeared to come into the lake, evidently due to the large-scale destruction of the brood fish by poachers. Samples of the spawn collected were reared in earthen gamlas and after a month the species composition was found to be: Cirrhina mrigala, 83.2%, Labeo bata, 10.1%, Labeo rohita, 4.7% and Cirrhina reba, 2.7%. Data on physico-chemical factors were collected during the entire period of study. Onset of floods in the Damodar river and conservation of breeders in the reservoir appeared to be most important factors associated with the spawn potential of the reservoir.

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Appendix Table I

Reservoir level and rainfall at Tilaiya Dam
Data obtained from D.V.C.

<u>Date</u>	<u>Level (in feet)</u>	<u>Rainfall (in mm)</u>
June '64		
28	1192.90	54.6
29	1193.50	14.6
30	1194.30	N i l
July '64		
1	1195.40	N i l
2	1195.60	N i l
3	1195.60	3.5
4	1195.60	3.2
5	1195.60	N i l
6	1195.70	13.1
7	1195.70	6.9
8	1195.70	32.7
9	1196.00	38.2
10	1196.50	13.5
11	1197.80	0.2
12	1199.60	8.6
13	1200.00	3.2
14	1200.40	15.6
15	1200.70	8.5
16	1201.20	7.9
17	1201.80	5.0
18	1202.00	7.2
19	1203.40	N i l
20	1203.60	2.4
21	1203.60	35.2
22	1203.35	1.3
23	1203.30	N i l
24	1203.90	N i l
25	1203.70	N i l
26	1203.55	5.5
27	1203.40	0.52
28	1203.40	0.5
29	1203.40	N i l
30	1203.60	N i l
31	1203.60	N i l
August '64		
1	1203.40	N i l
2	1203.20	-
3	1203.00	-

Observations on fishes caught from Tilaiya Reservoir (at Purhara)

Date	Species	Number	Approx. av. wt.	Remarks
1	2	3	4	5
1. 7.1964	<u>Catla batla</u>	120	5.25	Most fully mature
	<u>Labeo rohita</u>	23	2.25	"
	<u>Cirrhina mrigala</u>	31	0.7	Some males oozing
2. 7.1964	<u>Catla catla</u>	15	6.5	
	<u>Labeo rohita</u>	39	2.5	Some males oozing
	<u>Cirrhina mrigala</u>	347	0.9	
	<u>Labeo calbasu</u>	19	0.7	
3. 7.1964	<u>Catla catla</u>	39	5.25	Some males oozing
	<u>Labeo rohita</u>	57	2.5	"
	<u>Cirrhina mrigala</u>	378	0.8	"
	<u>Labeo calbasu</u>	22	0.6	"
	<u>Labeo bata</u>	43	0.3	
	<u>Wallago attu</u>	12	1.53	
4. 7.1964	<u>Catla catla</u>	25	5.5	
	<u>Labeo rohita</u>	30	2.25	Some males oozing
	<u>Cirrhina mrigala</u>	110	0.6	
	<u>Labeo calbasu</u>	7	0.4	
6. 7.1964	<u>Catla catla</u>	179	5.4	Fully mature
	<u>Labeo rohita</u>	68	2.0	
	<u>Cirrhina mrigala</u>	283	1.13	Fully mature
	<u>Labeo calbasu</u>	6	0.33	
	<u>Labeo bata</u>	12	0.4	
	<u>Wallago attu</u>	4	3.05	
7. 7.1964	<u>Catla catla</u>	127	5.52	
	<u>Labeo rohita</u>	46	2.46	
	<u>Cirrhina mrigala</u>	283	1.05	
	<u>Labeo calbasu</u>	4	-	
	<u>Labeo bata</u>	24	1.25	
	<u>Wallago attu</u>	6	2.66	

Appendix Table II (contd.)

