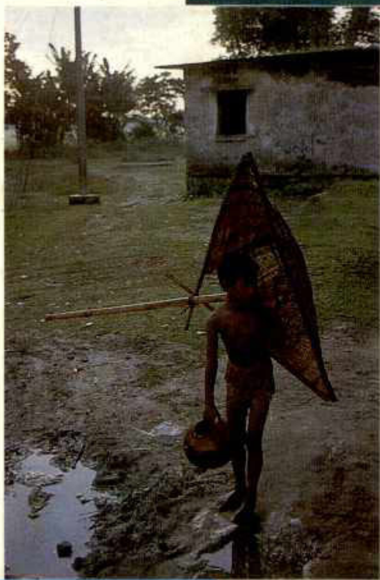
Government of the Peoples Republic of Bangladesh
Flood Action Plan

# FAP 17
## Fisheries Studies and Pilot Project





# FINAL REPORT

(Draft)

JUNE 1994



## Supporting Volume No. 8



## FISHERIES STUDY

## MANU IRRIGATION PROJECT AND HAKALUKI HAOR

ODA

Overseas Development Administration, U.K.

# FAP 17

# FINAL REPORT



## SUPPORTING VOLUME NO. 8

**** Draft ****

FISHERIES STUDY

**Manu Irrigation Project**
**and**
**Hakaluki Haor**



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 with 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 xii). Three further fisheries studies were completed, one of which described the fisheries of the main rivers Jamuna and Padma (Supporting Volume No. 10). 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 Volumes 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 19-28). Several of these studies have been documented previously as annexes to the FAP 17 Interim Report. To ensure wider circulation, however, 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.

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 movements and populations 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 depended 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.

## ACKNOWLEDGMENTS

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 its 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, Dr. A M Bhouyain, 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 fishermen's 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, and a small team in Dhaka, were responsible for the preparation of the report.

FAP 17 is grateful for the full cooperation and hospitality offered to project fisheries biologist by leaseholders of perennial *beel* in the MIP and Hakaluki *Haor*. We are also grateful for the cooperation of FAP 6, especially in the supply of hydrological information.

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## ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| *b. aman* | broadcast *aman* |
| BRRI | Bangladesh Rice Research Institute |
| BWDB | Bangladesh Water Development Board |
| °C | degree(s) centigrade |
| cm | centimetre(s) |
| CPUA | Catch Per Unit Area |
| CPUE | Catch Per Unit Effort |
| DO | Dissolved Oxygen |
| DoF | Department of Fisheries |
| DWR | Deepwater Rice |
| EC | European Community |
| EIRR | Economic Internal Rate of Return |
| EUS | Epizootic Ulcerative Syndrome |
| FAP | Flood Action Plan |
| FAP 17 | Flood Action Plan Study No. 17 (Fisheries Studies and Pilot Project) |
| FCD | Flood Control and Drainage |
| FCD/I | Flood Control and Drainage with or without Irrigation |
| FRI | Fisheries Research Institute |
| g | gram(s) |
| GPS | Geographical Positioning System |
| ha | hectare(s) |
| hr | hour(s) |
| HYV | High Yield Varieties |
| kg | kilogram(s) |
| km | kilometre(s) |
| m | metre(s) |
| mg/l | milligram(s) per litre |
| MIKE11 | A microcomputer based modelling system for rivers and channels |
| MIP | Manu Irrigation Project |
| NER | North East Region |
| NGO | Non Government Organisation |
| NS | Not significant |
| ODA | Overseas Development Administration |
| PIRDP | Pabna Irrigation and Rural Development Project |
| PWD | Public Works Datum (water level) |
| pH | Measure of acidity and alkalinity of water (log of hydrogen ion concentration) |
| SRP | Systems Rehabilitation Project |
| STD ERR | Standard Error |
| SWMC | Surface Water Modelling Centre |
| t | tonne(s) |
| *t. aman* | transplanted *aman* |

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## ABBREVIATIONS AND ACRONYMS (Contd.)

| | |
|---|---|
| TDWR | Transplanted Deepwater Rice |
| t/ha | tonne(s) per hectare |
| tk | taka |
| WAPDA | Water and Power Development Authority |
| WARPO | Water Resources Planning Organisation (previously MPO, Master Plan Organisation) |
| $\mu S$ | Measurement of conductivity of water (micro Siemens) |

## SUMMARY

1. The Manu Irrigation Project (MIP) is a full flood control and irrigation project constructed in 1983 and located at Moulvibazar, 80 km southwest of Sylhet in the North East Region. It is bounded by the Kushiyara River in the north and Manu River in the south and west. It is protected from their flooding by a 60 km embankment. On the eastern side it is bordered by the Bhatera Hills; about 8,000 ha of this area is included in the MIP catchment. The project itself covers an area of approximately 24,000 ha and supports a population of about 140,000 people.

2. Between February 1993 and February 1994, fisheries catch assessment surveys were conducted at fortnightly intervals on canals, floodplains and *beel* inside the MIP and on unregulated areas in Hakaluki *Haor* lying 25 km to the east of the MIP which was used as a control area for comparative purposes. The Kushiyara River which floods both areas was also surveyed.

### Flooding Patterns

3. Ever since its construction in 1983, the MIP has failed to provide the level of flood control for which it was designed. In at least five years of high floods in the Manu River, cuts were made in its embankment by people living immediately outside it to relieve flooding of their homesteads. Flood levels in the Manu have increased considerably in recent years as a result of confining floodwaters in the river channel by building flood control embankments and also because of increased local rainfall. Even during drier years, when no cuts were made in embankments, rainfall flooding inside the project was 1 to 2 m greater than the target design level of 7.15 m PWD. In all drier years flood levels normally ranged from 8 to 9 m PWD despite pumping out of floodwaters by Kashimpur pump station which has so far proved ineffective. This resulted in an additional inundated area of between 5,000 ha and 10,000 ha. During the year of study by FAP 17, cuts were made in embankments in June 1993. These allowed floodwaters to enter suddenly from the Manu River which reportedly resulted in extensive damage to rice crops but also allowed fish to enter the project. During the previous drier year of 1992, no cuts were made in embankments.

4. Since both the MIP and Hakaluki *Haor* drain into the Kushiyara River, flooding patterns in both were determined to a large extent by those of the river. Prior to embankment construction, flooding patterns in both areas were very similar. Because

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of slope of the river bed, however, water levels at a given land elevation in Hakaluki were about 1 m higher than those of the MIP prior to flood control.

5. During the period of study the MIP had the flowing impacts on flooding:-

i) Intermittent flooding by external rivers was prevented from 18 February until 8 June. Up to early May little extensive rainfall flooding occurred inside the MIP and water levels were reduced by 1 to 2 m compared with peak levels immediately outside the MIP. This resulted in a reduction in the extent of intermittent flooding on about 5,000 ha of floodplains immediately surrounding *beel* inside the MIP. In May heavy rainfall caused a 3 m rise in water level inside the MIP while that outside was up to 2 m higher. The extent of flooding was thus again reduced, this time by about 7,000 ha on higher land.

ii) The timing of the first entry of river waters on to *beel* and low floodplains was delayed by 3.5 months (18 February - 8 June). After embankments were cut in June flooding patterns inside the MIP were essentially the same as those outside apart from two brief periods of peak flood in June and July when water levels inside were about 0.5 m higher than those outside.

iii) There was slight entry of floodwaters from the Kushiyara River due to leakage in a 3-vent sluice gate at Kushiyara. No major entry was possible, however, until late July when erosion caused breaches in the Kushiyara embankment.

iv) A 3-vent sluice gate constructed at Kashimpur was not included in the original design of the MIP and its purpose has apparently not been documented. The gate has a sill level of 1.4 m PWD which is considerably lower than the approved level of 4.1 m PWD on the adjacent 6-vent gate. The 3-vent sluice was opened in late December to drain out water remaining in Khorodari *Khal* and the connecting Patasinga *Beel* to levels below those recommended in the project design. This was done to facilitate fishing in leased *beel* and *khal* (see Para 23 for fisheries impacts).

### Water Quality

6. Seasonal variations in water temperature, pH, dissolved oxygen concentration, conductivity, total dissolved solids and transparency were monitored on rivers, canals, floodplains and *beel*. No major differences in water quality were detected between the MIP and Hakaluki *Haor*, apart from an earlier decrease in transparency in Hakaluki (May) than in the MIP (June) caused by the earlier ingress of river floodwaters on to the unregulated *haor*.

### Total Catch

7. Estimates of annual catch per unit area (CPUA) from sampling sites covering different ranges of land heights were extrapolated to wider areas using area elevation curves to obtain estimates of the total catch from the MIP and Hakaluki *Haor*. Between March 1993 and February 1994 the total annual catch from 23,073 ha in Hakaluki *Haor* was tonnes with a CPUA of 142 kg/ha. This compares with a total catch from 19,597 ha in the MIP of 2,213 tonnes and a CPUA of 113 kg/ha, 20% lower than in Hakaluki *Haor*. Statistical analyses revealed significantly lower fish densities in the MIP before cuts were made in embankments but higher densities afterwards during the winter. When catch rate data were pooled for the year and differences in fishing effort taken into account there was no significant difference in total catches (see para 13).

8. The FAP 17 survey was the first study to employ detailed quantitative catch assessment techniques in the MIP. Previous studies by the BWDB Systems Rehabilitation Project (SRP) and the Northeast Regional Water Management Project (FAP 6) have however provided total catch estimates for 1992 and 1993 largely using secondary data sources. In 1992 SRP and FAP 6 estimated the catch to be 419 t and 337 t respectively. In 1993 FAP 6 estimated the catch at 801 t. The increase was attributed to greater flooding in 1993. The catch estimate for 1993 was considerably (64%) lower than the present FAP 17 estimate. This was due to the underestimation by FAP 6 of the number of different types of gear used, the duration of the fishing season and the number of units of major gears employed. It is clear that previous studies substantially underestimated the value of capture fisheries in the MIP. The present estimated catch of 2,213 t had an on-site value of 55 million taka per annum and was equivalent to the annual consumption of about 303,000 people which was more than twice the size of the population in the MIP.

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9. Of the total catch of 2,213 t from the MIP, 77% was taken from high floodplains surrounding villages on the periphery of the *haor* and only 10% was taken from perennial *beel*, some of which constituted important *jalmahal*. The remaining 13% was taken from low floodplains immediately surrounding *beel*. These were usually some distance from villages and fished less than shallower water near villages. On Hakaluki *Haor* 50% of the total catch was taken from high floodplains and 15% from perennial *beel*. The remaining 35% was captured on low floodplains adjacent to *beel*. In both the MIP and Hakaluki *Haor* fishing effort during the monsoon concentrated on shallow peripheral areas while deep waters over *beel* were avoided completely for 2 or more months. There was no evidence that this was the result of prohibition of fishing by leaseholders' guards but rather that fishermen chose to fish in shallow waters where presumably catch rates were higher and gears could operate more efficiently. The results from both areas revealed the greater importance of small-scale fisheries operating in shallow waters than the better known leased winter *beel* fisheries, many of which are famous in the North East Region. The bulk of the catch from shallow waters was taken by subsistence or part-time fishermen using *thella jal* to harvest prawns (see paras 17-19).

10. Annual values of CPUA ranged from 115 kg/ha to 155 kg/ha on low and high floodplain sites respectively on Hakaluki *Haor*. In the MIP, values of CPUA were 77 kg/ha from low floodplains and 185 kg/ha on high floodplains. Higher catches from shallower waters on the periphery of the MIP and Hakaluki *Haor* resulted from the exploitation of abundant prawn stocks by *thella jal* fisheries. The CPUA from Patasinga *Beel* inside the MIP (512 kg/ha) was considerably higher than that from Tekuni/Baghalkuri *Beel* (193 kg/ha). This was due largely to the substantially greater amount of fishing effort per unit area used on Patasinga *Beel*.

11. Catches from the Juri River which drained Hakaluki *Haor* were compared with catches from Khorodari *Khal*, the main drainage canal of the MIP. The annual catch per kilometre from the Juri River was 2,726 kg/km compared with 4,069 kg/km from Khorodari *Khal*. In terms of catch per unit area, the unregulated river catch (723 kg/ha) was about half that of the regulated canal (1,498 kg/ha). Statistical analyses revealed no significant difference in fish densities between sites and that the substantially higher catch from Khorodari *Khal* resulted principally from increased fishing effort by dominant gears.

**Fish Densities**

12. Statistical analyses of seasonally pooled catch rates of gears used inside and outside the MIP were carried out separately for canals and for floodplains/*beel* combined. The underlying assumption of the methods was that once differences in catchabilities between gears had been accounted for, any further differences in catch rates inside and outside the MIP were due solely to differences in fish densities.

13. Statistical comparison of catch rates of dominant gears used on floodplain and *beel* inside the MIP and on Hakaluki *Haor* revealed that fish densities were significantly lower inside the MIP before embankments were cut in June but higher after cuts were made. Since the preceding year was relatively dry, no cuts were made in embankments and fish therefore had little opportunity to enter the MIP from external rivers. The significantly lower fish densities found in the MIP during the early part of 1993 could be attributed to this blockage to movement of migratory species which, in years when embankments are cut such as 1993, provided a major share of the winter catch. Lower densities found prior to embankment cuts were countered by higher densities found in the MIP during the drawdown and winter. In the winter higher densities in the MIP could be attributed to the important contribution made by migratory species which entered through breaches in embankments and also to the greater concentrating effect of Patasinga *Beel* which had a larger catchment area that of Baghalkuri *Beel* on Hakaluki *Haor*. The higher winter catch could also be attributed to higher fishing effort inside the MIP.

14. Statistical comparison of the catch rates of dominant gears used on canals inside the outside the MIP were not possible using the proposed model because of substantial differences in gear usage between sites. Only two gears, *uttar jal* and *veshal*, were used extensively at both sites where they accounted for 41% of the annual catch from the Juri and 35% from Khorodari *Khal* inside the MIP. An alternative statistical method which treated the gears separately revealed little evidence of significant differences in fish densities inside and outside the MIP. The higher catch from Khorodari *Khal* was therefore due to the higher fishing effort by dominant gears such as *ghori jal*, which was not used on the Juri, and by *veshal*.

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## Diversity

15. Between March 1993 and February 1994, an average of 70 species of fish was recorded from floodplains and *beel* on Hakaluki *Haor* compared with 68 species from the MIP during the same period. Data on different groups of fish from individual sites showed that the diversities of riverine species in the MIP was 21% lower on Patasinga *Beel* and 41% lower on deeper floodplains but 33% greater on high floodplains. Diversities of migratory species were between 5% and 13% lower on sites in the MIP than those from Hakaluki *Hoar*. Numbers of floodplain resident species were almost identical between study areas. It appears therefore that, despite numerous cuts made in the Manu embankment in June and breaks in the Kushiyara embankment in July, the entry of riverine and migratory species into the MIP was still restricted compared with that into the unregulated Hakaluki *Hoar*.

16. An annual total of 95 fish species was found in the Juri River compared with 81 species on Khorodari *Khal* inside the MIP. The difference between sites was due almost solely to the 46% reduction in the diversity of riverine species on the regulated canal. The number of migratory species was only slightly reduced (5%) compared with that on the Juri and numbers of floodplain resident species were identical between sites. The results closely support those found on floodplain and *beel* and indicate that embankments of the MIP, even when breached in places, still had a harmful impact on biodiversity and that riverine species were more adversely affected than migratory or floodplain resident fish.

## Catch Composition

17. Of the 3,278 t of fish and prawns captured from floodplains *beel* and small *khal* on Hakaluki *Haor*, riverine and migratory species comprised 2% and 23% respectively. The most abundant of these were four catfish species, *guizza*, *kabashi*, *ayre* and *golsha tengra* and one clupeid, *chapila*. Floodplain resident species comprised 25% of the annual catch. No single species was particularly abundant; instead there were 11 species which each provided between 1% to 3% of the catch and some of these were closely related e.g. 3 species of *puti*, 2 species of *chanda* and 2 *baim* species. Prawns formed the single most important component of the catch providing an estimated 1,639 t (50%) annually.

18. The total annual catch of 2,213 t from floodplains, *beel* and small *khal* in the MIP comprised 1% riverine, 12% migratory and 46% floodplain resident fish. Prawns formed the second most important component of the catch providing an estimated annual total of 918 t (41%). The most abundant migratory species included *guizza*, *chapila* and the major carp, *catla*. The carp probably included a high proportion of escapees from flooded fish ponds in the MIP as well as wild fish. Compared with Hakaluki *Haor* the relative abundances of catfish species such as ayre, *guizza*, *kabashi* and *golsha tengra* were lower while that of *chapila* was about the same. Another difference between regulated and unregulated areas was seen in the catch of floodplain resident fish. In the MIP there was a less equitable distribution of the catch between different species. A few floodplain species were particularly abundant, notably 2 species of *chanda* which together comprised 15% of the catch, *taki* (5%) and *bailla* (4%). The high abundance of a few species in the MIP may have been a longer term response to flood control and high fishing pressure during winter. The over drainage of *beel* in winter and intensive fishing on the remaining shallow water would favour species adapted to harsh environmental conditions imposed by the turnover of bottom muds causing, among other things, severe oxygen depletion. Unfortunately, oxygen levels could not be measured during leaseholder fishing in January and February 1994 because of equipment failure.

19. Examination of catch compositions from individual floodplain and *beel* sampling sites revealed that the main differences between the MIP and Hakaluki *Hoar* in terms of riverine and migratory fish were: a 24% reduction in the catch contribution of migratory fish on perennial *beel* in the MIP; an 18% reduction from its low floodplains, and a 5% reduction in riverine species again from its low floodplains. Prawns accounted for 46% (85 kg/ha) of the catch from high floodplains surrounding villages in the MIP and 22% (113 kg/ha) from perennial *beel*, compared with 70% (109 kg/ha) and 6% (12 kg/ha) respectively from the same habitats in Hakaluki *Haor*. On the higher floodplains *thella jal* captured of most of the prawns; 71 kg/ha in the MIP and 106 kg/ha on Hakaluki *Haor*. Annual fishing effort expended by *thella* per hectare of floodplain was only 26% higher in the MIP (109 gear hours/ha) than on Hakaluki (81 gear hours/ha) which implies that prawns were more abundant on unregulated floodplains. Since the prawns were not identified during the present study, it is not known whether they were migratory or floodplain residents. Other FAP 17 studies on fish hatchling movements by passive drift in rivers found juvenile prawn to be a major component of the catch. This suggests there is widespread breeding on floodplains by some species.

20. On Khorodari *Khal* riverine species comprised less than 2% of the annual catch compared with 10% on the Juri River which drained Hakaluki *Haor*. In contrast, migratory species contributed more on Khorodari *Khal* (49%) than on the Juri (40%). Floodplain resident fish provided 36% of the catch at both sites while prawns were more abundant in the regulated canal where they comprised 13% of the annual catch compared with 9% on the Juri.

**Fish Movements**

21. Preliminary catch assessment surveys undertaken in January 1993 found no riverine species and only one migratory species, *golsha tengra*, on floodplains and *beel* inside the MIP. This followed a dry year when embankments were not cut and entry of fish into the MIP from external rivers was greatly restricted. In February 1993, five riverine/migratory species were found on floodplains and *beel*. These included adult *guizza*, *boal* and *goni* and juvenile *balichata* and *fulchela*. All species except *guizza* were found on Khorodari *Khal* during the same period and it seems highly likely that they entered the MIP by upstream migration against rainfall runoff draining into the Kushiyara River. As river levels rose sharply in late February sluice gates were closed and fish from external rivers had no major opportunity to enter the MIP until early June when the Manu embankment was cut. Comparison of catch compositions between years showed that in January 1994, 22 riverine and migratory species contributed 47% of the catch and in the following month 18 species contributed 28%. This contrasts greatly with 6 riverine and migratory species found in February 1993 which comprised only 3% of the catch.

22. When embankments were cut and river floodwaters entered the MIP in June there was an influx of 7 migratory and 2 riverine species. These included adult *ilish*, *goni*, *ghaura* and *kabashi*; juvenile *ayre* and *fulchela*, and fry of *chapila*. Further influxes of riverine and migratory species were seen later in July when river floods once again entered the MIP. The most abundant species were *kajuli*, *boal* and *katari*. In July *rui* fry ( 1 g/individual) were found. These may have escaped from pond overspills or entered from the Manu River. Other FAP 17 studies on movements of fish hatchlings by passive downstream drift found major carp hatchlings in the Manu between late July and mid-August which suggested that there were upstream breeding grounds. Hatchlings of *catla* and *rui* were also found on the Kushiyara River upstream of the MIP during late July and August. It was possible for these to enter the MIP through embankment breaches only during a few days in late July when river levels peaked.

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## Future Flood Control Proposals

23. Two engineering studies of the MIP and the Manu River have been undertaken in recent years. In 1992 the BWDB Systems Rehabilitation Project (SRP) studied the MIP and recommended that it should be fully repaired. At the same time the Northeast Regional Water Management Project (FAP 6) examined the major problem of the area, that of increased flooded levels in the Manu River. The SRP rehabilitation proposals involved strengthening embankments; repair of Kashimpur sluice gates (6-vent and 3-vent); rehabilitation of the pump station, and repair and re-excavation of irrigation and drainage canals. It concluded that rehabilitation measures would result in increased agricultural production and have no impact on capture fisheries. Two crucial conditions were placed on project implementation. The first was that detailed designs for flood control embankments should be postponed until a regional solution to reduce peak flows in the Manu River was identified and approved. The second was that local Government authorities and the public agree to prevent further embankment cutting. The assumption made by the SRP study that rehabilitation measures would have no impact (negative or positive) on capture fisheries is incorrect. Repair of the 3-vent sluice gate at Kashimpur and excavation of the main drainage canal, Khorodari *Khal*, would increase the capability to drain the largest and most important *beel* fishery of Patasinga *Beel* to a level of 1.4 m PWD. This is 2.7 m lower than the dry season level of 4.1 m PWD recommended in the design of the MIP which did not include the construction of the 3-vent sluice gate. The over-drainage of Patasinga *Beel* would allow it to be almost fished out each year. This would have disastrous consequences for capture fisheries of the MIP which rely on the survival of overwintering broodstock in the *beel*.

24. The FAP 6 study attributed increased peak flood levels in the Manu River during the previous decade to confinement of the river by the recent construction of flood control embankments, including that on the MIP, and also to increased local rainfall. Increased flooding threatened homesteads of people living immediately outside the MIP, the town of Moulvibazar, the Sylhet-Dhaka highway, the Manu River barrage and embankments of the MIP. After examining several engineering options to reduce flood levels in the river, FAP 6 proposed that the most cost-effective approach was to construct a 32 km channel to divert peak flows from the river into Hakaluki *Haor*. It was also proposed to embank a further 27 km of the Dhalai River, a tributary of the Manu. The potential benefits of flood alleviation derived principally from the protection of Moulvibazar town and the Dhaka-Sylhet road and increased rice

production from the MIP. These benefits would accrue, however, at the expense of fisheries and wetlands in both Hakaluki *Haor* and the MIP. It was predicted that the diversion of Manu floodwaters would cause rapid siltation in Hakaluki *Haor* area where flooding would increase. It was accepted that people adversely affected by the proposed diversion might jeopardise the success of the project. An alternative solution to the flooding problem is recommended as a fisheries mitigation measure (see para 25).

**Mitigation Measures**

25 The recommended mitigation measures question a principal rationale of full flood control i.e. to convert low-lying seasonal wetland to drier land where deepwater rice can be replaced with HYV *t.aman*. Experience in Bangladesh has shown that most flood control projects have failed, for one reason or another, to achieve this objective. The MIP is no exception and in this case the reason is increased flooding in the Manu River resulting in repeated embankment cuts made by local people living outside it. An alternative approach, which already exists for much of the North East Region and has also been advocated by the North West Regional Study (FAP 2) based on partial flood control on lowlands, is to allow the production of deepwater rice. It would seem a more rational option in areas where full flood control has resulted in social inequities. This approach would cause considerably less damage to capture fisheries providing measures were taken to allow fish movements between rivers and floodplains during the pre-monsoon.

26. The most important mitigation measure recommended for the MIP is to reduce flood levels in the Manu River by converting the MIP into a partial flood control project using submersible embankments along the Manu to protect the harvest of winter rice. This should be done in conjunction with diversions of the Manu and its tributary, the Dhalai River, into Hail *Hoar* so that former floodplains of the Manu are utilised to absorb peak floodwaters and thus protect the urban area of Moulvibazar. Other measures for the MIP include the protection of dry season fish habitats by preventing over-drainage and maintaining water depths in *beel* at 1 metre or more. This involves both raising the sill level on the 3-vent sluice gate at Kashimpur from 1.4 m PWD to the agreed design level of 4.1 m PWD and the excavation of Patasinga *Beel* to increase water depths.

27. Once dry season fish habitats are protected, a series of other mitigation measures focuses on fisheries conservation using large perennial *beel* such as Patasinga *Beel* as dry season sanctuaries. The construction of large *katha* (brush shelters) within the *beel* would prevent the use of most fishing gears during the winter. Prohibition of fishing on Kashimpur regulators and in the main drainage canal, Khorodari *Khal*, is also recommended together with protection of important dry season fish habitats (*duar*) in external rivers such as the Kushiyara. These measures require modification of the present leasing system of *jalmahal* and effective enforcement of fisheries regulations. FAP 6 has already constructed a fish pass at Kashimpur and the results of that study will provide further information on fish movements and assist in the design of additional regulators which are recommended on the Kushiyara to increase fish and hatchling movements between river and floodplains of the MIP.

28. Several measures are recommended which relate to institutional improvement mainly within BWDB. The most important of these is the need to establish an effective multidisciplinary technical assessment unit in BWDB or WARPO comprising expertise from fisheries, agriculture, environment, hydrology and hydraulic engineering. The unit should be responsible for the re-evaluation of operating procedures of existing flood control projects and for the examination of future project proposals. Plans for major new road or rail links which may affect flooding and drainage patterns should also be assessed by the unit.

**Future Research**

29. Several topics which require further research work were identified. Many of these follow on from baseline data provided by the FAP 17 studies. In relation to the impact of the MIP on capture fisheries, future research requirements were identified in three broad areas. The first focused on the need for a more detailed understanding of the movements of fish between rivers and floodplains at different stages of their life cycles and the impact of flood control structures on such movements. The second emphasised the need for detailed long-term studies running for at least five years to understand the functioning of complex floodplain fisheries in relation to biological, environmental and socioeconomic factors which influence fish populations. Quantitative fisheries data obtained from these studies, when linked with hydrological data on flooding patterns, will provide a basis for the development of a floodplain fisheries model. This can then be used as a predictive tool to advise on future fisheries management and development. The third area of research highlighted the

need for detailed stock assessments of selected fish and prawns dominating floodplain catches from flood controlled areas. These studies are particularly relevant to the MIP where the diversity of fish communities has decreased and a greater dependence has been placed on a small number of floodplain resident species. The current status of the stocks of these species is not known nor is the degree to which they can continue to sustain prevailing levels of fishing pressure particularly during the season. Prawns were identified as the single most important component of catches from both the MIP and Hakaluki *Haor*. Basic research on their identification, seasonal movements and biological status is urgently required.

# MANU IRRIGATION PROJECT AND HAKALUKI HAOR

## 1 STUDY AREA: BACKGROUND

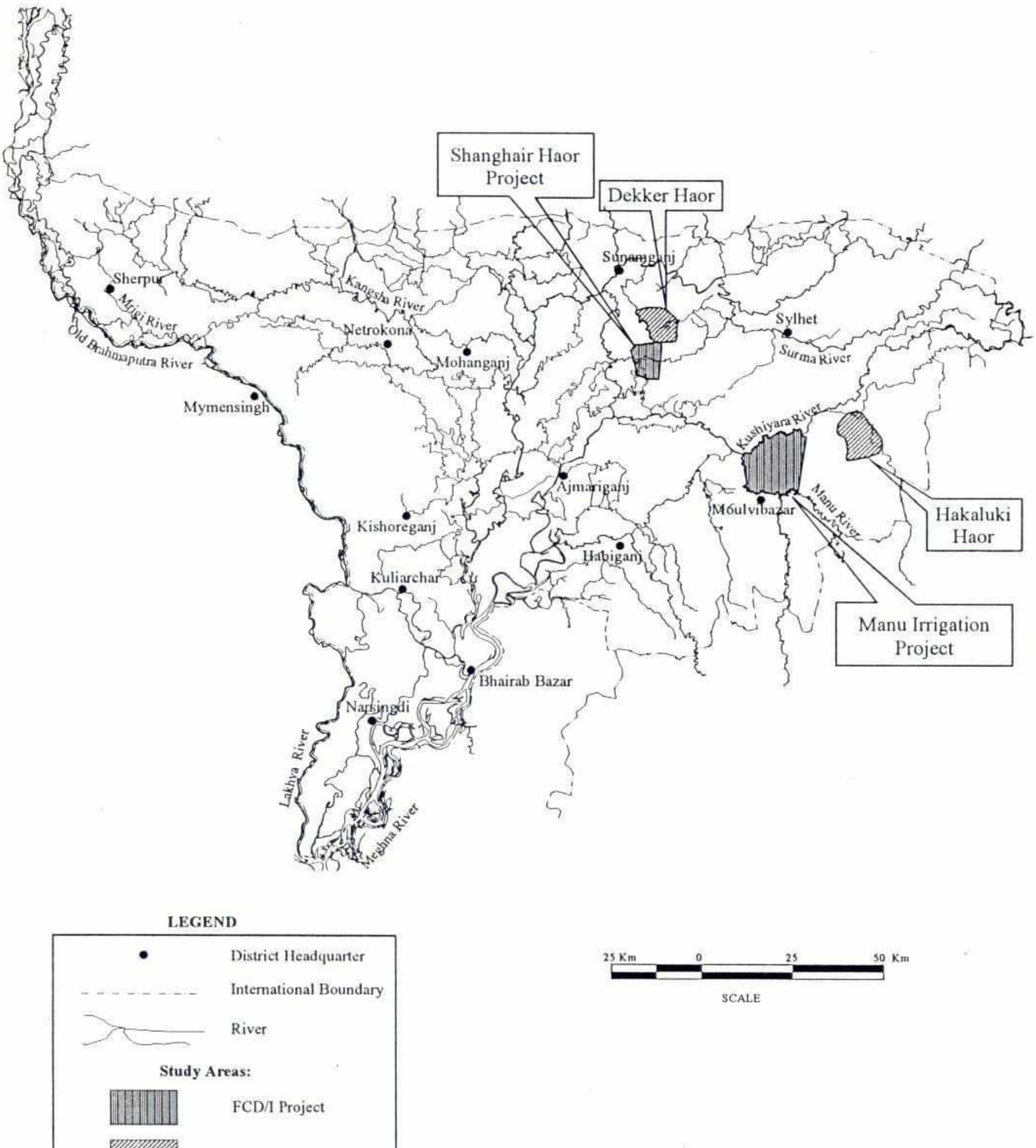
Following extensive preliminary surveys carried out between October and December 1992, two flood control projects were selected for study in the North East Region of Bangladesh. One partial flood control project (Shanghair *Haor*) was located near Sunamganj in the deeply flooded central basin and the other (Manu Irrigation Project) was located in moderately flooded areas to the east (Fig. 1.1).

The Manu Irrigation Project (MIP) is a large full flood control and irrigation (FCDI) scheme located in Moulvibazar District about 80 km south west of Sylhet. It is bounded by the Kushiyara River in the north and the Manu River in the south and west where it is protected from their flooding by the construction of a 60 km embankment (Fig. 1.2). The two rivers meet at Manumukh in the north west corner of the project area. The project is bordered on the eastern side by the Bhatera Hills from which it receives rainfall runoff from a catchment area of 8,000 ha. Internally, there is a complex natural drainage system which flows into a central basin known as Kawadighi *Haor*, a previously renowned fishery. The *haor* is drained by one main canal, Khorodari *Khal*, which empties into the Kushiyara River a short distance upstream of the confluence with the Manu River. The district headquarters town of Moulvibazar is located along the Manu River immediately outside the project area in the south west corner. There are no major urban centres within the project which covers an area of approximately 24,000 ha supporting a population of about 140,000 people.

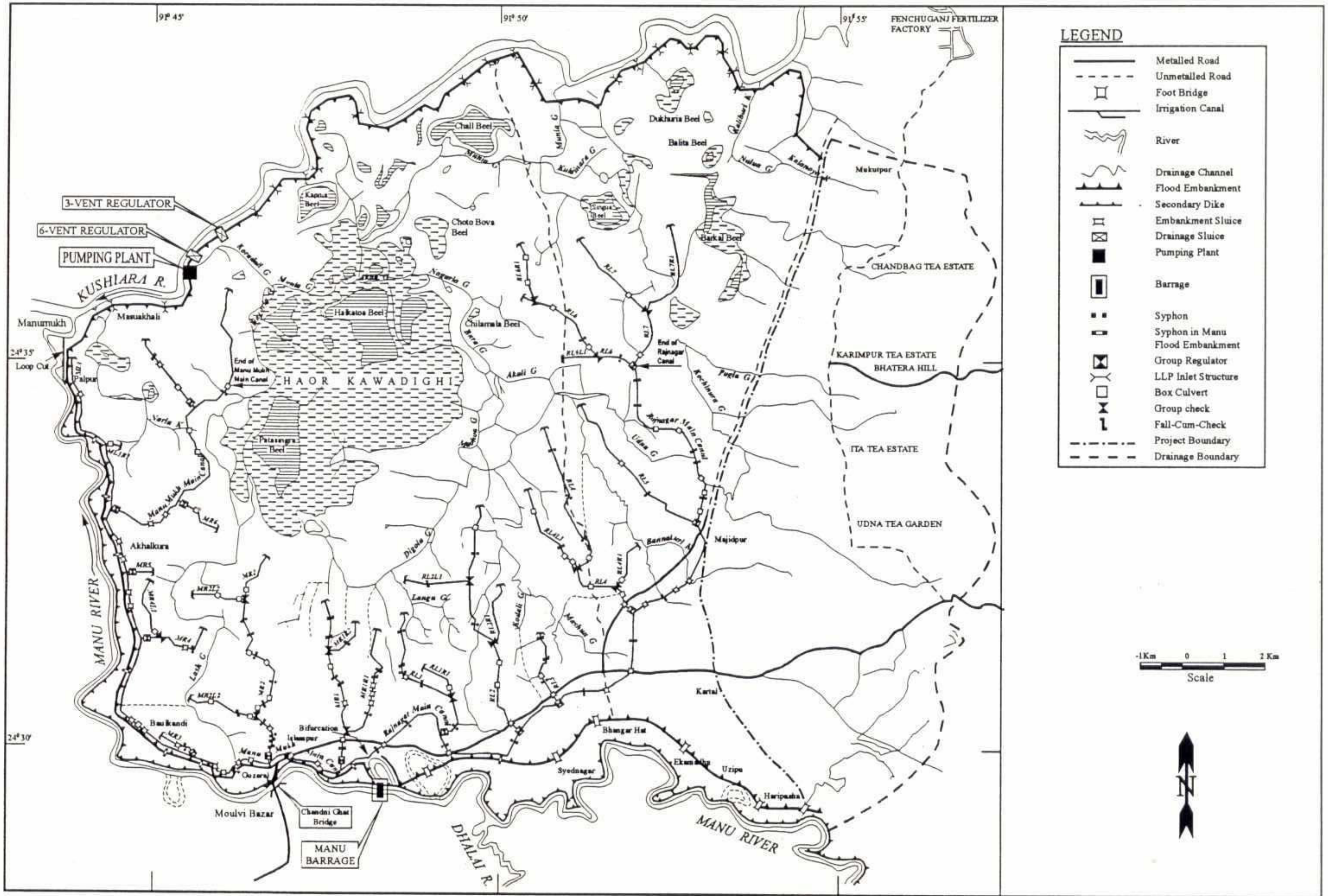
Planning of the MIP started in 1960; prior to this local authorities constructed a low submersible embankment along the right bank of the Manu River to protect the *boro* crop from early river flooding. An initial feasibility study was completed in 1962 and this was followed by further feasibility, planning and design studies between 1968 and 1971 which resulted in the submission of reports to WAPDA in 1971[1]. Construction work started in 1976 and was completed in 1983 with financial support from Kuwait.

During the planning and design stages of the project, no consideration was given to the needs of, or impact on, fish stocks and fishing communities dependent to varying degrees on the stocks. Indeed, project proposals submitted in 1971 omitted any mention of fish, fisheries or fishing communities and economic analyses of project performance ignored potential losses of capture fisheries. The principal aim of the project was to increase rice production and thereby decrease the projected local rice deficit estimated for the area.

**Figure 1.1 Location of study areas in the North East Region**



## Figure 1.2 Infrastucture of the Manu Irrigation Project




Source: ACE(1991) [1] and FAP6(1994) [3]

The project comprised three major components. The first was river embankments to prevent river flooding on 22,660 ha of floodplain. The second included the provision of pumped drainage facilities located on the confluence of the Kushiyara River and Khorodari *Khal*, the main drainage canal of the project. The main aim of these two components was to reduce flooding during the monsoon season so that *b. aman* could be replaced by higher yielding *t. aman*. At the time of study (1969) it was estimated that there were 6251 ha of *b. aman* which covered 41% of the net cultivable area. The third component involved the construction of the Manu River Barrage so that river water could be stored in the upstream reach and water levels raised to provide gravity irrigation to 11, 560 ha of floodplain for the cultivation of winter rice.

Embankments were designed to prevent high river floods with a return period of 100 years. Planners did not, however, take into account the effect of increased river water levels which would inevitably arise from the prevention of overbank spillage and confinement of floodwaters within the river channel. Since completion of the project in 1983, extensive river flooding of the project area has occurred in at least five years out of ten due to high river levels which resulted in unauthorised public cuts in the Manu embankment to relieve flooding on inhabited land immediately outside the project. In response to sudden flooding caused by breaches in the Manu embankment, farmers living within the scheme also cut the Kushiyara embankment to reduce internal flooding. The cutting of embankments has reportedly resulted in considerable crop damage and frequent social conflicts. The impact on capture fisheries, however, has not been assessed but such breaches clearly provide new opportunities for fish to migrate between rivers and floodplains. In years when no cuts in embankments were made, flood levels inside the project exceeded design levels (6.9 PWD) by 1 to 2 metres despite pumping out of floodwaters at Kashimpur pump station. The project has thus never achieved its hydrological or agricultural objectives.

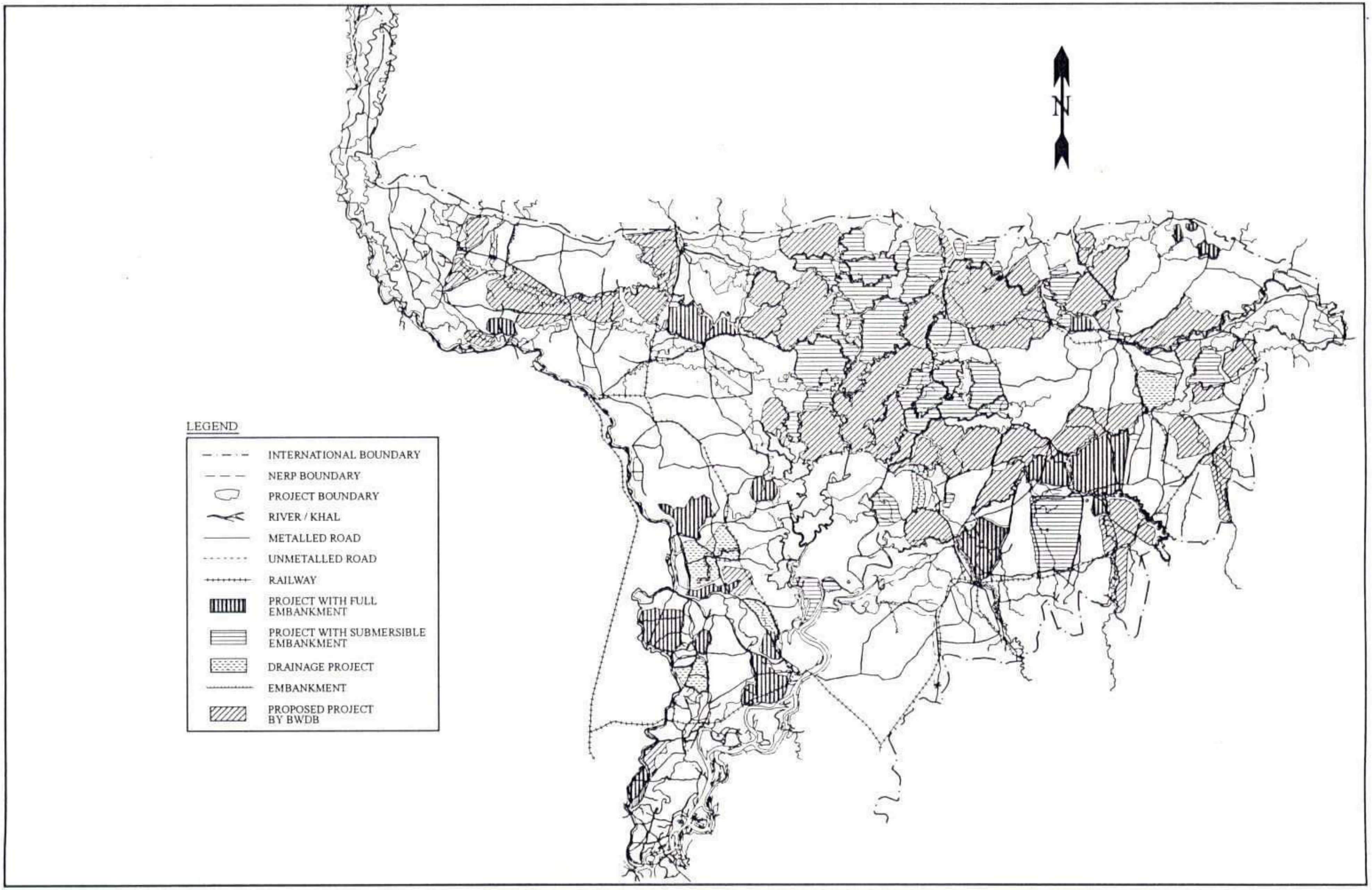
Flooding has also increased in recent years in Moulvibazar town. Increased confinement of the river by the MIP embankment on its right bank and a town protection embankment on its left bank together with additional upstream embankments have exacerbated the flooding problem. A detailed flood protection project has been included in the Secondary Town Protection Project of the Flood Action Plan (FAP 9A).

In recent years, the Manu River and the MIP have been studied in detail by the Northeast Regional Water Management Project (FAP 6) [2, 3, 4] and as part of the BWDB Systems Rehabilitation Project[5]. FAP 6 studied various possible engineering solutions to alleviate the flooding problem and proposed a major river diversion from the Manu River into Hakaluki *Haor*[2]. More detailed examination of this proposal is presented in Section 8 of this report.

Trends in flood control development within the North East Region have been documented previously by FAP 6[6]. This report indicated that, prior to 1975, there was little development of full flood control projects in the region. Up to this time about 23,000 ha were under full flood control but from 1975 to 1990 FCD projects were established at an average rate of 14,000 ha per year. Most projects were located outside the deeply flooded central basin where potential benefits to agriculture were considered to be greater (Fig. 1.3). FAP 6 estimated that a further 845,000 ha of floodplain ranging from 0.3 to 1.8 m in elevation could be brought under full flood protection in the North East Region.

FAP 17 selected the MIP for study because it was a large, important full flood control project which reportedly had resulted in a serious reduction in capture fisheries. It was known at the time of selection that public cuts in the embankment were inevitable if Manu River flooding was high. During 1992, when the project was initially surveyed by FAP 17, no cuts in the embankment were made. The present study was complemented by a FAP 17 socioeconomic survey of MIP, the results of which have been documented separately[7]. The free-flooding control area for comparison with the fisheries of MIP was Hakaluki *Haor*, located about 25 km to the east of the project area. This area was identified as an important "mother fishery" in a fisheries management pre-feasibility study of the North East Region recently completed by FAP 6[8]. The MIP was also selected by FAP 6 to undertake a pilot project involving the construction of a fish pass at Kashimpur. This is the first study of its kind carried out in Bangladesh[9].

