Government of the Peoples Republic of Bangladesh
Flood Action Plan

FAP 17

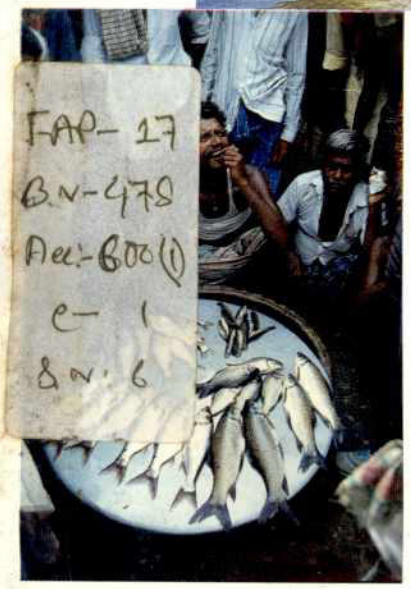
Fisheries Studies and Pilot Project

FINAL REPORT

(Draft)

JUNE 1994

Supporting Volume No. 5



FISHERIES STUDY

THE REGULATED BARAL RIVER

ODA
Overseas Development Administration, U.K.

FAP 17

FINAL REPORT

SUPPORTING VOLUME NO. 5

** Draft **

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FAP 17
FISHERIES STUDIES
AND PILOT PROJECT

June, 1994

Funded by ODA in conjunction with the Government of Bangladesh

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PREFACE

The Fisheries Studies and Pilot Project (FAP 17) was funded by the British Overseas Development Administration (ODA) in conjunction with the government of Bangladesh. The national implementing agency for the Fisheries Studies was the Department of Fisheries of the Ministry of Fisheries and Livestock. FAP 17 also reported to the Flood Plan Coordination Organisation of the Ministry of Water Resources. The project was one of a number of supporting studies of a broader programme known as the Flood Action Plan (FAP) of Bangladesh. The FAP consisted of a series of eleven major engineering studies, five of which comprised separate regional studies which aimed to identify feasible large-scale flood control and drainage projects through which it would be possible to regulate the extent of flooding during the monsoon. The engineering components were supported by a range of complementary studies several of which were designed to address various social and environmental impacts which were anticipated to result from large-scale flood control.

FAP 17 was designed to address issues relating to fisheries and aimed to collect, analyse and interpret information on which to make predictions of the impacts of the planned flood control action upon the inland capture fisheries of Bangladesh. To do this, quantitative baseline fisheries and socioeconomic data were collected from inside and outside a range of different types of flood control projects in four regions of the country.

A total of eight FCD/I projects was studied and the results of each study were documented in a series of Supporting Volumes (Fisheries Studies) of the project Draft Final Report (see list of reports on page vi). Three further fisheries studies were completed one of which described the fisheries of the main rivers Jamuna and Padma (Supporting Volume No. 10) and the other two investigated the movements of a) adult and juvenile fish and b) fish hatchlings in regulated and unregulated rivers and assessed the impact of regulators on these movements (Supporting Volume Nos. 5 and 11). A parallel set of socioeconomic studies was carried out and the results documented in seven village study reports (Supporting Volumes 12-18). In addition to the fisheries and village studies, several special studies, mainly desk studies, were completed during the course of the project. These provided background information on fish, the environment and socioeconomics (Supporting Volumes No. 19-28). Several of these studies have been documented previously as annexes to the FAP 17 Interim Report. However, to ensure wider circulation they were also included as part of the Draft Final Report.

One extremely important output from the FAP 17 study was the establishment of a detailed and comprehensive fisheries database which provides quantitative baseline information on inland fish resources and fisheries in Bangladesh. Fisheries and socioeconomic databases were submitted to the Government of Bangladesh through the Flood Plan Co-ordination Organisation of the Ministry of Water Resources and the Department of Fisheries in the Ministry of Fisheries and Livestock. Documentation of each database was included as Appendices 1 and 2 of the Draft Final Report.

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The present report is one of a series of eight fisheries studies which form part of the Supporting Volumes to the Draft Final Report. The principal objectives of the supporting studies are listed below.

1) Evaluation of the effects of different flood control measures on the production of fisheries.
2) Evaluation of the effects of different flood control measures on the movement and population of fish.
3) Assessment of the feasibility of technical and developmental measures to compensate for or reduce potential losses to fisheries due to flood control.

Descriptions of the methods employed for field data collection, laboratory studies and analyses of data are provided in the FAP 17 Inception and Interim Reports and are presented again with some additions in Appendix 3 of the Draft Final Report.

Two taxonomic guides were used for the identification of fish found during this study. The first was Rahman, A. K. A. 1989, Freshwater Fishes of Bangladesh, published by the Zoological Society of Bangladesh. The second was Talwar, P. K. and Jhingran, A. G. 1991, Inland Fishes of India and Adjacent Countries, Vols. 1 and 2, published by Oxford and IBM Publishing Co. Ltd. The more recent guide was used to provide a systematic listing of the scientific names of fish. However, the guide by Rahman was used more widely by fisheries biologists and all Bengali names of fish used in the present report were derived from this guide. The FAP 17 database also provides comprehensive lists of local names of fish collected in each region studied.

The term "species diversity" was used in this report in its simplest sense to denote the total number of different species of fish recorded at each site. The numbers of species recorded were dependent on the sampling effort deployed. No doubt more species would have been recorded had more sites or gear units been sampled more often using larger sub-samples of catches. All species recorded were divided into three categories of habitat preference: riverine, migratory and floodplain residents based on distributions identified using the complete FAP 17 database. The categorisations should be regarded as provisional only. As more knowledge is gained of the ecology and behaviour of individual fish and prawn species in Bangladesh more accurate revisions to the list will be needed.

Local names of gears were used throughout the report despite considerable geographical differences in names used in Bangladesh. A list of all gears recorded by FAP 17, with local and English names and a brief description of each is provided as an appendix to this report.

The source of all tables and figures presented in this report, unless otherwise stated, is from data collected by FAP 17 fisheries surveys.

ACKNOWLEDGEMENTS

This report is based on the concerted efforts of a large number of people whose responsibilities covered field data collection, administrative support, entry of data into computers, management of databases, analyses and interpretation of results and report preparation.

Under the guidance of a senior fisheries supervisor, fisheries biologists, directly recruited by the project or provided through temporary employment by the Department of Fisheries, were responsible for the collection of fisheries, hydrological and limnological data. Field survey schedules required the team to monitor fishing activities from dawn to dusk, 12 hours each day with additional surveys carried out before dawn to monitor night fishing. That the team accomplished their objectives despite arduous working conditions and long, unsocial hours of work warrants the highest recognition and is a credit to both the team and the senior fisheries supervisor who was responsible for maintaining not only discipline and high quality survey work but also team morale. The achievements of the FAP 17 fisheries survey teams demonstrated that it is possible in Bangladesh to obtain detailed quantitative fisheries appraisals based on the direct monitoring of fishermens' activities on water.

Administrative support staff and computer operators both in the field station and in Dhaka headquarters were responsible for the smooth running of the field programme and ensured that data were entered into the database promptly and accurately.

Mr. Asaf Hussain, senior computer programmer, was responsible for database management and programming and worked closely with Drs. James Scullion and Bernadette McCarton on data analyses. Fisheries resource assessment specialists, Professor John Beddington and Dr. Geoffrey Kirkwood of the Marine Resource Assessment Group, Imperial College, London, UK advised on the statistical methods for the analysis of catch rates of gears which formed the basis of comparisons of fish catches inside and outside the flood control project.

Mr. Goutam Chandra Dhar, computer specialist, together with a small team in Dhaka were responsible for the preparation of the report.

Personnel contributing to the production of this report are listed below:

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ABBREVIATIONS AND ACRONYMS

BWDB	Bangladesh Water Development Board
CPUA	Catch Per Unit Area
FAP 17	Flood Action Plan Study No. 17 (Fisheries Studies and Pilot Project)
FRI	Fisheries Research Institute
NC	North Central
NW	North West
ODA	Overseas Development Administration (UK)
PIRDP	Pabna Irrigation and Rural Development Project
PWD	Public Works Datum (water level)
SW	South West

UNITS OF MEASURE

ft.	feet
g	gram
ha	hectare
kg	kilogram
km	kilometre
m	metre

SUMMARY

1. The Baral River is a seasonal distributary of the Padma River. From its offtake point on the Padma located 15 km downstream from Rajshahi in the North West Region of Bangladesh, it flows eastwards for 85 km to join the Atrai which in turn flows into the Jamuna River. Since 1983 the flow of the Baral has been controlled by Charghat regulator situated on the offtake point with the Padma.

2. Since the river connects the Jamuna and Padma systems it was considered as a potentially significant migration route for fish and was selected for study by FAP 17 to assess the impact of the regulator on movements of fish. These were identified from spatial and temporal variations in fish distributions in fishermens' catches at sampling sites on the Padma, Baral and Atrai rivers. The site on the Baral extended from Charghat regulator for a distance of 19 km downstream.

3. The regulator has three undershot vertical lift gates that usually remained partially open throughout the period of hydraulic connection with the Padma which ranged from June or July to November. Gate openings were adjusted so that the downstream water levels rarely exceeded 14.5 m PWD. This resulted in peak flood level reductions ranging from 1.5 m to 4.0 m between years, fewer and less rapid seasonal fluctuations in flood levels and a reduction in the extent and depth of flooding on lower-lying floodplains in the eastern part of the Baral basin.

4. Species composition of catches from the Baral, Padma and Atrai revealed that fish entered the Baral from the Padma by crossing the regulator during the monsoon and from the Atrai by upstream migration. The regulator had little impact on species diversity in the Baral. The annual total number of fish species found in catches from the Baral was 86 compared with 81 in the Padma and 96 to 98 in the Atrai.

5. Although the gates of the regulator remained partially open throughout the monsoon, allowing fish to enter the Baral, the high water velocities and turbulence caused by water level differences across the structure created a barrier to the movement of upstream migrating fish and increased their susceptibility to capture. Even when there was little or no difference in water levels, the presence of the structure and its funnelling effect on fish increased the chances of capture by gears operating on the gates.

6. On the downstream walls of regulator a variety of hand-held scoop nets (*hat tana*) exploited upstream migrating fish. A total of 41 species of fish was captured by *hat tana* between July and October 1993, of which 33 species were migratory or riverine types. The principal target species was *ilish* which undertook an upstream spawning migration from the Bay of Bengal along the Padma, Jamuna and Atrai rivers between June and September. *Ilish* arrived in the Baral from the Atrai in July and comprised the bulk of the total river catch between August and September. Two other gears, *shangla jal* and *hat bauli* operating from boats, specifically targeted *ilish* immediately downstream of the regulator. The catch per unit area of *ilish* in September was 64 kg/ha, this was the highest catch rate recorded in any river and was caused by the blockage to upstream passage and concentration of fish in the downstream vicinity of the regulator.

7. Other relatively abundant species blocked whilst moving upstream and captured at the regulator by *hat tana* comprised the carps, *rui*, *catla*, *mrigel* and *raik*, large catfish *boal* and *shillong* and smaller species such *telchitta* and *kajuli*. Whilst most species were captured as adults or juveniles of at least one year old, for species such as *shillong*, *boal* and *mrigel*, fry and juveniles under one year old were also blocked by the regulator.

8. The effects of the regulator on the downstream passive drift of newly hatched fish was the subject of an independent study (Draft Final Report, Supporting Volume No. 11). The principal conclusion from that study was that the regulator significantly reduced the downstream supply of fish hatchlings and that the reductions were related directly to water level differences across the structure. It seems likely that these very young fish were more vulnerable to large, rapid changes in pressure induced by water level differences across the regulator.

9. The catch per unit area (CPUA) of the Baral (250 kg/ha) was 14% lower than that in the adjacent Atrai (291 kg/ha). However, much of the Baral catch resulted from the obstruction by the regulator to upstream passage of *ilish* and many other migratory and riverine species and their consequent capture by *hat tana*, *hat bauli* and *shangla jal*. Omitting these from catch estimates resulted in a CPUA of 129 kg/ha, 56% lower than that from the Atrai.

10. The construction of Charghat regulator on the Baral resulted in substantial changes in fishing methods and catch composition. *Ilish* was the most abundant species by weight in the Baral, comprising 40% of the annual catch compared with less than 3% in adjacent sites on the Padma and Atrai rivers. The next most abundant species included *ayre*, *rui* and *catla* all of which were blocked at Charghat regulator during upstream migrations. Floodplain resident species were considerably less abundant in the Baral than the Atrai. This was due not only to reduced peak flooding caused by regulation but also to the higher elevations of the upper catchment of the Baral which would be expected to support lower fish populations.

11. Two mitigation measures were recommended to increase the safe upstream passage of fish across Charghat regulator. The first involved the establishment of a prohibited fishing zone on the regulator itself and for a distance of 1 km downstream. The second involved improvement in gate operations to reduce water level differences whilst remaining within an agreed maximum regulated level of flow. These measures required no changes in structural design or construction work on the regulator. Additional mitigation measures were suggested for implementation on a broad national basis. Areas of work which required further research were identified.

12. The proposal by BWDB to construct a second regulator on the Baral River, 50 km downstream from Charghat without first completing detailed and comprehensive social and environmental impact assessments, is a retrograde step with regard to the current concept of integrated water management emanating from the Flood Action Plan of Bangladesh.

THE REGULATED BARAL RIVER

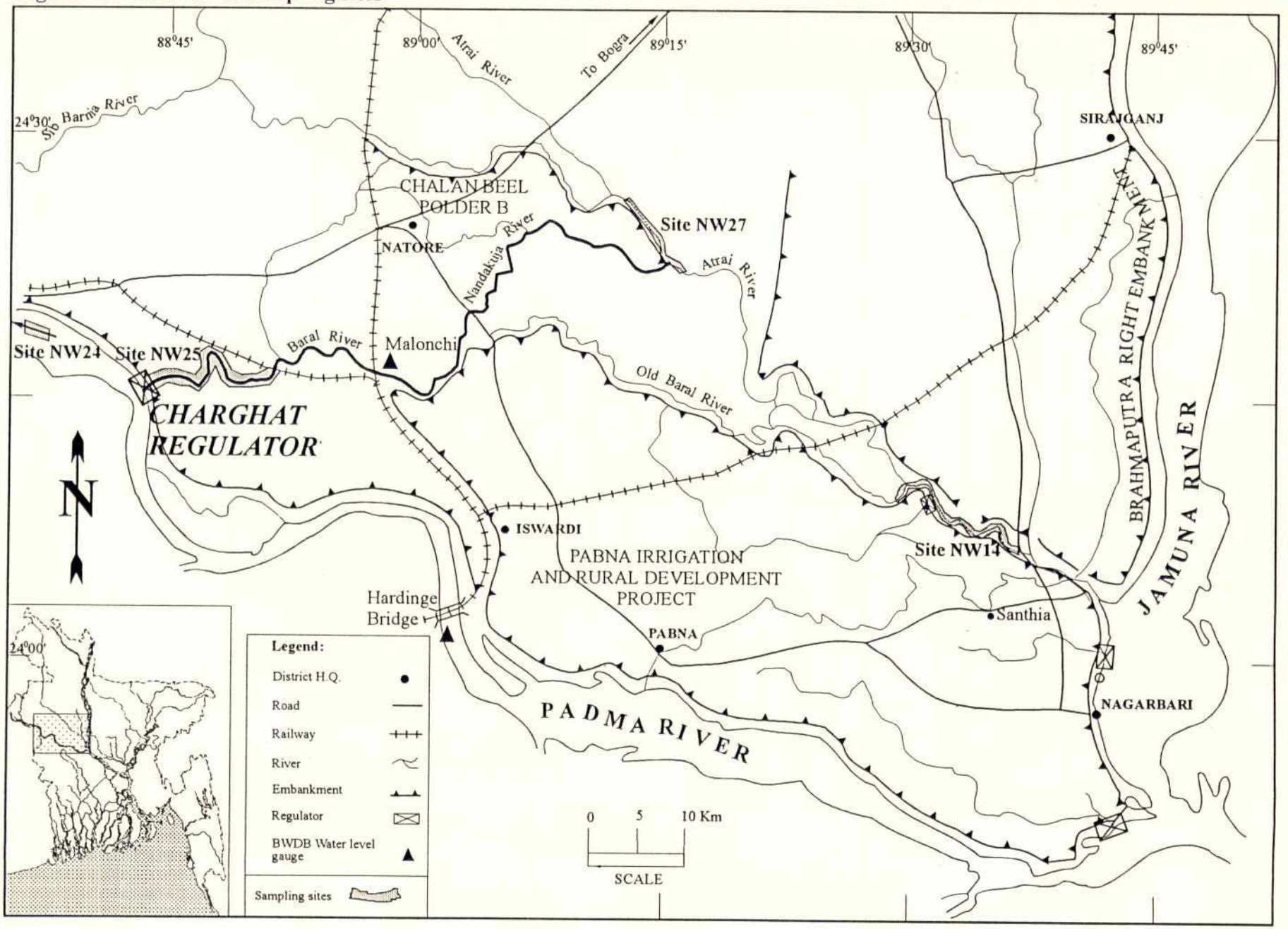
1 STUDY AREA: BACKGROUND

The Baral River is a distributary of the Padma River located approximately 15 km to the east of Rajshahi in the North West Region of Bangladesh (Fig. 1.1). The river flows eastwards for about 85 km with most flow following the Nandakuja River which joins the Atrai River at Gurudaspur. The Atrai then flows southeast into the Jamuna. The original course of the Baral followed a more southeasterly route of the "dead" Baral which flowed through extensive lower-lying floodplains. This course dried up long before the construction of Charghat regulator and is shown on the topographical map of 1967 as a dried course of the "Mara Baral", the dead Baral.

In 1983 a regulator was constructed on the Baral at Charghat, about 0.5-1.0 km downstream of its offtake point from the Padma. The purpose of the regulator was to provide flood protection along the extensive floodplains of the river. This was achieved so effectively that it obviated the need to construct further flood protection embankments along its length to prevent overland flooding into the area of the Pabna Irrigation and Rural Development Project (PIRDP).

Since the river served as an important connection between the Padma and Jamuna rivers, it was considered to be a potentially significant migration route for fish and was selected for study by FAP 17 to assess the impact of the regulator on movements of fish. Migration was expected to occur in two directions: upstream movements by adults and possibly juveniles from the Jamuna and Atrai systems along the Baral to the Padma and downstream movements from the Padma into the Baral by both adult fish and hatchlings. Movements of adult fish were identified from seasonal changes in species distributions in the Baral and its linking rivers, the Padma and Atrai. Movements of fish hatchlings by downstream passive drift across the regulator were examined in an independent study and results are reported separately (Draft Final Report, Supporting Volume No. 11). A detailed review of the use of passes and water regulators to allow movements of fish through flood control embankments is provided in the FAP 17 Draft Final Report, Supporting Volume No. 23.

Figure 1.1 Location of sampling sites



2 SAMPLING SITES

Sites on the regulated Baral and the unregulated Padma and Atrai rivers were monitored at fortnightly intervals from October 1992 to February 1994 using sampling methods described in the FAP 17 Inception and Interim Reports.

Table 2.1 Description of sampling sites

Site code	Site name	Regulated Yes/No	Length (km)	Area (ha)
NW25	Baral	Yes	18.90	65
NW24	Padma	No	2.50	641
NW27	Atrai	No	12.65	87
NW14	Baral/Atrai	No	14.00	177

One site was selected on the Baral (NW25) covering a distance of 19 km downstream from its starting point at Charghat regulator (Fig. 1.1). A second site was selected on the Padma River (NW24), opposite Rajshahi, 15 km upstream from Charghat. Two further sites were selected on the Atrai, one crossing the confluence with the Nandakuja while the second was located downstream between Baghabari and Faridpur (Table 2.1).

The Baral basin mainly comprised high ground in the west, upstream of Malonchi (Fig. 1.1) and lower-lying floodplains downstream of it, particularly in the areas surrounding the former course of the Baral River.

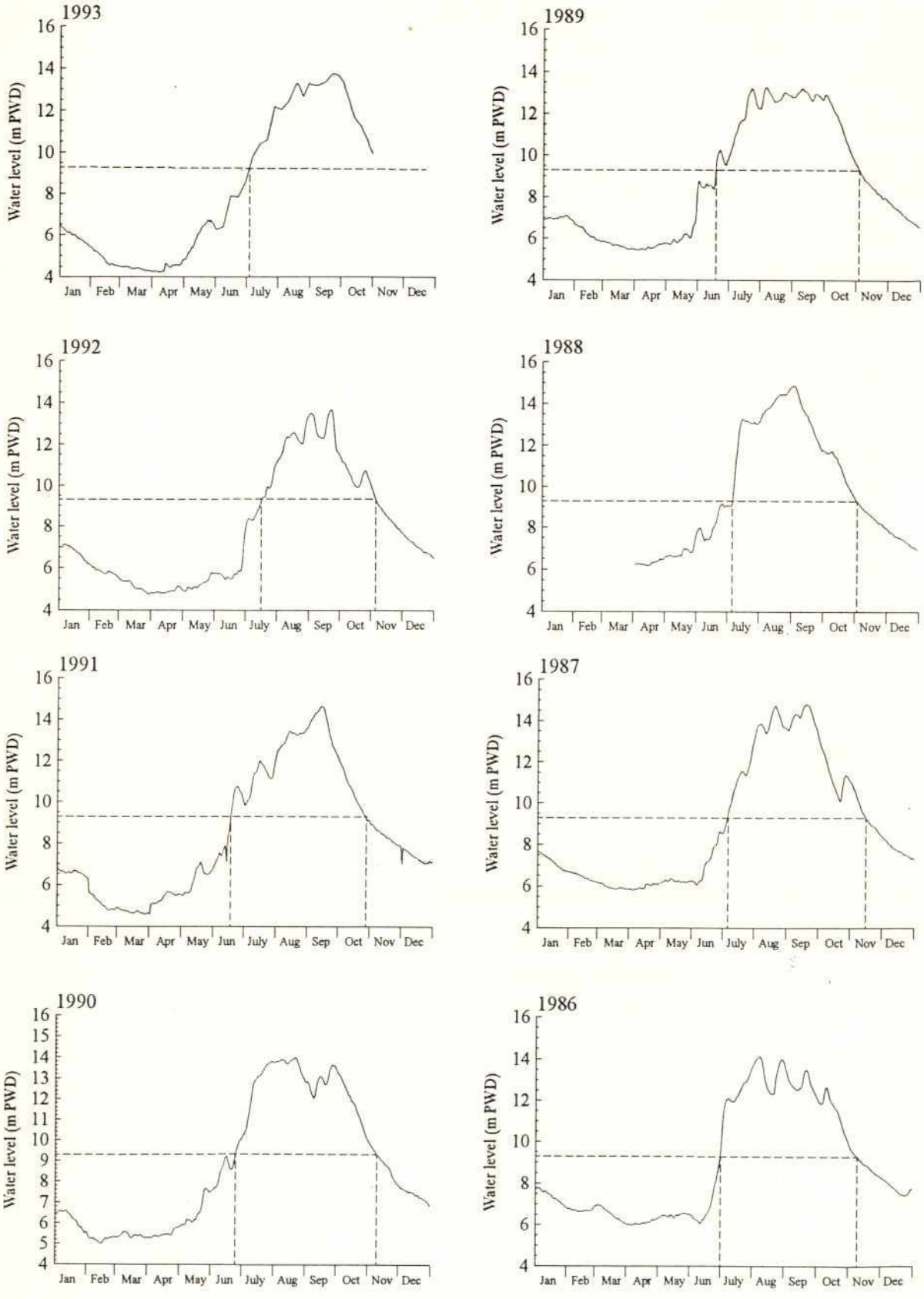
3 HYDROLOGY

Charghat regulator has three vertical lift gates through which water flow is undershot i.e. when the gates are mechanically raised water flows beneath them. Flow in the Baral was determined by that of its feeder river, the Padma, and by the height to which gates were opened. Siltation at the mouth of the river upstream of the regulator delayed the annual entry of floodwaters often until July and the connection was later broken with the Padma during the drawdown in early November (Fig. 3.1). It is reasonable to assume that construction of the regulator may have increased siltation immediately upstream by obstructing flow and reducing water velocities resulting in further delays in the entry of the Padma floodwaters. Gates usually remained partially open throughout the monsoon season generating water level differences across the regulator which were also dependent on outside river levels and the height to which gates were opened (Fig. 3.2).

Water level data collected at Charghat by BWDB from 1986 to 1994 revealed that gates were operated to maintain a regulated flow at a level of about 14.5 m PWD (Fig. 3.2). As a result of this operating criterion, head differences across the regulator varied considerably between years (Fig. 3.3). The lowest head differences occurred in the drought year of 1992, when a maximum value of 1.9 m was recorded but for most of the year head differences were below 1 metre. In contrast, in the high flood years of 1988 and 1987, a head difference of 3 m was maintained for 3 and 5 weeks respectively. The maximum head difference was recorded not during the high flood years of 1987 and 1988 but in September 1991 when gates were lowered more than necessary and consequently generated very high head differences of 5 m for a day or two.

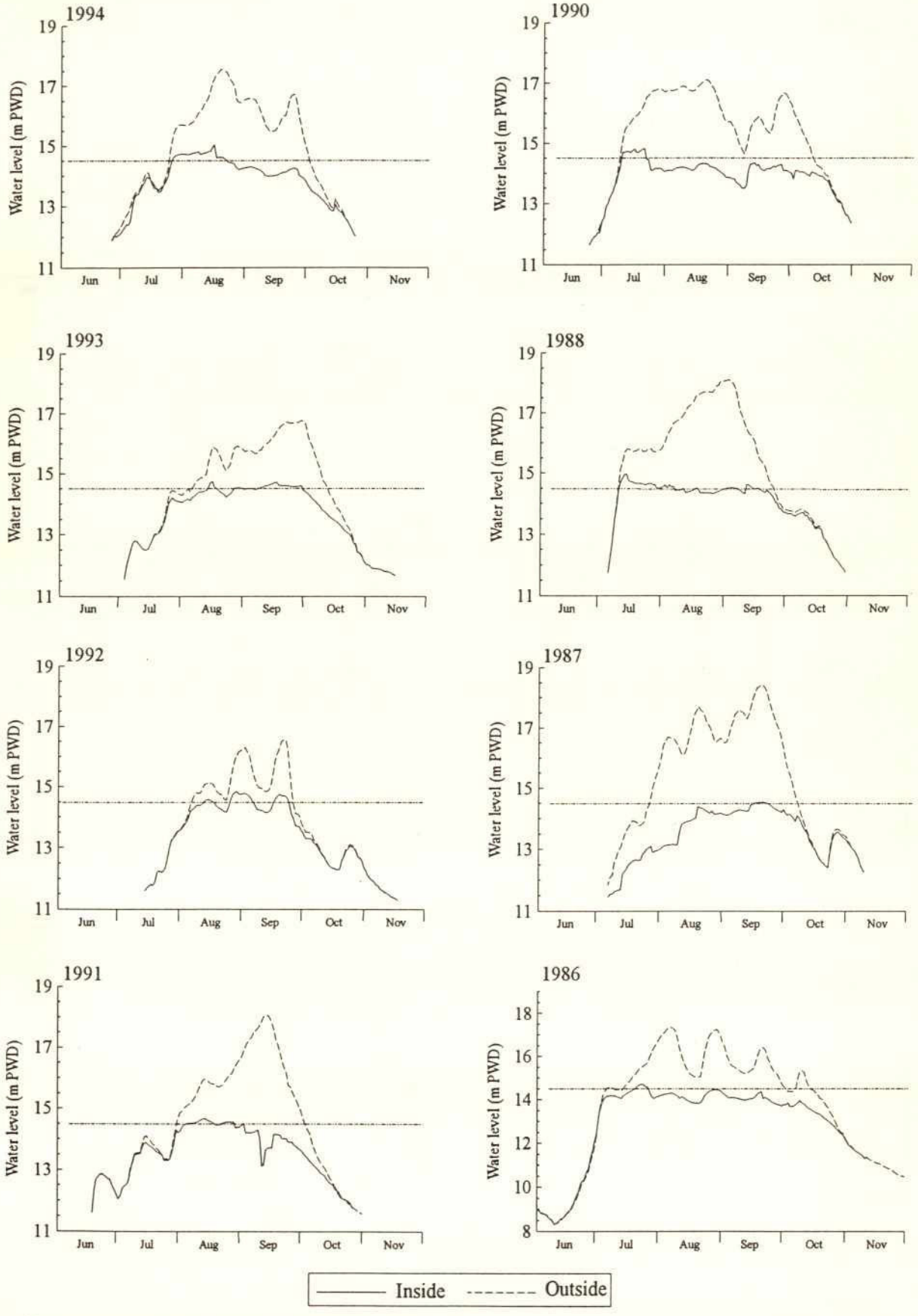
Evidence provided by this study (Section 4.4) indicated that moderate head differences of 0.4 m created a barrier to upstream migrating fish by inducing high water velocities and turbulent conditions across the gates. On 24 August 1992, at a head difference of 0.4 m, gates were open to almost the maximum height of 8 feet with a flow beneath them as shown in Figure 3.4 (b). Under higher head differences, the flow could transform to that shown in Figure 3.4 (a) where intense turbulence was produced further downstream. Under such conditions, the turbulence created would be more physically harmful to fish and this together with increased water velocities at the river bed, would make the structure impassable to fish moving upstream.

