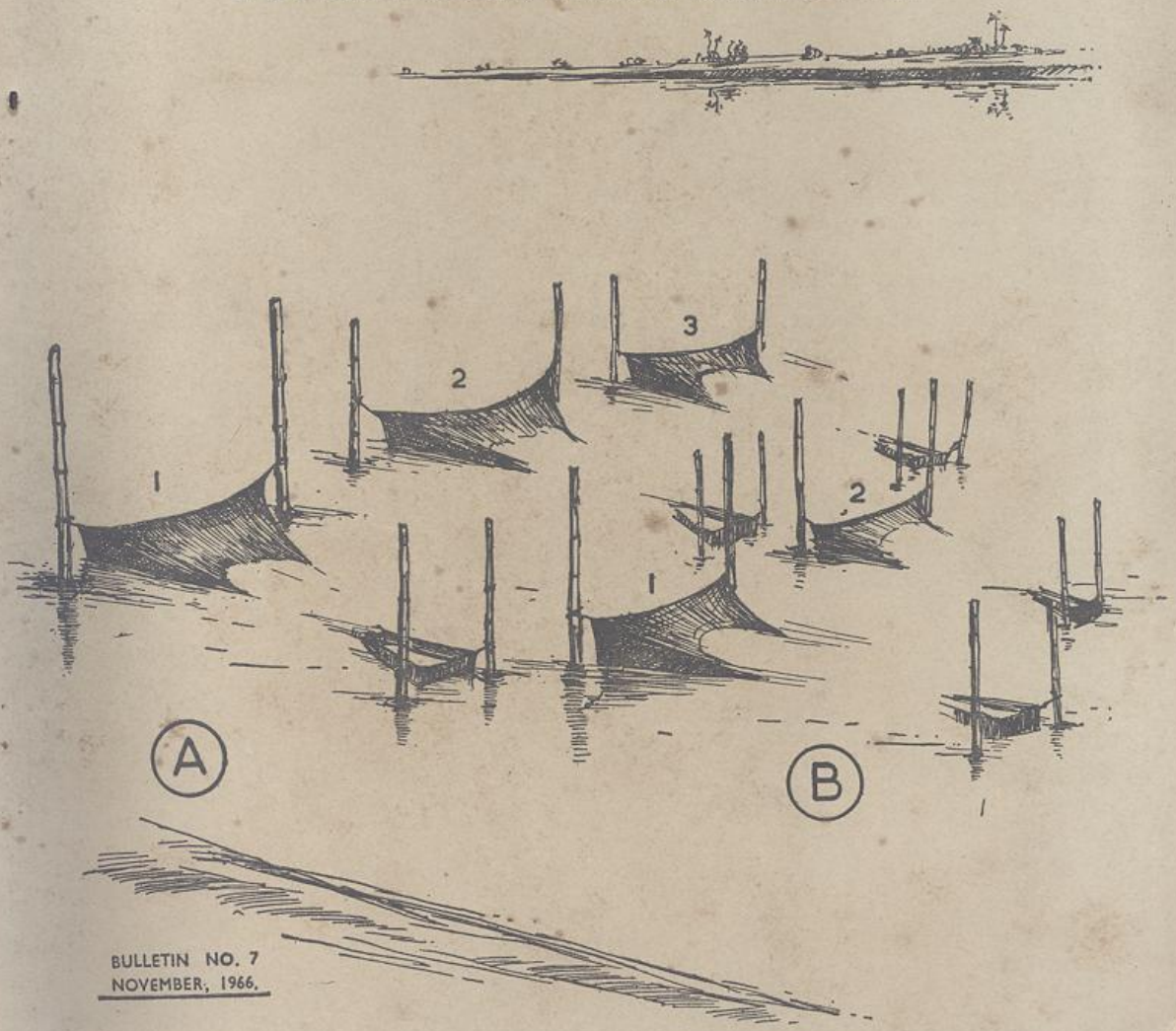
REPORT ON FISH SPAWN PROSPECTING INVESTIGATIONS, 1965

2, UTTAR PRADESH, BIHAR & MAHARASHTRA



BULLETIN NO. 7
NOVEMBER, 1966.

GOVERNMENT OF INDIA
CENTRAL INLAND FISHERIES RESEARCH INSTITUTE
BARRACKPORE, WEST BENGAL,
INDIA

REPORT ON FISH SPAWN PROSPECTING INVESTIGATIONS, 1965
2, UTTAR PRADESH, BIHAR & MAHARASHTRA

By

J.C. Malhotra, K.K. Ghosh
and other staff of the Riverine Division

Bulletin No.7
November, 1966

GOVERNMENT OF INDIA
CENTRAL INLAND FISHERIES RESEARCH INSTITUTE,
BARRACKPORE, WEST BENGAL,
I N D I A

Foreword

This report embodies the results of spawn prospecting investigations conducted by the Allahabad Substation of the Central Inland Fisheries Research Institute, Barrackpore (West Bengal), during the South-West monsoon months June-September, 1965.

These seasonal investigations were planned by Dr.V.G. Jhingran, the then Officer in-charge, Allahabad Substation, but due to his deputation on a group-fellowship study tour to the U.S.S.R. in the month of July 1965, the supervisory control for their execution was exercised by Shri J.C. Malhotra, Research Officer, who was also the Camp in-charge of one of the centres covered in these investigations. The names of the staff who worked in the field and carried out analyses of the collected data and material are as shown below :

1. Shri J.C. Malhotra, Research Officer (Camp in-charge, Dhumanpura)
2. Shri S.J. Karamchandani, Research Officer (Camp in-charge, Paithan/Shahgarh)
3. Shri K.K. Ghosh, Assistant Research Officer (Camp in-charge, Anwara)
4. Shri H.A. Khan, Assistant Research Officer (Camp in-charge, Babuaghat)
5. Shri A.G. Jhingran, Assistant Research Officer (Camp in-charge, Bansi)
6. Shri D.V. Pahwa, Senior Research Assistant
7. Shri S.P. Singh, Senior Survey Assistant (Camp in-charge, Dangwar)
8. Shri C.B. Srivastava, Senior Survey Assistant
9. Shri K.P. Srivastava, Senior Survey Assistant (Camp in-charge, Dhundhua)
10. Shri S.K. Wishard, Survey Assistant
11. Shri M.D. Pisolkar, Survey Assistant
12. Shri V.R. Desai, Research Assistant (Camp in-charge, Nanded)
13. Shri M.R. Sinha, Research Assistant
14. Shri A.G. Godbole, Research Assistant
15. Shri J.K. Verma, Research Assistant
16. Shri S.D. Gupta, Research Assistant
17. Shri N.K. Srivastava, Junior Survey Assistant
18. Shri A.K. Chatterjee, Junior Survey Assistant

19. Shri B. Ghosh, Junior Survey Assistant
20. Shri R.K. Dwivedi, Junior Survey Assistant
21. Shri K.K. Agrawal, Laboratory and Field Assistant

In addition twelve members of the subordinate service of the Allahabad Substation assisted in these investigations.

Staff of the Department of Fisheries, Bihar, who participated in the field investigations were :

1. Shri P.M. Sinha, Fisheries Inspector
2. Shri S. Singh, Fisheries Inspector
3. Shri R.N. Upadhyay, Assistant Fisheries Inspector
4. Shri N.K. Singh, Assistant Fisheries Inspector
5. Shri R.P. Yadav, Fisheries Surveyor
6. Shri A.B. Singh, Fisheries Development Supervisor

In addition, nine fishermen of the Department and sixteen contingent labourers drawn from the villages close to the sites helped in the work, while being trained in the spawn collection techniques.

The staff members of the Department of Fisheries, Uttar Pradesh, who participated in the field investigations were :

1. Shri V.S. Gaur, Fisheries Development Worker
2. Shri H.C. Sharma, Fisheries Development Worker
3. Shri S.S. Dwivedi, Fisheries Development Worker
4. Shri M.S. Siddique, Fisheries Development Worker

Besides the above, two fishermen of the department and nine contingent labourers drawn from the villages in the close vicinity of the sites, helped in the work while being trained in all aspects of spawn collection.

Staff of the Fisheries Department of Maharashtra who participated in the field investigations were :

1. Shri R.P. Ramdasi, Fishery Assistant
2. Shri H.G. Sorte, Pisciculturist

In addition, two fieldmen of the State Fisheries Department of Maharashtra assisted in these investigations.

Shri R.K. Saxena, Survey Assistant, analysed the entire materi of Spawn and Associates in the laboratory collected at the Bansi Centr He also made the originals of all the drawings incorporated in this report.

Shri D.V. Pahwa, who was posted at Dhumanpura Centre, attended to the duties of Shri J.C. Malhotra, Camp in-charge of the Centre dur- ing the periods the latter was away on other duty at Allahabad.

Names of the ten spawn collectors from Midnapore District of West Bengal, specially recruited to assist in these investigations wer

1. Shri Gaur Hari Bhanja, Vill.Rajnagar, P.O.Putputia, Dist.Midnapore.
2. Shri Prodyat Kumar Bhanja, - do -
3. Shri Banshi Bhanja, - do -
4. Shri Jagan Nath Burman, - do -
5. Shri Rampada Mantri, - do -
6. Shri Durjodhan Bhanja, - do -
7. Shri Sudhansu Sekar Burman, - do -
8. Shri Narayan Burman, - do -
9. Shri Kumud Bandhab Burman, Vill.Rajnagar Chak, P.O.Dobondi, Dist.Midnapore.
10. Shri Sudhansu Kumar Burman, - do -

These spawn prospecting investigations were carried out with the whole-hearted co-operation of the Fisheries Departments of the States of Uttar Pradesh, Bihar and Maharashtra. It is a privilege to place on record the kind help of the Directors of these departments who not only readily placed their staff and field and some laboratory equipment at the disposal of the Camps in-charge but also bore the contingent expenditure involved in running the camps.

Shri G.N. Mitra, Fisheries Development Adviser to the Governmen of India, who had kindly given a pioneering lead towards the initiation of similar investigations on a large scale in 1964 continued to encoura the conduct of these investigations as well. It is a privilege to recor the inspiration he gave to the entire staff who worked in mud and slush under trying monsoon conditions in isolated riverine terrains of the country.

November, 1966.
Central Inland Fisheries
Research Institute,
BARRACKPORE.

V.G. JHINGRAN
DIRECTOR

C O N T E N T S

DKB

1 INTRODUCTION

The present food scarcity in India has made it imperative to intensively and extensively tap all avenues of food production. India has vast potentiality of increasing its fish production. At present only about ten lakh acres of water area is under pisciculture in the country. Six lakh acres of hitherto unutilised water area is readily available for the purpose, and an additional twelve lakh acres need reclamation for pisciculture. Rivers contribute the main natural sources of fish seed, commonly called spawn, a prerequisite for pisciculture. The spawn is collected in the monsoon season from many rivers and streams of India. The discovery and location of new riverine sources of spawn by systematically prospecting stretches of rivers is essential to meet the heavy need of spawn in bringing more waters under pisciculture. An organised effort at systematically surveying the spawn resources of the country was made in 1964 when the Allahabad Substation of the Central Inland Fisheries Research Institute prospected for new sources of spawn in the States of Uttar Pradesh and Gujarat.* While commercially exploited fish seed resources, whether by the States or private entrepreneurs, are generally known, little information exists on their respective productive potential. For a scientific appraisal and economically desirable exploitation of resources, it is necessary to grade all spawn resources of the country according to a uniform basis. The first effort in evolving a measure for grading different spawn resources according to their potentiality was made in 1964 (C.I.F.R.I. 1965). The investigations initiated in 1964, to locate new sources of fish spawn, standardise techniques of collection and measurement and determine causative factors of the availability of quality spawn were continued in 1965. This report embodies the findings of the further work done in this direction in 1965.

The investigations were undertaken by the Riverine Substation of the Central Inland Fisheries Research Institute in collaboration with the State Governments of Uttar Pradesh, Bihar and Maharashtra. Five centres on different rivers were sponsored by the State Governments concerned, two in Bihar, one in Uttar Pradesh and two in Maharashtra. Three centres were sponsored by the Union Government, two in Uttar Pradesh and one in Bihar. While the technical know-how at all the centres was furnished by the Central Government, the entire contingent expenditure at the State sponsored centres and a major share those of at the centrally sponsored centres was borne by the State concerned.

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* The findings of this investigation are published by the Central Inland Fisheries Research Institute, Barrackpore, in Bulletin No.4 (1965) entitled "Report on the fish spawn prospecting investigations, 1964 1. Gujarat & Uttar Pradesh". Hereinafter this bulletin is referred to as "C.I.F.R.I., 1965" in this report.

The smooth and orderly work against many odds that are beset in such prospecting investigations could only be done by the active and praiseworthy cooperation of the fisheries department of the States of Uttar Pradesh, Bihar and Maharashtra.

2 AIMS AND OBJECTS

(i) To prospect for new riverine quality spawn resources to suit the needs of the States of the country.

(ii) To determine the effect of hydrographical and environmental factors on availability of quality fish spawn at a site.

(iii) To develop measures for grading different sources of spawn.

(iv) To train local fishermen and State Government personnel in riverine spawn collection techniques.

3 GEOGRAPHICAL COVERAGE

Based on their respective needs and requirements the Government of

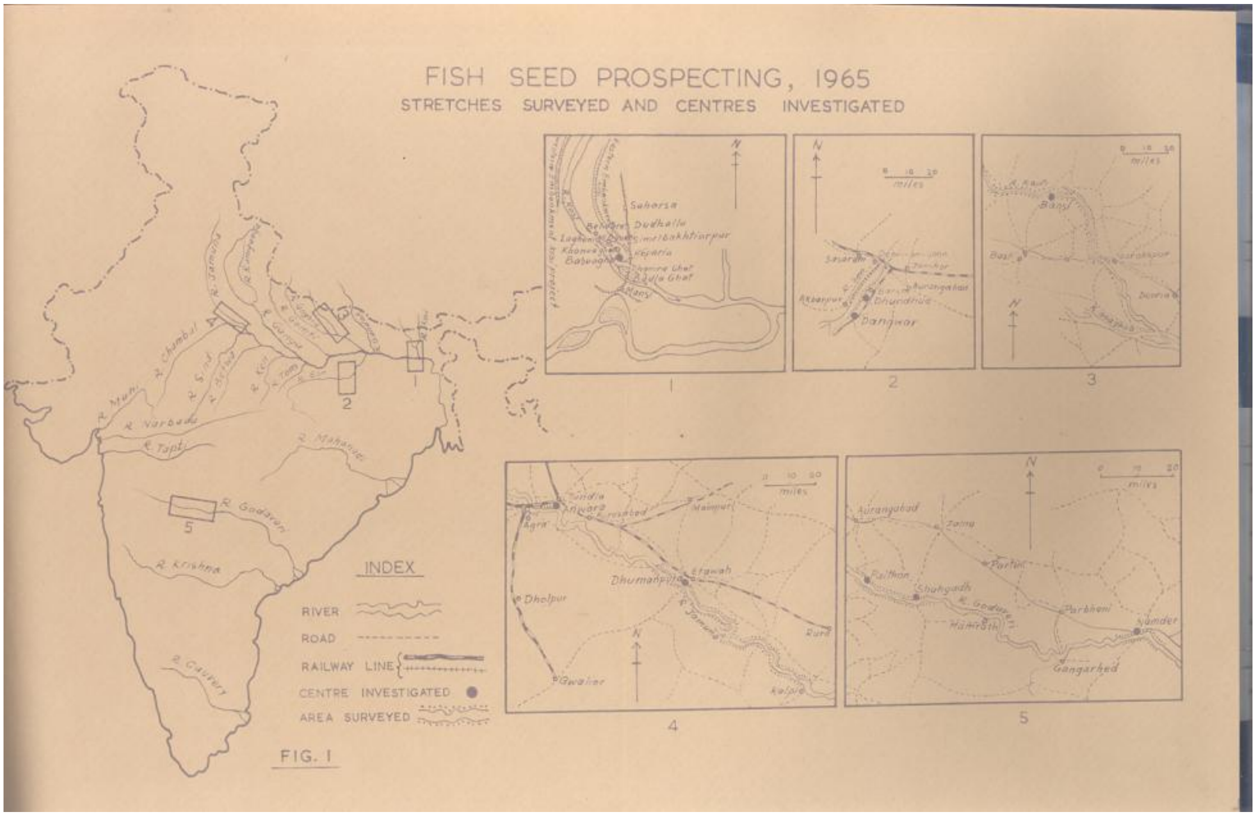
i) Uttar Pradesh suggested a stretch of the river Rapti

ii) Bihar, a stretch of the river Khanua Kosi Dhar and a stretch of the river Son, and

iii) Maharashtra, two sites on the river Godavari

for location of new fish spawn resources (Fig.1).

All these stretches were prospected in 1965. In addition to these, two stretches of the river Yamuna were also included for prospecting in 1965, being an extension of the systematic survey of the river Yamuna initiated in 1964 (C.I.F.R.I., 1965, p.2). The stretch between Etawah and Firozabad was excluded being extremely ravined. The southern bank between Bateshwar and Agra was also excluded on similar consideration. However, during the actual survey a few accessible suitable grounds were examined in the excluded stretches (Fig.1).



FISH SEED PROSPECTING, 1965

STRETCHES SURVEYED AND CENTRES INVESTIGATED

FIG. I

4 PRE-MONSOON SURVEY

A pre-monsoon survey of the stretches for choosing suitable sites was undertaken in the months of April and May, 1965. All accessible riverside spots were examined. However, collection of detailed data and information was limited to only such sites which appeared accessible during monsoon months. For this purpose, motorable accessibility upto 5 km from the site and thereafter good pedestrain accessibility upto site was considered sufficient.

Information on the following more important technical aspects among others was collected on a specially designed proforma (Appendix-1), and based thereon, the suitability of each site was determined.

(i) The topography of the terrain around the site (5 km up and down stream) to determine the extent of operational area expected in different floods.

(ii) The topography of the dry beds and bank features, up and down the stream, to gauge the likely current pattern of the flooded river.

(iii) The distribution and composition of the fish fauna in the stretch of the river, resident or immigrant, to determine the abundance of major carps during the monsoon season.

(iv) The location of tributaries, rivulets and nullahs, along with their confluences with the river under investigation, which might contribute important connecting links between the river and the breeding grounds.

Information of non-technical nature but of considerable importance for establishing identity and determining communication facilities of the site was also collected.

Details of stretches and sites surveyed during the pre-monsoon survey along with those investigated for spawn in 1965 are summarised in Table 4.1 . Identity and approach details of the main sites selected in different stretches for investigation are given in Table 4.2 .

Table 4.1 STRETCHES AND SITES SURVEYED IN THE PREMONSOON SURVEY AND SELECTED FOR PROSPECTING INVESTIGATIONS.