Figure 1.3 Flood control development in the North East Region: existing and proposed projects




Source FAP 6 Pres. Comm.

# 2 SAMPLING SITES

Rivers, canals, floodplains and *beel* were sampled at fortnightly intervals for a total of 13 months from February 1993 to February 1994 inclusive. Site selection and fisheries data collection were carried out following procedures previously outlined in the FAP 17 Inception and Interim Reports.

## 2.1 Inside Sites

Three floodplain/*beel* sites and two canal sites were surveyed inside the MIP; no rivers occurred in the area (Table 2.1 and Fig. 2.1). The floodplain sites were selected to cover as wide a range of land elevations as possible. The lowest site selected was Patasinga *Beel* (NE04), the largest perennial *beel* and *jalmahal* within Kawadighi *Haor*. Runoff from an extensive area of floodplain to the east and south east drained into the *beel* during the drawdown. The *beel* itself was drained by Magura *Khal* in the north which in turn joined the main drainage canal of the *haor*, Khorodari *Khal*. Land elevations within the central *beel* area of 215 ha were below about 4.5 m PWD. Two floodplain sites were surveyed; one, at Islampur (NE02) to the east of Patasinga *Beel*, was located on very low land type ranging from below 6.8 m to 7.8 m and the other, to the south of the *beel* at Baraimabad (NE05), covered mainly lowland but also some medium low and medium high land, ranging from 6.6 m to 8.4 m (Fig. 2.2). Area elevation curves were constructed for floodplain sites using topographical maps and electronic planimetry (Fig. 2.3). Average heights (50% level) at NE02 and NE05 were 6.8 m and 7.0 m respectively. An area elevation curve of the MIP project area was constructed by FAP 6 based on digitized elevation data on a 1 kilometre grid (Figs 2.4 and 2.5). This was approximate, particularly for the estimation of perennial *beel*; satellite images were therefore used to measure the areas of these water bodies more accurately.

The two canals selected for study included one large feeder canal, Akali *Gang*, running into the scheme from the Bhatera Hills in the east and a main drainage canal, Khorodari *Khal* which emptied into the Kushiyara River via Kashimpur sluice gates at Manu pump station. Smaller drainage canals were included in surveys of floodplain sites.

Figure 2.1 Location of sampling sites within the MIP

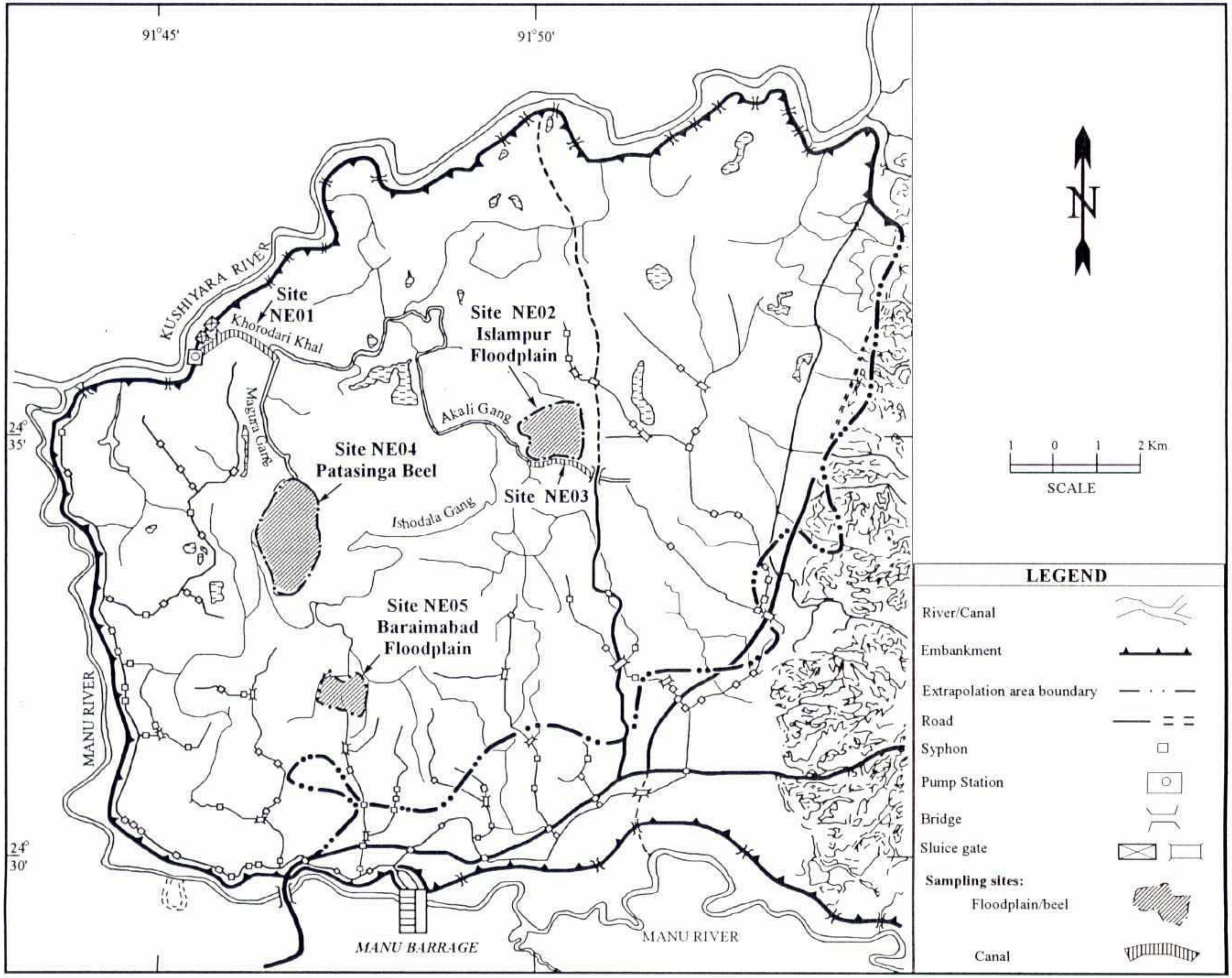
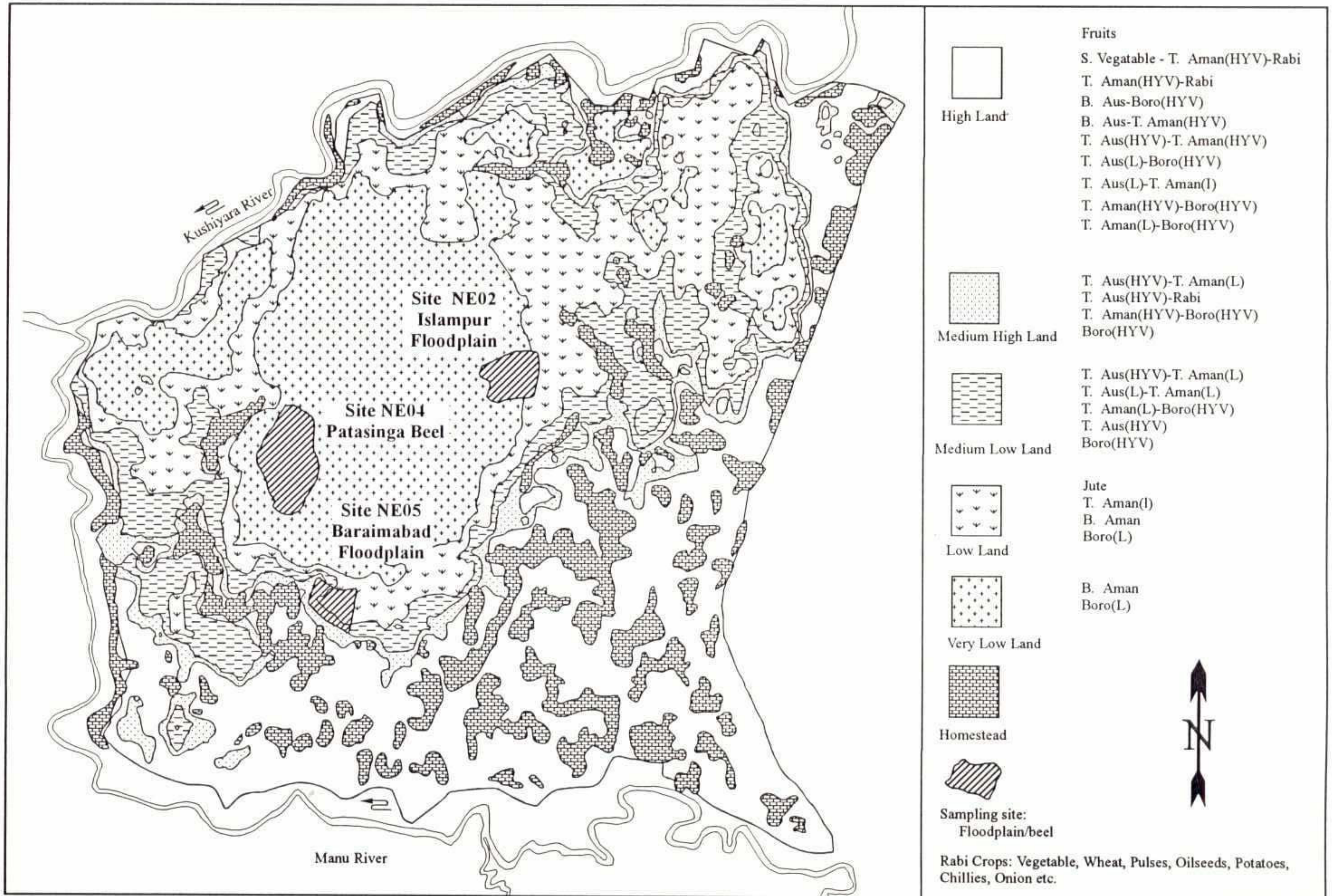
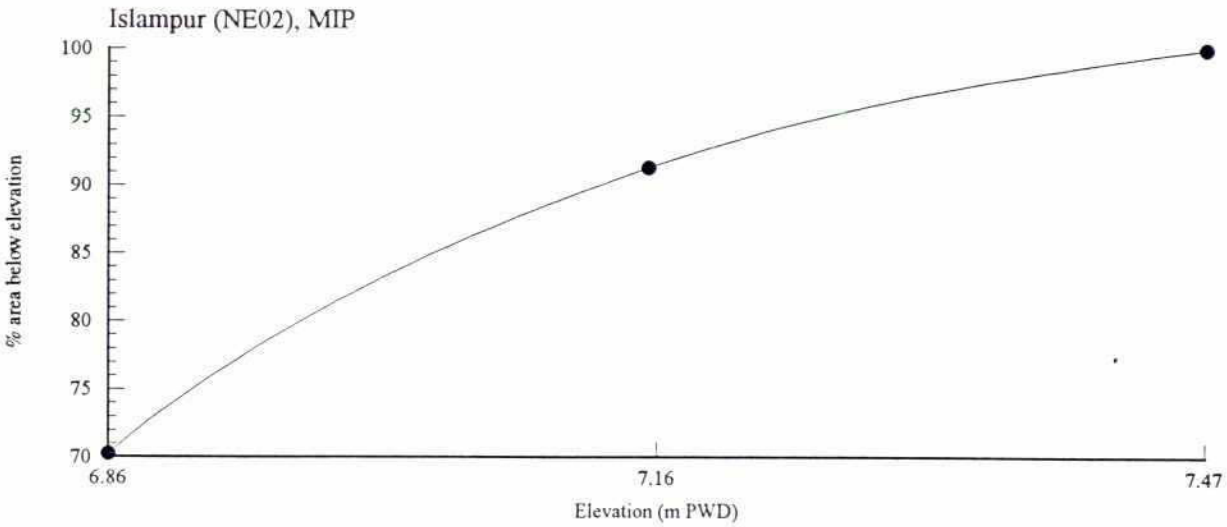


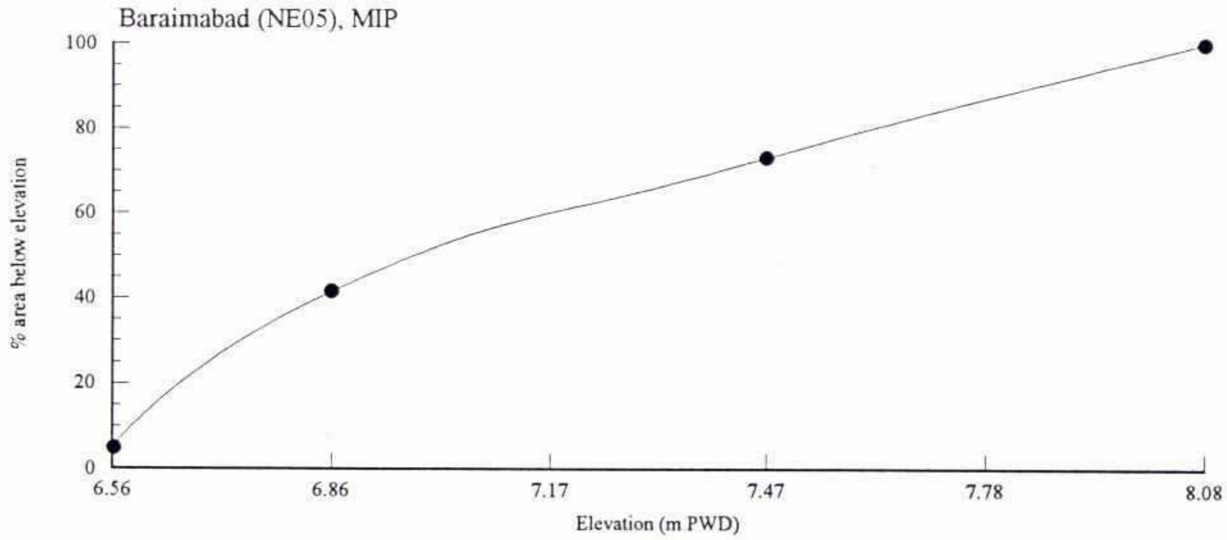
**Figure 2.2 Distribution of different land types in the MIP in relation to floodplain and beel sampling sites**




Source: Halcrow (1993)[5]

**Figure 2.3 Area elevation curves at floodplain sites on the MIP and Hakaluki *Haor***



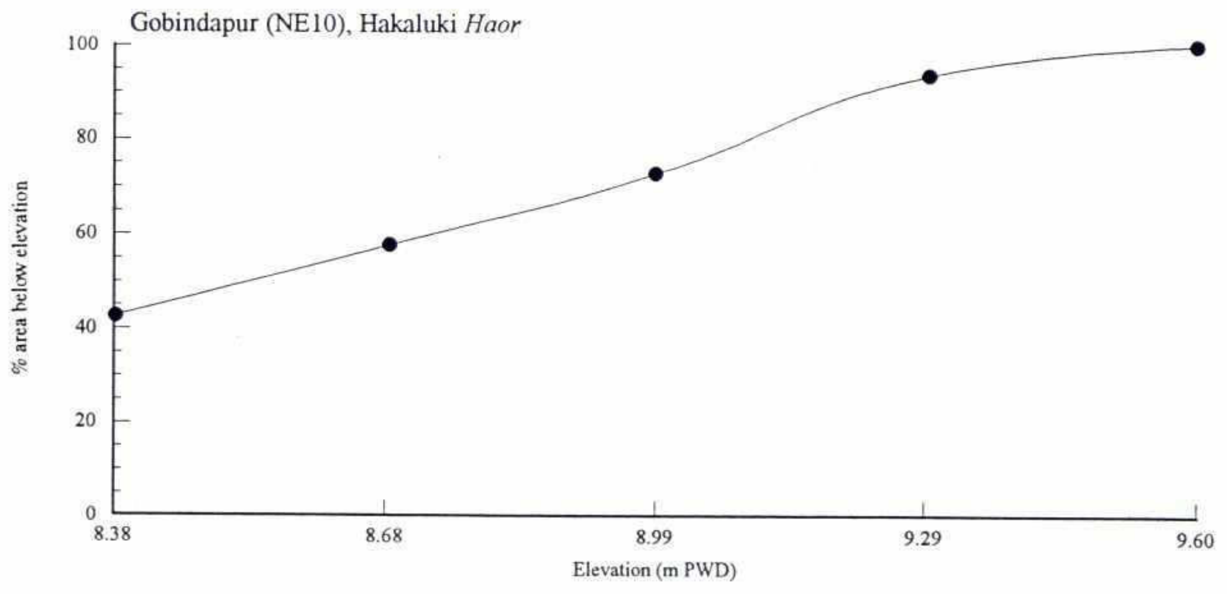
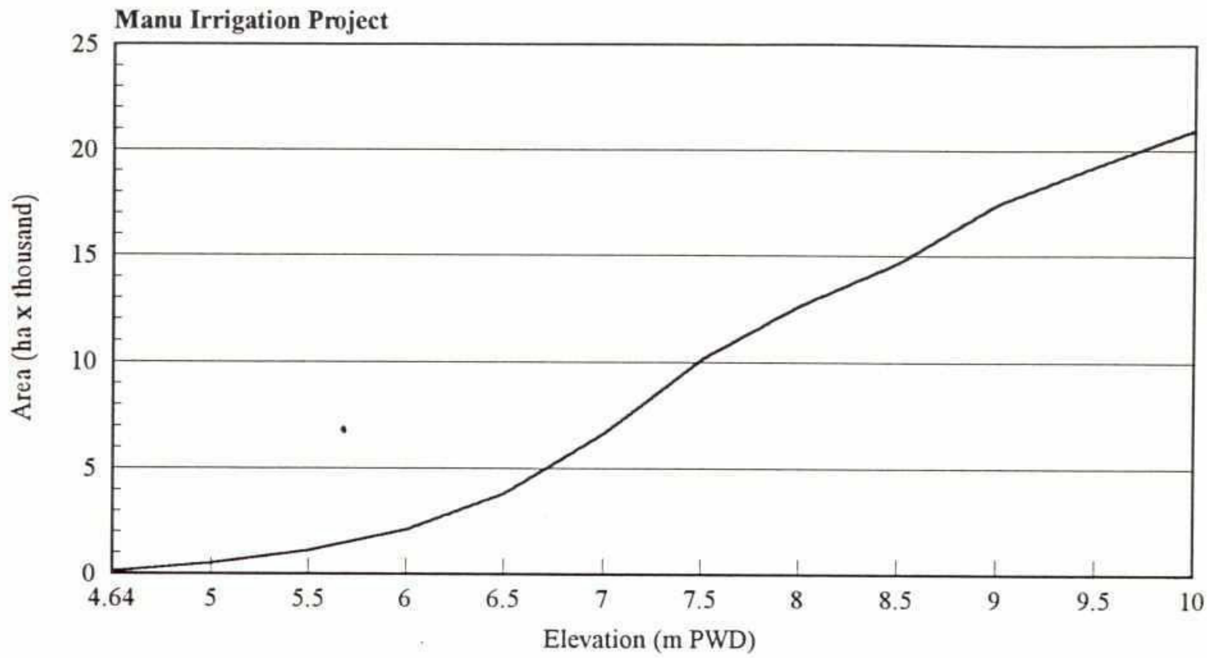
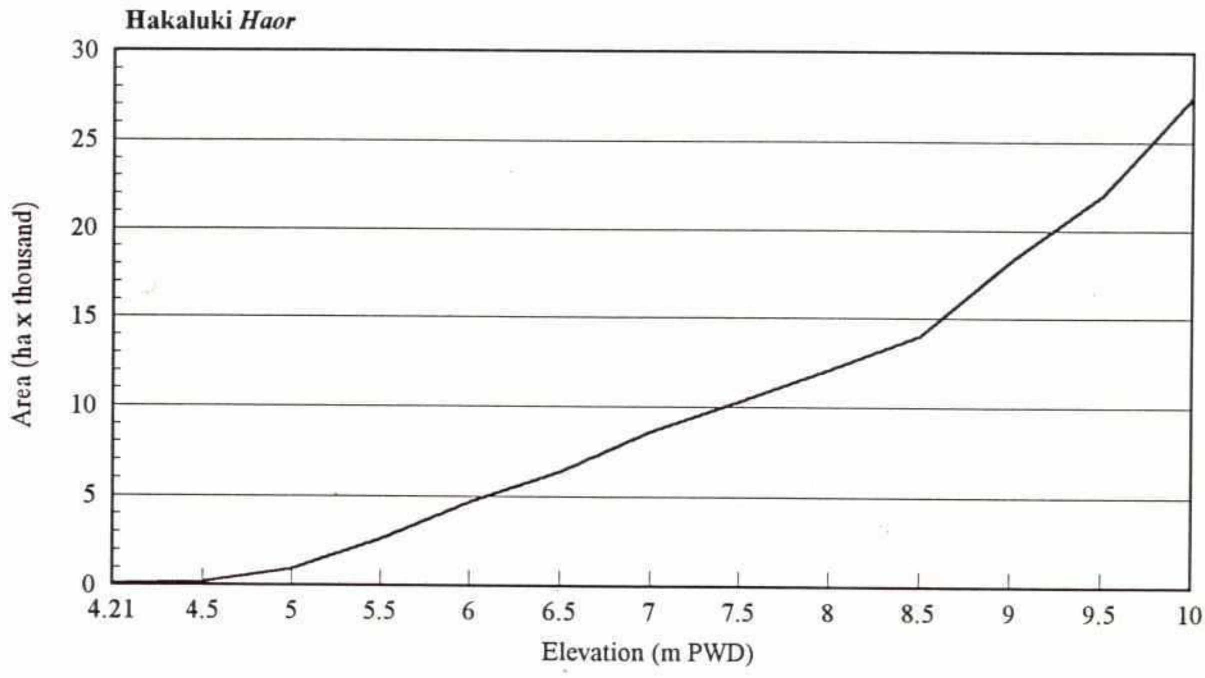



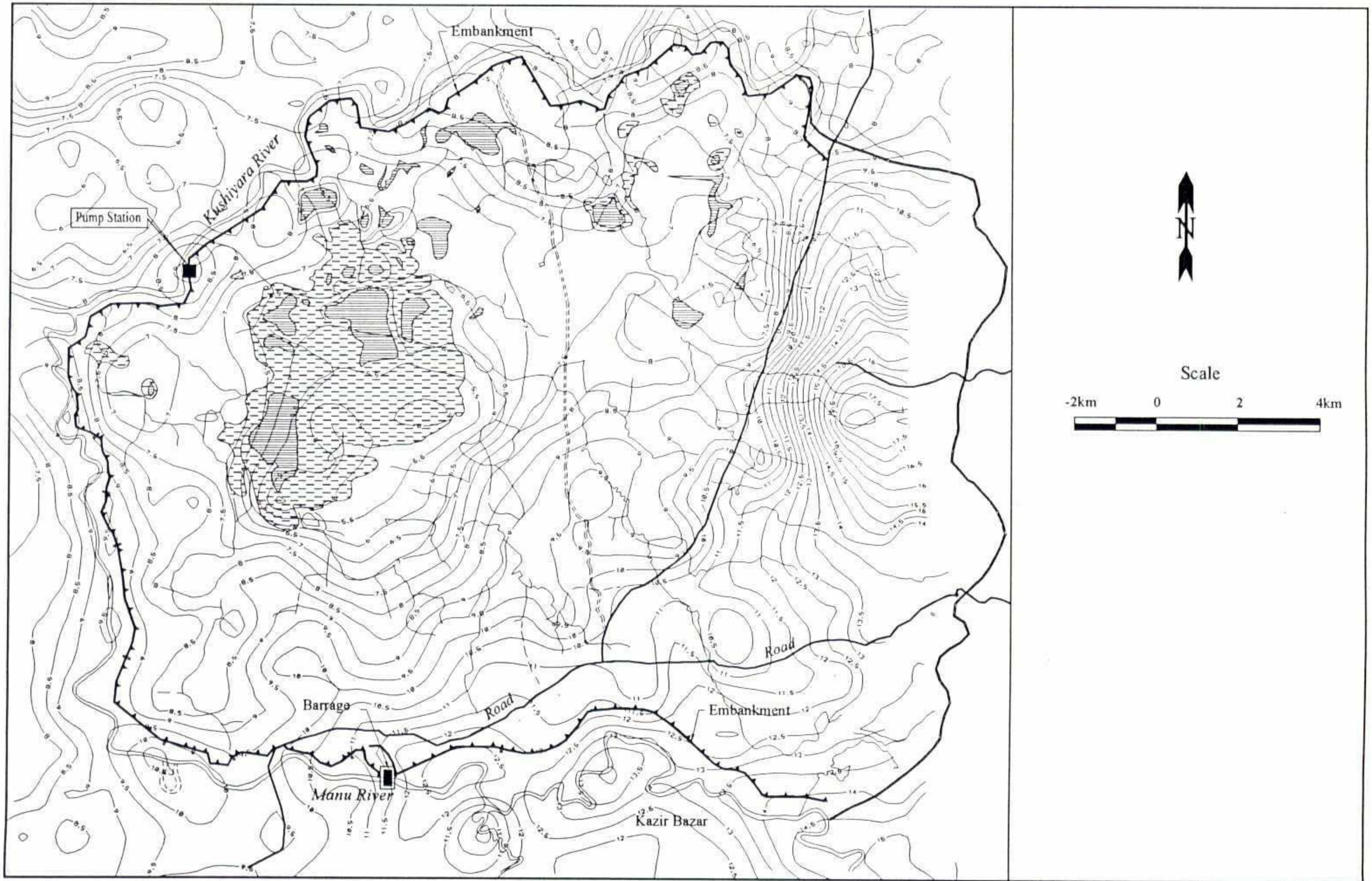
**Figure 2.4 Area elevation curves of the MIP and Hakaluki *Haor***




Source: FAP 6

## Figure 2.5 Topography of the MIP




Note: Contours (mPWD) are derived from point elevations on a 1km grid provided by MPO and are approximate
Source: FAP6(1994)3

**Table 2.1 Description of sampling sites**

| Site Code | Site Name | Habitat | In/Out MIP | Size of site | |
|---|---|---|---|---|---|
| | | | | Area (ha) | Length (km) |
| NE06 | Kushiyara River | Secondary River | Outside | 95 | 10.5 |
| NE07 | Juri River/*Khal* | Canal | Outside | 36 | 9.55 |
| NE01 | Khorodari *Khal* | Canal | Inside | 11 | 4.05 |
| NE03 | Akali *Gang* | Canal | Inside | 11 | 2.55 |
| NE08 | Tekuni Floodplain | Floodplain | Outside | 99 | - |
| NE09/21 | Tekuni/Baghalkuri *Beel* | *Beel* | Outside | 427 | - |
| NE10 | Gobindapur Floodplain | Floodplain | Outside | 79 | - |
| NE02 | Islampur Floodplain | Floodplain | Inside | 163 | - |
| NE04 | Patasinga *Beel* | *Beel* | Inside | 216 | - |
| NE05 | Baraimabad Floodplain | Floodplain | Inside | 75 | - |

## 2.2 Outside Sites

Four floodplain/*beel* sites were surveyed in the control area of Hakaluki *Haor* (Fig. 2.6). The area was drained by the Juri River. This was therefore treated as a site comparable with Khorodari *Khal* in the MIP and, for the purpose of this study, categorised as a canal habitat. The Kushiyara River was sampled from Fenchuganj bridge for a distance of 11.5 km upstream which included the confluence with the Juri River.

Two *beel* were surveyed, Tekuni (NE09) and Baghalkuri (NE21). The latter was locally known as Baghalkuri *Beel*. Initially, only Tekuni *Beel* was selected. A violent dispute over the fishing rights of a *jalmahal* immediately to the west of the *beel*, however, was considered to have reduced the winter fishing effort by the leaseholder of this *beel*. Therefore the bordering Baghalkuri *Beel* to the east was also monitored during winter fishing by the leaseholder. The *beel* was surveyed each month during the monsoon by extending surveys from Tekuni.

Two floodplain sites were selected on different land heights. Tekuni floodplain (NE08) covered on area of intermediate elevation ranging from 4.5 m to 7.1 m while further south Gobindapur floodplain covered an area of higher land ranging from 8.4 m to 9.6 m. Average (50% level) elevations at Tekuni and Gobindapur were 6.3 m and 8.6 m respectively.

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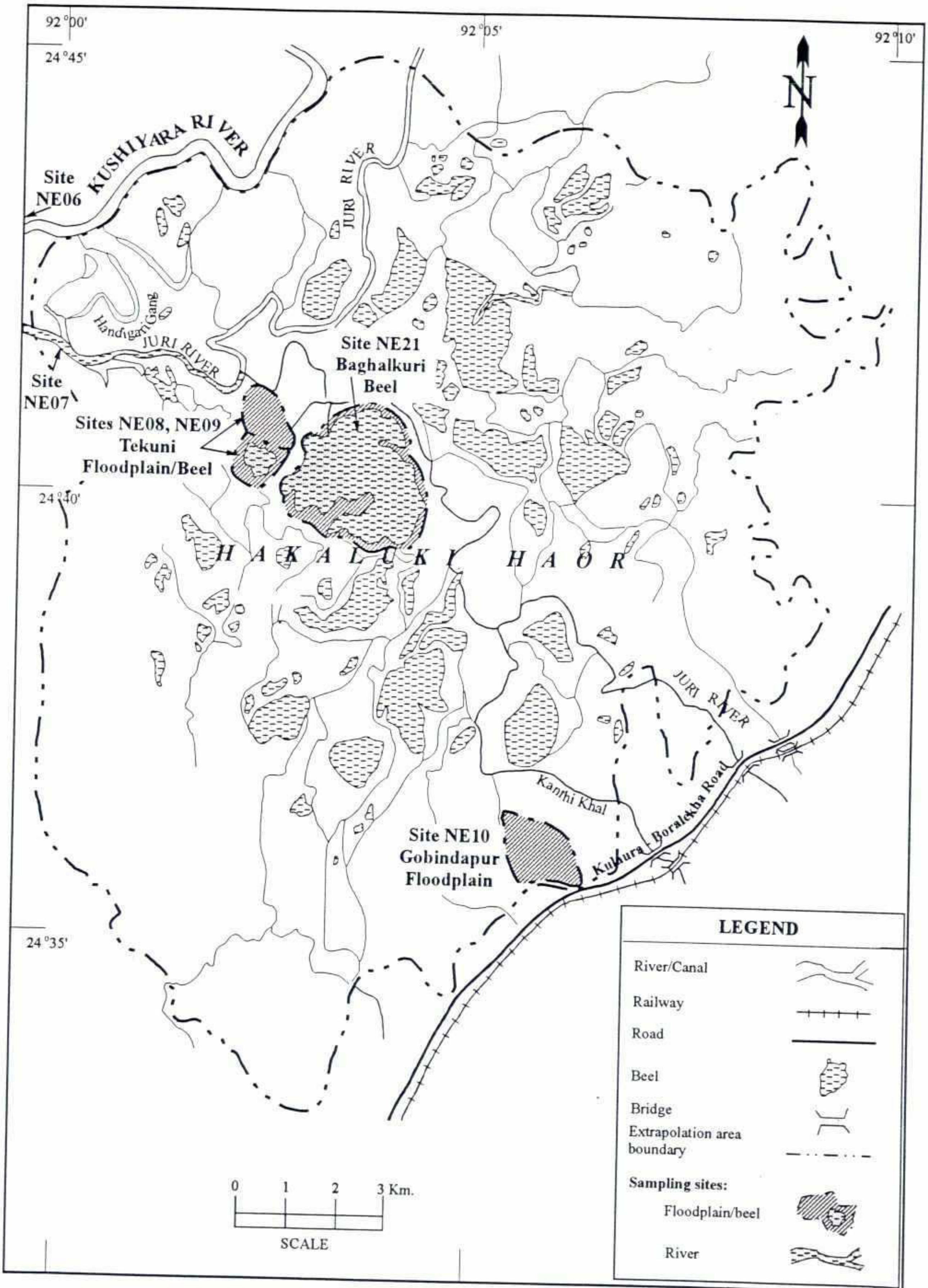
Figure 2.6 Location of sampling sites on Hakaluki Haor



# 3 HYDROLOGY

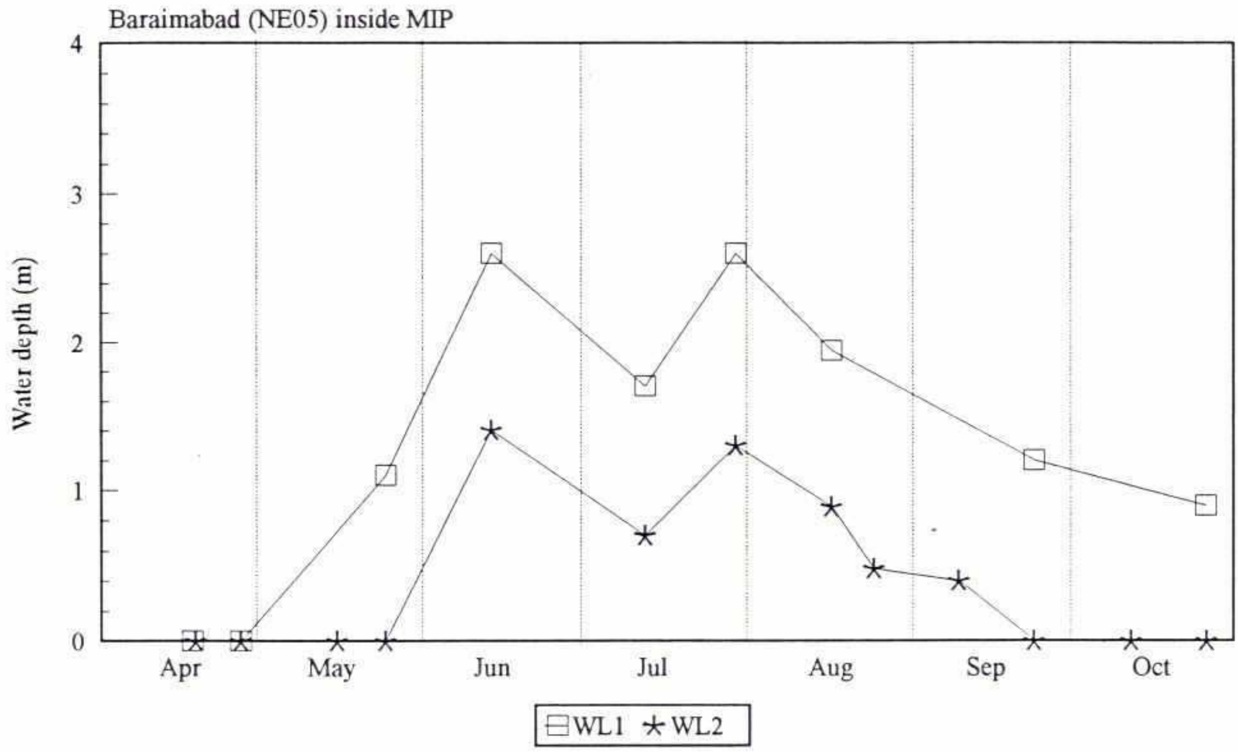
Three data sources provided quantitative and qualitative descriptions of flooding patterns inside the MIP and on Hakaluki *Haor*. The first was information collected directly during fisheries surveys. At each floodplain and *beel* site, water depths were measured every two weeks at fixed points on different land heights. At the same time, the extent of the flood was recorded on sketch maps. On sites some distance from villages, difficulty was encountered in fixing exact locations of depth readings which resulted in some inaccuracies. Only those locations which could be identified accurately on topographical maps, and for which elevations could therefore be determined, were used in comparisons between study areas.

The second and third sources of data applied mainly to the MIP. Daily water level data for the Manu and Kushiyara rivers were obtained from BWDB. Water level data inside and outside the Kashimpur sluice gates at the Manu pump house were obtained from FAP 6 together with analyses of flooding patterns inside the project during 1992 and 1993. The latter have been documented previously by FAP 6[3].

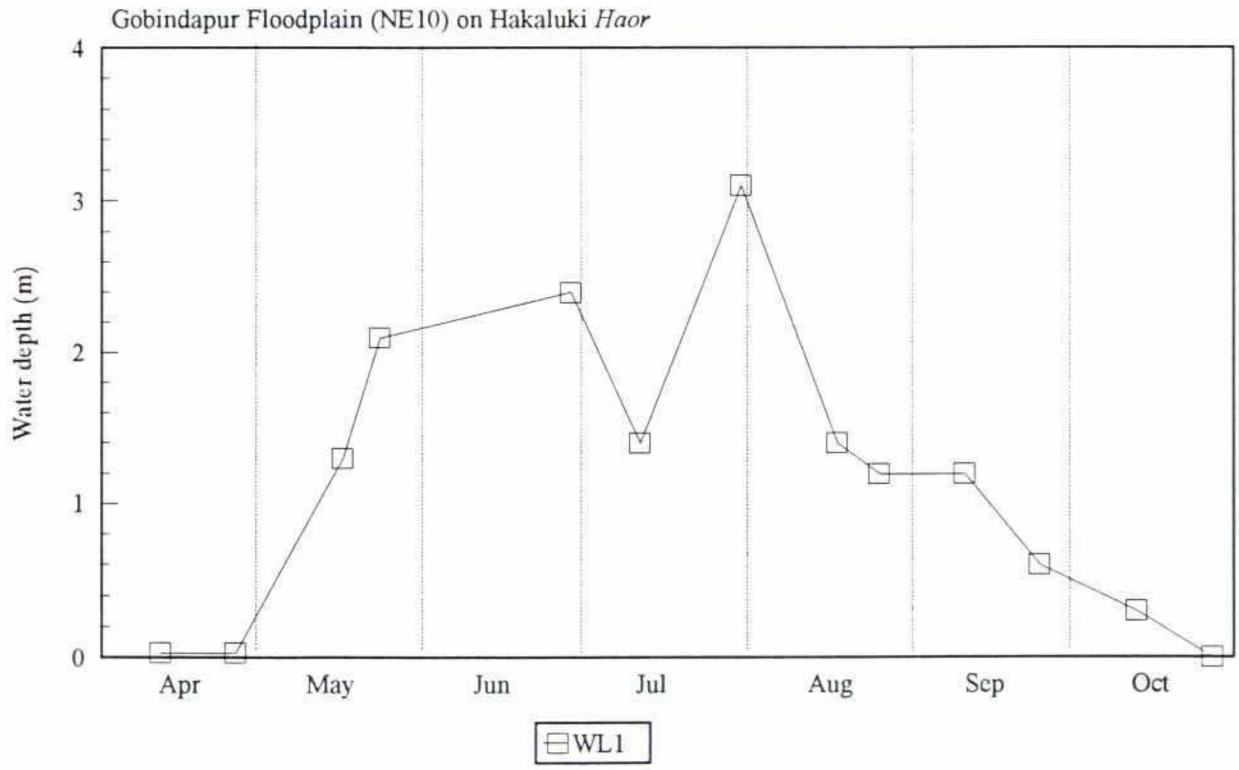
## 3.1 Inside the MIP

At the beginning of February 1993, floodplains were dry and used mainly for the cultivation of irrigated winter rice. At this time, residual water remained in only the lowest areas of *beel* and in irrigation canals. During mid-February, heavy rainfall resulted in the extensive inundation of floodplains to depths of 0.2 m to 0.5 m. These floods were short-lived and the only lasting effect was a rise in levels surrounding *beel*. During March and April water levels decreased again but further heavy rain in the first week of May caused extensive flooding to depths of 1 metre on higher floodplains such as those at Baraimabad (Fig. 3.1). In early June, continued heavy rainfall resulted in high water levels in the Manu River, immediately upstream of Moulvibazar. A protective secondary embankment along this stretch of river was eroded by rising waters causing flooding to a large population outside the Manu embankment. These people cut the Manu embankment on 8 June which led to sudden extensive flooding inside the scheme (Figs 3.2 and 3.3). Additional cuts were made on the western Manu embankment on the same day and, about week later, at Machhuakhali just west of the Manu pump station. The latter cuts were made to release water from inside the scheme. Wave action from high floodwaters within the project resulted in the erosion and subsequent breaching of the embankment at two points along the Kushiyara River during the last week of July.