Figure 3.1 Seasonal variation in water levels of the Padma River at Hardinge Bridge, 1986 - 1993



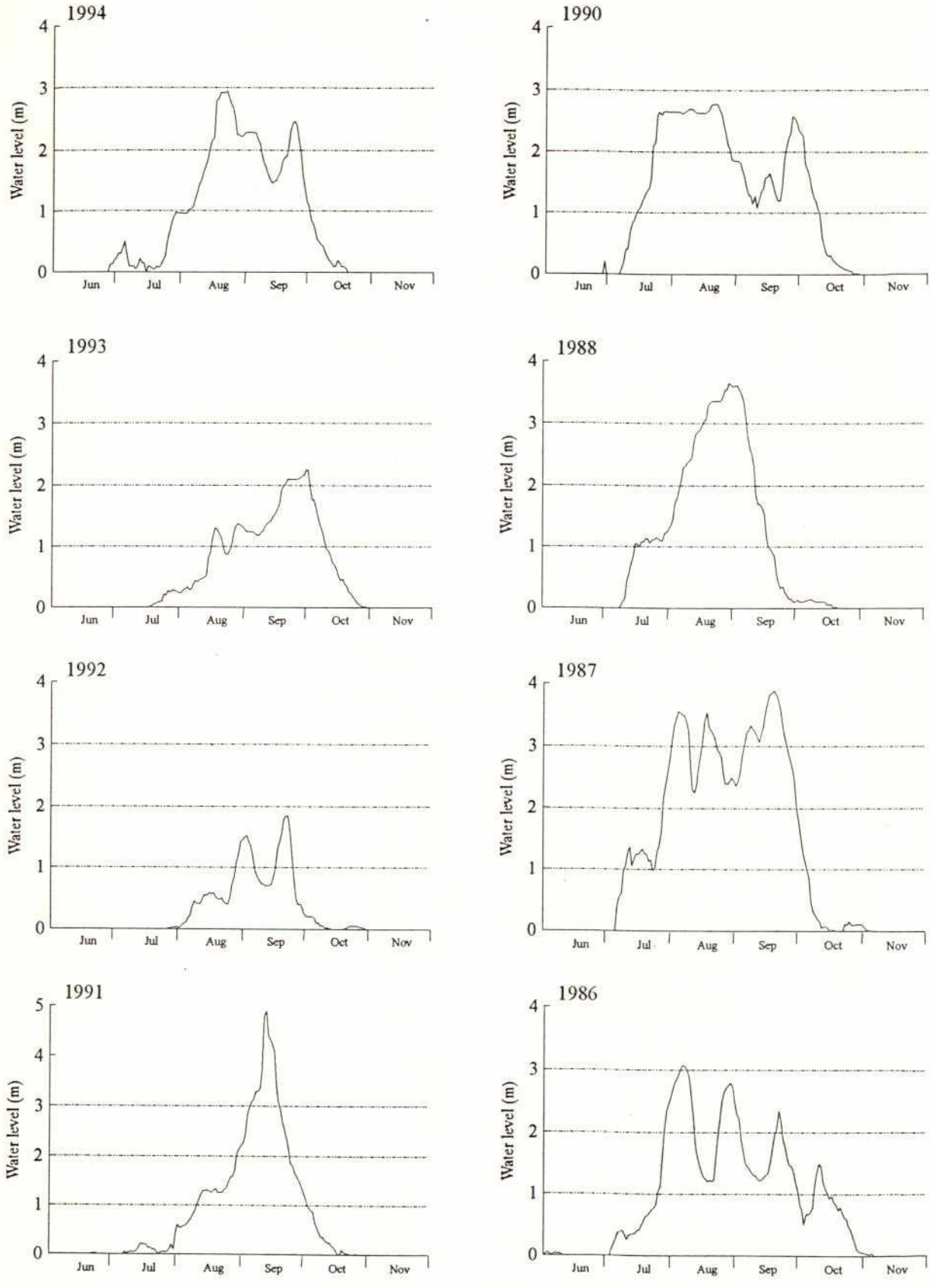
Note: _____ Denotes water level and month at which a connection is made and broken at Charghat regulator

Figure 3.2 Seasonal variation in water levels outside and inside Charghat regulator, 1986 - 1994



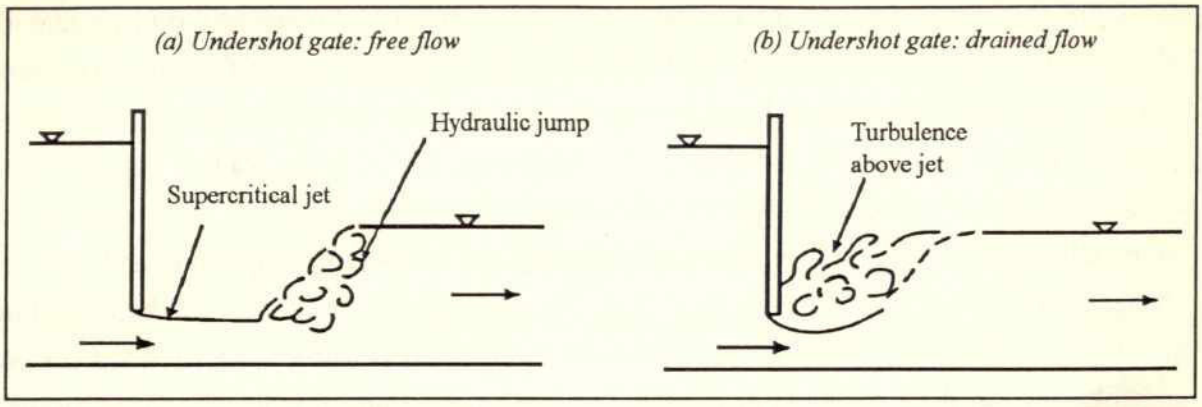
Notes: 1. Only 2 months data available in 1989 therefore omitted
2. --- Denotes the maximum regulated water level at Charghat

Figure 3.3 Seasonal variation in water level differences across Charghat regulator, 1986 - 1994



Note: Only 2 months data available in 1989 therefore omitted

Figure 3.4 Flow downstream of undershot gate



Source: FAP 17 Draft Final Report, Supporting Volume No. 23

During the study period, October 1992 - February 1994, head differences exceeded 0.4 m from early August to late October 1993. Higher differences of 1 m and 2 m were recorded for periods of 8 weeks and 2 weeks respectively. In other years, with the exception of 1992, such head differences prevailed for even longer periods between July and October. The implications of these hydraulic conditions are discussed in more detail later in this report (Section 4.4), when an examination is made of gate operations in relation to head differences and their impact on upstream migrating fish.

A further concern about regulating structures is the pressure change imposed by the creation of head differences. Fish adjust to changes in pressure with the aid of the swim bladder. Where pressure changes are high and rapid such as across man-made barriers, then it is possible that fish are unable to adjust sufficiently swiftly to avoid damage to the swim bladder. It is assumed that juveniles and fry are at greatest risk. At Charghat, fish entering the Baral from the Padma River were subjected to sudden pressure changes under high prevailing head differences. An independent study was established by FAP 17 to assess the impact of the regulator on the survival and movement of fish hatchlings. Results of this study are documented separately (Final Draft Report, Supporting Volume No. 11) but summarised briefly in Section 4.4.

The impact of river regulation at Charghat on downstream floodplains varied substantially within the Baral catchment. Water level data collected from the Baral at Malonchi railway bridge, 38 km downstream from Charghat showed that the Padma River was the principal source of flooding for the Baral basin and that river levels did not increase in either wet or dry years prior to the first water level increases at Charghat (Fig. 3.5). On the highest land

upstream of Malonchi where flooding occurred only during the rarer high flood events, river regulation had little impact. In contrast, on the lower-lying floodplains downstream of Malonchi flood levels were reduced significantly. Prior to construction of Charghat regulator, this area was regularly deeply flooded from overflows from the Nandakuja. The extensive flooding drained southwards and flooded the north west basins of the Padma Irrigation and Rural Development Project (PIRDP)[1]. After construction of the regulator, peak flood levels were reduced by 1.5 to 4.0 m between years and the frequency, magnitude and rates of change of seasonal fluctuations in water levels were also reduced. Flood control by regulation at Charghat proved so effective that it obviated the need to construct further flood control embankments on the right bank of the Baral to prevent overland flooding into the PIRDP[2].

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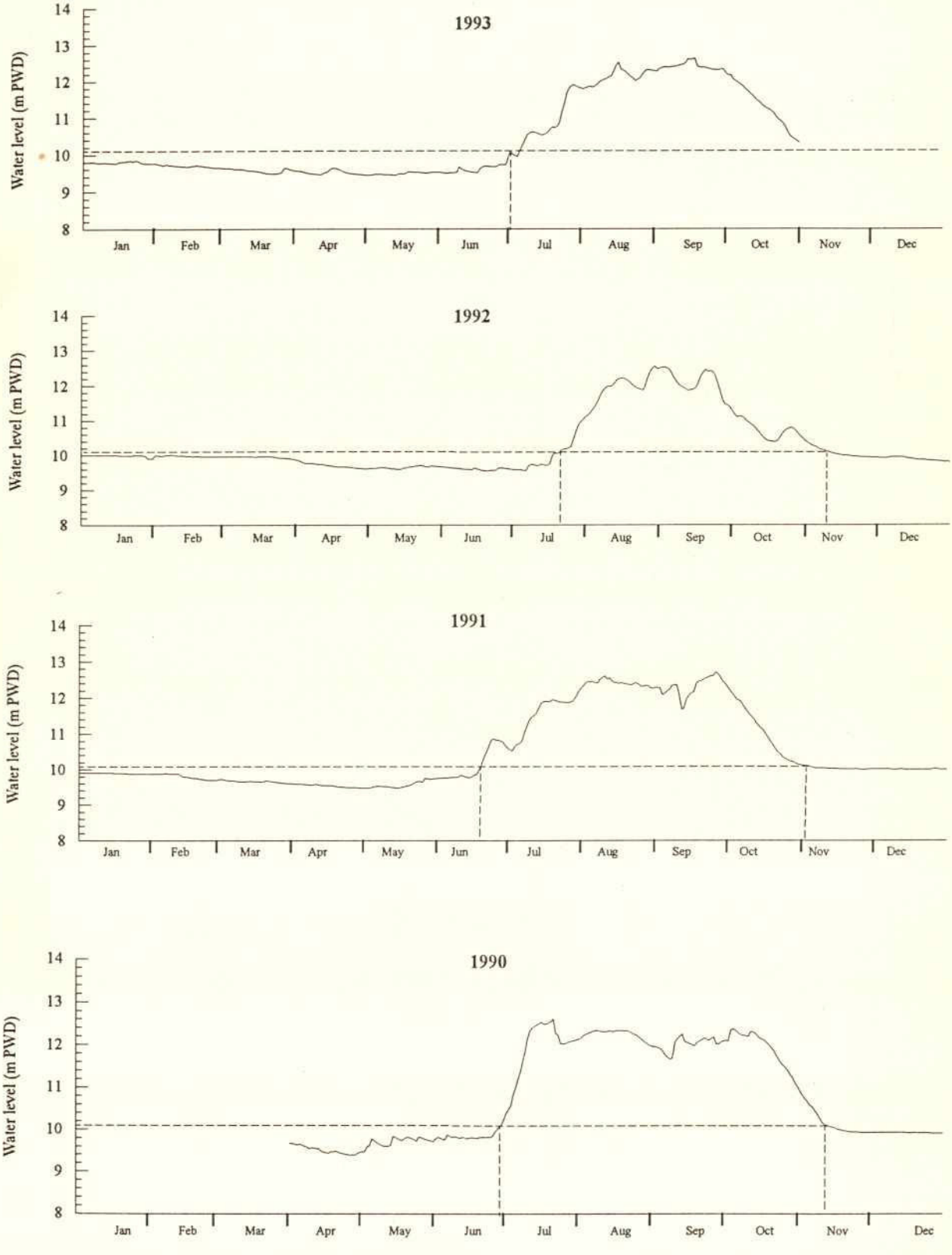
1 Feasibility Study of Pabna Irrigation and Rural Development Project, Phase 1. Final Report to the Government of Bangladesh 1978. ADC-NK Engineering Consultants.

2 Feasibility Study of the Second Pabna Irrigation and Rural Development Project. Final Report to the Government of Bangladesh, November 1991. M. MacDonald and Partners UK Ltd.

Figure 3.5 Seasonal variation in water levels of the regulated Baral River at Malonchi Railway Bridge, 1990 - 1993



Note: ---- Denotes water level at which Padma River flows through Charghat regulator into Baral River

4 RIVER FISHERIES

4.1 Total Catch

4.1.1 Pattern of catch

There were marked differences in seasonal variations in catch from rivers. In the Baral, there was distinct seasonality with very low catches during the winter and pre-monsoon (December - May), a slight rise between June and August as water levels increased, followed by a very sharp rise in September, remaining high in October before falling again during the late drawdown in November. Between September and October 59% of the total annual catch was taken.

On the Padma River, catches fluctuated more frequently due to intermittent increases in the abundance of individual fish species. On the lower reaches of the Atrai (NW14), catches increased gradually from March to May, then increased sharply in June with the onset of a drift-net fishery targeting upstream migrating *ilish*. Catches declined rapidly in July and continued to do so until September before again rising sharply during the drawdown of October and November. Through the winter (December - February) catches remained high as a result of *katha* harvests.

Further upstream on the Atrai (NW27) the seasonal pattern was different again with relatively low catches for most of the year except between October to January when they increased by three to four-fold. During the winter (December - February) several temporary cross-dams were constructed to divert water on to the adjacent floodplains to irrigate rice fields. This effectively trapped fish which were then captured by *jhaki jal* and *katha*.

4.1.2 Size of catch

The highest catch per kilometre of river was recorded on the Padma River but this was due solely to the considerably greater sampled river width (Table 4.1). In terms of catch per unit area, the Padma supported the lowest yield of all sites, however, its production rate was typical of other reaches of the Padma and lower Jamuna rivers, when *ilish* catches were excluded (Draft Final Report, Supporting Volume No. 10).

Table 4.1 Annual catch from regulated and unregulated rivers, March 1993 - February 1994

Site code	Site name	Regulated Yes/No	Catch	
			kg/km	kg/ha
NW25	Baral	Yes	856	250
NW24	Padma	No	11,329	44
NW27	Atrai	No	2,009	291
NW14	Baral/Atrai	No	5,062	400

The catch per kilometre from the regulated Baral was substantially lower than those from the Atrai but when its smaller width was taken into account by computing catch per unit area (CPUA), the difference between sites was reduced. The CPUA of the Baral (250 kg/ha) was 14% lower than that from the upstream site on the Atrai (291 kg/ha). However, much of the Baral catch resulted from obstruction by the regulator to the upstream migration of *ilish* and many other migratory and riverine species and their subsequent capture by *hat tana*, *hat bauli* and *shangla jal* (see Section 4.2.1). Omitting these from catch estimates resulted in a CPUA of 129 kg/ha, 56% lower than that of the Atrai.

4.2 Pattern of Catch

4.2.1 Catch by gear

Percentage contributions made by dominant gears to the total annual catch from each river are presented in Table 4.2. More detailed information on percentage monthly and annual catches of all observed gears is given in Tables 4.3 - 4.6.

Seasonal patterns of catch were quite different in each river (Fig. 4.1). In the Baral, the presence of the regulator had a profound impact on the types of fishing gears deployed. On the downstream side walls of the regulator itself, large hand-held scoop nets (*hat tana*) fished for *ilish* moving upstream to the Padma River. In the area immediately downstream of the regulator *hat bauli* and *shangla jal* also targeted *ilish*. That these three gears could operate effectively was a reflection of the concentration in numbers of *ilish* and other riverine and migratory fish caused by blockage to their upstream movement. Thus, in effect the regulator and its associated fishing gears operated as a "fixed engine", a term used in existing fisheries regulations to describe any fixed gear set across the full width of a water course to trap fish. The fixed engine is an illegal method of fishing in Bangladesh.

Other gears making important contributions to the catch but which were more widespread along the river included, *ber jal*, *jhaki jal*, *thella jal*, *veshal* and *sip* which together accounted for 42% of the annual catch.

Table 4.2 Percentage contribution (by weight) to the total annual catch by dominant gears in regulated and unregulated rivers, March 1993 - February 1994

	Regulated	Unregulated		
Gear	Baral (NW25)	Padma (NW24)	Atrai (NW27)	Baral/Atrai (NW14)
Hat Tana	17.5	-	-	-
Afa/Hat bauli	13.0	-	-	-
Ber jal	12.4	15.0	-	12.6
Jhaki jal	11.1	5.4	28.5	4.4
Shangla jal	7.6	-	-	-
Thella jal	6.5	3.2	-	-
Veshal	6.1	-	7.4	-
Sip	5.6	2.8	7.8	3.9
Deal trap	4.1	-	5.1	-
Current jal (Stationary)	3.5	-	-	-
Tana Barsi	2.9	-	-	-
Doiar trap	-	40.6	7.1	4.3
Daun	-	6.7	-	-
Koi jal	-	6.4	-	-
Moi jal	-	4.5	-	7.2
Current jal (Drifting)	-	3.7	-	19.2
Kajuli jal	-	2.3	-	-
Dhor jal	-	-	2.5	-
Suti jal	-	-	12.3	-
Baoli jal	-	-	8.0	6.3
Katha	-	-	8.1	31.4
Dharma jal	-	-	3.4	-
Nimbaich	-	-	-	3.3

Note: Dominant gears are defined as those gears which when ranked in order of abundance, comprised at least 90% of the annual catch

Figure 4.1 Seasonal variation in the catch per unit length from regulated and unregulated rivers, October 1992 - February 1994

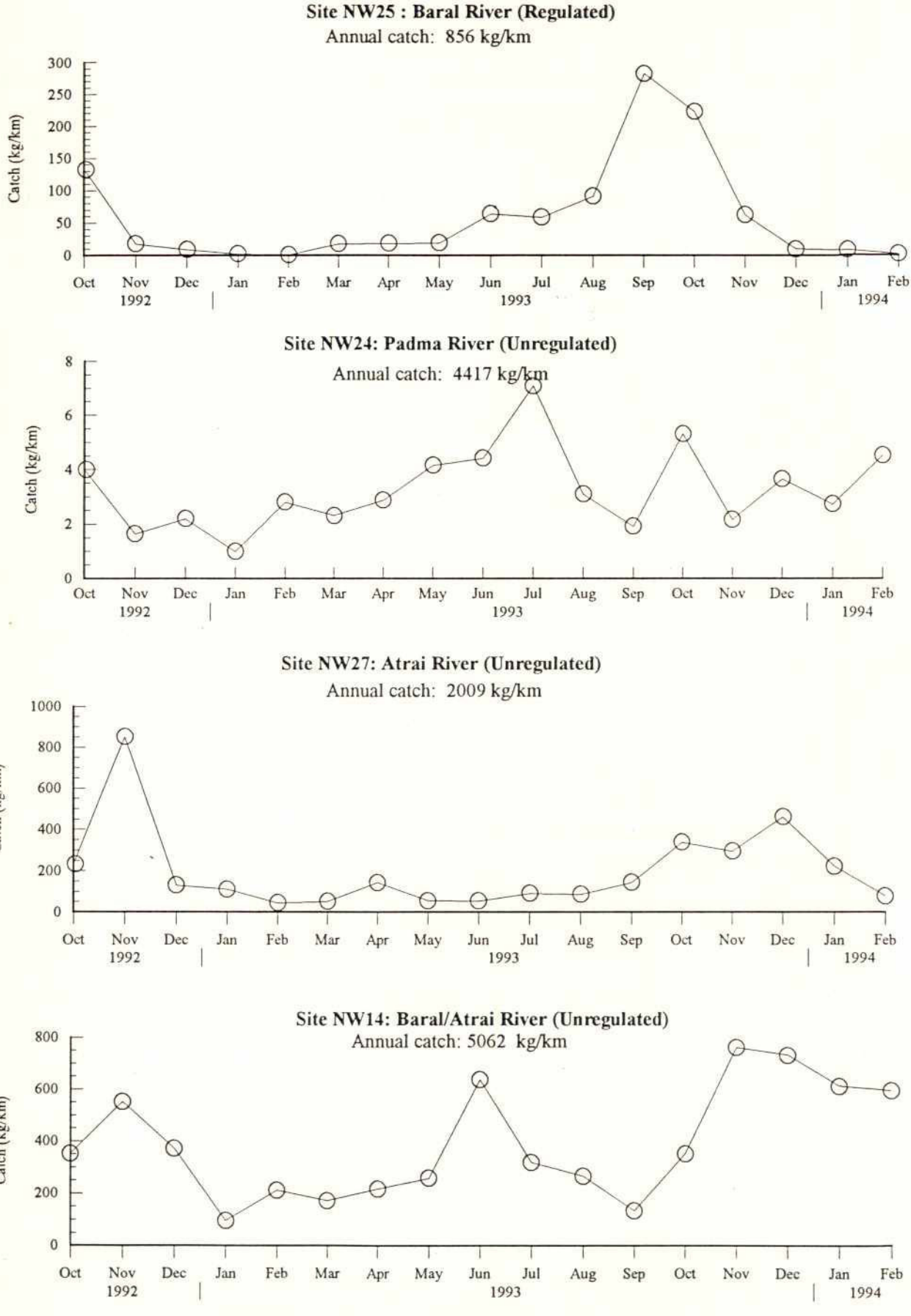


Table 4.3 Percentage monthly catch from the regulated Baral River by gear type: site NW25

Gear		Year: 1992			Year: 1993												Year: 1994		Total annual catch (Mar'93 – Feb'94)	
Code	Gear name	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Kg	%
287	*Hat Tana*	7.827	–	–	–	–	–	60.885	2.663	–	13.029	2.704	34.241	14.028	–	–	–	–	2828.573	17.481
321	*Afa/Hat bauli*	0.126	–	–	–	–	–	–	–	–	4.597	45.550	17.739	7.490	–	–	–	–	2097.302	12.962
45	*Ber jal*	–	–	–	–	–	–	–	9.723	36.041	6.232	–	6.220	6.017	67.335	32.855	–	73.708	2012.262	12.436
164	*Jhaki jal*	11.130	10.785	–	3.268	3.498	55.331	8.520	23.599	13.488	17.607	12.392	7.087	12.217	1.732	8.552	–	–	1796.259	11.101
234	*Shangla jal*	–	–	–	–	–	–	–	–	–	–	15.819	17.783	–	–	–	–	–	1221.733	7.551
255	*Thella jal*	3.823	–	–	–	–	1.710	–	0.521	0.638	26.171	6.597	1.477	11.897	1.807	14.745	–	–	1047.857	6.476
266	*Veshal*	7.711	1.024	–	–	–	–	–	–	1.634	13.682	3.532	6.434	9.362	1.185	–	–	–	983.929	6.081
30	*Sip*	47.531	47.284	74.824	–	–	6.208	10.423	1.198	26.448	5.331	2.253	0.630	4.659	1.686	19.402	90.501	26.292	913.763	5.647
286	*Deal trap*	4.139	2.747	–	–	–	–	11.738	6.668	6.477	7.128	6.470	2.585	3.812	3.338	0.331	–	–	671.247	4.148
88	*Current jal (Stationary)*	0.502	33.138	10.967	60.298	96.502	34.878	5.078	26.134	11.291	1.993	–	–	–	12.487	11.442	9.500	–	567.441	3.507
152	*Tana Barsi*	–	–	13.667	30.243	–	–	0.201	0.565	0.556	–	–	–	10.465	0.984	–	–	–	461.575	2.853
65	*Chandi jal*	–	–	–	–	–	–	–	–	–	0.129	0.521	2.429	4.687	–	–	–	–	337.428	2.085
271	*Suti jal*	6.448	2.227	–	–	–	–	–	–	–	–	–	1.276	5.362	–	–	–	–	293.873	1.816
95	*Doiar trap*	1.777	–	–	–	–	–	–	2.372	3.271	3.485	0.487	0.768	1.097	–	–	–	–	182.187	1.126
307	*Hand fishing*	–	–	–	–	–	0.314	2.839	–	–	–	0.211	0.403	3.091	–	–	–	–	166.080	1.026
316	*Kajuli jal*	–	–	–	–	–	–	–	–	–	–	–	–	3.750	–	–	–	–	157.845	0.976
123	*Koi jal*	8.804	–	–	–	–	–	–	–	–	–	–	0.877	–	6.316	12.673	–	–	145.178	0.897
282	*Current jal (Drifting)*	–	–	–	–	–	–	–	–	–	–	2.414	–	1.370	–	–	–	–	99.200	0.613
149	*Horgra*	0.184	2.614	–	–	–	–	–	–	–	0.126	1.052	0.051	0.228	3.131	–	–	–	68.773	0.425
170	*Juti*	–	–	–	–	–	–	–	12.582	–	–	–	–	–	–	–	–	–	44.926	0.278
331	*Malai pata*	–	–	–	–	–	–	–	11.121	0.156	–	–	–	–	–	–	–	–	41.591	0.257
89	*Dhor jal*	–	–	–	6.191	–	–	–	–	–	–	–	–	0.468	–	–	–	–	19.710	0.122
222	*Polo*	–	–	–	–	–	–	–	2.855	–	–	–	–	–	–	–	–	–	10.193	0.063
296	*Tukri*	–	–	–	–	–	1.559	–	–	–	–	–	–	–	–	–	–	–	5.131	0.032
263	*Ucha*	–	–	–	–	–	–	–	–	–	0.274	–	–	–	–	–	–	–	3.038	0.019
272	*Daun*	–	–	–	–	–	–	–	–	–	0.219	–	–	–	–	–	–	–	2.427	0.015
314	*Boat Katha*	–	–	0.541	–	–	–	0.316	–	–	–	–	–	–	–	–	–	–	1.087	0.007
202	*Moi jal*	–	0.182	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	16180.608	100

Note: – denotes zero catch

Table 4.4 Percentage monthly catch from the unregulated Padma River by gear type: site NW24

Gear Code	Gear name	Year: 1992			Year: 1993												Year: 1994		Total annual catch (March'93 – Feb'94)	
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	kg	%
95	*Doiar trap*	5.342	8.426	0.472	–	0.403	5.037	34.394	33.153	40.984	84.115	25.512	66.180	10.376	37.697	33.074	59.127	32.735	11513.065	40.649
45	*Ber jal*	6.479	13.015	–	–	–	20.675	36.754	42.229	13.862	8.206	13.941	19.639	7.481	6.651	–	–	17.737	4249.075	15.002
272	*Daun*	3.998	15.305	11.801	–	46.650	5.530	10.853	9.628	12.989	0.033	20.681	9.476	4.158	23.347	–	–	–	1895.386	6.692
123	*Koi jal*	0.117	2.906	29.163	4.839	1.854	19.024	1.190	–	–	3.417	2.985	–	4.471	0.771	41.148	8.479	0.957	1817.416	6.417
164	*Jhaki jal*	1.371	8.010	1.455	–	–	0.079	2.179	2.355	15.280	0.812	6.419	0.629	20.440	5.624	1.787	–	–	1522.359	5.375
202	*Moi jal*	–	–	7.566	13.934	2.136	5.543	–	–	–	–	1.169	–	–	0.226	2.829	–	37.479	1263.891	4.462
282	*Current jal (Drifting)*	–	–	13.511	–	33.472	21.381	11.402	3.549	2.708	–	–	–	–	3.284	11.722	1.072	–	1034.533	3.653
255	*Thella jal*	0.050	–	–	–	–	–	–	–	1.729	0.917	10.746	0.201	17.602	–	–	–	–	904.049	3.192
30	*Sip*	49.253	9.737	17.490	38.904	7.054	0.451	1.682	1.889	0.776	–	2.627	1.431	6.414	11.486	3.934	4.848	2.080	793.057	2.800
316	*Kajuli jal*	–	–	–	19.269	–	–	–	–	–	–	–	–	0.064	–	4.715	19.312	6.475	638.548	2.254
307	*Hand fishing*	–	–	–	–	–	2.038	1.507	0.518	6.643	–	–	–	9.744	–	–	–	–	590.997	2.087
287	*Hat Tana*	–	–	–	–	–	–	–	–	–	0.401	0.188	–	16.618	0.032	–	–	–	587.391	2.074
152	*Tana Barsi*	–	30.920	13.699	6.059	4.101	13.166	–	1.246	–	–	–	–	0.686	10.520	0.126	5.191	1.772	541.360	1.911
65	*Chandi jal*	21.737	–	–	–	–	–	–	–	–	2.099	13.795	2.444	1.741	–	–	–	–	457.228	1.614
88	*Current jal (Stationary)*	11.654	11.681	3.256	3.984	2.614	0.489	0.040	0.423	3.730	–	1.936	–	0.206	0.361	0.209	–	0.766	202.237	0.714
268	*Konaber jal*	–	–	–	–	–	–	–	5.009	1.298	–	–	–	–	–	–	–	–	170.227	0.601
266	*Veshal*	–	–	0.560	8.476	1.715	6.587	–	–	–	–	–	–	–	–	–	–	–	97.307	0.344
271	*Suti jal*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1.971	–	34.487	0.122
89	*Dhor jal*	–	–	1.026	4.536	–	–	–	–	–	–	–	–	–	–	0.456	–	–	10.655	0.038
		100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	28323.268	100