River	SURVEYED STRETCH From	SURVEYED STRETCH To	Length in km	Bank	Name	Suitability S/US*	Justification for acceptance/ rejection	SELECTED FOR PROSPECTING STRETCH From	SELECTED FOR PROSPECTING STRETCH To	Distance in km	Main site for investigation
1	2	3	4	5	6	7	8	9	10	11	12
Yamuna	Shankarpur (Firozabad)	Tajganj (Agra)	135	North	1.Shankarpur	US	Precipitous bank accessibility poor	Chandawar	Kailash	76	Anwara
				-do-	2.Chandawar	US	Poor accessibility				
				-do-	3.Anwara	S	Good collection site Good accessibility				
				South west	4.Kailash	US	Precipitous bank				
				West	5.Tajganj	US	Precipitous bank				
Yamuna	Kalpighat	Karchhaghat (Jaswantnagar)	209	North	1.Qasba Khanpur (Shergarhghat)	US	Precipitous bank	Kandesi	Jaswant-nagar	61	Dhumanpura
				South	2.Kuronista	US	Inaccessible				
				-do-	3.Bijewapur	US	Inaccessible				
				North	4.Dhumanpura	S	Good accessibility Good collection site				
				-do-	5.Manikpur	US	Precipitous bank				
				-do-	6.Jaswantnagar	S	Accessibility poor Good collection site				
Rapti	Gorakhpur	Damariaganj	115	North	1.Bale ka Maidan	US	No suitable operational area	Gorakhpur	Domaria-ganj	115	Bansi
				-do-	2.Sahajanwan	US	No suitable operational area				
				-do-	3.Gauri Thana	S	Good collection site but accessibility doubtful				

* S - for suitable
US - for unsuitable

1	2	3	4	5	6	7	8	9	10	11	12
Rapti	Gorakhpur	Domariaganj	115	North	4.Dhanibazar (Mehendawal)	US	Accessibility poor operation site on opposite bank only				
				-do-	5.Narkataha (Bansi)	S	Good collection site accessibility				
				-do-	6.Domariaganj	S	Good collection site accessibility good				
Son	Dehri-on-Son	Narainpur	60	West	1.Dehri-on-Sone	US	Precipitous bank	-	-	-	-
				-do-	2.Indrapuri	US	-do-				
				-do-	3.Tilothu	US	-do-				
				-do-	4.Saraiya	US	-do-				
				-do-	5.Tumba	US	-do-				
				-do-	6.Nishanpur	US	-do-				
				-do-	7.Rasulpur	US	-do-				
				-do-	8.Akbarpur	US	-do-				
				-do-	9.Nawadih	US	-do-				
				-do-	10.Daranagar	US	-do-				
				-do-	11.Bandu	US	Possible site available accessibility poor				
				East	1.Barun		Exploited by Bihar Govt. Fisheries Department	Koiridih	Majhiaon	35	Dhundhua
				-do-	2.Mahuawan	US	Preciptous bank				
				-do-	3.Barem	S	Accessibility poor suitable				
				-do-	4.Dhundhua	S	Suitable site accessibility good				
				-do-	5.Jhikatia	US	Highly precipitous bank				

1	2	3	4	5	6	7	8	9	10	11	12
Son (Contd)	Dehri-on-Sone	Narainpur	30	East	6.Tetaria	US	Precipitous bank	-	-	-	-
				-do-	7.Naur	US	Precipitous bank				
				-do-	8.Baghadabar	US	Current pattern unsuitable				
				-do-	9.Koiridih	US	Precipitous bank				
				-do-	10.Dangwar	S	Suitable, accessibility good	Narainpur	Dangwar	25	Dangwar
				-do-	11.Deori	US	Precipitous bank				
Khanua Kosi Dhar	Simri Bakhtiyarpur	Dhamra ghat	20	East	1.Babuaghat	S	Good collection site accessibility good	Simri Bakhtiyarpur	Dhamra ghat	20	Babuaghat (Simri Bakhtiyarpur)
				-do-	2.Koparia	US	Good collection site accessibility poor				
				-do-	3.Dhamra ghat	US	No suitable operation area				
Godavari	-	-	-	North	1.Paithan	S	Suggested by the Government of Maharashtra	-	-	-	Paithan/ Shahgarh
				-do-	2.Shahgarh	S	Good collection site accessibility good				
				-do-	3.Nanded	S	Suggested by the Government of Maharashtra	-	-	-	Nanded

S = Suitable ; US = Unsuitable

Table 4.2 THE ROAD AND APPROACH DETAILS OF THE MAIN SITES SELECTED FOR INVESTIGATIONS ALONG WITH THE AREA AVAILABLE AT EACH SITE FOR NET OPERATION

	Yamuna		Ganga	Kharua Kosi-Dhar	Sone		Godavari	
Stretch (from - to)	Chandawar to Kailash	Kandesi to Batesar	Mehndawal to Domariaganj	Simri Bakhtiyarpur to Dhamraghat	Dehri-on Sone to Narainpur	-	-	
Selected site	Anwara	Dhumanpura	Bansi	Babuaghat	Dangwar	Dhundhua	Paithan	Nanded
Bank	North	North	North	East	East	East	North	North
Tehsil/Taluk/Sub-Division	Itmadpur	Etawah	Bansi	Simri Bakhtiyarpur	Daltonganj	Aurangabad	Paithan	Nanded
Police Station	Tundla	Etawah	Bansi	Simri Bakhtiyarpur	Husainabad	Nabinagar	Paithan	Nanded
District/State	Agra U.P.	Etawah U.P.	Basti U.P.	Monghyr Bihar	Palamau Bihar	Gaya Bihar	Aurangabad Maharashtra	Nanded Maharashtra
Block	Tundla	Barhpura	Bansi	Simri Bakhtiyarpur	Husainabad	Nabinagar	Paithan at Aurangabad	Nanded Maharashtra
Distance from Block Head Quarters	14 km	14 km	1 km	12 km	0 km	15 km	1 km	2 km
Nearest Post Office Distance	Tundla 14 km	Etawah 10 km	Bansi 1 km	Simri Bakhtiyarpur 12 km	Dangwar 0.5 km	Barem 6 km	Paithan 1 km	Nanded 2 km
Telegraph Office	-do-	-do-	-do-	-do-	Japla 9 km	Nabinagar 15 km	Paithan 1 km	-do-
Telephone	-do-	-do-	-do-	-do-	-do-	-do-	Aurangabad	-do-

	Yamuna		Ganti	Khanua Kosi-Dhar	Sone			Godavari
Stretch (from - to)	Chandavar to Kailash	Kandesi to Batesar	Belondawal to Ramariaganj	Simri Bakhtyarpur to Dhamraghat	Dehri-on-Sone to Narainpur	-	-	-
Selected site	Anvara	Dhumanpura	Bansi	Babhaghat	Dangvar	Dhandhna	Paithan	Nanded
Nearest all weather road at and Distance	Anwara 1 km	Dhumanpura 1 km	Bansi 1 km	Simri Bakhtiyarpur 12 km	Jamla 9 km	Suriyar 5 km	Paithan 1 km	Nanded 1 km
Nearest Railway Station and Distance	Tundla on N.R. 10 km	Etawah on N.R. 10 km	Pachara on N.E.R. 22 km	-do- on N.E.R. 12 km	-do- on N.R. 9 km	Dehinagar Road on E.R. 13 km	Aurangabad on C.R. 36 km	Nanded on C.R. 2 km
Area available for nets at different flood levels	For 4 m 20 to 25 nets	For 5 m 40 to 50 nets	100 to 150 nets	About 100 nets	About 100 nets	About 150 nets	About 50 nets	About 30 to 40 nets
	For 4 m 50 to 80 nets	For 5 m About 30 nets	Throughout the season	Throughout the season	Throughout the season	Throughout the season	Throughout the season	Throughout the season

5 MATERIAL AND METHODS

5.1 The nets used

The prospecting was done by using standard nets defined in 1964 (C.I.F.R.I., 1965, p.2 & p.175). Apart from this at the centres

(i) situated in Bihar, nets[1] supplied by the State Government were used for determination of their efficiencies;

(ii) situated on Yamuna, specially designed research nets[2] were used to test efficiencies and hydrographical factor effects; and

(iii) situated on Godavari, 1/16" meshed Midnapore type of nets (C.I.F.R.I., 1965, p.3) were used to study effects of turbidity and current velocity on net efficiency.

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1 Bihar State supplied nets made of round meshed mosquito netting with stitched-in tailpieces, without rings, made of muslin, (Commonly called Jaunpur type of net) of different dimension at the three sites investigated in Bihar, typical dimensions being approximately: length 380 cm, width at mouth 260 cm. In addition to these at Babuaghat on Khanua Kosi Dhar, Murshidabad type of net, made of fine netting of about 1/16" mesh with stitched-in wings, that extend into the river when stretched and of dimensions: length of net 375 cm, length of wings 170 cm, height of wings 80 cm, length of net mouth 200 cm, were supplied by the State.

2 Two types of research nets were used :

(i) The first type, called in this report as Research net, was made of 1/8" meshed material of Midnapore type having dimensions: length 170 cm, width at mouth 121 cm, height at mouth 30 cm, ring diam. 18 cm using 7 yards of cloth as against 11 yards used for standard net;

(ii) The second type of net fabricated was the Trouser net. The trouser type of net, with the front half of the net made of 1/16" meshed Midnapore type of material and the two legs made one each of 1/8" meshed and 1/16" meshed Midnapore type of material, was of dimensions: width at mouth 340 cm, height at mouth 35 cm, length of belly 145 cm, length of limbs 180 cm and ring diameter 19 cm. On both the limbs the standard gamcha were used.

5.2 Method of spawn collection

At the selected site, one standard net was operated round the clock as a trial net. This operation commenced on different dates at different sites. However, it was ensured that the observations commenced everywhere before the onset of monsoon. The catch in the gamcha of the trial net was scooped every two hours and spawn catch measured as described in 5.3. When this quantity reached 2 ml it was deemed that bulk spawn availability had commenced and the trial netting operations were replicated at other available spots nearabout. The spot yielding the highest spawn catch in the next two hours was taken as the field of maximum spawn concentration for that period of availability. Three to five standard nets were operated at the spot of maximum concentration throughout the period of bulk availability - called a spawn spurt in this report. In addition to the standard nets three departmental nets were also used at the sites situated in Bihar, one or two Research nets and one trouser type of net were used at the sites on Yamuna and two 1/16" meshed Midnapore type of nets were used at the sites on Godavari, during the period of bulk availability of spawn. With the waning of spawn quantity single trial netting operation round the clock was resorted to till the appearance of the next spurt.

Apart from the observations made at the main selected site in the stretch, a few more sites were prospected periodically by operating a trial net between 6 A.M. to 6 P.M. As far as possible, effort was made to prospect the other sites for spawn during availability of spawn in the stretch.

5.3 Measurement of spawn

The catch lifted every two hours either by a single haul or more, depending on the intensity of collection in gamcha, was sieved through a round meshed mosquito netting on to a piece of muslin cloth. The hatchlings that passed through the mosquito netting sieve and collected on the muslin, were defined as spawn and their quantity as spawn catch of the corresponding two hours. Larger animal aquatic forms, collecting on the sieve were defined as Associates.

The quantity of spawn was measured in cylindrical brass cups having brass netting at the bottom to sieve out water. Cups of measures 200 ml, 100 ml, 50 ml, 30 ml, 20 ml, 10 ml & 5 ml were used (C.I.F.R.I., 1965, p.178). For measuring less than 5 ml of spawn a glass tube with reverse graduation upto 2 ml was used.

5.4 Relative position of nets

To study the effect of net positions on the quantity of spawn catch, the position of each net measured in terms of depth of operation at the distance of the farthest bamboo from the bank at the net mouth was recorded during the periods of availability of spawn. Also recorded was the position of each net relative to others (see Appendix 2).

5.5 Spawn quality analysis

Spawn samples collected

(i) twice a day at 6 A.M. and 6 P.M. from catches of trial net during periods of non-availability of spawn and

(ii) every two hours, round the clock, during spawn spurts were preserved in 4% formalin.

The method of analysis was the same as adopted in 1964 (C.I.F.R.I., 1965, p.7).

5.6 Hydrographical and environmental factors

Flood level

The method of flood level recording was the same as adopted in 1964 (C.I.F.R.I., 1965, p.8).

Current velocity

Current velocity of sub-surface water was determined by freely floating a cork float near the banks over a distance of 50 metres along the current. The cork float device was made of a common spinning needle riveted on a brass bar inserted into the cork. The weight of the device made the cork to sink just as much as to make its upper surface coincide with the water surface with the brass bar sticking out of water. In addition to above, at two centres on Yamuna, flow-meters, graduated with the help of the aforementioned method, were used to measure current velocity.

Turbidity

Turbidity was measured by using a secchi's disc as in 1964 (C.I.F.R.I., 1965, p.10).

Spawn associates

Samples of spawn associates, defined earlier were preserved in 4% formalin every two hours for species-wise analysis.

Temperature and weather

Air and water temperatures, and weather condition were recorded following the method of 1964 (C.I.F.R.I., 1965, p.11).

5.7 Frequency of recording of observations

a) Two-hourly round the clock observations

(i) Netwise spawn quantity
(ii) Netwise associate quantity
(iii) Position of nets
(iv) Flood level
(v) Air and water temperatures
(vi) Weather condition

b) Two hourly observations from 6 A.M. to 6 P.M.

(i) Turbidity
(ii) Current velocity

c) Species composition in reared samples of spawn collected in different hauls.

DEFINITIONS ADOPTED FOR THIS INVESTIGATION

(i) Day : the twenty four hour period commencing from 4 A.M. (excluding 4 A.M.) of a calendar day to 4 A.M. (including 4 A.M.) of the following calendar day

(ii) Date for a day : the calendar date at 6 A.M. of the day

(iii) Surveyed site: a site which was surveyed in the pre-monsoon survey only

(iv) Prospected site : a site where actual observations for spawn availability alone were made in the monsoon season

(v) Investigated site : a site where detailed round the clock observations on spawn and other hydrographical and environmental factors were made in the monsoon season

(vi) A prospected stretch has been named after its main [illegible] investigated site

(vii) Period of spawn availability : the period through which more than 1 ml per net per hour spawn was available

(viii) Period of spawn non-availability : Periods not covered by (vii)

(ix) Spawn burst or spawn spurt : Period of continuous spawn availability

(x) Desirable spawn : the catch of spawn having 10% or more of major carps as revealed by spawn analysis

(xi) Undesirable spawn : all the spawn catches not covered by (x)

(xii) Spawn and spawn associates : while sieving the total catch in a net through a round meshed mosquito netting on to a muslin cloth, the quantity that collected on the muslin has been defined as spawn and the animal aquatic forms left over on the sieve as spawn associates-called in this report as Associates

7 QUANTITY AND QUALITY OF SPAWN IN VARIOUS STRETCHES WITH DETAILED DATA AT THE INVESTIGATION SITE

7.1 Ganga river system

River Yamuna : As mentioned earlier systematic survey of the river Yamuna, initiated in 1964, was extended further during the rainy season of 1965. After a comprehensive pre-monsoon survey (see Chapter 3) two stretches, called here the Anwara and Dhumanpura stretches, were selected for detailed prospecting.

7.1.1 Anwara stretch of Yamuna

This 72 km long prospected stretch of the Yamuna extends from the village Kailash in the west to Chandawar in the east. The investigations lasted from July 1 to September 8, 1965. While detailed, round the clock, observations were recorded at Anwara proper, six more sites, one each at Kailash, Mahal, Sayyed, Surehra, Rudhaon and Chandawar were also prospected (Fig. 2).

At Anwara, trial nets were simultaneously operated at spots A, B, C, D & E (Fig. 3) with the appearance of spawn in each spurt to determine the spot of maximum spawn concentration during respective spurts. The results of these trial net operations are shown in Table 7.1.

Table 7.1 Two hourly spawn yield in different spurts at different spots in the Yamuna at Anwara

Spurt No.	Spot with spawn catch in ml				
	A	B	C	D	E
1	100	20	-	-	5
2	10	100	nil	nil	20
3	5	50	-	-	2
4	nil	14	5	nil	nil
5	10	800	50	5	50
6	nil	20	nil	2	nil

Table 7.2 shows that spawn in the river Yamuna was available at Anwara in six spurts which varied in duration from 26 to 86 hours. While spurts 1, 2, 4 and 6 occurred either during the receding or the

rising phases of the different floods, spurts 3 and 5 fell in the vacillation periods occurring between the floods I-II and II-III respectively. Spawn was available at Anwara during a total period of 280 hours in the entire season of which only 104 hours yielded desirable quality. The catch of desirable spawn by five standard nets was 15,102 ml which formed 40.7% of the total spawn yield in the entire season. Spawn spurt 1, which was devoid of desirable spawn, lasted for 86 hours in the rising phase of flood I. Spawn spurt 2, which occurred in the receding phase of the same flood, lasted 40 hours and accounted for 36.4% of the season's yield of desirable spawn. Spurt 3, which formed 8.1% of the yield of the desirable spawn, lasted for 46 hours in the vacillation period between floods I-II. Spurt 4, which yielded only desirable quality of spawn, was of 26 hours duration in the receding phase of flood II and accounted for 5.3% of the season's total desirable spawn catch. Spurt 5, which lasted for 56 hours in the vacillation period between floods II-III, yielded only undesirable spawn. The last spurt 6 of 26 hours duration in the rising phase of flood III contributed 0.2% to the total catch of desirable spawn.

The important spurts, from the point of view of desirable spawn were spurts 2, 3 and 4 which cumulatively accounted for 99.8% of the total desirable spawn catch at Anwara. The catch in these spurts, in its entirety, was made in 100 hours. The durations in which maximum desirable spawn were harvested in the above stated three spurts lasted for 14, 20 and 12 hours respectively (catch/net hour was 173, 8.5 and 12.2 ml respectively). The contributions of these bulk spells were 92.8, 69.3 and 90.3 percent to the catch of the respective spurts. The collections in these spells made up 90.6% of the seasonal catch of desirable spawn. The period of maximum availability of spawn in spurts 2, 3 and 4 commenced 14, 36 and 18 hours respectively after the first appearance of spawn in the different spurts.

Analyses of spawn samples (Table 7.2) showed that the percentages of major carps amongst the desirable spawn in spurts 2, 3, 4 and 6 were 24.8, 47.0, 75.1 and 80.0 respectively. Spawn samples of spurts 2 and 4 were reared in nurseries to determine spurt-wise major carp content in the species composition. Percentage of major carps in these two spurts were estimated to be 37 and 75 respectively. These percentages are based on two rearings of the spawn of spurt 2 and one rearing of spurt 4. In both the cases C.mrigala was the most dominant species followed by L.rohita (see Table 7.2).

Amongst the six other sites prospected in the 72 km long Anwara stretch of the Yamuna, the sites at Kailash, Surehra and Rudhaon were found unsuitable for shooting net operation because of steep banks.

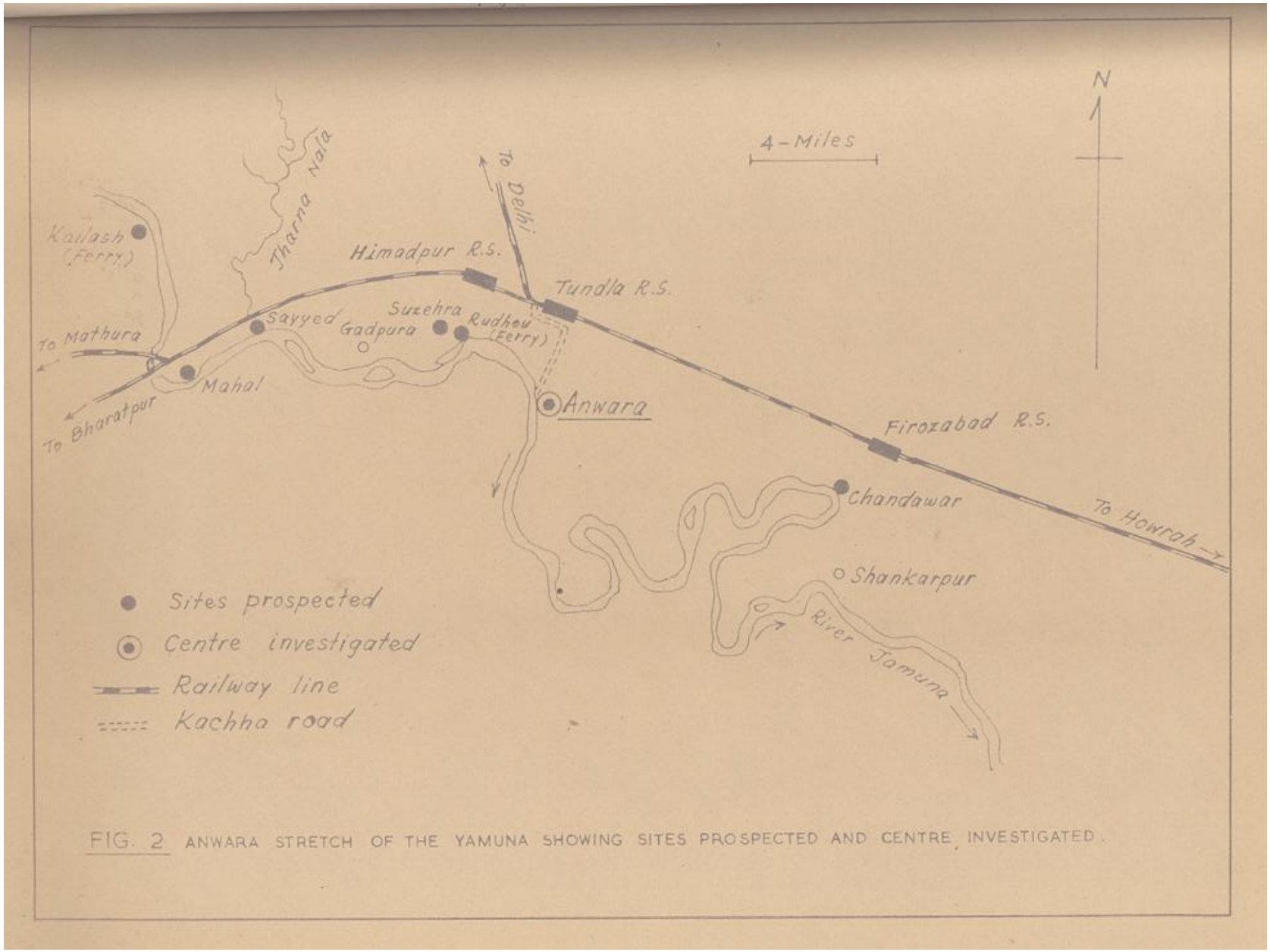

FIG. 2 ANWARA STRETCH OF THE YAMUNA SHOWING SITES PROSPECTED AND CENTRE INVESTIGATED.

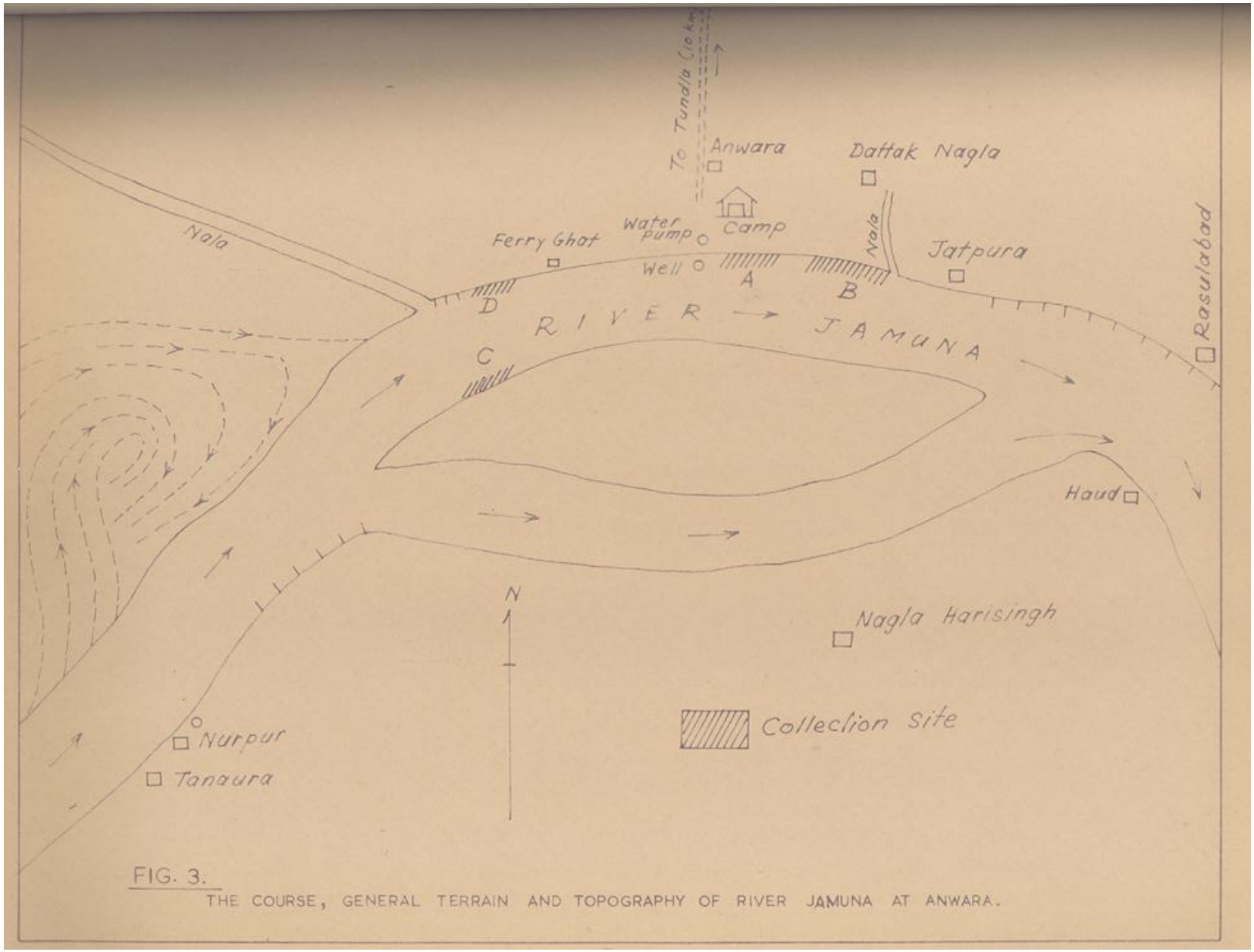

FIG. 3.