**Figure 3.1 Seasonal variation in water levels on higher floodplains inside MIP and Hakaluki *Haor***



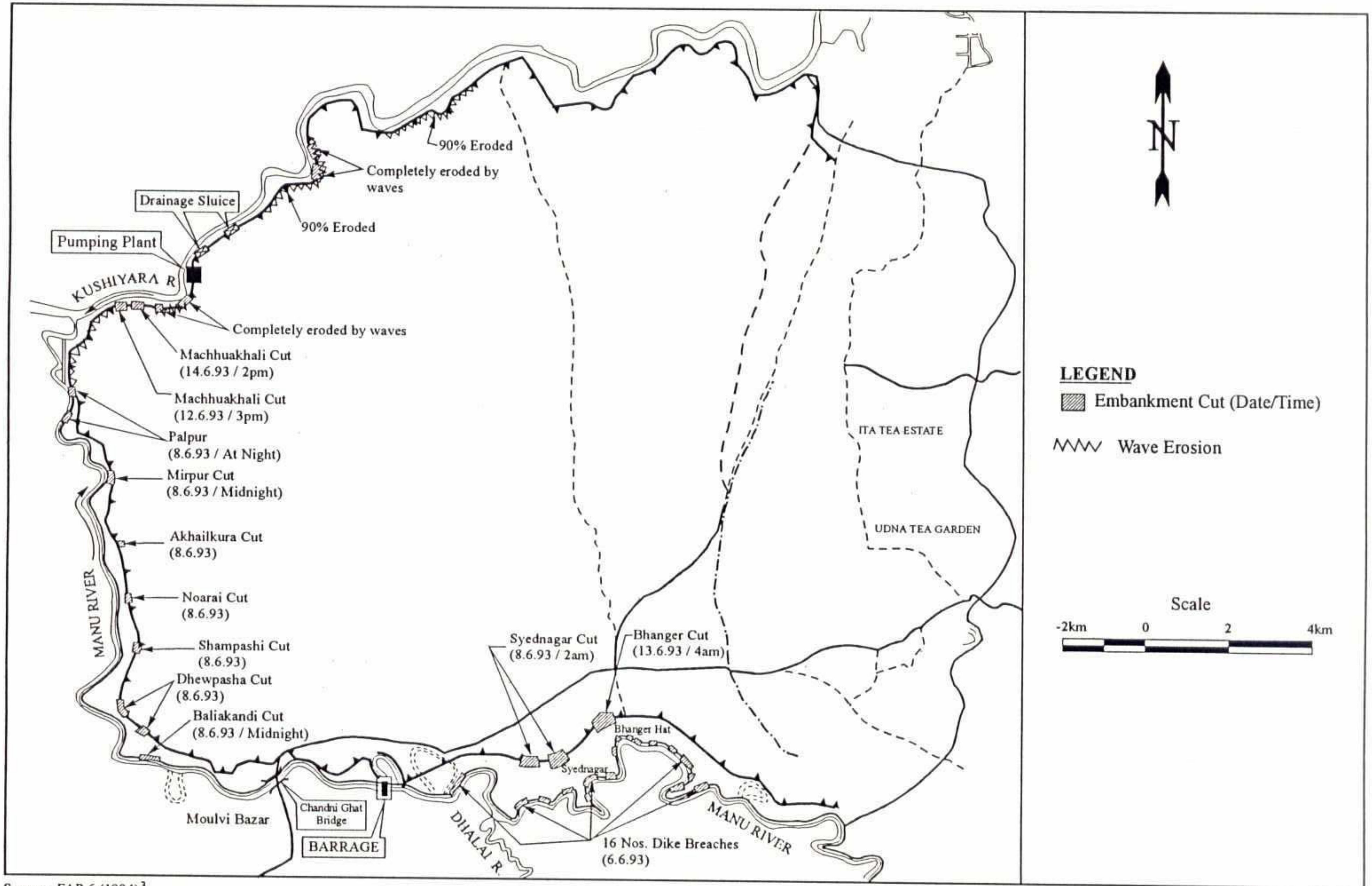

WL1 = 7.1 m PWD and 8.4 m PWD




WL1 = 8.8 m PWD

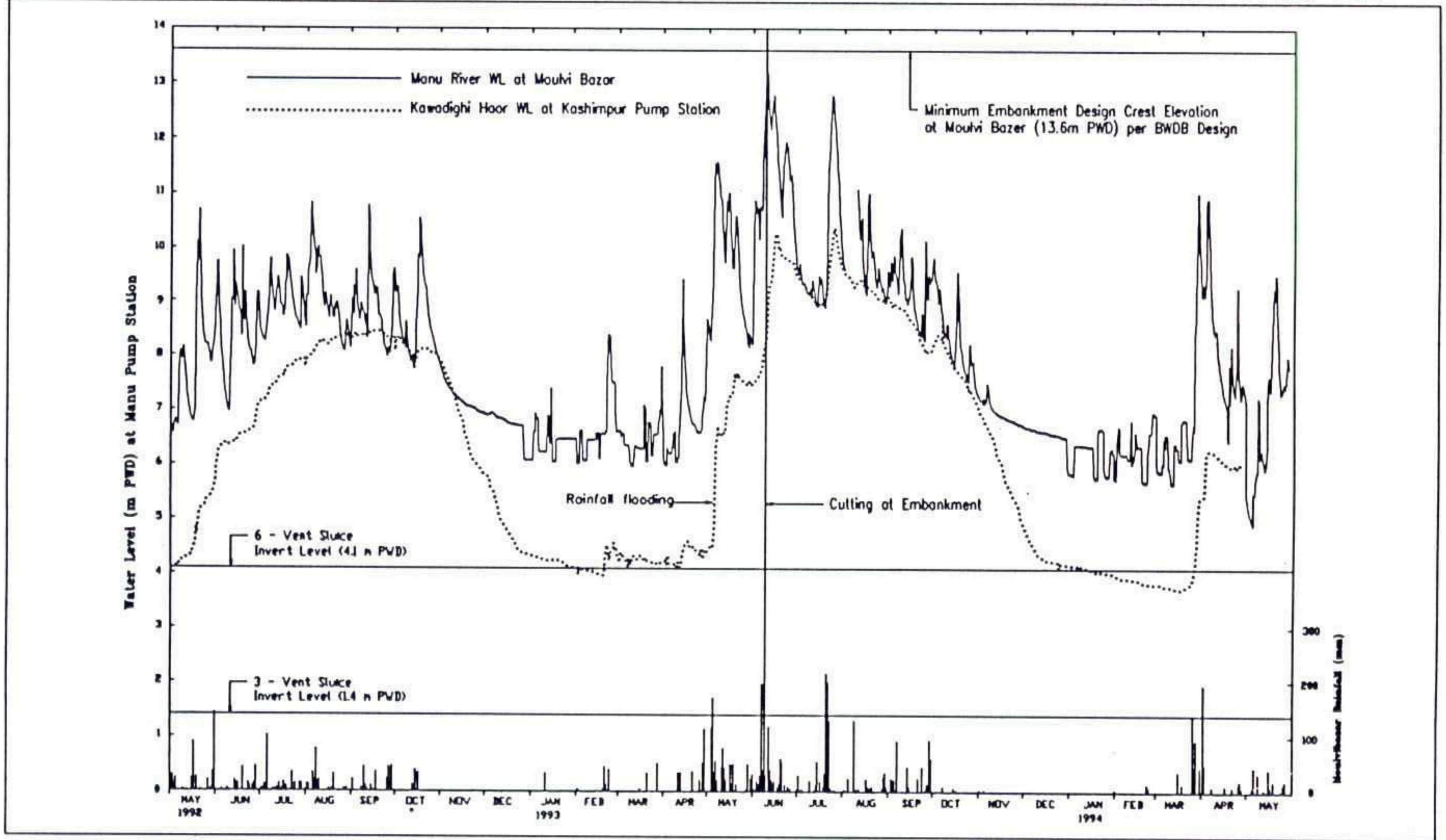
WL = Land elevations (m PWD) at positions of depth measurements

## Figure 3.2 Cuts made in the MIP embankment during 1993




Source: FAP 6 (1994)[3]

**Figure 3.3 Comparison of water levels inside the MIP and in the Manu River at Moulvibazar, May 1992 to May 1994**



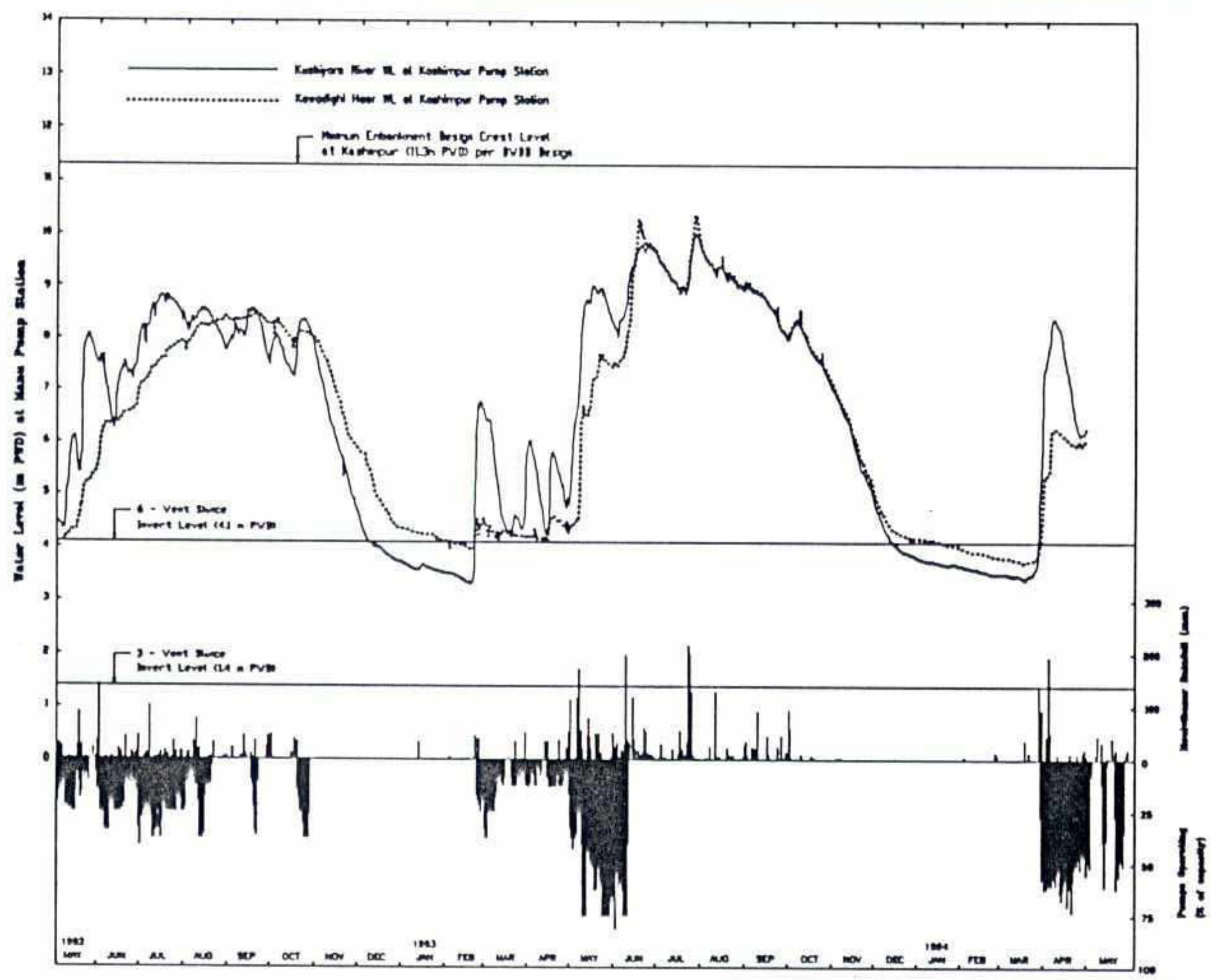

Source: FAP 6 (1994)[3]

Despite pumping operations at Manu pump station, peak water levels inside the MIP exceeded those in the Kushiyara for a short period in June (Fig. 3.4). Flood levels decreased between late June and early July coinciding with a fall in river levels. Heavy rainfall in late July resulted in further rapid rises in the Manu and Kushiyara rivers which in turn caused flooding inside the MIP since the project was by now effectively unregulated. On the higher floodplains (7 m PWD) such as those near Baraimabad, water depths of 2.5 m were recorded during fisheries surveys but peak levels reached 3 m during intervening periods between surveys in mid-June and late July while on the lowest areas such as Patasinga *Beel*, depths of up to 8 m were recorded.

The gates of the 6-vent and 3-vent regulators at Kashimpur were open early in the year between January and mid-February 1993 but closed as soon as river levels rose quickly in late February (Fig. 3.5). Gates remained closed until cuts in embankments caused heavy flooding in June after which gates were opened to drain out floodwaters. During periods of gate closure between February and May, water levels outside the MIP were between 1 to 2 metres higher than inside levels for intermittent periods. From February to April water levels outside the MIP reached 6 to 7 m PWD which, if allowed entry, would have caused extensive flooding on land immediately surrounding *beel*. This in turn would have increased opportunities for the spawning of floodplain resident fish.

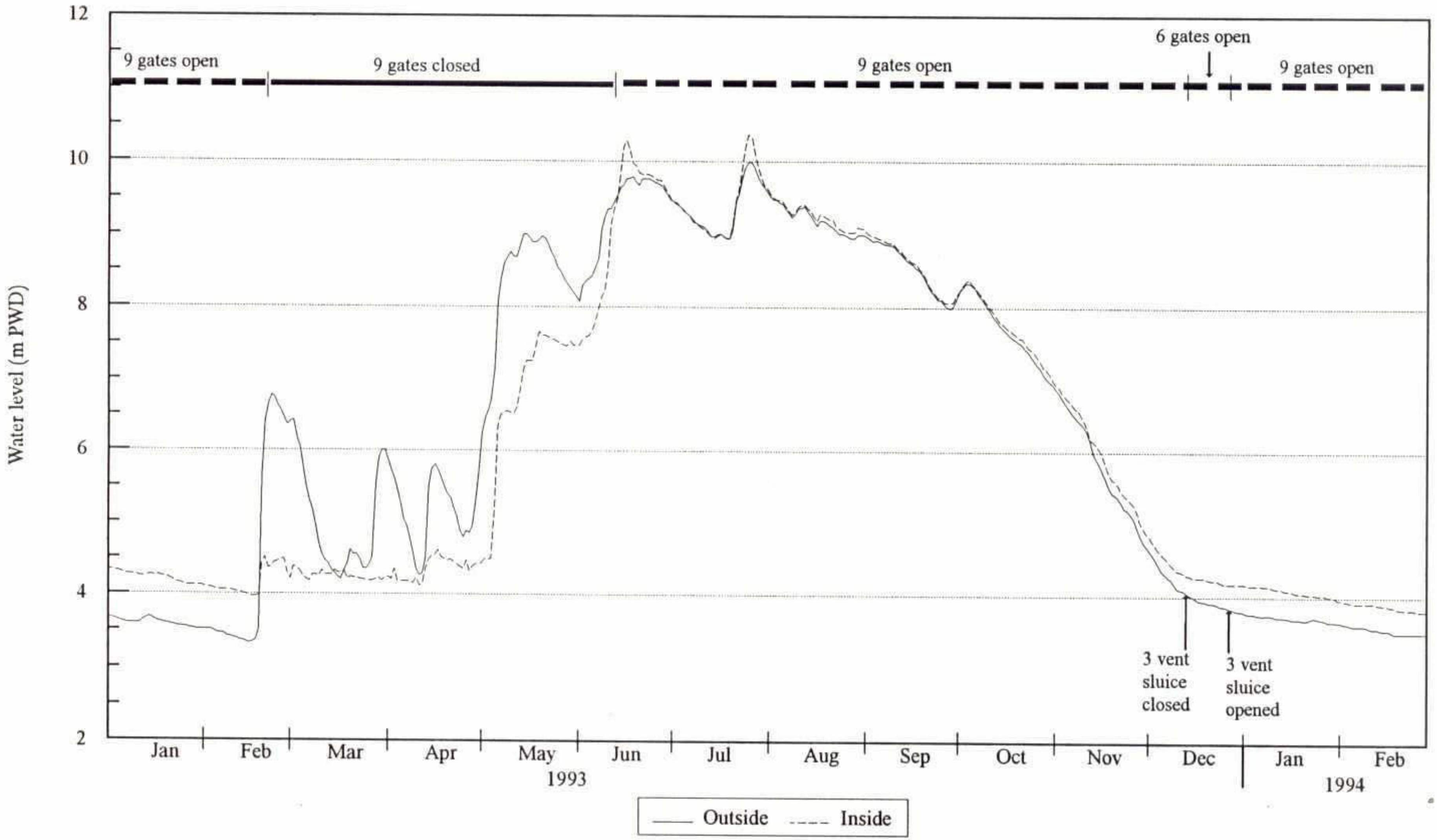
From August until mid-September water levels inside the MIP gradually declined. The first dry land appeared in late September on the areas immediately adjacent to the sampled floodplains at Baraimabad. The hydrograph at Manu pump station indicated a temporary increase in flood levels in the MIP in late September and early October (Fig. 3.5) but this occurred between fortnightly fisheries surveys which recorded increased areas of dry floodplain during the second week in October. During the flood drawdown the scheme was drained not only by Kashimpur sluice gates but also by breaches in the embankment, particularly at Machhuakhali, where there was a natural drainage channel to the river. By early December, higher floodplains at Baraimabad were dry while small, isolated depressions remained flooded to depths of 1 - 2 m on the lower floodplains of Islampur (NE02). The boundary of Patasinga *Beel* (NE04) emerged in December and was guarded by the leaseholder of the fishery to prevent unauthorised fishing. All canals connecting with the *beel* were blocked with cross dams except one, Magura *Gang*, which was under controlled fishing by the leaseholder.

Figure 3.4 Comparison of water levels inside the MIP and in the Kushiyara River outside Manu Pump Station, May 1992 – May 1994



Source: FAP 6 (1994)[3]

**Figure 3.5 Water levels inside and outside Kashimpur sluice gates, January 1993 - February 1994**



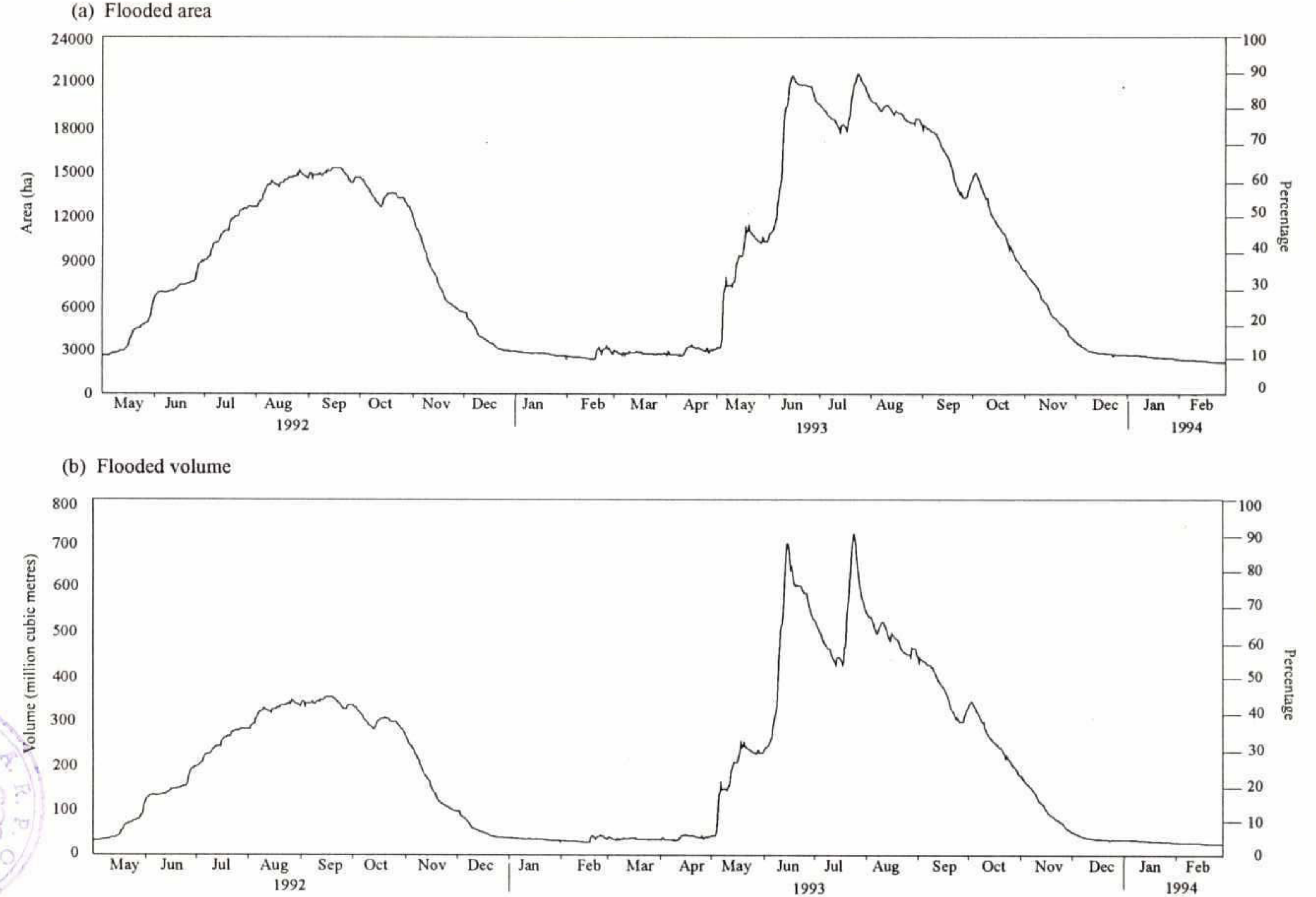
In late December, the 3-vent sluice gate at Kashimpur was opened and cross dams on Magura *Khal* were cut by the leaseholder of Patasinga *Beel* to allow fishing on the canal by *veshal* and to drain the *beel* be that a complete harvest could be made.

During January 1994, water levels in the *beel* decreased from 1.3 m in the deepest area to 0.4 m by the end of the mouth. During this period, the *beel* was heavily fished by the leaseholder. Irrigation waters from the Manu River system entered the *beel* during the last week in January and raised waters by about 0.4 m in early February, after which they progressively declined to the low January levels. Irrigation water again raised water levels again in late February by 0.5 m. Leaseholder fishing continued throughout the period but ended in the second half of March (outside the survey period) when heavy rainfall resulted in inundation of the *beel*.

From the area elevation curve of the MIP and water level data inside Kashimpur sluice gates, seasonal variation in flooded area and volume were calculated for 1992 and 1993 by FAP 6 (Fig. 3.6). Considerable differences were observed between years resulting, in part, from more rainfall during 1993, but principally from the cuts in embankments during that year. Using the area under the flooded volume curve as an index of annual flooding, FAP 6 reported that during 1992 the flood index was 67% lower than that in 1993[3]. Such a reduction in flooding would be expected to result in a significant reduction in fish yield during the drier year. Studies carried out by FAP 17 in the North West Region reported a reduction of 61% in an annual flood index on Chalan *Beel* in 1992 compared with that of 1993 and a 32% reduction in fish yield from unregulated floodplains during the dry year[12]. The maximum flooded areas estimated for 1992 and 1993 both greatly exceeded the intended inundated area anticipated during the design of the project (Fig. 3.7). The limit of the flooded area in 1993 agrees fairly closely with the limit of extrapolation of the FAP 17 catch estimates (see Fig. 2.1 and Section 7.1).

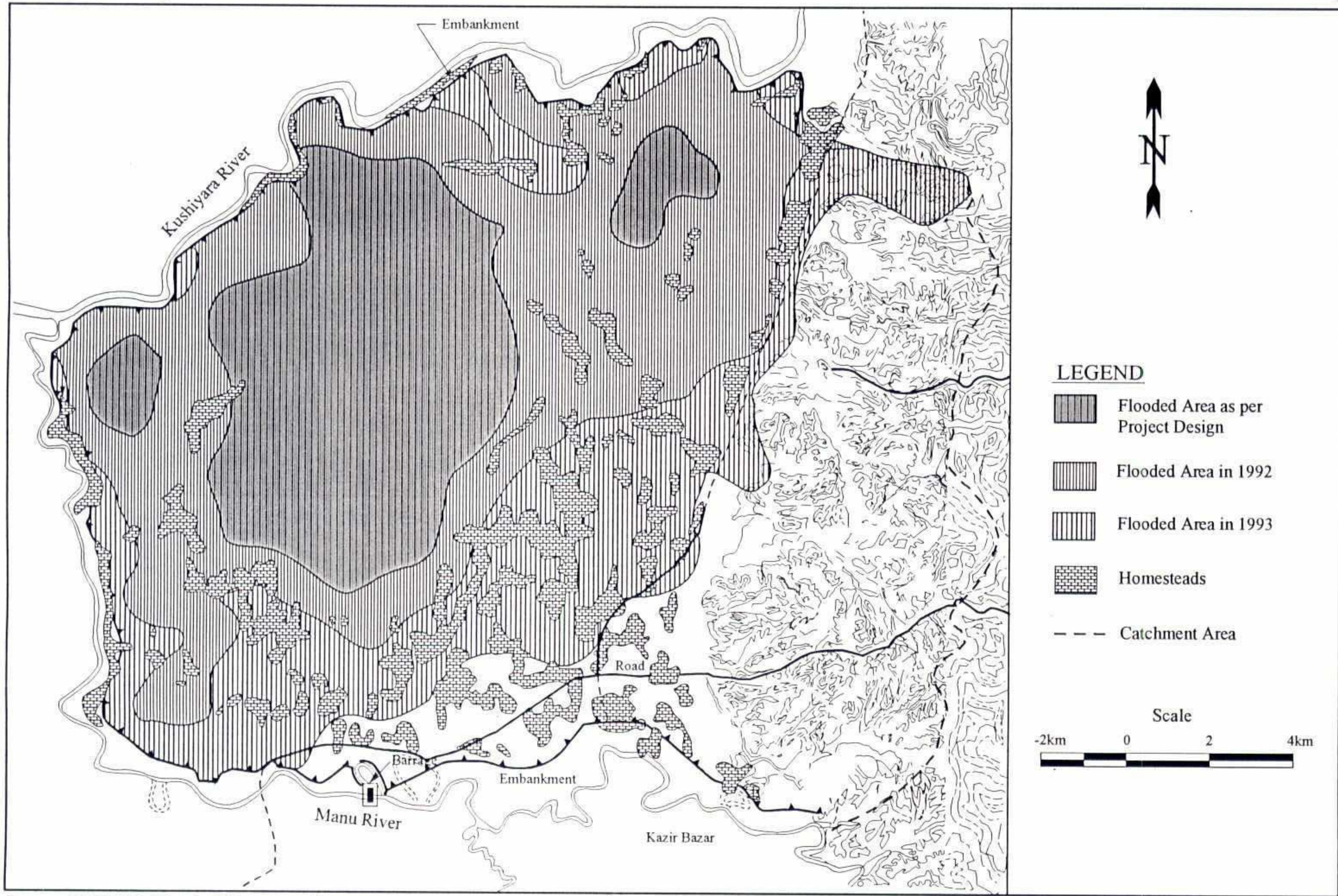
Since its construction in 1983, cuts have been made in the Manu embankment in at least 4 or 5 years (Fig. 3.8). The cuts have always been in response to high river levels in the Manu River causing flooding of village immediately outside the MIP. Even during drier years when no cuts were made flood levels inside the MIP always exceeded the design target level of 7.15 m PWD by about 1 to 2 m. The flooded area has thus always exceeded that predicted during the project design. This is clearly seen in Figure 3.7 for the relatively dry year of 1992. The flooding pattern in this year was generally typical of other years when embankments were not cut.

**Figure 3.6 Seasonal variation in flooded area and volume in the MIP, 1992 and 1993**



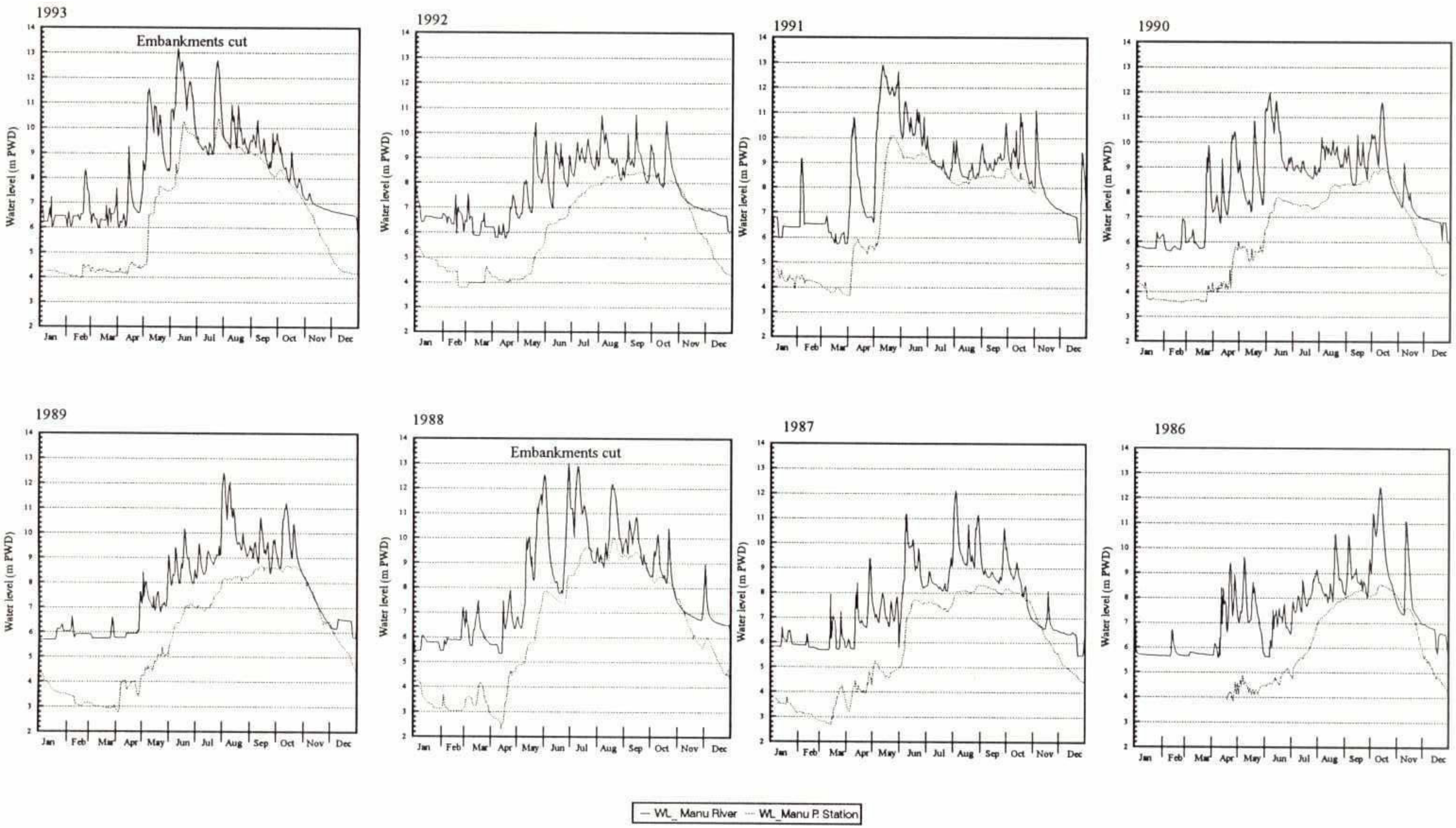

Source: FAP 6 (1994)[3]

**Figure 3.7 Comparison of maximum flooded areas within the MIP in 1992 and 1993**

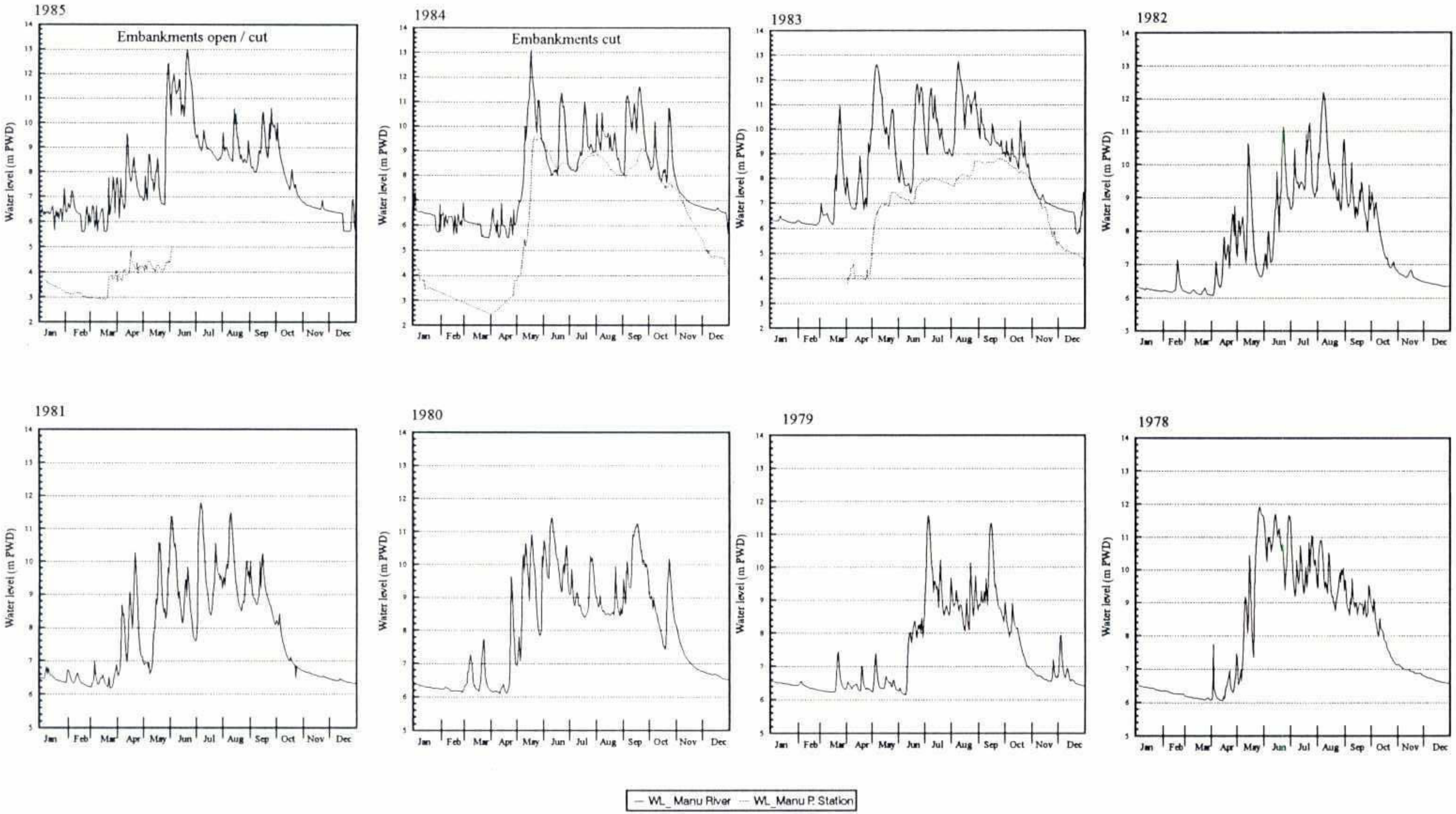



Sources: FAP 6 (1994)[3] and Halcrow (1993)[5]

## Figure 3.8 Water levels inside the MIP and in the Manu River at Moulvibazar, 1983 - 1993



## Figure 3.8 (continued)




Note: 1978 - 1982 is pre-construction period of MIP

**Figure 3.9 Water levels inside the MIP and in the Kushiyara River, 1983 - 1993**

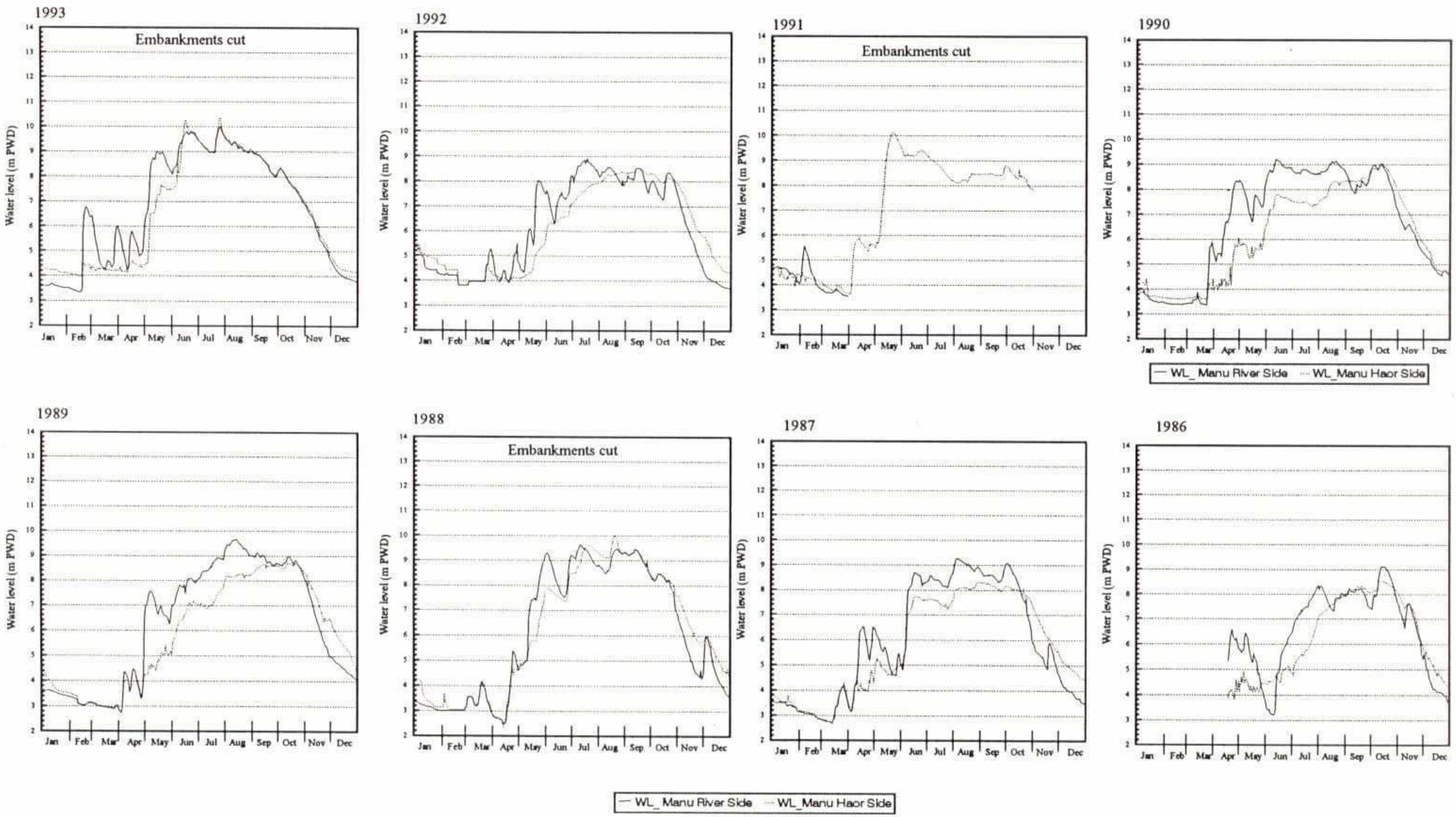
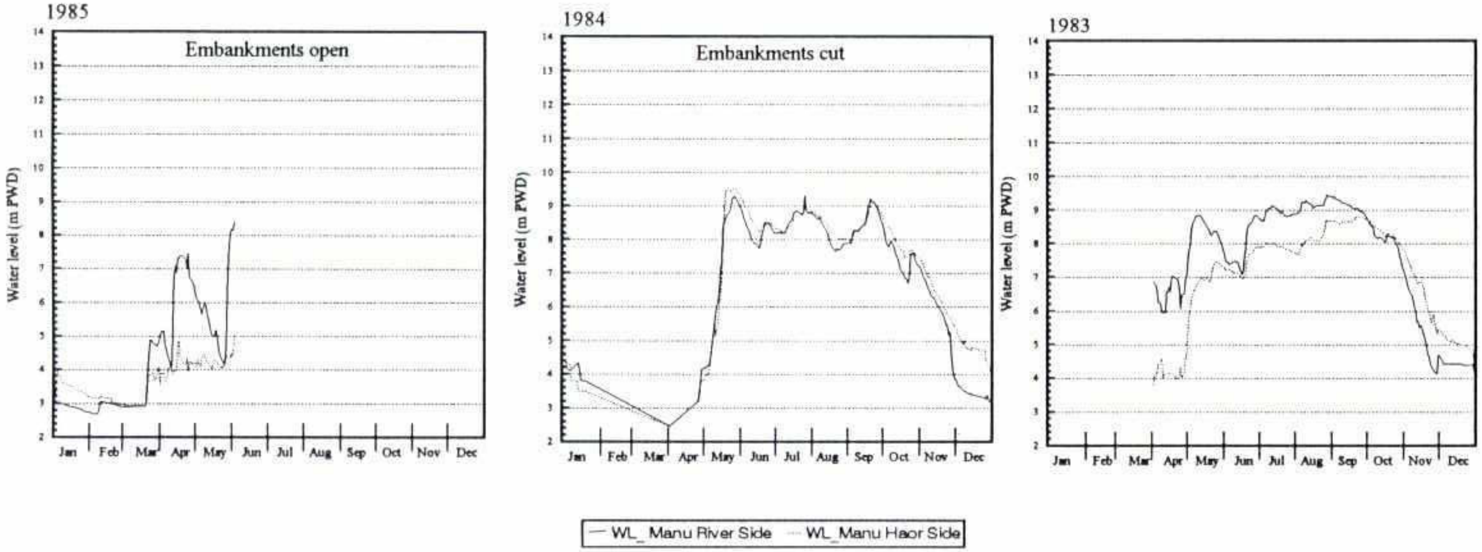


**Figure 3.9 (continued)**



During high flood years when cuts were made, levels of flooding in the MIP were determined mainly by levels in the Kushiyara River into which the system drained (Fig. 3.9). The maximum extent of flooding in the MIP shown in Figure 3.7 for 1993 was typical of other years e.g. 1991 and 1988 when embankments were also cut. The fact that there has been increased flooding in both wet and dry years has undoubtedly reduced the advised impacts of the MIP on capture fisheries had it functioned as planned. Embankment cuts have resulted however, in sudden, unpredictable and higher flooding than before the project. This has reportedly inflicted extensive damage on rice crops. The project has therefore failed to achieve both its hydrological and agricultural objectives.

### 3.2 Hakaluki *Haor*

Water level readings taken at Gobindapur floodplain (NE10) provided a consistent set of data on flooding patterns at sampling sites on Hakaluki *Haor*. In addition, water levels of the Kushiyara River at Fenchuganj about 1 km downstream from the confluence with the Juri (Fig. 3.10) provided a continuous record of daily flood levels in the *haor*. The same pattern of flooding was seen from water levels in the Juri River on the southern boundary of the *haor* (Fig. 3.11). This river served as a one of the main feeder rivers of Hakaluki *Haor* and was submerged during the monsoon as it passed through the *haor* to drain it at its confluence with the Kushiyara River at Fenchuganj.

Seasonal variations in flooding were similar to those inside the MIP. Higher floodplains (>6.5 m PWD) received temporary shallow rainfall flooding in February but dried out again in March and April. Lower floodplains adjacent to *beel* areas, however, were inundated to depths of 2 m to 3 m from February onwards. Further heavy rainfall in early May resulted in a rapid rise in the Kushiyara River and the complete inundation of Hakaluki *Haor*. At this time, the Juri River overspilled its banks upstream of its confluence with Kushiyara making it difficult to distinguish from the adjacent flooded land. The main source of flooding was rainfall runoff from the surrounding hills in India brought into the *haor* by rivers such as the Juri in the south. In May these rivers were completely submerged. Since Hakaluki *Haor* was drained by the Juri which entered the Kushiyara River at Fenchuganj, water levels in the *haor* were determined principally by levels in the Kushiyara. These decreased in the second half of May but rose again to peak levels in mid-June and remained fairly constant for about two weeks. They dropped slightly in mid-July before rising sharply again towards the end of the month. Levels then gradually decreased from early August onwards. During periods of peak flooding, depths in Tekuni and Baghalkuri *Beel* ranged from about 6 m to 8.5 m

**Figure 3.10 Comparison of water levels in the MIP and Kushiyara River, 1993 - 1994**

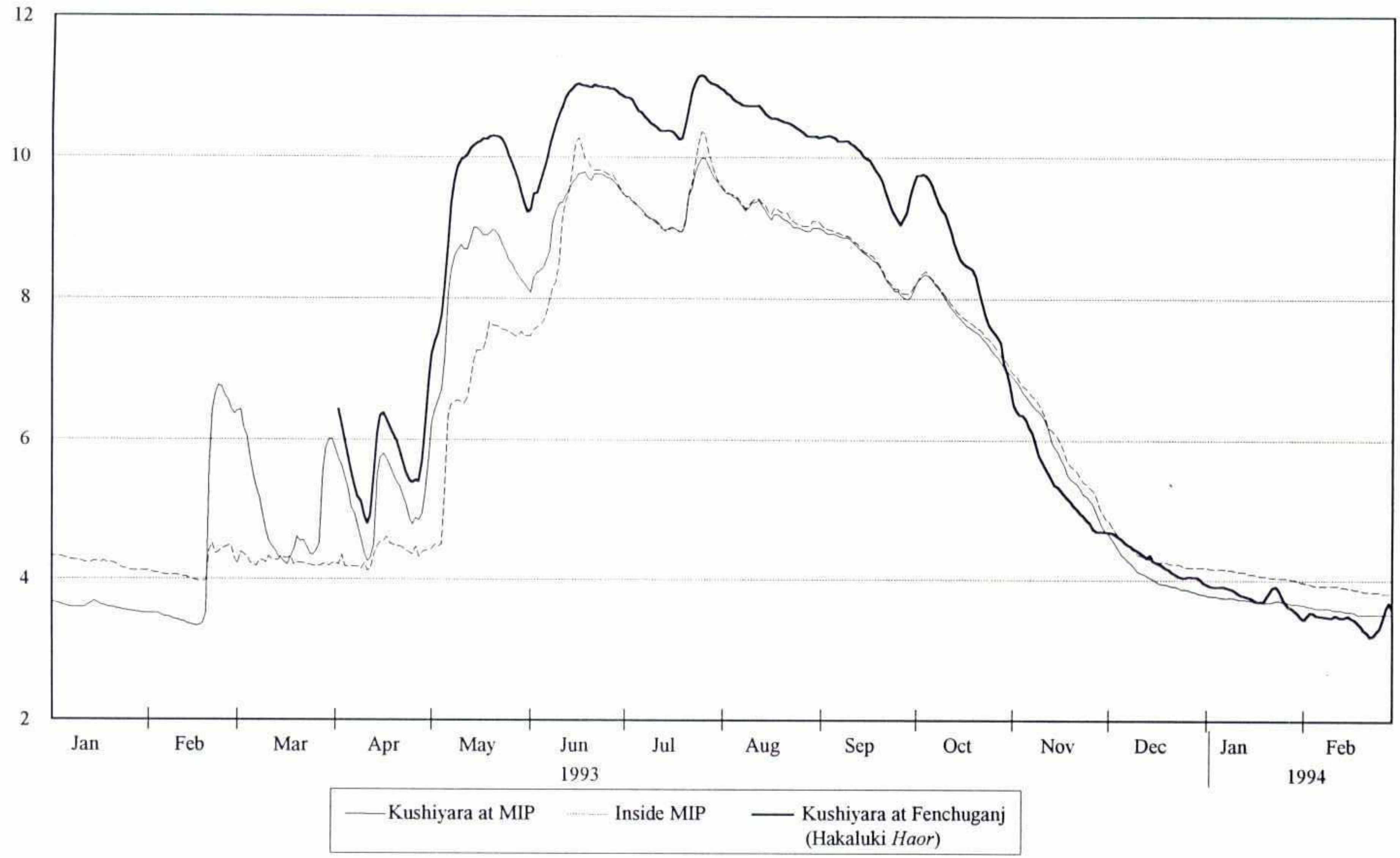
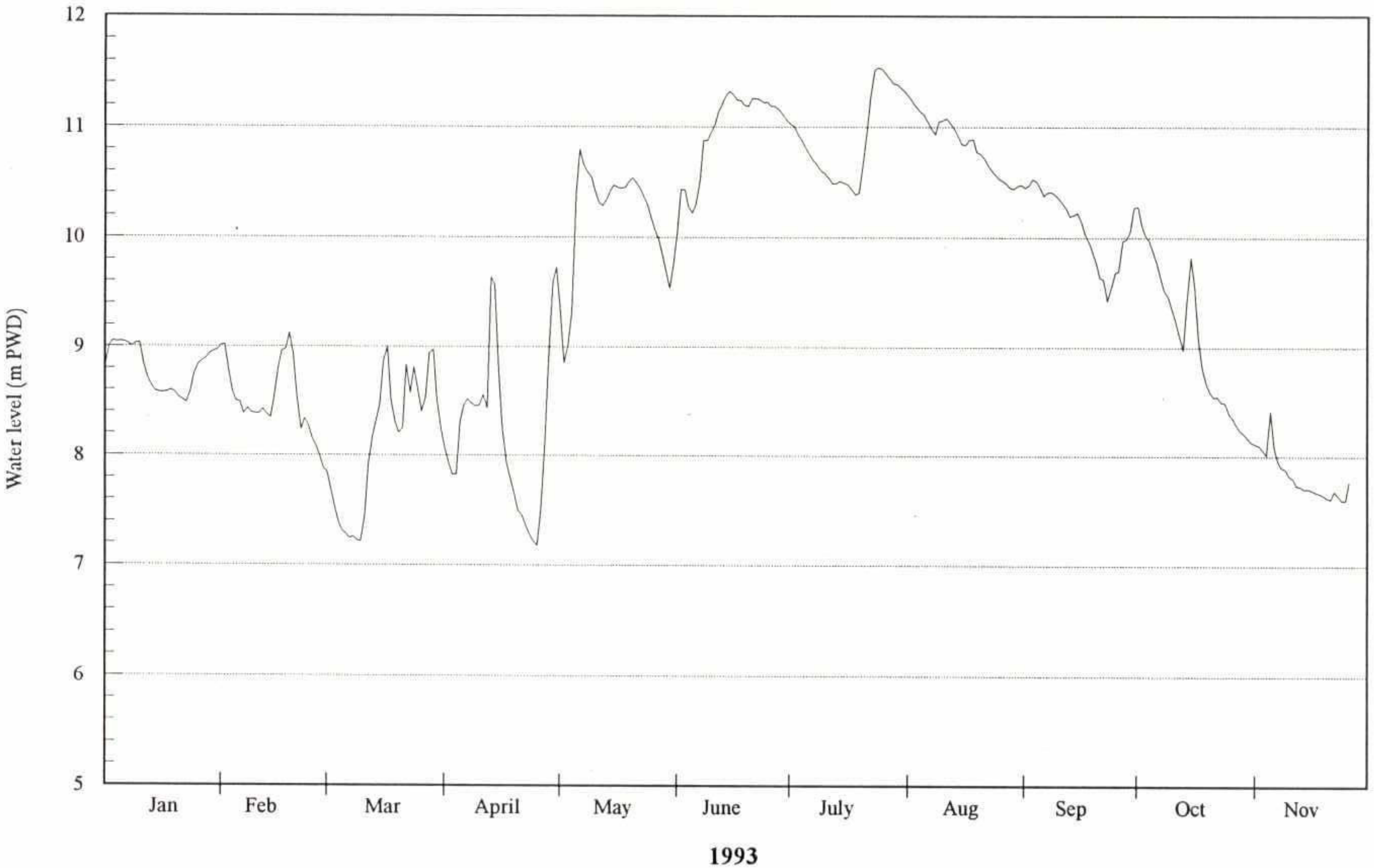


Figure 3.11 Water levels in the Juri River at Juri, January - November 1993



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while on higher floodplains of Gobindapur, depths ranged from 2 m to 3 m. The flood drawdown accelerated from mid-September onwards but was interrupted by temporary increased flooding in the first week of October before continuing on a rapid decline for the remainder of the month and in November. Higher floodplains at Gobindapur dried out completely in mid-October while lower floodplains at Tekuni dried out during early December leaving only small, scattered, flooded depressions.