Note: – denotes zero catch

Table 4.5 Percentage monthly catch from the unregulated Atrai River by gear type: site NW27

Gear Code	Gear name	Year: 1992			Year: 1993												Year: 1994		Total annual catch (Mar'93 – Feb'94)	
		Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Kg	%
164	*Jhaki jal*	28.180	21.805	60.354	25.647	8.547	8.787	0.190	2.786	15.911	6.114	28.582	14.647	33.829	44.417	36.398	43.439	–	7246.045	28.507
271	*Suti jal*	10.391	67.461	–	–	–	–	–	–	–	–	–	–	29.937	18.595	19.981	–	–	3123.413	12.288
270	*Katha*	–	–	–	23.049	23.475	–	63.472	–	–	–	–	–	–	–	–	11.977	59.007	2061.707	8.111
306	*Baoli jal*	–	–	–	–	–	43.520	24.230	8.174	–	–	–	–	–	4.921	4.385	23.462	15.549	2023.105	7.959
30	*Sip*	12.450	4.637	1.310	0.131	–	3.259	2.407	18.617	1.159	0.830	6.747	3.126	2.709	10.945	17.450	3.826	0.323	1984.046	7.806
266	*Veshal*	17.445	1.095	–	–	11.248	8.019	3.403	–	11.175	60.251	1.817	3.038	4.039	6.842	7.580	–	5.161	1869.607	7.355
95	*Doiar trap*	2.409	0.036	0.130	–	1.126	0.181	1.884	53.569	67.809	15.283	26.950	19.121	0.631	0.192	–	0.516	6.463	1794.306	7.059
286	*Deal trap*	1.517	0.053	–	–	–	–	–	–	–	5.884	15.216	32.350	8.206	0.590	0.007	–	9.800	1287.454	5.065
105	*Dharma jal*	14.725	0.073	–	–	–	–	–	–	0.062	0.086	0.065	6.923	17.385	0.100	–	–	–	871.356	3.428
89	*Dhor jal*	7.546	4.116	1.093	0.639	0.562	7.562	0.268	12.291	–	1.900	–	–	0.483	8.816	0.301	4.152	–	641.497	2.524
282	*Current jal (Drifting)*	–	–	0.544	0.905	–	–	–	–	1.003	5.439	4.212	10.918	1.463	0.475	–	2.548	–	463.396	1.823
317	*Thushi*	–	–	0.517	7.579	2.884	–	–	–	–	–	–	–	–	0.068	3.902	6.558	–	411.653	1.620
123	*Koi jal*	–	–	–	1.108	–	–	–	–	–	–	–	–	–	0.721	4.573	1.120	–	323.186	1.271
234	*Shangla jal*	–	–	–	–	–	–	–	–	2.799	3.751	10.514	3.628	0.559	–	–	–	–	266.532	1.049
298	*Akra*	–	–	14.739	–	–	–	–	–	–	–	–	–	–	0.665	2.158	1.896	–	202.634	0.797
202	*Moi jal*	–	–	19.358	40.943	50.155	25.742	–	–	–	–	–	–	–	0.044	–	–	–	170.467	0.671
272	*Daun*	1.481	0.045	–	–	–	–	0.163	–	0.083	0.109	4.394	2.736	0.759	–	–	0.314	2.633	169.482	0.667
126	*Ferra jal*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.405	–	–	139.500	0.549
255	*Thella jal*	0.304	0.516	–	–	–	–	0.995	4.563	–	0.354	0.068	–	–	1.486	0.295	–	–	126.342	0.497
88	*Current jal (Stationary)*	3.553	0.161	–	–	1.416	1.842	0.168	–	–	–	0.860	1.979	–	–	–	–	1.065	70.842	0.279
296	*Tukri*	–	–	–	–	0.587	1.089	2.608	–	–	–	–	–	–	0.097	0.128	–	–	65.162	0.256
307	*Hand fishing*	–	–	1.954	–	–	–	–	–	–	–	–	–	–	0.942	0.360	0.193	–	61.189	0.241
321	*Afa/Hat bauli*	–	–	–	–	–	–	–	–	–	–	–	1.119	–	–	–	–	–	20.218	0.080
278	*Nol barsi*	–	–	–	–	–	–	–	–	–	–	0.574	0.413	–	–	–	–	–	13.764	0.054
301	*Chunga*	–	0.002	–	–	–	–	–	–	–	–	–	–	–	0.029	0.061	–	–	4.605	0.018
45	*Ber jal*	–	–	–	–	–	–	0.213	–	–	–	–	–	–	–	–	–	–	3.840	0.015
170	*Juti*	–	–	–	–	–	–	–	–	–	–	–	–	–	0.057	0.017	–	–	3.088	0.012
		100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	25418.436	100

Note: – denotes zero catch

Table 4.6 Percentage monthly catch from the unregulated Baral/Atrai River by gear type: site NW14

Gear Code	Gear name	Year: 1992			Year: 1993											Year: 1994		Total annual catch (Mar'93 – Feb'94)	
		Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Kg	%
270	*Katha*	–	0.319	–	–	13.713	35.718	33.937	–	–	–	–	–	–	48.984	41.191	56.313	73.183	22253.097	31.400
282	*Current jal (Drifting)*	0.533	0.188	–	–	–	1.731	2.227	0.823	68.454	41.639	71.004	39.154	38.257	0.968	0.713	–	–	13584.883	19.169
45	*Ber jal*	38.567	27.833	16.357	7.671	7.556	12.226	46.318	62.091	17.391	25.854	7.352	5.934	5.505	7.472	6.324	0.201	1.999	8961.060	12.644
202	*Moi jal*	3.104	13.483	45.797	18.191	9.508	11.113	5.251	14.337	6.020	2.491	4.246	11.363	4.900	6.831	11.793	2.247	9.357	5120.960	7.226
306	*Baoli jal*	–	–	8.793	40.874	61.127	23.727	2.532	3.047	–	–	–	–	–	3.217	25.748	4.149	4.560	4475.993	6.316
164	*Jhaki jal*	33.328	21.500	8.485	7.461	3.843	3.844	3.267	4.258	0.470	2.367	3.573	7.500	7.702	9.054	7.147	0.798	2.586	3131.578	4.419
95	*Doiar trap*	2.980	17.573	1.119	2.710	–	–	0.385	5.935	1.610	16.090	4.502	3.796	21.051	3.711	2.286	0.798	–	3069.703	4.331
30	*Sip*	7.739	6.509	16.733	23.093	4.252	2.105	3.470	2.832	0.121	0.165	1.229	1.796	5.494	7.135	3.354	4.095	7.926	2743.489	3.871
335	*Nimbaich*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	27.628	–	2365.000	3.337
272	*Daun*	3.537	1.372	–	–	–	0.517	0.436	1.033	1.183	2.819	3.074	8.130	5.068	1.819	0.083	1.453	–	1140.801	1.610
255	*Thella jal*	1.136	0.805	0.399	–	–	0.070	–	–	–	1.561	1.845	2.917	2.192	4.520	0.046	–	–	790.577	1.116
266	*Veshal*	8.373	8.079	–	–	–	–	–	–	–	–	0.182	11.538	6.065	2.151	0.041	–	–	757.569	1.069
297	*Horhori*	–	0.104	0.374	–	–	8.787	0.674	4.258	–	–	–	–	0.670	1.197	–	1.502	–	677.023	0.955
285	*Thaga*	–	–	–	–	–	–	–	1.146	3.273	4.270	–	–	–	–	–	–	–	525.310	0.741
268	*Konaber jal*	–	–	–	–	–	–	–	–	0.968	2.538	2.331	7.555	–	–	–	–	–	429.957	0.607
170	*Juti*	–	–	–	–	–	–	–	–	0.275	–	–	–	0.209	1.829	0.042	0.065	–	239.780	0.338
307	*Hand fishing*	–	1.989	1.944	–	–	–	–	–	–	–	–	0.318	1.949	0.843	0.028	0.065	–	200.679	0.283
317	*Thushi*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1.205	0.480	–	164.435	0.232
88	*Current jal (Stationary)*	0.324	0.206	–	–	–	0.164	1.504	0.132	0.234	–	–	–	–	–	–	–	0.388	107.975	0.152
89	*Dhor jal*	0.379	0.039	–	–	–	–	–	–	–	0.207	0.662	–	0.695	0.270	–	–	–	97.176	0.137
175	*Kathi jal*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.204	–	17.438	0.025
65	*Chandi jal*	–	–	–	–	–	–	–	–	–	–	–	–	0.243	–	–	–	–	11.990	0.017
296	*Tukri*	–	–	–	–	–	–	–	0.107	–	–	–	–	–	–	–	–	–	3.869	0.005
		100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	70870.342	100

Note: – denotes zero catch

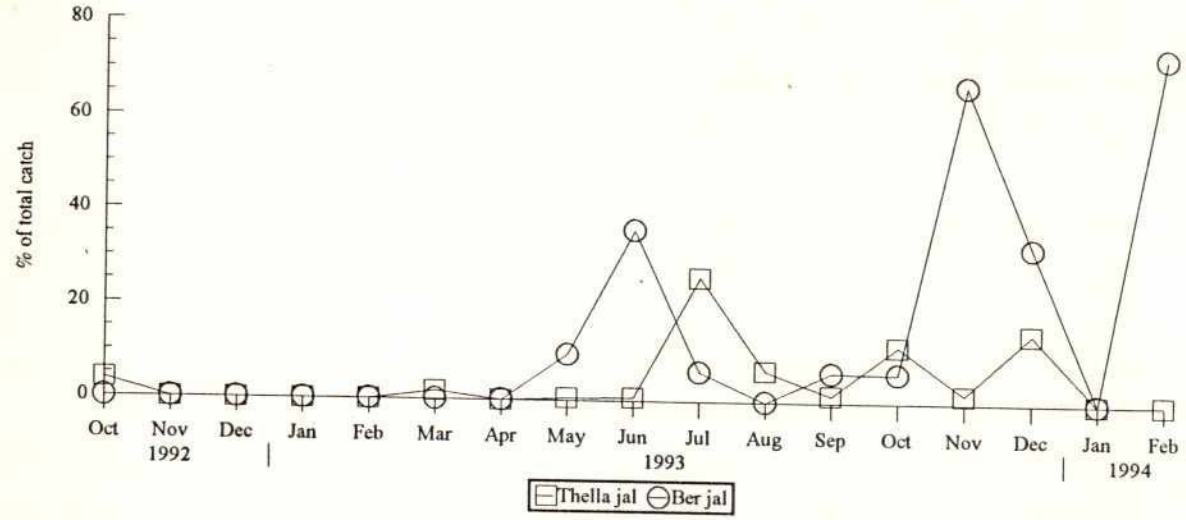
On the Padma River, small *doiar* traps dominated catches, taking 41% of the annual total. *Ber jal* was the second most important gear accounting for 15% of the catch and smaller drag nets, *moi jal* took a further 5%. Stationary-set gill nets, *koi jal*, captured 6% while *jhaki jal* and *thella jal* together provided a further 9% of the catch. All these gears operated mainly in shallow waters and together accounted for 76% of the annual catch. Gears which exploited the deeper, open, swift-flowing water e.g. *kajuli jal* and *chandi jal* were relatively unimportant along the Padma at Rajshahi.

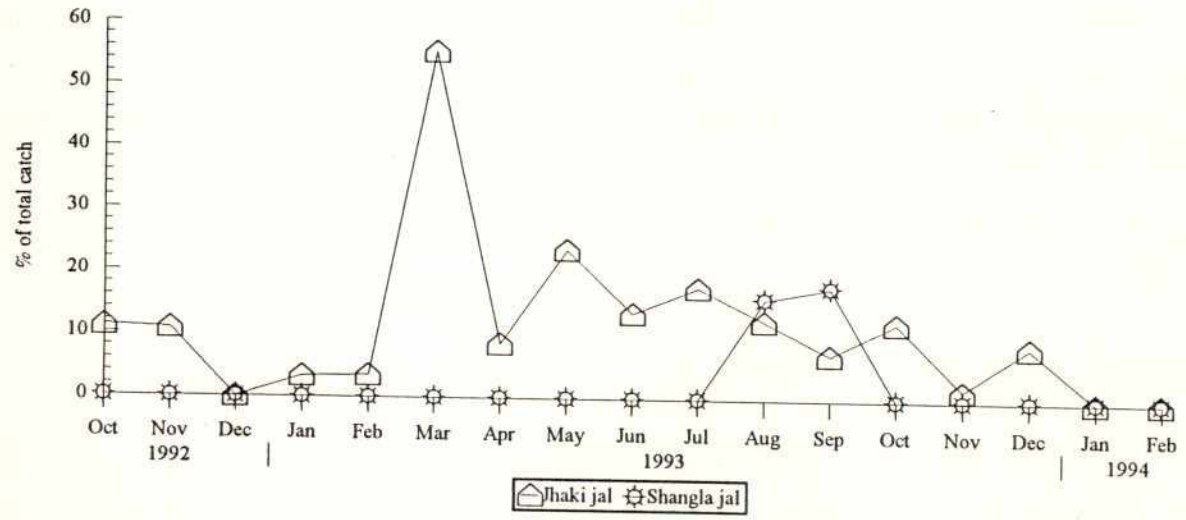
On the lower reaches of the Baral/Atrai, *katha* dominated catches providing 31% of the total catch. A drift net fishery for migrating *ilish* was particularly important at this site. The nets used were mainly monofilament *current jal*. Other important gears included seine and drag nets, *ber jal*, *baoli jal* and *moi jal*, which together captured 26% of the catch. Further upstream on the Atrai, fishing patterns differed from those downstream. At site NW27, the annual catch was dominated by *jhaki jal* (29%), *suti jal* (12%) and lift nets: *veshal* and *dharma jal* (10%). Large *ber jal* were unimportant here but smaller seines such as *dhor jal* and *baoli jal* took 11% of the catch and traps (*deal* and *doiar*) captured 12%. The differences between the two sites could be largely attributed to differences in channel morphology and hydrology. The upper site was narrower thus increasing the efficiency of gears such as *suti jal* and lift nets and favouring small rather than large seines. In winter, cross dams built across the river to retain water for irrigation, allowed *jhaki jal* to operate more efficiently in sections between dams.

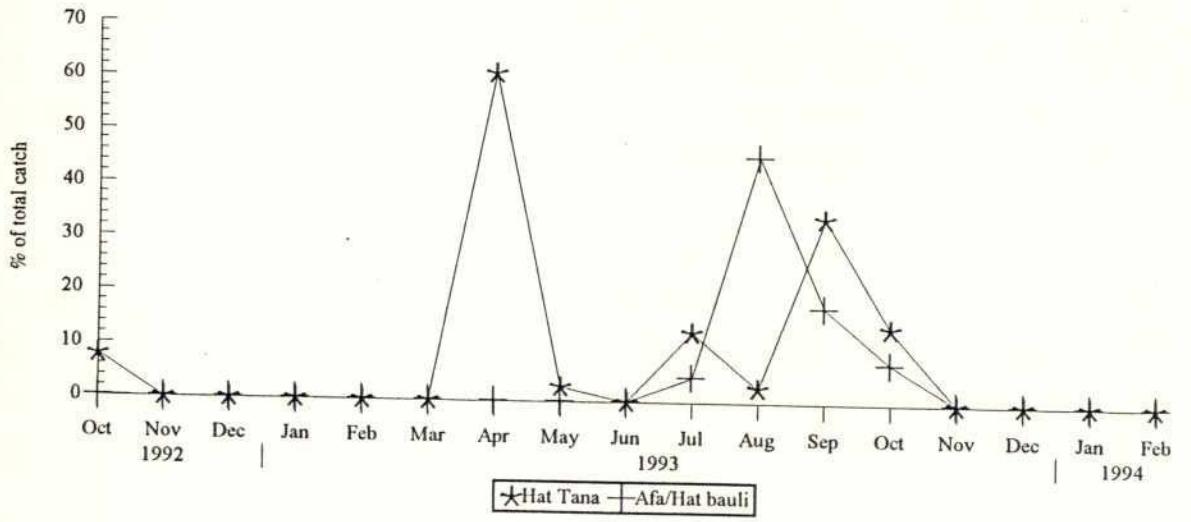
4.2.2 Catch by gear by month

During the pre-monsoon period between March and May, when fishing activity and catches were very low on the Baral River, gears contributing most of the catch included, *jhaki jal*, *hat tana* and stationary *current jal* (Fig. 4.2). As water levels increased in June, *ber jal* and *sip* gained in importance but *jhaki jal* also remained as one of the most important gears. In July water levels continued to rise and migrating *ilish* made their first appearance in the catch. *Hat tana* increased operations at the regulator but more widespread gears such as *thella jal*, *jhaki jal* and *veshal* dominated catches. Under peak flow conditions in August and September, gears targeting *ilish* on or near the regulator dominated catches. These comprised *hat tana* operating from the side walls of the regulator and *hat bauli* and *shangla jal* drifting downstream of it which together accounted for 64% to 70% of monthly catches. During the flood drawdown in October, these three specialist *ilish* gears took 21% of the catch while different types of drifting gill nets (*chandi*, *kajuli*, *current jal*) captured 10% and *thella jal*

Figure 4.2 Percentage of total monthly catch taken by dominant gears on the regulated Baral River (site NW25)







and *jhaki jal* together took 24%. During the winter, when the river lost its connection with the Padma and dried into a series of isolated pools, *ber jal* and *sip* took most of the catch of trapped fish.

During the pre-monsoon on the Padma River, *ber jal*, *doiar* traps and *daun* fisheries dominated catches (Fig. 4.3). As water levels rose between June and September, the contribution made by *ber jal* decreased but the *doiar* trap fishery remained very important and contributed most to the peak catch in July. A secondary peak in catch during the drawdown in October resulted from *jhaki jal*, *thella jal* and *hat tana* operating from the river bank. *Doiar* traps were the most important winter gears and provided 33% to 59% of monthly catches. Other gears important in one or more months during winter included gill nets, *koi jal* and *kajuli jal* and small drag nets, *moi jal*.

On the Baral/Atrai River, large *katha* provided 34-36% of catches during March and April 1993 after which the *katha* harvesting season ended with the rise in water levels (Fig. 4.4). Large *ber jal* and smaller seines (*baoli*) and drag nets (*moi jal*) caught significant shares of the catch from shallow water in March but as the river levels increased the smaller nets caught less while the larger and deeper *ber jal* increased its share of the monthly catch to between 46% and 62% in April and May respectively. In June, *ilish* appeared after migrating upstream from the Bay of Bengal to reach spawning grounds on the Atrai River. A drifting monofilament *current jal* fishery targeted this species and accounted for 68% of the June catch. This fishery dominated catches through the full flood and the drawdown up to October. From November onwards *katha* fishing once again predominated whilst small *baoli* and *moi jal* exploited the increasingly shallower waters.

Upstream on the Atrai, at its meeting with the Baral-Nandakuja River, low pre-monsoon catches were taken largely by *baoli* and *moi jal* in March, *katha* in April and *doiar* and *sip* in May (Fig. 4.5). As river levels rose, reaching a peak in September, catches increased slightly and were taken by a mixture of *jhaki jal*, *doiar* and *deal* traps, *veshal* and drifting gears such as *shangla jal* and *current jal* targeting *ilish*. During the drawdown, catches increased somewhat with greatest contributions again from *jhaki jal* and also bag nets (*suti jal*) which were set to exploit the concentrated numbers of fish such as *boal* moving off the drying floodplains. During early winter, *jhaki jal* continued to dominate catches together with *baoli*. At this time of year, dams constructed illegally across the full width of the river made it easier for these gears to catch trapped fish. Later in the winter, *katha* contributed most of the catch and continued to do so into the pre-monsoon season.

Figure 4.3 Percentage of total monthly catch taken by dominant gears on the unregulated Padma River (site NW24)

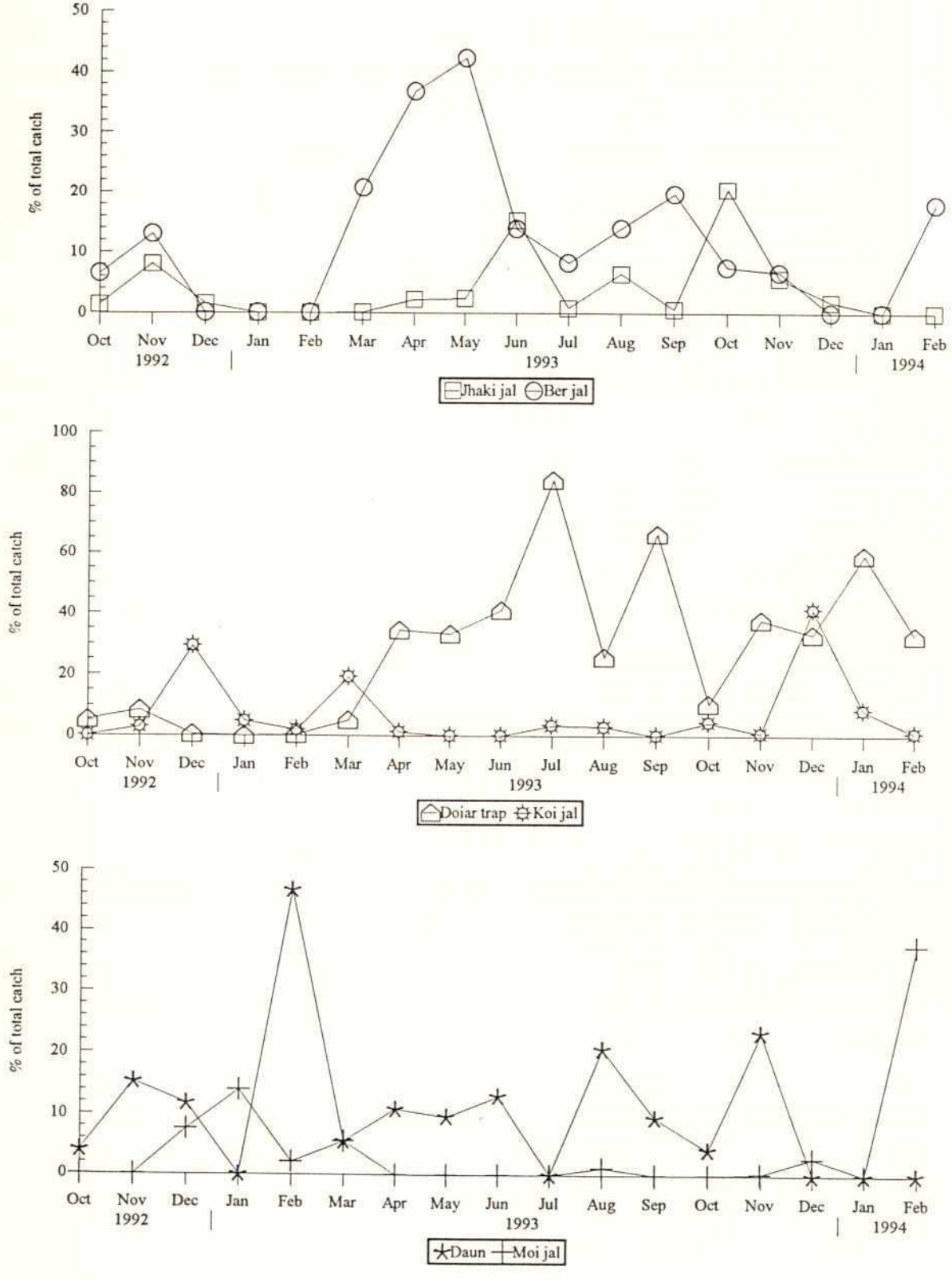


Figure 4.4 Percentage of total monthly catch taken by dominant gears on the unregulated Baral/Atrai River (site NW14)