THE COURSE, GENERAL TERRAIN AND TOPOGRAPHY OF RIVER JAMUNA AT ANWARA.

Table - 7.2

Details of spawn spurts — Occurrence, duration and quality in the river Jamuna at Anwara (Tundla).

Flood details				Spawn spurt No.	Spurt duration		Associate catch in Nos.	Spawn desirability **	Total spawn catch in ml	Duration		Spawn Quality — Percentage composition by					
												Spawn analysis			Rearing		
No.	Phase *	Duration From No. of days	Peak Date Flood level in metres		From Date Hour	Period in hours				From Date Hour	Period in hours	Major carps	Minor carps	Others	Major carps	Minor carps	Others
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
I	Ri	10.7.65 / 12	22.7.65 / 3.06	1	10.7.65 / 10	86	910	U	13280	10.7.65 / 10	86	0.8	1.6	97.6	-	-	-
	Re	22.7.65 / 2	-	2	22.7.65 / 12	40	647	U	3500	22.7.65 / 14	12	1.0	-	99.0	-	-	-
								D	13050	22.7.65 / 4	28	24.8	9.9	65.3	87 +	13.0	-
	V	24.7.65 / 7	-	3	26.7.65	46	461	D	1219	26.7.65	46	47.0	6.6	46.4	-	-	-
II	Ri	2.8.65 / 4	4.8.65 / 3.25	-	-	-	291		N I L C A T C H								
	Re	5.8.65 / 3	-	4	5.8.65 / 18	26	665	D	808	5.8.65 / 18	26	75.1	14.1	10.8	75 @	25.0	-
	V	7.8.65 / 16	-	5	14.8.65 / 14	56	1525	U	4625	14.8.65 / 14	56	-	2.7	97.3	-	-	-
III	Ri	24.8.65 / 8	31.8.65 / 3.28	6	24.8.65 / 10	26	492	U	610	24.8.65 / 10	22	-	46.0	54.0	-	-	-
								D	25	29.8.65 / 10	4	60.0	34.0	6.0			
	Re	1.9.65 / 10	-	-			20										
								Total: D	15102		104						
								Total: U	22015		176						
Total: 62						280	5011		37117		280						

Contd.....

Contd. Table - 7.2

* Ri - Rising
Re - Receding
V - Vacillation

** U - Undesirable
D - Desirable

	C.mrigala	C.catla	L.rohita	L.calbasu
+	60%	4%	21%	2%
@	48%	-	24%	3%

At the other three sites i.e. Chandawar, Mahal and Sayyed, trial net operations were done during the period of spawn availability at Anwara. Spawn catches per net hour at various sites along with those

Table 7.3 Spawn catch per net per hour between 6 A.M. to 6 P.M. at various sites including Anwara

Dates	Spawn catch/net hour between 6 A.M. to 6 P.M.			
	Chandawar	Mahal	Sayyed	Anwara
9.7.65				nil
10.7.65	15			77
26.7.65	32			neg
27.7.65	5			15
6.8.65		35		60
7.8.65		neg		neg
9.8.65			neg	neg
10.8.65			neg	neg
19.8.65			neg	neg
20.8.65			neg	neg
22.8.65		neg		3
23.8.65	neg			6
2.9.65			nil	nil
5.9.65			nil	nil

N.B. neg. stands for negligible

at Anwara are presented in Table 7.3. A scrutiny of this table reveals that spawn is available throughout the Anwara stretch and may be collected at any suitable site.

The index* of spawn quantity at Anwara in 1965 was found to be 3,493 ml (estimated at 13.2 lakhs) and of quality 81.0% major carps, 19.0% minor carps and 0% others.

Associates : It is clear from Table 7.2 that the spawn associates were captured in greater quantities in the early part of the season in the first flood. Thereafter, a declining trend was observed in their

* The quantity of desirable spawn taken by one single standard net in the course of the whole season.

abundance with the advancement of monsoon season. During spawn availability period their high quantities effected the net efficiency by choking the tail-piece. Further, the occurrence of associates in abundance resulted in heavy damage to the spawn during segregation by repeated sieving.

7.1.2 Dhumanpura stretch of Yamuna

The stretch of the Yamuna, referred to as Dhumanpura stretch, extends from the village Kandesi in the east to village Karchhaghat in the west, a distance of 61 km by river. The duration of observations was from July 4 to September 8, 1965. The site at Dhumanpura was selected for round the clock investigations, and one site each at Kandesi, Nawadakalan, Setaura, Ekdil, Jhenna, Pirthipura, Jasauhan and Karchhaghat were prospected (Fig. 4). Three more accessible sites namely Balakipura, Rura and Batesar, farther west of Karchhaghat, were also prospected although they were not covered by the premonsoon surve

To select the points of maximum spawn concentration, during different spurts at Dhumanpura, trial nets were simultaneously operated at spots A, B, C, D and E (Fig. 5) as soon as spawn appeared in each spurt. Table 7.4 shows the results of these trials nettings.

Table 7.4 Two hourly spawn yield in different spurts at different spots in the Yamuna at Dhumanpura

Spurt No.	Spot with spawn catch in ml				
	A	B	C	D	E
1	neg*	neg	2	5	-
2	-	neg	20	5	2
3	2	2	10	5	-
4	neg	neg	5	5	-

* neg. stands for negligible

An examination of Table 7.5 brings out that in the Yamuna at Dhumanpura, spawn was available in four spurts ranging in duration from 32 to 92 hours. All the four spurts occurred in association with the floods and unlike at Anwara, the vacillation period between floods were devoid of spawn. Spawn of desirable quality was available at Dhumanpura for 176 hours, while the total period of its availability was 204 hours. In the entire season 3-4 standard nets collected 8,017 ml of desirable spawn which accounted for 92.6% of the total spawn yield. Spawn spurt 1, of 32 hours duration, occurred in the receding

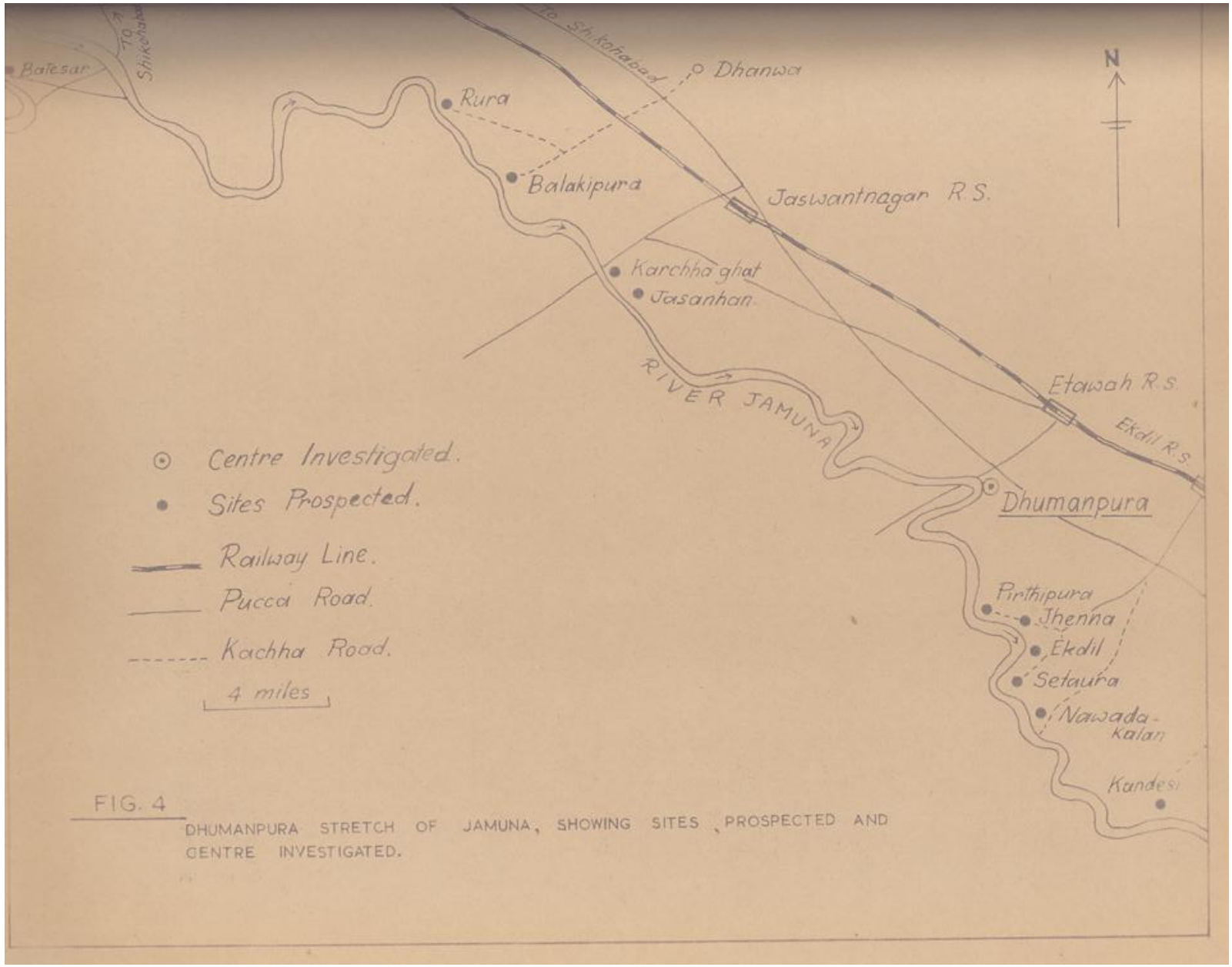

FIG. 4

DHUMANPURA STRETCH OF JAMUNA, SHOWING SITES PROSPECTED AND CENTRE INVESTIGATED.

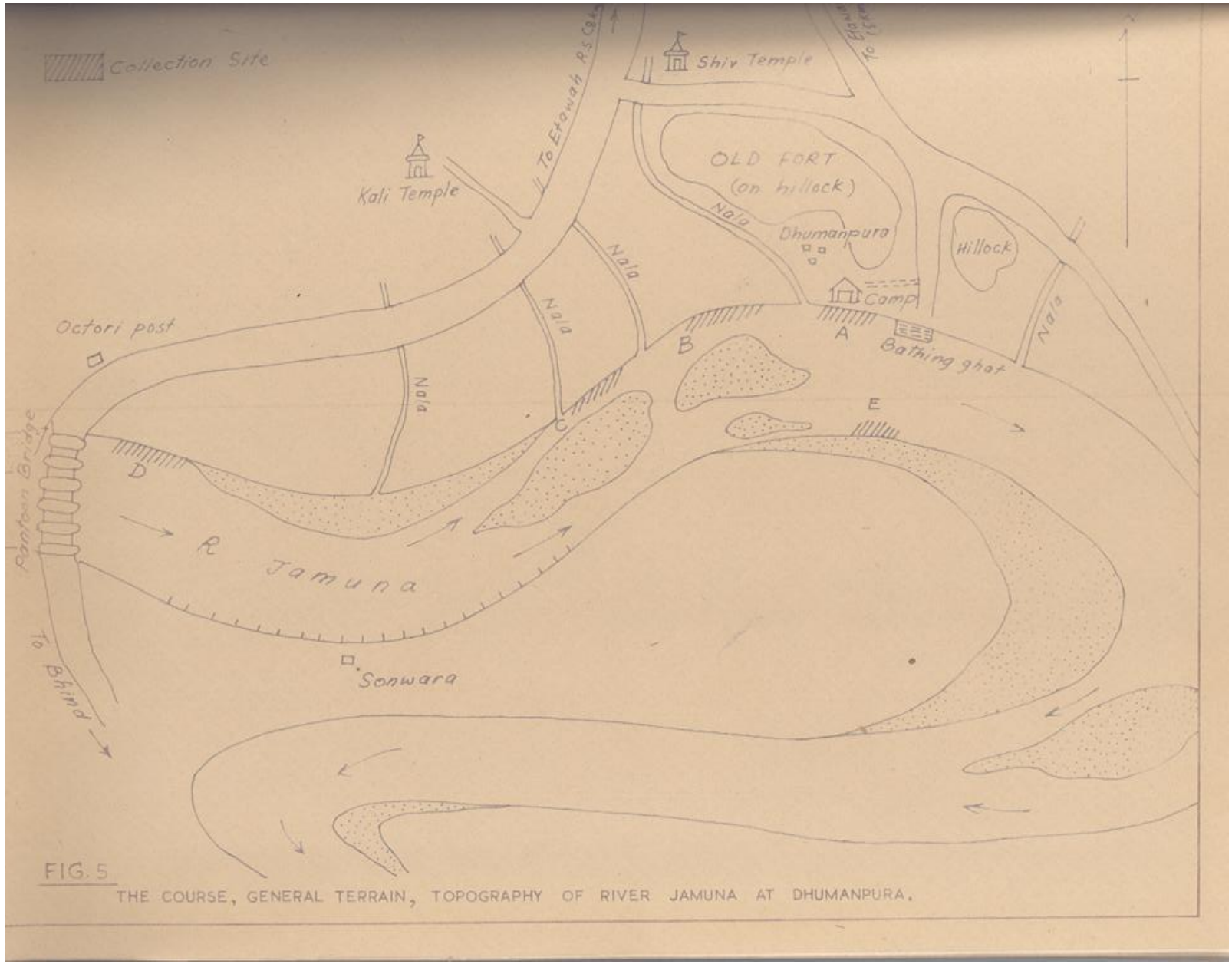

FIG. 5

THE COURSE, GENERAL TERRAIN, TOPOGRAPHY OF RIVER JAMUNA AT DHUMANPURA.

Table - 7.5

Details of spawn spurts—Occurrence, duration and quality in the river Jamuna at Dhumanpura

Flood details				Spawn spurt	Spurt duration		Associate catch in Nos.	Spawn desirability **	Total spawn catch in ml	Duration		Spawn quality					
												Percentage composition by					
												Spawn analysis			Rearing		
No.	Phase *	Duration From No. of days	Peak Date Flood level in metres	No.	From Date Hour	Period in hours				From Date Hour	Period in hours	Major carps	Minor carps	Others	Major carps	Minor carps	Others
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
I	Ri	21.7.65 3	23.7.65 4.18	-			140.6 lakhs		N I L C A T C H								
	Re	24.7.65 5	-	1	25.7.65 8	32	212.0 lakhs	D	492	25.7.65 8	32	35.2	5.7	59.1	10 +	13	77
	V	29.7.65 2	-	-			2.97 lakhs		N I L C A T C H								
II	Ri	31.7.65 2	1.8.65 4.84	-			12582		N I L C A T C H								
	Re	1.8.65 4	-				3765	U	80	3.8.65 16	4	5.0	6.0	89.0	-	-	-
								D	1655	3.8.65 20	14	80.0	14.0	6.0	-	-	-
	Ri	4.8.65 2	5.8.65 5.43	2	3.8.65 16	92	439	D	4834	4.8.65 10	42	70.7	19.3	10.0	59 @	36	5
	Re	5.8.65 19	-				2629	D	606	5.8.65 4	32	53.0	28.0	19.0			
	V	23.8.65 5	-	-			323		N I L C A T C H								
III	Ri	28.8.65 5	1.9.65 5.02	3	29.8.65 12	36	1342	U	547	29.8.65 12	20	8.6	30.0	61.4	Rearing not possible		
								D	203	30.8.65 8	16	19.0	40.0	41.0			
	Re	2.9.65 4	-	4	2.9.65 10	44	1460	U	18	2.9.65 10	4	3.0	35.0	62.0	- do -		
								D	227	2.9.65 14	40	53.0	20.0	27.0			

Contd.....

Contd. Table - 7.5

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
								Total:	D	8017		176						
								Total:	U	645		28						
Total:		51				204	355.78			8662		204						

* Ri - Rising
Re - Receding
V - Vacillation

** U - Undesirable
D - Desirable

	C.mrigala	C.catla	L.rohita	L.calbasu
+	-	5%	4%	1%
@	7%	2%	50%	-

phase of flood I, yielding only desirable spawn and formed 6.1% of the total desirable spawn yield. Spurt 2, which contributed 88.4% to the total catch of desirable spawn at the centre, lasted for 92 hours during flood II. This flood had a subsidiary peak (4.84 m on 1.8.65) preceding the main peak (5.4 m on 5.8.65). Spawn was first available in the receding phase following the subsidiary peak and continued thereafter even upto the receding phase succeeding the main peak. Spawn spurt 3 occurred in the rising phase of flood III, continued for 36 hours and contributed 2.5% of the entire yield of desirable spawn. The last spurt 4, which was of 44 hours duration in the receding phase of flood III, accounted for 2.8% of the total desirable spawn.

Table 7.5 further brings out that spawn spurts 1 and 2, which together lasted for 120 hours, accounted for 94.5% of the season's catch of desirable spawn. The peak spells of desirable spawn catch in these two spurts were of 8 and 36 hours duration and contributed 86.3 and 80.0% of the desirable spawn in respective spurts with catch/net hour 18 and 42 ml respectively. Cumulatively they accounted for 75.4% of the season's catch of desirable spawn at the centre. In spurts 1 and 2, peak periods of desirable spawn commenced two and four hours respectively after the initial appearance of spawn.

As revealed by the analyses of spawn samples (Table 7.5) the major carp content of the desirable spawn in spurts 1, 2, 3 and 4 were 35.2, 67.9, 19.0 and 53.0 percent respectively. To determine spurt-wise species composition spawn samples of spurts 1 and 2 were reared in nursery ponds which revealed major carps percentage in the two spurts to be 10 and 59 respectively. These percentages are based on 2 and 1 rearings of spawn collected in spurts 1 and 2 respectively. It may be mentioned here that the rearing of spawn samples of spurt 1 was not satisfactory as the rain fed nurseries had very little water due to poor monsoon. Samples of spurts 3 and 4 could not be reared as the late rains overflooded the nurseries. Labeo rohita was the dominant species in both the spurts. It was followed by C.catla in spurt 1 and C.mrigala in spurt 2.

From amongst the other sites prospected, those at Kandesi, Nawadakalan, Ekdil, Jhenna, Pirthipura and Rura had steep banks where shooting nets could not be operated. At other sites the nets were operated from 6 A.M. to 6 P.M. on different dates. Spawn catch per net hour at different sites along with that at Dhumanpura for identical time is presented in Table 7.6.

Table 7.6 Spawn catch per net hour between 6 A.M. to 6 P.M. at different sites of Dhumanpura stretch.

Dates	Dhuman-pura	Karchha-ghat	Seta-ura	Balaki-pura	Jasau-han	Bate-sar
27.7.65	7					2
28.7.65	2					2
4.8.65	385	150				
10.8.65	2	2				
11.8.65	nil	nil				
18.8.65	nil		nil			
19.8.65	nil		nil			
22.8.65	nil			nil		
23.8.65	nil			nil		
4.9.65	12				2	
5.9.65	8				2	

It is evident from this table that spawn is available all along the stretch and can be harvested at suitable sites and appropriate time.

The index of spawn quantity at Dhumanpura in 1965 was 2,200 ml (c. 7.7 lakhs) and of quality 35% major carps, 24% minor carps and 41% others.

Associates : Table 7.5 shows that in the early part of the season during first flood, greater quantities of spawn associates were captured by the shooting nets though their abundance dwindled as the season advanced. The quantitative magnitude of the associates, when viewed in conjunction with the spawn spurts, points to their higher magnitude in spurt 1. This not only adversely effected the net efficiency by choking the tail piece of the net, but also the spawn during straining etc.

7.1.3 Bansi stretch of Rapti

This stretch of the Rapti runs from Domariaganj to Goralhpur situated 115 km downstream. Investigations began on July 1 and contin

unto September 10, 1965. The site on the north bank at Bansi was selected for detailed investigations and those at Domariganj, Panghatia and Gaighat for prospecting (Fig. 6).

At Bansi, trial nets were simultaneously operated at spots A, B and C in the four spurts 1, 2, 4 and 6 no sooner than the spawn appeared in each spurt to locate pockets of maximum availability (Fig. 7). Spurts 3 and 5 fell in the rising phase of floods III and IV when trial netting at spot B, located as it was on a sand bar, being extremely hazardous, was not done. Though spawn concentration by trial netting was assessed in spurts 4 and 6 at spot C, because of public objection to spawn collection at this spot, work could not be done there. The results of these operations are indicated in Table 7.7.