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1	2	3	4	5
8. 7.1964	<u>Catla catla</u>	39	5.25	
	<u>Labeo rohita</u>	43	2.1	
	<u>Cirrhina mrigala</u>	551	1.0	
	<u>Labeo calbasu</u>	20	0.62	
11.7.1964	<u>Catla catla</u>	47	6.3	Oozing
	<u>Labeo rohita</u>	8	2.5	"
	<u>Cirrhina mrigala</u>	5	1.3	"
	<u>Labeo calbasu</u>	6	0.8	
12.7.1964	<u>Catla catla</u>	62	5.5	Some oozing and
	<u>Labeo rohita</u>	31	2.0	others spent
	<u>Cirrhina mrigala</u>	164	0.73	"
13.7.1964	<u>Catla catla</u>	66	5.75	Oozing and spent
	<u>Labeo rohita</u>	8	2.5	"
	<u>Cirrhina mrigala</u>	295	0.8	"
	<u>Labeo calbasu</u>	11	0.7	"
14.7.1964	<u>Catla catla</u>	203	5.0	Fully mature and/a
	<u>Labeo rohita</u>	87	2.4	few spent.
	<u>Cirrhina mrigala</u>	290	1.0	"
	<u>Labeo calbasu</u>	27	0.6	"
15.7.1964	<u>Catla catla</u>	58	5.0	Mostly oozing
	<u>Labeo rohita</u>	70	2.2	"
	<u>Cirrhina mrigala</u>	537	0.7	"
	<u>Labeo calbasu</u>	16	0.5	"
19.7.1964	<u>Catla catla</u>	10	4.96	Mostly spent
	<u>Labeo rohita</u>	2	2.25	"
	<u>Cirrhina mrigala</u>	8	1.25	"
20.7.1964	<u>Catla catla</u>	5	4.2	Mostly spent
	<u>Labeo rohita</u>	7	0.7	"
	<u>Cirrhina mrigala</u>	6	0.6	"

Appendix Table II (contd.)

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1	2	3	4	5
22.7.1964	<u>Catla catla</u>	13	5.0	
	<u>Labeo rohita</u>	21	2.0	
	<u>Cirrhina mrigala</u>	197	0.7	
	<u>Labeo calbasu</u>	40	0.5	
	<u>Labeo bata</u>	71	0.5	
	<u>Wallago attu</u>	8	4.9	
23.7.1964	<u>Labeo rohita</u>	6	0.9	
	<u>Cirrhina mrigala</u>	8	0.6	
	<u>Labeo calbasu</u>	1	0.3	
25.7.1964	<u>Catla catla</u>	4	4.5	
	<u>Labeo rohita</u>	21	1.2	
	<u>Cirrhina mrigala</u>	23	0.7	
	<u>Labeo calbasu</u>	1	0.6	

Appendix Table IV

Observations on fishes caught from Panchet Reservoir

Date	Species	Number seen	Weight (kg)		Remarks
			Range	Average	
23.6.64	<u>Catla catla</u>	10	6.9-13.4	9.43	Most fully mature
	<u>Cirrhina mrigala</u>	3	2.0-6.2	3.4	All females, oozing.
	<u>Labeo calbasu</u>	9	0.9-2.3	1.28	
	<u>Labeo bata</u>	1	1.2		
24.6.64	<u>Catla catla</u>	4	9.1-17.3	12.25	All fully mature
	<u>Cirrhina mrigala</u>	5	2.3-4.6	2.88	Females spent, Males oozing
	<u>Puntius sarana</u>	2	0.6-0.9	0.75	
	<u>Mystus seenghala</u>	7	1.5-4.7	3.6	

Appendix Table V

Species composition of fry, as on 31.7.64, reared from samples of spawn collected at Kargali on 30.6.64.

<u>Species</u>	<u>Length range</u>	<u>Number</u>	<u>Percentage</u>
<u>Cirrhina mrigala</u>	15 - 25 mm	124	83.2
<u>Labeo bata</u>	14 - 21 mm	15	10.1
<u>Labeo rohita</u>	16 - 23 mm	6	4.0
<u>Cirrhina reba</u>	15 - 17 mm	4	2.7

Appendix

Associates collected at the

June 1954

30 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

Species

<u>Oxygaster bacaila</u>	1	2	1	1					4			1	2	1	1	2	2
<u>Esomus danrica</u>															1		1
<u>Amblypharyngodon mola</u>									8	3							1
<u>Puntius sarana</u>		3								268							1
<u>Puntius sophore</u>		3		1			3		6			17	42	5	13	2	1
<u>Osteobrama cotio</u>									22		2					9	1
<u>Ambassis nama</u>	4	11	4	2			6	2	7		3	3	4	1	2	3	4
<u>Glossogobius giuris</u>	13					2	1	1	11	10	3	4	19	1	1	4	2
<u>Mystus aor</u>	1					2						2					
<u>Ompok bimaculatus</u>							8										
<u>Notopterus chitala</u>	2	2								260	4			1	1		
<u>Mastacembelus pancalus</u>							14	11	1	6			5	1			1
<u>Colisa fasciatus</u>	2												2				
Insect larvae	16	9					2	18	14	3	3	12	2	2	171	207	1
Insects															12		5
Frog eggs	35	Many										971	122	112		4	
Tadpoles	212	Many	7				84	27	53	80	29	80	73	34	64	128	79
Prawns																	
Prawn larvae			1				1								3		1
				8			113	63	52	1	14	7	2	1			1