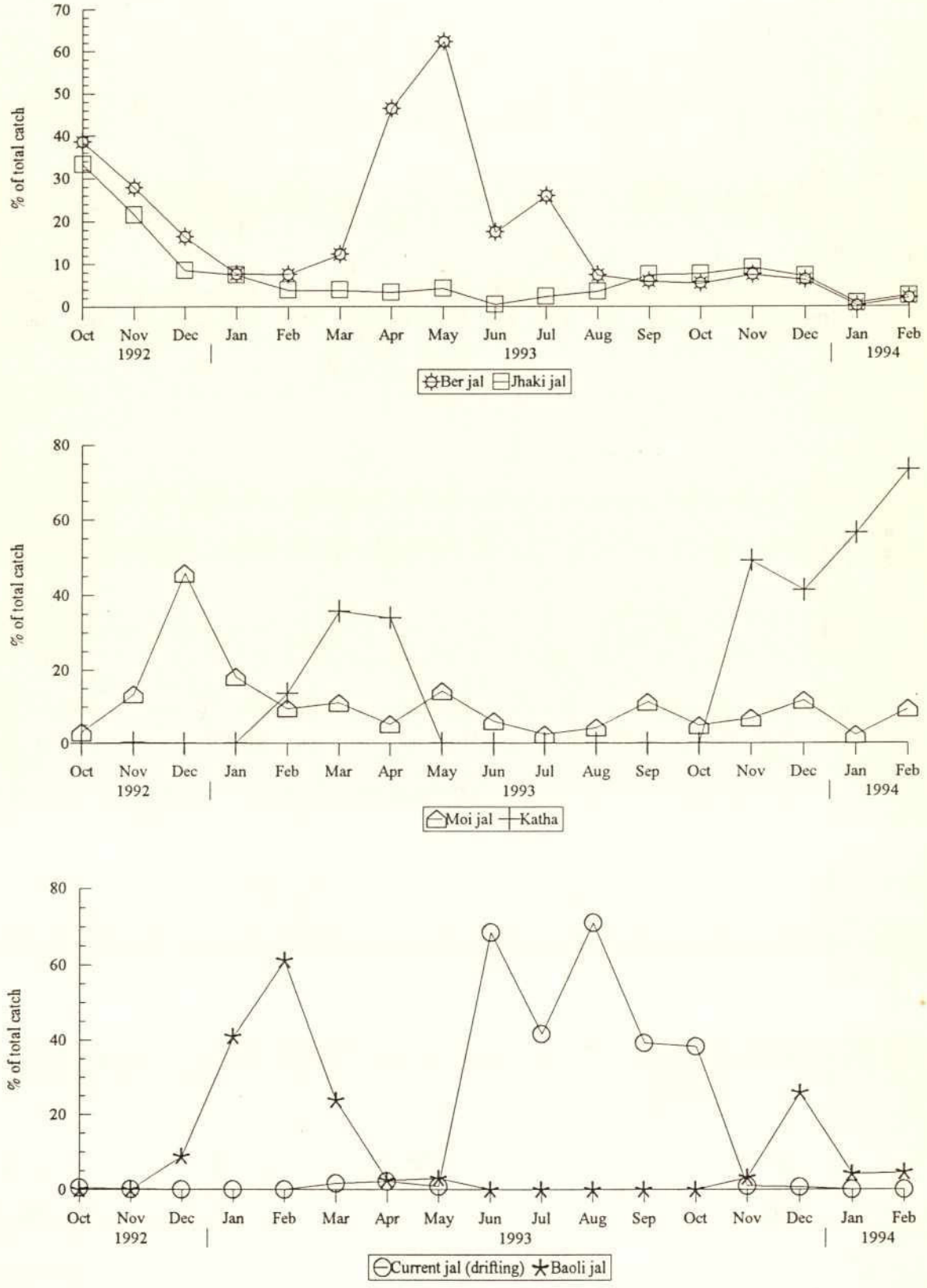
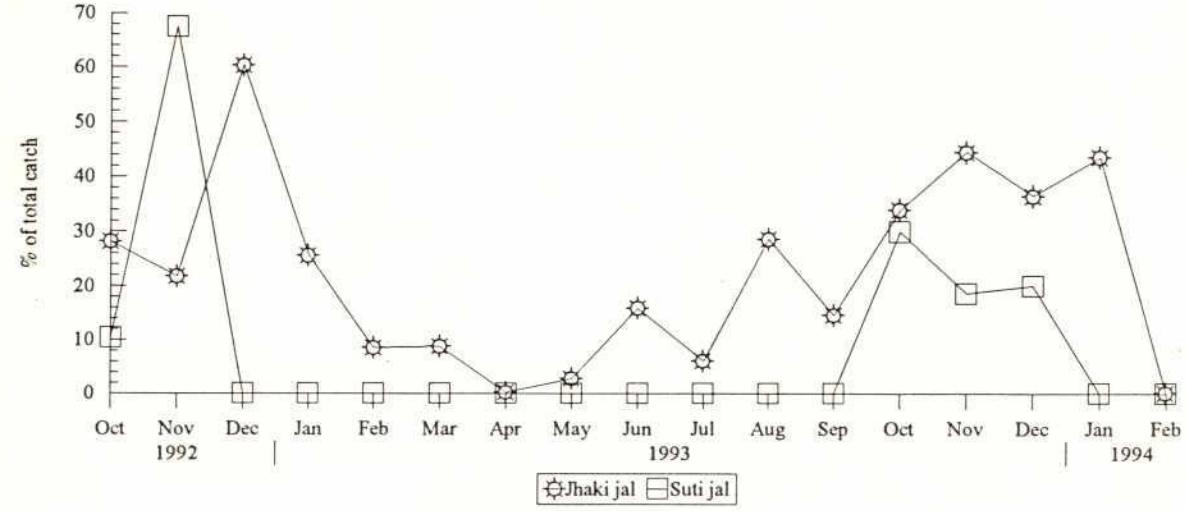
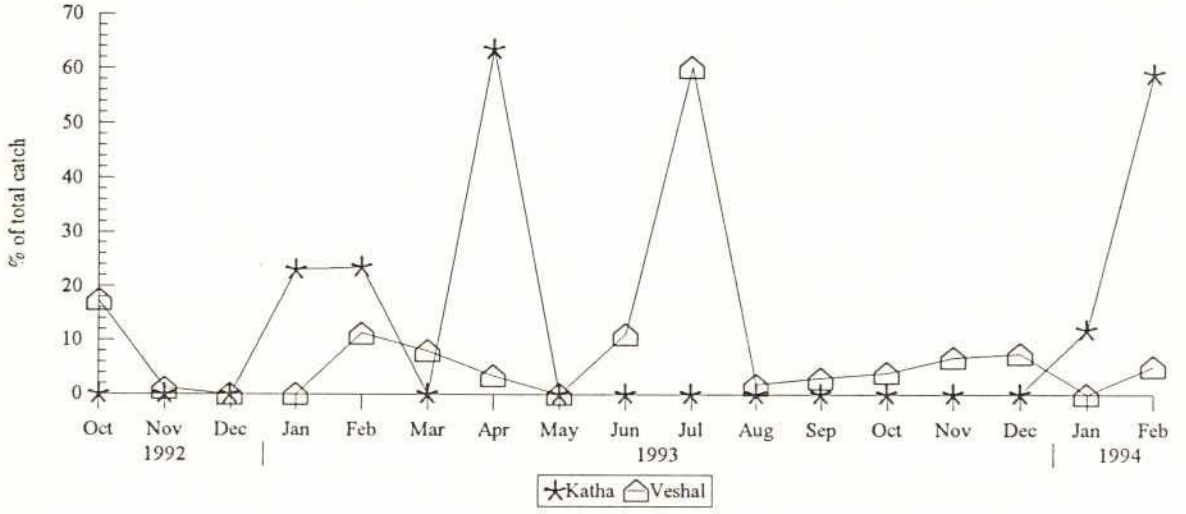
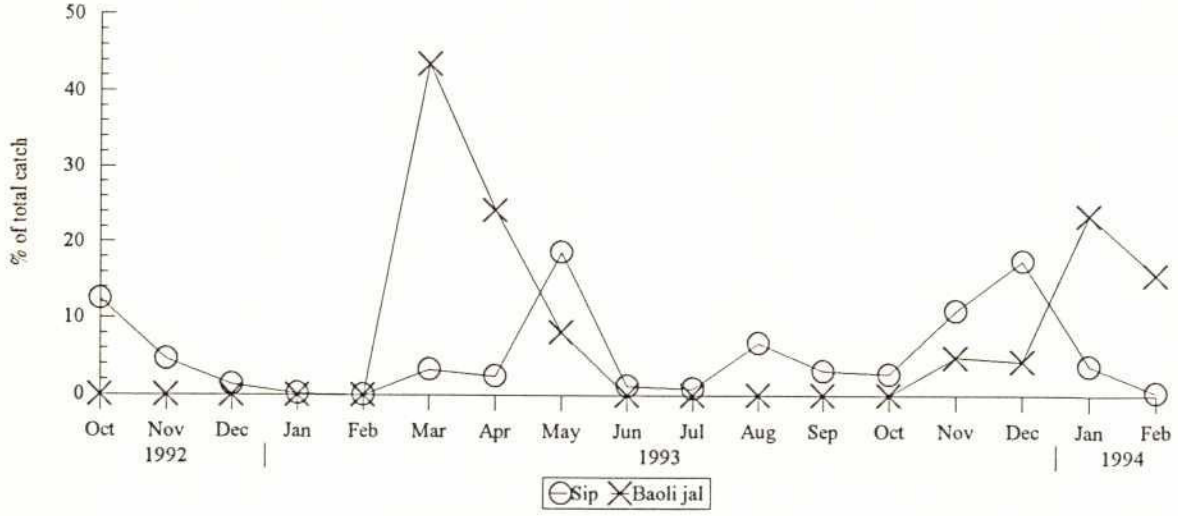


Figure 4.5 Percentage of total monthly catch taken by dominant gears on the unregulated Atrai River (site NW27)







4.3 Biodiversity and Catch Composition

4.3.1 Species richness

A total of 86 species of fish was recorded from the Baral River between March 1993 and February 1994. This is slightly higher than the number found on the Padma but lower than on the Atrai River (Table 4.7). When data from the whole 17 month survey were examined, a similar pattern was observed with numbers of species in the Baral and Padma being almost the same but both being somewhat lower than in the Atrai.

Table 4.7 Number of fish species recorded from regulated and unregulated rivers

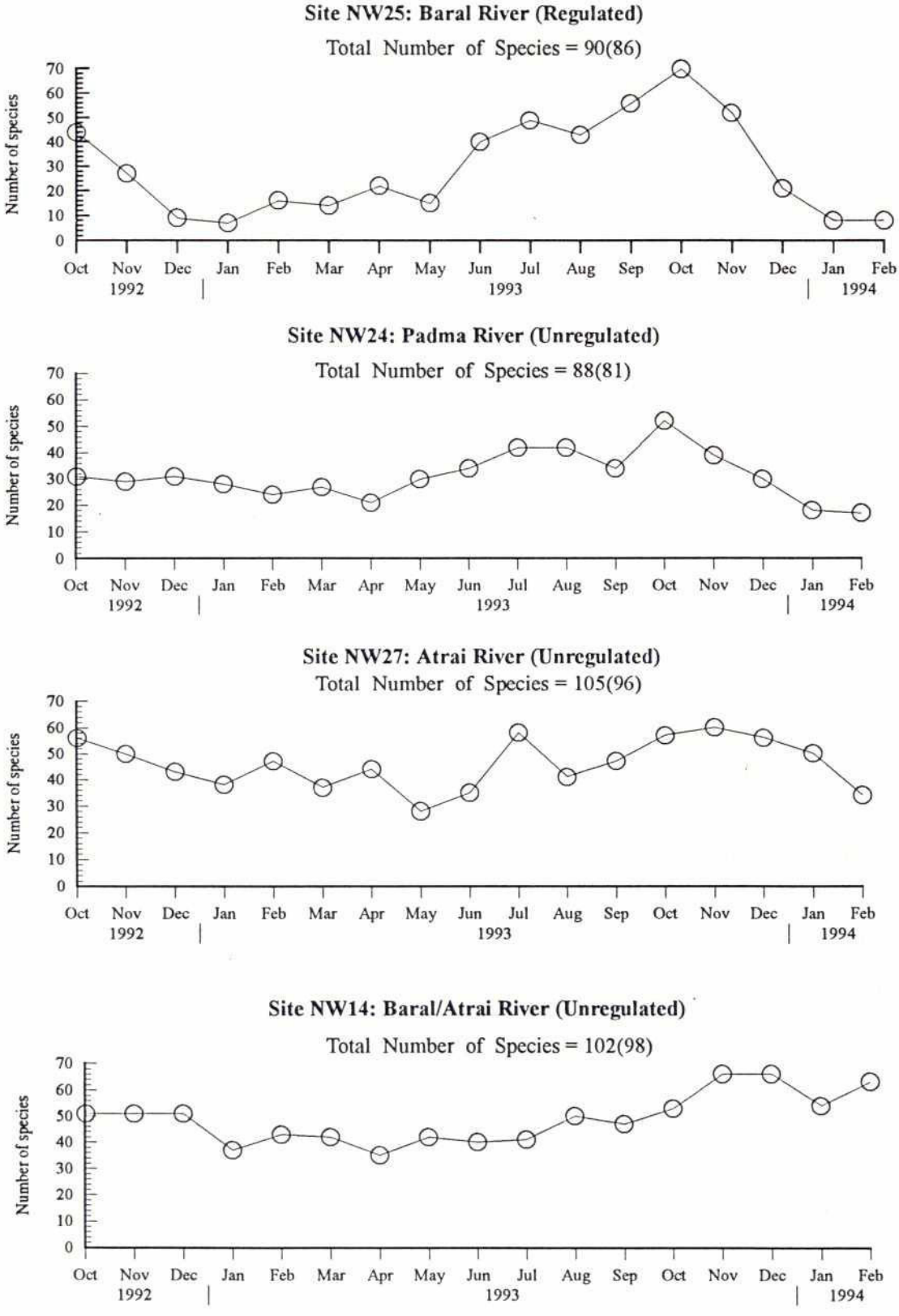
Site Code	Site name	Number of species	
		Total (October 1992 - February 1994)	Annual (March 1993 - February 1994)
NW25	Baral River	90	86
NW24	Padma River	88	81
NW27	Atrai River	105	96
NW14	Baral/Atrai River	102	98

Of the three sampled rivers, the Baral displayed the greatest degree of seasonality (Fig. 4.6). This was largely due to its highly seasonal flow caused by the disconnection with the Padma River during winter when few (<10) species were recorded in extremely low catches. Species diversity increased slightly during the pre-monsoon probably due to a slight increase in sampled catches rather than an influx of fish into the river. From May onwards diversity increased progressively, reaching a peak in October coinciding with the flood drawdown. The progressive increase in diversity resulted from migrations of fish from both the Padma and Atrai systems. From October to December species numbers rapidly declined as the river dried up in many places leaving isolated pools.

On the Padma River, a similar seasonal pattern in species diversity was observed with numbers rising during the monsoon to reach a peak in October and falling again in winter. However, because of the larger winter discharge and continuous flow, species diversity remained at a higher level than in the Baral. In contrast, on the Baral/Atrai (NW14), species

88

Figure 4.6 Seasonal variation in the number of fish species recorded from regulated and unregulated rivers, October 1992 - February 1994



Note: Annual total number of species recorded between March 1993 - February 1994 given in parentheses.

diversity remained relatively high and stable for most of the year, rising slightly in the monsoon and more noticeably in the drawdown of October and especially November. Diversity remained high throughout the winter due to the high catches made during the harvesting of large *katha* which provided shelter for many different species of fish. Further upstream on the Atrai (NW27), a greater degree of seasonality in diversity was observed probably due to a larger seasonal variation in discharge at this point compared to that in the lower reaches of the river. Lowest numbers of species were recorded in the winter and pre-monsoon, and highest between October and December when catches were also highest.

4.3.2 Catch composition

Percentage monthly catch compositions are presented in Tables 4.8 to 4.11. Species listed in these tables have been divided into three categories of habitat preference based on spatial distributions derived from the total FAP 17 fisheries database covering four FAP regions. The categories are defined below.

a) Riverine

Species which are usually confined to rivers and estuaries (or sea in the case of *ilish*) throughout their life cycle with no dependence on floodplains, although some species can be found on more extensive floodplains, particularly in the North East Region.

b) Migratory

Species which move between river and floodplain during different stages of their life cycle.

c) Floodplain resident

Species which are capable of surviving in perennial waters of the floodplain throughout the year and are largely dependent upon them for growth and reproduction. Many of these species inhabit a variety of freshwater habitats, including large rivers.

Table 4.8 Monthly catch composition from the regulated Baral River (% by weight): site NW25

Species	Habitat	Species name		Year: 1992			Year: 1993												Year: 1994		Total annual catch (Mar'93 – Feb'94)	
Code	Preference	Scientific	Bengali	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Kg	%
186	Riverine	*Rita rita*	*Rita*	–	–	–	–	–	–	1.485	–	–	–	0.023	0.0004	0.869	–	–	–	–	42.077	0.260
12		Aspidoparia jaya	*Piali*	0.431	–	–	10.219	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
13		*Aspidoparia morar*	*Piali*	0.386	0.015	–	–	0.423	3.300	–	4.130	0.925	4.143	2.340	0.337	2.400	0.244	0.059	–	–	245.070	1.515
59		*Crossocheilus latius*	*Kalabata*	0.071	0.523	–	–	17.725	3.682	–	–	1.040	0.018	0.061	0.501	0.007	0.207	–	–	–	55.388	0.342
139		*Nemacheilus botia*	*Balichata*	0.185	–	–	–	0.287	–	–	–	0.339	0.089	–	0.005	–	–	–	–	–	5.330	0.033
198		*Somileptes gongota*	*Gharpoia*	–	–	0.570	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
28		*Botia dario*	*Rani*	1.271	0.669	0.055	–	–	–	0.009	–	–	–	0.277	0.057	0.404	0.217	1.261	–	–	29.775	0.184
29		*Botia lohachata*	*Putul*	–	–	–	–	–	–	–	–	–	–	0.021	0.044	0.221	0.003	–	–	–	12.045	0.074
89		*Hilsa ilisha*	*Ilish*	0.448	–	–	–	0.363	–	–	–	–	5.784	63.523	77.329	27.858	0.003	–	–	–	6459.228	39.919
85		*Gonialosa manmina*	*Goni chapila*	–	–	–	–	–	–	–	–	–	0.215	–	–	–	–	–	–	–	2.386	0.015
58		*Corica soborna*	*Kachki*	0.022	0.007	–	–	–	–	–	–	0.086	0.104	0.081	–	0.002	3.999	–	–	–	49.500	0.306
193		*Setipinna phasa*	*Phasa*	0.135	–	–	–	–	–	–	–	–	0.556	0.410	0.004	0.028	0.002	–	–	–	14.639	0.090
14		*Awaous stamineus*	*Bele*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.369	–	–	0.693	0.004
185		*Rhinomugil corsula*	*Khorsula*	1.178	–	–	–	–	–	1.357	0.711	–	5.553	0.315	0.037	0.429	0.032	–	–	–	94.659	0.585
923		*Sicamugil cascasia*	*Bata*	–	–	–	–	–	–	–	–	–	0.120	0.010	–	0.024	0.100	–	–	–	3.668	0.023
163		*Pisodonophis boro*	*Kharu*	–	–	–	–	–	–	–	–	0.125	0.276	–	0.008	0.032	–	–	–	–	6.307	0.039
2		*Ailia coila*	*Kajuli*	23.299	0.090	–	–	–	–	–	–	0.248	1.137	2.207	0.962	6.177	0.346	–	–	–	369.061	2.281
51		*Clupisoma garua*	*Ghaura*	1.789	1.990	–	–	–	–	–	–	0.557	1.322	3.022	1.099	3.736	5.317	–	–	–	352.137	2.176
52		*Clupisoma naziri*	*Muri Bacha*	–	–	–	–	–	–	–	–	–	–	–	0.004	0.016	–	–	–	–	0.872	0.005
196		*Silonia silondia*	*Shillong*	–	–	–	–	–	–	–	–	–	–	0.532	0.701	0.472	–	–	–	–	66.472	0.411
16		*Bagarius bagarius*	*Baghair*	0.058	3.513	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
77		*Gagata cenia*	*Kauwa*	0.262	0.082	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
80		*Gagata viridescens*	*Gang tengra*	1.769	–	–	–	–	–	–	–	–	–	0.034	0.103	1.234	0.047	–	–	–	58.561	0.362
81		*Gagata youssoufi*	*Gang tengra*	0.692	0.130	–	–	–	–	–	–	0.181	0.407	1.248	1.422	1.359	0.454	–	–	–	166.661	1.030
84		*Glyptothorax telchitta*	*Telchitta*	–	–	–	–	–	–	–	–	–	0.838	2.603	0.646	0.465	0.019	–	–	–	108.354	0.670
958		*Glyptothorax sp*	*Lal moina*	0.660	–	–	–	–	–	–	–	–	–	–	0.394	–	–	–	–	–	21.028	0.130
95		*Johnius coitor*	*Koitor*	–	–	–	–	–	–	–	–	–	–	0.142	–	0.169	0.014	0.332	–	–	10.335	0.064
155		*Pama pama*	*Poa*	0.037	–	–	–	–	–	–	–	–	–	–	–	0.330	–	–	–	–	13.890	0.086
171		*Psilorhynchus balitora*	*Balitora*	–	–	–	–	–	–	–	–	–	–	–	–	0.014	–	–	–	–	0.608	0.004
158		*Pangasius pangasius*	*Pangas*	0.397	0.213	–	–	–	–	–	–	–	–	–	0.040	0.187	0.013	–	–	–	10.133	0.063
955		*Amblyceps mangois*	*Magur*	–	–	–	–	–	–	–	–	–	0.084	–	–	–	–	–	–	–	0.930	0.006
	Subtotal			33.087	7.232	0.6248	10.219	18.798	6.9818	2.8512	4.8405	3.4991	20.644	76.768	83.690	46.431	11.017	2.02	–	–	8199.80	50.6755
130	Migratory	*Aorichthys aor*	*Ayre*	0.516	74.526	68.526	–	–	–	–	–	0.373	0.936	1.079	–	12.365	18.420	31.462	–	–	830.570	5.133
135		*Aorichthys seenghala*	*Guizza*	–	–	–	–	–	–	–	–	0.487	–	0.046	–	–	–	–	–	–	6.678	0.041
24		*Batasio batasio*	*Tengra*	–	–	–	–	–	–	–	–	–	–	–	0.006	0.024	–	–	–	–	1.304	0.008
131		*Mystus bleekeri*	*Golsha tengra*	–	0.557	–	–	0.921	–	0.003	–	0.114	–	–	0.059	0.501	0.503	0.221	–	–	31.954	0.197
132		*Mystus cavasius*	*Kabashi*	0.043	–	–	–	–	3.444	0.050	–	0.376	–	1.660	0.117	1.795	0.139	–	–	–	128.044	0.791
32		*Catla catla*	*Catla*	0.735	–	–	–	–	–	–	–	–	–	6.925	11.154	–	19.983	–	–	–	950.645	5.875
47		*Cirrhinus mrigala*	*Mrigel*	1.225	–	–	–	–	–	–	–	–	–	0.353	0.926	0.844	0.925	2.969	–	–	107.542	0.665
48		*Cirrhinus reba*	*Raik*	2.318	0.144	0.712	4.699	2.003	–	28.428	12.850	3.966	1.076	–	0.045	0.738	0.358	1.237	0.159	–	243.616	1.506
100		*Labeo bata*	*Bata*	–	0.447	–	–	–	1.895	0.480	–	–	–	–	0.051	0.302	0.007	–	–	–	23.438	0.145
101		*Labeo boga*	*Bhangan*	0.040	–	–	–	–	–	–	–	–	–	0.777	0.127	0.169	–	–	–	–	27.263	0.168
102		*Labeo calbasu*	*Kalbaus*	0.013	1.072	–	–	–	–	15.410	–	–	–	0.184	1.034	0.973	1.667	13.858	59.585	17.311	296.744	1.834
107		*Labeo rohita*	*Rui*	0.912	–	0.171	–	–	–	–	–	27.036	–	–	0.011	12.479	12.037	8.187	–	–	1009.699	6.240
188		*Salmostoma bacaila*	*Katari*	0.228	0.182	–	–	3.922	–	–	–	0.720	0.115	0.018	–	0.893	14.682	–	0.093	–	221.340	1.368
189		*Salmostoma phulo*	*Fulchela*	1.052	0.076	–	–	9.357	–	–	–	1.998	2.512	0.729	0.012	0.259	0.813	–	–	5.923	88.180	0.545
154		*Securicula gora*	*Chora chela*	–	–	–	–	–	–	–	–	–	0.009	0.132	–	0.110	–	–	–	–	7.020	0.043
86		*Gudusia chapra*	*Chapila*	2.300	0.572	–	–	0.287	–	–	–	0.035	0.341	0.073	0.261	1.213	8.485	–	–	36.854	186.310	1.151
76		*Eutropiichthys vacha*	*Bacha*	0.158	–	–	–	–	–	–	–	–	0.637	0.504	–	0.805	–	–	–	–	49.626	0.307

Note: – denotes zero catch

(Cont.)

Table 4.8 Monthly catch composition from the regulated Baral River (% by weight): site NW25

Species	Habitat	Species name		Year: 1992			Year: 1993												Year: 1994		Total annual catch (Mar'93 – Feb'94)	
Code	Preference	Scientific	Bengali	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Kg	%
169		*Pseudeutropius atherinoides*	*Batasi*	0.048	0.053	–	–	–	–	–	–	0.365	0.191	–	0.009	0.189	0.004	–	–	–	15.005	0.093
209		*Wallagu attu*	*Boal*	0.301	–	13.666	30.240	–	–	23.621	14.514	–	7.503	–	0.014	1.062	0.828	2.771	–	–	276.668	1.710
144		*Notopterus chitala*	*Chital*	–	–	–	–	–	–	–	–	–	0.068	–	–	0.073	–	–	–	–	3.805	0.024
142		*Nemacheilus scaturigina*	*Dari*	–	–	–	–	–	–	–	–	–	–	–	0.002	0.008	–	–	–	–	0.436	0.003
	Subtotal			9.8892	77.628	83.075	34.939	16.490	5.3382	67.991	27.364	35.471	13.386	12.480	13.826	34.800	78.851	60.704	59.836	60.088	4505.88	27.8467
6	Floodplain	*Anabas testudineus*	*Koi*	–	–	–	–	–	–	–	–	–	0.070	–	–	–	–	–	–	–	0.775	0.005
136	Resident	*Mystus tengara*	*Bajari tengra*	0.043	0.015	–	–	–	–	–	–	–	–	–	0.013	0.016	–	–	–	–	1.386	0.009
137		*Mystus vittatus*	*Tengra*	0.015	–	–	–	–	–	0.078	–	0.260	–	–	0.151	0.024	0.003	3.329	1.677	–	21.325	0.132
55		*Colisa fasciatus*	*Khalisha*	–	–	–	–	–	–	–	–	0.203	0.018	–	0.024	0.665	0.050	–	–	–	32.538	0.201
211		*Colisa labiosus*	*Khalisha*	–	–	–	–	–	–	–	–	0.104	0.025	–	–	–	–	–	–	–	1.531	0.009
210		*Xenentodon cancila*	*Kaikka*	–	–	–	0.498	–	0.060	0.452	1.446	3.970	0.754	–	0.035	0.164	0.004	–	–	–	72.023	0.445
187		*Osteobrama cotio cotio*	*Keti*	–	–	–	–	–	0.109	–	–	–	0.137	0.007	0.009	0.040	0.027	–	–	–	4.497	0.028
174		*Puntius chola*	*Chala puti*	–	–	–	–	–	–	–	–	–	–	–	–	0.014	–	–	–	–	0.610	0.004
175		*Puntius conchonius*	*Canchan puti*	–	0.114	–	7.130	15.552	19.864	12.583	14.148	1.325	15.538	0.126	0.009	0.606	0.104	2.799	23.376	6.167	420.708	2.600
176		*Puntius gelius*	*Giliputi*	–	–	–	–	–	–	–	–	–	–	–	0.022	0.072	–	–	–	–	4.173	0.026
178		*Puntius phutunio*	*Phutani puti*	–	–	–	–	–	–	–	–	0.104	0.018	–	0.026	0.103	–	–	–	–	7.193	0.044
179		*Puntius sarana*	*Sarputi*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	9.872	4.200	0.026
180		*Puntius sophore*	*Puti*	–	0.053	2.537	–	12.180	1.513	0.342	1.504	0.327	0.488	0.046	0.170	1.484	0.352	4.358	4.568	14.478	118.763	0.734
181		*Puntius terio*	*Teri punti*	–	–	–	–	–	–	–	10.454	1.247	0.077	–	–	–	–	–	–	–	53.235	0.329
212		*Puntius ticto*	*Tit puti*	0.124	–	–	–	–	0.030	–	–	0.110	0.019	–	0.033	0.128	–	–	–	–	8.814	0.054
5		*Amblypharygodon mola*	*Mola*	–	–	–	–	–	–	–	–	–	0.006	–	0.005	0.013	0.001	–	–	–	0.881	0.005
68		*Danio devario*	*Chebli*	2.665	0.921	–	–	–	–	–	–	–	–	–	–	0.128	0.017	–	–	–	5.595	0.035
75		*Esomus danricus*	*Darkina*	–	–	–	–	–	–	–	0.347	0.028	–	0.020	0.048	0.350	0.025	–	–	–	19.514	0.121
83		*Glossogobius giurus*	*Bailla*	0.281	0.408	7.130	39.442	27.276	37.841	3.265	11.809	13.116	14.471	3.477	0.207	2.259	0.525	8.195	9.945	2.813	700.864	4.331
43		*Chela cachius*	*Chep Chela*	–	–	–	–	–	–	–	–	–	–	0.041	–	–	0.012	–	–	–	0.842	0.005
110		*Lepidocephalus guntea*	*Gutum*	0.057	–	–	–	–	–	0.151	–	0.305	–	–	–	–	–	–	–	–	4.198	0.026
9		*Aplocheilus panchax*	*Kanpona*	–	–	–	–	–	–	–	–	0.012	0.079	–	0.005	0.133	0.010	–	–	–	7.000	0.043
39		*Channa marulius*	*Gajar*	–	–	–	–	–	–	–	–	–	–	–	–	0.141	–	–	–	–	5.934	0.037
40		*Channa orientalis*	*Cheng*	–	–	–	–	–	–	–	–	0.651	–	–	–	–	–	–	–	–	7.855	0.049
41		*Channa punctatus*	*Taki*	0.050	–	–	–	–	–	–	–	2.613	1.061	0.118	0.036	2.000	0.116	0.579	0.597	–	134.825	0.833
42		*Channa striatus*	*Shol*	–	–	–	–	–	–	–	10.236	–	–	–	–	0.046	–	–	–	–	38.478	0.238
88		*Heteropneustes fossilis*	*Shingi*	0.051	–	–	–	1.133	–	–	–	–	0.992	0.758	0.017	0.076	1.512	0.105	–	–	46.222	0.286
121		*Macrognathus aculeatus*	*Tara baim*	–	–	–	–	–	–	0.044	–	–	0.839	–	–	–	–	–	–	–	9.459	0.058
123		*Macrognathus pancalus*	*Guchi*	–	–	–	–	6.001	2.547	0.220	1.874	2.218	2.954	0.080	0.002	0.008	–	–	–	–	77.186	0.477
122		*Mastacembelus armatus*	*Baral baim*	47.642	8.025	6.293	2.964	2.147	1.460	3.749	4.450	0.307	3.501	0.346	0.010	0.274	2.000	1.402	–	–	120.376	0.744
15		*Badis badis*	*Napit koi*	–	–	–	–	–	–	–	–	0.521	0.342	–	–	0.066	0.009	0.066	–	–	13.115	0.081
147		*Ompok bimaculatus*	*Kani pabda*	–	–	–	–	–	–	–	–	–	–	–	–	–	0.013	–	–	–	0.152	0.001
148		*Ompok pabda*	*Madhu pabda*	0.019	–	–	–	–	–	0.020	–	–	–	–	–	–	–	–	–	–	0.069	0.0004
145		*Notopterus notopterus*	*Foli*	0.195	0.425	–	–	–	–	0.870	0.660	2.710	2.244	0.383	0.056	0.540	0.038	0.184	–	–	96.100	0.594
203		*Tetraodon cutcutia*	*Potka*	–	–	–	–	–	–	–	–	–	0.136	–	0.019	0.346	0.020	–	–	–	17.305	0.107
33		*Chaca chaca*	*Cheka*	–	–	–	–	–	–	–	–	–	–	–	–	0.008	–	–	–	–	0.329	0.002
35		*Chanda baculis*	*Chanda*	0.015	–	–	–	–	0.244	0.008	–	1.840	0.457	0.001	0.081	0.492	0.062	–	–	–	53.898	0.333
36		*Chanda nama*	*Nama Chanda*	0.078	0.007	–	–	0.423	2.097	–	–	5.903	1.394	0.030	0.026	0.263	1.013	–	–	–	118.530	0.733
37		*Chanda ranga*	*Lal chanda*	–	–	–	–	–	–	0.050	0.035	4.722	2.122	0.002	0.051	0.211	0.008	0.033	–	6.581	95.419	0.590
	Subtotal			51.235	9.9678	15.96	50.033	64.711	65.764	21.832	56.963	42.594	47.740	5.4341	1.0538	10.670	5.9215	21.050	40.162	39.911	2325.91	14.3743
998		Unidentified fish		–	–	–	–	–	–	–	–	–	0.267	–	–	–	–	–	–	–	2.964	0.018
117		*Machrobrachium styliferus*	*Gura icha*	2.221	0.430	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
931		Prawn spp.	*Chingri/Icha*	3.565	4.740	0.339	4.808	–	21.916	7.324	10.833	18.435	17.960	5.315	1.427	8.095	4.210	16.224	–	–	1146.415	7.085
	Subtotal			5.7865	5.1704	0.3393	4.8084	–	21.916	7.324	10.833	18.435	18.227	5.3146	1.4273	8.095	4.2099	16.224	–	–	1149.37	7.10326
	Grand total			100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	16180.990	100