Table 7.7 Two hourly spawn yield in different spurts at different spots in river Rapti at Bansi

Spurt No.	Spot with spawn catch in ml		
	A	B	C
1	50	-	-
2	150	265	-
3	2	-	-
4	85	-	175
5	5	-	-
6	30	-	50

It is seen in Table 7.8 that in Rapti at Bansi, spawn was available in six spurts each of which concurred with distinct phases of different floods. Though spawn at this centre was available for a total duration of 560 hours, the desirable quality was harvested, in its entirety, in 416 hours. Total yield of desirable spawn in the entire season was 24,668 ml constituting 72.9% of the season's total spawn catch. Spawn spurt 1, of 212 hours duration, passed in the receding phase of flood I and contributed 8.3% of season's desirable spawn catch. Spurt 2, falling in the receding phase of flood II, lasted for 134 hours and formed 54.0% of the total catch of desirable spawn. Spurt 3 lasted for only 10 hours in the rising phase of flood III and accounted for only 0.1% of the desirable spawn catch. Spurt 4, which like spurt 3 produced only desirable spawn, flowed in the receding phase of the same flood for 92 hours composing 28.2% of the seasonal desirable spawn yield. Spurt 5 yielded only undesirable spawn

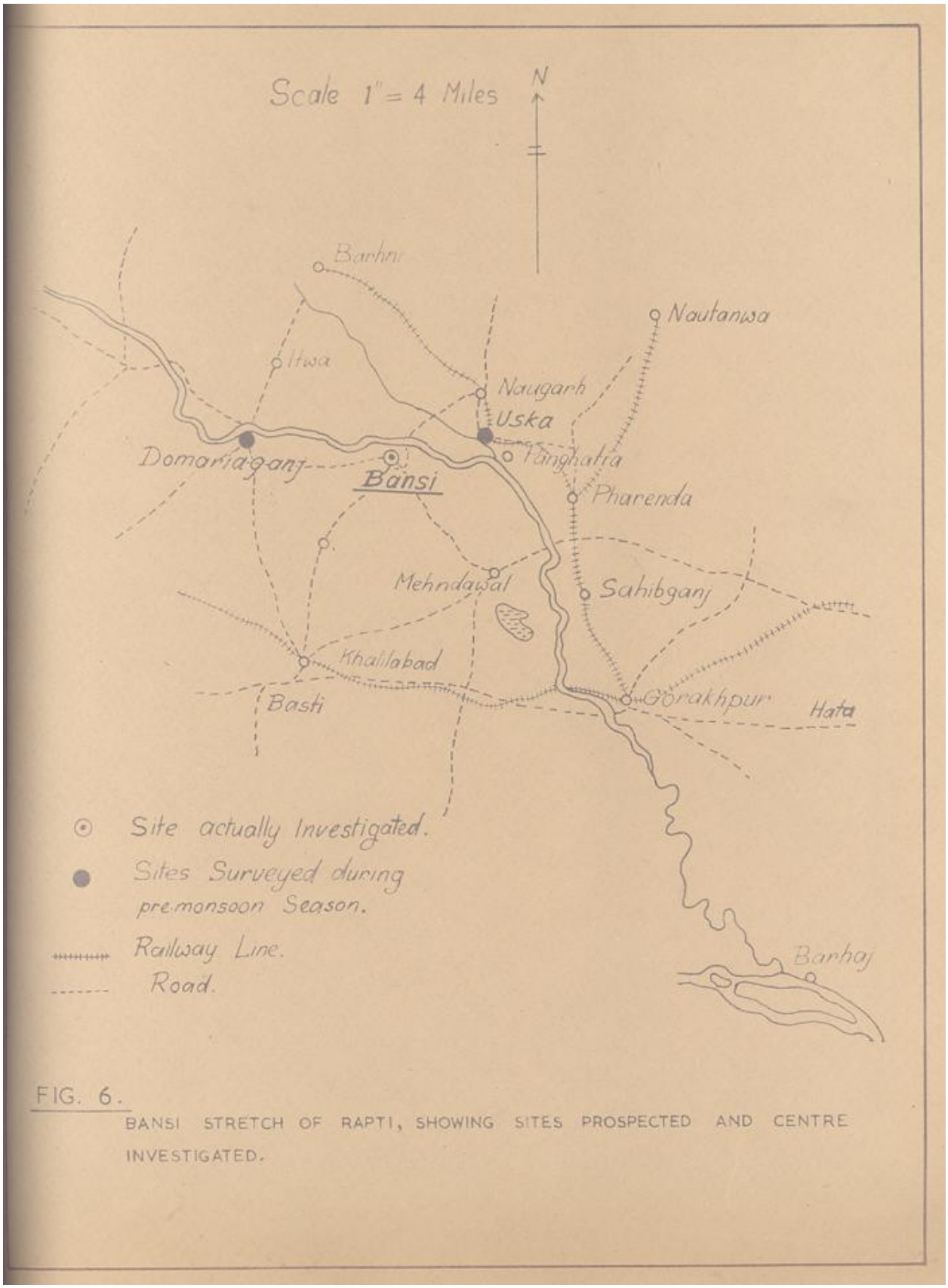

FIG. 6.

BANSI STRETCH OF RAPTI, SHOWING SITES PROSPECTED AND CENTRE INVESTIGATED.

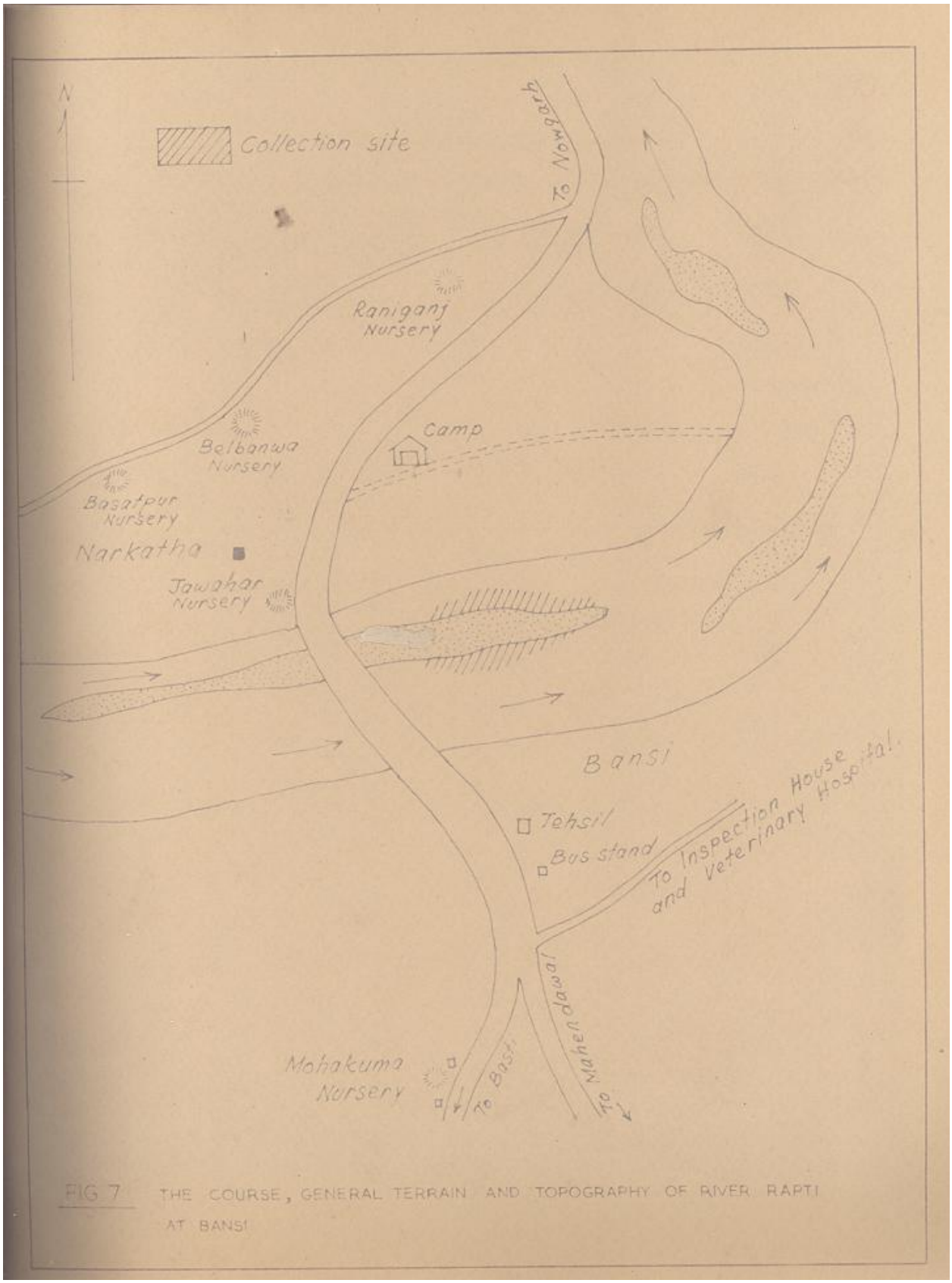

FIG 7 THE COURSE, GENERAL TERRAIN AND TOPOGRAPHY OF RIVER RAPTI AT BANSI

Table - 7.8

Details of spawn spurts—Occurrence, duration and quality in the river Rapti at Bansi

Flood details				Spawn spurt No.	Spurt duration		Associate catch in Nos.	Spawn desirability **	Total spawn catch in ml	Duration		Spawn quality					
												Percentage composition by					
												Spawn analysis			Rearing		
No.	Phase *	Duration From No. of days	Peak Date Flood level in metres		From Date Hour	Period in hours				From Date Hour	Period in hours	Major carps	Minor carps	Others	Major carps	Minor carps	Others
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
I	Re	1.7.65 / 9	-	1	1.7.65 / 8	212	1118	U	8778	1.7.65 / 8	46	5.6	87.2	7.2	-	-	-
								D	2051	3.7.65 / 6	166	45.0	54.5	0.5	63.9	+ 33.4	2.7
	Ri	11.7.65 / 1	11.7.65 / 0.90	-			30	N I L C A T C H									
II	Re	11.7.65 / 6	-	2	11.7.6 / 22	134	693	D	13320	11.7.65 / 22	96	54.8	45.2	-	68.1	@ 31.9	-
								U	317	15.7.65 / 22	38	1.7	98.3	-	-	-	-
	V	17.7.65 / 3	-	-			139	N I L C A T C H									
III	Ri	21.7.65 / 1	21.7.65 / 0.68	-			-	N I L C A T C H									
	Re	22.7.65 / 2	-	-			-	N I L C A T C H									
	Ri	24.7.65 / 3	26.7.65 / 1.85	3	24.7.65 / 8	10	600	D	40	24.7.65 / 8	10	68.8	29.1	2.1	-	-	-
	Re	26.7.65 / 3	-	4	26.7.65 / 8	92	817	D	6950	26.7.65 / 8	92	77.0	21.9	1.1	83.4	$ 16.6	-
IV	Ri	30.7.65 / 3	2.8.65 / 1.68	-			-	N I L C A T C H									
	Re	2.8.65 / 1	-	-			-	N I L C A T C H									

Contd.....

Contd. Table - 7.8

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	Ri	3.8.65 1	4.8.65 2.62	5	2.8.65 8	44	911	U	95	2.8.65 8	44	-	96.1	3.9	-	-	-
	Re	4.8.65 6	-	6	5.8.65 8	68	254	D	2307	5.8.65 8	68	42.1	57.9	-	55.3	£ 44.7	-
	V	10.8.65 30	-	-			848		N I L	C A T C H							
							Total :	D	24668		432						
							Total :	U	9190		128						
T o t a l :		69				560	5410		33858		560						

* Ri - Rising
Re - Receding
V - Vacillation

** U - Undesirable
D - Desirable

	C.mrigala	C.catla	L.rohita	L.calbasu
+	23.8%	18.1%	16.5%	5.5%
@	39.0%	20.0%	6.8%	2.3%
$	26.4%	35.0%	17.5%	4.5%
£	8.2%	11.3%	33.9%	1.9%

for 44 hours in the rising phase of flood IV. In 68 hours of the receding phase of flood IV emanted the last spurt of the season (spurt number 6) which formed 9.4% of the seasonal desirable spawn catch.

It is further deducted from Table 7.8 that 82.2% of the catch of total desirable spawn was collected in spurts 2 and 4 in 188 hours. Spells of maximum spawn availability in these spurts lasted for 62 and 24 hours when catch/net hour was 39.4 and 36.2 ml respectively accounting for 92.3 and 62.6% of the catch of desirable spawn in respective spurts. 75.9% of the entire season's desirable spawn catch at the Bansi centre was taken during these spells. In these spurts the peak periods of abundant spawn commenced 6 and 30 hours respectively after its initial appearance.

Table 7.8 further shows that in spurts 1, 2, 3, 4 and 6 major carp percentage in the catch of desirable spawn was 45.0, 54.8, 38.8, 77.0 and 42.1 percent respectively. Samples of spurts 1, 2, 4 and 6 were reared in nursery ponds to determine their species composition and the percentages of major carps were 63.9, 68.1, 83.4 and 55.3 respectively. C.mrigala was the dominant species in spurts 1 and 2, C.catla in spurt 4 and L.rohita in spurt 6.

At the three prospected sites of the stretch, trial nets were periodically operated from 6 A.M. to 6 P.M. Spawn catch per net hour at different sites along with that at Bansi for the corresponding period is shown in Table 7.9.

Table 7.9 Spawn catch per net hour at different sites of the Bansi stretch

D a t e	Bansi	Domariaganj	U S K A	
			Panghatia	Gaighat
23.7.65	neg		nil	
24.7.65	18		7	
5.8.65	nil	19		
6.8.65	62	14		
7.8.65	18	7		
18.8.65	nil			nil
19.8.65	nil			nil

It may be concluded that spawn is available throughout the Bansi stretch and can be fruitfully collected at suitable sites. The

index of spawn quantity in this stretch was observed to be 4,715 ml (c. 13.5 lakhs hatchlings); qualitatively major carps formed 77.7% minor carps 21.6% and others 0.7%.

Associates : Abundance of associates followed the same trend as at the two sites on the river Yamuna. Here too, the associates adversely affected the spawn catch in the net as also its segregation during sieving.

7.1.4 Dhundhua stretch of Son

This 35 km long stretch of the Son extends from Koiridih in the south to Mahuawan in the north and the period of investigations was from July 1 to September 12, 1965. Dhundhua was selected for detailed investigations and one site each at Koiridih, Baghadabar, Naur, Nawadih, Ragunathpur, Mahuawan and Majhiaon situated on the east bank, and Banjari, Tumba, Tilothu and Mandhania on the west bank for spawn prospecting (Fig. 8).

At Dhundhua, with the appearance of spawn in different spurts trial nets were simultaneously operated at spots A, B, C, D and E (D and E on sand bars) to delimit the pockets of maximum spawn concentration in each spurt (Fig. 9). In spurt 2, which occurred in flood II, when alone in the entire season vast areas of the river were inundated were the spots F, G, H, I and J also prospected. But in other spurts, these latter spots were either dry (G, H, I & J) or in the the deeper portion of the river (F). The results of these trials are given in Table 7.10.

Table 7.10 Two hourly spawn yield in different spurts at different spots in the Son at Dhundhua.

Spurt No.	Spots with spawn catch in ml									
	A	B	C	D	E	F	G	H	I	J
1	15	10	-	-	5	-	-	-	-	-
2	-	5	2	-	-	neg	2	neg	nil	neg
3	-	neg	4	-	-	-	-	-	-	-
4	8	5	22	-	2	-	-	-	-	-
5	-	8	15	3	-	-	-	-	-	-

neg - negligible

Table 7.11 shows that at Dhundhua spawn was available in five spurts of which the first four occurred either in the rising or the

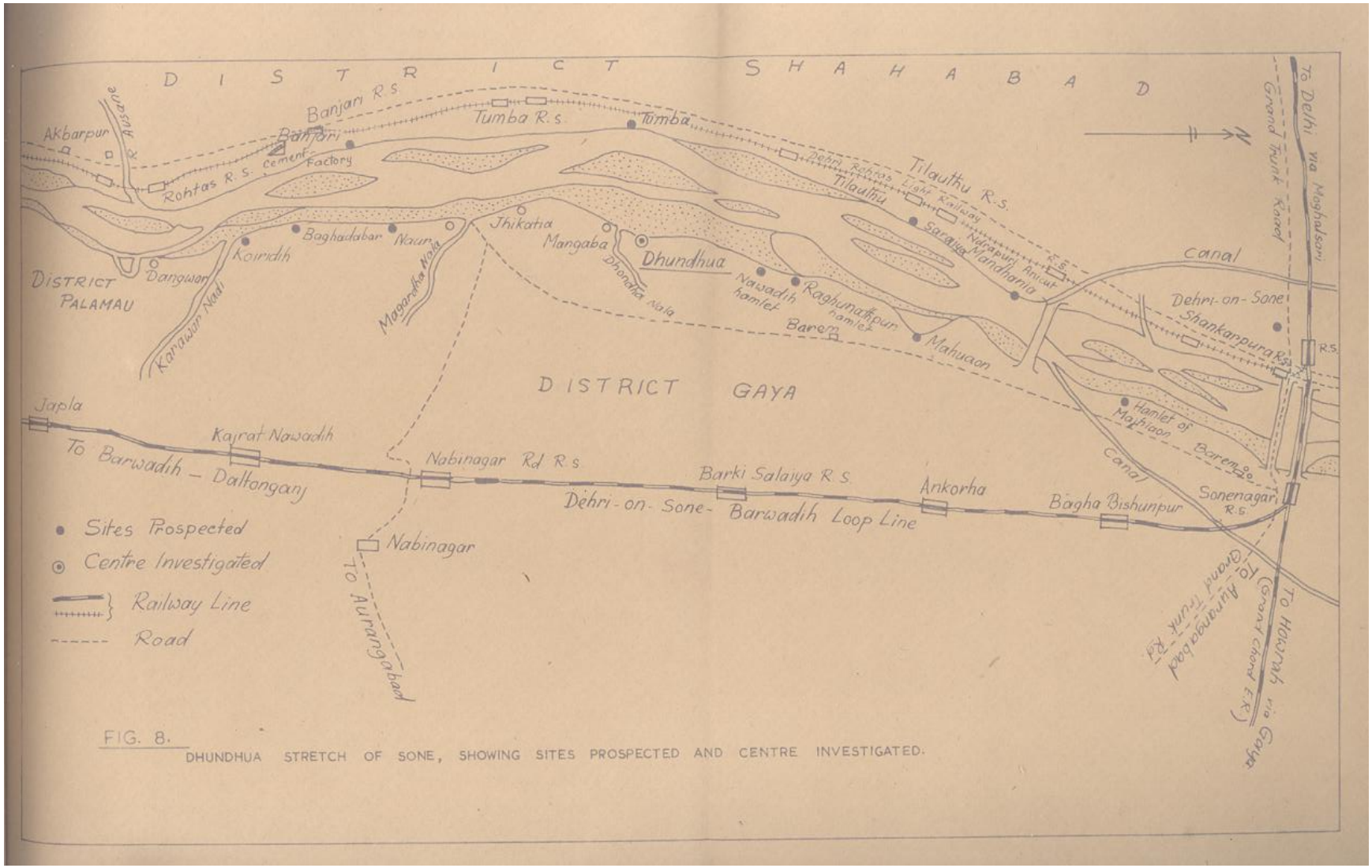

FIG. 8.

DHUNDHUA STRETCH OF SONE, SHOWING SITES PROSPECTED AND CENTRE INVESTIGATED.

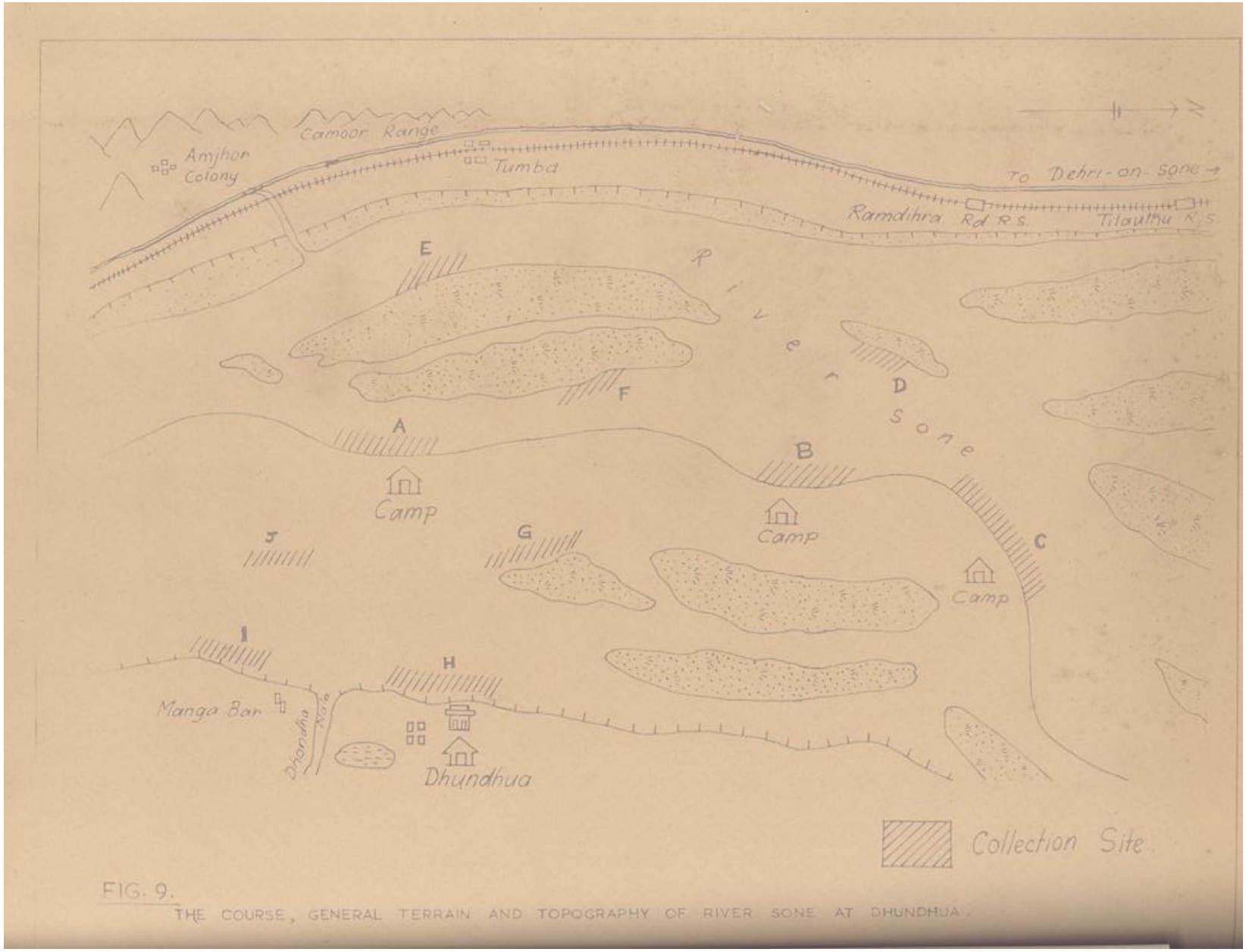

FIG. 9.