In the larger of the two *beel* surveyed, Baghalkuri, an artificial channel excavated by previous leaseholders connected the *beel* to the Juri River. During the drawdown flow through this channel was controlled by the leaseholder. In December the channel was closed to allow fishing by large *ber jal*. It was reopened on 10 January but closed again whenever levels in the Juri River were higher than those in the *beel*. From January to February 1994, levels in the deepest part of the *beel* dropped from about 1.5 m to 1.0 m. Average depths over wider areas of the *beel* ranged from 0.7 m to 0.9 m.

## 3.3 Impact of MIP on Flooding Patterns

### 3.3.1 Source of flood

Until the embankments of the MIP were breached in early June, floodwaters from the Manu River were excluded and those from the Kushiyara were highly restricted, entering only by leakage of sluice gates. For the period of rising river floods from February to early June, therefore, a greater proportion of the pre-monsoon flood resulted from local rainfall than that in Hakaluki *Haor* which received floodwaters from the Kushiyara and Juri rivers and the numerous surrounding external hill streams entering the *haor*. Even after embankments of the MIP were breached in June on the Manu River and in late July on the Kushiyara, the proportion of external river to rainfall flooding was probably lower than that occurring in a totally free-flooding situation due to the restricted entry through breaches.

### 3.3.2 Flood timing and duration

The timing of the occurrence of the first rainfall flooding was similar inside the MIP and on Hakaluki. Rainfall flooding in February receded in March and April in both areas before increasing rapidly in May. In contrast, the first extensive inundation by river floodwaters occurred in May on Hakaluki *Haor* as rivers overspilled their banks and entered the floodplains and *beel*. In the MIP, therefore, this did not occur until early June when embankments were cut. The flood drawdown occurred at the same time in both areas; thus the total period of major river flooding was reduced by one month inside the MIP compared with that on Hakaluki *Haor*. During winter the larger and deeper *beel* of the MIP retained water for the same period as those on Hakaluki. In both areas the drainage of such *beel* was under the control of leaseholders of the fisheries.

### 3.3.3 Flood magnitude and extent

Water levels in Hakaluki *Haor* were generally about in higher than those 1 m the MIP following embankment cuts. This was due principally to the water slope in the Kushiyara River. Flooding patterns in the river opposite Hakaluki *Haor* and the MIP were essentially the same. Between late February and April water levels in the MIP were reduced by 1 to 2 m by sluice gate closure. If allowed entry these floodwaters would have raised the level of flooding in *beel* and on about 5,000 ha of low floodplain immediately surrounding *beel*. In May, despite extensive rainfall inundation of the MIP, sluice gate closures reduced flood levels by 1 to 2 m and flood extent by about 7000 ha on higher floodplains. After embankments were out in early June, water levels inside and outside the MIP were identical for most of time, although peak inside levels exceeded those outside by about 0.5 m for two short periods in June and July.

# 4 WATER QUALITY

Surface water measurements of temperature, pH, dissolved oxygen (DO), conductivity and total dissolved solids were made at sites on rivers, canals, floodplains and *beel* at fortnightly intervals using electronic metering techniques. Seasonal variations in these parameters are presented for sites inside MIP and on Hakaluki *Haor* in Figures 4.1 to 4.6. Given that temperature, pH and DO levels on floodplains generally depend on the time of day, attempts were made to standardise times when measurements were made. This was not always achieved, however, and whilst most readings were taken between 10.00-12.00, some were outside this range. Data in Figures 4.1 and 4.2 therefore also reflect diurnal as well as seasonal changes.

Dissolved oxygen concentrations on Tekuni *Beel* ranged from 4 to 8 mg/l while those on Patasinga were in a slightly lower range from 2 to 6 mg/l. A wider range from about 2 to 9 mg/l was recorded in canals. Previous more detailed studies carried out in Bangladesh showed that oxygen levels ranged over a 24 hour period from a completely anoxic (zero oxygen) condition near dawn to supersaturation in mid-afternoon in both open flooded fallow land and in deepwater rice fields where depths reached up to 3 m [10, 11]. The studies also revealed considerable vertical stratification in oxygen levels in fallow areas and rice fields with lowest concentrations (near zero) in the bottom layer whilst surface layers remained near saturation. The effects of stratification were more pronounced towards the end of the monsoon season when amounts of decomposing macrophytic vegetation increased in decreasing volumes of water.

No seasonal trends in pH levels were detected on *beel*, canals or rivers. Values ranged from about 7 to 9 which posed no danger to fish health or survival. Conductivities were lowest during the monsoon on both Tekuni and Patasinga *Beel* where they averaged about 40-60 $\mu$S compared with values of 60 $\mu$S in the Kushiyara River and 40 $\mu$S in Akali *Gang*, a feeder canal of the MIP. Conductivities on Patasinga *Beel* increased during the drawdown and winter probably due to the decomposition of plant material in smaller volumes of water and to the disturbance of bottom mud by intensive fishing activity. The same seasonal increase was observed in canals and rivers, even in the Kushiyara which retained a greater perennial flow but, for reasons which are unclear, was not seen on Tekuni *Beel*.

Values of transparency on Tekuni *Beel* decreased in May and reached a minimum in June due to the ingress of silt-laden waters from the Juri and Kushiyara rivers. On Patasinga *Beel*, transparencies did not decline sharply until June when the Manu embankment was breached and silt-laden river waters then entered the MIP. In both *beel*, transparencies progressively increased from August to September when water levels in the Kushiyara River and *beel* gradually declined and suspended solids were deposited on the floodplain. Values of transparency decreased in December in both *beel*. Normally at this time of year transparency increases as suspended solids are deposited on the bed. Fishing by *ber jal* may have disturbed bed sediments and reduced transparencies in the *beel*.

## Figure 4.1 Water quality, Tekuni *Beel* (site NE09): Hakaluki *Haor*

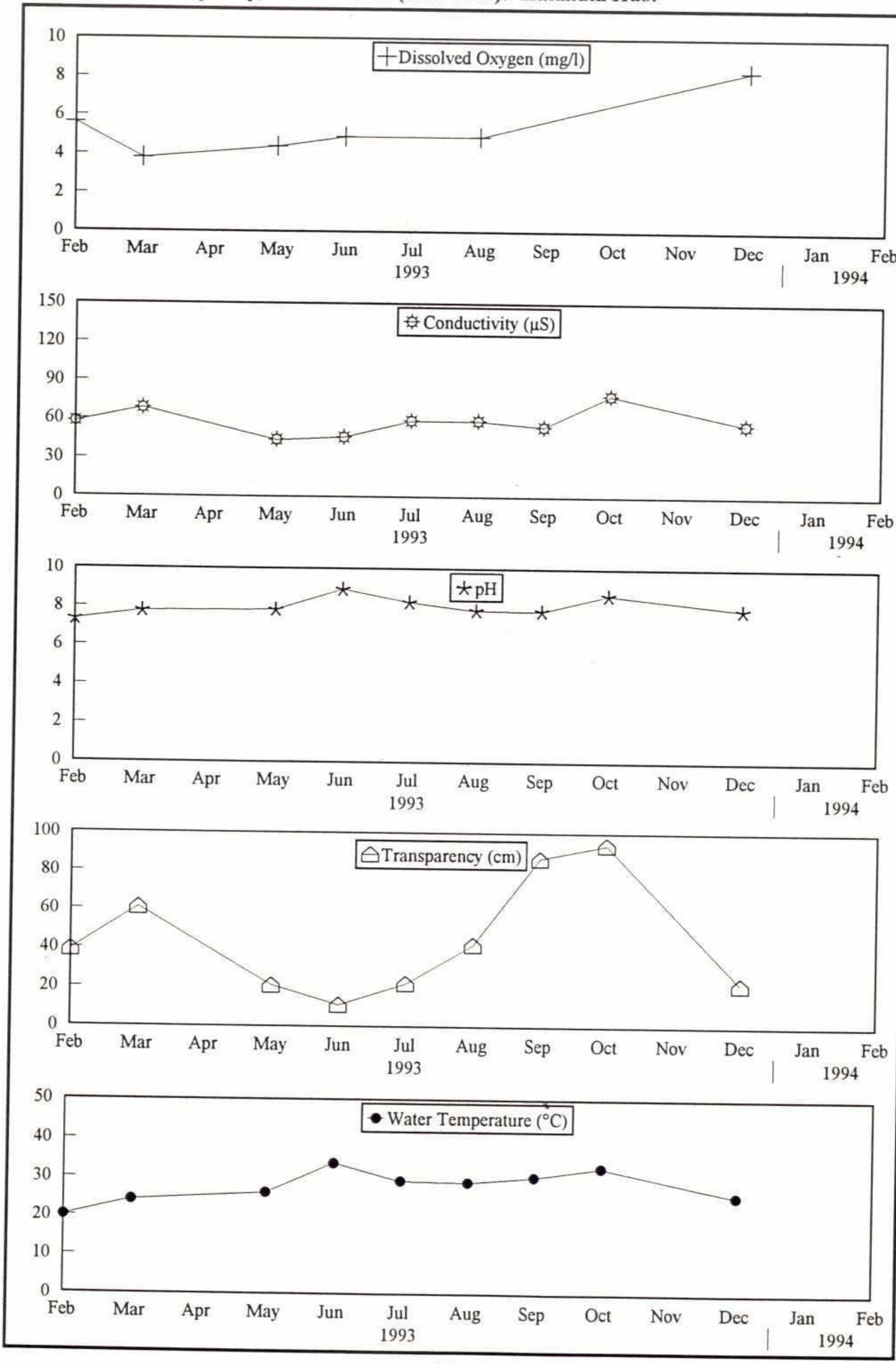

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**Figure 4.2 Water quality, Patasinga *Beel* (site NE04): inside MIP**

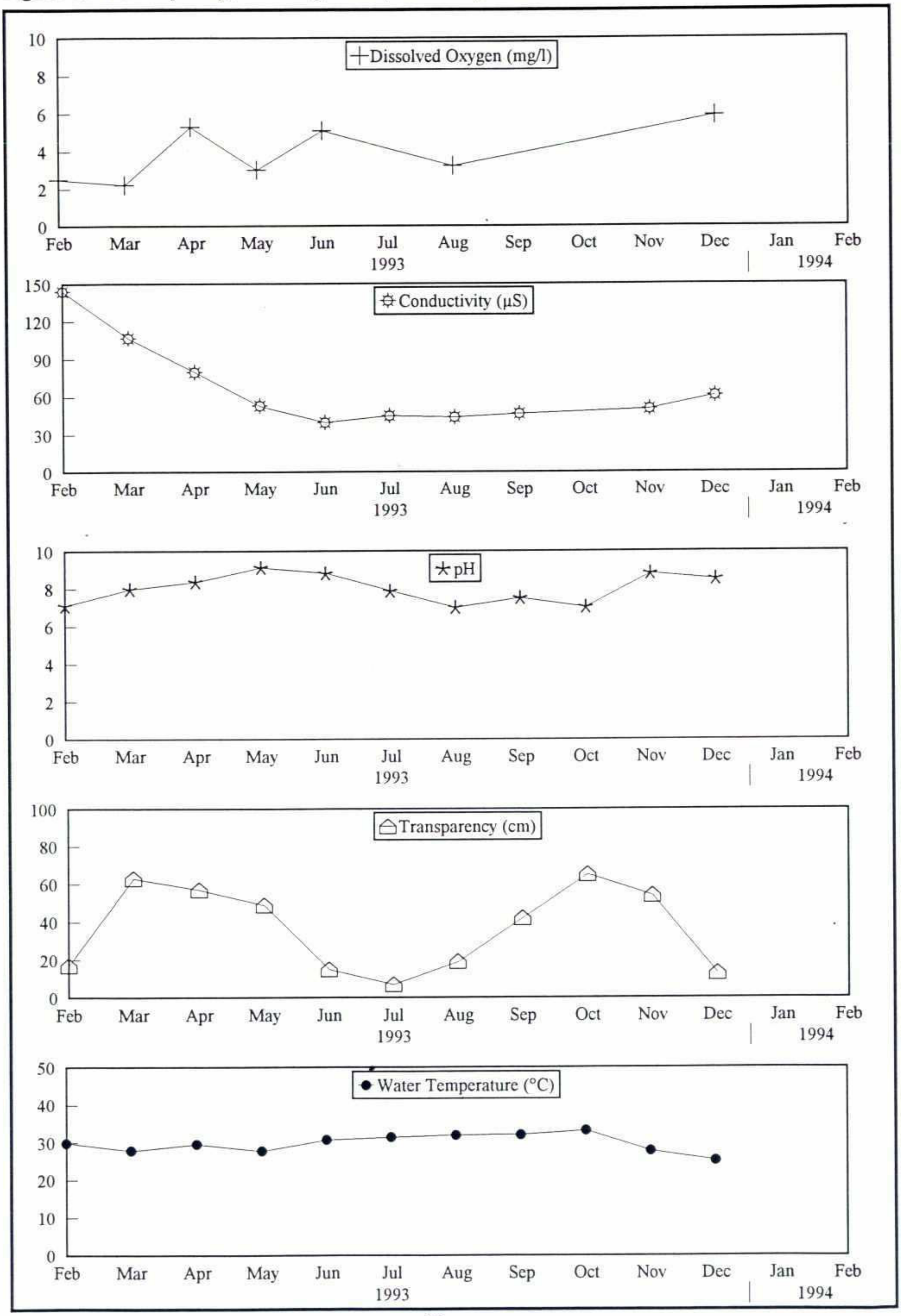

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Figure 4.3 Water quality, Juri River (site NE07): main drainage system of Hakaluki *Haor*

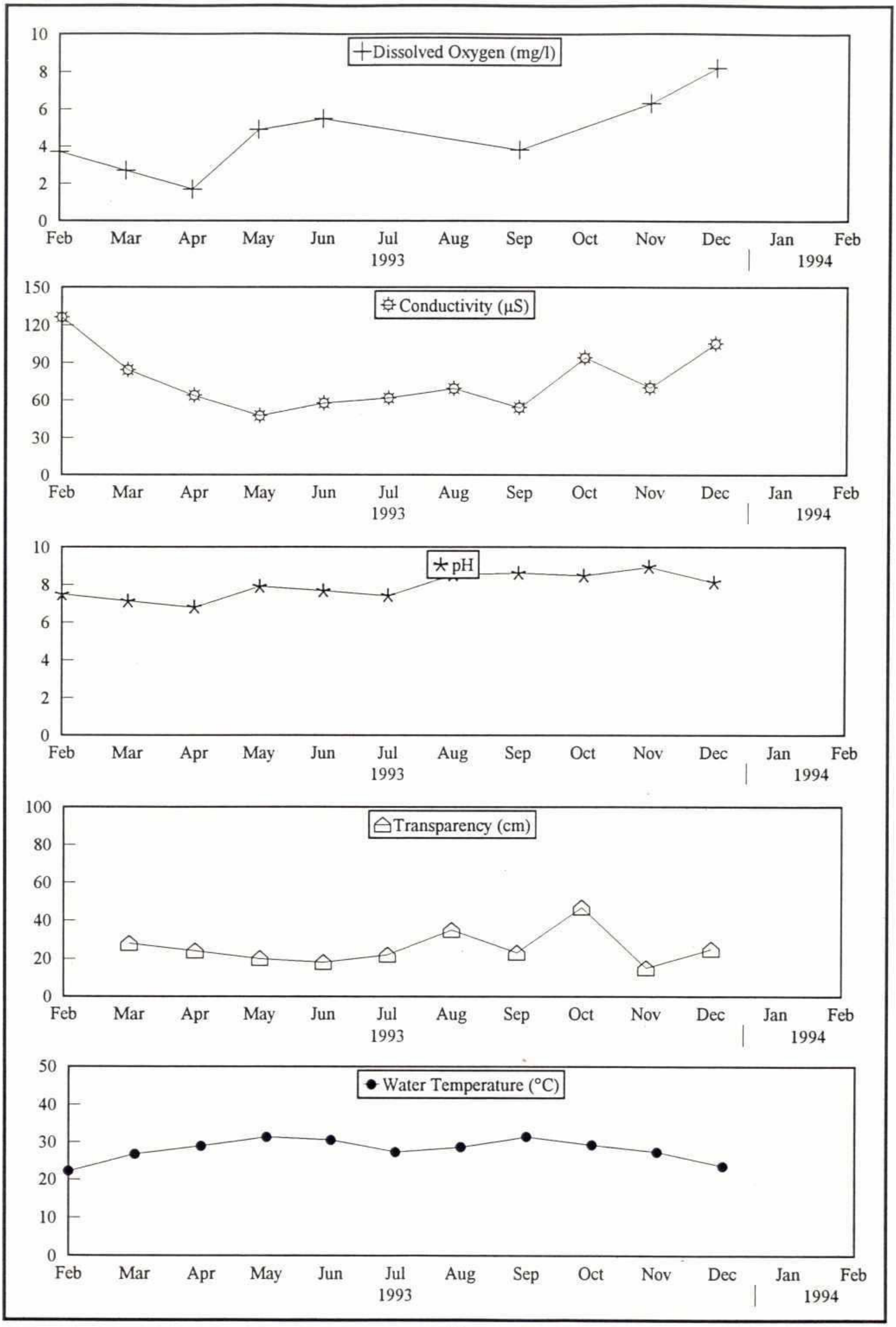

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**Figure 4.4 Water quality, Khorodari *Khal* (site NE01): main drainage canal of MIP**

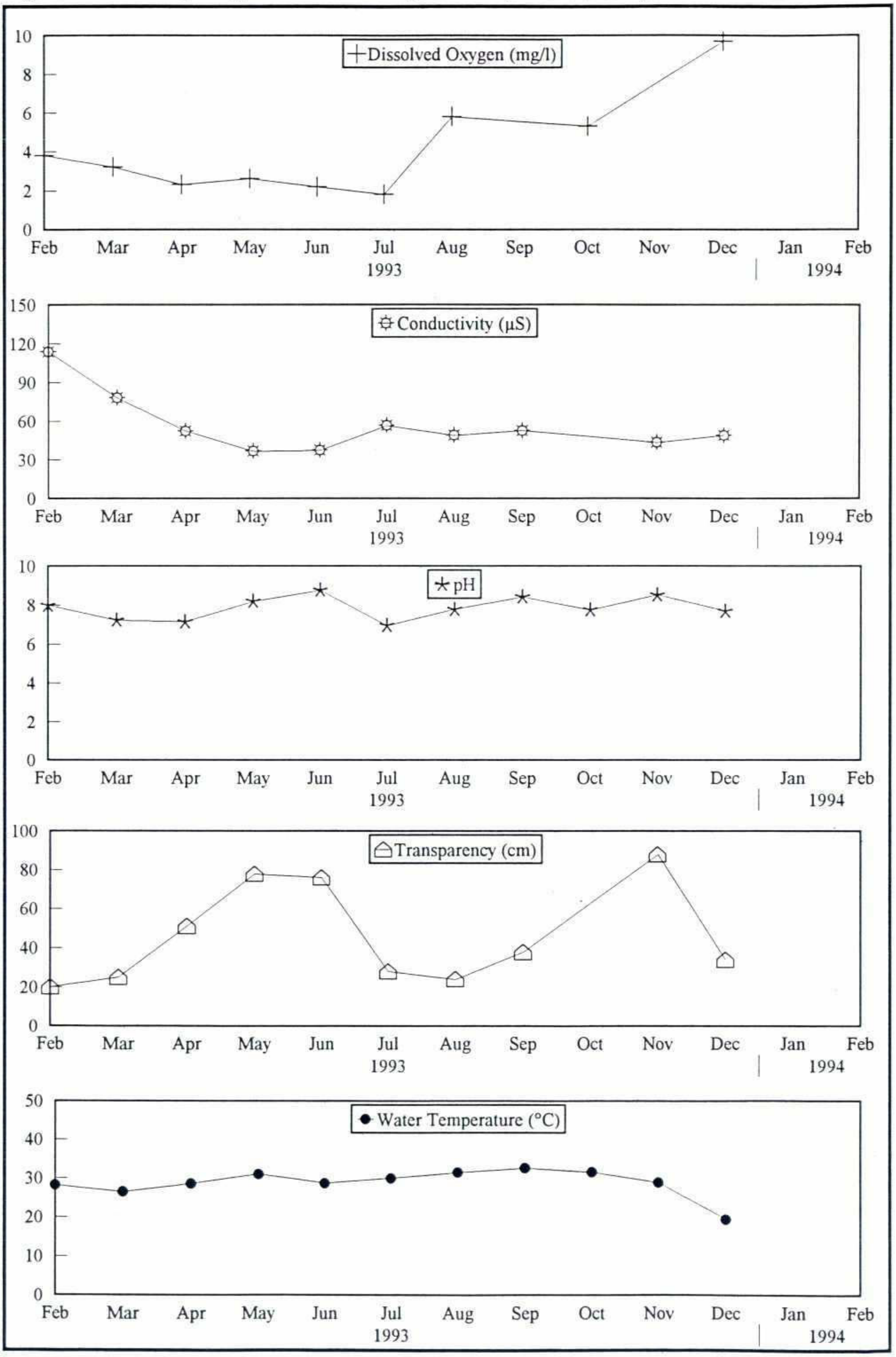

**Figure 4.5 Water quality, Akali *Gang* (site NE03): feeder canal inside MIP**

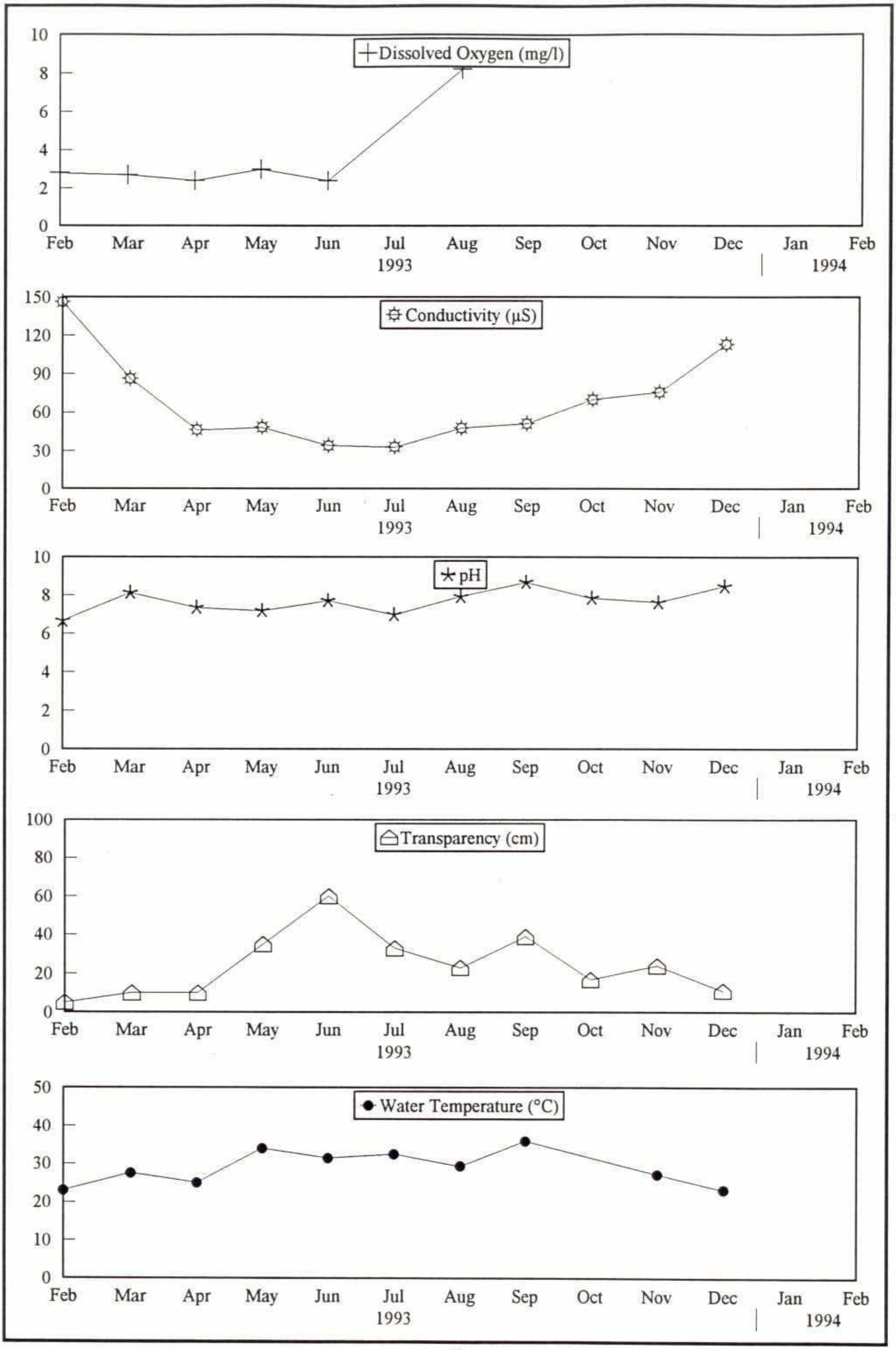

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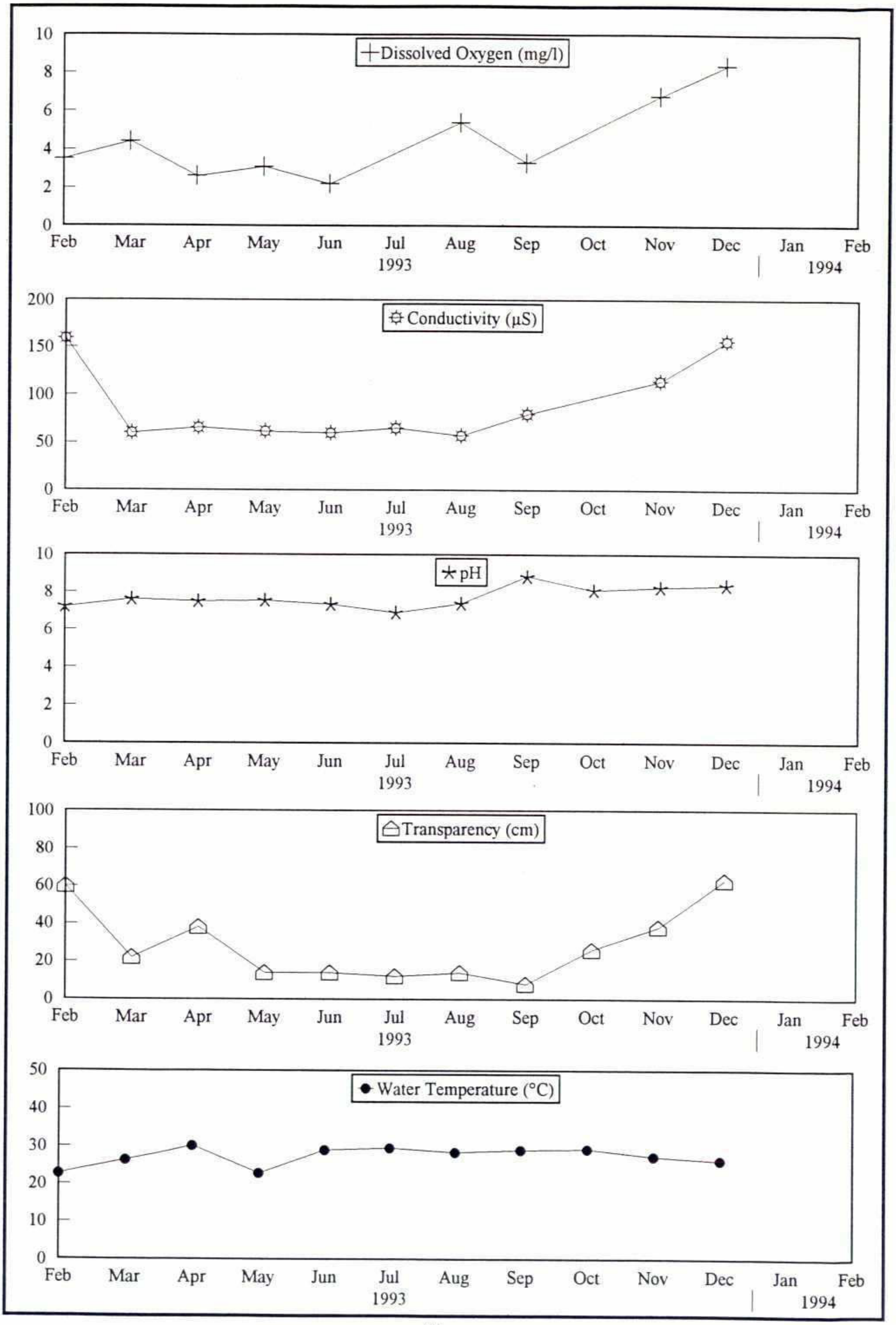
**Figure 4.6 Water quality, Kushiyara River (site NE06): outside MIP**



# 5 CANAL FISHERIES

In the analyses and interpretations of data which follow, the results from one site on the Kushiyara River are also included to compare changes in catch compositions with those from regulated and unregulated canals. Such comparisons were used to identify movements of fish between the river and floodplains and to assess the impact of flood control on these movements.

## 5.1 Total Catch

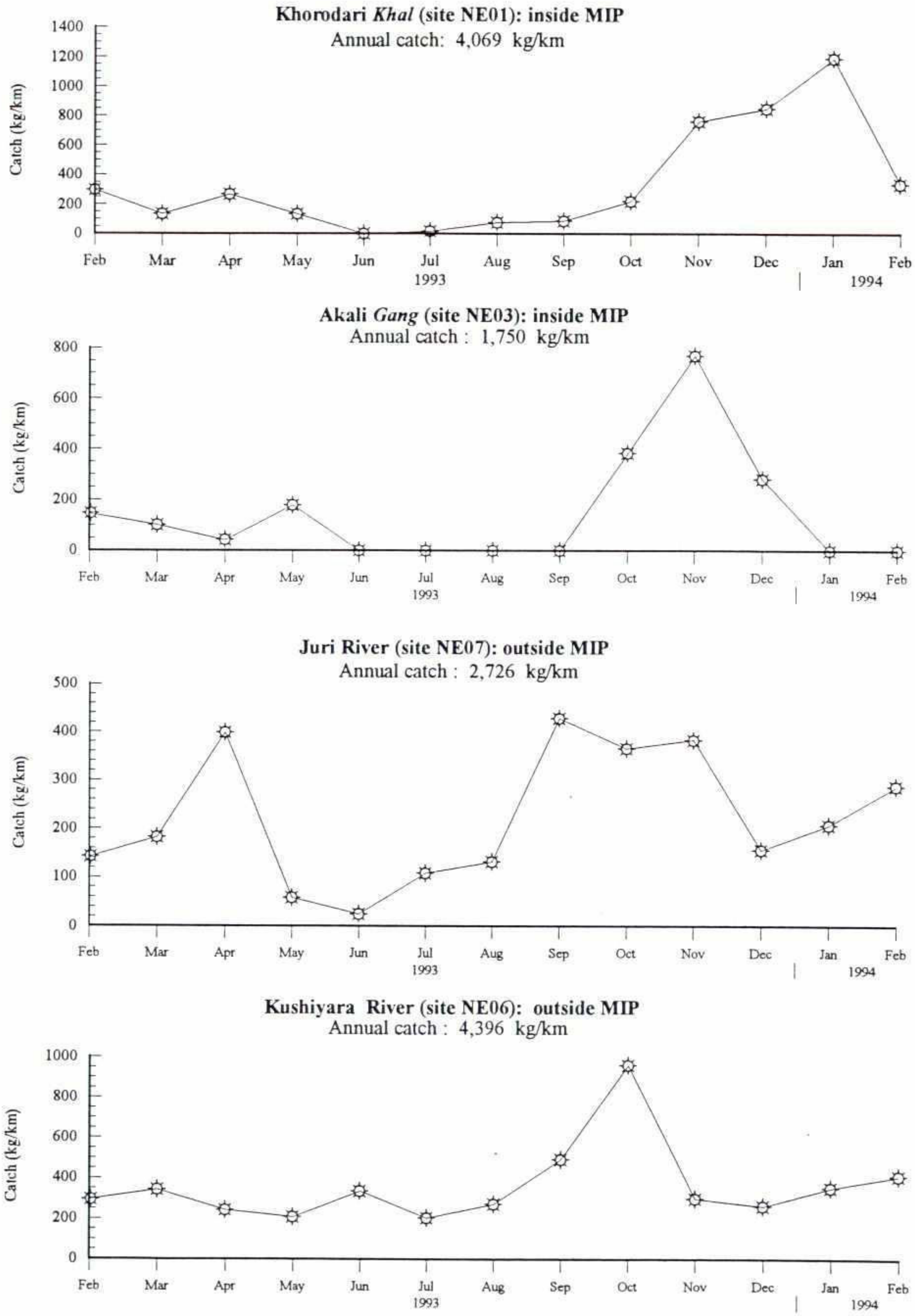
### 5.1.1 Pattern of catch

In the Kushiyara River, catches remained relatively stable between February and August 1993, despite considerable increases in discharge (Fig. 5.1). During the drawdown, catches rose moderately in September and greatly in October before declining equally rapidly in November. Winter catches increased slightly in January and February as a result of *katha* harvesting.

Seasonal variation in catch followed a different pattern in the Juri River, the main drainage route of Hakaluki *Haor*. Catches were low in February and March 1993 when local rainfall and river flooding expanded *beel* areas. In April catches increased sharply coinciding with increased rainfall runoff from floodplains/*beel* to river. In May and June catches dropped to the lowest level of the year coinciding with the a rapid and large rise in water levels of the Kushiyara and Juri rivers and the submergence of much of the sampled stretch of Juri. Catches increased slightly in July and August and more sharply in September as water levels rapidly decreased during the second half of the month. From a peak in September, catches declined a little in October and stabilized in November, before declining more abruptly in December and increasing thereafter, mainly as a result of *katha* fishing.

On the regulated Khorodari *Khal* draining the MIP, catches remained low from February to July, despite major rainfall runoff during May which would normally be expected to stimulate increased fishing activity and raise catches. Flood levels increased so rapidly, however, that more than 80% of the sampled reach was completely submerged and indistinguishable from the rest of the *haor*, leaving only a 500 m length immediately in front of the sluice gates visible. Catches from this stretch of canal remained low throughout the monsoon and drawdown period between September and October. From November onwards,

**Figure 5.1 Seasonal variation in the catch (kg/km) from rivers and canals inside and outside the MIP, February 1993 - February 1994**




Note: Site NE03 was totally submerged from June to September 1993 and was not surveyed in January and February 1994 when the full length of canal emerged once again, catches increased progressively until February when there was a marked decline.

On Akali *Gang*, one of the natural feeder canals inside the MIP, catches were low from February to May. From June until September, the canal was completely submerged and indistinguishable from the floodplain and therefore, as with the Juri River and Khorodari *Khal*, could not be surveyed as a water body distinct from flooded land. The canal re-emerged in October and supported relatively high catches as fish moved off the drying floodplains towards the centre of the *haor* or the Kushiyara River. Catches peaked in November but decreased equally rapidly in December. The canal was not sampled in January and February 1994 since fisheries survey teams had to be permanently posted on the more important leased *beel* fisheries to monitor daily catches.

### 5.1.2 Size of catch

Between March 1993 and February 1994, the total annual catch from the Juri River was 2,726 kg/km and 723 kg/ha compared with 4,049 kg/km and 1,498 kg/ha from Khorodari *Khal* inside the MIP (Table 5.1). Although statistical comparison of fish densities between sites was made difficult by major differences in gear usage, limited analyses on two dominant gears revealed no significant difference in catch rates. The higher catch from Khorodari *Khal* resulted therefore from higher fishing effort by dominant gears such as *veshal*, *katha* and *ghori jal*.

**Table 5.1 Comparison of the annual catch from canals and rivers inside and outside the MIP, March 1993 - February 1994**

| Site code | Site name | Inside/ Outside MIP | Annual catch | | |
|---|---|---|---|---|---|
| | | | Total (kg) | Kg/ha | Kg/km |
| NE07 | Juri River | Outside | 26,035 | 723 | 2,726 |
| NE01 | Khorodari *Khal* | Inside | 16,481 | 1,498 | 4,069 |
| NE03 | Akali *Gang* | Inside | 4,463 | 412 | 1,750 |
| NE06 | Kushiyara River | Outside | 46,155 | 486 | 4,396 |

The catch from Khorodari *Khal* was also substantially higher than that from Akali *Gang* (1,750 kg/km). The difference between canals was related to their function; *Akali Gang* is a feeder canal supplied by rainfall runoff from the Bhatera Hills whereas Khorodari *Khal*,

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being the main drainage canal of the *haor*, attracts and concentrates fish during the drawdown. High catches from major drainage systems are characteristic of many flood control projects studied by FAP 17 in other regions of Bangladesh[12, 13].

## 5.2 Pattern of Fishing

### 5.2.1 Catch by gear

Percentage contributions made by dominant gears to the annual catch from canals and rivers are presented in Table 5.2. More detailed information on percentage monthly and annual catches of all observed gears is given in Tables 5.3 to 5.6.