Note: – denotes zero catch

Table 4.9 Monthly catch composition from the unregulated Padma River (% by weight): site NW24

Species Code	Habitat Preference	Species name		Year: 1992			Year: 1993												Year: 1994		Total annual catch (March'93 – Feb'94)	
		Scientific	Bengali	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	kg	%
186	Riverine	Rita rita	*Rita*	1.082	16.239	11.801	7.730	1.400	2.038	6.300	2.504	2.756	6.222	0.455	10.017	5.922	56.522	44.884	48.285	28.223	4399.005	15.538
13		*Aspidoparia morar*	*Piali*	1.210	5.990	5.437	9.798	3.452	17.585	3.238	9.873	10.356	8.316	3.051	2.071	1.055	2.864	4.666	3.041	1.762	1626.456	5.745
18		*Barilius barna*	*Bani Koksa*	–	–	–	3.535	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
218		*Barilius evezardi*		–	–	–	–	–	–	–	0.078	–	–	–	–	–	0.018	–	–	–	2.338	0.008
20		*Raiamas bola*	*Bhol*	0.317	2.614	0.416	–	–	–	–	0.094	–	0.209	0.547	–	–	–	–	–	–	22.773	0.080
59		*Crossocheilus latius*	*Kalabata*	–	0.063	0.539	0.196	0.007	1.442	–	–	–	–	–	0.031	–	0.026	0.131	1.380	–	49.248	0.174
139		*Nemacheilus botia*	*Balichata*	–	–	–	–	–	–	–	0.004	–	0.456	0.075	–	–	–	–	–	–	22.234	0.079
28		*Botia dario*	*Rani*	–	–	–	0.114	–	0.258	–	–	0.048	–	0.123	–	0.018	–	0.056	–	0.141	13.633	0.048
89		*Hilsa ilisha*	*Ilish*	29.563	8.140	9.384	6.294	1.434	12.068	3.596	0.552	–	2.465	13.802	2.448	0.919	0.811	1.246	2.212	–	783.753	2.768
85		*Gonialosa manmina*	*Goni chapila*	–	–	–	–	–	1.368	–	3.997	0.913	0.071	–	0.091	–	–	–	–	–	156.904	0.554
58		*Corica soborna*	*Kachki*	0.179	–	0.017	0.052	0.015	–	2.121	1.802	1.571	0.240	0.253	–	0.009	0.040	–	–	–	148.139	0.523
193		*Setipinna phasa*	*Phasa*	0.518	1.854	0.524	0.148	1.082	0.755	1.769	3.566	0.503	0.408	2.591	1.590	1.039	0.157	0.261	0.041	–	286.439	1.012
14		*Awaous stamineus*	*Bele*	–	–	–	–	–	–	–	0.478	0.343	–	–	–	–	–	–	–	–	22.463	0.079
30		*Brachygobius nunus*	*Nunabailla*	–	–	–	–	0.520	3.376	0.659	0.726	0.040	0.083	–	–	–	–	–	–	–	86.216	0.305
128		*Liza parsia*	*Bata*	–	–	–	–	–	–	–	0.388	–	–	–	–	–	–	–	–	–	10.333	0.036
922		*Liza sp*	*Bata*	–	0.345	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
185		*Rhinomugil corsula*	*Khorsula*	0.248	3.181	0.466	0.927	2.496	3.505	0.933	0.909	0.424	0.284	0.851	0.378	16.081	0.752	1.943	–	0.706	762.520	2.693
923		*Sicamugil cascasia*	*Bata*	–	–	0.009	–	–	–	–	–	–	–	–	0.155	0.016	0.314	–	–	–	6.746	0.024
163		*Pisodonophis boro*	*Kharu*	–	–	–	–	–	–	–	1.208	0.132	0.001	–	–	–	–	–	–	–	35.987	0.127
2		*Ailia coila*	*Kajuli*	0.577	5.491	26.841	11.908	0.585	1.709	–	0.550	0.010	1.143	5.015	11.218	0.121	1.111	7.186	4.394	3.531	695.439	2.456
3		*Ailia punctata*	*Kajuli*	–	–	–	0.097	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
51		*Clupisoma garua*	*Ghaura*	42.730	27.769	10.650	4.714	10.716	19.489	5.636	5.952	4.032	0.484	21.578	10.821	4.305	11.286	0.120	0.702	–	1562.264	5.518
52		*Clupisoma naziri*	*Muri Bacha*	–	–	–	0.342	–	–	–	0.047	0.017	–	–	–	0.060	1.625	–	–	–	26.163	0.092
196		*Silonia silondia*	*Shillong*	–	–	–	–	–	–	0.400	–	–	–	0.106	1.065	0.270	0.015	–	–	–	31.872	0.113
16		*Bagarius bagarius*	*Baghair*	0.075	0.098	–	0.065	–	–	–	–	–	–	–	–	–	0.443	–	–	–	6.111	0.022
80		*Gagata viridescens*	*Gang tengra*	–	–	0.495	1.231	–	–	–	–	–	0.002	–	–	–	0.035	–	–	1.208	35.711	0.126
81		*Gagata youssoufi*	*Gang tengra*	–	0.147	4.391	–	0.731	1.877	–	0.128	–	0.010	0.302	0.381	0.097	0.082	0.591	6.575	1.543	220.436	0.779
84		*Glyptothorax telchitta*	*Telchitta*	–	–	–	0.008	–	–	–	–	–	–	–	–	0.016	–	–	–	–	0.551	0.002
87		*Hara hara*	*Kutakanti*	0.010	0.437	–	–	0.009	–	–	–	–	–	–	–	–	–	–	–	–	–	–
95		*Johnius coitor*	*Koitor*	–	–	–	0.062	0.613	0.421	–	–	0.609	2.301	0.940	0.278	2.526	2.239	0.249	0.770	–	285.640	1.009
155		*Pama pama*	*Poa*	–	–	–	–	–	–	–	–	–	–	1.004	2.336	–	–	–	1.379	–	72.605	0.256
171		*Psilorhynchus balitora*	*Balitora*	–	–	–	–	–	–	–	–	–	–	0.017	–	–	–	–	–	–	0.332	0.001
158		*Pangasius pangasius*	*Pangas*	0.525	0.026	2.316	0.889	0.506	0.096	0.027	1.393	–	–	–	0.155	1.644	0.153	–	0.033	–	99.517	0.352
956		*Eurvglossa orientalis*	*Kathal pata*	–	–	–	–	0.008	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Subtotal			77.033	72.392	73.284	48.109	23.572	65.987	24.679	34.250	21.754	22.693	50.709	43.033	34.095	78.491	61.332	68.810	37.114	11471.828	40.5197
130	Migratory	*Aorichthys aor*	*Ayre*	9.503	–	1.285	1.232	0.402	0.566	0.203	–	0.339	3.902	7.366	14.259	4.977	0.863	–	0.145	5.984	876.334	3.095
135		*Aorichthys seenghala*	*Guizza*	–	–	0.298	–	–	–	–	–	0.591	–	0.441	–	–	–	–	–	–	25.458	0.090
131		*Mystus bleekeri*	*Golsha tengra*	–	1.270	–	–	–	–	–	–	–	–	–	0.176	0.906	1.313	–	–	0.129	54.792	0.194
132		*Mystus cavasius*	*Kabashi*	–	0.412	0.938	–	0.033	–	–	–	0.621	2.985	0.025	–	4.865	1.581	0.009	0.415	6.743	543.956	1.921
32		*Catla catla*	*Catla*	–	–	–	–	–	–	–	–	–	–	–	0.742	–	–	–	–	–	9.093	0.032
47		*Cirrhinus mrigala*	*Mrigel*	–	–	–	–	–	–	–	–	–	–	–	2.071	0.556	–	–	–	–	44.279	0.156
48		*Cirrhinus reba*	*Raik*	0.484	1.414	0.022	–	0.135	0.134	0.025	–	–	0.124	0.502	0.286	1.491	0.275	–	–	–	75.959	0.268
100		*Labeo bata*	*Bata*	–	–	–	–	–	–	–	–	–	–	0.011	1.546	–	–	–	–	–	19.162	0.068
101		*Labeo boga*	*Bhangan*	–	–	–	–	–	–	–	–	–	–	–	–	0.033	–	–	–	–	1.112	0.004
102		*Labeo calbasu*	*Kalbaus*	–	–	16.885	31.392	6.426	–	–	–	–	–	0.050	0.031	0.424	–	32.471	7.568	–	907.149	3.204

Note: – denotes zero catch

(Cont.)

Table 4.9 Monthly catch composition from the unregulated Padma River (% by weight): site NW24

Species Code	Habitat Preference	Species name		Year: 1992			Year: 1993												Year: 1994		Total annual catch (March'93 – Feb'94)	
		Scientific	Bengali	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	kg	%
107		*Labeo rohita*	*Rui*	–	–	–	–	–	–	–	–	–	0.643	–	0.216	–	–	–	–	–	31.754	0.112
188		*Salmostoma bacaila*	*Katari*	0.093	0.259	0.005	–	–	–	–	–	0.083	–	–	–	0.079	–	–	–	–	5.007	0.018
189		*Salmostoma phulo*	*Fulchela*	–	0.499	0.113	0.244	–	1.197	–	0.502	0.217	0.120	–	–	0.385	0.040	–	–	–	56.294	0.199
154		*Securicula gora*	*Chora chela*	–	–	–	0.170	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
86		*Gudusia chapra*	*Chapila*	5.400	2.877	1.150	1.630	13.210	8.848	28.142	14.349	0.434	0.304	1.255	2.912	1.205	1.296	0.783	2.972	0.266	1253.592	4.428
76		*Eutropiichthys vacha*	*Bacha*	0.193	0.377	0.152	0.319	–	0.562	0.364	0.147	–	0.251	0.124	0.511	0.256	0.089	0.288	–	–	55.654	0.197
169		*Pseudeutropius atherinoide*	*Batasi*	0.357	–	0.265	–	–	0.219	0.499	–	–	0.220	0.026	–	0.010	–	0.005	–	–	23.328	0.082
209		*Wallagu attu*	*Boal*	–	–	–	–	–	–	–	–	–	–	–	–	1.280	–	–	–	–	43.534	0.154
144		*Notopterus chitala*	*Chital*	–	–	–	–	–	–	–	–	–	–	–	–	2.658	0.127	–	–	–	92.112	0.325
	Subtotal			16.029	7.1078	21.114	34.985	20.206	11.526	29.233	14.997	2.2858	8.5487	9.7998	22.750	19.124	5.5834	33.556	11.099	13.122	4118.569	14.5472
137	Floodplain	*Mystus vittatus*	*Tengra*	0.109	0.722	0.040	–	–	–	–	–	–	–	0.109	–	0.072	0.314	0.256	0.778	0.394	39.986	0.141
55	Resident	*Colisa fasciatus*	*Khalisha*	–	–	–	–	–	–	–	–	–	–	0.026	0.124	–	–	–	–	–	2.037	0.007
211		*Colisa labiosus*	*Khalisha*	–	–	–	–	–	–	–	–	–	0.124	0.005	–	–	–	–	–	–	5.737	0.020
210		*Xenentodon cancila*	*Kaikka*	–	–	–	–	–	0.127	–	–	–	0.031	0.041	–	0.408	–	0.116	–	–	20.672	0.073
62		*Cyprinus carpio*	*Karfu*	–	–	–	–	–	–	–	–	–	–	–	2.690	–	–	–	–	–	32.962	0.116
129		*Mylopharyngodon piseeus*	*Kalo carp*	–	–	–	–	–	–	–	0.016	0.044	–	–	–	–	–	–	–	–	1.646	0.006
187		*Osteobrama cotio cotio*	*Keti*	0.008	–	–	–	–	–	–	0.150	0.013	0.028	0.109	–	0.116	0.025	0.032	–	0.118	16.253	0.057
174		*Puntius chola*	*Chala puti*	–	–	–	–	–	–	–	–	–	–	–	–	0.131	–	–	–	–	4.460	0.016
175		*Puntius conchonius*	*Canchan puti*	0.004	2.900	0.172	0.269	2.369	2.111	1.431	1.788	3.155	8.295	0.111	–	0.701	2.210	0.341	0.137	0.361	647.265	2.286
176		*Puntius gelius*	*Giliputi*	–	–	–	–	–	–	–	–	–	0.124	0.011	–	–	–	–	–	–	5.849	0.021
177		*Puntius guganio*	*Mola puti*	–	–	–	–	–	–	–	–	–	0.003	–	–	0.053	–	–	–	–	1.945	0.007
178		*Puntius phutunio*	*Phutani puti*	–	–	–	–	–	–	–	–	–	0.001	–	–	–	–	–	–	–	0.057	0.0002
180		*Puntius sophore*	*Puti*	0.222	0.552	0.079	–	0.117	0.383	–	0.005	1.318	0.768	0.343	0.272	1.489	1.190	0.361	–	0.984	192.066	0.678
181		*Puntius terio*	*Teri punti*	–	–	–	–	–	–	–	1.506	0.220	0.180	–	–	–	–	–	–	–	54.511	0.193
212		*Puntius ticto*	*Tit puti*	0.089	–	–	–	–	–	–	–	0.113	–	–	–	–	–	0.003	–	–	3.273	0.012
5		*Amblypharygodon mola*	*Mola*	–	–	–	–	–	–	–	–	–	–	0.026	–	0.014	0.019	0.005	–	–	1.364	0.005
68		*Danio devario*	*Chebli*	–	–	–	–	–	–	0.437	–	0.046	–	0.026	–	0.531	–	0.003	–	–	28.006	0.099
75		*Esomus danricus*	*Darkina*	0.003	–	–	–	–	–	–	–	–	–	0.079	–	0.416	–	0.087	–	–	17.740	0.063
83		*Glossogobius giurus*	*Bailla*	1.319	5.735	1.142	3.685	51.263	11.340	12.377	12.664	21.507	9.998	9.072	11.655	11.998	5.307	1.144	–	7.774	2849.631	10.065
43		*Chela cachius*	*Chep Chela*	–	–	0.014	0.123	0.002	0.037	–	–	–	–	–	–	0.014	0.006	–	–	–	1.088	0.004
110		*Lepidocephalus guntea*	*Gutum*	–	–	–	–	–	–	–	–	–	–	–	–	–	0.333	–	–	–	4.592	0.016
40		*Channa orientalis*	*Cheng*	–	–	–	–	–	–	–	–	–	–	–	–	0.211	–	–	–	–	7.179	0.025
41		*Channa punctatus*	*Taki*	0.025	0.486	–	–	–	–	–	–	–	7.548	0.290	0.371	3.810	0.204	0.034	–	–	485.104	1.713
151		*Oreochromis nilotica*	*Nilotica*	–	–	–	–	–	–	–	–	–	–	–	0.526	–	–	–	–	–	6.441	0.023
88		*Heteropneustes fossilis*	*Shingi*	–	–	–	–	–	–	–	–	–	0.009	–	–	0.229	–	–	–	–	8.186	0.029
121		*Macrognathus aculeatus*	*Tara baim*	–	0.194	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
123		*Macrognathus pancalus*	*Guchi*	–	–	–	–	–	–	0.027	0.016	0.169	0.021	0.174	–	1.189	–	–	–	–	50.511	0.178
122		*Mastacembelus armatus*	*Baral baim*	0.003	0.243	–	–	–	0.154	0.574	–	0.410	2.448	–	0.385	2.277	1.456	0.051	0.484	0.873	272.495	0.962
15		*Badis badis*	*Napit koi*	–	–	–	–	–	–	–	–	–	–	–	–	0.013	–	–	–	–	0.436	0.002
124		*Monopterus cuchia*	*Kuchia*	0.402	–	–	–	–	–	–	–	0.077	–	–	–	–	–	–	–	–	2.187	0.008
147		*Ompok bimaculatus*	*Kani pabda*	0.001	0.042	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
148		*Ompok pabda*	*Madhu pabda*	–	–	–	–	–	–	–	–	–	0.010	–	–	–	–	–	–	–	0.450	0.002
145		*Notopterus notopterus*	*Foli*	–	1.295	–	–	–	–	–	–	–	–	–	0.155	0.390	1.664	–	–	–	38.080	0.135
35		*Chanda baculis*	*Chanda*	0.010	–	0.080	0.122	–	–	–	–	0.048	0.017	0.044	0.031	0.143	–	0.003	–	–	8.339	0.029
36		*Chanda nama*	*Nama Chanda*	0.268	–	–	–	–	0.005	0.440	0.125	0.048	0.244	0.113	–	0.043	0.066	0.057	–	–	29.822	0.105

Note: – denotes zero catch

(Cont.)

Table 4.9 Monthly catch composition from the unregulated Padma River (% by weight): site NW24

Species Code	Habitat Preference	Species name		Year: 1992			Year: 1993												Year: 1994		Total annual catch (March'93 – Feb'94)	
		Scientific	Bengali	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	kg	%
37		*Chanda ranga*	*Lal chanda*	–	–	0.026	–	–	–	–	–	0.080	0.179	0.132	–	0.307	0.023	–	–	–	23.739	0.084
	Subtotal			2.4623	12.167	1.5523	4.1982	53.750	14.156	15.285	16.268	27.249	30.028	10.713	16.207	24.551	12.816	2.4924	1.3983	10.504	4864.109	17.1805
998		*Unidentified fish*		–	–	–	0.071	0.001	–	–	–	–	–	–	–	–	–	–	–	–	–	–
931		Prawn spp.	*Chingri/Icha*	4.474	8.331	4.048	12.635	2.469	8.331	30.801	34.482	48.709	38.728	28.777	18.007	22.228	3.109	2.617	18.691	39.257	7857.164	27.752
	Subtotal			4.4743	8.3309	4.0477	12.705	2.4702	8.3308	30.801	34.482	48.709	38.728	28.777	18.007	22.228	3.1089	2.6171	18.691	39.257	7857.164	27.7523
	Grand total			100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	28311.670	100

Note: – denotes zero catch

Table 4.10 Monthly catch composition from the unregulated Atrai River (% by weight): site NW27

Species	Habitat	Species name		Year: 1992			Year: 1993											Year: 1994		Total annual catch (Mar'93 – Feb'94)	
Code	Preference	Scientific	Bengali	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Kg	%
957	Riverine	*Mystus punctatus*	*Gagur*	–	–	4.183	1.317	2.580	–	9.539	–	–	–	–	–	–	–	–	–	–	171.845	0.676
186		*Rita rita*	*Rita*	0.812	0.006	0.217	–	0.400	–	–	–	–	0.898	6.415	1.295	1.244	1.253	0.237	–	–	217.176	0.854
12		*Aspidoparia jaya*	*Pfali*	0.294	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
13		*Aspidoparia morar*	*Pfali*	–	0.004	–	–	–	0.005	–	–	–	–	–	–	–	0.028	0.010	0.092	0.101	5.212	0.021
67		*Danio dangila*	*Nipati*	–	–	–	–	–	–	–	–	0.250	–	–	–	–	–	0.003	–	–	1.900	0.007
20		*Raiamas bola*	*Bhol*	0.403	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
59		*Crossocheilus latius*	*Kalabata*	0.105	0.163	0.431	6.395	1.640	0.783	0.004	–	0.201	0.038	–	0.016	0.008	0.070	0.358	0.899	1.903	74.906	0.295
139		*Nemacheilus botia*	*Balichata*	0.179	0.017	0.069	0.118	1.180	2.859	2.752	2.448	0.181	0.212	–	0.004	0.244	0.218	0.245	0.593	0.336	141.506	0.557
198		*Somileptes gongota*	*Gharpoia*	–	0.026	0.121	0.239	12.800	1.606	0.206	1.934	–	2.581	0.089	–	0.109	0.236	0.332	0.459	2.338	126.652	0.498
28		*Botia dario*	*Rani*	0.384	0.083	–	–	–	–	–	–	–	0.060	0.044	0.125	0.087	0.659	0.081	0.057	–	37.835	0.149
29		*Botia lohachata*	*Putul*	–	–	–	–	–	–	–	–	–	–	0.089	–	0.032	0.126	0.012	–	–	7.716	0.030
89		*Hilsa ilisha*	*Ilish*	2.859	0.016	–	–	–	–	–	–	3.655	8.394	14.797	14.310	1.778	0.166	–	–	–	623.465	2.453
58		*Corica soborna*	*Kachki*	0.339	0.034	–	0.010	–	0.980	0.006	0.166	0.283	0.736	0.222	0.068	0.288	2.460	0.003	–	1.134	136.581	0.537
193		*Setipinna phasa*	*Phasa*	0.690	0.013	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
30		*Brachygobius nunus*	*Nunabailla*	–	–	–	–	0.012	–	–	–	–	–	–	–	–	–	–	–	–	–	–
128		*Liza parsia*	*Bata*	–	–	–	–	–	0.007	–	–	–	–	–	–	–	–	–	–	–	0.048	0.0002
922		*Liza sp*	*Bata*	–	–	–	0.020	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
185		*Rhinomugil corsula*	*Khorsula*	0.109	0.005	–	–	0.066	–	–	–	–	–	0.001	–	0.001	–	–	–	–	0.047	0.0002
923		*Sicamugil cascasia*	*Bata*	–	–	–	–	–	–	–	–	–	–	–	0.011	0.046	0.004	–	–	–	2.282	0.009
163		*Pisodonophis boro*	*Kharu*	–	–	–	–	–	–	–	–	0.259	–	–	–	–	–	–	–	–	1.765	0.007
2		*Ailia coila*	*Kajuli*	3.029	0.108	0.822	0.035	0.162	–	–	–	9.439	18.685	9.471	27.033	9.956	2.805	0.264	–	–	1413.500	5.561
51		*Clupisoma garua*	*Ghaura*	5.140	3.439	0.850	1.185	0.054	–	–	–	0.320	1.539	5.485	2.825	2.005	1.916	0.631	0.177	–	328.829	1.294
52		*Clupisoma naziri*	*Muri bacha*	–	–	–	–	–	–	–	–	–	–	–	–	–	0.179	0.142	–	–	14.896	0.059
196		*Silonia silondia*	*Shillong*	0.124	–	–	–	–	–	–	–	–	–	0.642	0.226	0.124	0.063	–	–	–	18.743	0.074
16		*Bagarius bagarius*	*Baghair*	0.114	0.056	3.221	–	1.735	–	0.478	–	–	–	0.044	–	–	–	0.302	0.774	0.940	57.504	0.226
74		*Erethistes pussilus*	*Kutakanti*	–	–	–	–	0.006	–	0.141	–	0.734	–	0.018	–	–	–	0.049	0.012	–	10.915	0.043
77		*Gagata cenia*	*Kauwa*	–	0.006	0.032	3.895	–	–	–	–	–	–	–	–	0.118	–	–	0.168	–	9.710	0.038
80		*Gagata viridescens*	*Gang tengra*	0.239	–	–	–	–	–	–	–	0.156	0.015	2.326	2.799	0.713	0.812	1.517	0.706	–	245.449	0.966
81		*Gagata youssoufi*	*Gang tengra*	0.234	0.107	0.105	0.194	0.010	1.463	–	–	1.692	0.403	1.172	7.061	2.227	1.730	1.270	0.745	0.044	420.004	1.652
84		*Glyptothorax telchitta*	*Telchitta*	–	–	–	–	–	–	–	–	–	0.565	2.610	1.004	0.310	1.024	2.058	0.544	–	238.888	0.940
958		*Glyptothorax sp*	*Lal moina*	0.111	0.056	0.0002	–	0.048	–	–	–	–	–	–	–	–	–	–	–	–	–	–
87		*Hara hara*	*Kutakanti*	0.033	0.011	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
95		*Johnius coitor*	*Koitor*	–	–	–	–	–	–	–	–	–	–	–	0.023	–	–	–	–	–	0.417	0.002
155		*Pama pama*	*Poa*	–	–	–	–	–	–	–	–	–	0.074	–	–	–	–	–	–	–	0.843	0.003
195		*Sillaginopsis panijus*	*Tular dandi*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.554	5.488	0.022
45		*Chelonodon fluviatilis*	*Potka*	0.018	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
171		*Psilorhynchus balitora*	*Balitora*	–	–	–	–	0.037	–	0.002	–	–	–	–	0.003	0.076	0.006	–	0.074	–	5.602	0.022
158		*Pangasius pangasius*	*Pangas*	0.033	–	–	–	–	–	–	–	–	–	–	–	0.030	–	–	–	–	1.284	0.005
955		*Amblyceps mangois*	*Magur*	–	–	–	–	–	0.641	–	0.088	0.604	0.673	–	–	–	–	0.022	–	–	17.886	0.070
	Subtotal			15.249	4.151	10.052	13.406	20.729	8.344	13.128	4.636	17.774	34.873	43.425	56.802	19.394	13.756	7.536	5.299	7.349	4338.894	17.070
130	Migratory	*Aorichthys aor*	*Ayre*	–	–	0.322	2.438	–	–	–	–	–	–	3.128	0.494	–	0.721	–	1.503	–	111.836	0.440
135		*Aorichthys seenghala*	*Guizza*	–	–	–	–	–	–	–	–	–	0.133	5.490	–	–	–	2.120	2.293	–	248.573	0.978
24		*Batasio batasio*	*Tengra*	–	–	–	–	–	–	–	–	–	0.029	–	–	–	–	0.022	–	0.194	3.542	0.014
131		*Mystus bleekeri*	*Golsha tengra*	10.005	0.704	8.568	11.764	9.771	32.844	18.793	12.255	2.623	3.643	5.169	0.806	3.417	9.963	10.480	16.387	6.788	2415.997	9.505

Note: – denotes zero catch

(Cont.)