THE COURSE, GENERAL TERRAIN AND TOPOGRAPHY OF RIVER SONE AT DHUNDHUA.

Table - 7.11

Details of spawn spurt— Occurrence, duration and quality in river Son at Dhundhua

Flood details				Spawn spurt No.	Spurt duration		Associate catch in Nos.	Spawn desirability **	Total spawn catch in ml	Duration		Spawn Quality					
												Percentage composition by					
												Spawn analysis			Rearing		
No.	Phase *	Duration From No. of days	Peak Date Flood level in metres		From Date Hour	Period in hours				From Date Hour	Period in hours	Major carps	Minor carps	Others	Major carps	Minor carps	Others
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
I	Ri	20.7.65 / 1	20.7.65 / 0.82	-			4608		N I L C A T C H								
	Re	21.7.65 / 3	-	1	22.7.65 / 8	16	11284	U	250	22.7.65 / 8	16	-	81.6	18.4	2.7	+ 94.7	2.6
II	Ri	24.7.65 / 6	29.7.65 / 1.76	-			1571		N I L C A T C H								
	Re	30.7.65 / 15	-	2	30.7.65 / 16	92	820	D	1119	30.7.65 / 16	60	26.2	71.7	2.1	6.8	@ 92.9	0.3
								U	305	1.8.65 / 4	32	5.0	91.8	3.2			
III	Ri	16.8.65 / 2	18.8.65 / 0.47	-			37		N I L C A T C H								
	Re	18.8.65 / 2	-	3	18.8.65 / 14	90	1144	D	1010	18.8.65 / 14	32	18.0	81.0	1.0	-	-	-
								D	323	19.8.65 / 22	22	27.6	69.4	3.0	2.4	$ 94.0	3.6
	Ri	19.8.65 / 2	21.8.65 / 0.70	-			826	U	280	19.8.65 / 2	18	5.0	91.7	3.3	-	-	-
	Re	21.8.65 / 4	-	-			150	D	364	21.8.65 / 14	18	28.0	69.0	3.0	-	-	-
IV	Ri	26.8.65 / 2	27.8.65 / 1.17	-			60										

Contd.....

7:17

Contd. Table - 7.11

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	Re	27.8.65 / 6	-	4	27.8.65 / 0	142	359	D	249	27.8.65 / 0	40	17.6	75.8	7.6	2.0	£ 98.0	-
								U	1119	29.8.65 / 16	102	5.9	90.7	3.4	-	-	-
	V	2.9.65 / 4	-	5	4.9.65 / 10	24	891	U	709	4.9.65 / 10	18	5.7	89.2	5.1	Nursery overflooded		
								D	46	4.9.65 / 4	6	26.0	71.3	2.7			
V	Ri	6.9.65 / 4	9.9.65 / 2.71	-			133	N I L C A T C H									
	Re	9.9.65 / 3	-	-			165	N I L C A T C H									
								Total : D	3111		178						
								Total : U	2663		186						
T o t a l :		54				364	21048		5774		364						

* Ri - Rising
Re - Receding
V - Vacillation

** U - Undesirable
D - Desirable

	C.mrigala	C.catla	L.rohita	L.calbasu
+	-	-	-	2.7 %
@	1.0 %	3.8 %	1.0 %	1.0 %
$	-	-	1.2 %	1.2 %
£	-	-	1.0 %	1.0 %

or the receding phases of the floods and spurt 5 in the vacillation period between floods IV and V. Though spawn at Dhundhua was available for 364 hours in the entire season, desirable spawn was collected in only 178 hours. The yield of desirable spawn at this centre was 3,111 ml which accounted for 53.9% of the total yield in the entire season. Spawn spurt 1, which occurred in the receding phase of flood I, lasted for 16 hours but was devoid of desirable spawn. Spurt 2, which formed 36.1% of the total desirable catch, continued for 92 hours in the receding phase of flood II. Spurt 3, which contributed 54.7% of the total harvested desirable spawn, was of 90 hours duration and contained only desirable spawn. This spurt continued through the main peak of the flood having commenced in the receding phase of a subsidiary peak preceding the main. Spawn spurt 4, of 142 hours, fell in the receding phase of flood IV and accounted for 8.0% of the total desirable spawn catch. Spurt 5, which appeared in the vacillation period between floods IV and V, lasted for 24 hours contributing 1.2 % of the season's desirable catch.

It is deducible from Table 7.11 that spurts 2 and 3 accounted for 90.8% of the total desirable spawn catch at Dhundhua which was harvested in 132 hours. Unlike other centres, spawn at Dhundhua was more or less uniformly distributed throughout its period of availability in different spurts and no spells of extremely heavy availability were observed.

Analyses of spawn samples (Table 7.11) revealed the percentage of major carps in the desirable spawn of spurts 2, 3, 4 and 5 to be 26.2, 24.3 , 17.6 and 26.2 respectively. However, rearings of spawn samples pertaining to spurts 1, 2, 3 and 4 showed major carp percentages as only 2.7, 6.8, 2.4 and 2.0 respectively. These percentage are based on 2, 4, 2 and 2 samples in respect of spurts 1 to 4. This discrepancy between spawn and reared sample analyses may be attributed to one or more of the following reasons: 1. Due to paucity of nurseries a mixture of desirable and undesirable spawn of different spurts had to be reared in the same nurseries; 2. spawn was reared in unprepared nurseries harbouring fish enemies like predators, insects etc. in high density: 3. advance fry were periodically removed before samples were taken for analyses. Catla catla, followed by L.calbasu, were the dominant major carps in the reared samples.

The index of spawn quantity of Dhundhua was 637 ml (c. 2.2 lakhs). Qualitative index was 3.5% major carps, 94.9% minor carps and 1.6% others. The low major carp percentage in reared samples, on which the index of spawn quality is based, appears to be underestimated due to the above-stated reasons. Support to this contention is obtainable

from the fact that at Dangwar, situated only 16 km upstream on the same river, a major carp content of 25.2% was observed in the rearc samples.

Of the sites prospected in the stretch, those at Koiridih, Baghadabar, Naur, Banjari, Tumba, Tilothu, Mahuawan, Mandhania and Majhiaon had precipitous bank and were unfit for net operation. Sit at Nawadih and Ragunathpur besides Dhundhua were found suitable for spawn collection.

Associates : Associates were captured in greater quantities during early part of the season and with its advancement their number dwin dled considerably. As at other centres, they adversely affected the net efficiency early in the season by choking tail pieces. They als caused heavy spawn mortality during its segregation.

7.1.5 Dangwar stretch of Son

The Dangwar stretch of Son covers a distance of 25 km and extends from the village Narainpur in the south to Dangwar in the north. Prospecting investigation were conducted from July 1 to Sep tember 11, 1965. While the site at Dangwar was selected for detail investigations, other sites at Narainpur, Adhaura, Ranideva, Kabra Saijwan, Soanpurwa, Purnadih, Deori, Budhva and Gorbandha were sel ted for prospecting (Fig.10).

As at other centres, trial nets were operated at spots A, B C, D and E (Fig.11) on appearance of spawn in each spurt for locat areas of maximum concentration. The results of these trial netting are shown in table 7.12.

Table 7.12 Two hourly spawn yield in different spurts at different spots in River Son at Dangwar

Spurt No.	Spot with spawn catch in ml				
	A	B	C	D	E
1	-	neg	neg	-	-
2	-	--	4	10	-
3	2	neg	2	7	-
4	-	neg	2	6	-
5	neg	-	-	5	-
6	-	neg	neg	2	-
7	-	neg	2	4	neg

'neg' stands for negligible

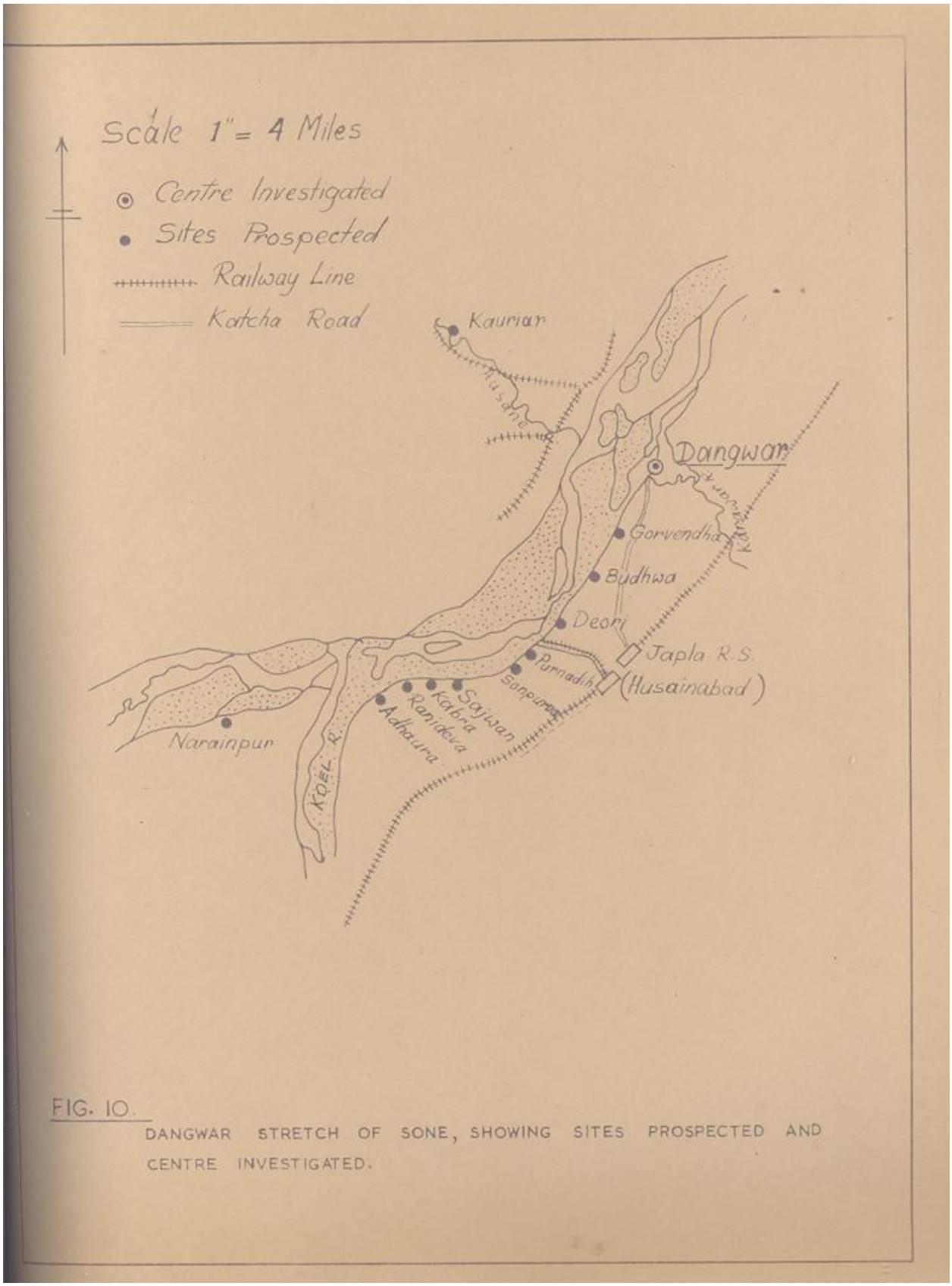

FIG. 10.

DANGWAR STRETCH OF SONE, SHOWING SITES PROSPECTED AND CENTRE INVESTIGATED.

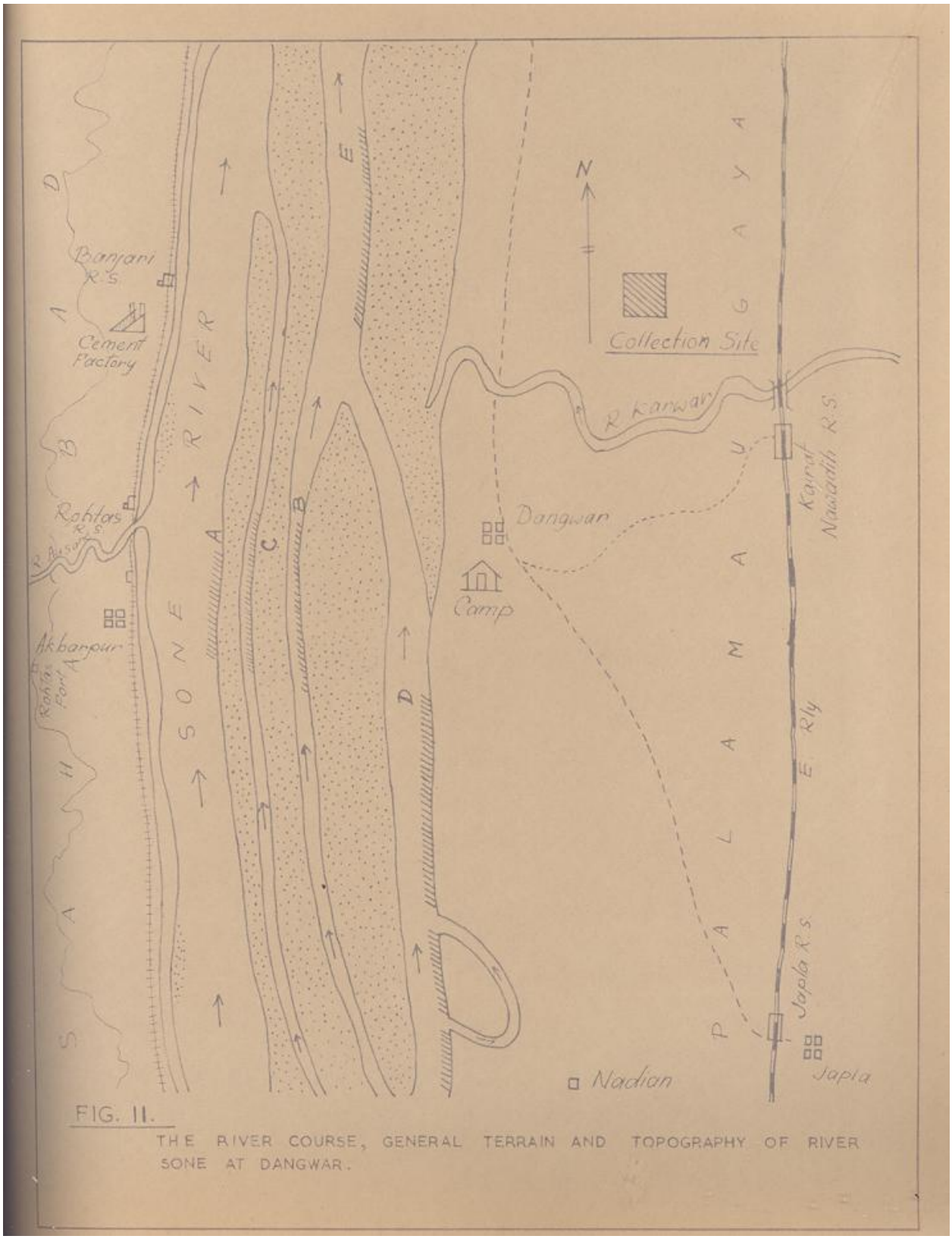

FIG. II.

THE RIVER COURSE, GENERAL TERRAIN AND TOPOGRAPHY OF RIVER SONE AT DANGWAR.

In Son at Dangwar, spawn was available in seven spurts (Table 7.13) ranging individually in duration from 6 to 58 hours. All the spawn spurts were associated with either the rising or the receding phases of the floods and no spawn was available in the vacillation period. The total period when spawn was available at Dangwar was 208 hours comprising 178 hours of the availability of desirable spawn. A total of 11,953 ml of desirable spawn catch, forming 82.1% of the entire season's yield at the site, was taken by 5 standard nets. Spawn spurt 1, which afforded 10.6% to the total catch of desirable spawn, passed in 58 hours in the receding phase of flood I. Spurt 2, of 36 hours duration, also fell in the receding phase of the same flood and accounted for 17.8% of the total desirable spawn catch. Both these spurts yielded desirable spawn only. Spurt 3, which occurred for 30 hours in the receding phase of flood lacked desirable spawn. The contribution of the desirable spawn of spurt 4 to the total was 32.4%. This spurt lasted for 24 hours in the receding phase of flood III. Spurt 5, in the rising phase of flood IV, accounted for 2.6% of the total catch of desirable spawn at the centre and prevailed for only 6 hours. The same flood in its receding phase contributed 34.0% of the total desirable spawn catch in the sixth spurt lasting for 28 hours. The last spurt (7) of 26 hours duration yielded 2.6% of the season's desirable catch and was observed in the receding phase of flood V.

Table 7.13 further elucidates that spurts 2, 4 and 6 together constituted 85.2% of the season's total desirable spawn yield collected in 88 hours. The peak periods of availability, of desirable spawn in spurts 2, 4 and 6 were of 10, 18 and 24 hours, duration respectively (catch/net hour being 31.2, 41.3 and 33.5 ml), contributing 74.1, 95.8 and 96.4% of the yield of respective spurts. Collectively these 3 spells of intense abundance of spawn gave 77.4% of the season's desirable spawn yield. While in spurts 2 and 4 they commenced 2 hours after the appearance of spawn, that of 6 synchronised with its very commencement.

Major carp content in spawn samples was found to be 22.6, 23.9, 39.5, 47.0, 36.7 and 52.1 percent of the total desirable spawn catch in spurts 1, 2, 4, 5, 6 and 7 respectively. Spawn samples of spurts 1, 3 and 4 were reared in nurseries. Of these, spurts 1 and 4 comprised desirable spawn with 13.5 and 36.9% major carps. Spurt 3 was of undesirable spawn (8.2% major carp by spawn analysis) with 3.6% major carps. C.catla was the most dominant species followed by L.rohita, C.mrigala and L.calbasu.

The index of spawn quantity at Dangwar was 2,417 ml (c. 8.5 lakhs) and of quality 25.2% major carps, 74.8% minor carps and 0% others.

Table - 7.13

Details of spawn spurts—Occurrence, duration and quality in river Son at Dangwar.

Flood details				Spawn spurt No.	Spurt Duration		Associate catch in Nos.	Spawn desirability **	Total spawn catch in ml	Duration		Spawn Quality					
												Percentage composition by					
												Spawn analysis			Rearing		
No.	Phase *	Duration From No. of days	Peak Date Flood level in metres		From Date Hour	Period in hours				From Date Hour	Period in hours	Major carps	Minor carps	Others	Major carps	Minor carps	Others
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
I	Ri	25.7.65 5	29.7.65 2.38	-			426		N I L C A T C H								
	Re	29.7.65 9	-	1	1.8.65 8	58	1633	D	1262	1.8.65 8	58	22.6	69.7	7.9	13.5 + 86.5		-
				2	6.8.65 16	36	913	D	2127	6.8.65 16	36	23.9	66.7	9.4	-	-	-
	V	7.8.65 9	-	-			-		N I L C A T C H								
II	Ri	17.8.65 1	18.8.65 0.28	-			8		N I L C A T C H								
	Re	18.8.65 3	-	3	19.8.65 8	30	661	U	2615	19.8.65 8	30	8.2	82.1	9.7	8.6 @ 91.4		-
III	Ri	21.8.65 1	21.8.65 0.53	-			25		N I L C A T C H								
	Re	21.8.65 4	-	4	24.8.65 16	24	969	D	3883	24.8.65 16	24	39.5	44.0	16.5	36.9 $ 63.1		-
	V	25.8.65 3	-	-			-		N I L C A T C H								
IV	Ri	28.8.65 2	30.8.65 0.66	5	29.8.65 6	6	126	D	310	29.8.65 6	6	47.0	43.3	9.7	Rearing not possible due to drying up of nurseries		
	Re	30.8.65 2	-	6	30.8.65 8	28	195	D	4054	30.8.65 8	28	36.7	53.8	9.5			
V	Ri	1.9.65 2	3.9.65 0.82	-			-		N I L C A T C H								

Contd.....