**Table 5.2 Percentage contribution (by weight) to the total annual catch made by dominant gears in canals and rivers inside and outside the MIP, March 1993 -February 1994**

| Gear | Inside MIP | | Outside MIP | Outside MIP |
|---|---|---|---|---|
| | Khorodari *Khal*: site NE01 | Akali *Gang*: site NE03 | Juri River: site NE07 | Kushiyara River: site NE06 |
| *Katha* | 26.8 | - | 14.4 | 8.8 |
| *Veshal* | 25.4 | - | 14.0 | 8.7 |
| *Ghori jal* | 21.3 | - | - | - |
| *Uttar jal* | 9.9 | - | 27.3 | 14.5 |
| *Chandi jal* | 4.6 | - | - | - |
| *Daun* | 2.5 | - | - | 5.2 |
| *Dara jal* | - | 37.2 | - | - |
| *Thella jal* | - | 25.5 | 4.7 | 12.7 |
| *Ber jal* | - | 21.4 | 22.6 | 16.2 |
| *Doiar* trap | - | 7.4 | - | - |
| *Jhaki jal* | - | - | 6.8 | - |
| *Sip* | - | - | 2.2 | 7.8 |
| *Afa/Hat bauli* | - | - | - | 15.3 |
| *Shangla jal* | - | - | - | 6.0 |

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

Table 5.3 Percentage monthly catch from Juri River by gear type: outside MIP (site NE07)

| Gear | | Year: 1993 | | | | | | | | | | | Year: 1994 | | Total annual catch (Mar'93 – Feb'94) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Code | Gear name | Feb | Mar | April | May | June | July | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Kg | % |
| 68 | *Uttar jal* | 15.372 | 5.995 | 2.225 | 29.098 | 20.174 | 65.839 | 75.923 | 37.444 | 55.413 | 13.452 | – | 2.023 | 40.009 | 7115.899 | 27.332 |
| 45 | *Ber jal* | 22.274 | 12.664 | 77.090 | – | – | 16.855 | 5.599 | 38.019 | 26.382 | – | – | – | – | 5870.430 | 22.549 |
| 270 | *Katha* | 10.351 | – | – | – | – | – | – | – | – | – | 73.555 | 83.989 | 36.875 | 3755.604 | 14.425 |
| 266 | *Veshal* | 3.754 | 26.773 | 7.527 | 56.679 | 79.826 | 17.306 | 2.843 | 4.010 | 2.085 | 42.676 | 11.876 | – | 7.146 | 3634.596 | 13.961 |
| 164 | *Jhaki jal* | 26.412 | 25.176 | 2.350 | 11.116 | – | – | – | 1.016 | 3.793 | 16.615 | 9.403 | 3.286 | 7.481 | 1778.936 | 6.833 |
| 255 | *Thella jal* | 8.778 | 12.839 | 0.692 | – | – | – | 2.400 | 10.900 | – | 13.281 | 0.894 | – | – | 1223.862 | 4.701 |
| 30 | *Sip* | – | 0.221 | 0.098 | – | – | – | 2.022 | 2.297 | 3.787 | 7.400 | 2.543 | – | – | 566.926 | 2.178 |
| 321 | *Afa/Hat bauli* | – | – | 5.638 | – | – | – | – | – | – | 1.153 | – | 7.689 | 3.686 | 509.179 | 1.956 |
| 95 | *Doiar trap* | 8.515 | 16.138 | 4.004 | 3.107 | – | – | – | – | – | – | – | – | – | 450.429 | 1.730 |
| 325 | *Dora jal* | – | 0.194 | 0.376 | – | – | – | – | 1.105 | 6.249 | 4.381 | – | – | – | 440.731 | 1.693 |
| 301 | *Chunga* | 1.236 | – | – | – | – | – | – | – | – | – | 1.730 | 3.014 | 4.640 | 211.996 | 0.814 |
| 272 | *Daun* | – | – | – | – | – | – | 1.805 | 3.549 | – | – | – | – | – | 167.666 | 0.644 |
| 286 | *Deal trap* | – | – | – | – | – | – | – | 1.513 | 2.291 | 0.340 | – | – | – | 154.092 | 0.592 |
| 65 | *Chandi jal* | – | – | – | – | – | – | 9.408 | – | – | – | – | – | – | 118.125 | 0.454 |
| 307 | Hand fishing | – | – | – | – | – | – | – | – | – | 0.703 | – | – | 0.163 | 30.143 | 0.116 |
| 234 | *Shangla jal* | – | – | – | – | – | – | – | 0.147 | – | – | – | – | – | 6.000 | 0.023 |
| 88 | *Current jal (Stationary)* | 3.309 | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| | | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 26034.614 | 100 |

Note: – denotes zero catch

Table 5.4 Percentage monthly catch from Khorodari Khal by gear type: inside MIP (site NE01)

| Gear Code | Gear name | Year: 1993 | | | | | | | | | | Year: 1994 | | Total annual catch (Mar'93 – Feb'94) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Feb | Mar | April | May | July | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Kg | % |
| 270 | *Katha* | – | 25.628 | – | – | – | – | – | – | 1.532 | 1.431 | 82.989 | 12.515 | 4413.425 | 26.779 |
| 266 | *Veshal* | 44.026 | 35.879 | 93.856 | 100.000 | 65.662 | – | – | 27.651 | 4.618 | 30.805 | 9.699 | 35.005 | 4188.241 | 25.412 |
| 320 | *Ghori jal* | 23.503 | – | – | – | – | – | – | – | 74.962 | 32.289 | 2.231 | – | 3516.315 | 21.335 |
| 68 | *Uttar jal* | 4.142 | 24.667 | – | – | – | – | – | 18.593 | 18.604 | 16.855 | – | 13.329 | 1631.214 | 9.897 |
| 65 | *Chandi jal* | – | – | – | – | – | – | – | – | – | 18.297 | 2.825 | – | 764.778 | 4.640 |
| 272 | *Daun* | – | – | – | – | – | 32.388 | 37.708 | 20.946 | – | – | – | – | 419.085 | 2.543 |
| 45 | *Ber jal* | – | – | – | – | – | – | – | – | – | – | – | 23.962 | 327.600 | 1.988 |
| 255 | *Thella jal* | 3.180 | 0.975 | 5.038 | – | – | 42.227 | – | 13.925 | – | – | – | – | 314.999 | 1.911 |
| 123 | *Koi jal* | – | – | – | – | – | 18.053 | 42.632 | 8.156 | – | – | – | – | 277.537 | 1.684 |
| 164 | *Jhaki jal* | 19.929 | 2.049 | – | – | – | – | – | – | – | – | 0.973 | 15.189 | 265.717 | 1.612 |
| 89 | *Dhor jal* | – | 9.174 | – | – | – | – | 18.023 | – | – | – | – | – | 112.445 | 0.682 |
| 88 | *Current jal (Stationary)* | – | – | 1.106 | – | 21.396 | 7.331 | 0.648 | 1.306 | 0.284 | 0.322 | – | – | 82.693 | 0.502 |
| 202 | *Moi jal* | 5.219 | 1.628 | – | – | – | – | 0.989 | – | – | – | 1.284 | – | 74.254 | 0.451 |
| 329 | *Dara jal* | – | – | – | – | – | – | – | 7.916 | – | – | – | – | 70.701 | 0.429 |
| 30 | *Sip* | – | – | – | – | – | – | – | 1.507 | – | – | – | – | 13.463 | 0.082 |
| 105 | *Dharma jal* | – | – | – | – | 12.942 | – | – | – | – | – | – | – | 8.667 | 0.053 |
| | | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 16481.134 | 100 |

Notes: 1. No fishing activities were observed in June 1993

2. – denotes zero catch

## Table 5.5 Percentage monthly catch from Akali Gang by gear type: inside MIP (site NE03)

| Gear | | Year:1993 | | | | | | | Total annual cach (Mar'93 – Feb '94) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Code | Gear name | Feb | Mar | April | May | Oct | Nov | Dec | Kg | % |
| 329 | *Dara jal* | – | – | – | – | 88.976 | 36.082 | 11.826 | 1658.523 | 37.165 |
| 255 | *Thella jal* | 74.126 | 71.702 | 72.101 | 19.775 | 8.669 | 12.693 | 63.900 | 1138.263 | 25.507 |
| 45 | *Ber jal* | – | – | – | – | – | 48.825 | – | 956.391 | 21.431 |
| 95 | *Doiar trap* | – | – | – | 73.033 | – | – | – | 331.798 | 7.435 |
| 164 | *Jhaki jal* | 25.874 | 25.230 | 27.899 | – | – | 2.400 | 5.558 | 180.523 | 4.045 |
| 266 | *Veshal* | – | – | – | – | – | – | 17.754 | 126.755 | 2.840 |
| 89 | *Dhor jal* | – | – | – | 7.192 | – | – | – | 32.674 | 0.732 |
| 88 | *Current jal (Stationary)* | – | – | – | – | 2.355 | – | – | 22.959 | 0.514 |
| 307 | Hand fishing | – | 3.068 | – | – | – | – | 0.962 | 14.711 | 0.330 |
| | | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 4462.597 | 100 |

Notes: 1. No fishing activities were observed from June to September 1993 and from January to February 1994

2. – denotes zero catch

Table 5.6 Percentage monthly catch from Kushiyara River by gear type: outside MIP (site NE06)

| Gear Code | Gear name | Year: 1993 | | | | | | | | | | | Year: 1994 | | Total annual catch (Mar'93 – Feb'94) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Feb | Mar | April | May | June | July | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Kg | % |
| 45 | *Ber jal* | 53.568 | 60.764 | 59.570 | – | – | – | – | – | 12.407 | 2.448 | 4.473 | 6.900 | 47.021 | 7460.412 | 16.164 |
| 321 | *Afa/Hat bauli* | 0.376 | – | 1.340 | 15.195 | 61.938 | 35.645 | 46.794 | 42.862 | 0.270 | 4.792 | – | – | – | 7066.152 | 15.310 |
| 68 | *Uttar jal* | 29.945 | 18.145 | 27.298 | 22.337 | 0.575 | 0.750 | 28.166 | 11.937 | 7.607 | 22.693 | 30.949 | 13.128 | 12.706 | 6686.065 | 14.486 |
| 255 | *Thella jal* | 0.266 | 4.929 | 0.193 | 5.233 | – | 1.193 | 6.340 | 7.042 | 48.254 | 2.379 | 2.061 | – | 0.129 | 5867.198 | 12.712 |
| 270 | *Katha* | – | – | – | – | – | – | – | – | – | – | 25.692 | 68.482 | 18.659 | 4063.808 | 8.805 |
| 266 | *Veshal* | – | 5.182 | 3.099 | 6.870 | 6.275 | 38.833 | 7.696 | 9.600 | 10.497 | 23.923 | 0.679 | – | – | 4026.725 | 8.724 |
| 30 | *Sip* | 8.220 | 5.105 | 1.611 | – | – | – | – | 2.029 | 10.353 | 21.524 | 19.287 | 6.991 | 17.266 | 3593.804 | 7.786 |
| 234 | *Shangla jal* | – | – | 3.204 | 17.304 | 30.496 | 19.553 | 6.735 | 9.175 | 1.161 | – | – | – | – | 2749.583 | 5.957 |
| 272 | *Daun* | 0.631 | 2.656 | – | 19.879 | 0.715 | 2.663 | 3.160 | 13.833 | 4.225 | 12.435 | 0.870 | 0.726 | 2.349 | 2395.693 | 5.191 |
| 164 | *Jhaki jal* | – | 1.557 | 1.229 | 3.293 | – | 0.910 | 0.103 | 2.736 | 3.361 | 7.581 | 4.306 | 3.197 | 1.201 | 1192.411 | 2.583 |
| 95 | *Doiar trap* | – | 1.662 | 1.412 | 6.695 | – | 0.453 | 0.586 | – | – | – | – | – | – | 270.872 | 0.587 |
| 152 | *Tana Barsi* | 5.280 | – | – | – | – | – | – | – | – | 0.695 | 6.552 | 0.438 | – | 219.678 | 0.476 |
| 325 | *Dora jal* | – | – | – | – | – | – | – | – | – | – | 5.132 | – | 0.669 | 171.110 | 0.371 |
| 286 | *Deal trap* | – | – | – | – | – | – | 0.419 | 0.620 | 0.768 | – | – | – | – | 121.378 | 0.263 |
| 105 | *Dharma jal* | – | – | 1.045 | 3.193 | – | – | – | 0.166 | 0.114 | – | – | – | – | 117.528 | 0.255 |
| 282 | *Current jal (Drifting)* | – | – | – | – | – | – | – | – | 0.807 | – | – | 0.138 | – | 86.356 | 0.187 |
| 149 | *Horgra* | – | – | – | – | – | – | – | – | 0.178 | 1.530 | – | – | – | 66.185 | 0.143 |
| 126 | *Ferra jal* | 1.715 | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| | | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 46154.962 | 100 |

Note: – denotes zero catch

A total of 17 different types of gear was recorded on the unregulated Juri River compared with 16 types of the regulated Khorodari *Khal*. Gear usage between sites differed considerably. On the Juri, drifting *uttar jal* took 27% of the annual catch, compared with 10% on the regulated canal. The difference between sites was related to the greater current speeds and flow in the Juri which favoured this fishing technique. *Ber jal* were used at both sites but provided 23% of the Juri catch compared with only 2% from Khorodari *Khal*. Other gears which caught higher shares of the catch on the Juri than on the regulated canal included small-scale gears such as *jhaki jal*, *thella jal* and, to a lesser degree, *sip*. In contrast, gears which predominate more on the canal comprised large-scale gears such as *veshal*, *ghori jal* and *katha*, all of which were under the control of the leaseholder of Khorodari *Khal*. These three gears together accounted for 74% of the annual catch.

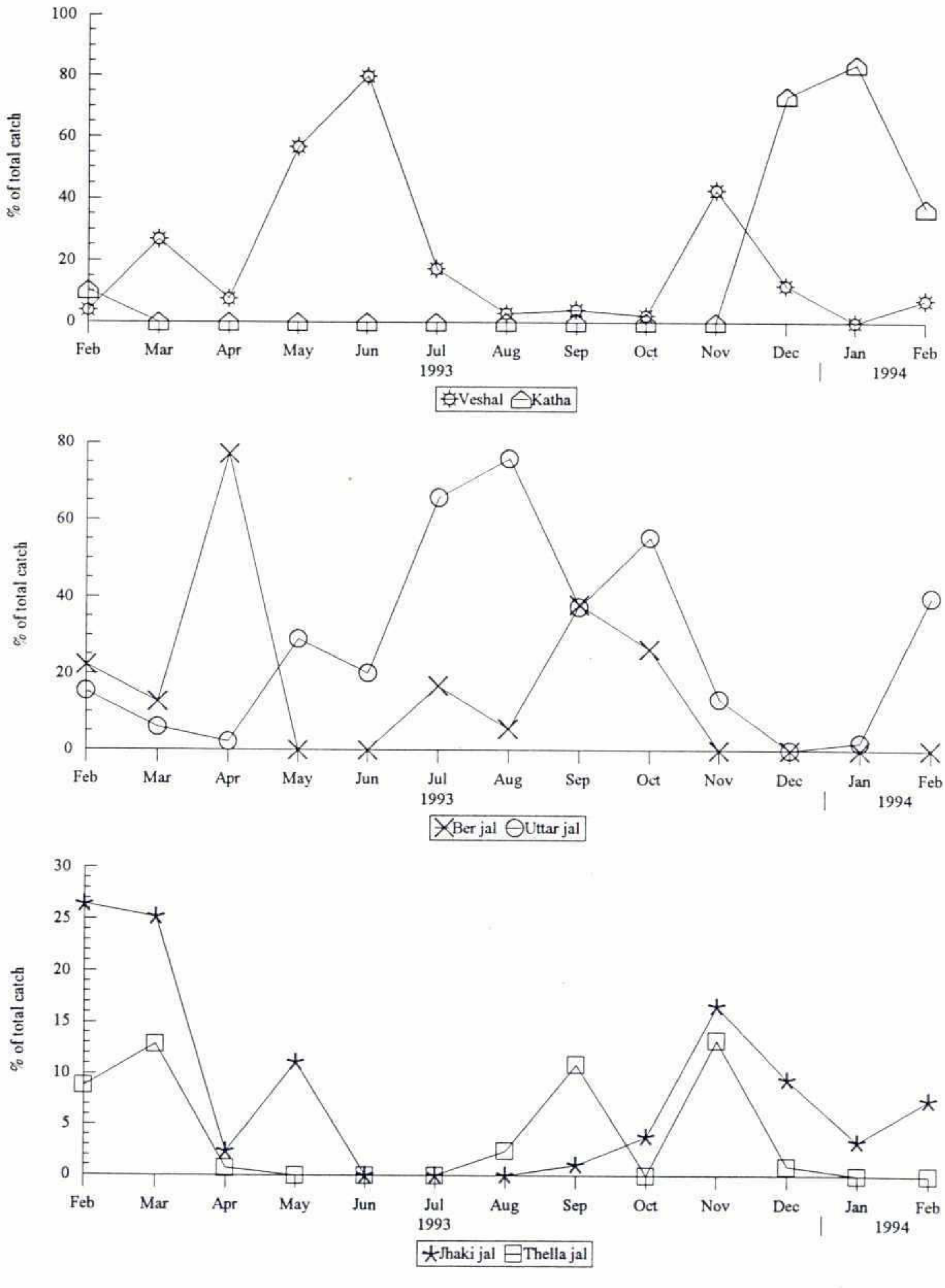
On the feeder canal, Akali *Gang*, inside the MIP, only 9 different gear types were recorded. Of these, three dominated catches: *dora jal*, 37%, *thella jal*, 26% and *ber jal*, 21%. The *dora jal* functioned in essentially the same way as the *ghori jal* set on Khorodari *Khal*; both used a barrier set across the canal to funnel fish towards the net.

A total of 18 different gear types was recorded on the Kushiyara River. Drifting gears such as *afa jal*, *uttar jal* and *shangla jal* captured 36% of the annual catch. These gears utilised the greater current speeds of this large river and one gear, *shangla jal*, specifically targeted upstream migrating *ilish*.

### 5.2.2 Catch by gear by month

On the Juri River during March, *veshal* took the largest share of the catch (27%) while small-scale gears such *jhaki jal* captured a further 25% and *doiar* traps and *thella jal* took 16% and 13% respectively (Fig. 5.2). In the following month, *ber jal* predominated, taking 77% of the catch which was a considerable increase compared with previous months. As river discharge and water levels rapidly rose in May, *veshal* and *uttar jal* gained in importance but the monthly catch dropped. In June, under higher prevailing flows, only *uttar jal* and *veshal* fished and accounted for the lowest monthly catch of the year. Similarly, in July, these two gears again took a high proportion (83%) of the catch, with most (65%) provided by *uttar jal*. In August, *uttar jal* provided 76% of the catch and a further 9% was taken by drifting gill nets, *chandi jal*. At this time of the year, the upper reaches of the sampled site were submerged and indistinguishable from the floodplain so that the drifting gears such as *uttar jal* and *chandi jal* operated mainly in the lower reaches of the Juri near the confluence with the Kushiyara River.

**Figure 5.2 Percentage of total monthly catch taken by dominant gears: Juri River (site NE07, outside MIP)**



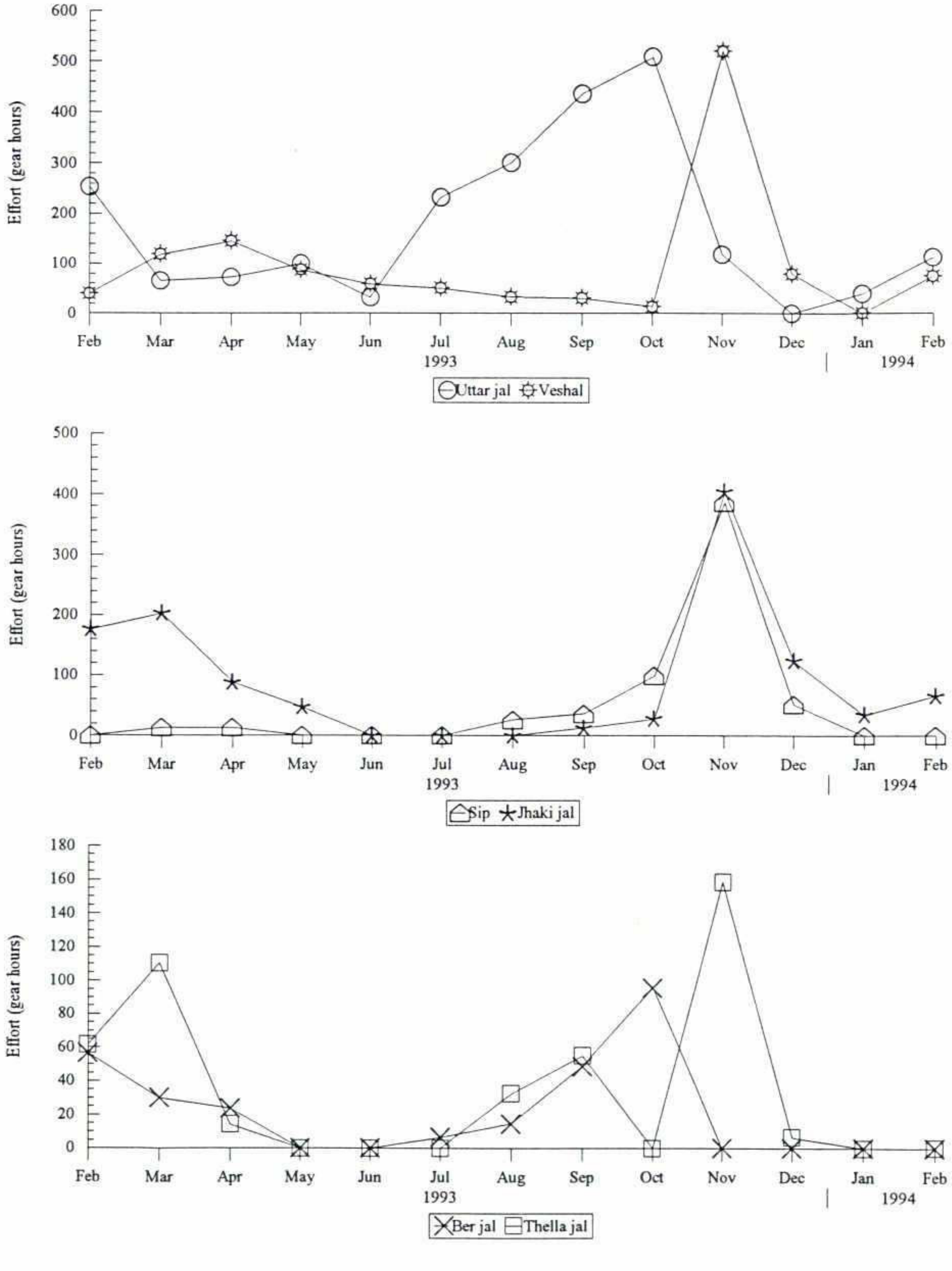
During the drawdown from September to November, when peak catches were recorded, *uttar jal* provided 13% to 55% of monthly catches. *Ber jal* increased in importance, taking 78% to 36% in September and October, while in November *veshal* accounted for almost half the catch. Peak catches were caused by peak fishing effort by dominant gears (Fig. 5.3) and high catch rates (Fig. 5.4). During the early winter, *katha* harvests accounted for the bulk of the catch but later, in February 1994, *uttar jal* captured the highest share.

On Khorodari *Khal*, three gears, *uttar jal*, *veshal* and *katha* accounted for 86% of the catch in March (Fig. 5.5). From April to July, *veshal* took most of the catch and in May was the only gear fishing in the short reach near Kashimpur sluice gates which was not submerged by rising floods. During August and September, *daun* and *koi jal* provided the bulk of the catch but later during the drawdown, as the canal re-emerged from submergence, drifting *uttar jal* and *veshal* gained in importance. In November, *ghori jal* were set across the canal and captured 75% of the catch, while in December, this gear and *veshal* captured an equal share of the catch, 31-32%. Peak monthly catches recorded between November and January resulted from peak fishing effort and catch rates of dominant gears, particularly *ghori jal*, *veshal* and *katha* (Figs. 5.6 and 5.7). In January, most (83%) of the catch was taken by *katha* while in February, a more equitable distribution of catch was shared between *veshal*, *ber jal*, *uttar jal* and *katha*.

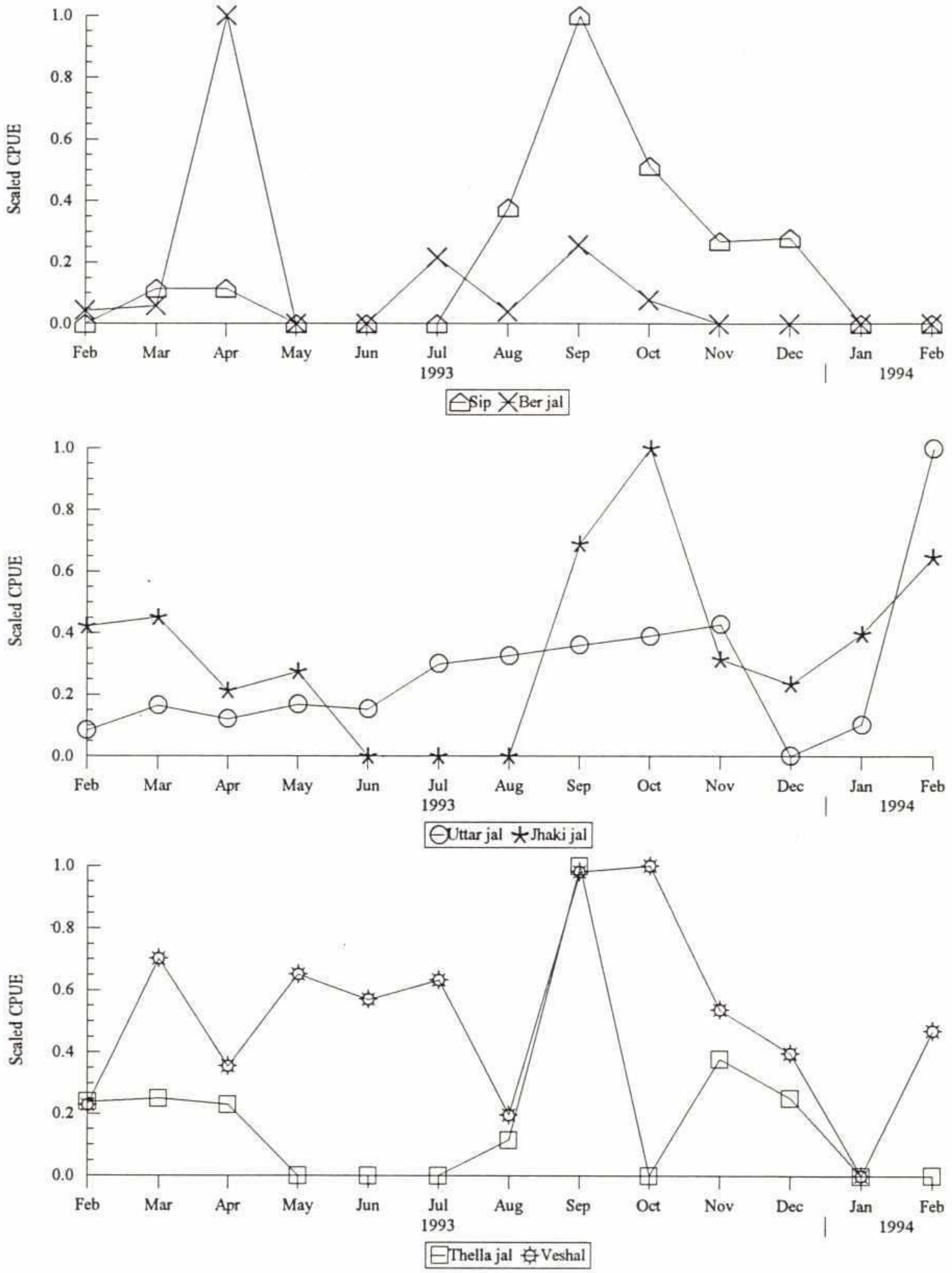
In the feeder canal, Akali *Gang*, inside the MIP, small-scale fishing by *thella jal* and *jhaki jal* dominated catches from February to April 1993 and *doiar* traps predominated in May (Fig. 5.8). The canal remained submerged from June to September. On reappearance in October, *dora jal* captured the bulk of the catch but as water levels dropped in November, *ber jal* increased in importance. Water levels continued to drop in December allowing *thella jal* to move in and capture most of the catch.

On the Kushiyara River, *ber jal* accounted for 55% to 61% of the monthly catches in February to April 1993 (Fig. 5.9). *Uttar jal* captured a further 18% to 30% during the same period. As flows increased from May to July drifting *afa jal* and *shangla jal* caught high shares of the catch as did *veshal*, but only in July. The *shangla jal* targeted an upstream spawning migration by *ilish*. In August and September *afa jal* accounted for almost half the catch but *uttar jal* also regained dominance. As water levels dropped in October and November, a larger range of gears shared the bulk of the catch. These included *thella jal*, *veshal* and *sip*, in addition to *uttar jal*. *Katha* harvesting started in December and provided a quarter of the monthly catch, rising to 68% in January. Later, in February, *ber jal* captured almost half the monthly catch but small-scale fishing by *sip* was also important and provided 17% of the catch.

**Figure 5.3 Total monthly fishing effort per kilometre of Juri River by dominant gears: (site NE07, outside MIP)**



## Figure 5.4 Scaled CPUE of dominant gears: Juri River (site NE07, outside MIP)




Note: Scaled CPUE are values of CPUE expressed as a proportion (decimal) of the maximum monthly value recorded

**Figure 5.5 Percentage of total monthly catch taken by dominant gears: Khorodari *Khal* (site NE01, inside MIP)**

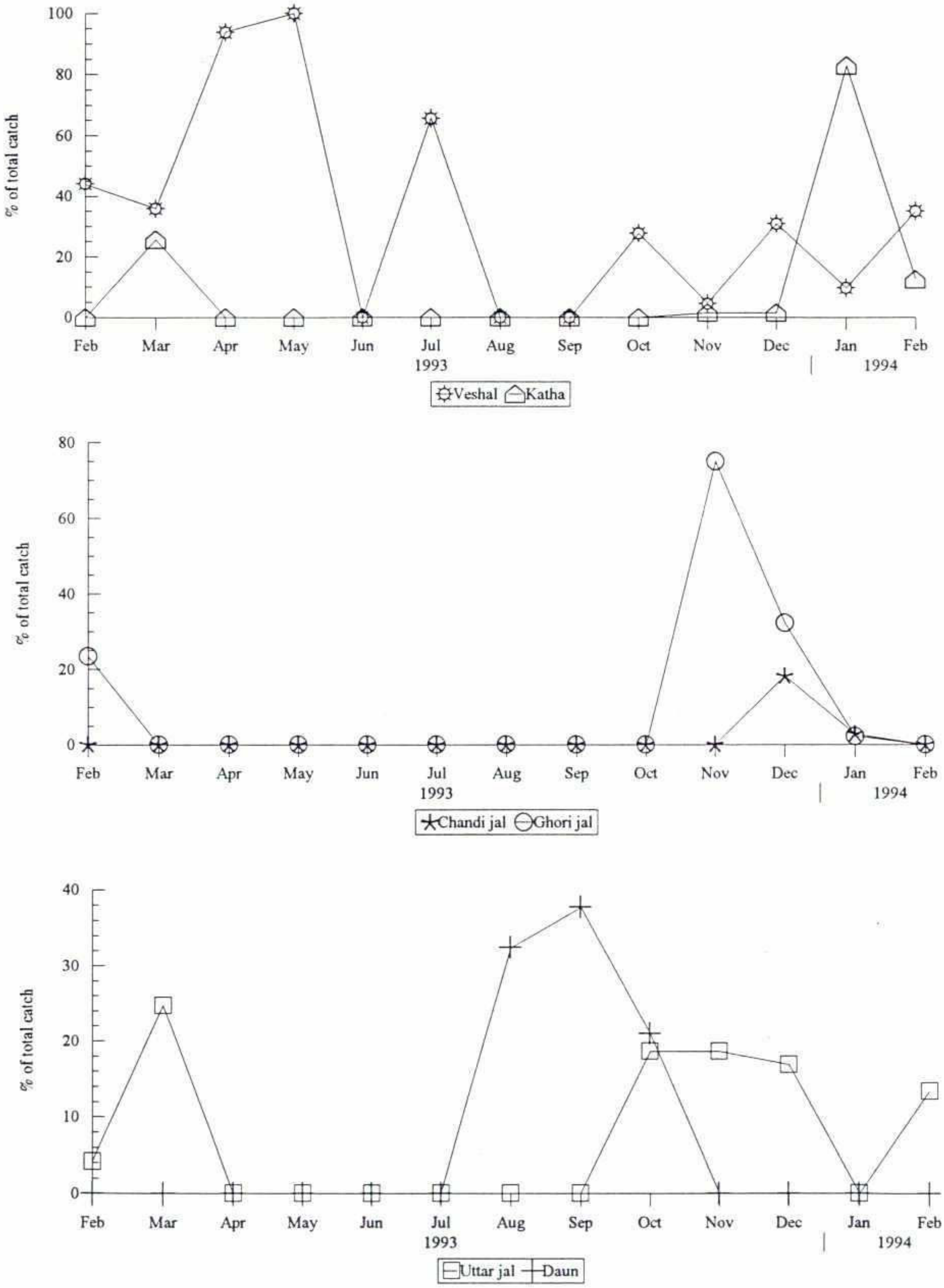


**Figure 5.6 Total monthly fishing effort per kilometre of Khorodari *Khal* by dominant gears: (site NE01, inside MIP)**

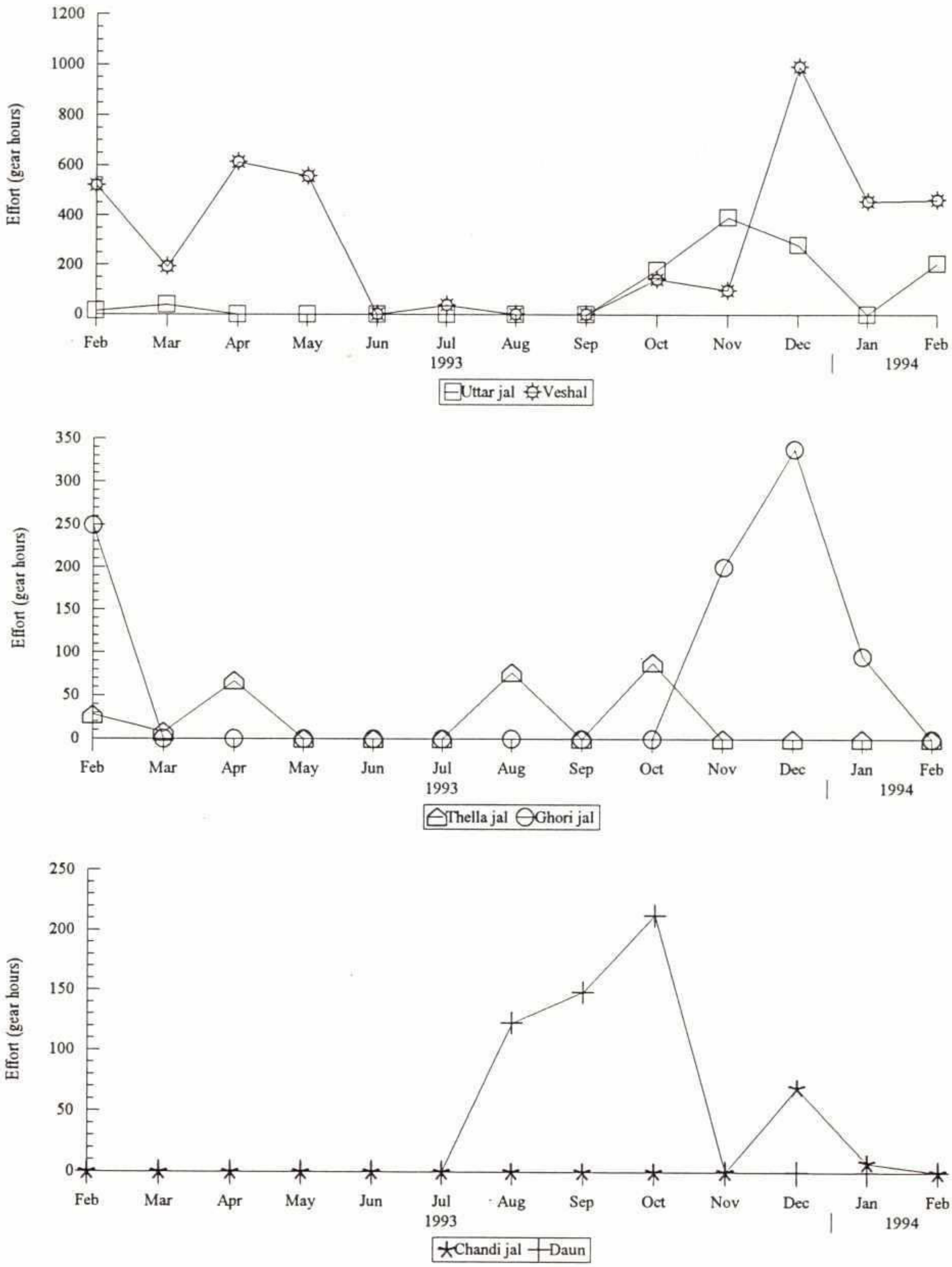
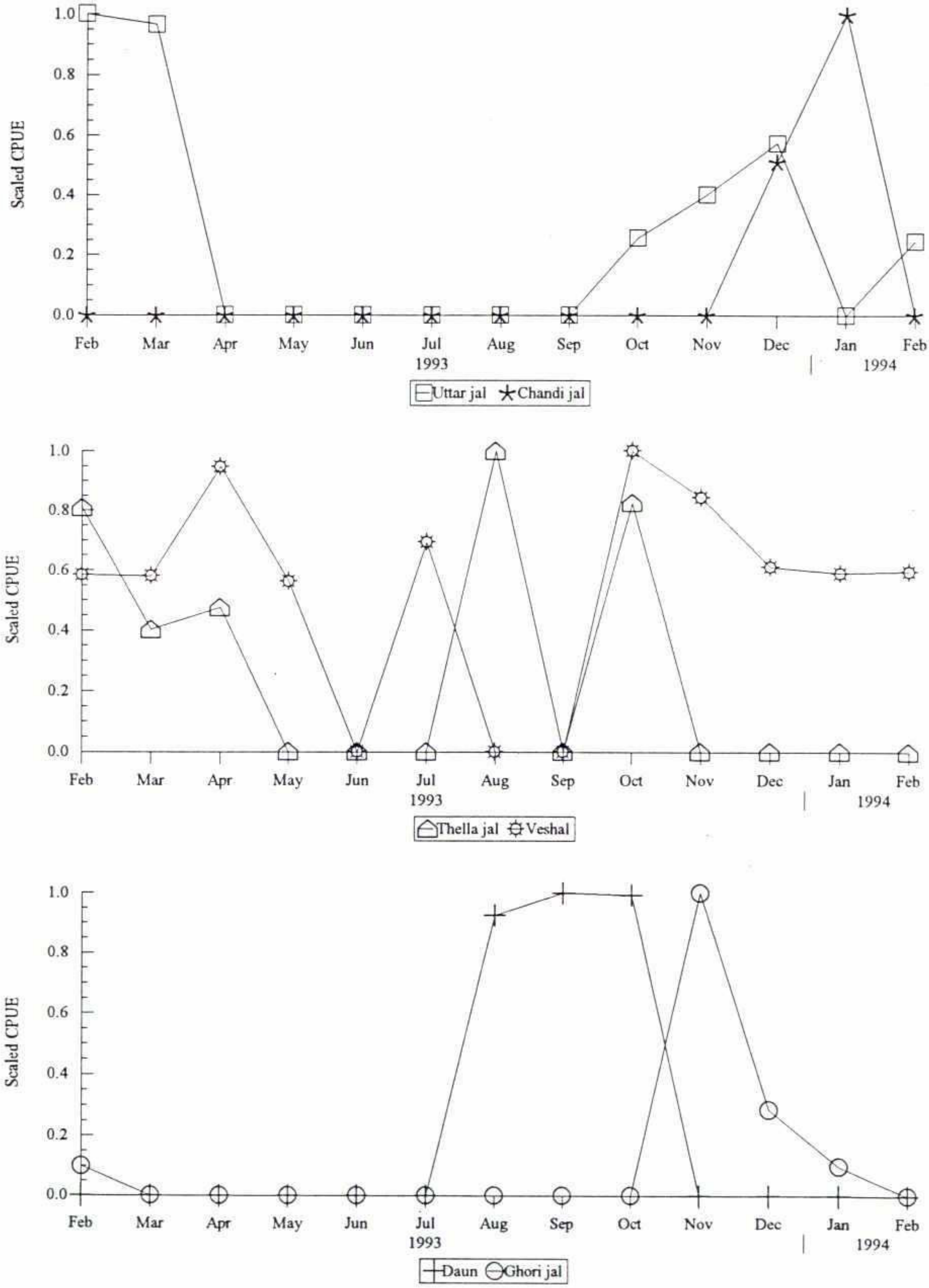


**Figure 5.7 Scaled CPUE of dominant gears: Khorodari *Khal* (site NE01, inside MIP)**




Note: Scaled CPUE are values of CPUE expressed as a proportion (decimal) of the maximum monthly value recorded

**Figure 5.8 Percentage of total monthly catch taken by dominant gears: Akali *Gang* (site NE03, inside MIP)**

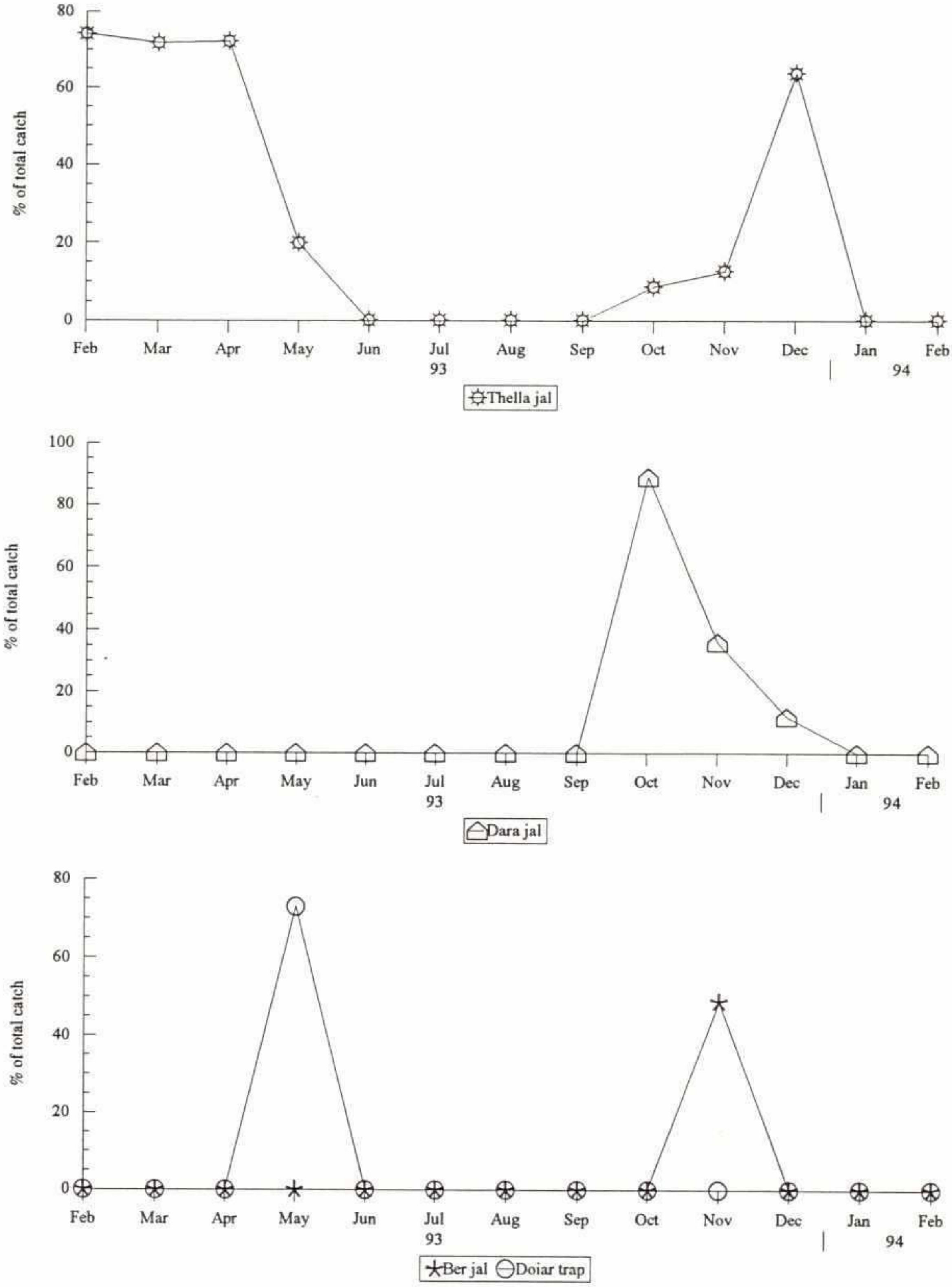
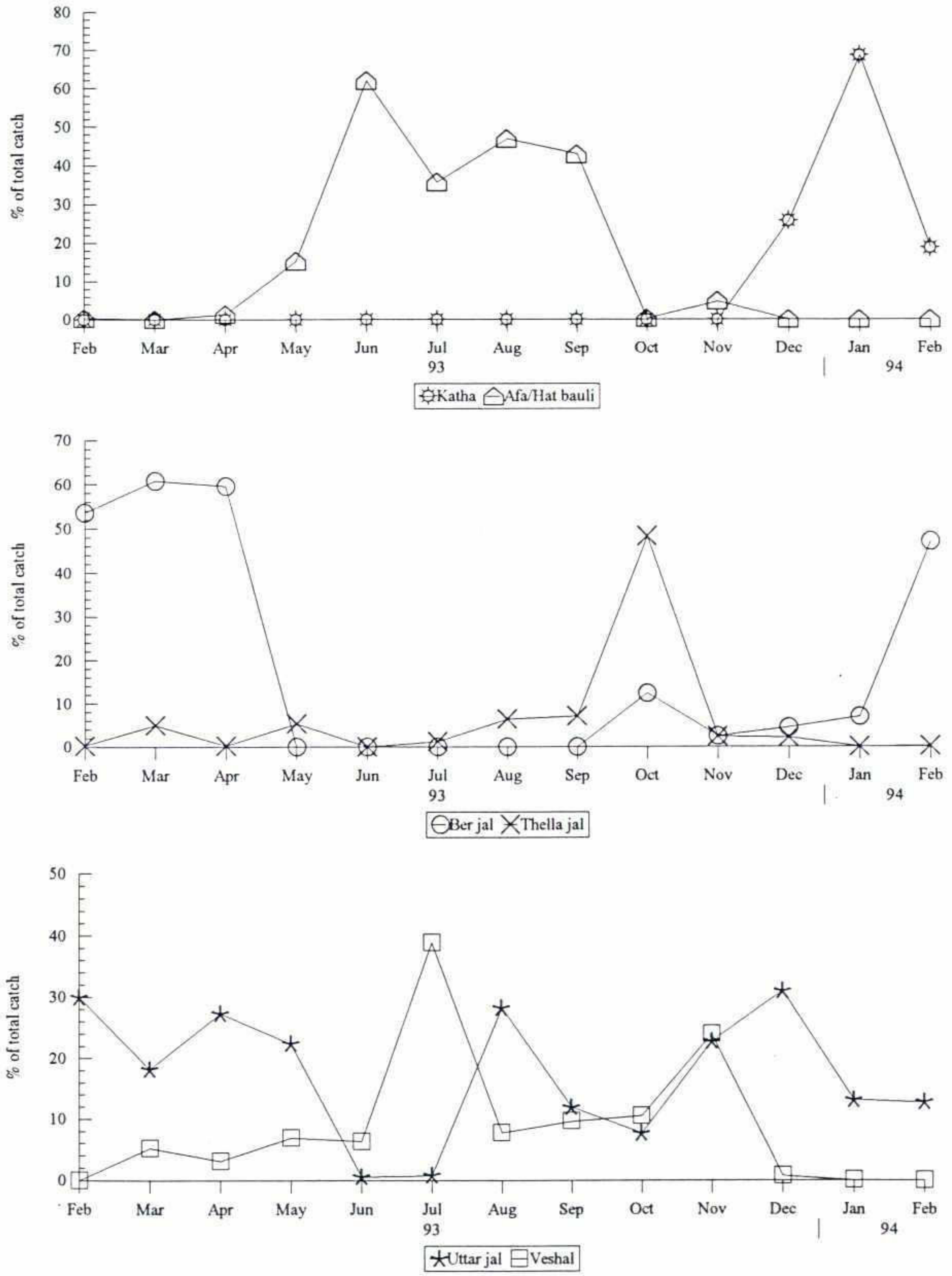


**Figure 5.9 Percentage of total monthly catch taken by dominant gears: Kushiyara River (site NE06, inside MIP)**



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## 5.3 Statistical Comparison of Catch Rate from Canals Inside and Outside the MIP

Statistical analyses of seasonally pooled catch rates of dominant gears used on Khorodari *Khal* inside the MIP and on the Juri River outside it, were attempted using the method outlined in Appendix 3 of the Draft Final Report. The underlying assumption of the method was that once differences in catchabilities between gears were accounted for, any further differences in catch rates inside and outside the MIP were due solely to differences in fish densities.