Table 4.10 Monthly catch composition from the unregulated Atrai River (% by weight): site NW27

Species Code	Habitat Preference	Species name		Year: 1992			Year: 1993											Year: 1994		Total annual catch (Mar'93 – Feb'94)	
		Scientific	Bengali	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Kg	%
132		*Mystus cavasius*	*Kabashi*	2.102	1.998	15.588	9.689	8.139	19.570	20.553	7.193	0.469	0.954	1.982	2.158	2.078	2.267	4.306	8.024	10.803	1376.027	5.413
32		*Catla catla*	*Catla*	0.213	–	–	–	–	–	–	–	–	–	–	2.579	–	–	–	–	–	46.609	0.183
47		*Cirrhinus mrigala*	*Mrigel*	0.817	0.487	–	–	0.302	–	–	–	–	0.201	–	–	3.525	1.985	0.136	–	–	233.950	0.920
48		*Cirrhinus reba*	*Raik*	3.229	2.217	1.119	1.875	0.766	–	0.495	–	–	1.960	0.362	1.494	4.674	1.174	0.336	–	0.037	324.746	1.278
100		*Labeo bata*	*Bata*	2.249	0.821	0.768	–	–	–	–	–	–	0.043	–	–	–	0.341	0.088	1.276	–	53.794	0.212
101		*Labeo boga*	*Bhangan*	–	–	–	0.539	–	0.112	0.010	–	–	–	0.447	–	–	–	–	–	–	5.817	0.023
102		*Labeo calbasu*	*Kalbaus*	6.092	9.299	2.293	1.505	2.892	0.440	5.878	–	–	0.417	1.182	3.735	0.634	1.270	0.104	3.336	8.882	455.072	1.790
107		*Labeo rohita*	*Rui*	3.531	–	–	–	–	–	–	–	–	–	–	4.411	15.470	0.450	–	–	–	755.278	2.971
188		*Salmostoma bacaila*	*Katari*	3.302	0.724	1.004	0.120	0.319	1.962	0.058	–	–	0.894	–	0.007	0.262	0.403	0.233	–	–	63.903	0.251
189		*Salmostoma phulo*	*Fulchela*	0.190	0.277	0.744	0.402	0.123	0.208	0.084	0.215	0.354	0.699	0.065	0.142	0.303	0.688	0.130	0.025	0.259	67.266	0.265
154		*Securicula gora*	*Chora chela*	–	–	–	0.400	–	–	–	–	–	0.569	0.001	0.221	0.341	0.024	1.244	–	–	98.062	0.386
86		*Gudusia chapra*	*Chapila*	6.992	0.318	–	–	–	0.029	–	–	0.354	2.079	0.012	0.716	3.491	1.006	0.335	–	0.022	245.032	0.964
76		*Eutropiichthys vacha*	*Bacha*	1.412	0.665	–	–	–	–	–	0.055	0.084	0.076	0.195	0.336	1.438	1.120	0.074	–	–	117.096	0.461
169		*Pseudeutropius atherinoides*	*Batasi*	0.867	0.322	0.570	0.379	1.765	0.381	4.659	5.555	4.498	0.430	1.471	–	0.489	5.762	1.170	0.411	3.693	526.749	2.072
209		*Wallagu attu*	*Boal*	13.689	67.837	8.761	9.544	5.015	–	7.170	–	–	0.652	–	–	0.147	25.681	33.107	6.722	9.479	3296.585	12.969
144		*Notopterus chitala*	*Chital*	–	–	–	1.447	–	–	–	–	–	0.222	–	–	–	–	–	0.054	–	4.031	0.016
140		*Nemacheilus corica*	*Koirka*	–	–	0.016	0.032	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
142		*Nemacheilus scaturigina*	*Dari*	–	–	–	–	–	–	–	–	–	0.500	–	–	–	–	–	0.092	–	8.271	0.033
216		*Nemacheilus zonalternans*		–	–	–	–	–	–	–	1.362	–	–	–	0.002	–	0.020	–	0.028	–	10.949	0.043
	Subtotal			54.690	85.668	39.753	40.134	29.092	55.546	57.700	26.635	8.380	13.501	19.503	17.102	36.270	52.875	53.885	40.151	40.158	10469.185	41.187
136	Floodplain	*Mystus tengara*	*Bajari tengra*	3.264	0.001	1.058	2.317	–	–	0.197	1.181	0.682	0.108	–	–	0.405	0.009	–	–	–	35.148	0.138
137	Resident	*Mystus vittatus*	*Tengra*	0.071	0.421	6.278	4.709	3.481	0.603	1.609	0.097	–	0.443	0.013	0.029	1.453	0.965	7.295	3.626	2.101	681.992	2.683
55		*Colisa fasciatus*	*Khalisha*	–	–	0.009	–	0.097	–	0.099	–	–	0.181	–	2.579	0.081	0.214	0.047	0.199	1.086	80.848	0.318
211		*Colisa labiosus*	*Khalisha*	–	–	–	–	–	–	–	–	–	0.157	–	–	–	–	–	–	–	1.788	0.007
56		*Colisa lalia*	*Lal khalisha*	–	–	–	–	0.027	0.004	0.043	–	–	–	–	–	–	–	–	–	–	0.801	0.003
57		*Colisa sota*	*Khalisha*	–	–	0.060	–	0.011	0.005	–	–	0.009	–	–	–	0.002	0.014	–	0.368	–	10.932	0.043
210		*Xenentodon cancila*	*Kaikka*	0.429	0.102	0.174	0.157	0.099	0.331	0.301	–	1.132	0.222	0.026	0.146	1.868	1.786	0.873	0.008	0.981	227.144	0.894
62		*Cyprinus carpio*	*Karfu*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.197	–	5.505	0.022
64		*Cyprinus nudus*	*Leather carp*	–	–	–	–	–	–	–	–	–	–	2.024	–	–	–	–	–	–	22.186	0.087
187		*Osteobrama cotio cotio*	*Kei*	0.094	0.001	0.159	–	0.018	0.220	0.001	0.044	–	–	–	–	–	–	0.035	0.002	–	3.824	0.015
174		*Puntius chola*	*Chala puti*	–	–	–	–	–	0.060	0.006	–	–	–	–	–	–	–	–	–	–	0.494	0.002
175		*Puntius conchonius*	*Canchan puti*	0.098	1.175	2.004	2.443	3.223	1.407	2.607	10.317	14.324	17.449	0.013	0.186	8.726	5.546	7.357	2.621	0.248	1507.279	5.930
176		*Puntius gelius*	*Gilputi*	–	–	–	0.050	–	–	0.023	0.028	–	0.038	0.001	–	0.014	–	0.003	–	–	1.850	0.007
177		*Puntius guganio*	*Mola puti*	–	–	–	–	–	–	0.043	–	–	–	–	–	–	0.007	–	–	–	1.031	0.004
178		*Puntius phutunio*	*Phutani puti*	–	–	–	–	–	–	0.001	–	–	0.039	–	–	0.017	0.099	0.030	–	–	6.602	0.026
179		*Puntius sarana*	*Sarputi*	–	–	–	–	0.034	–	–	–	–	–	–	–	–	–	–	0.017	–	0.473	0.002
180		*Puntius sophore*	*Puti*	2.748	1.062	5.772	3.200	5.739	1.631	0.391	0.519	0.261	2.873	0.054	2.179	2.290	3.578	4.784	4.751	2.473	760.468	2.992
212		*Puntius ticto*	*Tit puti*	0.927	0.021	0.005	–	–	–	–	–	0.316	0.074	–	–	0.926	0.642	0.016	0.019	–	67.682	0.266
5		*Amblypharyngodon mola*	*Mola*	0.083	–	–	–	–	0.025	0.035	–	–	0.046	–	–	0.105	0.007	0.002	–	0.048	6.632	0.026
69		*Brachydanio rerio*	*Anju*	–	–	–	–	0.006	–	–	–	–	0.074	–	–	0.008	–	–	–	–	1.175	0.005
68		*Danio devario*	*Chebli*	–	–	–	–	–	–	–	0.035	–	0.074	–	0.056	–	0.018	0.040	–	–	5.049	0.020
75		*Esomus danricus*	*Darkina*	0.008	0.023	0.0004	–	–	0.025	0.191	0.273	2.332	1.235	–	0.656	0.414	–	–	–	–	64.970	0.256
83		*Glossogobius giurus*	*Bailla*	0.035	0.186	1.923	0.849	4.190	1.959	0.384	4.998	3.526	10.731	2.085	3.023	0.843	0.417	1.794	1.838	0.278	487.724	1.919

Note: – denotes zero catch

(Cont.)

Table 4.10 Monthly catch composition from the unregulated Atrai River (% by weight): site NW27

Species Code	Habitat Preference	Species name		Year: 1992			Year: 1993											Year: 1994		Total annual catch (Mar'93 – Feb'94)	
		Scientific	Bengali	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Kg	%
91		*Hypophthalmichthys molitrix*	*Silver carp*	2.997	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
43		*Chela cachius*	*Chep chela*	–	–	–	–	–	–	0.002	–	–	0.026	–	–	–	–	–	–	–	0.331	0.001
110		*Lepidocephalus guntea*	*Gutum*	0.408	0.149	1.193	1.096	3.685	3.610	1.422	1.928	4.447	0.894	0.065	0.040	0.654	0.632	0.148	0.496	0.079	178.984	0.704
9		*Aplocheilus panchax*	*Kanpona*	–	0.002	–	–	0.133	–	0.027	0.177	–	0.189	–	0.214	0.018	–	–	–	–	8.490	0.033
40		*Channa orientalis*	*Cheng*	–	–	–	–	–	–	–	–	–	–	–	–	–	0.093	–	–	–	3.443	0.014
41		*Channa punctatus*	*Taki*	0.248	0.054	0.137	2.128	1.694	0.307	2.368	–	0.990	1.911	–	1.847	2.781	1.897	0.257	6.150	3.887	520.252	2.047
42		*Channa striatus*	*Shol*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.195	–	–	11.335	0.045
49		*Clarias batrachus*	*Magur*	–	0.002	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
88		*Heteropneustes fossilis*	*Shingi*	0.104	0.135	0.028	0.238	0.622	0.314	–	–	0.078	0.389	–	–	–	–	0.019	0.025	0.566	14.431	0.057
121		*Macrognathus aculeatus*	*Tara baim*	–	–	0.082	–	0.734	–	–	0.513	–	0.318	0.462	1.505	–	0.319	–	0.238	–	57.878	0.228
123		*Macrognathus pancalus*	*Guchi*	1.110	0.249	2.913	2.459	6.628	4.609	4.680	23.756	14.691	1.228	0.195	0.113	4.162	1.896	0.640	2.919	5.751	819.635	3.225
122		*Mastacembelus armatus*	*Baral baim*	4.076	4.884	21.940	21.091	7.557	7.741	2.788	0.264	4.701	0.285	3.496	2.781	6.814	9.550	11.472	21.618	16.124	2298.587	9.043
138		*Nandus nandus*	*Bheda*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2.599	0.168	74.109	0.292
15		*Badis badis*	*Napit koi*	0.080	0.020	–	–	0.136	0.096	0.352	1.588	0.311	0.630	–	0.220	0.040	0.032	0.032	0.012	–	36.305	0.143
147		*Ompok bimaculatus*	*Kani pabda*	2.056	0.115	0.136	–	0.125	–	0.456	–	–	–	–	0.033	0.005	–	–	–	–	9.032	0.036
148		*Ompok pabda*	*Madhu pabda*	0.237	0.231	–	0.991	2.928	–	0.473	–	–	–	–	–	–	0.030	–	0.523	4.992	73.658	0.290
145		*Notopterus notopterus*	*Foli*	–	–	–	–	0.165	–	–	–	–	–	–	–	–	0.584	–	0.402	–	32.873	0.129
203		*Tetraodon cutcutia*	*Potka*	0.149	–	–	–	–	–	–	–	–	–	–	–	0.007	0.078	0.006	0.017	–	4.009	0.016
33		*Chaca chaca*	*Cheka*	–	–	0.145	–	–	0.045	–	–	–	–	–	–	–	–	–	–	–	0.296	0.001
35		*Chanda baculis*	*Chanda*	4.467	0.084	0.576	0.118	1.574	0.356	0.231	0.009	0.026	0.424	0.018	0.024	0.723	0.117	0.317	0.425	0.892	86.392	0.340
36		*Chanda nama*	*Nama chanda*	1.240	0.562	1.948	1.837	2.085	0.255	0.454	0.219	0.844	4.410	0.092	0.070	2.501	0.476	0.140	0.481	0.249	217.925	0.857
37		*Chanda ranga*	*Lal chanda*	0.115	0.007	0.079	0.020	0.167	0.100	0.671	0.257	0.815	2.867	0.015	0.271	2.983	0.503	0.283	0.014	0.521	225.545	0.887
	Subtotal			25.043	9.483	46.618	43.702	45.156	23.702	19.852	46.202	49.483	47.312	8.559	15.971	37.839	29.507	35.784	49.564	40.443	8655.107	34.050
998	Others	Unidentified fish		–	–	0.002	0.292	–	–	–	–	–	–	–	–	0.572	–	–	–	0.067	25.016	0.098
931		Prawn spp.	*Chingri/Icha*	5.017	0.695	3.573	2.465	5.021	12.407	9.319	22.527	24.362	4.311	28.511	10.124	5.924	3.860	2.794	4.985	11.983	1930.358	7.594
	Subtotal			5.017	0.695	3.575	2.758	5.021	12.407	9.319	22.527	24.362	4.311	28.511	10.124	6.495	3.860	2.794	4.985	12.050	1955.374	7.693
	Grand total			100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	25418.560	100

Note: – denotes zero catch

Table 4.11 Monthly catch composition from the unregulated Baral/Atrai River (% by weight): site NW14

Species Code	Habitat Preference	Species name		Year:1992			Year:1993											Year:1994		Total annual catch (Mar'93–Feb'94)	
		Scientific	Bengali	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Kg	%
133	Riverine	*Mystus gulio*	*Nuna tengra*	-	-	-	-	0.006	-	-	-	-	-	-	-	-	-	-	-	-	-	-
957		*Mystus punctatus*	*Gagur*	-	-	-	-	-	-	0.445	-	-	-	-	-	-	-	-	-	-	13.600	0.019
186		*Rita rita*	*Rita*	-	0.626	0.020	0.611	0.267	-	-	-	0.035	1.332	-	-	0.374	0.120	0.305	0.651	0.012	181.945	0.257
13		*Aspidoparia morar*	*Pisli*	-	-	0.029	-	-	1.933	0.238	0.599	-	-	0.039	-	-	-	-	-	0.010	78.094	0.110
218		*Barilius evezardi*		-	-	-	-	-	-	-	-	-	0.013	-	-	-	-	-	-	-	0.593	0.001
20		*Raiamas bola*	*Bhol*	2.901	0.417	0.846	3.132	0.178	0.274	0.266	1.408	-	-	-	0.247	-	0.060	0.023	0.384	0.097	120.098	0.169
59		*Crossocheilus latius*	*Kalibata*	0.476	0.445	0.743	2.186	0.885	0.795	0.313	-	-	-	-	-	-	0.018	0.110	0.307	0.087	75.500	0.107
139		*Nemacheilus botia*	*Balichata*	0.369	0.077	1.554	0.582	0.904	0.565	0.163	3.155	0.128	0.150	-	-	-	0.047	0.206	0.141	0.178	204.255	0.288
941		*Neoeucirrhichthys maydelli*	*Gutum*	-	-	-	-	-	-	-	0.015	-	-	-	-	-	-	-	-	-	0.528	0.001
198		*Sauvagesia gongota*	*Ghatpoia*	-	-	0.167	0.495	0.816	0.639	0.941	0.762	0.111	0.033	-	-	-	-	0.106	0.060	0.016	100.498	0.142
28		*Botia dario*	*Rani*	0.057	0.155	0.069	0.464	0.292	0.226	-	-	-	0.200	0.055	0.068	0.331	0.306	0.626	0.116	0.225	159.530	0.225
29		*Botia lohachata*	*Putul*	-	-	-	-	-	-	-	-	0.037	-	-	-	-	-	-	-	0.287	27.134	0.038
89		*Hilsa ilisha*	*Ilish*	0.089	0.265	0.065	-	-	0.005	0.007	3.913	74.124	46.228	74.123	37.754	15.578	0.003	-	-	0.042	13097.002	18.480
85		*Gonialosa manmina*	*Goni chapila*	-	-	-	-	-	-	-	-	-	-	-	-	0.080	0.004	-	-	0.022	6.180	0.009
58		*Corica soborna*	*Kachki*	0.690	2.989	0.749	-	0.019	2.694	0.801	0.515	0.594	0.127	0.058	0.217	0.061	1.516	0.524	1.184	0.917	569.409	0.803
193		*Setipinna phasa*	*Phasa*	0.273	-	0.044	0.045	-	0.012	0.015	-	-	-	-	0.217	0.314	0.125	0.406	-	0.510	117.707	0.166
14		*Anacus stamineus*	*Bele*	-	-	-	-	0.012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30		*Brachygobius nunus*	*Nunabelila*	-	-	-	-	-	-	-	0.127	0.080	-	-	0.028	0.009	-	0.002	0.002	-	13.199	0.019
128		*Liza parsia*	*Bata*	-	-	-	-	-	-	-	0.064	-	-	-	-	-	-	-	-	-	2.307	0.003
185		*Rhinomugil corsula*	*Khorsula*	0.088	0.001	0.083	0.117	0.012	0.008	5.628	0.449	0.457	-	0.166	0.048	0.374	0.019	0.095	-	0.091	274.265	0.387
923		*Sicamugil cascasia*	*Bata*	-	-	0.124	0.126	-	-	-	-	0.007	-	0.027	0.083	-	-	-	-	0.023	5.105	0.007
2		*Ailia coila*	*Kajuli*	5.138	1.672	2.440	0.133	0.109	0.717	-	1.152	2.654	11.333	3.415	3.116	0.784	0.339	2.137	2.933	2.891	1775.876	2.506
51		*Chupisoma garua*	*Ghaura*	7.743	4.856	8.202	0.814	-	0.111	2.669	0.964	1.408	6.041	1.561	8.713	6.652	4.022	5.049	5.705	8.907	3242.428	4.575
52		*Chupisoma naziri*	*Muri bacha*	0.221	-	-	-	-	-	-	-	-	-	-	-	0.478	0.152	0.105	0.389	0.168	97.840	0.138
196		*Silonia silondia*	*Shillong*	0.059	0.118	0.053	-	0.139	-	-	-	0.487	0.723	0.102	0.331	0.477	0.918	0.191	-	0.242	247.151	0.349
16		*Bagarius bagarius*	*Baghair*	-	0.297	-	-	-	-	-	-	-	-	0.054	0.043	-	0.041	-	0.516	0.168	65.354	0.092
74		*Erethistes pusillus*	*Kutakanti*	-	-	-	-	-	-	-	-	-	0.004	-	-	-	-	-	-	-	0.196	0.0003
77		*Gagata cenia*	*Kauna*	-	0.138	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
79		*Gagata nangra*	*Gang tengra*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.013	-	1.096	0.002
80		*Gagata viridescens*	*Gang tengra*	-	-	-	0.013	-	-	-	-	0.099	-	-	0.012	0.157	2.171	0.719	0.041	0.022	327.220	0.462
81		*Gagata youssoufi*	*Gang tengra*	0.208	1.699	0.432	0.780	0.287	0.088	-	0.778	2.302	1.131	0.636	1.254	0.755	1.060	2.600	0.850	2.147	1002.041	1.414
84		*Glyptothorax telchitta*	*Telchitta*	-	0.038	-	-	-	-	-	-	-	0.035	0.055	0.130	0.026	0.155	0.085	0.007	-	33.172	0.047
958		*Glyptothorax sp*	*Lal moina*	0.038	0.111	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
87		*Hara hara*	*Kutakanti*	1.258	-	0.602	-	-	0.013	-	-	-	-	-	-	-	-	-	-	-	0.307	0.0004
95		*Johnius coitor*	*Koitor*	-	-	0.488	2.208	0.888	4.279	-	1.567	1.259	0.569	0.890	0.176	0.855	0.497	6.300	1.766	0.806	1293.558	1.825
155		*Pama pama*	*Poa*	-	-	-	-	-	-	-	0.005	-	0.885	0.224	-	-	-	0.221	0.233	0.223	109.358	0.154
171		*Pallorhynchus ballitora*	*Ballitora*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.157	0.133	-	27.462	0.039
158		*Pangasius pangasius*	*Pangas*	6.966	2.096	0.474	-	-	-	-	-	1.805	-	-	0.009	0.949	1.454	0.045	-	-	367.899	0.519
955		*Ambyceps mangois*	*Magur*	-	-	-	0.013	-	0.015	-	-	-	-	-	-	-	-	-	-	0.006	0.862	0.001
	Subtotal			26.572	16.002	17.183	11.719	4.814	12.374	11.487	15.473	85.585	68.807	81.406	52.447	28.254	13.025	20.012	15.430	18.095	23638.771	33.355
130	Migratory	*Acrichthys ator*	*Ayre*	0.251	0.006	-	-	0.595	0.266	-	0.905	0.009	1.347	0.392	-	1.523	1.567	0.942	1.041	0.949	621.928	0.878
135		*Acrichthys seenghala*	*Guizza*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.006	-	-	0.576	0.001
24		*Batasio batasio*	*Tengra*	-	1.318	0.357	-	-	-	-	-	-	0.301	0.004	-	-	-	-	-	-	13.657	0.019
131		*Mystus bleekeri*	*Golsha tengra*	1.978	7.624	15.822	23.748	20.211	8.799	6.153	2.213	0.200	0.483	0.659	1.004	3.073	6.377	8.523	11.816	10.471	4151.779	5.858
132		*Mystus cavasius*	*Kabashi*	14.501	7.305	25.790	23.665	35.300	20.398	17.399	7.010	0.259	1.069	1.540	1.605	6.785	13.842	15.569	25.408	12.842	8087.268	11.412
134		*Mystus menoda*	*Ghagla*	-	-	-	-	-	-	-	-	0.445	-	-	-	-	-	-	-	-	39.731	0.056
32		*Catla catla*	*Catla*	-	0.026	-	-	-	-	-	-	-	-	-	3.633	0.580	-	-	-	-	97.158	0.137
47		*Cirrhinus mrigala*	*Mrigel*	1.474	-	-	-	-	-	-	-	-	-	0.017	0.678	4.680	0.107	0.072	-	0.140	275.020	0.388
48		*Cirrhinus reba*	*Raik*	15.629	1.808	2.249	1.614	0.348	0.014	0.394	0.090	-	0.143	0.099	3.460	3.646	2.104	0.562	1.482	0.869	752.025	1.061
100		*Labeo bata*	*Bata*	4.876	0.500	0.228	0.594	0.365	-	-	-	-	-	-	-	-	-	0.061	0.352	0.386	68.489	0.097
101		*Labeo boga*	*Bhangan*	-	-	0.032	0.259	-	-	-	-	-	-	-	-	0.712	-	0.072	-	0.017	44.037	0.062
102		*Labeo calbasu*	*Kalbaus*	-	4.119	-	-	0.114	-	10.850	-	0.028	0.061	0.404	0.565	3.418	1.639	0.537	0.136	1.536	900.421	1.271
107		*Labeo rohita*	*Rui*	-	-	-	-	-	-	0.323	-	-	-	-	6.494	12.269	0.187	0.115	-	-	769.984	1.086
188		*Salmostoma bacaila*	*Katuri*	0.433	0.084	-	-	-	-	-	-	-	-	-	-	0.172	0.170	0.108	-	0.385	69.722	0.098
189		*Salmostoma phulo*	*Fulchela*	1.551	2.489	0.263	-	0.285	0.005	1.609	1.220	0.072	0.008	0.040	0.221	0.096	1.298	0.417	0.231	0.547	356.991	0.504
154		*Securicula gora*	*Chora chela*	-	-	-	-	-	-	-	-	0.024	0.037	0.015	-	-	0.209	0.217	0.040	0.040	55.576	0.078
86		*Gudusia chapra*	*Chapila*	6.716	0.374	0.049	0.115	-	0.268	3.852	6.120	0.943	-	0.210	7.169	3.253	1.025	0.899	0.126	1.449	1066.672	1.505
76		*Eutropiichthys vacha*	*Bacha*	0.134	0.234	0.060	-	0.179	0.026	0.033	3.260	0.508	-	0.429	0.140	1.707	0.537	2.646	2.258	3.094	1047.146	1.478
169		*Pseudeutropius atherinoides*	*Batasi*	0.474	2.066	0.405	3.434	0.171	0.471	1.669	0.647	0.057	0.008	-	-	0.665	6.163	2.952	3.148	3.255	1623.875	2.291
944		*Ompok pabo*	*Pabda*	-	-	-	-	-	-	-	-	-	-	-	-	-	0.024	-	-	-	2.608	0.004
209		*Wallagu attu*	*Boal*	2.824	6.408	0.666	1.023	-	7.361	3.116	-	-	4.627	0.335	-	-	8.568	7.042	11.916	11.546	4108.789	5.798
144		*Notopterus chitala*	*Chital*	-	0.057	-	-	-	-	-	-	-	-	-	-	-	0.462	-	-	-	49.300	0.070
216		*Nemacheilus zonatherinus*		-	-	-	-	-	-	-	-	-	-	0.034	-	-	-	0.004	-	-	1.726	0.002
	Subtotal			50.841	34.416	45.920	54.451	57.568	37.609	45.397	21.466	2.545	8.083	4.177	24.967	42.578	44.278	40.743	57.954	47.525	24204.478	34.154

Note: – denotes zero catch

(Cont.)

Table 4.11 Monthly catch composition from the unregulated Baral/Atrai River (% by weight): site NW14

Species Code	Habitat Preference	Species name		Year:1992			Year:1993											Year:1994		Total annual catch (Mar'93–Feb'94)	
		Scientific	Bengali	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Kg	%
136	Floodplain	*Mystus tengara*	*Bajari tengra*	0.053	0.007	0.235	0.290	0.481	0.289	0.236	0.007	-	-	0.028	-	0.047	0.354	0.669	0.345	0.485	193.933	0.274
137	Resident	*Mystus vittatus*	*Tengra*	0.984	0.434	4.075	2.084	3.382	2.759	0.163	0.405	-	-	0.048	0.236	0.122	2.354	8.234	3.749	7.210	2113.689	2.983
55		*Colisa fasciatus*	*Khalisha*	0.239	0.149	0.013	-	0.019	-	1.301	-	0.004	0.098	0.147	0.081	0.026	1.070	0.076	0.317	0.067	207.394	0.293
211		*Colisa labiosus*	*Khalisha*	-	-	-	-	-	-	-	-	0.005	0.015	-	-	-	-	-	-	-	1.152	0.002
56		*Colisa lalia*	*Lal khalisha*	-	-	-	-	-	-	-	-	-	-	-	-	0.021	-	0.002	-	-	1.213	0.002
57		*Colisa sota*	*Khalisha*	0.055	0.097	0.018	-	0.056	-	-	-	-	-	-	-	0.082	-	-	-	-	4.065	0.006
210		*Xenentodon cancila*	*Kaikka*	0.675	0.727	0.060	-	0.031	0.424	0.286	0.409	0.238	0.034	0.015	0.204	0.399	4.786	1.211	1.439	0.612	889.090	1.255
62		*Cyprinus carpio*	*Kartu*	-	-	-	-	-	-	-	-	-	-	-	-	-	0.034	-	-	-	3.655	0.005
187		*Osteobrama cotio cotio*	*Keti*	0.185	0.002	0.001	-	0.006	0.064	0.004	0.853	-	-	-	-	0.022	0.107	0.066	0.145	0.288	88.168	0.124
175		*Puntius conchonius*	*Canchan puti*	-	1.185	6.655	1.361	0.773	0.438	1.869	7.618	0.021	0.071	0.072	0.062	0.330	0.645	0.683	0.307	0.076	540.360	0.762
176		*Puntius gelius*	*Giliputi*	-	-	-	-	0.006	-	-	-	-	-	0.006	-	0.016	0.048	0.029	0.004	0.008	10.069	0.014
178		*Puntius phutunio*	*Phutani puti*	-	-	-	-	-	-	-	-	-	-	-	-	0.054	0.039	-	0.003	0.020	8.766	0.012
180		*Puntius sophore*	*Puti*	0.511	6.021	2.851	2.453	0.571	1.725	0.370	0.101	0.165	0.626	0.124	1.213	1.536	6.754	2.457	1.298	1.945	1447.560	2.043
181		*Puntius terio*	*Teri punti*	-	-	-	-	-	-	-	0.012	-	-	-	-	-	-	-	-	-	0.436	0.001
212		*Puntius ticto*	*Tit puti*	0.242	1.229	0.209	-	-	-	-	-	-	-	-	-	-	0.032	-	-	-	3.400	0.005
5		*Amblypharyngodon mola*	*Mola*	-	0.098	-	-	-	-	-	-	-	-	0.006	0.276	-	0.016	0.021	-	-	9.357	0.013
69		*Brachydanio rerio*	*Anju*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.003	-	-	0.322	0.0005
68		*Danio devario*	*Chebil*	0.023	-	-	-	-	-	-	-	-	-	-	0.034	-	0.055	0.004	0.012	0.006	8.521	0.012
75		*Esomus danricus*	*Darkina*	0.002	0.111	0.030	-	-	0.011	-	1.003	-	0.023	0.273	0.083	0.021	0.095	-	-	-	60.529	0.085
83		*Glossogobius giurus*	*Baila*	6.016	1.865	2.887	3.567	9.360	14.141	17.452	13.287	1.847	4.288	4.360	1.871	4.402	5.542	4.208	0.990	3.675	3542.626	4.999
43		*Chela cachius*	*Chep chela*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.008	-	0.682	0.001
110		*Lepidocephalus guntea*	*Gutum*	0.263	0.429	2.348	0.213	1.223	1.573	0.075	0.118	-	0.100	-	0.138	-	0.167	0.140	0.150	0.088	103.994	0.147
9		*Aplocheilus panchax*	*Kanpona*	-	-	-	-	0.019	0.008	-	-	-	-	0.014	0.028	0.016	0.0003	0.031	-	0.010	6.021	0.008
39		*Channa marulius*	*Gajar*	0.072	-	-	-	-	-	-	-	-	-	-	-	-	0.191	0.181	0.177	0.458	92.080	0.130
40		*Channa orientalis*	*Cheng*	-	-	-	-	-	-	-	-	0.006	-	0.034	-	-	-	-	-	-	1.812	0.003
41		*Channa punctatus*	*Taki*	0.168	-	0.045	0.860	0.087	0.640	-	-	0.153	0.332	0.447	0.445	0.109	1.252	1.171	1.519	0.280	481.307	0.679
42		*Channa striatus*	*Shol*	-	-	-	-	-	-	-	-	-	-	-	-	-	0.007	0.015	-	-	2.265	0.003
88		*Heteropneustes fossilis*	*Shingi*	-	0.332	0.103	-	0.034	-	-	-	-	-	0.013	0.109	-	0.030	-	-	0.031	8.278	0.012
121		*Macrognathus aculeatus*	*Tara baim*	0.183	0.034	-	-	-	-	-	0.028	-	0.021	0.077	-	-	-	-	-	-	4.866	0.007
123		*Macrognathus pancalus*	*Guchi*	0.292	0.041	0.428	0.379	0.872	2.988	2.237	5.000	0.248	0.238	0.510	0.578	0.540	0.086	0.196	0.166	1.323	564.951	0.797
122		*Mastacembelus armatus*	*Baral baim*	1.247	25.401	7.360	9.733	4.453	8.541	7.305	3.850	0.335	0.176	0.231	2.276	9.965	3.827	5.481	2.287	1.993	2481.795	3.502
15		*Badis badis*	*Napit koi*	0.042	-	0.008	0.013	0.062	0.047	0.196	0.051	0.007	-	0.053	0.026	0.050	0.112	0.037	0.075	0.110	45.810	0.065
124		*Monopterus cuchia*	*Kuchia*	-	-	-	-	-	-	-	0.065	-	-	-	-	-	-	-	-	-	2.345	0.003
147		*Ompok bimaculatus*	*Kani pabda*	2.225	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
148		*Ompok pabda*	*Madhu pabda*	0.329	-	-	-	-	-	-	-	-	-	0.156	-	-	1.654	0.345	-	-	217.561	0.307
145		*Notopterus notopterus*	*Foli*	-	-	-	-	-	-	-	-	-	-	-	-	-	0.300	0.121	0.636	0.065	104.269	0.147
203		*Tetraodon cutcutia*	*Potka*	0.755	-	0.002	0.103	-	-	-	1.472	-	-	-	0.223	0.030	0.295	0.390	0.030	0.057	137.737	0.194
33		*Chaca chaca*	*Cheka*	-	-	-	-	-	-	-	-	-	0.215	0.140	-	-	-	-	-	-	14.864	0.021
35		*Chanda baculis*	*Chandi*	1.057	0.221	0.076	0.347	1.138	0.092	-	0.023	0.008	0.209	0.031	0.062	0.121	0.583	0.549	0.417	0.579	223.794	0.316
36		*Chanda nama*	*Nama chanda*	0.813	1.639	1.329	0.095	0.257	0.941	4.562	4.105	0.666	0.426	0.167	0.492	0.236	0.823	0.499	0.220	0.119	584.273	0.824
37		*Chanda ranga*	*Lal chanda*	0.409	0.024	0.007	0.014	0.012	0.081	0.134	0.079	0.373	0.242	0.038	0.213	2.459	2.670	0.100	0.007	0.022	477.171	0.673
	Subtotal			16.840	40.045	28.737	21.511	22.840	34.763	36.190	38.484	4.078	7.113	6.990	8.650	20.603	33.926	26.916	14.297	19.527	14690.180	20.729
998	Others	Unidentified fish		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.072	5.967	0.008
119		*Macrobrachium malcolmsonii*	*Chingri chotka*	-	-	-	-	-	-	-	-	-	-	-	-	-	0.520	-	-	-	55.480	0.078
931		Prawn spp.	*Chingri/Icha*	5.745	9.536	8.158	12.318	14.776	15.253	6.926	24.576	7.791	15.995	7.427	13.935	8.565	8.249	11.790	12.318	14.779	8219.538	11.598
207		*Trionyx gangeticus*	*Kachhim*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.537	-	-	55.000	0.078
	Subtotal			5.745	9.536	8.158	12.318	14.776	15.253	6.926	24.576	7.791	15.995	7.427	13.935	8.565	8.769	12.327	12.318	14.851	8335.985	11.762
	Grand total			100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	70869.414	100

Note: – denotes zero catch

The percentage contributions made by riverine, migratory and floodplain resident species to annual catches are summarised in Table 4.12. Contributions to the catch made by riverine species in the regulated Baral were higher than in unregulated rivers whilst contributions made by floodplain resident species were lower. The difference between rivers can be attributed to a combination of two effects. The first relates to differences in catchment elevations where the Baral basin contained a larger proportion of higher land therefore lower contributions by floodplain resident species might be expected. The second relates to the reduction in the flood magnitude and extent due to river regulation. This in turn would to lead to a reduction in fish production from the floodplains and thus fewer fish would return to the river during the drawdown which is typically a time of high, if not peak catch, in most unregulated rivers. In other regions of Bangladesh unregulated seasonal rivers were highly dependent on this influx of floodplain resident species during the drawdown and contributions made by these fish to the annual catches were substantially higher than in regulated Baral. For example, in the seasonal rivers, Gazikhali (NC21), Pungli (NC02), Lohajang (NC12) and Bhubaneswar (SW03), floodplain resident fish comprised between 61% to 68% of annual catches.