Contd. Table - 7.13

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	Re	3.9.65 / 3		7	4.9.65 / 6	26	77	D	317	4.9.65 / 6	26	52.1	36.7	11.2	Rearing not possible due to drying up of nurseries.		
VI	Ri	6.9.65 / 2	8.9.65 / 2.61	-			127		N I L C A T C H								
	Re	8.9.65 / 3	-	-			525		N I L C A T C H								
								Total : D	11952		178						
								Total : U	2615		30						
T o t a l :		49				208	5685		14567		208						

* Ri - Rising
Re - Receding
V - Vacillation

** U - Undesirable
D - Desirable

	C.mrigala	C.catla	L.rohita	L.calbasu
+	4.1%	2.9%	2.0%	4.5%
@	0.5%	4.5%	-	3.6%
$	6.1%	15.5%	9.2%	6.1%

No other site in the Dangwar stretch, except Dangwar itself, was found suitable for spawn collection due to rocky terrain and precipitous bank

Associates : Quantitatively, the spawn associates followed the same pattern as at Dhundhua, adversely affecting the catch of spawn and its segregation.

7.1.6 Babuaghat stretch of Khanua Kosi Dhar

The 15 km stretch of Khanua Kosi Dhar, called here as Babuaghat stretch, runs from Balwara in the west to Babuaghat in the east. Spawn prospecting investigations in this stretch commenced on May 22 and continued upto August 8, 1965. Detailed investigations were made at Babuaghat (Fig.12). Site at Chanan, Laghuni and Balwara were prospected but found unsuitable for shooting net operations because of steep bank (Fig.13).

Contrary to expectations, Khanua Kosi Dhar at Babuaghat yielded very little spawn in 1965. Only two spawn spurts, one of 22 and the other of 10 hours duration, occurred in the entire season. The first spurt produced 4,500 ml and the second only 320 ml of spawn. The major carp content of these spurts was bafflingly low, being less than 1%. The possible reasons for low major carp content may be:

1 Poor flooding, the maximum rise in recorded water level being only 3.5 m above the summer level of the river;

2 Possible loss of breeding grounds due to construction of eastern and western Kosi embankments.

While the percentage of major carps in the reared sample in Saharsa nursery was 0.8% and reported to be nil by the State officer, who later fished the nursery, the sample of the same spawn, reared in Khagaria nursery was reported in personal communication to consist of 95% mrigal. However, the sample of reared fry collected from the Khagaria nursery showed only 1% major carp content. This inexplicable inconsistency warrants repetition of spawn prospecting investigation in Khanua Kosi Dhar at Babuaghat in a normal year (Table 7.14).

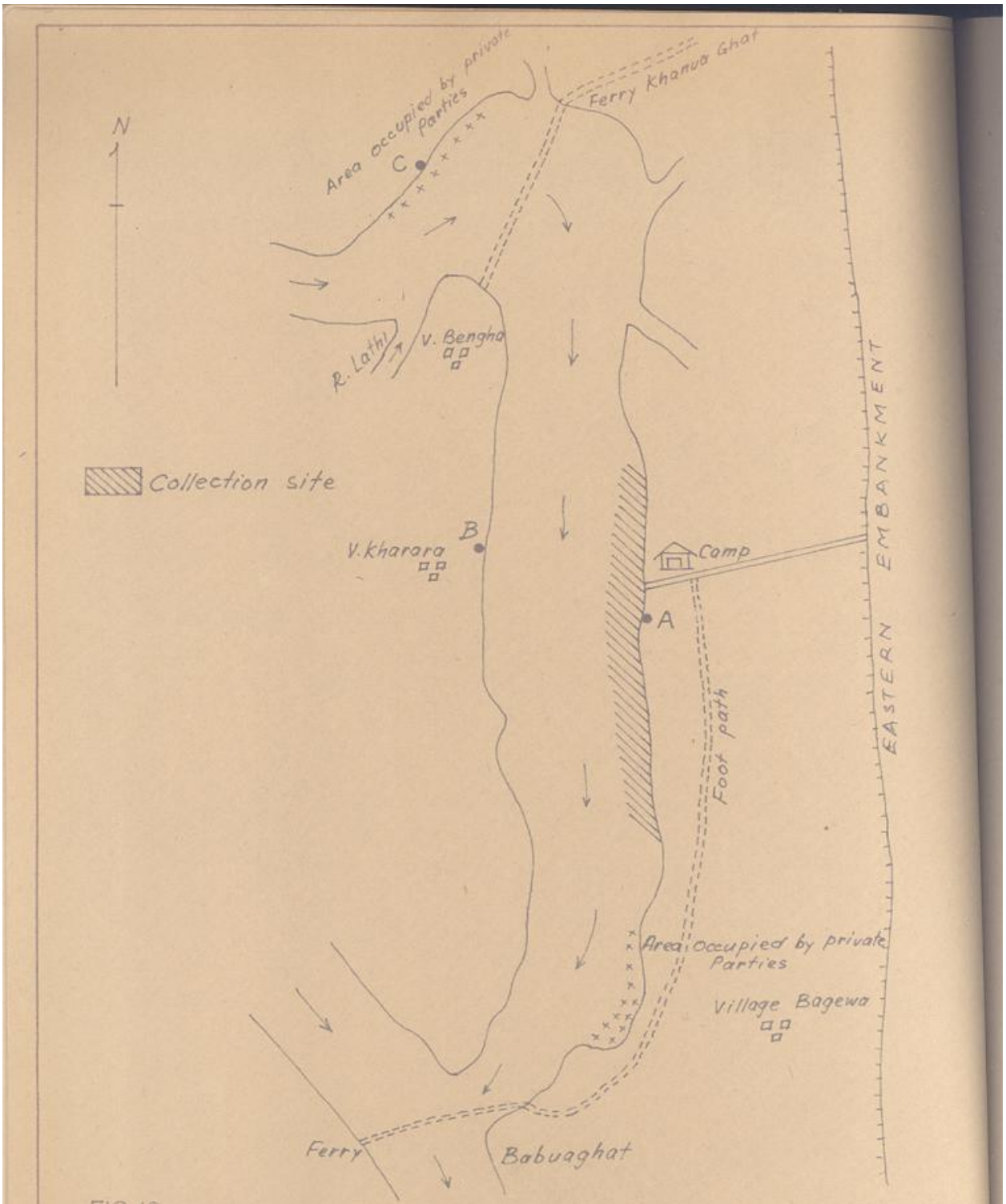

FIG. 12

THE COURSE, GENERAL TERRAIN AND TOPOGRAPHY OF RIVER KHANUA KOSI DHAR AT BALUAGHAT.

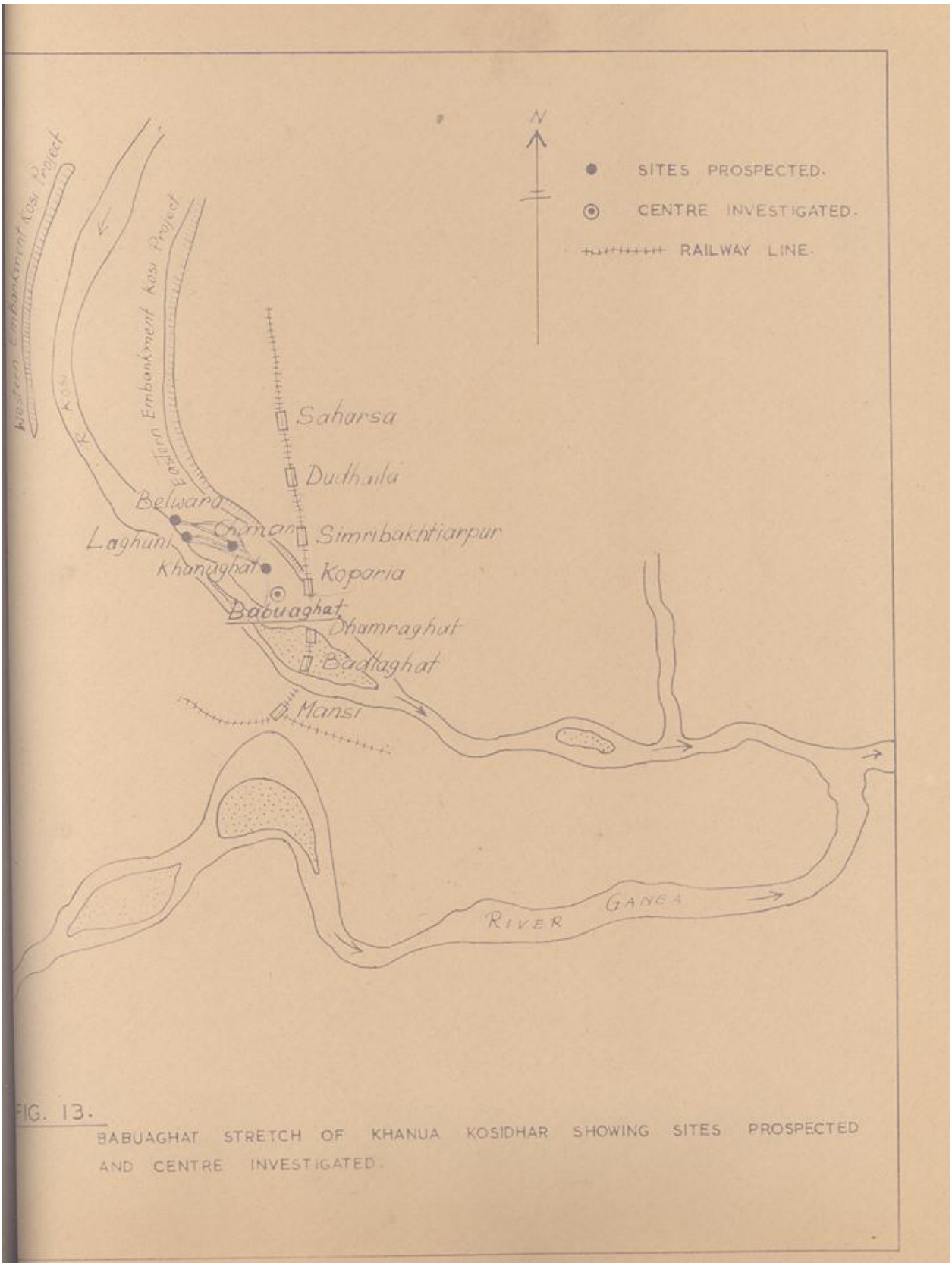

FIG. 13.

BABUAGHAT STRETCH OF KHANUA KOSIDHAR SHOWING SITES PROSPECTED AND CENTRE INVESTIGATED.

Table - 7.14

Details of spawn spurts — Occurrence, duration and quality in Khanua Kosi Dhar at Babuaghat

Flood details				Spawn spurt No.	Spurt duration		Associate catch in Nos.	Spawn desirability **	Total spawn catch in ml	Duration		Spawn Quality					
												Percentage composition by					
												Spawn analysis			Rearing		
No.	Phase *	Duration From / No. of days	Peak Date / Flood level in metres		From Date / Hour	Period in hours				From Date / Hour	Period in hours	Major carps	Minor carps	Others	Major carps	Minor carps	Others
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
									N I L C A T C H								
I	Ri	11.6.65 / 3	14.6.65 / 1.13	-			827										
	Re	15.6.65 / 3	-	1	16.6.65 / 16	22	661	U	3870	16.6.65 / 16	14	0.2	99.7	0.1	0.8 + 99.2		-
	Ri	17.6.65 / 5	22.6.65 / 1.54	-			313	U	630	17.6.65 / 6	8	1.9	97.6	0.5	-	-	-
	Re	22.6.65 / 3	-	-			976		N I L C A T C H								
II	Ri	25.6.65 / 8	3.7.65 / 2.85	2	1.7.65 / 20	10	1110	U	220	1.7.65 / 20	10	-	98.0	2.0	1.0 @ 99.0		-
	Re	3.7.65 / 3	-	-			36		N I L C A T C H								
III	Ri	6.7.65 / 5	11.7.65 / 3.45	-			266		N I L C A T C H								
	Re	11.7.65 / 14	-	-			766		N I L C A T C H								
IV	Ri	24.7.65 / 2	26.7.65 / 2.55	-			135		N I L C A T C H								
	Re	26.7.65 / 3	-	-			313		N I L C A T C H								
							Total :	D	N I L		0						
							Total :	U	4720		32						
Total: 49						32	5403		4720		32						

Contd.....

Contd. Table - 7.14

* Ri - Rising
Re - Receding

** - U - Undesirable
D - Desirable

	L.rohita	L.calbasu
+	0.6%	0.2%
@	-	1.0%

7.2 Godavari river system

River Godavari : One site each at Paithan and Nanded were investigated at the instance of the Government of Maharashtra.

7.2.1 Paithan on Godavari

Spawn prospecting investigations at Paithan on the Godavari were conducted from June 25 to September 5, 1965. In the early part of the season, investigations were conducted at Paithan (Fig.14) but on July 24 the centre of operation was shifted to Shahgarh (Fig. 15), 39 km downstream of Paithan. This shifting of the site in the mid-season was done as the collection area at Paithan had turned entirely unsuitable after a certain stage of flooding.

In the region covered at both the sites, spawn was available only in one spurt lasting for 6 hours during the rising phase of flood IV, the last flood of the season. The total yield of spawn at Shahgarh was only 102 ml which comprised entirely undesirable quality. The earlier three floods brought no spawn at all (Table 7.15).

Non-availability of major carp spawn (L.rohita, C.catla, C.mrigala and L.calbasu) in the area is attributed to the absence of major carps in the upper reaches of Godavari. It may be mentioned here that Barbus tor, L.fimbriatus and L.porcellus made up 37.5% in the reared samples.

7.2.2. Nanded on Godavari

Fish seed prospecting investigations at Nanded (Fig.16) situated 243 km downstream of Paithan, were done from July 1 to September 10, 1965.

Three spawn spurts, falling either in rising or receding phase of floods II to IV, were discerned at Nanded. The desirable spawn in those totalled upto 863 ml and was collected in 80 hours in 3-5 nets. This catch formed 63.1% of the total spawn yield at the site, the latter having been fished in 108 hours (Table 7.16). Spurts 1 to 3 lasted for 24, 62 and 22 hours respectively. The first two spurts came in the receding phases of floods II and III contributing 18.4 and 38.8% respectively to the season's catch of desirable spawn. The last burst surged with the rising phase of flood IV yielding 42.8% of the seasonal catch of desirable spawn at Nanded. The pattern of the rise of flood IV was marked with a few oscillations in water level

when spawn was available. Due to high peak (8.74 m on August 25) in the flood, nets could not be operated for eight days, including four in the receding phase, when some desirable spawn is likely to have escaped collection. This restriction imposed by high water level points out a serious limitation of spawn collection at Nanded.

The distribution of spawn in spurt 2 was diffused throughout its availability. However, spurt 3 presented a spell of bulk availability for 8 hours during which period, catch/net hour was 8.3 ml. This spell yielded 90.5% of the spurts and 38.2% of the season's desirable spawn catch.

29.3, 24.6 and 12.2% of major carps were found in the spawn samples of spurts 1 to 3 respectively. The dearth of nurseries in the near vicinity of the site limited the number of nursery rearings to only one. Samples of spawn from all the spurts were thus reared in the only available nursery. C.catla was seen to be the only major carp present forming 12.3% of the reared samples. The other importan carps of the region, Labeo fimbriatus formed 35.6%, Cirrhina cirrho and Tor sp. together formed less than 1%. Besides the above, a litti spawn from the collection of the second spurt made on August 7, were experimentally reared in a plastic pool. Of the 70 survivors in thi experiment, L.fimbriatus formed 41.1%, minor carps 35.4% and others 23.5%.

The index of spawn quantity at Nanded was 215 ml (c. 0.75 lakhs) and of quality 12.3% major carps, 67.1% minor carps and 20.6% others.

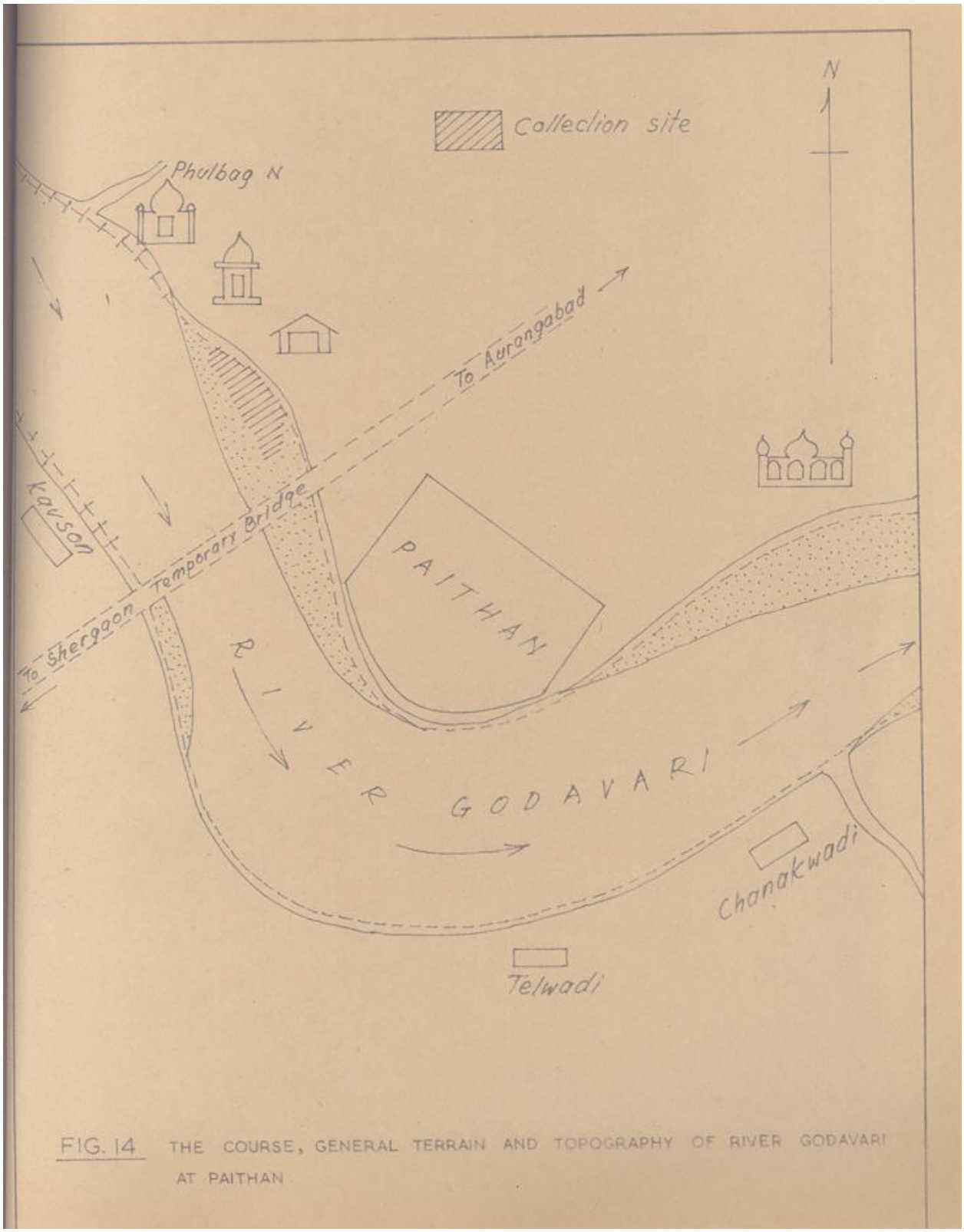

FIG. 14 THE COURSE, GENERAL TERRAIN AND TOPOGRAPHY OF RIVER GODAVARI AT PAITHAN

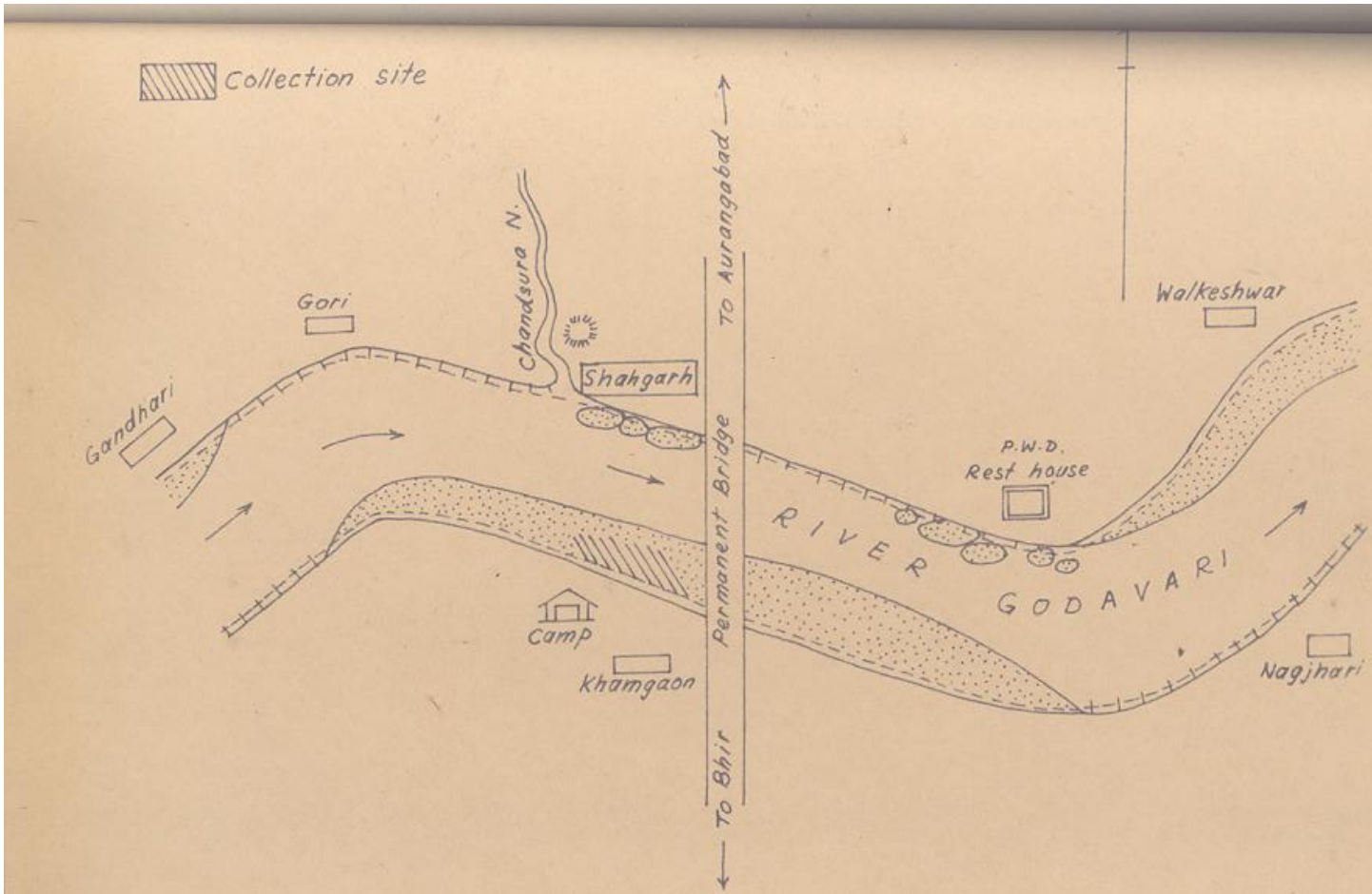

FIG. 15 THE COURSE, GENERAL TERRAIN AND TOPOGRAPHY OF RIVER GODAVARI AT SHAHGARH.