Inspection of catch rate trends and patterns of use of gears common to both sites revealed substantial difference which precluded statistical comparison using the proposed model. An alternative method was therefore applied which involved separate analyses of catch rates of two dominant gears, *uttar jal* and *veshal*, which together accounted for 41% of the annual Juri catch and 35% at Khorodari *Khal* (Fig. 5.10). Mean catch rates of each gear were compared for each of five seasons, where data were available, and for all seasons combined between March 1993 and February 1994 (Table 5.7). The non-parametric Mann-Whitney U-test was used since initial tests indicated that catch rate data were not normally distributed. The parametric Student's t-test on logarithmic transformed catch rates, however, produced essentially the same results as those shown in Table 5.7. Of the 10 gear/season combinations examined statistically, a significant difference was found in only one case: the catch rate of *uttar jal* was significantly higher in Khorodari *Khal* between March and April 1993. In other seasons, however, catch rates were higher in the Juri River but differences were not statistically significant. From these results it can be concluded tentatively that there was no significant difference between fish densities in drainage system inside and outside the MIP. The higher catch from Khorodari *Khal* therefore resulted from higher fishing effort by dominant gears such as *ghori jal*, which was not used on the Juri, and by *veshal* (Table 5.8).

**Figure 5.10 Comparison of mean monthly catch rates (kg/hr) of dominant gears used on the Juri River and Khorodari *Khal***

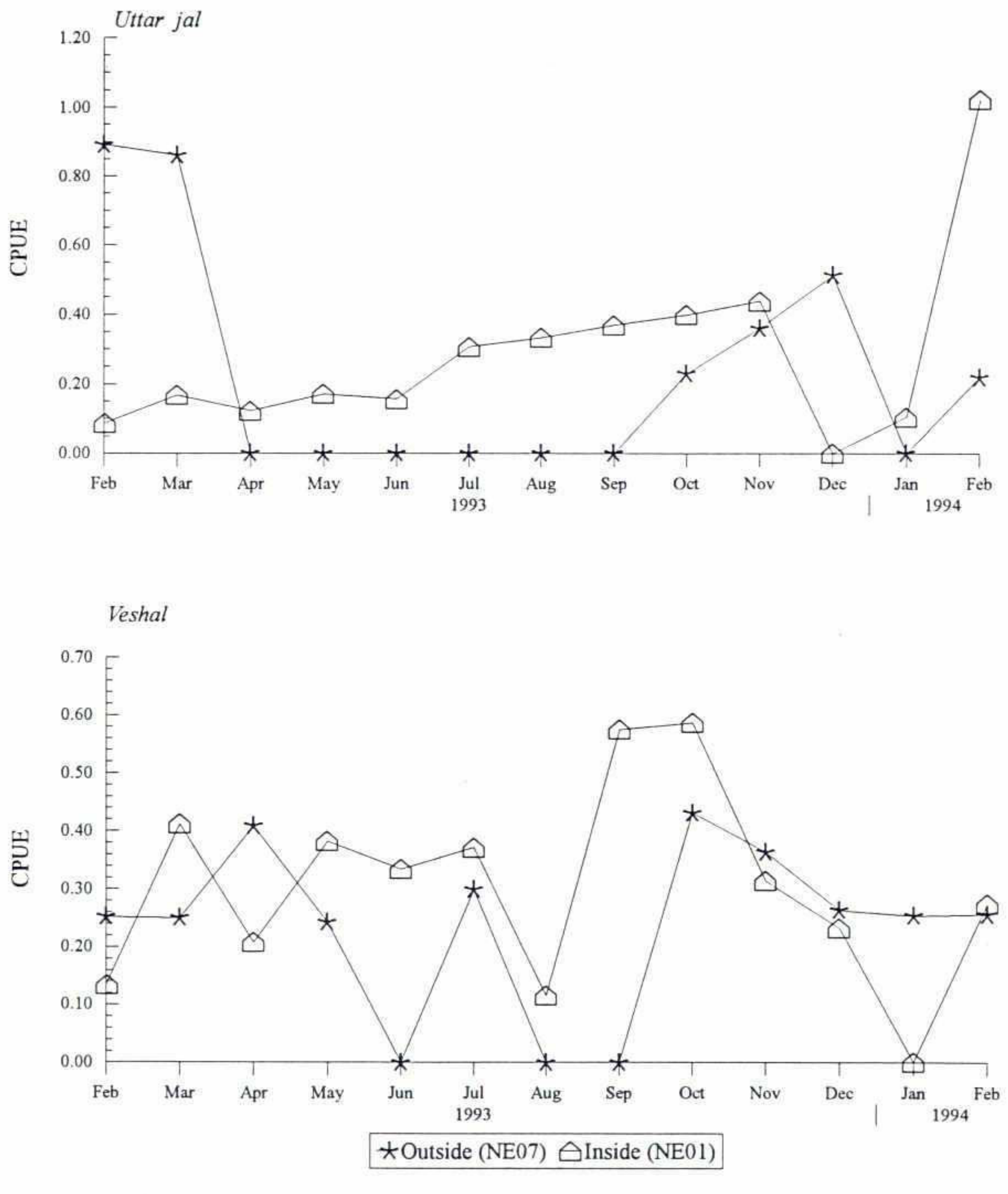

**Table 5.7** Statistical comparison of mean catch rates (kg/hr) of dominant gears used on the regulated Khorodari *Khal* and unregulated Juri River, March 1993 - February 1994

| Gear | Season | Juri River: Outside MIP | | Khorodari *Khal:* Inside MIP | | Non-parametric Mann-Whitney U-test on CPUE | | |
|---|---|---|---|---|---|---|---|---|
| | | Sample size | Mean CPUE | Sampled size | Mean CPUE | Z-value | P-value | Comment |
| *Uttar jal* | 1 | 8 | 0.174 | 3 | 0.904 | -2.45 | 0.014 | SIG |
| | 4 | 12 | 0.452 | 8 | 0.312 | -0.93 | 0.354 | NS |
| | 5 | 11 | 0.603 | 11 | 0.494 | -1.21 | 0.224 | NS |
| | All season | 31 | 0.434 | 22 | 0.484 | -0.02 | 0.986 | NS |
| *Veshal* | 1 | 6 | 0.278 | 14 | 0.335 | -0.49 | 0.621 | NS |
| | 2 | 11 | 0.358 | 4 | 0.279 | -0.91 | 0.361 | NS |
| | 3 | 10 | 0.314 | 2 | 0.275 | -0.21 | 0.830 | NS |
| | 4 | 8 | 0.370 | 5 | 0.420 | -0.59 | 0.558 | NS |
| | 5 | 11 | 0.262 | 18 | 0.256 | -0.52 | 0.605 | NS |
| | All season | 46 | 0.317 | 43 | 0.304 | -0.50 | 0.614 | NS |

Notes: 1. NS - Not significant, SIG - Significant at 5% level
2. Seasons: 1. March-April, 2. May-June, 3. July-September, 4. October-November and 5. December-February

**Table 5.8** Comparison of annual fishing effort on the regulated Khorodari *Khal* and the unregulated Juri River, March 1993 - February 1994

| Gear Name | Khorodari *Khal* Site NE01, MIP | Juri River Site NE07 |
|---|---|---|
| *Uttar jal* | 1,095 | 2,013 |
| *Veshal* | 3,545 | 1,206 |

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## 5.4 Biodiversity and Catch Composition

### 5.4.1 Species richness

Between March 1993 and February 1994, 95 species of fish were recorded from the unregulated Juri River (Table 5.9). This compares with 81 species from the regulated Khorodari *Khal*, a reduction in species diversity of 15%. In Table 5.9 species have been divided into three categories of habitat preference based on spatial distributions derived from the 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 direct 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 and therefore have some dependence on floodplains for growth and/or reproduction.

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 occupy a variety of habitats, including large rivers.

It is clear from the results in Table 5.9 that differences between sites were due almost solely to differences in riverine species. In the Juri River, 28 riverine species were recorded compared with only 15 in Khorodari *Khal*, a reduction in diversity of 46%. In contrast, the numbers of migratory species were similar, and numbers of floodplain residents identical, between sites.

In the Kushiyara River, the annual total numbers of species (100) was slightly higher than in the Juri but this was due to the greater diversities of riverine and migratory species. It appears, therefore, that movements of riverine species from external rivers into the MIP were reduced despite numerous breaches in the Manu embankment in early June and two breaches in the Kushiyara embankment in late July together with drainage of floodwaters through open sluice gates on Khorodari *Khal*.

**Table 5.9 Total annual number of fish species, classified by habitat preference, recorded from canals and rivers inside and outside the MIP, March 1993 - February 1994**

| Site name | Site Code | In/Out MIP | Number of species | | | Total |
|---|---|---|---|---|---|---|
| | | | Riverine | Migratory | Floodplain resident | |
| Juri River | NE07 | Out | 28 | 22 | 45 | 95 |
| Khorodari *Khal* | NE01 | In | 15 | 21 | 45 | 81 |
| Akali *Gang* | NE03 | In | 9 | 12 | 37 | 58 |
| Kushiyara River | NE06 | Out | 32 | 25 | 43 | 100 |

In the feeder canal (Akali *Gang*) inside the MIP, species diversity was considerably reduced compared with that in the main drainage canal, Khorodari *Khal*. Greater reductions were observed for riverine (40%) and migratory species (43%) than for floodplain residents (18%).

### 5.4.2 Catch composition

Percentage contributions made by riverine, migratory and floodplain resident species to annual catches from canals and rivers are shown in Table 5.10. On the Juri, riverine species accounted for about 10% of the catch whereas on Khorodari *Khal* they provided less than 2%. In contrast, migratory species contributed less to the Juri catch (40%) than that of Khorodari (49%). Taken together the groups of fish accounted for a similar proportion (50%-51%) of annual catches. Floodplain resident species provided 36% of the catch both inside and outside the MIP.

Percentage catch contributions of individual dominant species showed that 3 riverine species, *kajuli*, *ilish* and *rani*, each comprised slightly more then 1% of the catch while 8 migratory species totalled 35% (Table 5.11). On the Khorodari *Khal* no riverine species formed more than 1% of the annual catch but 10% dominant migratory species provided 48%. Of the 8 dominant migratory species occurring in the Juri River, only 1 species, *mrigel*, was not dominant in Khorodari *Khal* and only 1 other species, *kabashi*, was relatively more abundant outside. Of the 3 most abundant migratory species in Khorodari, *chapila* and *rui* were considerably more abundant inside than outside the MIP while the relative abundances of the third species, *boal*, were similar between sites.

**Table 5.10 Percentage contribution of riverine, migratory and floodplain resident species to annual catches from canals and rivers inside and outside the MIP, March 1993 - February 1994**

| Site code | Site name | Inside/ Outside MIP | % Total annual catch | | |
|---|---|---|---|---|---|
| | | | Riverine | Migratory | Floodplain resident |
| NE07 | Juri River | Outside | 9.6 | 40.2 | 35.9 |
| NE01 | Khorodari *Khal* | Inside | 1.4 | 49.6 | 36.3 |
| NE03 | Akali *Gang* | Inside | 22.9 | 5.9 | 32.6 |
| NE06 | Kushiyara River | Outside | 52.5 | 35.9 | 9.6 |

Nine dominant floodplain resident species were found on the Juri, 6 of which also occurred on the regulated canal. Species which were relatively more abundant outside the MIP included *baral baim*, *guchi baim*, *bailla* and silver carp. The exotic carp species was captured mainly in September and probably originated from flooded carp ponds. Species which were more abundant inside the MIP included *nama chanda*, *taki*, *gajar* and the common carp, another exotic species which probably originated from pond overspills. Prawns were important at both sites but were more abundant inside the MIP where they provided 13% of the catch compared with 9% outside. Turtles, were targeted by hook and line fisheries on Juri where they provided 5% of the catch. These are protected species in Bangladesh and their capture is illegal.

## 5.5 Fish Migration

Seasonal movements of fish were identified from changes in monthly catch compositions (Tables I-IV, Appendix 2) and changes in monthly species numbers and catch contribution of riverine, migratory and floodplain resident fish. Where available, additional information on the average size (weight) of fish was used to determine whether fish were adults or juveniles, and thus whether movements were primarily for growth, breeding or both.

**Table 5.11 Percentage contribution (by weight) to the total annual catch by dominant species from canals and rivers inside and outside the MIP, March 1993 – February 1994**

| Habitat Preference | Scientific name: Scientific | Scientific name: Bengali | Inside MIP: Khorodari *Khal* NE01 | Inside MIP: Akali *Gang* NE03 | Outside MIP: Juri River NE07 | Outside MIP: Kushiyara River NE06 |
|---|---|---|---|---|---|---|
| Riverine | *Rita rita* | *Rita* | – | – | – | 3.9 |
| | *Botia dario* | *Rani* | – | – | 1.2 | 1.1 |
| | *Hilsa ilisha* | *Ilish* | – | – | 1.1 | 19.1 |
| | *Corica soborna* | *Kachki* | – | 22.6 | – | – |
| | *Ailia coila* | *Kajuli* | – | – | 1.4 | 7.4 |
| | *Clupisoma garua* | *Ghaura* | – | – | – | 5.8 |
| | *Clupisoma naziri* | *Muri bacha* | – | – | – | 1.1 |
| | *Bagarius bagarius* | *Baghair* | – | – | – | 1.5 |
| | *Gagata youssoufi* | *Gang tengra* | – | – | – | 5.2 |
| Subtotal | | | – | 22.6 | 3.7 | 45.0 |
| Migratory | *Aorichthys aor* | *Ayre* | 1.0 | – | 2.0 | – |
| | *Aorichthys seenghala* | *Guizza* | 2.8 | – | 3.1 | 2.5 |
| | *Mystus bleekeri* | *Golsha tengra* | 1.1 | – | 3.1 | 1.9 |
| | *Mystus cavasius* | *Kabashi* | 2.3 | – | 10.9 | 11.9 |
| | *Cirrhinus mrigala* | *Mrigel* | – | 1.2 | 1.7 | – |
| | *Labeo calbasu* | *Kalbaus* | 3.8 | – | 5.2 | 2.1 |
| | *Labeo gonius* | *Goni* | 1.2 | – | – | – |
| | *Labeo rohita* | *Rui* | 8.9 | – | – | 1.6 |
| | *Salmostoma phulo* | *Fulchela* | 2.9 | – | – | 3.9 |
| | *Gudusia chapra* | *Chapila* | 15.2 | 3.1 | 1.2 | 2.5 |
| | *Eutropiichthys vacha* | *Bacha* | – | – | – | 2.9 |
| | *Wallagu attu* | *Boal* | 8.7 | – | 8.2 | 1.3 |
| Subtotal | | | 47.8 | 4.3 | 35.4 | 30.5 |
| Floodplain resident | *Mystus vittatus* | *Tengra* | 1.4 | – | 2.4 | – |
| | *Cyprinus carpio* | *Karfu* | 5.9 | – | | – |
| | *Puntius chola* | *Chala puti* | 1.5 | 2.7 | 1.6 | – |
| | *Puntius conchonius* | *Canchan puti* | – | – | 2.3 | – |
| | *Puntius sophore* | *Puti* | – | 4.0 | – | – |
| | *Glossogobius giurus* | *Bailla* | – | 4.1 | 4.2 | – |
| | *Hypophthalmichthys molitrix* | *Silver carp* | – | – | 5.1 | – |
| | *Lepidocephalus guntea* | *Gutum* | – | 1.1 | – | – |
| | *Channa marulius* | *Gajar* | 2.8 | 3.1 | – | – |
| | *Channa punctatus* | *Taki* | 3.3 | 3.2 | – | – |
| | *Macrognathus pancalus* | *Guchi* | – | 1.6 | 2.8 | – |
| | *Mastacembelus armatus* | *Baral baim* | 1.8 | – | 8.3 | 3.3 |
| | *Notopterus notopterus* | *Foli* | 1.5 | – | 1.5 | – |
| | *Chaca chaca* | *Cheka* | – | 2.3 | – | – |
| | *Chanda baculis* | *Chanda* | 2.2 | 1.1 | 2.4 | – |
| | *Chanda nama* | *Nama chanda* | 5.6 | 2.8 | – | – |
| | *Chanda ranga* | *Lal chanda* | 1.0 | 1.3 | – | – |
| Subtotal | | | 27.1 | 27.2 | 30.3 | 3.3 |
| Others | Prawn spp. | *Chingri/Icha* | 12.6 | 38.5 | 8.6 | 4.6 |
| | *Turtle* | *Dur kasim* | – | – | 4.8 | 1.3 |
| Subtotal | | | 12.6 | 38.5 | 13.5 | 6.0 |
| Grand total | | | 87.5 | 92.7 | 82.8 | 84.8 |

Notes: 1. Dominant species are those species contributing 1% or more by weight to the annual catch

2. Shaded values highlight the most important species (>4%)

3. See text for definitions of habitat preference categories (Section 5.4.1)

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Between February and October 1993, total numbers of riverine species recorded each month on the Juri River remained surprisingly stable with the exception of a temporary decrease in May (Fig. 5.11). From November onwards, numbers gradually declined to a minimum in February 1994. Numbers of migratory species fluctuated slightly but again showed no clear seasonal trends nor did floodplain resident species which exhibited the greatest stability throughout the year. While diversities of these different groups of fish remained relatively stable, greater seasonality was evident in their contributions to monthly catches (Fig. 5.12). The percentage catch of riverine species increased through the flood season to reach a peak in August before dropping sharply in September and again in December. Relative abundances of migratory species followed a different pattern, rising slightly in July and August and more steeply during the drawdown in September and October when floodplains dried out. The catch contribution then dropped sharply in November but rose again during the winter when *katha* were harvested.

On the Kushiyara River, a greater degree of seasonality in the diversity of riverine species was observed than that on the Juri (Fig. 5.13). Species numbers rose rather unevenly from June to September then declined progressively until February 1994. Seasonal trends in migratory species numbers were less clear. Again there was an uneven rise from June to September followed by a decline until November, after which numbers rose until January but dropped in February. The percentage catch of riverine species gradually increased in May and June and remained at peak levels until August after which there was an uneven decline to low levels during the winter (Fig. 5.14). In contrast, catch shares of migratory species remained low until August, rose slightly between September and November and then very sharply in December to reach a peak in January and a high level in February when *katha* were harvested.

On the Khorodari *Khal*, species numbers decreased from March until May and no fishing was recorded in June by which time only the final 500 m of canal remained identifiable from the rest of the flooded *haor* (Fig. 5.15). In July, a peak number of species was recorded but this dropped considerably in August before gradually rising again to reach a secondary peak in November. Numbers of migratory species followed a similar pattern until November, after which they continued to rise to reach a peak in January.

In February 1993, 6 riverine species and 8 migratory species were found in Khorodari *Khal*. Both species number and composition were similar to these recorded in February 1994, despite considerable differences in flooding patters and opportunity for movement from rivers

**Figure 5.11 Seasonal variation in the number of riverine, migratory and floodplain resident fish species from the Juri River (site NE07, outside MIP)**

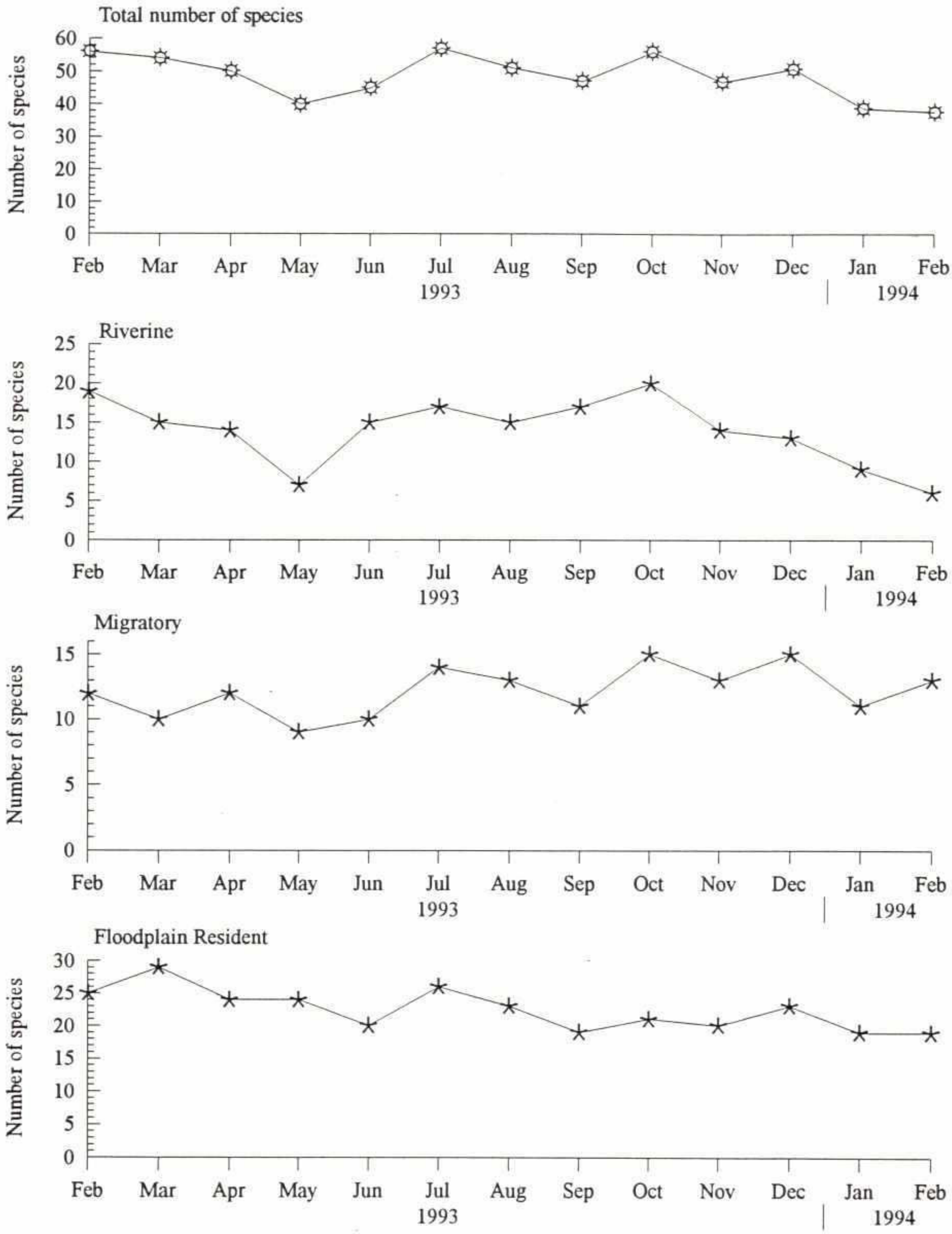
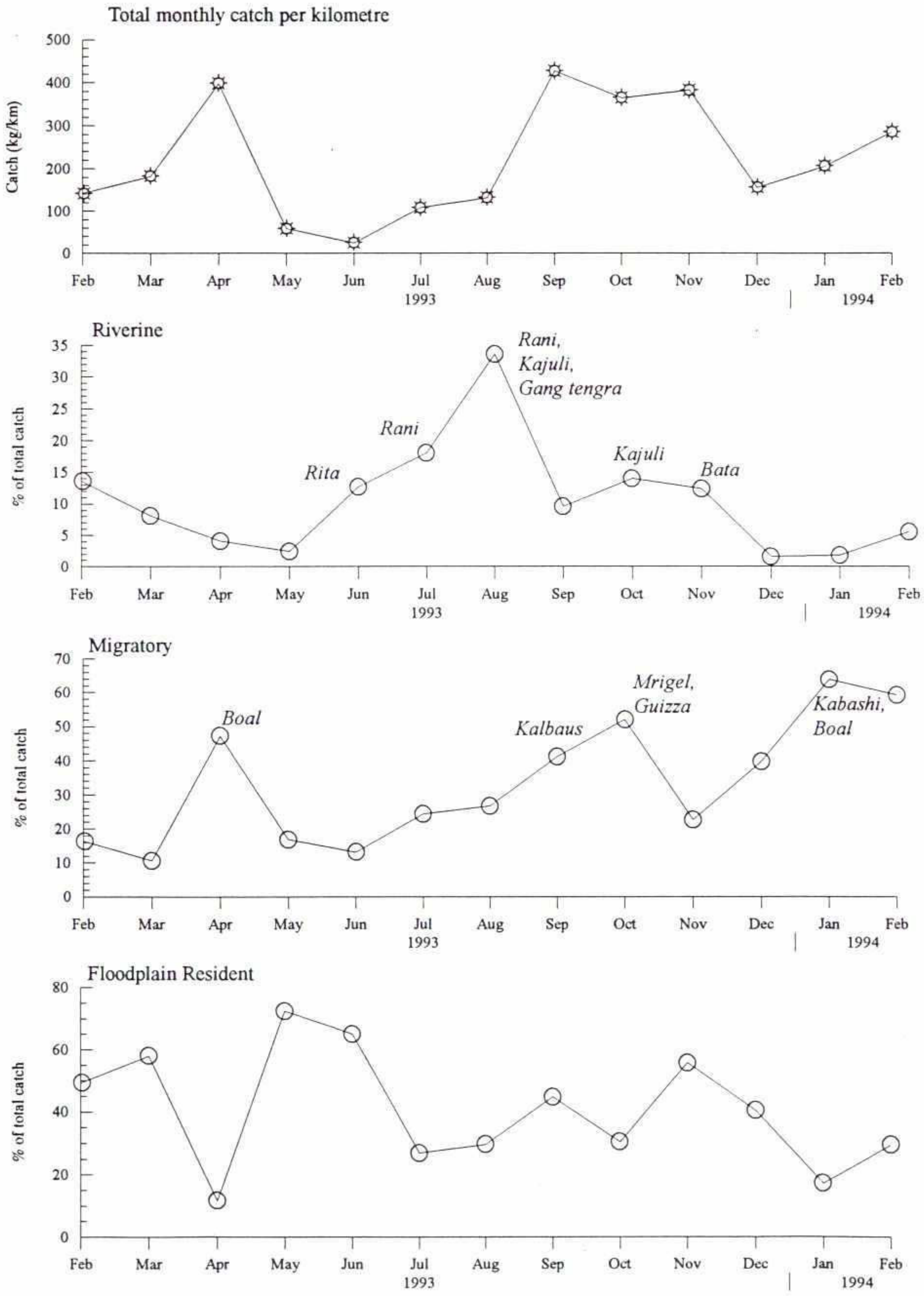


Figure 5.12 Percentage total monthly catch of riverine, migratory and floodplain resident groups of fish from the Juri River (site NE07, outside MIP)




Notes: 1. See text for definition of different categories of fish based on habitat preference (Section 5.4.1)
2. Dominant species are shown for peak relative abundances of riverine and migratory fish

**Figure 5.13 Seasonal variation in the number of riverine, migratory and floodplain resident fish species from the Kushiyara River (site NE06, outside MIP)**

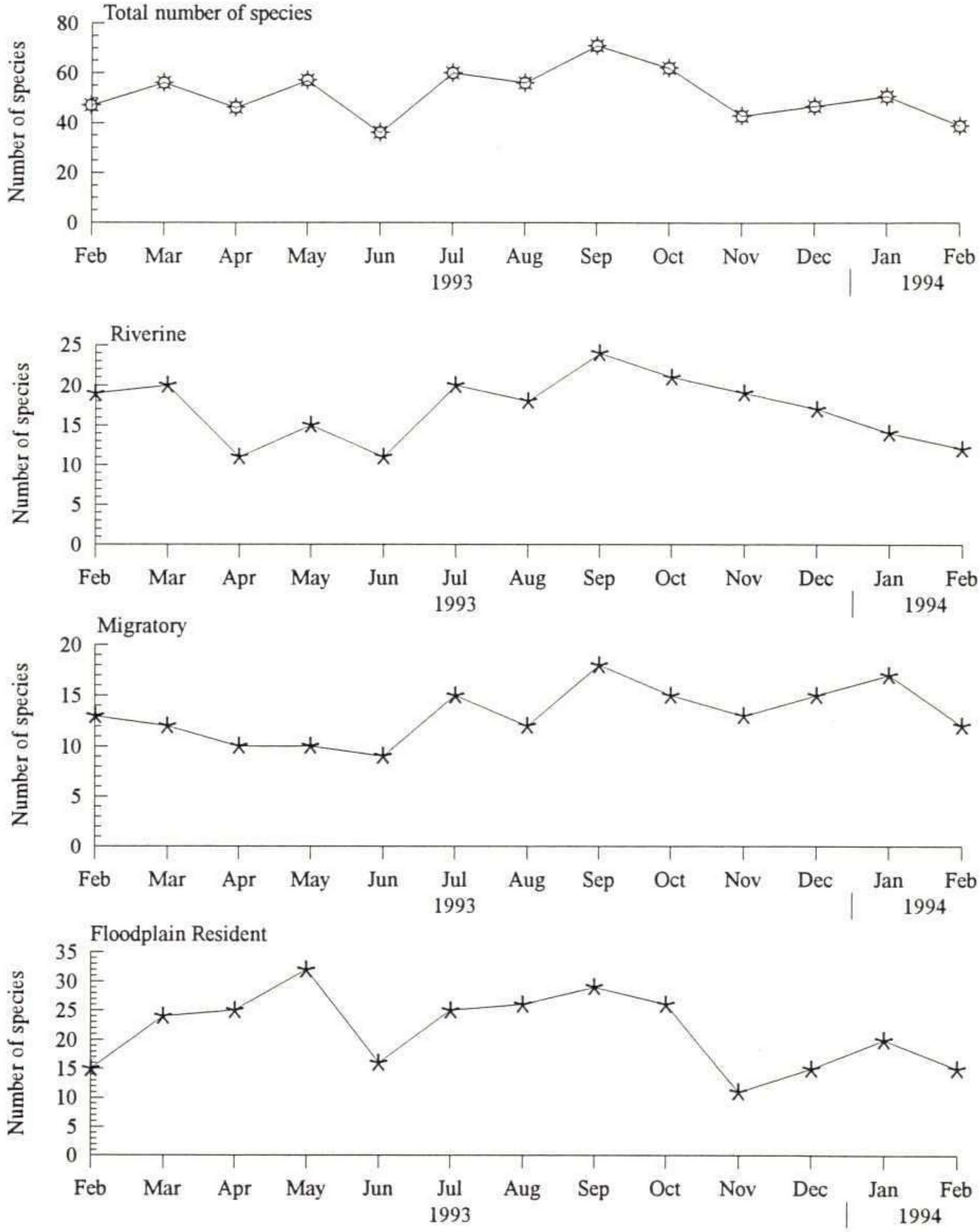
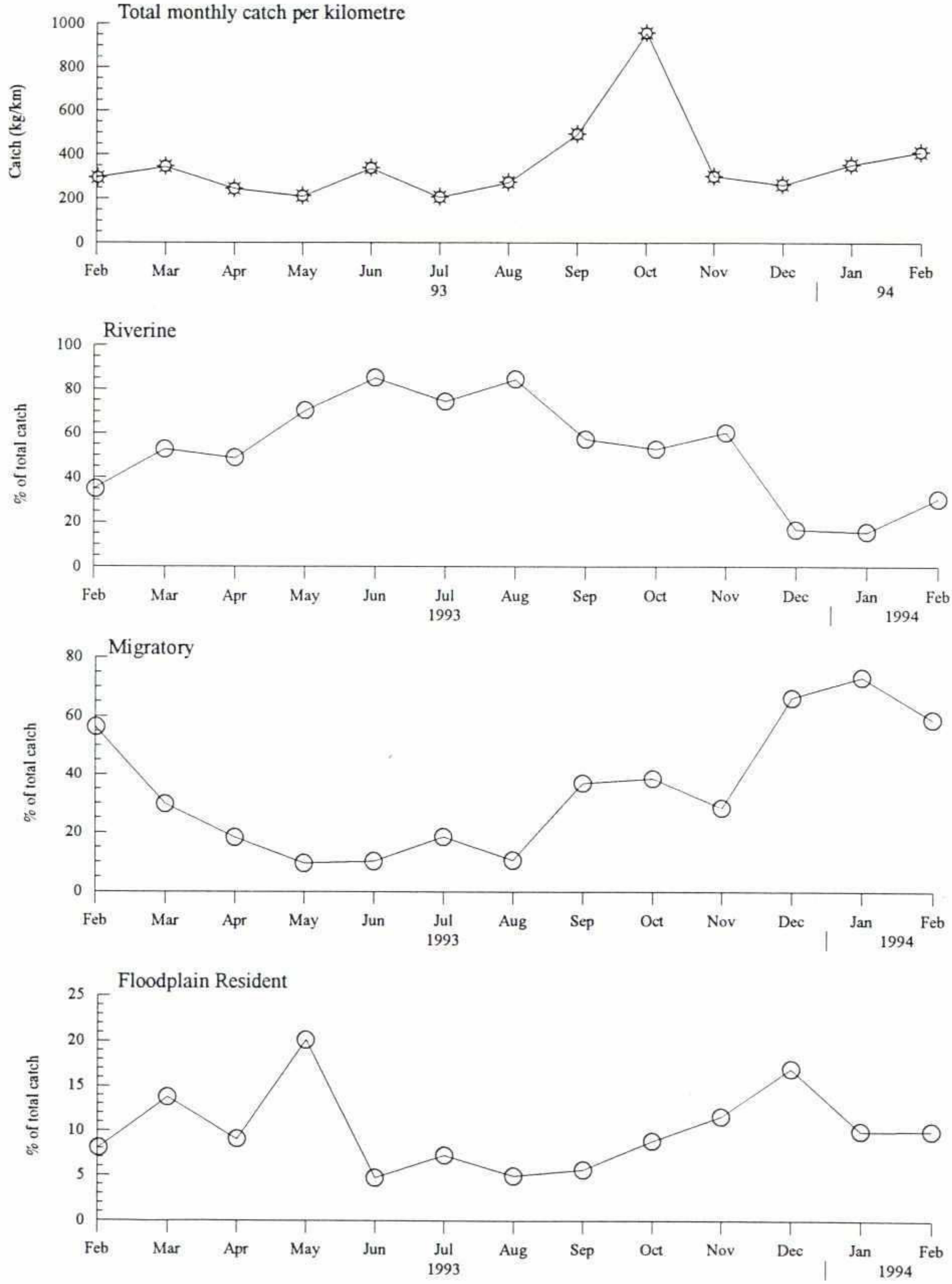
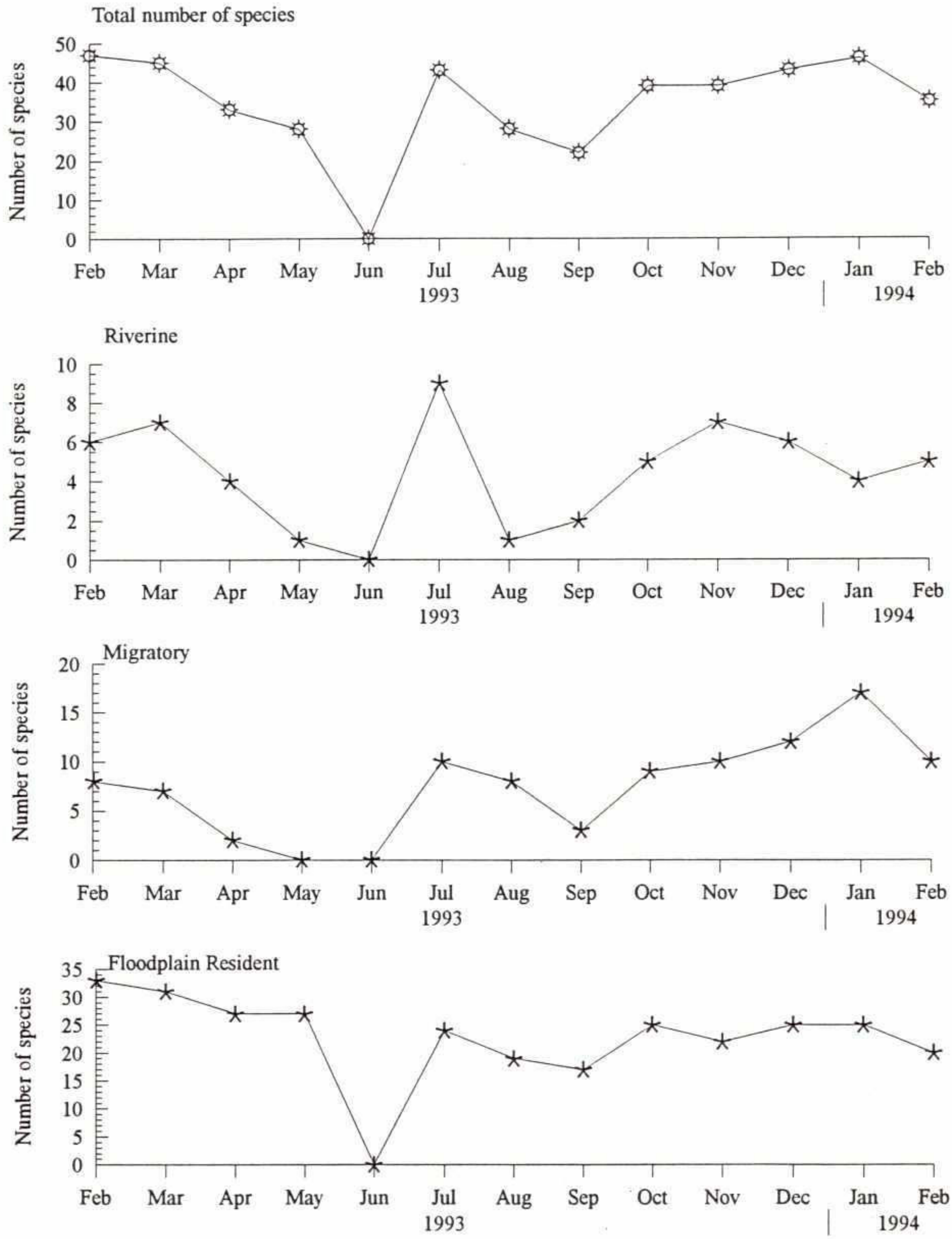


**Figure 5.14 Percentage total monthly catch of riverine, migratory and floodplain resident groups of fish from the Kushiyara River (site NE06, outside MIP)**




Notes: 1. See text for definition of different categories of fish based on habitat preference (Section 5.4.1)
2. Dominant species are shown for peak relative abundances of riverine and migratory fish

**Figure 5.15 Seasonal variation in the number of riverine, migratory and floodplain resident fish species from Khorodari *Khal* (site NE01, inside MIP)**




Note: No fishing activities were observed in June to floodplains between the two years. In mid-February 1993, the level of the Kushiyara rose considerably and consequently sluice gates were closed to prevent river flooding. Data on compositions were examined separately for each fortnightly survey in February and compared with catch data collected during 2 surveys of this site carried out in January 1993 as part of an initial training period for fisheries biologists (Table 5.12). The results showed that 3 riverine species, *balichata*, *gharpoia* and *kharu* and 7 migratory species, *golsha tengra*, *raik*, *goni*, *katari*, *fulchela*, *chapila* and *boal* were present in small numbers in the canal during the dry season prior to the rapid rise in Kushiyara levels in mid-February. Since gates were closed promptly as river levels rose, there was little opportunity in late February for the migration of fish into the MIP; only 3 new riverine species, *gutum* (*N. maydelli*), *kajuli*, *kachki* and 2 migratory species, *kabashi* and *batasi*, appeared in catches at this time. Riverine species made low contributions (<2%) to catches in both February 1993 and 1994, while migratory were more important, accounting for 11% and 26% of monthly catches respectively (Fig. 5.16).