Table 4.12 Percentage contribution of riverine, migratory and floodplain resident fish to the total annual catches from regulated and unregulated rivers, March 1993 - February 1994

Site Code	Site name	Regulated (Yes/No)	% Total annual catch			
			Riverine	Migratory	Floodplain resident	Prawns
NW25	Baral River	Yes	51	28	14	7
NW24	Padma River	No	41	15	17	28
NW27	Atrai River	No	17	41	34	8
NW14	Baral/Atrai River	No	33	34	21	12

Examination of the total numbers of riverine, migratory and floodplain resident species in each river revealed that while the catch contribution of floodplain residents was lowest in the Baral River, diversity was slightly higher than that in the Padma River (Table 4.13). The numbers of riverine and migratory species were similar between the two rivers but lower than those recorded from the Atrai.

Table 4.13 Total annual number of fish species, classified by habitat preference, recorded from regulated and unregulated rivers, March 1993 - February 1994

Site Code	Site name	Number of species			Total
		Riverine	Migratory	Floodplain resident	
NW25	Baral River	26	21	39	86
NW24	Padma River	29	18	34	81
NW27	Atrai River	31	22	43	96
NW14	Baral/Atrai River	35	23	40	98

Percentage contributions to annual catches made by dominant species (comprising 1% or more of the catch) are presented in Table 4.14. Although there was little difference in the total numbers of riverine, migratory and floodplain resident species in the Baral and Padma rivers, there were several important differences in their catch compositions. In the Baral, there were five dominant riverine species, of which *ilish* was by far the most important comprising 40% of the catch. The others included *ghaura*, *kajuli*, *piali* and *gang tengra* which together contributed 7% of the catch. In the Padma River, *ilish* formed only 3% of the catch whilst *rita* comprised 16%. This species occurred only in low numbers on the Baral where it formed less than 1% of the catch. Other dominant riverine species which were relatively more abundant outside the regulated Baral included *piali*, *ghaura*, *khorsula* and *phasa* which together contributed a further 15% of the Padma catch. Of the five dominant riverine species recorded at two sites on the Atrai, *ilish* dominated downstream catches but was considerably less abundant upstream at NW27 where it provided less than 3% of the annual catch. This catch was significantly lower than on the upstream Baral and provides further evidence that Charghat regulator acted as a barrier to upstream migrating *ilish*, concentrating the fish in front of the gates as they attempted to cross and thereby increasing their susceptibility to capture. Other dominant riverine species on the Atrai included *kajuli*, *ghaura* and *gang tengra* from both sites and *koitor* at the downstream site in closer proximity to Jamuna.

Eight dominant migratory species were recorded on the Baral of which three were major carps *rui*, *catla* and *kalbaus* that accounted for 14% of the total annual catch. Other dominant fish included two large catfish *ayre* and *boal* and two smaller species, *chapila* and *katari*.

Table 4.14 Percentage contribution (by weight) to the total annual catch by dominant species from regulated and unregulated rivers, March 1993 – February 1994

Habitat Preference	Species name		Regulated	Unregulated		
	Scientific	Bengali	Baral (NW25)	Padma (NW24)	Atrai (NW27)	Baral/Atrai (NW14)
Riverine	*Rita Rita*	*Rita*		15.5		
	Aspidoparia morar	*Piali*	1.5	5.8	–	–
	Hilsa ilisha	*Ilish*	39.9	2.8	2.5	18.5
	Setipinna phasa	*Phasa*	–	1.0		
	Rhinomugil corsula	*Khorsula*	–	2.7		
	Ailia coila	*Kajuli*	2.3	2.5	5.6	2.5
	Clupisoma garua	*Ghaura*	2.2	5.5	1.3	4.6
	Gagata youssoufi	*Gang tengra*	1.0	–	1.7	1.4
	Johnius coitor	*Koitor*	–	1.0	–	1.8
Subtotal			46.9	36.8	11.1	28.8
Migratory	*Aorichthys aor*	*Ayre*	5.1	3.1	–	–
	Mystus bleekeri	*Golsha tengra*	–	–	9.5	5.9
	Mystus cavasius	*Kabashi*	–	1.9	5.4	11.4
	Catla catla	*Catla*	5.9	–	–	–
	Cirrhinus reba	*Raik*	1.5	–	1.3	1.1
	Labeo calbasu	*Kalbaus*	1.8	3.2	1.8	1.3
	Labeo rohita	*Rui*	6.2	–	3.0	1.1
	Salmostoma bacaila	*Katari*	1.4	–	–	–
	Gudusia chapra	*Chapila*	1.2	4.4	–	1.5
	Eutropiichthys vacha	*Bacha*	–	–	–	1.5
	Pseudeutropius atherinoide	*Batasi*	–	–	2.1	2.3
	Wallagu attu	*Boal*	1.7	–	13.0	5.8
Subtotal			24.8	12.6	36.1	31.9
Floodplain Resident	*Mystus vittatus*	*Tengra*	–	–	2.7	3.0
	Xenentodon cancila	*Kaikka*	–	–	–	1.3
	Puntius conchonius	*Canchan puti*	2.6	2.3	5.9	–
	Puntius sophore	*Puti*	–	–	3.0	2.0
	Glossogobius giurus	*Bailla*	4.3	10.1	1.9	5.0
	Channa punctatus	*Taki*	–	1.7	2.0	–
	Macrognathus pancalus	*Guchi*	–	–	3.2	–
	Mastacembelus armatus	*Baral baim*	–	–	9.0	3.5
Subtotal			6.9	14.1	27.7	14.8
Other	Prawn spp.	*Chingri/Icha*	7.1	27.8	7.6	11.6
Subtotal			7.1	27.8	7.6	11.6
Grand total			85.7	91.3	82.5	87.1

Notes:

1. Dominant species are defined as those species which comprised 1% or more of the total annual catch
2. Shaded values highlight the most abundant species (>4%)
3. See text for definations of habitat preference categories (Section 4.3.2)

On the Padma, the only major carp that comprised more than 1% of the catch was *kalbaus*. Other species abundant in the Baral but not in the Padma included *boal*, *raik* and *katari*. On the Atrai, *boal* was very important comprising 13% and 6% of catches on upper and lower reaches. Two smaller catfish, *golsha tengra* and *kabashi* were also relatively abundant in the Atrai but less so in the Baral. Percentage catch contributions of *kalbaus* and *raik* were similar to those on the Baral whilst those of *rui* and *catla* were lower.

Only two dominant floodplain resident species, *bailla* and *canchan puti*, were recorded on the Baral compared with three on Padma, again *bailla* and *canchan puti* together with *taki*. The percentage catch of *bailla* was more than twice as high on the Padma due to the predominance of the *doiar* trap fishery which targeted this species together with prawns. On the Atrai eight dominant floodplain species were recorded which included the three species from the Baral and Padma. Other important species included *tengra*, *puti* and *baral baim*.

Prawns were a major component from the Padma comprising 28% of the annual catch compared with 7% to 8% on the Baral and Atrai and 12% on the lower reaches of the Baral/Atrai. Because of taxonomic difficulties prawns were rarely identified in the field, however sub-samples were sent regularly to the University of Chittagong for identification. Results provided so far indicate that all species belong to the genus *Macrobrachium*. This genus is regarded as an estuarine spawner which makes migrations into freshwaters at the juvenile stage in its life cycle. Evidence from FAP 17 studies using drift nets (savar nets) at Charghat regulator and other areas in Bangladesh indicate that newly-hatched prawns form an extremely important component of catches which indicates that there is widespread breeding on floodplains by some of these species.

4.4 Fish Migrations

Seasonal migrations of fish in and out of the Baral River were identified from changes in catch composition, temporal changes in distributions of important individual species and changes in monthly species numbers of riverine, migratory and floodplain resident fish. Data on catch compositions and the average size of different species caught by gears operating on the side walls of Charghat regulator or in mid-water close to it, provided a further insight into the impact of the structure on fish movements. It should be noted that the following discussion focuses only on the movements of adult or juvenile fish which are capable of swimming with or against the water current and therefore which can potentially enter the

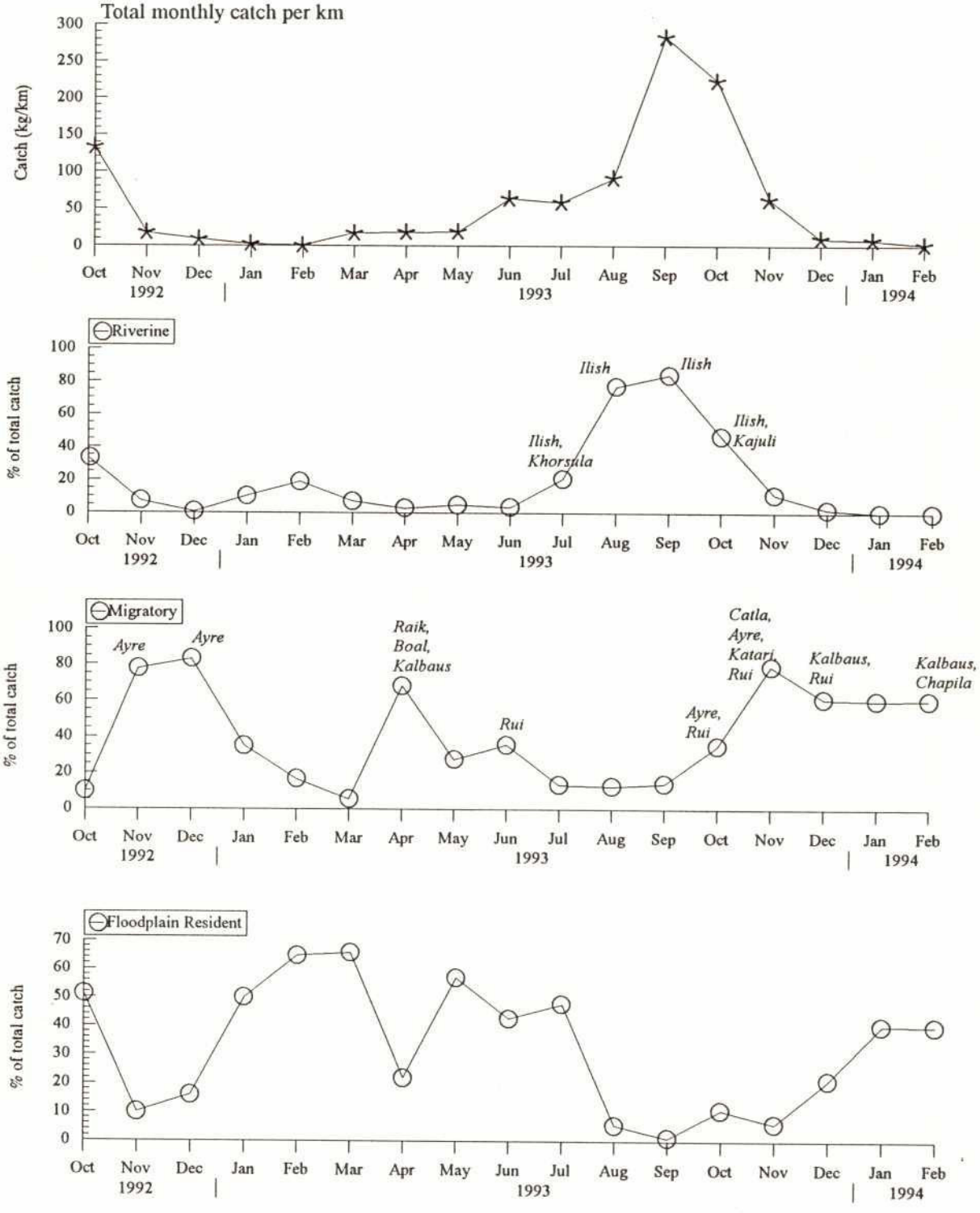
Baral from either its feeder river, the Padma or by swimming upstream from the Atrai. Movements of fish hatchlings by passive downstream drift from the Padma to the Baral and the impact of Charghat regulator on these movements are described in detail in the Draft Final Report, Supporting Volume No. 11.

Seasonal variations in the percentage catch and numbers of species of riverine, migratory and floodplain resident fish in the Baral are shown in Figures 4.7 and 4.8. Riverine species, notably *ilish*, dominated peak catches in August and September whilst migratory species were relatively more abundant in catches of the pre-monsoon and flood recession. Floodplain residents made up the bulk of low winter and pre-monsoon catches. On the Atrai at its junction with the Baral, floodplain resident species comprised almost 40% of the catch during the drawdown in October 1993 (Fig. 4.9). The lower percentage catch in the Baral can be attributed, in part, to the relatively higher elevation of the surrounding catchment of the sampled reach and also to the reduction in flood magnitude and extent caused by regulation at Charghat. Downstream of the sampled reach on the Baral, where surrounding floodplains were substantially lower, its seems probable that reduced flooding due to regulation would have had an equally severe, if not more adverse impact on the abundance of floodplain resident species.

Seasonal variation in species numbers of each category of fish followed a similar pattern, rising with increasing water levels in June progressively increasing through the flood season to reach a peak in October followed by rapid decline in November and December. The only exception to this general pattern was a temporary decline in the number of floodplain resident species during August (Fig. 4.8). That the regulator had little impact on species diversity in the Baral indicated that fish entered the river from both the Padma by crossing the regulator and from the Atrai by upstream migration. However, such freedom of movement from the Padma to the Baral was not evident in the return direction because of the obstruction caused by the regulator.

Of all species captured on the Baral, *ilish* was the most important in terms of catch by weight. It was also the primary target species of specialised scoop net fisheries established on Charghat regulator and a short distance downstream from it. Examination of seasonal changes in catch per unit area of this species from different rivers revealed its circular migratory route more clearly (Fig. 4.10). *Ilish* starts its migration from the Bay of Bengal,

Figure 4.7 Percentage total monthly catch of riverine, migratory and floodplain resident species from the Baral River, (site NW25)



Notes: 1. See text for definition of different categories of fish based on habitat preference (Section 4.3.2)
2. The most abundant species are shown for peak percentage catches of riverine and migratory fish, less abundant species are not shown

Figure 4.8 Seasonal variation in the number of riverine, migratory and floodplain resident fish species on the Baral River, (site NW25)

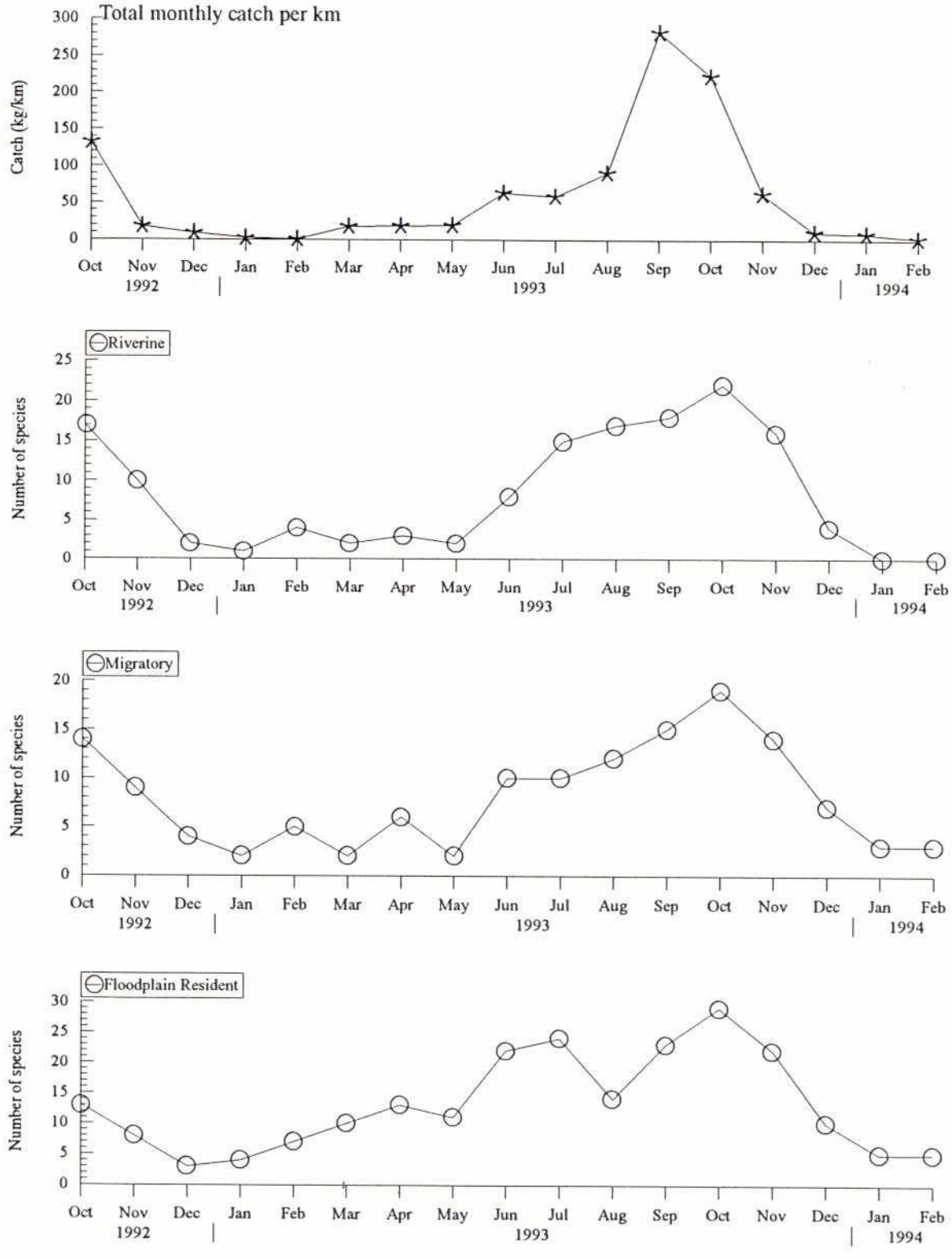
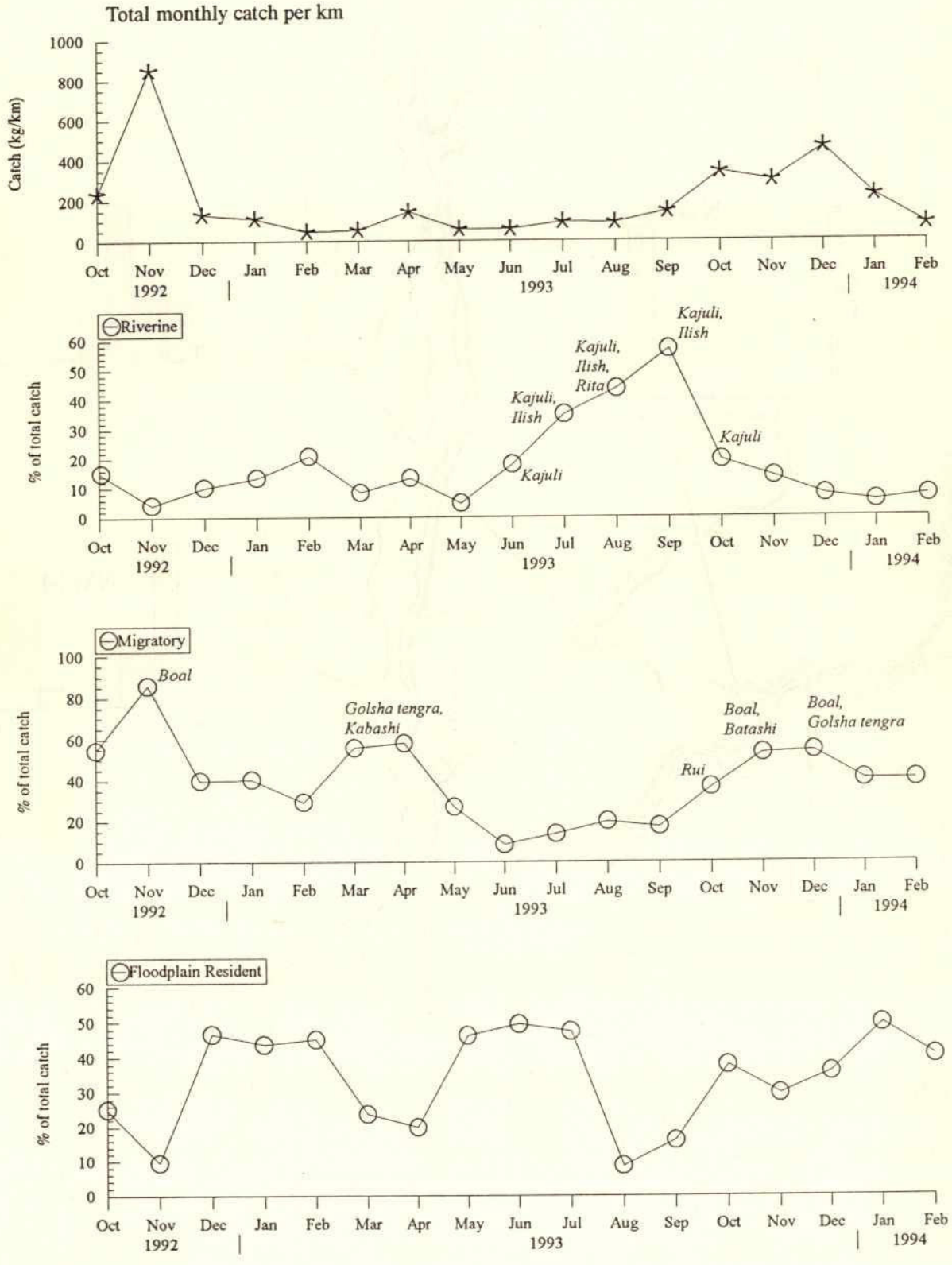
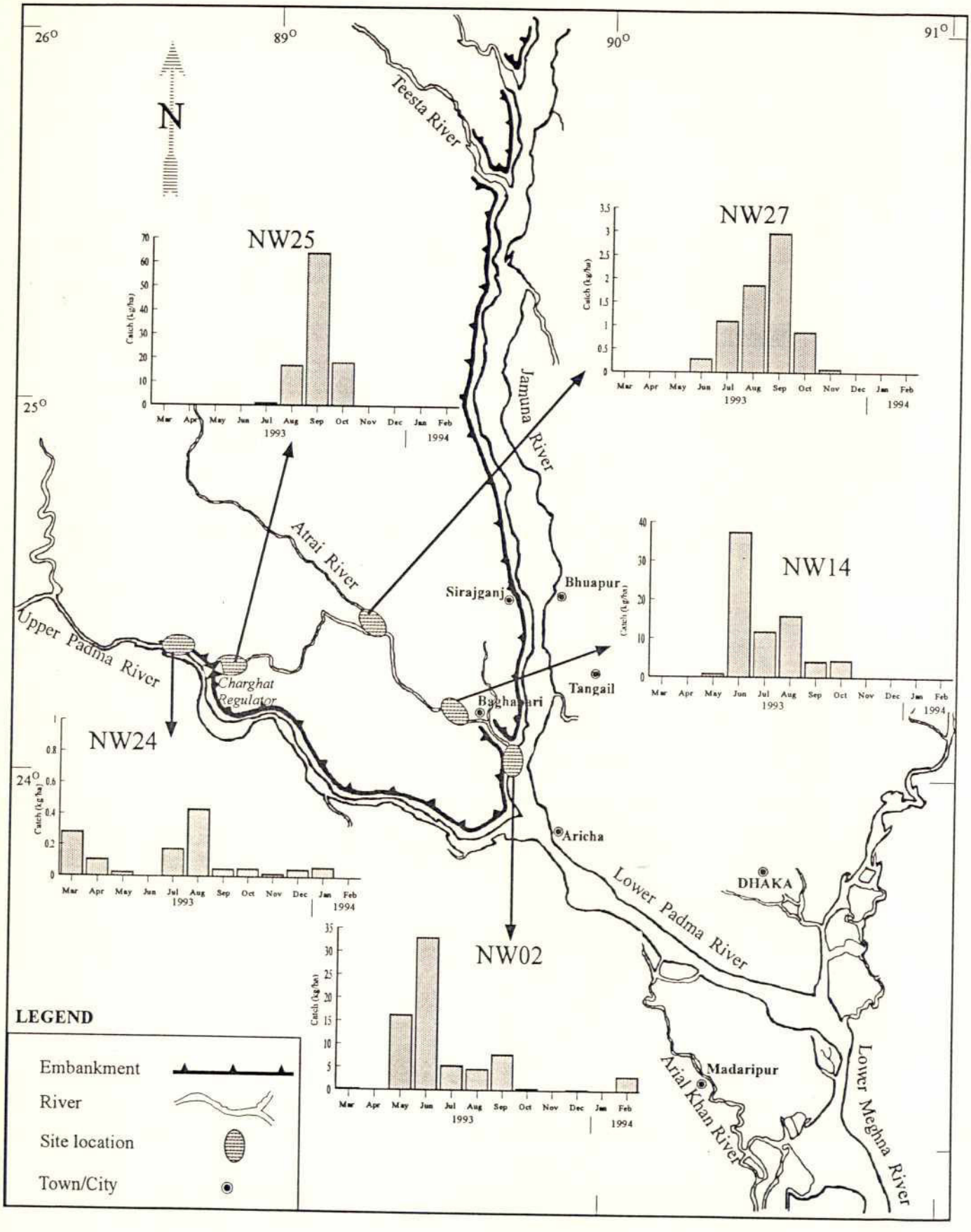


Figure 4.9 Percentage total monthly catch of riverine, migratory and floodplain resident species from the Atrai River, (site NW27)



Notes: 1. See text for definition of different categories of fish based on habitat preference (Section 4.3.2)
2. The most abundant species are shown for peak percentage catches of riverine and migratory fish, less abundant species are not shown

Figure 4.10 Seasonal variation in the catch (kg/ha) of *ilish* on the Jamuna, Atrai and Upper Padma rivers, March 1993 - February 1994



moving up the Meghna, and lower Padma reaching the confluence with the Jamuna in May where part of the population continues up the Padma and part turns northwards into the Jamuna (see Draft Final Report, Supporting Volume No. 10). In 1993 *ilish* arrived at the mouth of the Baral/Atrai in high numbers in May and catches here remained high until September. The migrating *ilish* population split again, some continuing up the Jamuna whilst others were attracted by the inflowing waters of the Atrai. *Ilish* first appeared along the lower reaches of the Baral/Atrai in June and made their way upstream on a spawning migration which extended up to September. They appeared on the Atrai at Gurudaspur (NW27) in low numbers in June and further upstream on the Baral in July. As fish moved up the Baral, they were blocked by Charghat regulator and became concentrated in number immediately downstream of the structure reaching a peak catch in September of 64 kg/ha, the highest catch rate recorded in any river, most of which was taken by gears such as *hat tana*, *hat bauli* and *shangla jal* operating on or near the regulator. In contrast, no fishing was carried immediately upstream of the regulator indicating that fish were indeed attempting to migrate upstream into the Padma River. The average size of *ilish* caught in the Baral ranged from 150-350 g in August and 350-750 g in September with a few individuals occasionally exceeding 1 kg confirming that the population comprised mainly young adults on their first spawning run. Very few young *jatka* were caught in the Baral indicating that no breeding occurred there and that any which were spawned in the Atrai system migrated out using the Atrai-Jamuna route.