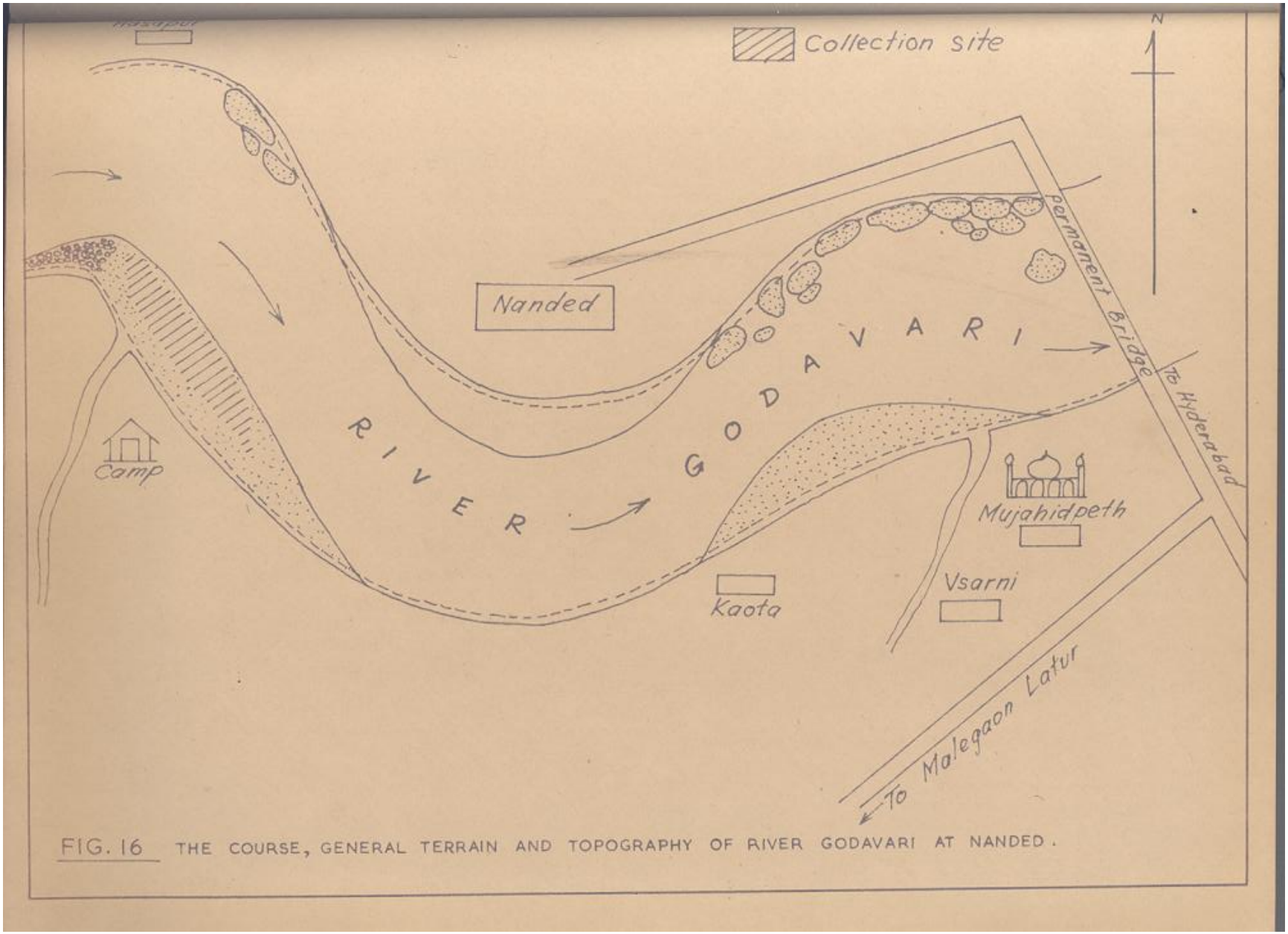

FIG. 16 THE COURSE, GENERAL TERRAIN AND TOPOGRAPHY OF RIVER GODAVARI AT NANDED.

Table - 7.15

Details of spawn spurts— occurrence, duration and quality in the Godavari at Paithan - Shahgarh centres

Flood details				Spawn spurt No.	Spurt duration		Associate catch in Nos.	Spawn desirability **	Total spawn catch in ml	Duration		Spawn Quality					
												Percentage composition by					
												Spawn analysis			Rearing ***		
No.	Phase	Duration From / No. of days	Peak Date / Flood level in metres		From Date / Hour	Period in hours				From Date / Hour	Period in hours	Major carps	Minor carps	Others	Major carps	Minor carps	Others
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
I	Ri	25.6.65 / 6	1.7.65 / 1.79	-			1288		N I L C A T C H								
	Re	1.7.65 / 9	-	-			1171		N I L C A T C H								
II	Ri	9.7.65 / 7	16.7.65 / 6.01	-			516		N I L C A T C H								
	Re	16.7.65 / 4	-	-			188		N I L C A T C H								
	Ri	20.7.65 / 1	22.7.65 / 3.43				37		N I L C A T C H								
	Re	22.7.65 / 6	-	-			89		N I L C A T C H								
III	Ri	27.7.65 / 3	31.7.65 / 7.45	-			24		N I L C A T C H								
	Re	31.7.65 / 13	-	-			407		N I L C A T C H								
IV	Ri	12.8.65 / 10	23.8.65 / 7.99	1	15.8.65 / 20	6	3142	U	102	15.8.65 / 20	6	-	95.9	4.1	-	62.5	37.5
	Re	23.8.65 / 13	-	-			1155		N I L C A T C H								
								Total D	N I L		0						
								Total U	102		6						
Total:		72				6	8017		102		6						

Contd.....

Contd. Table - 7.15

* Ri - Rising
Re - Receding

** U - Undesirable
D - Desirable

*** Rearing in plastic tub

Table - 7.16

Details of spawn spurts —occurrence, duration and quality in Godavari at Nanded

Flood details				Spawn spurt No.	Spurt duration		Associate catch in Nos.	Spawn desirability **	Total spawn catch in ml	Duration		Spawn Quality					
												Percentage composition by					
												Spawn analysis			Rearing		
No.	Phase *	Duration From / No.of days	Peak Date / Flood level in metres		From Date / Hour	Period in hours				From Date / Hour	Period in hours	Major carps	Minor carps	Others	Major carps	Minor carps	Others
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
I	Ri	1.7.65 / 3	4.7.65 / 2.86	-			511		N I L C A T C H								
	Re	4.7.65 / 7	-	-			118		N I L C A T C H								
II	Ri	10.7.65 / 8	18.7.65 / 5.86	-			1213		N I L C A T C H								
	Re	18.7.65 / 5	-	1	21.7.65 / 8	24	315	D	159	21.7.65 / 8	24	29.3	69.7	1.0			
	V	23.7.65 / 6	-	-			647		N I L C A T C H								
I	Ri	29.7.65 / 4	1.8.65 / 6.38	-			51		N I L C A T C H								
	Re	1.8.65 / 13	-	2	5.8.65 / 6	62	1483	D	336	5.8.65 / 6	44	24.6	64.9	0.5	@12.3	67.1	20.6
								U	63	8.8.65 / 6	18	2.4	97.4	0.2			
V	Ri	15.8.65 / 10	25.8.65 / 8.74	3	19.8.65 / 18	22	1348	D	368	19.8.65 / 18	12	12.2	87.0	0.8			
								U	452	20.8.65 / 6	10	7.6	91.3	1.1			
	Re	25.8.65 / 16	-	-			14566		N I L C A T C H								
							Total:	D	863		80						
							Total:	U	515		28						
Total		72				108	20252		1378		108						

Contd.....

Contd. Table - 7.16

* Ri - Rising
Re - Receding
V - Vacillation

** U - Undesirable
D - Desirable

@ C.catla - 12.3% C.mrigala - negligible

8 DISCUSSION ON THE EFFECTS OF HYDROGRAPHICAL AND AND ENVIRONMENTAL FACTORS ON CONCENTRATION OF QUALITY SPAWN

8.1 Flood phase and level

It was observed at all the investigated centres that sizeable spawn catches are encountered mostly associated with either the rising or receding phases of different floods in the season, the catch in the vacillation period being mostly negligible. With the very first rise of water level in the season, sometimes heavy catches are encountered, as was the case at Anwara on Yamuna, but these catches are made up of undesirable spawn. The desirable spawn is available mostly in the receding phase of different floods. In most of the rivers, during the rising phase of the floods, there are short spells of fall in water level, resulting in subsidiary peaks within a flood. These spells were also seen to contribute good catches of spawn. This fact was observed in Yamuna at Dhumanpura, in Rapti at Bansi and in Godavari at Nanded. During these investigations, only two vacillation periods were found to yield desirable spawn, one at Anwara on Yamuna and other at Dhundhua on Son. It is seen in Table 8.1 that the desirable spawn was available mostly in the receding phase except at Dhumanpura on Yamuna where a sizable quantity was collected in the rising phase.

Table 8.1 Percentage composition of desirable and undesirable spawn catch in different phases of floods at various centres

River	Centre	Desirable			Undesirable		
		Rising phase	Receding phase	Vicillation period	Rising phase	Receding phase	Vicillation period
Yamuna	Anwara	0.1	91.7	8.2	63.1	15.9	21.0
	Dhumanpura	62.8	37.2	0.0	84.8	15.2	0.0
Rapti	Bansi	0.1	99.9	0.0	0.0	100.0	0.0
Son	Dhundhua	10.3	88.2	1.5	1.5	62.9	35.6
	Dangwar	2.8	97.2	0.0	0.0	100.0	0.0
Khanua Kosi Dhar	Babuaghat	Nil	Nil	Nil	82.0	18.0	-
Godavari	Paithan	Nil	Nil	Nil	100.0	0.0	0.0
	Nanded	41.7	58.3	0.0	87.7	12.3	0.0

A detailed examination of the data collected at Dhumanpura shows that the burst which commenced in the receding spell of the rising phase of Flood II, did not cease at the termination of this spell but continued for 42 hours thereafter, when the water level rose by 1.42 m. It is likely that the spawn may have flown into the main stream with the receding spell and though discharge through flooded tributaries raised the level again, its availability was not affected. The only other site where sizable catch of desirable spawn came in the rising phase was Nanded. Here too a scrutiny of the data shows that though the catch was in the overall rising phase, actually the major part of this catch came within a few hours during a receding spell of water level.

It has also been found that availability of desirable spawn in the receding phase of a flood invariably has some dependence on the level attained by the flood at its peak. It might be safely assumed that the breeding grounds of major carps are situated at certain elevations and until and unless the floods touch those levels which inundate them, no sizable breeding takes place. On this hypothesis, it is necessary for the water level to fall to an extent which would drain out the breeding grounds resulting in the spawn to drift down and appear in nets at collection sites. If this fall is delayed, or in other words, the stationery period at flood peak is prolonged, it is natural to expect that the spawn would irregularly disperse itself widely resulting in negligible catch at the collection site. On the other hand, it is expected that if this rate of fall of the flood level is fast, the period of spawn availability will be comparatively reduced. In such cases the current velocity is bound to be high and its effect on the catching efficiency of nets assumes great importance. To examine the hypothesis postulated above, data of all the centres were analysed in detail and it has been found that a moderate rate of fall in flood level (about 1 to 2 cm/hour) commencing shortly after the attainment of peak, was conducive to high catches of desirable spawn. As each breeding ground has a specific elevation measured in terms of mean sea level and in that respect has a fixity about it, it is obviously difficult to pin point such levels in general for a river, vary as they do in their characteristics to terrain, catchment area and topography etc. However, an attempt has been made in table 8.2 to discern valid inferences for the sites prospected in 1965 in relation to the summer level of the river. For this purpose, only major bursts of desirable spawn have been reckoned. It is expected that for a river like Yamuna the breeding grounds perhaps lie at relatively higher elevations, as this river generally has very steep banks on both the sides in the stretches prospected. However, for rivers like Son and Rapti which have great expanses to inundate, even with slight rise in flood level, the breeding grounds of major carps may be

Table 8.2

River	Site	Desirable spawn burst (from major bursts only) Burst No.	Catch in ml	Percentage in total	Peak flood level attained before spawn appearance (in metres)	Flood level at the commencement of the burst (in metres)	Time elapsed from attainment of flood peak to spawn commencement (in hours)	Flood level at start of spell of bulk availability (in metres)	Rate of change of flood level during bulk spell or availability	Possible elevation of breeding grounds from summer level
Yamuna	Anwara	2	13,050	86.4	3.06	2.85	16	2.80	1 cm per hour	About 3 metres
	Dhumanpura	2	7,095	88.4	4.84	4.28	58	4.22	2 cm per hour	About 4.5 "
Rapti	Bansi	2	13,320	54.0	0.94	0.68	10	0.40	2 cm per hour	About 1 metre
		4	6,950	28.2	1.85	1.65	10	0.76	2 cm per hour	About 1 "
	Dhundhua	2	1,119	36.1	1.76	1.40	24	No bulk availability	1 cm per hour	About 1 "
		3	1,690	54.7	0.47	0.40	8	-do-	2 cm per hour	Less than 1 "
Son	Dangwar	1	1,262	10.6	2.38	0.80	66	-do-	1 cm per hour	About 1 metre
		2*	2,127	17.8	2.38	0.36	128	0.31	2 cm per hour	
		4	3,883	32.4	0.53	0.33	80	0.31	1 cm per hour	Less than 1 "
		6	4,054	34.0	0.66	0.64	4*	0.64	2 cm per hour	
Godavari	Nanded	2	336	38.8	6.38	3.59	74	No bulk spell	2.5 cm per hour	Above 6 metres
		3	368	42.8	3.28	2.80	22	2.64	2.5 cm per hour	Above 3 "

* This burst came shortly after the first had ceased

situated at lower elevations over their summer levels. Table 8.2 amply supports such a view. While in Yamuna it appears that important breeding grounds are located at elevations of about 3 to 4.5 metres from the summer level, in Son and Rapti, they are only about 1 metre higher than the summer level.

In the penninsular India, work was done in only one river viz., Godavari and it was inferred that important breeding grounds of available carps like C.catla, L.fimbriatus etc., are situated, near Nanded, about 4 metres above the summer water level.

8.2 Current velocity

Due to limitations of the method of measuring current velocity (by float method) night time observations could not be made. Further, every day observations on current velocity were made only at the investigation sites. The pattern of current velocity in a stretch of the river essentially affects the concentration of the drifting spawn. This effect can be elucidated only when the current pattern and discharge rates of the river are charted at various stages of floods. A limited study of current velocity at a site can at best reveal its effect on the catching efficiency of the shooting nets. This aspect is dealt with in chapter 9. The current velocities encountered during periods of spawn availability at the investigation sites varied from 0.9 to 3.8 km/hour and it may be mentioned that velocities lower than 1 km/hour are not conductive to collection of spawn in nets.

8.3 Turbidity

Turbidity does not appear to have any effect on concentration of desirable spawn at a site. Any apparent correlation of turbidity with the spawn catch is generally due to the factthat flood and current pattern play a vital part in spawn concentration at a site and turbidity is highly correlated with floods and even current. Turbidity, like current velocity, affects the catching efficiency of the nets, if at all, by clogging its mesh. This aspect of the study is mentioned in chapter 9.

8.4 Temperature-Air and Water

Temperature, air and water, doesnot appear to be directly correlated with the concentration of desirable spawn at a site. However, the pronounced effect of temperature on gonadial activity and the

stimulus it provides to breeding is well known. During the year under report, the monsoon was almost a complete failure, especially in the Ganga system in U.P., resulting in the occurrence of hot spells in mid-season when drought conditions prevailed. With the break of monsoon, the gonadial activity got the necessary stimulus, resulting in the availability of some major carp spawn in early floods of the season. This was probably generated from early breeders. Then followed the hot spells when air temperature ranged between 34°C to 39°C at the centres on Yamuna in U.P. as against 26-32°C in the pre-hot spell. Examination of gonads during this period of high temperature as well as the post-hot spell period revealed interesting results. It was found at both the centres on Yamuna as well as at Bansi on Rapti that mature females of major carps abound in late July or early August, soon after the first rains. But, with the advent of hot spells, in the monsoon, adult females showing resorbed gonads were encountered the frequency of which rose as the hot spell prolonged itself. An explanation for this phenomenon is found in the stage of maturity of the mid-season breeders, which produced the major share of the spawn in a season. These specimens attained maturity by the end of July or early August but the high temperature coupled with the lack of breeding opportunity and stimulus, which are believed to be imparted by floods, adversely affected the gonadial activity and caused the resorbtion process to set in. Once this process had set in, subsequent rains though did bring about floods during the late August, the major carp spawn was almost negligible in the catches (see Table 8.3).

In Son, the sizable catches of spawn came in middle and late August, true to expectation, as Son basin did not experience hot spells like the Yamuna or Rapti basins. The range of maximum air and water temperature observed at the centres on Yamuna and Rapti for the period of hot spell and those preceding and following it are presented in Table 8.3. Similar data for the Son basin for identical periods are also incorporated in this table for ready comparison.

8.5 Weather

Weather does not appear to have any direct correlation with the concentration of quality spawn at a site. However, it may be mentioned that overcast sky and/or little drizzle coupled with gentle wind, were generally found to be ideal for spawn collection. Heavy rains or stormy winds result in almost complete disappearance of spawn in the nets. This disappearance is possibly attributable to adverse effects on net operation and a temporary generation of disorderly current caused by such weather conditions.

Table 8.3 THE MAXIMUM TEMPERATURES DURING THE HOT SPELL PERIODS AND THOSE PRECEDING AND SUCCEEDING IT

	River centre		YAMUNA		RAPTI	SON*	
			Anwara	Dhumanpura	Bansi	Dhundhua	Dangwar
Pre-hot spell	Maximum temperature range (°C)	Water	28 - 31	29 - 31	29 - 32	28 - 34	27 - 34
		Air	26 - 32	28 - 31	27 - 35	28 - 34	29 - 34
Hot spell with no rain	Duration		6/8 to 23/8	5/8 to 23/8	6/8 to 23/8	6/8 to 23/8	6/8 to 23/8
	Maximum temperature range (°C)	Water	31 - 35	30 - 34	31 - 34	29 - 34	28 - 33
		Air	34 - 39	35 - 38	32 - 35	30 - 34	28 - 34
Post hot spell	Maximum temperature range (°C)	Water	29 - 32	29 - 32	29 - 32	28 - 35	30 - 33
		Air	29 - 33	27 - 33	29 - 33	29 - 35	29 - 34
	Desirable spawn yield in ml		25	430	0	295	4681
	% in total desirable spawn yield		0.2	5.3	0	3.0	58.9

* Though Son did not experience any hot spell within the season, the temperatures are given for identical periods for the sake of comparison, notwithstanding the fact that the break of monsoon is slightly earlier in the Son basin.

8.6 Associates

Species composition of two hourly samples of Associates, collected throughout the season at all the centres of investigations, was determined to find an indicator species, if any, which could forecast the appearance of major carp spawn. No such species could, however, be found. Associates constitute undesirable contaminants of the spawn. The process of repeated sieving for segregation of spawn is essential when the contamination by Associates is high. Repeated sieving injures spawn. The higher/quantity of Associates, the more is the expected loss of spawn due to injury in segregation.

The correlation of the relative abundances of spawn and Associates was also investigated. It was found that Associates were abundant from the onset of monsoon and dwindled thereafter to about nil at the end of the season. It is common experience that in normal seasons, the bulk of quality spawn appears associated with floods in the later half of the season. Breaking late in the season to start with, the monsoon, almost completely, failed in the year under report. Only the early floods yielded bulk of the season's desirable spawn in 1965 and with these catches there occurred a high abundance of Associates. However, by the middle of the season the Associates quantity when down but due to monsoon failure, only meagre quantity of pure quality, ready-to-pack, spawn was available. In a normal year these catches would have been much higher. However, the Son basin did not experience such an unusual monsoon as the others did and the pattern of pure spawn availability in the later half of the season was truly reflected therein.