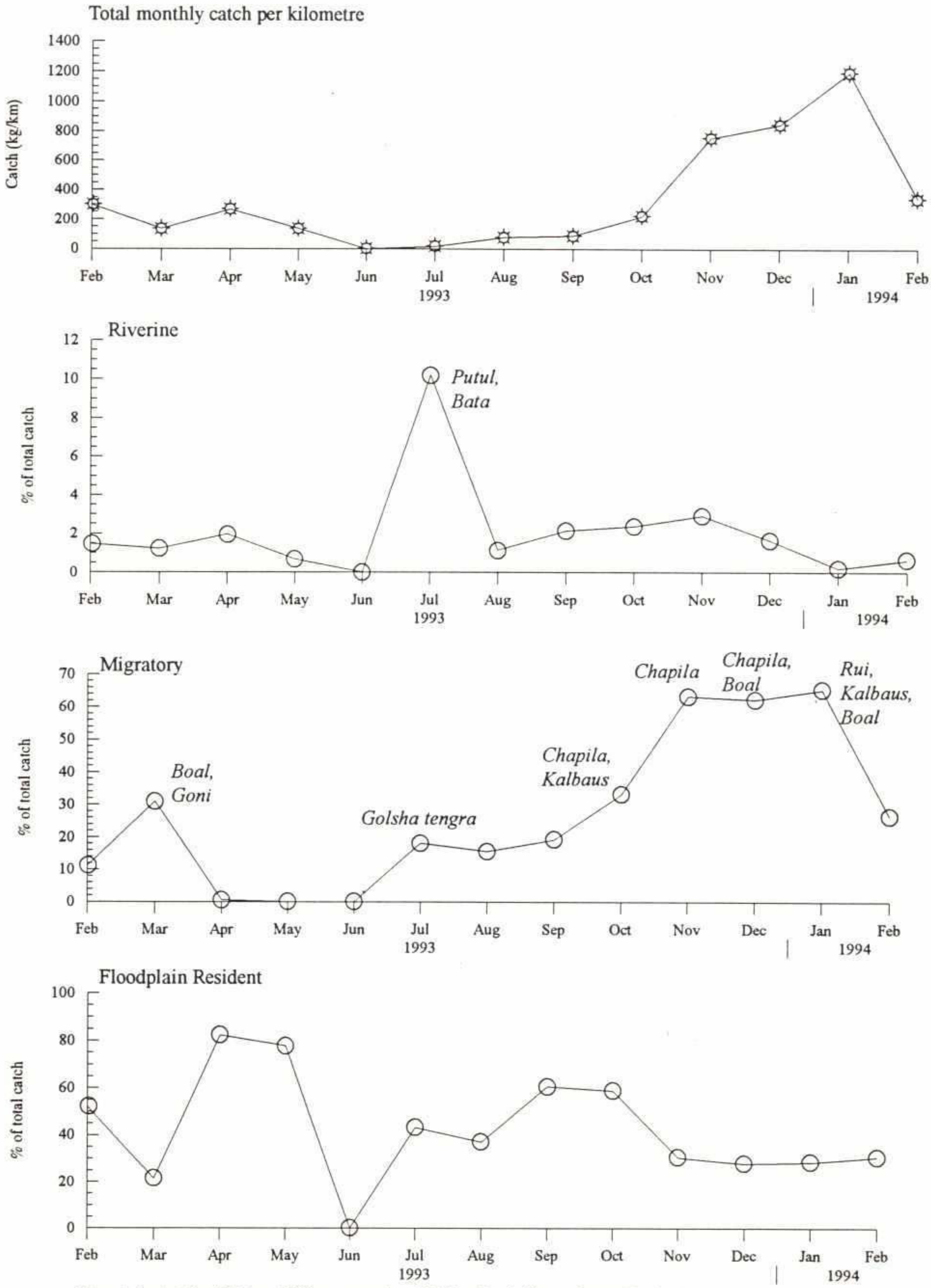
**Table 5.12 Riverine and migratory species in Khorodari *Khal* in January and February 1993**

| Habitat preference | Species name | | January 1993 | February 1993 | |
|---|---|---|---|---|---|
| | Scientific | Bengali | | 1st survey | 2nd survey |
| Riverine | *Nemacheilus botia* | *Balichata* | | x | |
| | *Neoeucirrhichthys maydelli* | *Gutum* | | | x |
| | *Somileptes gongota* | *Gharpoia* | x | | |
| | *Corica soborna* | *Kachki* | | | x |
| | *Pisodonophis boro* | *Kharu* | | x | x |
| | *Ailia punctata* | *Kajuli* | | | x |
| Migratory | *Mystus bleekeri* | *Golsha tengra* | x | x | x |
| | *Mystus cavasius* | *Kabashi* | | | x |
| | *Cirrhinus reba* | *Raik* | x | | |
| | *Labeo gonius* | *Goni* | | x | |
| | *Salmostoma bacaila* | *Katari* | x | x | x |
| | *Salmostoma phulo* | *Fulchela* | | x | x |
| | *Gudusia chapra* | *Chapila* | x | | x |
| | *Pseudeutropius atherinoides* | *Batasi* | | | x |
| | *Wallagu attu* | *Boal* | | x | |

Note: x denotes presence, blank denotes absence

Sluice gates remained closed until the Manu embankment was cut in June which allowed river waters to enter the MIP. From March to May, no new migratory species were recorded while only 2 new riverine species, *bata* and *kutakanti*, were found in very low numbers.

**Figure 5.16 Percentage total monthly catch of riverine, migratory and floodplain resident groups of fish from Khorodari *Khal* (site NE01, inside MIP)**




Notes: 1. See text for definition of different categories of fish based on habitat preference (Section 5.4.1)
2. Dominant species are shown for peak relative abundances of riverine and migratory fish
3. No fishing activities were observed in June

These may have entered through leakage in the three-vent sluice gate. In March, migratory species contributed 31% of the catch, most of which (23%) was provided by adult *boal* caught in *katha*. From 12 June onwards sluice gates were opened to drain off river flooding which entered through embankments cuts. In July, 10 new riverine and migratory species appeared in canal catches, the most abundant of which were *putul*, *bhangan*, *kalbaus*, *chapila* and *bacha*. Information on average size per individual revealed that the major and minor carps *kalbaus* and *bhangan* were juveniles (28 g and 10 g respectively) while *chapila* and *vacha* were adults (13 g and 25 g). Less common species entering the MIP at this time included adult *ilish* and juvenile *ayre* ranging in mean individual weight from 5 g to 200 g. The percentage catch of riverine species increased in July to a peak of 10% while migratory species provided a further 18%.

During August and September there was little evidence of migrations into the *khal*. Only two riverine species, adult *ilish* (105 - 188 g) and *ghaura*, and 1 new migratory species, *guizza* (305 - 320 g) were found in the 500 m sampled reach of canal adjacent to the sluice gates. The major carp, *kalbaus*, was one of the most abundant migratory species in September when it provided 7% of the catch. These fish were juveniles which may have been stocked a month earlier by the Department of Fisheries.

During October the canal re-emerged from seasonal submergence and migratory carps, *mrigel* and *raik* appeared for the first time while *boal* reappeared. *Mrigel* were more than one year old (1700 g/indiv.) and may have originated from pond overspills or have been wild fish. *Boal* were large juveniles (780 g) but later in the year, from October to February, adults were caught, mainly in *katha*, ranging in size from 2 to 6 kg. The catch contribution made by migratory species increased in October to 33% but that of riverine species remained low (2%). Riverine species gradually migrated out of the canal from October onwards but 5 species remained at the end of the survey period when flows were very low. In contrast, there was no evidence of migration out of the MIP by migratory species until February. Catch contributions made by migratory species between November and January remained high and steady, ranging from 62% to 65% of monthly catches. The most abundant species were *chapila* in November, *chapila* and *boal* in December and adult *rui* and juvenile *kalbaus* in January.

## 6 FLOODPLAIN FISHERIES

### 6.1 Total Catch

#### 6.1.1 Pattern of catch

Clear differences in the seasonality of catches were observed between different sites on Hakaluki *Haor* (Fig. 6.1). On high floodplains of Gobindapur the bulk of the annual catches (85%) was captured between June and August while on lower floodplains, most (69%) was taken during the drawdown in October and November. In the deepest areas of the *haor* almost all the catch (94%) was taken during the winter period (December to February) when floodplains were dry.

In the MIP, the sequential peaks in catches seen on different floodplains of Hakaluki *Haor* were not so apparent, probably because there was greater overlap in land elevations on sampled sites in the MIP (Fig. 6.2). On the higher floodplains of Baraimabad, catches were very low from February to April when there was little or no inundation of the area despite heavy rainfall in February. In May the catches rose considerably in response to the first major rainfall inundation but dropped equally rapidly in June when the Manu embankment was cut and river waters flooded the project. The reduction in catch was attributed to a decrease in fishing effort particularly by *thella jal* fishermen who may have moved out of the area temporarily to exploit possibly richer grounds in the proximity of the numerous breaks in the embankments. In July catches rose sharply again and continued to rise, a little unevenly, until reaching a peak in October after which they dropped rapidly to a low level in December.

On the lower floodplains at Islampur no fishing was recorded until May when a peak level was observed, after which catches gradually decreased until September. In October the catch dropped sharply but rose equally sharply in November before falling again in December. In the deepest area of Kawadighi *Haor*, on Patasinga *Beel*, catches remained low until leaseholder fishing started in January. Catches then increased considerably and between January and February the bulk of the catch (88%) was taken.

Cuts made in embankments in June had no immediate positive impact on catches. The cuts allowed the entry of many riverine and migratory species, however, which reproduced and grew in the MIP and made very important contributions to the catch from beel during the winter season. Detailed accounts of catch compositions and fish movements are given in Sections 6.5 and 6.6.

## Figure 6.1 Seasonal variation in the catch (kg/ha) from floodplains and *beel* on Hakaluki *Haor*, February 1993 - February 1994

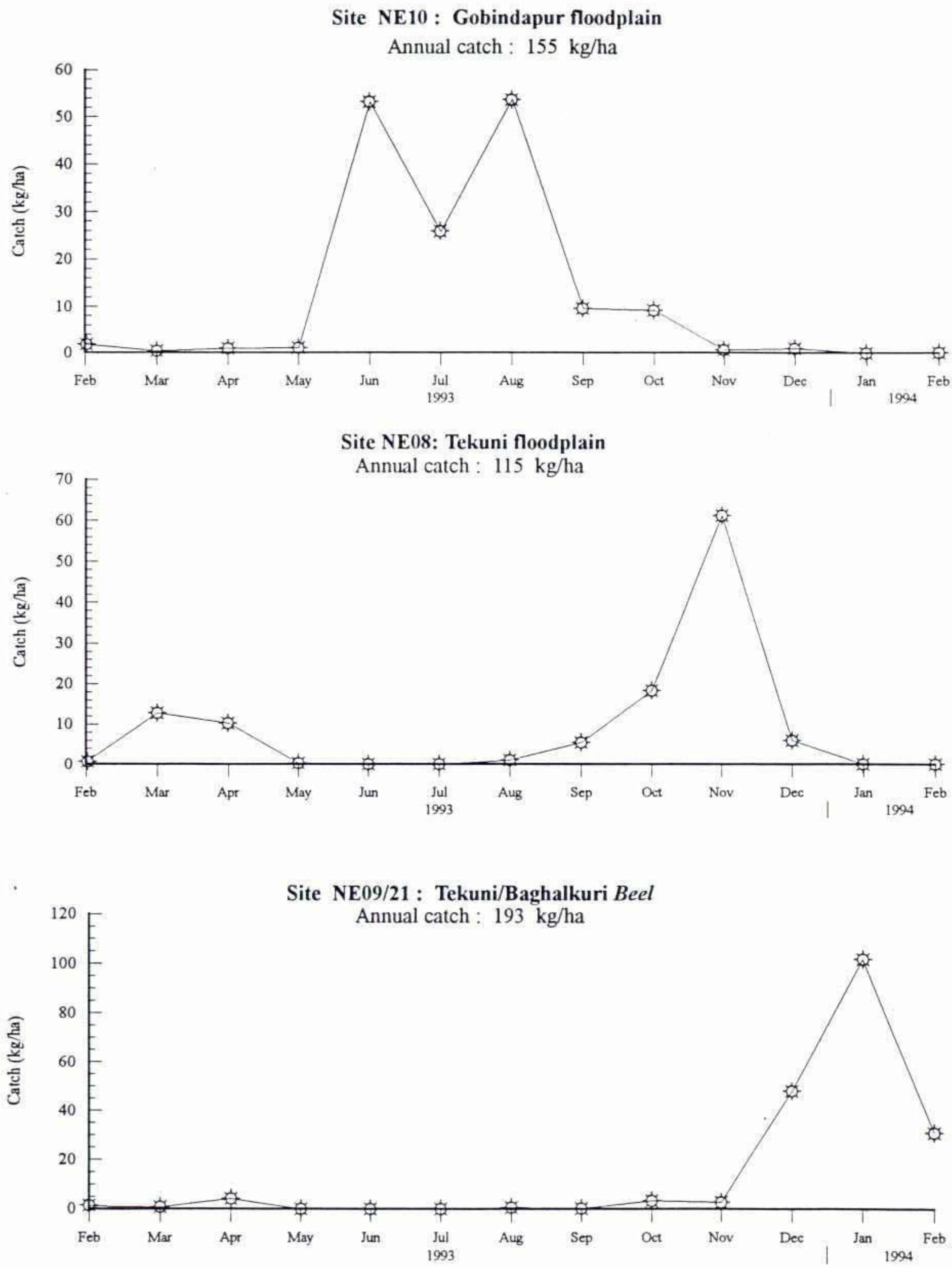


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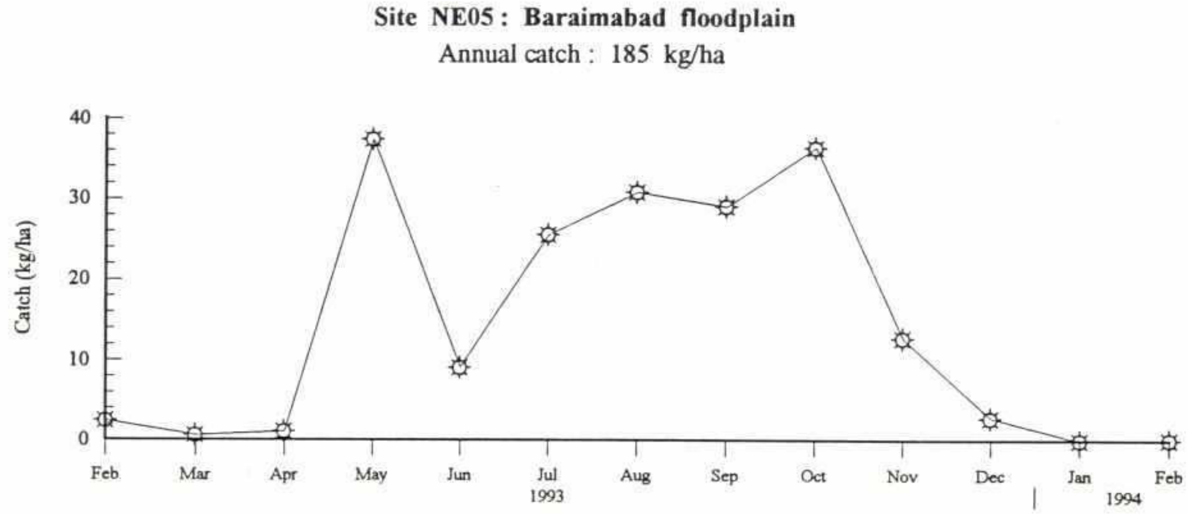
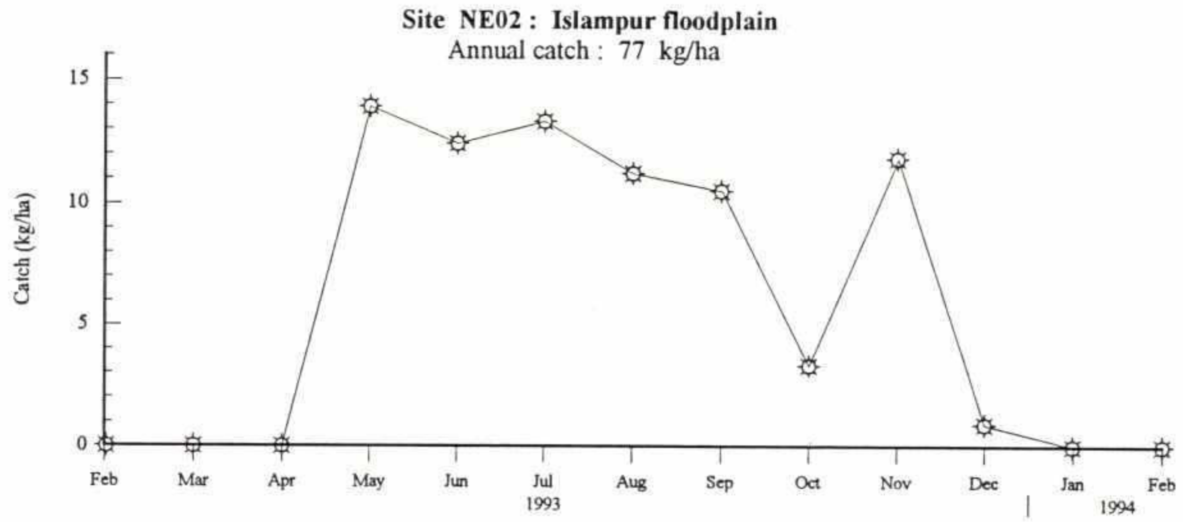
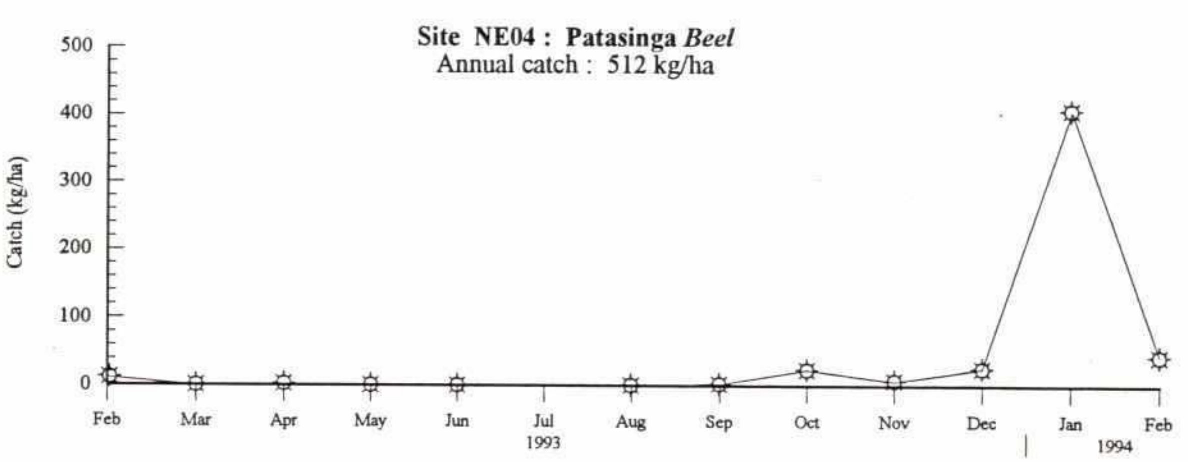
**Figure 6.2 Seasonal variation in the catch (kg/ha) of floodplains and *beel* in the MIP, February 1993 - February 1994**



6.1.2 Size of catch

On high floodplains, an annual catch of 155 kg/ha was recorded from Hakaluki *Haor* compared with a 19% higher catch (185 kg/ha) from the MIP (Table 6.1). Flooding patterns on these sites were similar apart from the greater rainfall/river flooding in Hakaluki in May. In contrast, the catch from the lower floodplains of the MIP (77 kg/ha) was 33% lower than that from Hakaluki (115 kg/ha). Catches from perennial *beel* were very different; on *beel*, inside the MIP, the annual catch was 512 kg/ha compared with 193 kg/ha from Tekuni/ Baghalkuri *Beel*. Extrapolation of yield estimates to wider areas in Hakaluki *Haor* and the MIP and integration of catches from floodplains and *beel* resulted in annual yields of 142 kg/ha from of Hakaluki *Haor* and 113 kg/ha from the MIP (see Section 7). Statistical analyses of catch rates of dominant gears revealed significantly lower densities of fish in the MIP prior to breaches in the embankment but higher densities later during the drawdown and winter (see Section 6.3).

**Table 6.1 Comparison of total annual catch per unit area (kg/ha) from floodplains and *beel* in the MIP and Hakaluki *Haor*, March 1993 - February 1994**

| Site code | Site name | Inside/ Outside MIP | Annual catch | |
|---|---|---|---|---|
| | | | Total (kg) | Kg/ha |
| NE10 | Gobindapur Floodplain | Outside | 12,197 | 155 |
| NE08 | Tekuni Floodplain | Outside | 11,409 | 115 |
| NE09/21 | Tekuni and Baghalkuri *Beel* | Outside | 61,473 | 68 |
| NE05 | Baraimabad Floodplain | Inside | 13,901 | 185 |
| NE02 | Islampur Floodplain | Inside | 12,617 | 77 |
| NE04 | Patasinga *Beel* | Inside | 110,288 | 512 |

The conclusion from these results was that, prior to embankments cuts, many fish were prevented from entering the MIP. During 1992 which was a relatively dry year, no cuts in embankments were made and fish therefore had extremely limited opportunity to enter the project area from the Manu and Kushiyara rivers. The impact of such restrictions in movements of fish was seen in the significantly lower densities prior to embankment cuts made in June 1993. Significantly higher fish densities during the flood drawdown and in winter could be attributed to increases in the populations of migratory species during the monsoon and to a greater concentrating effect by Patasinga *Beel* which attracted fish from a relatively larger catchment area than that of Baghalkuri *Beel* in Hakaluki *Haor*.

The substantially higher catch from Patasinga *Beel* than from Baghalkuri resulted not only from increased fish densities but from a considerably higher amount of fish effort applied by both leaseholder-controlled and subsistence fisheries (see Sections 6.3 and 6.4).

## 6.2 Pattern of Fishing

### 6.2.1 Catch by gear

Percentage contributions made by dominant gears to the total annual catch at each site are presented in Table 6.2. More detailed data on monthly and annual catches of all observed gears are provided in Tables 6.3 - 6.8.

**Table 6.2 Percentage contribution (by weight) to the total annual catch made by dominant gears on floodplains and *beel* in the MIP and Hakaluki *Haor*, March 1993 - February 1994**

| Gear | MIP | | | Hakaluki *Haor* | | |
|---|---|---|---|---|---|---|
| | Islampur Floodplain | Patasinga *Beel* | Baraimabad Floodplain | Tekuni Floodplain | Tekuni/ Baghalkuri *Beel* | Gobindapur Floodplain |
| | NE02 | NE04 | NE05 | NE08 | NE09/21 | NE10 |
| *Ber jal* | 36.5 | 44.7 | 33.9 | 46.2 | 78.9 | - |
| *Thella jal* | 19.1 | 9.6 | 49.4 | 13.3 | - | 80.8 |
| *Daun* | 16.6 | - | 5.3 | 4.1 | - | - |
| *Dhor jal* | 15.7 | - | - | - | - | - |
| *Current jal* (Stationary) | 5.3 | - | 6.1 | - | - | 8.6 |
| *Katha* | - | 13.9 | - | - | 10.1 | - |
| *Ghori jal* | - | 8.0 | - | - | - | - |
| *Jhaki jal* | - | 5.6 | - | 9.2 | - | - |
| *Chabi jal* | - | 5.0 | - | - | - | - |
| *Veshal* | - | 4.3 | - | 6.1 | - | - |
| *Deal* trap | - | - | - | - | - | 3.7 |
| *Dora jal* | - | - | - | 13.9 | 4.8 | - |

On the higher floodplains of Gobindapur in Hakaluki *Haor*, *thella jal* accounted for 81% of the annual catch while *current jal* and *deal* traps provided a further 9% and 4% respectively. On comparable floodplains at Baraimabad, inside the MIP, *thella jal* again predominated but took a smaller share of the catch (49%) than at Hakaluki. The higher catches taken at Gobindapur floodplain may be partly attributed to the use of *thella jal* not only by foot but also by boat which allowed deeper waters to be exploited. At Baraimabad, boats were not used for *thella jal* fishing. At this site *ber jal* captured 34% of the catch whereas at

**Table 6.3 Percentage monthly catch from Gobindapur floodplain by gear type: Hakaluki Haor (site NE10)**

| Gear Code | Gear name | Year: 1993 | | | | | | | | | | | Total annual catch (Mar'93 – Feb'94) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Feb | Mar | April | May | June | July | Aug | Sep | Oct | Nov | Dec | Kg | % |
| 255 | *Thella jal* | 15.242 | 93.951 | 85.516 | 55.537 | 95.366 | 92.337 | 84.131 | 37.615 | 0.391 | 58.164 | – | 9857.424 | 80.816 |
| 88 | *Current jal (Stationary)* | 1.030 | – | – | – | 4.221 | 5.409 | 13.379 | 17.901 | 6.882 | 28.653 | – | 1048.999 | 8.600 |
| 286 | *Deal trap* | – | – | – | – | – | – | 0.053 | 17.468 | 44.220 | – | – | 451.131 | 3.699 |
| 123 | *Koi jal* | – | – | – | – | – | 0.979 | 0.664 | 3.866 | 18.714 | – | – | 211.327 | 1.733 |
| 272 | *Daun* | – | – | – | – | 0.413 | – | 1.772 | 10.529 | – | – | – | 171.210 | 1.404 |
| 98 | Net/Basket+Dewatering | – | – | – | – | – | – | – | – | 19.656 | – | – | 141.139 | 1.157 |
| 164 | *Jhaki jal* | 26.289 | – | – | – | – | 0.918 | – | – | 7.851 | – | 33.103 | 98.037 | 0.804 |
| 266 | *Veshal* | – | – | – | 44.463 | – | – | – | 8.032 | – | – | – | 94.128 | 0.772 |
| 89 | *Dhor jal* | – | – | 14.484 | – | – | – | – | – | – | – | 41.171 | 39.185 | 0.321 |
| 30 | *Sip* | 2.285 | – | – | – | – | – | – | 3.434 | – | 13.183 | – | 32.438 | 0.266 |
| 302 | *Kua* | – | – | – | – | – | – | – | – | – | – | 25.726 | 17.924 | 0.147 |
| 97 | By hand/Dewatering | – | – | – | – | – | – | – | – | 1.681 | – | – | 12.073 | 0.099 |
| 95 | *Doiar trap* | 35.121 | – | – | – | – | 0.357 | – | 0.339 | – | – | – | 9.785 | 0.080 |
| 291 | *Urani* | – | – | – | – | – | – | – | 0.816 | – | – | – | 6.137 | 0.050 |
| 307 | Hand fishing | 20.033 | – | – | – | – | – | – | – | 0.604 | – | – | 4.340 | 0.036 |
| 314 | *Boat Katha* | – | 6.049 | – | – | – | – | – | – | – | – | – | 2.055 | 0.017 |
| | | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 12197.332 | 100 |

Note : 1. No fishing activities were observed in January and February 1994

2. – denotes zero catch

**Table 6.4 Percentage monthly catch from Tekuni floodplain by gear type: Hakaluki Haor (site NE08)**

| Gear | | Year: 1993 | | | | | | | | | Total annual catch (Mar'93 – Feb'94) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Code | Gear name | Feb | Mar | April | May | Aug | Sep | Oct | Nov | Dec | Kg | % |
| 45 | *Ber jal* | – | 29.430 | – | – | – | – | – | 81.164 | – | 5268.000 | 46.175 |
| 325 | *Dora jal* | – | – | – | – | – | – | 86.968 | – | – | 1582.645 | 13.872 |
| 255 | *Thella jal* | – | 45.517 | 55.965 | – | – | – | 3.534 | 4.814 | 2.793 | 1516.784 | 13.295 |
| 164 | *Jhaki jal* | 51.923 | 9.428 | 17.447 | – | – | – | – | 4.179 | 84.572 | 1050.177 | 9.205 |
| 266 | *Veshal* | – | 1.522 | 15.395 | – | – | – | – | 8.288 | 3.776 | 698.429 | 6.122 |
| 272 | *Daun* | – | – | – | – | 100.000 | 54.712 | 3.404 | – | – | 470.849 | 4.127 |
| 88 | *Current jal (Stationary)* | 48.077 | 2.145 | – | 100.000 | – | 45.288 | 3.941 | 0.709 | – | 414.083 | 3.629 |
| 95 | *Doiar trap* | – | 9.597 | 11.193 | – | – | – | – | – | – | 235.340 | 2.063 |
| 123 | *Koi jal* | – | 2.361 | – | – | – | – | 2.153 | – | – | 69.020 | 0.605 |
| 307 | Hand fishing | – | – | – | – | – | – | – | 0.017 | 8.860 | 53.515 | 0.469 |
| 30 | *Sip* | – | – | – | – | – | – | – | 0.829 | – | 50.000 | 0.438 |
| | | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 11408.842 | 100 |

Notes: 1. No fishing activities were observed from June to July 1993 and January to February 1994

2. – denotes zero catch



Dzc

Table 6.5 Percentage monthly catch from Tekuni/Baghalkuri Beel by gear type: Hakaluki Haor (site NE09/21)

| Gear Code | Gear name | Year: 1993 | | | | | | | | Year: 1994 | | Total annual catch (Mar'93 – Feb'94) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Feb | Mar | April | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Kg | % |
| 45 | *Ber jal* | 48.187 | – | – | – | – | 36.655 | 100.000 | 100.000 | 73.850 | 69.347 | 62410.135 | 78.853 |
| 270 | *Katha* | – | – | – | – | – | – | – | – | 17.764 | 2.270 | 8029.170 | 10.145 |
| 325 | *Dora jal* | – | 6.168 | – | – | – | 23.807 | – | – | 6.748 | 5.786 | 3837.222 | 4.848 |
| 255 | *Thella jal* | – | 20.446 | 19.736 | – | – | – | – | – | 0.379 | 16.501 | 2507.272 | 3.168 |
| 88 | *Current jal (Stationary)* | 33.462 | 61.186 | 8.450 | 100.000 | – | 7.159 | – | – | 0.140 | 4.165 | 902.665 | 1.140 |
| 97 | By hand/Dewatering | – | – | – | – | – | – | – | – | 0.790 | 1.293 | 514.190 | 0.650 |
| 272 | *Daun* | – | – | 48.987 | – | – | 20.092 | – | – | – | – | 448.105 | 0.566 |
| 164 | *Jhaki jal* | 13.385 | 12.199 | 22.827 | – | – | – | – | – | – | 0.201 | 201.141 | 0.254 |
| 286 | *Deal trap* | – | – | – | – | – | – | – | – | 0.266 | 0.016 | 117.907 | 0.149 |
| 123 | *Koi jal* | – | – | – | – | 100.000 | 12.286 | – | – | – | 0.065 | 105.329 | 0.133 |
| 68 | *Uttar jal* | – | – | – | – | – | – | – | – | – | 0.356 | 46.950 | 0.059 |
| 266 | *Veshal* | 4.966 | – | – | – | – | – | – | – | 0.063 | – | 27.456 | 0.035 |
| | | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 79147.550 | 100 |

Notes: 1. No fishing activities were observed from May to July 1993

2. – denotes zero catch

## Table 6.6 Percentage monthly catch from Baraimabad floodplain by gear type: MIP (site NE05)

| Gear Code | Gear name | Year: 1993 | | | | | | | | | | | Total annual catch (Mar'93 – Feb'94) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Feb | Mar | April | May | June | July | Aug | Sep | Oct | Nov | Dec | Kg | % |
| 255 | *Thella jal* | 24.799 | 15.319 | 25.990 | 98.759 | 22.020 | 46.837 | 28.811 | 7.467 | 49.066 | 87.935 | 6.521 | 6863.610 | 49.374 |
| 45 | *Ber jal* | – | – | – | – | – | 37.309 | 64.959 | 75.326 | 31.372 | – | – | 4706.060 | 33.854 |
| 88 | *Current jal (Stationary)* | – | – | – | – | 16.111 | 12.415 | 1.630 | 3.576 | 14.141 | – | – | 848.456 | 6.104 |
| 272 | *Daun* | – | – | – | – | 61.870 | 2.921 | 1.324 | 8.491 | 1.603 | – | – | 736.233 | 5.296 |
| 164 | *Jhaki jal* | 49.599 | 84.681 | 67.554 | – | – | – | – | – | – | 3.244 | 79.691 | 292.578 | 2.105 |
| 123 | *Koi jal* | – | – | – | – | – | 0.518 | 3.276 | 5.140 | 1.355 | – | – | 234.184 | 1.685 |
| 89 | *Dhor jal* | – | – | – | 0.821 | – | – | – | – | – | 8.822 | – | 107.051 | 0.770 |
| 266 | *Veshal* | – | – | – | – | – | – | – | – | 2.464 | – | – | 67.269 | 0.484 |
| 307 | Hand fishing | 25.602 | – | 6.456 | – | – | – | – | – | – | – | 13.102 | 32.513 | 0.234 |
| 97 | By hand/Dewatering | – | – | – | 0.419 | – | – | – | – | – | – | – | 11.759 | 0.085 |
| 302 | *Kua* | – | – | – | – | – | – | – | – | – | – | 0.686 | 1.422 | 0.010 |
| | | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 13901.135 | 100 |

Notes : 1. No fishing activities were observed in January and February 1994

2. – denotes zero catch



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Table 6.7 Percentage monthly catch from Islampur floodplain by gear type: MIP (site NE02)

| Gear | | Year: 1993 | | | | | | | | Total annual catch (Mar'93 – Feb'94) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Code | Gear name | May | June | July | Aug | Sep | Oct | Nov | Dec | Kg | % |
| 45 | *Ber jal* | – | 92.650 | 69.062 | 45.752 | 23.563 | – | – | – | 4603.315 | 36.484 |
| 255 | *Thella jal* | 82.731 | – | – | – | 3.153 | 42.936 | 11.393 | 12.430 | 2404.485 | 19.057 |
| 272 | *Daun* | 10.652 | – | 8.236 | 50.571 | 29.108 | 48.068 | – | – | 2100.525 | 16.648 |
| 89 | *Dhor jal* | 6.616 | – | – | – | – | – | 88.607 | 75.798 | 1977.104 | 15.670 |
| 88 | *Current jal (Stationary)* | – | 4.302 | 12.439 | 0.836 | 16.422 | – | – | 6.093 | 662.780 | 5.253 |
| 123 | *Koi jal* | – | 0.547 | 3.101 | – | 16.208 | – | – | 5.680 | 364.817 | 2.891 |
| 95 | *Doiar trap* | – | 2.502 | 7.161 | 2.842 | 3.380 | – | – | – | 315.532 | 2.501 |
| 329 | *Dara jal* | – | – | – | – | 8.166 | – | – | – | 139.963 | 1.109 |
| 291 | *Urani* | – | – | – | – | – | 5.187 | – | – | 28.182 | 0.223 |
| 320 | *Ghori jal* | – | – | – | – | – | 3.809 | – | – | 20.693 | 0.164 |
| | | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 12617.396 | 100 |

Notes: 1. No fishing activities were observed from February to April 1993 and from January to February 1994

2. – denotes zero catch

## Table 6.8 Percentage monthly catch from Patasinga Beel by gear type: inside MIP (site NE04)

| Gear Code | Gear name | Year: 1993 | | | | | | | | | Year: 1994 | | Total annual catch (Mar'93 – Feb'94) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Feb | Mar | April | May | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Kg | % |
| 45 | *Ber jal* | 18.290 | – | – | – | – | 45.304 | 8.263 | – | – | 55.258 | 2.006 | 49332.011 | 44.734 |
| 270 | *Katha* | – | – | – | – | – | – | – | – | – | 17.453 | – | 15311.650 | 13.885 |
| 255 | *Thella jal* | 38.852 | – | 68.650 | – | – | – | 54.213 | 51.038 | 77.279 | 1.056 | 18.214 | 10588.938 | 9.602 |
| 320 | *Ghori jal* | – | – | – | – | – | – | – | – | – | 9.608 | 3.795 | 8785.120 | 7.966 |
| 164 | *Jhaki jal* | 16.058 | – | – | – | – | – | – | – | 2.075 | 6.180 | 6.280 | 6123.516 | 5.553 |
| 293 | *Chabi jal* | – | – | – | – | – | – | – | – | – | 6.144 | 1.677 | 5547.192 | 5.030 |
| 266 | *Veshal* | – | – | – | – | – | – | – | – | 13.405 | 4.161 | 3.766 | 4730.130 | 4.289 |
| 88 | *Current jal (Stationary)* | 17.121 | 89.600 | 11.877 | – | – | 1.022 | 14.666 | 7.440 | 1.163 | – | 31.451 | 3998.424 | 3.626 |
| 123 | *Koi jal* | – | – | – | – | 12.892 | 9.492 | – | – | – | – | 26.457 | 2550.822 | 2.313 |
| 272 | *Daun* | – | – | 19.473 | 100.000 | 87.108 | 22.076 | 10.931 | 24.588 | – | – | 1.150 | 1386.176 | 1.257 |
| 291 | *Urani* | – | – | – | – | – | – | 9.593 | 15.561 | – | – | – | 716.081 | 0.649 |
| 97 | By hand/Dewatering | 7.411 | – | – | – | – | – | – | – | – | – | 5.139 | 482.480 | 0.438 |
| 89 | *Dhor jal* | – | – | – | – | – | – | – | – | 6.079 | 0.014 | 0.025 | 343.747 | 0.312 |
| 95 | *Doiar trap* | – | – | – | – | – | 22.106 | 2.334 | – | – | – | 0.040 | 242.214 | 0.220 |
| 334 | *Tui* | – | – | – | – | – | – | – | – | – | 0.122 | – | 106.950 | 0.097 |
| 286 | *Deal trap* | – | – | – | – | – | – | – | 1.372 | – | – | – | 20.026 | 0.018 |
| 222 | *Polo* | 2.270 | 10.400 | – | – | – | – | – | – | – | 0.005 | – | 12.922 | 0.012 |
| | | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 110278.397 | 100 |

Notes:
1. No fishing activities were observed from June to July 1993
2. – denotes zero catch

Gobindapur *ber jal* were not recorded at all. Other important gears at Baraimabad included *current jal* which took 6% of the catch and *daun* which provided a further 5%. *Deal* traps were not used at Baraimabad.

On lower floodplains of Hakaluki *Haor* (NE08) *ber jal* accounted for 46% of the catch and drag nets (*dora jal*) a further 14%. A slightly lower share of catch (37%) was taken by *ber jal* on lower floodplains inside the MIP. Here *dora jal* were not used; instead a small seine, *dhor jal*, provided 16% of the annual catch. *Thella jal* were important in both areas providing 19% of the MIP catch and 13% at Tekuni. Other important gears which provided higher catch shares in the MIP included *daun* and *current jal* while *jhaki jal* and *veshal* caught more at Tekuni.

Fishing patterns on large perennial *beel* differed considerably. On Baghalkuri *Beel* in Hakaluki *Haor*, *ber jal* accounted for 79% of the annual catch. *Katha* and *dora jal* provided a further 10% and 5% of the catch respectively but no other gear comprised more than 1%. In contrast, on Patasinga *Beel ber jal* provided only 45% while *thella jal* and *ghori jal* took 10% and 8%. *Katha* provided 14% of the annual catch and three other gears, *jhaki jal*, *chabi jal*, and *veshal*, made important contributions. The differences between *beel* resulted largely from greater access restrictions enforced by the leaseholder of Baghalkuri *Beel*. These are discussed in more detail in Section 6.3.

### 6.2.2 Catch by gear by month

*Hakaluki Haor: floodplains*

In February 1993, when catches were very low, small-scale gears such as *jhaki jal*, *current jal* and fishing by hand dominated catches (Fig. 6.3). In March, catches rose slightly and were taken mainly by *thella jal* and *ber jal*. In April and May, flooding increased on lower floodplains but *thella jal* still took the largest share of monthly catches from the shallower waters while *veshal* increased catches up to 33% in May. Other gears important at this time were *jhaki jal* in April and *current jal* in May. From June until September, *thella* completely dominated catches, providing 82% to 95% of individual monthly catches. The second most important gear was *current jal* which provided 4% to 13% of the catch. The *thella jal* fishery specifically targeted prawns which accounted for 79% of the annual catch from *thella jal* used on floodplains. During the beginning of the flood drawdown in September a wider range of gears provided important shares of the catch. These included *current jal* and *daun* which

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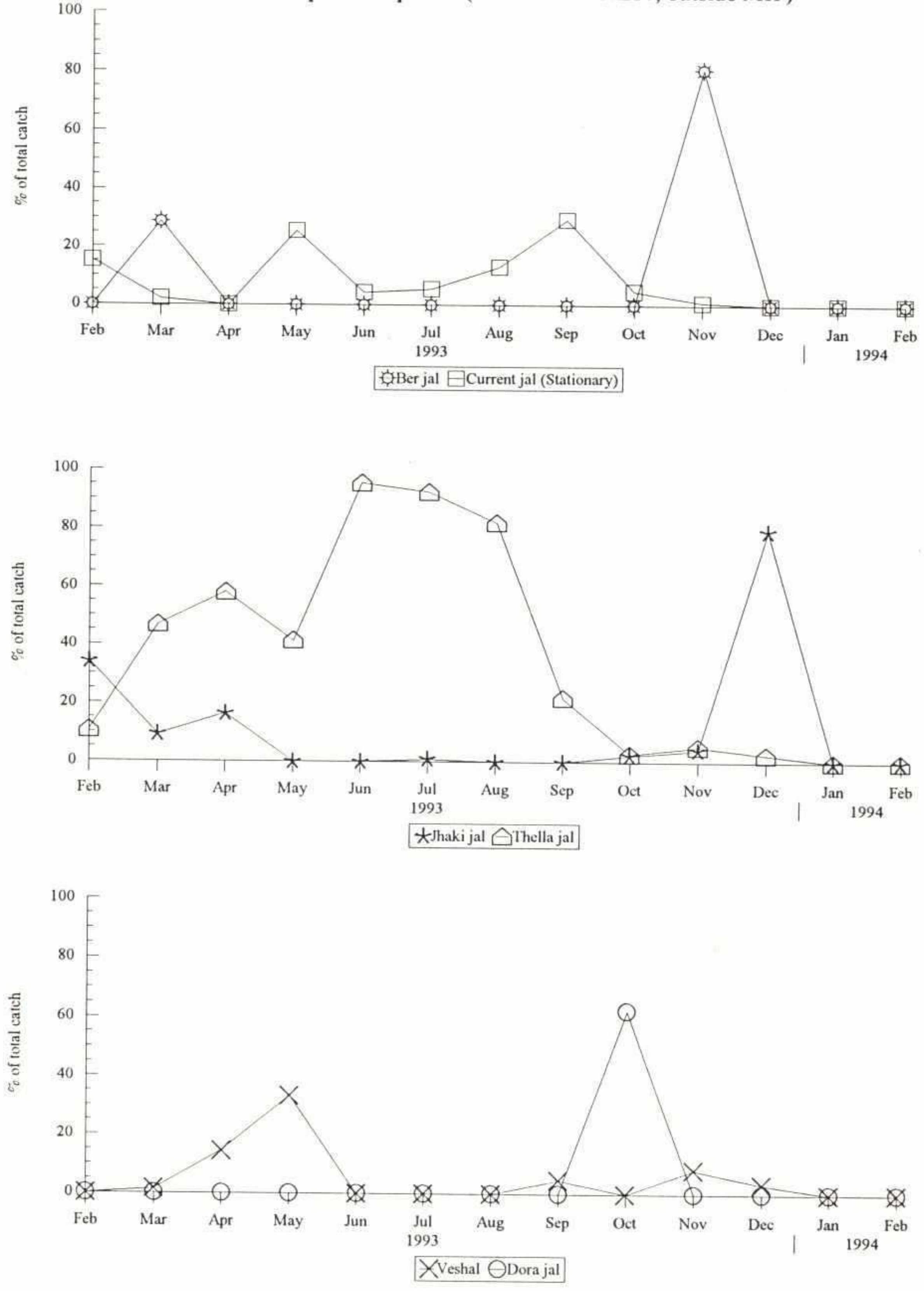
**Figure 6.3 Percentage of total monthly catch taken by dominant gears: Tekuni and Gobindapur floodplains (sites NE08 + NE10, outside MIP)**



each captured 29% of the catch as well as *thella jal* and *deal* traps. During the peak drawdown in October and November, first drag nets (*dora jal*) predominated, capturing 62% of the October catch, and later *ber jal* appeared and took 80% of the catch in November. As floodplains dried out in December, *jhaki jal* accounted for the bulk of the catch. Peak catches were recorded in June, August and November. The first two peaks resulted principally from increased fishing effort and high catch rates of *thella jal* (Figs. 6.4 and 6.5) while the peak in November was due to a peak in fishing effort and catch rate by *ber jal*.

*Hakaluki Haor - perennial beel*

Between February and April 1993 only 4 types of gear were observed in any one month. In February *ber jal* and *current jal* predominated in Tekuni *Beel* (Fig. 6.6). In March *current jal* increased its share of the catch to 61% while *thella jal* appeared and took a further 20%. In April *daun* predominated, capturing 49% while *thella jal* and *jhaki jal* each caught 20% and 23%. From May to July, water depths increased to peak levels of 6 m to 8 m and no further fishing activities were observed in *beel*. During this period there was no evidence of restrictions placed on fishing activities by leaseholders of *beel*. It is more likely that the deeper waters were not fished because they were more difficult to fish than shallower floodplains on the periphery of *beel* where catch rates were probably higher. From August onwards fishing activities resumed but were restricted to *current jal* in August, *koi jal* in September, *ber jal* in November and December and a wider range of gears in October (Fig. 6.7). The occurrence of *current jal* in these offshore waters during August when water levels were very high, may have been an avoidance response to policing and gear confiscations carried out by the Department of Fisheries as part of "Fish Fortnight" in August. In October water levels dropped by 2 metres which stimulated fishing by *ber jal*, *dora jal* and *daun* in addition to the gill nets *current jal* and *koi jal*. In November and December, leaseholder control of fishing was increased and only *ber jal* were allowed to operate. As water levels dropped in January and February, a wider range of gears operated under the control of leaseholders but *ber jal* remained the dominant gear. Peak catches recorded between December 1993 and February 1994 resulted from peak fishing effort and catch rates by dominant gears particularly *ber jal* and *dora jal* (Figs. 6.7 and 6.8). More details of leaseholder controlled fisheries in perennial *beel* are given in Section 6.3.