Hat tana operating from the regulator captured a total of 41 species between July and October 1993, of which 33 species were migratory or riverine types (Table 4.15). The principal target species was *ilish* which contributed 57% of the annual catch. Other relatively abundant species included carps, *catla*, *kalbaus*, *mrigel*, *rui* and *raik*, catfish, *boal* and *shillong* and smaller species, *kalabata*, *telchitta*, and *kajuli*. From data on the average weight per individual of the more abundant species in the *hat tana* catch, it would appear that most were adults or juveniles of at least one year old. This was true for the three species, *raik*, *kalbaus* and *boal* captured in April and May when no connection had yet been made with the Padma. Presumably, small increases in water levels on the Baral resulting from rainfall runoff stimulated upstream movements of these species. Later in the year, juveniles less than one year old were captured at the regulator, these included juvenile *mrigel*, *shillong* and *boal*. It is apparent from the pre-monsoon catches and others made by *hat tana* in mid-July, when there was no difference in water levels across the regulator, that the structure still acted as an obstruction to upstream movement of fish and increased their susceptibility to capture by funnelling them between the walls of the open gates.

Table 4.15 Monthly catch composition (% by weight) of hat tana (scoop nets) operating on Charghat regulator, October 1992 – February 1994

Species Code	Habitat Preference	Species name		Year: 1992	Year: 1993						Total annual catch (Mar'93 – Feb'94)	
		Scientific	Bengali	Oct	April	May	July	Aug	Sep	Oct	Kg	%
13	Riverine	*Aspidoparia morar*	*Piali*	0.680	–	–	8.343	1.958	0.042	0.104	15.226	0.538
59		*Crossocheilus latius*	*Kalabata*	–	–	–	0.135	–	1.377	–	25.374	0.897
139		*Nemacheilus botia*	*Balichata*	–	–	–	0.338	–	–	–	0.489	0.017
28		*Botia dario*	*Rani*	8.390	–	–	–	1.178	0.090	0.100	2.788	0.099
29		*Botia lohachata*	*Putul*	–	–	–	–	0.787	0.057	0.150	2.295	0.081
89		*Hilsa ilisha*	*Ilish*	–	–	–	8.139	15.084	63.263	74.386	1603.157	56.677
58		*Corica soborna*	*Kachki*	–	–	–	0.068	–	–	–	0.099	0.003
193		*Setipinna phasa*	*Phasa*	–	–	–	2.439	–	–	0.021	3.649	0.129
185		*Rhinomugil corsula*	*Khorsula*	–	–	–	5.284	–	–	0.708	11.820	0.418
923		*Sicamugil cascasia*	*Bata*	–	–	–	0.068	–	–	0.004	0.123	0.004
2		*Ailia coila*	*Kajuli*	64.625	–	–	1.761	11.765	0.129	7.388	56.377	1.993
51		*Clupisoma garua*	*Ghaura*	2.267	–	–	0.203	12.417	0.066	0.025	7.428	0.263
196		*Silonia silondia*	*Shillong*	–	–	–	–	–	2.045	3.349	57.158	2.021
80		*Gagata viridescens*	*Gang tengra*	2.948	–	–	–	–	–	1.333	7.871	0.278
81		*Gagata youssoufi*	*Gang tengra*	2.041	–	–	0.609	12.290	0.234	1.633	20.527	0.726
84		*Glyptothorax telchitta*	*Telchitta*	–	–	–	6.435	37.386	0.911	0.812	48.150	1.702
958		*Glyptothorax sp*	*Lal moina*	4.308	–	–	–	–	0.406	–	7.423	0.262
171		*Psilorhynchus balitora*	*Balitora*	–	–	–	–	–	–	0.033	0.197	0.007
	Subtotal			85.260	–	–	34.415	93.466	68.621	88.446	1870.151	66.116
130	Migratory	*Aorichthys aor*	*Ayre*	–	–	–	0.678	–	–	–	0.980	0.035
32		*Catla catla*	*Catla*	–	–	–	–	–	31.271	–	571.728	20.213
47		*Cirrhinus mrigala*	*Mrigel*	–	–	–	–	–	–	3.749	22.136	0.783
48		*Cirrhinus reba*	*Raik*	5.442	35.892	65.215	–	–	0.036	–	81.923	2.896
101		*Labeo boga*	*Bhangan*	0.227	–	–	–	3.660	0.006	–	1.812	0.064
102		*Labeo calbasu*	*Kalbaus*	–	23.311	–	–	–	–	–	52.933	1.871
107		*Labeo rohita*	*Rui*	–	–	–	–	–	0.015	6.248	37.169	1.314
188		*Salmostoma bacaila*	*Katari*	–	–	–	–	0.653	–	0.262	1.853	0.066
189		*Salmostoma phulo*	*Fulchela*	–	–	–	1.152	–	–	0.054	1.985	0.070
154		*Securicula gora*	*Chora chela*	–	–	–	0.068	–	–	0.104	0.715	0.025
86		*Gudusia chapra*	*Chapila*	–	–	–	–	–	–	0.025	0.147	0.005
76		*Eutropiichthys vacha*	*Bacha*	–	–	–	–	–	–	0.542	3.198	0.113
169		*Pseudeutropius atherinoides*	*Batasi*	–	–	–	–	–	–	0.042	0.345	0.012
209		*Wallagu attu*	*Boal*	–	38.796	–	0.068	–	–	–	164.396	5.812
144		*Notopterus chitala*	*Chital*	–	–	–	57.585	–	–	–	0.195	0.007
	Subtotal			5.669	100.000	65.215	0.135	–	–	–	941.515	33.286
187	Floodplain	*Osteobrama cotio cotio*	*Keti*	–	–	–	59.689	4.314	31.328	11.025	0.907	0.032
175	Resident	*Puntius conchonius*	*Canchan puti*	–	–	–	0.543	0.262	–	–	5.290	0.187
180		*Puntius sophore*	*Puti*	–	–	–	3.659	–	–	–	0.579	0.020
212		*Puntius ticto*	*Tit puti*	–	–	–	0.271	–	0.009	0.004	0.050	0.002
83		*Glossogobius giurus*	*Bailla*	–	–	–	–	–	–	0.008	3.406	0.120
9		*Aplocheilus panchax*	*Kanpona*	–	–	34.785	0.068	–	–	–	0.294	0.010
36		*Chanda nama*	*Nama chanda*	–	–	–	0.203	–	–	–	0.249	0.009
37		*Chanda ranga*	*Lal chanda*	–	–	–	0.135	–	0.003	–	1.107	0.039
	Subtotal			–	–	34.785	0.678	–	0.003	0.012	11.882	0.420
117	Others	*Machrobrachium styliferus*	*Gura icha*	0.227	–	–	5.558	0.262	0.015	0.025	–	–
931		Prawn spp.	*Chingri/Icha*	8.844	–	–	–	–	–	–	5.037	0.178
	Subtotal			9.071	–	–	0.338	1.958	0.036	0.504	5.037	0.178
	Grandtotal			100	100	100	100	100	100	100	2828.585	100

Notes:
1. No fishing activities were observed from November 1992 – March 1993, June and November 1993 – February 1994
2. Shading denotes most abundant species (> 5% of catch)
3. – denotes zero catch

Once head differences were generated by rising waters of the Padma River in late July, high water velocities and turbulence at the regulator gates created an even more effective barrier to upstream migrating fish. In early August when the head difference was fairly low (0.4 m), the gates were fully open and the downstream flow was heaving with frequent surges creating surface waves. Under such conditions *ilish* were caught by *hat tana* scooping in a downstream direction as the fish rested and prepared for a darting burst against the incoming current of water. Since the regulator could act as a barrier or hinderance to movement of a large, powerful swimming fish such as *ilish*, then it was certain to have presented an even more serious barrier to the smaller, or slower swimming species listed in Table 4.15.

Identification of the migration routes of species other than *ilish* was made more difficult because of their lower abundance by weight. However, examination of spatial and temporal distributions indicated that several small species such as *kajuli*, *gang tengra* and *telchitta* followed a similar but less extensive route to *ilish*, travelling up the Atrai, Nandakuja and Baral as far as Charghat. For these species, it would have been difficult to cross the regulator under the conditions imposed by relatively high head differences from early August to early October. Many other riverine and migratory species e.g. *piali*, *khorsula*, *phasa*, *ayre* undoubtedly entered the Baral from the Padma since they were rare in the Atrai at Gurudaspur. That several of these species were captured at Charghat regulator between July and September indicated that there were attempted return migrations from the Baral to the Padma. However, the structure effectively blocked these movements until head differences across it equalised towards the end of October 1993.

Examination of seasonal variations in water levels across the regulator revealed that there were times in almost all years when gate openings could be increased to reduce head differences without exceeding the maximum regulated level of approximately 14.5 m PWD (Figs. 3.2 and 3.3). During the first ingress of Padma floodwaters in July when gates were usually fully open, head differences would be impossible to reduce without expensive structural alteration to the design of the regulator to increase the width of gates.

Examination of gate operations during 1993 and 1992 which were two very different years in terms of flooding, illustrates the opportunities for improvement which are possible under varying flood conditions (Fig. 4.11). Assuming an inside flood level of 14.5 m PWD should not be exceeded, then in 1993 it was not possible to avoid head differences in late July and early August since gates were fully open. Between the second week of August and the end of September there was the opportunity to increase the "fish friendliness" of the regulator

for about one week by reducing head differences without exceeding and inside level of 14.5 m. In October, it was possible to increase gate openings from 5 ft to 8 ft from the middle of the month onwards and to a slightly lower height in the first half of the month.

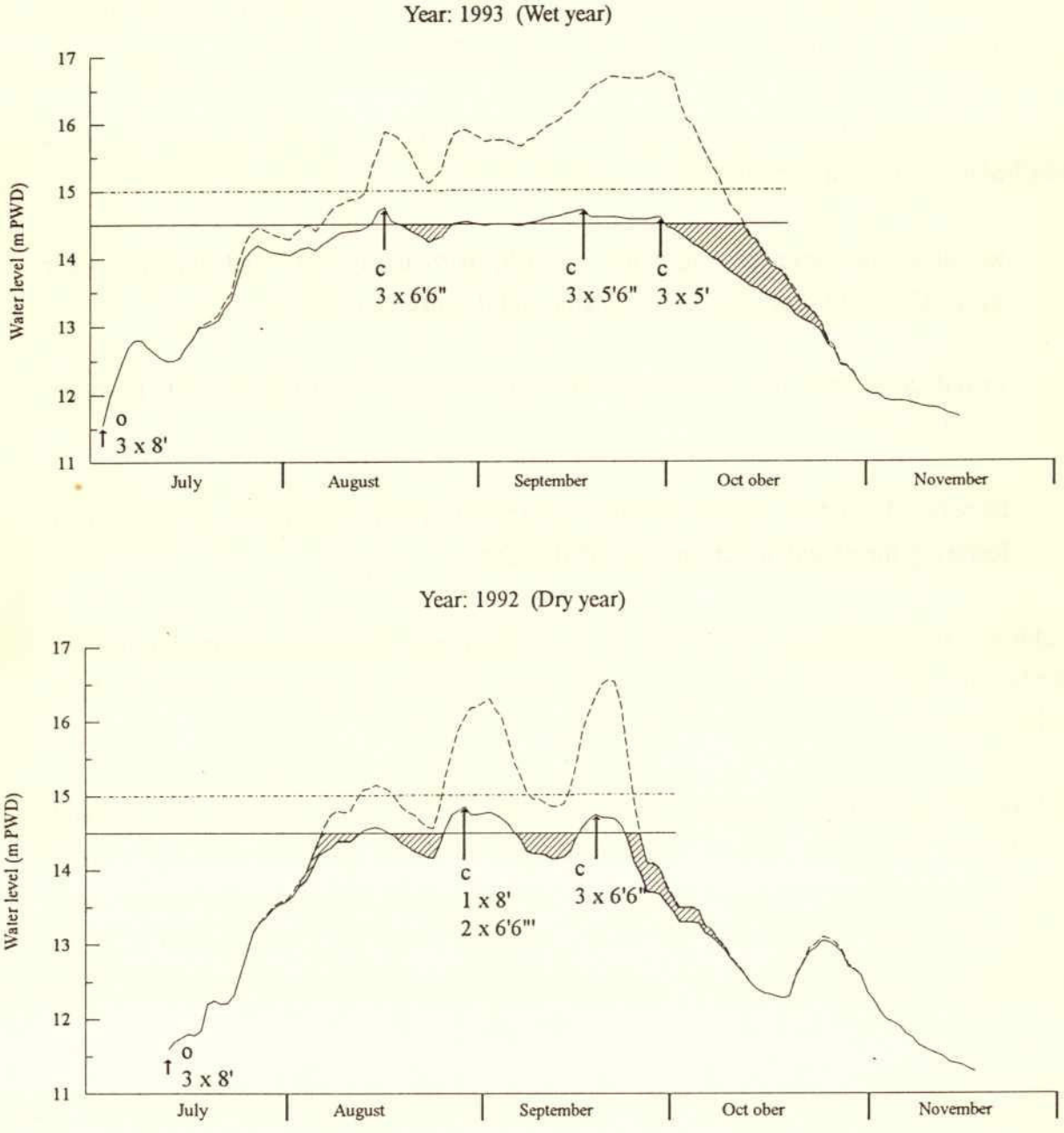
During the drier year of 1992, gates were reportedly fully open until 29 August. However, observations made by FAP 17 on 24 August indicated that the gates were lowered slightly and drowned. Under these conditions there was some opportunity to further open the gates to reduce head differences. There were further opportunities to increase gate openings in mid-September and again between late September and early October.

If the maximum allowable regulated water level at Charghat was increased by 0.5 m to 15 m PWD, then there would have been considerably greater opportunity to avoid head differences altogether in August and September 1992 and reduce then significantly in August 1993 (Fig. 4.11). The present maximum regulated water level of 14.5 m PWD is not the result of a formal agreement between BWDB and other agencies or water users. Rather, it stems from apparently informal local arrangements the basis of which remains unclear. The BWDB regard the Baral Project as incomplete and propose a second regulator downstream of Charghat (see Section 5). Once this is constructed then regulatory maximum discharges in the Baral would be established. With or without the construction of a second regulator, there is a need to reassess the objectives and impact of Charghat regulator on the Baral basin. The reassessment should consider in detail the interests of the fisheries sector and the impacts of the regulator already identified by the FAP 17 studies.

Improved gate operations to reduce head differences and thereby increase the fish-friendliness of the structure by lowering water velocities and turbulence would increase the chances of safe passage of upstream migrating fish. To further improve their safe passage requires the establishment of a prohibited fishing zone at the structure itself and for a distance of at least 1 km downstream to protect species such as *ilish* which congregate for some distance downstream.

An independent but closely related FAP 17 investigation of the impact of Charghat regulator on downstream drift of fish hatchlings concluded that the regulator significantly reduced the downstream supply of hatchlings into the Baral and that the reductions were directly related to water level differences across the regulator (Draft Final Report, Supporting Volume No. 11). The study suggested that very young fish were more vulnerable to large and rapid changes in pressure induced by water level differences across the structure. Thus, improved gate operations to reduce, whenever possible, head differences are also likely to result in less harm and greater recruitment of fish hatchlings of a wide variety of species.

Figure 4.11 Seasonal variation in water levels outside and inside Charghat regulator in relation to gate operations



Notes: 1. Vertical arrows denote dates when gates were raised (o) or lowered (c). Heights of gates are given below arrows together with number of gates at each height.

2. —— denotes existing maximum regulated water level (14.5 m PWD)
----- denotes suggested maximum regulated water level (15.0 m PWD)
see text (p 52) for explanation

3. ▨ Shading denotes periods when gates could have been opened more to reduce head differences under a maximum regulated water level of 14.5 m PWD

5 FUTURE DEVELOPMENTS ON THE BARAL RIVER

It is proposed by BWDB to construct a second regulator across the Baral, 50 km downstream from Charghat. The principal purpose of this regulator is to provide a storage reservoir within the upstream channel of the Baral for the irrigation of the upper catchment on both sides of the river. Feasibility studies have been completed without detailed fisheries impact assessments and construction work is due to begin in 1995.

The probable impacts of this regulator on capture fisheries will be the same as those described for Charghat regulator:

a) to block the upstream migration of fish, particularly *ilish* and increase their susceptibility to capture at the regulator and downstream of it

b) to reduce the recruitment of fish hatchlings by downstream passive drift from the Padma River

c) to seriously reduce capture fisheries production from downstream floodplains by lowering the extent and magnitude of flooding.

In addition, the presence of two regulators on the Baral would probably reduce the level of migration into it by riverine and migratory fish from the Padma and certainly from the Atrai for the section of river between the regulators.

The proposal by BWDB to proceed with the construction of a second regulator on the Baral without first conducting detailed and comprehensive social and environmental impact assessments contradicts the basis of the current concept of controlled flooding for the purpose of integrated water management which has emanated from the Flood Action Plan of Bangladesh.

6 RECOMMENDED MITIGATION MEASURES

Several mitigation measures are listed below. The first three measures listed could be established in the short or near term and would increase the safe passage of migrating fish across structures such as Charghat regulator without the need for expensive changes in design and further construction work. Most of the other measures relate to institutional changes and are therefore of a longer-term nature.

1. Flood control structures which block or delay movements of fish in rivers or canals thereby increasing their susceptibility to capture should be classified as prohibited fishing zones. Fishing from the structure itself and from a set distance upstream or downstream from it should be made illegal. Distances will vary depending on the location of the structure but as an example, at Charghat regulator fishing should be prohibited on it and for a distance of 1 km downstream.

2. Whenever possible water level differences across structures should be minimised to reduce water velocities and turbulence. To achieve this, an accurate assessment of the maximum allowable inside water levels and rates of increase at different times of the year is required. The primary objective of daily gate operations should then be to reduce head levels within the constraints imposed by the agreed limits.

3. The proposal by BWDB to proceed with the construction of a second regulator on the Baral River should be postponed until detailed and comprehensive social, environmental, agricultural and fisheries evaluations of the potential impact of the project on the Baral basin have been completed.

4. A regulator should be designed and field tested so that the principal form of control is through undershot gates with outer vents to provide overshot flow to facilitate the downstream passage of fish hatchlings. Undershot gates should be of sufficient width to generate minimum head differences across the structure when gates are fully open. This type of regulator was proposed for the regulation of the Lohajang River in the Tangail Compartmentalization Pilot Project. However, in view of current construction of the Jamuna Bridge which involves the closure of the Northern Dhaleswari River which feeds the Lohajang, a new location is needed for meaningful field trials of a new regulator design. The most appropriate location for such a regulator would be along the right or left banks of the Jamuna River.

5. There is a need to establish a multidisciplinary technical assessment unit comprising expertise from fisheries, agriculture, hydrology and hydraulic engineering. The unit should be responsible for the re-evaluation of operating procedures of existing structures and for the examination of future flood control projects. Proposals for major new road or rail links should also be assessed by the unit in terms of their impact on flooding patterns, fisheries and agriculture.

6. A detailed and comprehensive national database should be established by BWDB to provide information on all flood control projects in Bangladesh and the major regulatory structures within these projects. The database should provide a basic description of the design and size of each structure, its function within the project area and its state of repair. Daily water level data at each structure should also be provided with computed head differences. The database should be made available, in a user-friendly form, to other government agencies.

7. There is an urgent need to improve the quality of data collection by BWDB personnel responsible for the operation of regulatory structures. Supervisory personnel should ensure that accurate detailed daily records are maintained of water levels at the structure (inside and outside), numbers of gates open and height to which each gate is opened. These data should be incorporated into the national database at monthly intervals.

8. Local groups of water users should be established in flood control projects to represent the full range of sectors affected by modified flooding patterns. This should include capture fisheries as a water user group. Representatives from each group should form a local committee in association with relevant government departments to establish operating procedures of regulatory structures. The committee would provide the mechanism for the establishment of local integrated water management.

9. An annual series of training courses should be established within BWDB to provide engineers with a basic understanding of the water requirements within each natural resource sector, focusing attention on fisheries and agriculture. The course content relating to fisheries should contain descriptions of identified adverse impacts of flood control on fish and various methods of mitigation against such impacts.

7 FUTURE RESEARCH REQUIREMENTS

Further work is needed to collect information on the areas listed below.

1. Investigation of upstream and downstream movements of fish across Charghat regulator under controlled gate operations to reduce water head differences outlined in mitigation method no. 2.

2. Determination of water velocities from a range of different types of structures operating under varying head differences and gate openings. These data should be collected by BWDB and incorporated into a national database on water regulators (mitigation method no. 6).

3. Determination of swimming speeds of selected fish species. This work requires carefully controlled laboratory flume studies and therefore the most appropriate approach may be a joint study between the Fisheries Research Institute (FRI) and the River Research Institute. Results from this study would be related to data on water velocities at regulators (No. 2 above) to provide quantitative management advice on the operation of various types of regulator.

4. Investigation of the physiological effects on fish of passage through regulators under different prevailing head differences. This work requires the controlled release of selected species upstream of a regulator and their subsequent capture downstream. Physiological examinations could be undertaken by FRI and or universities.

5. Continued investigation of the impact of Charghat, and other regulators, on the downstream drift of fish hatchlings. Results obtained during FAP 17 Phase I, should be regarded as preliminary baseline data upon which further studies should be based.

6. Investigation of spawning migrations and spawning grounds of major carps in the Padma/Ganges River system.

7. Quantitative assessment of the impact of river regulation on hydrology, fisheries and agriculture in the Baral basin with a re-evaluation of the existing controlled flooding programme.

APPENDIX 1

Appendix 1 List of fishing gears recorded during FAP 17 surveys in Bangladesh

Gear Type	Name	Code	Description
Gill Net	*Current jal(Stationary)*	88	Monofilament fixed gill net, usually small mesh
	Current jal(Drifting)	282	Monofilament drifting gill net, usually top set, any mesh size
	Koi jal	123	Multifilament fixed gill net, usually small mesh
	Chandi jal	65	Multifilament drifting gill net, usually top set, any mesh size
	Par jal	315	Multifilament drifting gill net, usually bottom set, large mesh
	Kajuli jal	316	Multifilament drifting gill net, usually bottom set, small mesh
	Awo jal	324	Multifilament fixed gill net set in zig-zag pattern to catch large fish
	Foot jal	327	Very small gill set horizontally at surface in shallow water
	Gai Dasem	132	Drifting net used in rivers, has pockets at base
Seine Net	*Ber jal*	45	Seine net: small, medium or large size
	Baoli jal	306	Medium sized seine net pulled by 2 ropes
	Moi jal	202	Small drag net with pockets at base
	Dora jal	325	Similar to moi jal but pulled by 2 long ropes
	Konaber jal	268	Seine net with pocket at one end
	Dhor jal	89	Small seine usualy pulled by 2 men by sticks on each end of net
	Horhori	297	Seine net with a series of large pockets along net
	Kathi jal	175	Seine net with a series of vertical sticks along net
	Chabi jal	293	Seine/gill net pulled to shore, often used with polo traps
	Hat panch	276	Medium size seine pulled at each end by one man while man in boat beats water to drive fish into net
	Satiber jal	304	Seine net with a series of pockets at base
	Kachitana	277	Type of lift net hung from boat on floodplain or beel. Net used with drag rope to drive fish into net.
	Ferra jal	126	Drag rope used to drive fish into gill net/seine net
Bag Net	*Thaga*	285	Barrier across river with bag nets set perpendicular to it
	Suti jal	271	Single bag net staked to river bed
	Ghori jal	320	Barricade/fence with nets set in gaps to trap fish
	Bhuti jal	328	Clap net on bamboo frame hung from boat anchored in a gap of barrier fence
Lift Net	*Veshal*	266	Triangular lift net on large bamboo frame
	Dharma jal	105	Square or round lift nets on bamboo pole
	Jhali jal	160	Small veshal used on main rivers at night for prawns
	Jhap jal	319	Boat lift net: lifted at 4 corners by men in boats
	Chota jal	323	Gill net fixed horizontally on bottom to catch fish by spines
	Dara jal	329	Lift net and barrier used in canals or small rivers
Scoop Net	*Hat Tana*	287	Oval or triangular scoop nets used with pole and rope or by hand
	Ucha	263	Basket scoop on pole used by hand
	Tukri	296	Small basket scoop used by hand
	Afa/Hat bauli	321	Large thella jal, large mesh, used on boat
	Uttar jal	68	Like a cast net but hung from a boat drifting along river and lifted to catch fish
Clap Net	*Shangla jal*	234	Multifilament drifting bag net on bamboo frame boat used for hilsa fishing
FAD	*Katha*	270	Submerged brush shelter used to attract fish
	Boat Katha	314	Submerged boat filled with branches used to attract fish
	Horgra	149	Submerged basket filled with branches used to attract fish
	Kua	302	Fish pit on floodplain, invariably contains brush shelter

Appendix 1 Continued

Gear Type	Name	Code	Description
Traps	*Polo*	222	Bell-shaped trap used to catch fish by hand
	Doiar trap	95	Small, oval or box traps used for prawns or small fish
	Deal	286	Larger trap, bilaterally divided to catch fish on 2 sides of bana
	Kadum trap	311	Large box traps used to catch larger fish e.g. Koi, Taki
	Kakila bana	310	Bamboo fence pulled downstream to trap fish in small area
	Katra	326	Active trap: fish speared after entering trap
	Kalsi pata	299	Clay pot used to trap fish set in bank side.
	Kotta	318	Bunded area on floodplain used to trap fish as water recedes
	Char jal	322	Tidal fence trap
	Kharia/Kore	330	Fence trap used on floodplain during flood recession
	Malai pata	331	Coconut shell drilled with holes and baited to catch small fish
	Patar savar	332	Large active fence trap used to surround fish on flooplain
	Tui	334	Small polo-type trap used to catch fish in mud on floodplain
Hook/ Lines	*Daun*	272	Long line: many hooks set at intervals on one line
	Sip	30	Rod and line : usually one hook per line
	Nol barsi	278	Hook & line attached to bamboo floats. Many floats/hooks may be joined along line
	Tana barsi	152	Hand line (no rod) from bank or boat with or without groundbait
Spear	*Juti*	170	Spears of various types: fixed or detachable barbs
Other	*Jhaki jal*	164	Multifilament circular net thrown by hand
	Thella jal	255	Small triangular push net set on bamboo frame
	Urani	291	Various barrier nets/fences used to catch jumping fish.
	Akra	298	Pole with metal hooks used to catch mud-dwelling fish e.g. baim
	Chunga	301	Hollow bamboo rod shelter used to attract baim
	Thushi	317	Cloth/basket traps used to drive baim into them
	Hand fishing	307	Picking fish by hand but without dewatering
	By hand/Dewatering	97	Empty water and catch fish by hand in mud
	Net/Basket+Dewatering	98	Empty water through an outlet where net or basket used to trap fish
	Nimbaich	335	Large scale fishing by whole village using many different gears
	Canal dewatering	336	Large section of canal isolated by cross dams and emptied by pumping by other means to catch fish by various methods

Notes:

1. Local names of gears vary between different districts and regions in Bangladesh. Those listed in the table above are generally used in the North Central Region. If gears were not found in this region, then the name from the region in which the gear was most recorded was used.
2. Some names e.g. juti (spear) doiar traps and hat tana were used to denote a group of similar gears. A more detailed list and description of individual gears is provided in the FAP 17 database.
3. FAD = Fish Aggregation Device.