9 EFFICIENCY OF NETS

9.1 Efficiency of nets supplied by Bihar Government

The State Government supplied, at all the three centres investigated in Bihar, departmental nets in vogue in that State for determination of their relative efficiencies vis-a-vis the standard net.

Two different types of nets were supplied by the State viz., the Jaunpur type and the Murshidabad type. While the Jaunpur type of net (the net type most commonly used by the State of Bihar) was supplied at all the three sites viz., Dhundhua and Dangwar on Son and Babuaghat on Khanua Kosi dhar, the Murshidabad type was supplied only at the latter. It may be remarked that the Murshidabad type of net is commonly used by the commercial fishermen in that area of Kosi. It has been stated earlier (see foot note page 5:1) that the dimensions of the supplied Jaunpur type of net varied from centre to centre though essentially they were of the same type. In view of their variable dimensions, the comparison of their catching efficiencies in relation to the standard net has been done independently for each centre.

These State nets were operated alongside the standard nets, taking care that their catch was not affected by relative position. This was done by randomly changing their positions within spurts. The spawn catches by the State nets were compared with those by the standard nets for identical periods of operation. The efficiencies of state nets were determined by taking the standard net to be of unit efficiency.

Constructional defects, such as there being no provision for creating height at the mouth and absence of split bamboo ring, were noticed in the Jaunpur type of nets, which resulted in their getting sagged while in operation and thereby affecting the flow of water into the net. High turbidities were seen to very adversely affect the catch as the net got clogged at its muslin gamcha resulting in greatly reduced filtration. Table 9.1 presents the net efficiencies observed at all the centres. The results are to be viewed within the limitations of the efficiency being dependent on hydrographical factors, because they determine the effective mesh size, on which depends the filtration rate.

Table 9.1 EFFICIENCY OF BIHAR NETS

Type of net	Centre	Flood No.	Spawn catch per net in ml		Floodwise efficiency	Pooled efficiency
			State net	Standard net		
Jaunpur type of net	Dhundhua on Son	I	8.3	51.0	0.16	
		II	30.7	269.2	0.11	
		III	23.7	398.4	0.06	0.06 or 6%
		IV	7.3	274.0	0.03	
		Post IV	Negligible	151.0		
	Dangwar on Son	I	10.2	658.7	0.016	
		II	7.8	541.5	0.014	0.01 or 1%
		III	3.8	774.5	0.005	
		IV	6.7	869.8	0.008	
		V	1.0	63.5	0.016	
	Babuaghat on Khauna Kosi dhar	I	120.0	750.0	0.16	0.16 or 16%
Murshidabad type of net	Babuaghat on Khanua Kosi dhar	II	70.0	150.0	0.47	0.47 or 47%

9.2 The effect of turbidity and current velocity on net efficiency with special reference to mesh size

It has been reported (C.I.F.R.I., 1965, p.128) that turbidity and current velocity affect the catching efficiency of nets. On logical considerations, it appears very probable that when current velocity is sufficiently high, hatchlings are prone to pass through the net if its mesh size is big enough. On the other hand, high turbidities are extremely likely to choke the meshes of a net, thereby reducing its effective mesh size which on the one hand reduces the filtration rate and on the other prevents the escape of the hatchlings. On these reasonings, it is obviously expected that some optimum combination of these two characters may be most conducive to collection of spawn in nets of a particular mesh size. To test these reasonings further and obtain an estimate of such optimum combination of these two characters may be most conducive to collection of spawn in nets of a particular mesh size. To test these reasonings further and obtain an estimate of such optimum combination of characters for a standard net, experiments were conducted at the centres investigated on the rivers Yamuna and Godavari. While at Paithan and Nanded on Godavari, Midnapore nets of 1/16" mesh were used against the standard net, at Anwara and Dhumanpura on Yamuna, a specially designed trouser type of net (see foot note page 5:1) was used.

Due to failure of monsoon and extremely low catches of spawn at the two centres on the river Godavari, the study was per force limited to just a few observations made in the brief durations of spawn availability. In as far as the effect of combination of turbidity and current velocity on net efficiency is concerned, some of the observations within the above stated limitations corroborated the tentative conclusions drawn last year (low velocity and high turbidity yield better catch in 1/8" meshed net than in 1/16th and vice versa) while certain others were at variance.

At the two centres on Yamuna, a trouser type of net was used to compare the catches by limbs made of 1/8" and 1/16" meshed material over combinations of turbidity and current velocity as encountered in the river. It was found that the catch in the two tails did not differ significantly over the range of turbidities and current velocity prevailing in river during the periods of operation of this net. These observations were also perforce reduced to very few as the spawn was available for a very short duration. The paired "t" - test criterion was used for testing the significance of the catches in the two types of tails of the trouser net at the two centres on Yamuna. The results are given in table 9.2.

Table 9.2 Test of significance of the mean catches taken by the two limbs of the trouser type net

Centre	Average catch per hour in ml		No. of observations	Cal 't'	Degrees of freedom	Inference
	1/8" tail	1/16" tail				
Anwara	5.3	4.98	20	1.11	19	Not significant
Dhumanpura	2.08	0.91	23	1.40	22	-do-

During the short period of observations, imposed by the failure of monsoon, many combinations of velocity and turbidity were not encountered and whatsoever were did not show any significant difference between the efficiencies of 1/8" and 1/16" meshed materials.

9.3 The effect of position of net on its catching efficiency

The position of a net in a river can be characterised by its distance from the bank and its operational depth, when operated at an optimum angle to the current. Another aspect of the position of a net is its relative position vis-a-vis the other nets in operation i.e. whether it is the formost in a column or in one of the positions behind, or whether it is nearest to bank or in one of the positions farther in a row. Both these aspects of the positions were examined in detail at all the centres. The results differed from river to river.

At the centres on Godavari, it was seen that when operated in a column, the formost net invariably caught more than those behind it.

At the centres prospected on Son and Rapti, it was found that depth of water had an effect on the spawn catch. Nets in shallow water caught more than those in deep water. Nets nearer the bank were seen to catch more than those far away. Their relative position did not appear to have any effect on quantity of spawn catch.

The data collected at Yamuna centres was subjected to more rigorous statistical tests. The effect of depth or distance were tested by building up regression coefficients from analysis of covariance

tables. Neither distance from bank nor operational depth were found to significantly effect the catch over the range of distances and depthsexamined.

The effect of relative position was tested by using Fisher's 'F' test criterion after eliminating the distance and depth regressions. No significant effect could be established. The b - values and the 'F' - test are given in Table 9.3.

Table 9.3 Test of significance of regressions of depth and distance on the spawn catch and mean catches at different positions

Centres	Partial regression coefficient b 12.3*	b 13.2*	Significance	Cal 'F' for position effect	d.f.	Inference
Anwara	0.1036	0.0526	both n.s.	2.78	4, 76	n.s.
Dhumanpura	0.1293	0.0841	both n.s.	2.63	4, 72	n.s.

* b 12.3 is the partial coefficient between spawn catch and distance after eliminating depth effect, and

b 13.2 is the partial coefficient between spawn catch and depth after eliminating distance effect.

Because of heavy computational labour involved, a more rigorous statistical analysis was done only on the data collected at centres on Yamuna and it is likely that the apparent significance suggested by the data, at other centres prospected and mentioned earlier in this section, may not be found really to be so if tested rigorously by statistical techniques.

9.4 The effect of size of net on its catching efficiency

Towards devising a more economic gear than the standard net, it is necessary to experiment with different sizes and shapes of gears. The experience of 1964 investigations was that the shape of the standard net as well as its mesh size viz., 1/8" were fairly good. The first attempt at examining the effect of net size on its efficiency, by using the same material as used in the standard net and

maintaining the same shape, was made in 1965. A net called here "a research net", was designed by this Substation, to test its efficiency against the standard net (Sec. 5.1). The research net was made with half the material required for preparing a standard net. If the efficiency of this net compares favourably with that of the standard then, with its advantages of reduced size and cost, it can be called a great leap forward towards devising of a more economic and potential gear for use in commercial exploitation of spawn resources.

Two research nets were operated alongside the standard nets during the periods of bulk availability of spawn at both the centres on Yamuna.

As no positional effect could be established, the catches in these nets were directly compard with those in standard nets for determination of their efficiency. It was found that the spawn catches by Research nets did not differ significantly from those by standard nets for identical periods of time in parallel operation. While for the data collected at Anwara in 30 observations on July 22, 23 and 28 and August 6, paired 't' - test criterion was used to test the significance of difference, yielding a non-significant 't' value of 0.8 on 29 d.f., for the data collected at Dhumanpura on two days viz., August 4 and 5, the equality of means, using the 't' test criterion, was tested which gave the following results.

Table 9.4 The test for equality of mean catches in Standard and Research nets at Dhumanpura

Date	Mean two hourly catches in ml		Cal 't'	d.f.	Inference
	Standard net	Research net			
4.8.'65	86.0	117.5	1.8	22	Not significant
5.8.'65	20.2	16.7	1.0	22	-do-

It is therefore concluded that the Research net may prove efficient when compared to the standard net. These observations, made in a year of scanty rains and low floods, need further corroboration in a fuller measure by using nets of about half a dozen different sizes. These experiments are planned in the year 1966. It is also proposed to vary the shape of nets by attachment of wings.

10 TRAINING OF STATE GOVERNMENT PERSONNEL AND LOCAL FISHERMEN

To acquaint the State Government personnel with scientific techniques of spawn collection comprising selection of a suitable spot, method of fixing nets and scooping catch therefrom, method of sieving which would segregate desirable spawn without injuring it, the manner of storing live spawn awaiting transport etc., the State Governments collaborating in these investigations were requested to depute as many technical workers and fishermen as possible to the sites of investigations.

Seven technical officers and two fishermen of the Fisheries Department of Uttar Pradesh, ten technical officers and four fishermen of the Fisheries Department of Bihar and two technical officers of the Fisheries Department of Maharashtra were trained in the year 1965.

Towards the goal of extension of scientific techniques, local fishermen and other interested parties were trained in various aspects of spawn collection work. To encourage the spawn collection and induce local populace to take to it, the labourers required for these investigations were drawn only from the villages close to the sites. It was taken care of at each site that these labourers, while earning for themselves, picked up the techniques sufficiently well to apply themselves independently to the occupation of fish spawn collection and then raising it in nurseries. Eleven contingent labourers in Uttar Pradesh, fifteen in Bihar and four in Maharashtra in addition to a score of other interested parties were trained fully in the 1965 investigations to that end.

SUMMARY

(i) Six riverine stretches, two of Son and one of Khanua Kosi Dhar in Bihar, two of Yamuna and one of Rapti in U.P. and two sites on Godavari in Maharashtra were prospected in 1965.

(ii) After a premonsoon survey detailed investigations were conducted at eight sites viz., Anwara and Dhumanpura on Yamuna, Bansi on Rapti, Babnaghat on Khanua Kosi Dhar, Dhundhua and Dangwar on Son and Paithan and Nanded on Godavari.

(iii) Round the clock two hourly observations were recorded at every investigated site on Spawn and Associate catch in each net along with the operational depth and distance from the bank, flood level, air and water temperature and weather condition. Current direction, water velocity and turbidity were similarly recorded but only between 6 A.M. and 6 P.M.

(iv) Single trial net operation was done to test the availability of spawn (1 ml/net/hour), which when found to occur, all suitable sites nearabout were examined for highest yield and the full battery of nets was operated at best indicated site.

(v) At Anwara on Yamuna, spawn was available in six spurts lasting for 280 hours. The catch of desirable spawn, made in 104 hours, was 15,102 ml which formed 40.7% of the total yield. Spurts 2, 3 and 4 yielded 99.8% of the total desirable spawn yield.

(vi) At Dhumanpura on Yamuna, the spawn occurred in four spurts which yielded 8,017 ml of desirable spawn in 176 hours forming 92.6% of the total yield made in 204 hours. Spurts 1 and 2 were major in character yielding 94.5% of the total desirable spawn yield.

(vii) 24,668 ml of desirable spawn was harvested in 416 hours in six spurts at Bansi on Rapti of which 82.3% was collected in spurts 2 and 4. The desirable spawn yield at the site formed 72.9% of the total spawn yield which was collected in 560 hours.

(viii) Five spawn spurts lasting 364 hours, observed at Dhundhua on Son, yielded 53.9% desirable spawn collected in 178 hours amounting in quantity to 3,111 ml. Spurts 2 and 3 were the important ones producing 90.8% of the total yield of desirable spawn.

(ix) At Dangwar on Son seven spurts spread over 208 hours were experienced producing 11,953 ml of desirable spawn in 178 hours. The desirable spawn yield which accounted for 82.1% of the total at the site was almost wholly collected in spurts 2, 4 and 6.

(x) The Khanua Kosi Dhar worked at Babuaghat site gave only undesirable spawn in two spurts. 1% major carp content in a total yield of 4820 ml of spawn was found. The possible effects on breeding of the construction of Kosi embankments and poor flooding due to scanty rains need further examination.

(xi) The upper stretch of Godavari is bereft of major carp populations as was found at Paithan/Shahgarh where only 102 ml of undesirable spawn was obtained comprising a pooled 37.5% Barbus tor, L.fimbriatus and L.porcellus.

(xii) 863 ml of desirable spawn was collected in three spawn spurts at Nanded on Godavari. This catch accounted for 63.1% of the total spawn yield of the site. Here too, L.fimbriatus (35.6%) dominated, the reared samples followed by C.catla (12.3%) being the only major carp available.

(xiii) The quantitative and qualitative indices of spawn were built up for each site and found to be as follows :

River	Site	Index of quantity	Index of quality		
			Major carps	Minor carps	Others
1	2	3	4	5	6
Yamuna	Anwara	3493 ml	81.0%	19.0%	0.0%
Yamuna	Dhumanpura	2200 ml	35.0%	24.0%	41.0%
Rapti	Bansi	4715 ml	77.7%	21.6%	0.7%

1	2	3	4	5	6
Son	Dhundhua	637 ml	3.5%	94.9%	1.5%
Son	Dangwar	2417 ml	25.2%	74.8%	0.0%
Khanua Kosi Dhar	Babuaghat	-	-	-	-
Godavari	Paithan Shahgarh	-	-	-	-
Godavari	Nanded	215 ml	12.3%	67.1%	20.6%

(xiv) High quantities of desirable spawn were encountered only in receding phases of floods. Moderate rate of fall commencing shortly after the attainment of peak was found most conducive for high catch. Though each breeding ground has a specific height in relation of M.S.L., their elevation relative to summer levels of the river only could be discerned. While in Yamuna 3 to 4.5 metres of flooding was felt necessary for inundation and utility of breeding grounds, in Rapti and Son only 1 metre rise in flood level was inferred to be sufficient for the purpose.

(xv) Current velocities ranged between 0.9 to 3.8 km/hour at the collection sites. Extremely low velocities (less than 1 km/hour) were found unfavourable for spawn collection.

(xvi) Turbidity was not found to effect the concentration of quality spawn, though it affected the catching efficiency of gears.

(xvii) Temperature did not show any direct effect on spawn concentration at a site though its effect on breeding success did affect the spawn availability. The mid-season hot spell in U.P. when monsoon completely failed resulted in resorbtion of matore gonads of carps in Yamuna and Rapti.

(xviii) Gentle weather with a slight drizzle was favourable for collection of quality spawn.

(xix) No indicator species amongst Associates could be found anywhere that could fortell appearance of desirable spawn. Associate abundance was seen to damage spawn in segregation process.

(xx) Jaunpur type of nets, supplied by the State of Bihar were found to be only 5% efficient at Dhundhua, 1% at Dangwar and 16% at Babuaghat. The Murshidabad type of net tested at Babuaghat, was found to be 47% efficient. The shortness of height at mouth and absence of ring in Jaunpur type of net were felt to be the reasons of their poor efficiency.

(xxi) Low velocities and high turbidities were seen to yield better catches in 1/8" meshed nets than in 1/16" meshed nets at centres on Godavari confirming the 1964 observations, though some observation were at variance.

(xxii) Trouser type of nets with limbs of 1/8" and 1/16" meshed material operated at Yamuna centres yielded no sifnificant difference in catches by both limbs when tested statistically.

(xxiii) The effect of depth and distance from bank on spawn catch was felt significant at some sites, though rigid statistical tests of partial regression coefficients on data collected at centres on Yamuna yielded non-significant results over the range examined.

(xxiv) The relative position of a net has been found to be not affecting spawn catch when tested statistically on the data of Yamuna centres.

(xxv) A research net, specially designed with half the material required for a standard net, was found to be equally efficient as the latter. Further testing is necessary to draw acceptable conclusions on most efficient net size.

(xxvi) Many technical officers of the State Governments and private interested fishermen were trained in the technique of spawn collection and transport.

APPENDIX 1

SPAWN PROSPECTING INVESTIGATIONS

Proforma for Pre-Monsoon Survey*

ADMINISTRATIVE

a. Name of the River _____ b. Drainage _____
Name of the Village _____ 3. District _____
Tehsil/Taluka _____ 5. Police Station _____
C.D. Block _____ H.Q. _____ Distance _____ km

	Name	Distance	Frequency of delivery or Hour of operation
Nearest Post Office	_____	____ km	_____
" Telegraph Office	_____	____ km	_____
" Telephone Office	_____	____ km	_____

Nearest (i) Railway station _____ on ____ Rly. Distance ____ km
(ii) All-weather road at _____ Distance ____ km
(iii) Fairweather road at _____ Distance ____ km

Camping space available at (1) _____ Distance ____ km

Field Lab. accommodation at _____ Distance ____ km

**Likely minimum rent p.m. for (i) Field laboratory accommodation ____
(ii) Camping space _____

Availability of general amenities (i) Drinking water _____
(ii) Market _____
(iii) Medical _____

---

* All distances are to be given from the proposed or likely sites of operation.

* This should be assessed or enquired indirectly rather than openly. An open enquiry raises monetary hopes amongst villagers which should be avoided.

B: TECHNICAL

12. Confluences of Rivers, upstream and downstream.

River	Confluence at	Distance	Up/Down

13. Location of Dams/Weirs/Anicuts on the River

Name	Location	Distance	Upstream	Downstream

14. Position and distance of fixed engines, if any _____

15. Kind of terrain (Rocky/sandy/clay)
(i) Locally _____ (ii) Catchment area _____

16. Highest flood level known in the area (i) Height _____ (ii) Year _____

17. (i) Average annual Rainfall in the locality _____
(ii) Usual time of onset of monsoons _____

18. Species-wise quantitative analysis of fish catches either from area near the site or from the river in general _____

19. Location of major carps' congregation centres in areas inundated during Monsoon 1 _____ 2 _____ 3 _____
4 _____ 5 _____ 6 _____

20. Nature of the river bank near collection site _____

21. Location and distances of deep pools _____

. Extent of area available for operation of nets in relation to floods

Flood rise from summer level	Approximate week of flood	Area available at site for Operation of nets with number	Camping	Approachability by land

23. Availability of pits/ditches/ponds for experimental rearing near site

Sl. No.	Location	Size	Distance	Whether Freehold or lease	Whether Ready for use	Chances of flooding/ overflowing

24. Whether fishermen will be available locally for casual employment during monsoon period _____

25. A diagram showing the general topography of the river 8 km up and down streams of the site, location of Nallahs, rivulets with their names (and important land maps) should be prepared separately on a foolscap size paper and attached to this proforma. The locations of sites entered under items 20, 22, 23 and 24 should also be shown in this diagram.

Surveyor _____

Date of survey _____

APPENDIX 2

Name of River _____

Spawn Prospecting Survey

Proforma No.1 (65)

Name of Centre _____

Positional Identity of Nets

Date _____ 196 .

Net No.1 (N_1)				Net No.2 (N_2)			Net No.3 (N_3)			Net No.4 (N_4)			Net No.5 (N_5)			Remarks if any
Hour of observations	Distance from bank in m	Operational depth in m.	Relative position (coded)	Distance from bank in m	Operational depth in m	Relative position (coded)	Distance from bank in m	Operational depth in m	Relative position (coded)	Distance from bank in m	Operational depth in m	Relative position (coded)	Distance from bank in m	Operational depth in m	Relative position (coded)	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

APPENDIX - 3

Instructions for filling proformae of spawn prospecting survey

Proforma No.1/65 (Positional Identity of Nets)

(a) Distance of different nets (N_1-N_5) from bank (Col.Nos. 3, 5, 8, 11 and 14). Shortest distance between the water mark on the bank and the farthest pole of the net to be recorded in metric measure for each net.

(b) Operational depth of different nets (N_1-N_5) (Col.Nos.3, 6, 9, 12 and 15)..Water depth at the farthest pole of each net i.e. from the water mark on the pole of river bed to be recorded in metric measure for each net.

(c) Relative position of different nets (N_1-N_5) (Col.Nos.4, 7, 10, 13 and 16):- Nets may be operated in rows, and each row may have one or more than one net. First identify the rows; i.e., the first row facing the current may be called row 'A', the one behind as row 'B' the one behind row 'B' as row 'C' and so on. Thereafter, different nets of the rows are to be identified. The net closest to the bank may be called net '1' and the next net in the same row, when fixed abreast, as net '2' and so on for each row. Thus, the net closest to the bank in the first row facing the current will be termed as net 'A_1' and the next abreast to 'A_1' in the same row as 'A_2'. The net close to the bank in the second row would have the identity number as 'B_1' and the one next to it in the same row as 'B_2'. Where all the five nets are fixed one behind the other, the first net facing the current would be termed as 'A_1', the one behind it as 'B_1' and so on, and the last one will be net 'E_1'. Three hypothetical positions (I-III), illustrating the coding of the positional identify of nets, are shown in Figure 1.

(d) In cases, where, for some reason or other, net-wise catches are not possible to be individually recorded the pooled catches of Midnapore nets or other similar nets should be shown along with the number of nets operated. Such an eventualityvshould, however, be an exception rather than the rule.