*MIP - floodplains*

From February to April 1993 *jhaki jal* and *thella jal* predominated and together accounted for between 74% and 100% of monthly catches (Fig 6.9). As water levels increased in May *thella jal* took 92% of the catch from peripheral areas on high floodplains where it was still

**Figure 6.4 Total monthly fishing effort per hectare of floodplains by dominant gears: Tekuni and Gobindapur floodplains (sites NE08 + NE10, outside MIP)**

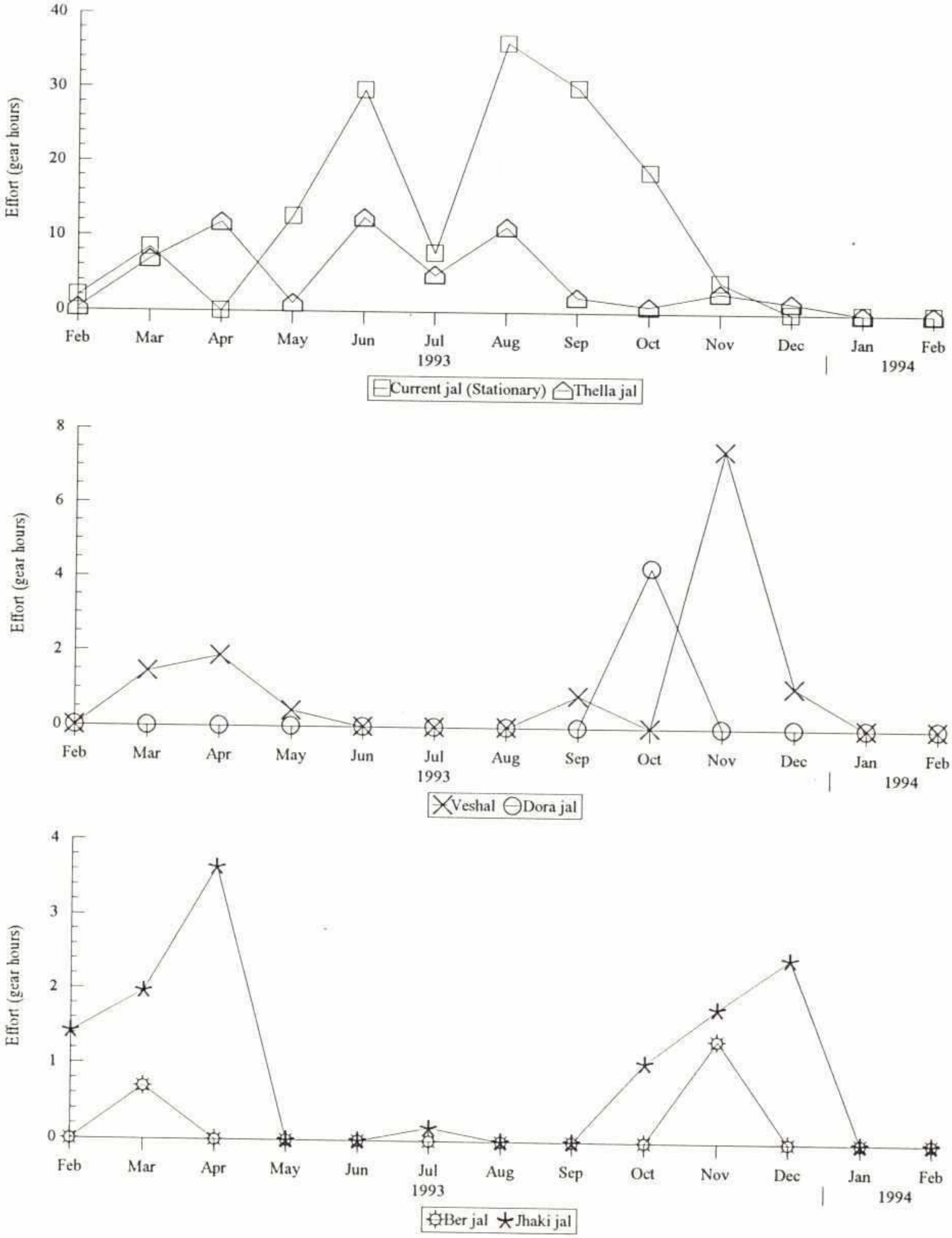
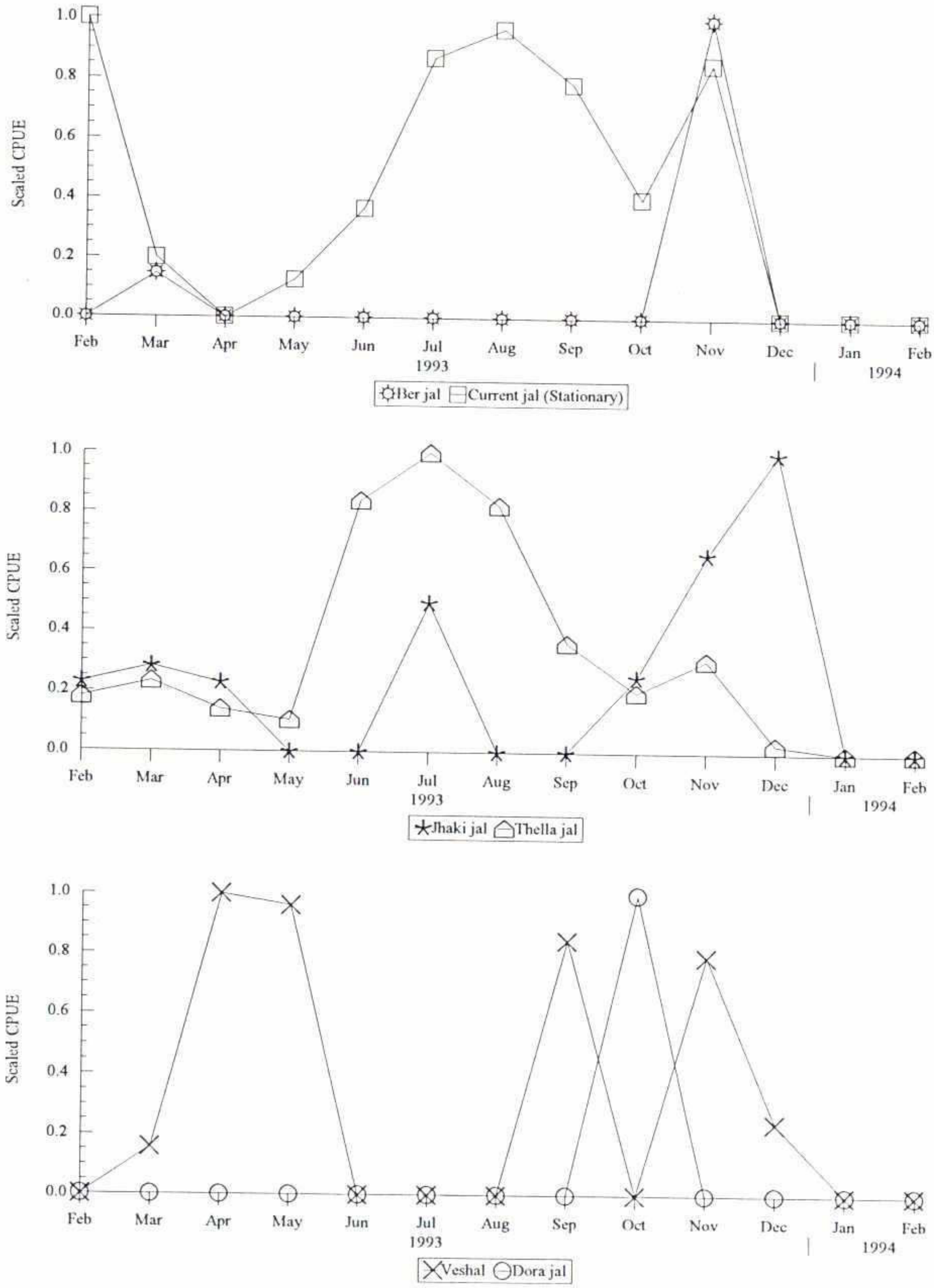


**Figure 6.5 Scaled CPUE of dominant gears: Tekuni and Gobindapur floodplains (sites NE08 + NE10, outside MIP)**




Note: Scaled CPUE are values of CPUE expressed as a proportion (decimal) of the maximum monthly value recorded

**Figure 6.6 Percentage of total monthly catch taken by dominant gears: Tekuni /Baghalkuri *Beel* (site NE09/21, outside MIP)**

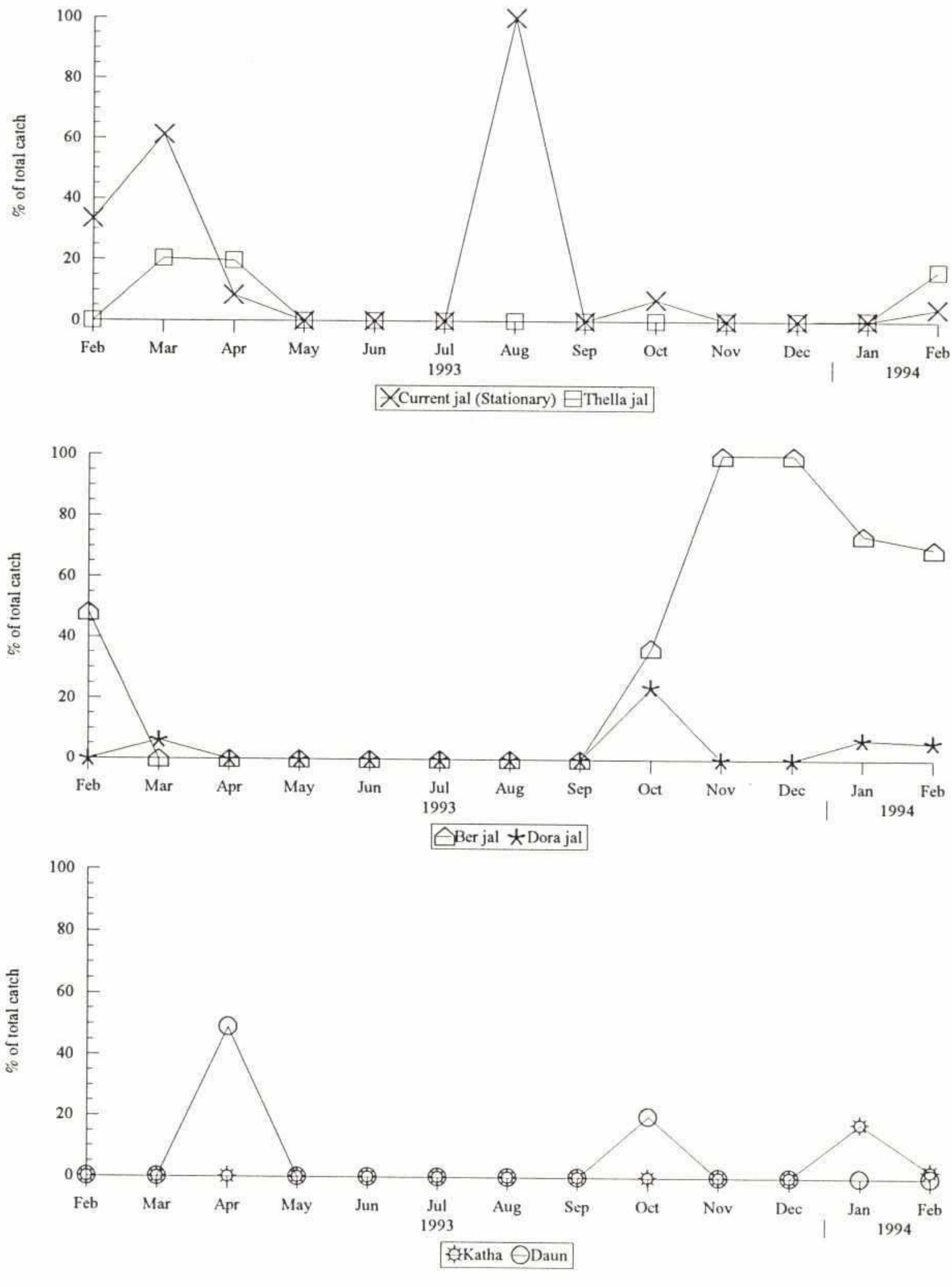


**Figure 6.7 Total monthly fishing effort per hectare of floodplains by dominant gears: Tekuni /Baghalkuri *Beel* (site NE09/21, outside MIP)**

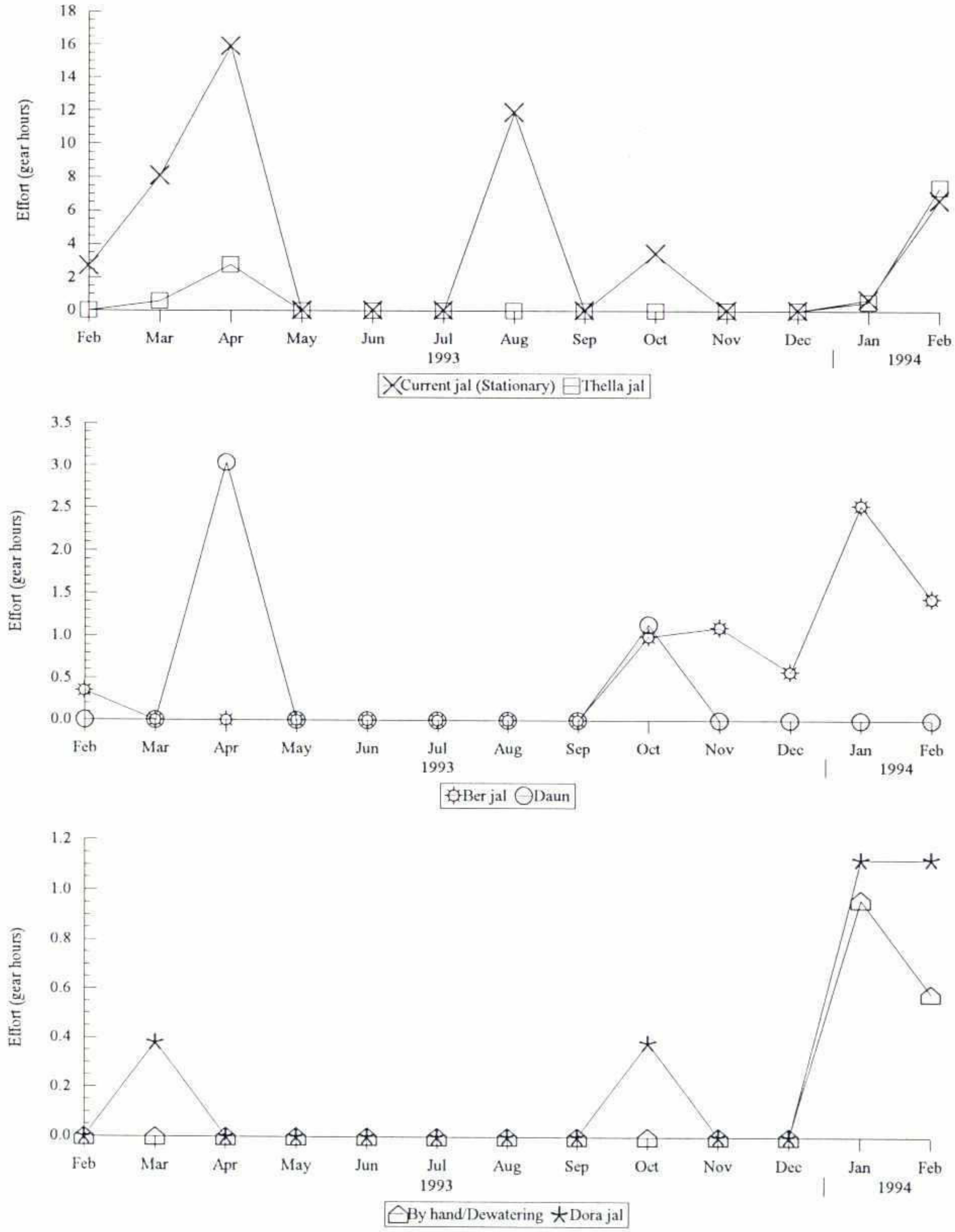
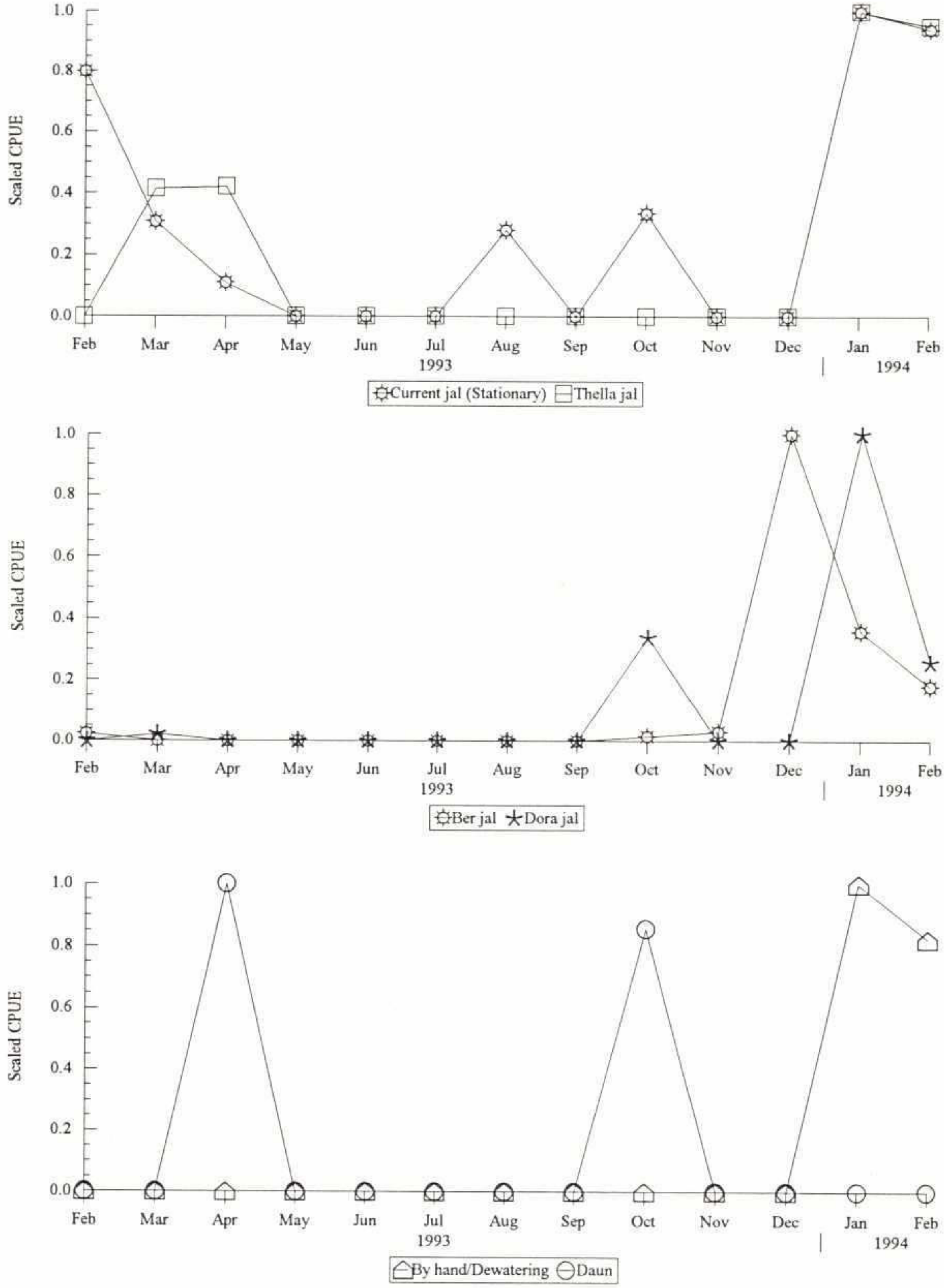
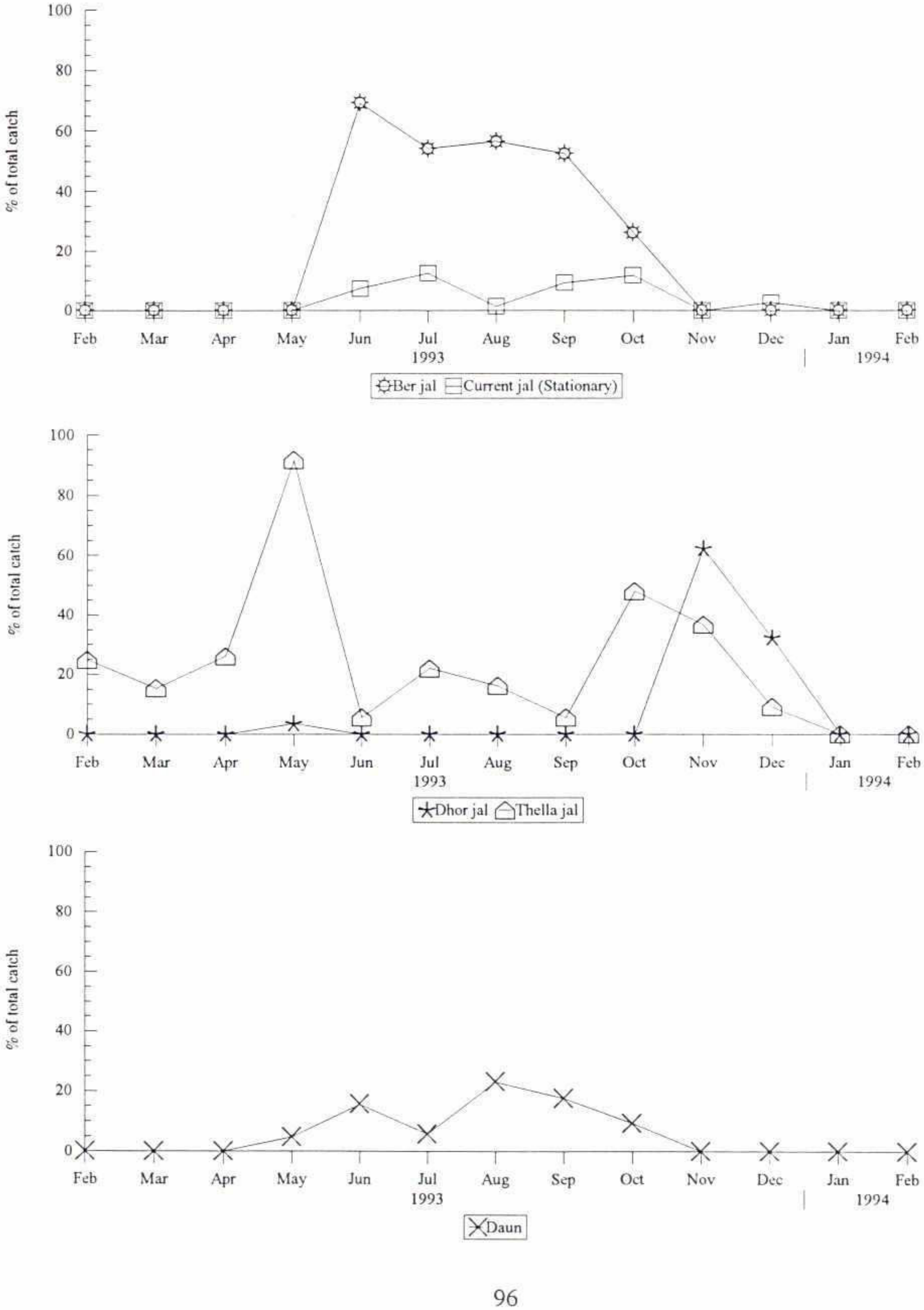


**Figure 6.8 Scaled CPUE of dominant gears: Tekuni/Baghalkuri *Beel* (site NE09/21, outside MIP)**




Note: Scaled CPUE are values of CPUE expressed as a proportion (decimal) of the maximum monthly value recorded

**Figure 6.9 Percentage of total monthly catch taken by dominant gears: Islampur and Baraimabad floodplains (sites NE02 + NE05, inside MIP)**



possible to wade and operate this gear by hand. As in Hakaluki *Haor*, this gear targeted prawns which accounted for 82% of its annual catch from floodplains. On the low floodplains only *current jal* were observed at this time. From June to September, *ber jal* dominated catches and provided between 53% to 63%. Other gears making important contributions included *thella jal*, *daun* and *current jal*. *Ber jal* were used more in deeper waters of low floodplains while *thella jal* and *current jal* were used in the shallower waters on high floodplains. As water levels dropped rapidly in October, *thella jal* again predominated, accounting for 48% of the catch. *Ber jal* and *current jal* retained importance and provided a further 26% and 12% of the catch respectively. Gears of minor importance such as *veshal*, *ghori jal* and *urani* appeared at this time and operated in drainage canals which had remained submerged since May. As floodplains dried out in November and December the bulk of the catch was provided by small seine nets, *dhor jal*, and also by *thella jal* and *jhaki jal*. Only one distinct peak in catch was observed when catch data from low and high floodplains were combined (Fig 6.2). This occurred in May and resulted principally from a peak in fishing effort by *thella jal* on floodplains newly inundated by rainfall (Fig. 6.10).

The catch rate of *thella jal* at this time was lower than those observed during July and August and during the flood drawdown (Fig. 6.11). From July to November, catches remained high but showed a slight decrease with time. In contrast, the amount of fishing effort by dominant gears fluctuated more but this did not coincide with variation in catch rates. Most dominant gears showed two peaks in catch rate, one of which occurred at some stage during the flood drawdown depending on the nature of gear use. At this time of year fish were concentrated in smaller areas of water and therefore higher catch rates are expected.

In comparison with seasonal patterns of fishing seen on Hakaluki *Haor*, the principal difference in the MIP was the greater exploitation of low floodplains. On Hakaluki *Haor*, between 82% to 95% of the catch taken between June and August was derived from high land on the periphery of the *haor* using *thella jal*. In the MIP, while the *thella jal* fisheries on high land were very important, *ber jal* and *daun* fisheries operating on lower floodplains contributed the bulk (60-85%) of the catch between June and September. The difference between sites could be attributed to differences in topography. The MIP continued one major area of perennial *beel* into which floodplains gradually sloped over long distances whereas on Hakaluki there were a large number of almost contiguous perennial *beel* with depths of 8 m or more, which would be difficult to fish in the monsoon.

**Figure 6.10 Total monthly fishing effort per hectare of floodplains by dominant gears: Islampur and Baraimabad floodplains (sites NE02 + NE05, inside MIP)**

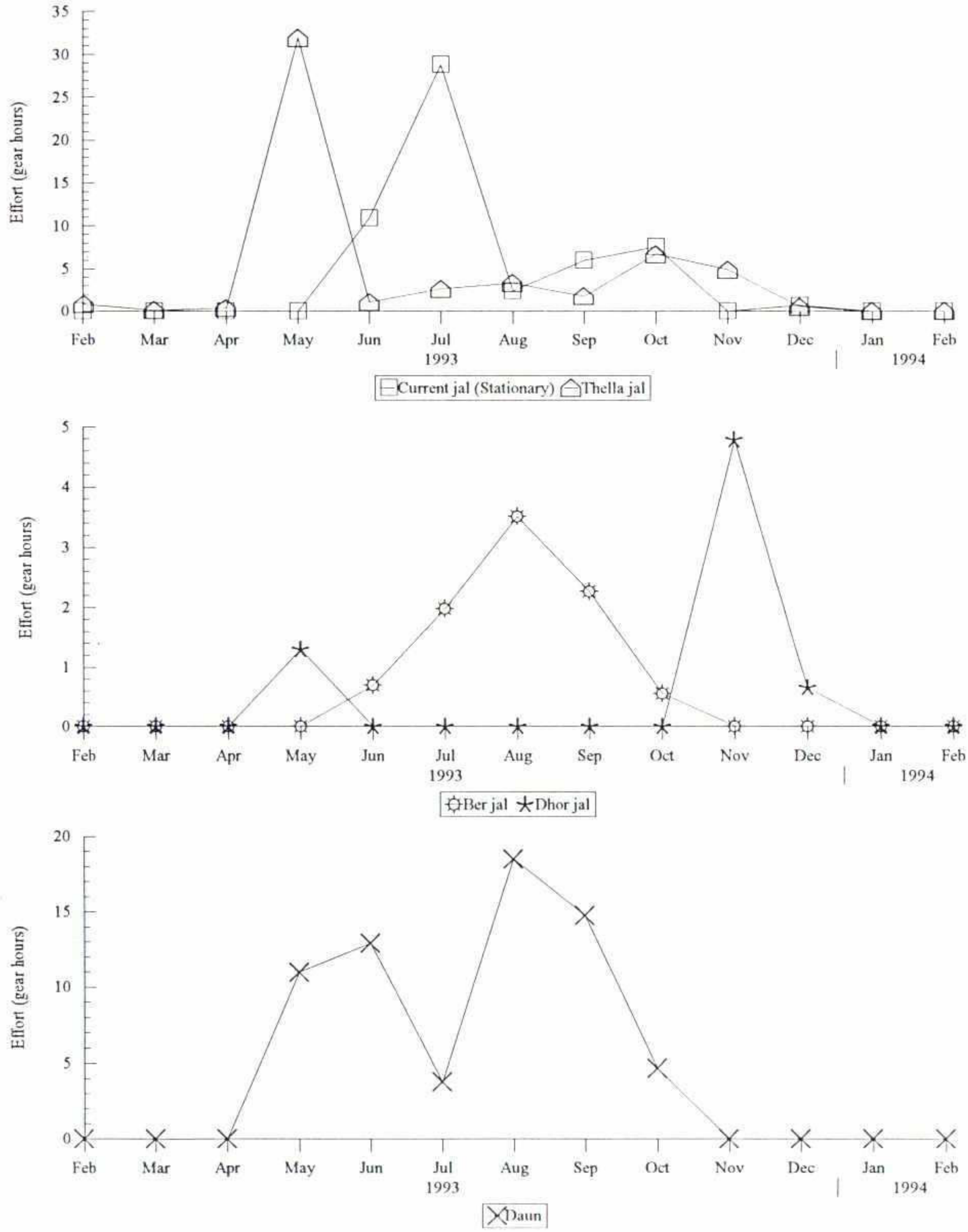
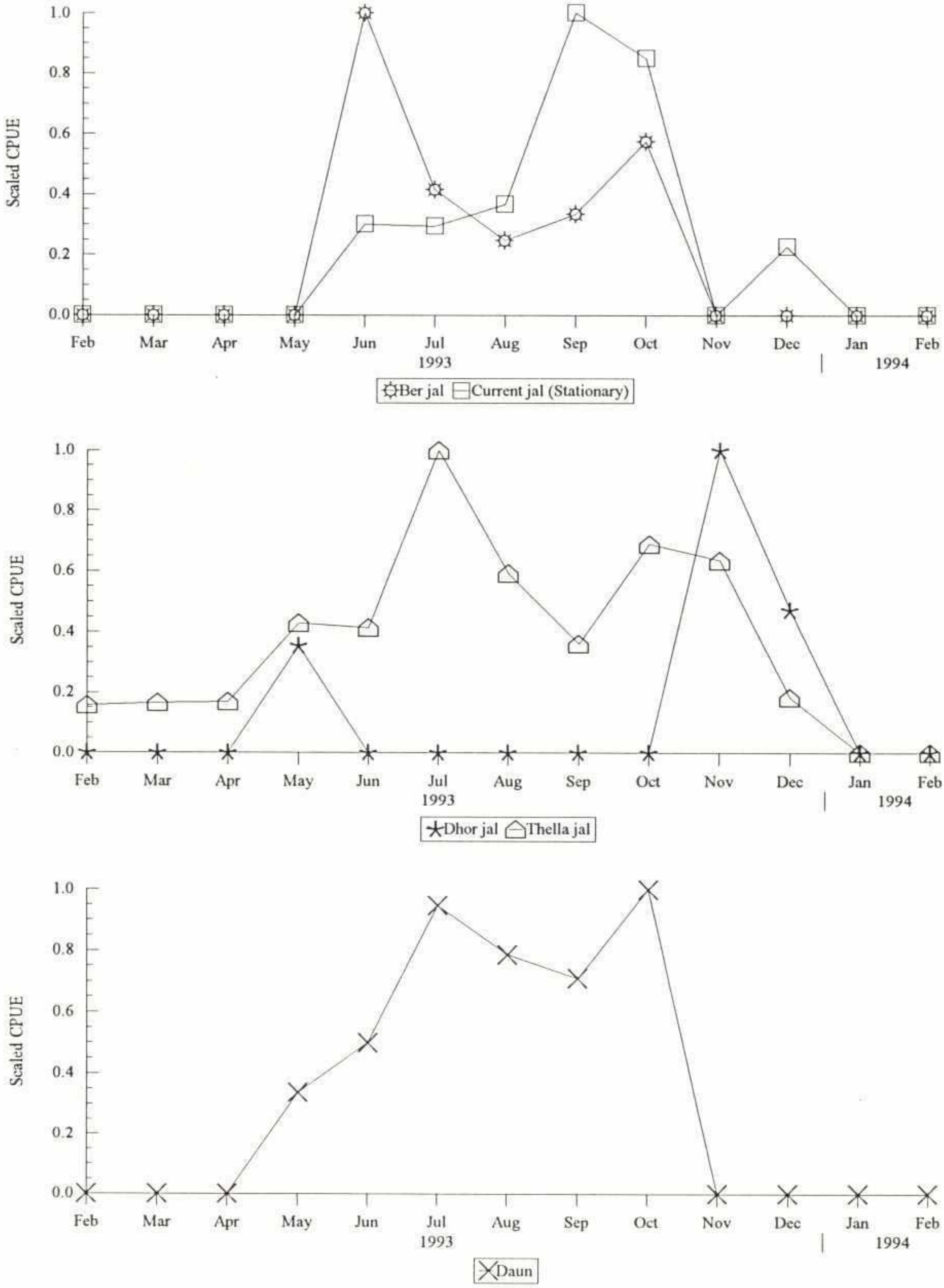


**Figure 6.11 Scaled CPUE of dominant gears: Islampur and Baraimbad floodplains (sites NE02 + NE05, inside MIP)**




Note: Scaled CPUE are values of CPUE expressed as a proportion (decimal) of the maximum monthly value recorded

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*MIP - perennial beel*

Leaseholder controlled fishing of Patasinga *Beel* ended in January 1993 after which very low catches were taken between February and April by *current jal*, *thella jal* and *ber jal* (Fig. 6.12). In May, only *daun* fished and caught very little despite the rapid rise in water level in that month. In June and July no fishing was observed in the *beel*. This was not because of leaseholder restrictions but because of the lower efficiency of gears operating in waters which reached a depth of 8 m. Avoidance by fishermen of such deep water areas was also observed on Hakaluki *Haor* at this time of year. Fishing resumed in August when water levels were still very high. Only two gear types were found, *daun* and *koi jal*, which took 87% and 13% of the catch respectively. In September and October a wider range of gears operated as water levels dropped. During the early stage of the drawdown in September, *ber jal* captured 45% of the catch while *daun* and *doiar* traps caught a further 22%.

As water levels dropped more rapidly in October and November, *thella jal* took just over half the catch but *current jal*, *daun* and *urani* were also important. At this time of year the leaseholder of Patasinga *Beel* posted guards to reduce fishing in the designated area of the *jalmahal* and catches consequently remained low. In December the leaseholder's control over the fishery increased but unauthorised fishing by subsistence gears continued. *Thella jal* used by day accounted for 77% of the catch while *veshal* fished under the control of the leaseholder and took a further 13% of a low monthly catch. In January and February, leaseholder fishing operations started in earnest.

Figures 6.13 and 6.14 show the clear seasonality in fishing effort and catch rates of the top 6 dominant gears used on Patasinga *Beel*. Catch rates of all gears reached peak levels in either January or February when fish were concentrated in a decreasing area of water after migrating from the surrounding floodplain. Fishing effort by all gears except *thella jal* also reached peak levels during this period. For *thella jal*, peak effort was recorded in December when the leaseholder had not yet established full control of the fishery.

Seasonal fishing patterns observed in Patasinga Beel were very similar to those seen on Hakaluki *Haor*. More detailed descriptions of leaseholder controlled fishing in both areas are presented in the next section.

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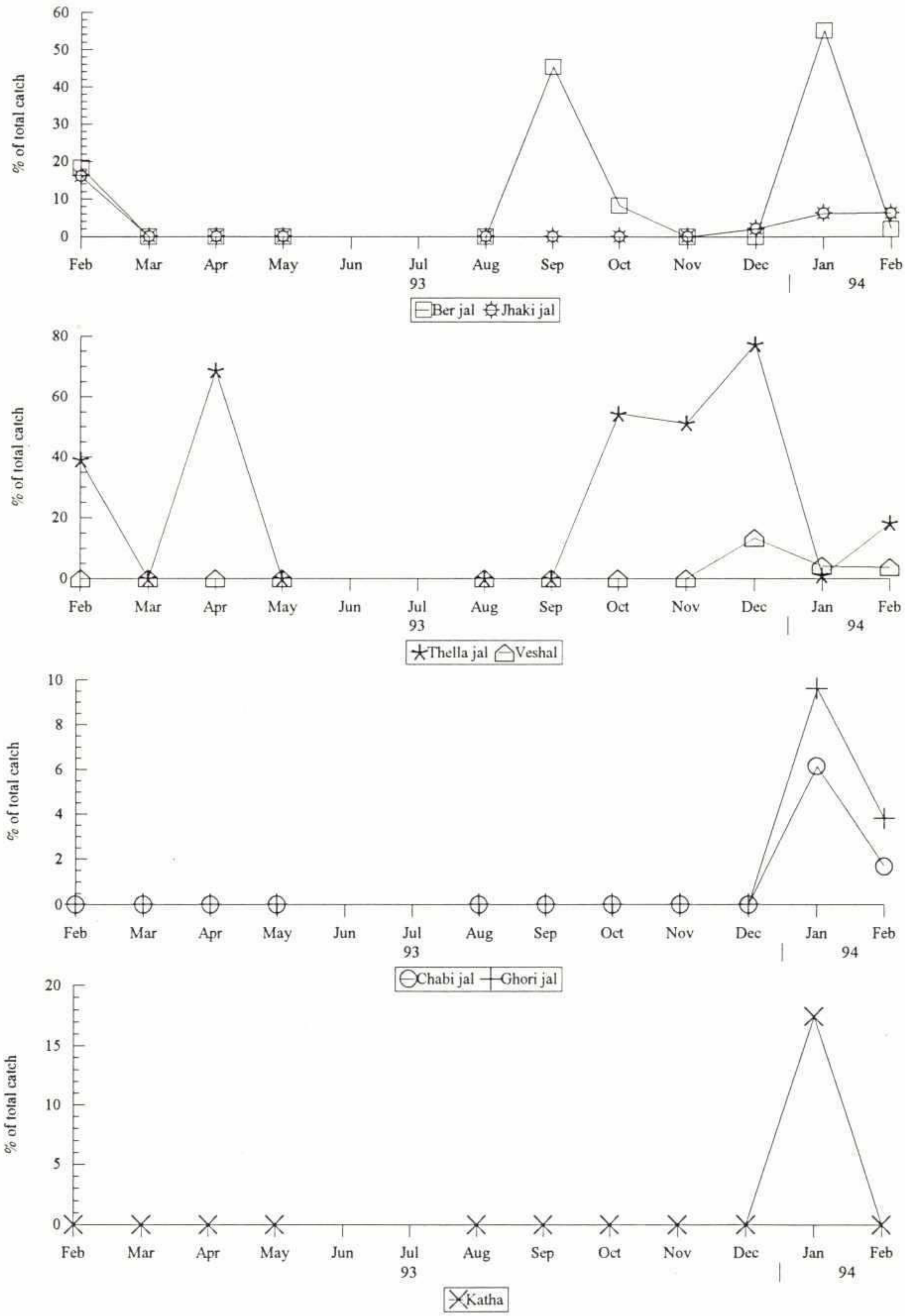
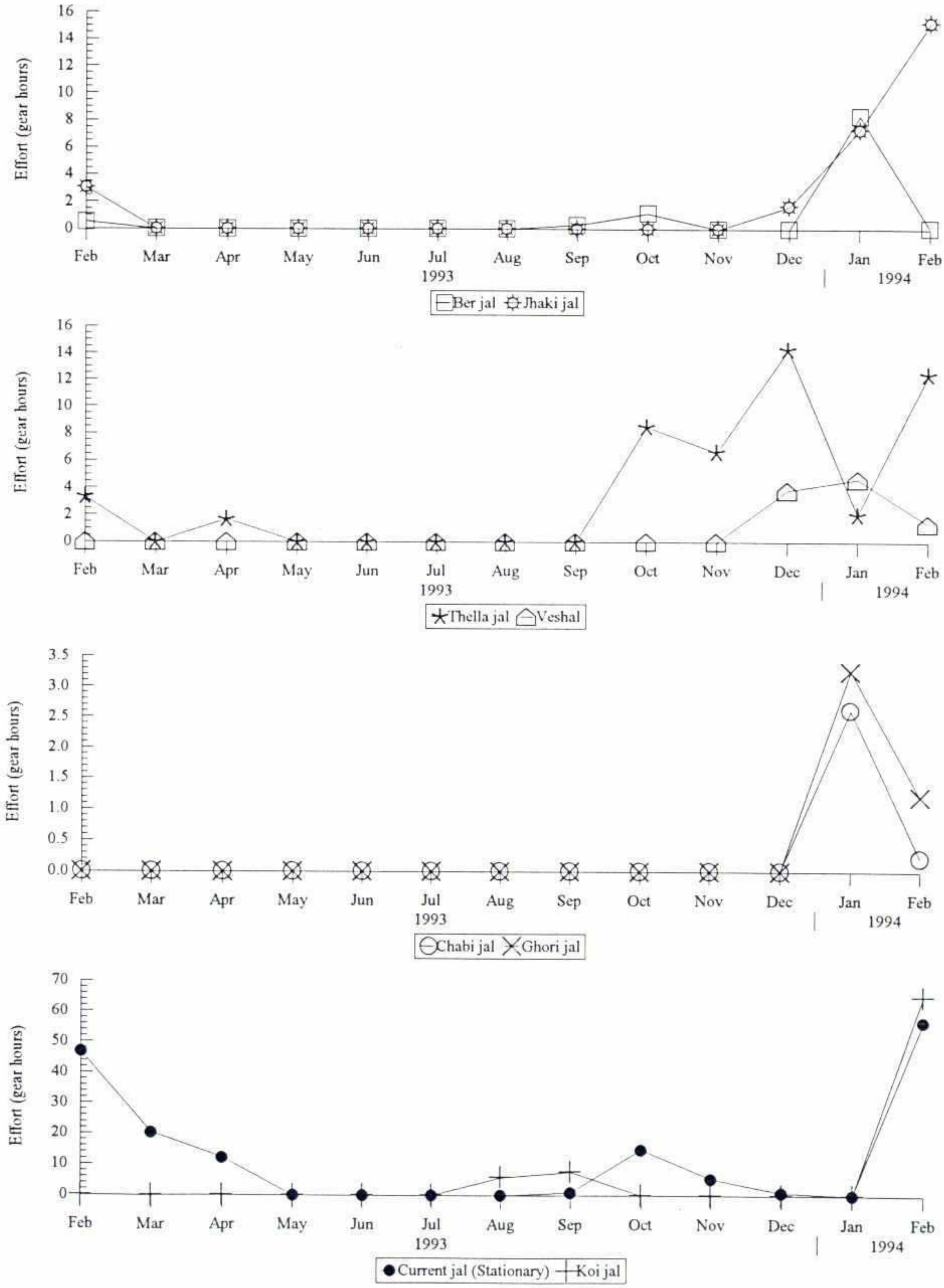
**Figure 6.12 Percentage of total monthly catch taken by dominant gears: Patasinga *Beel* (site NE04, inside MIP)**



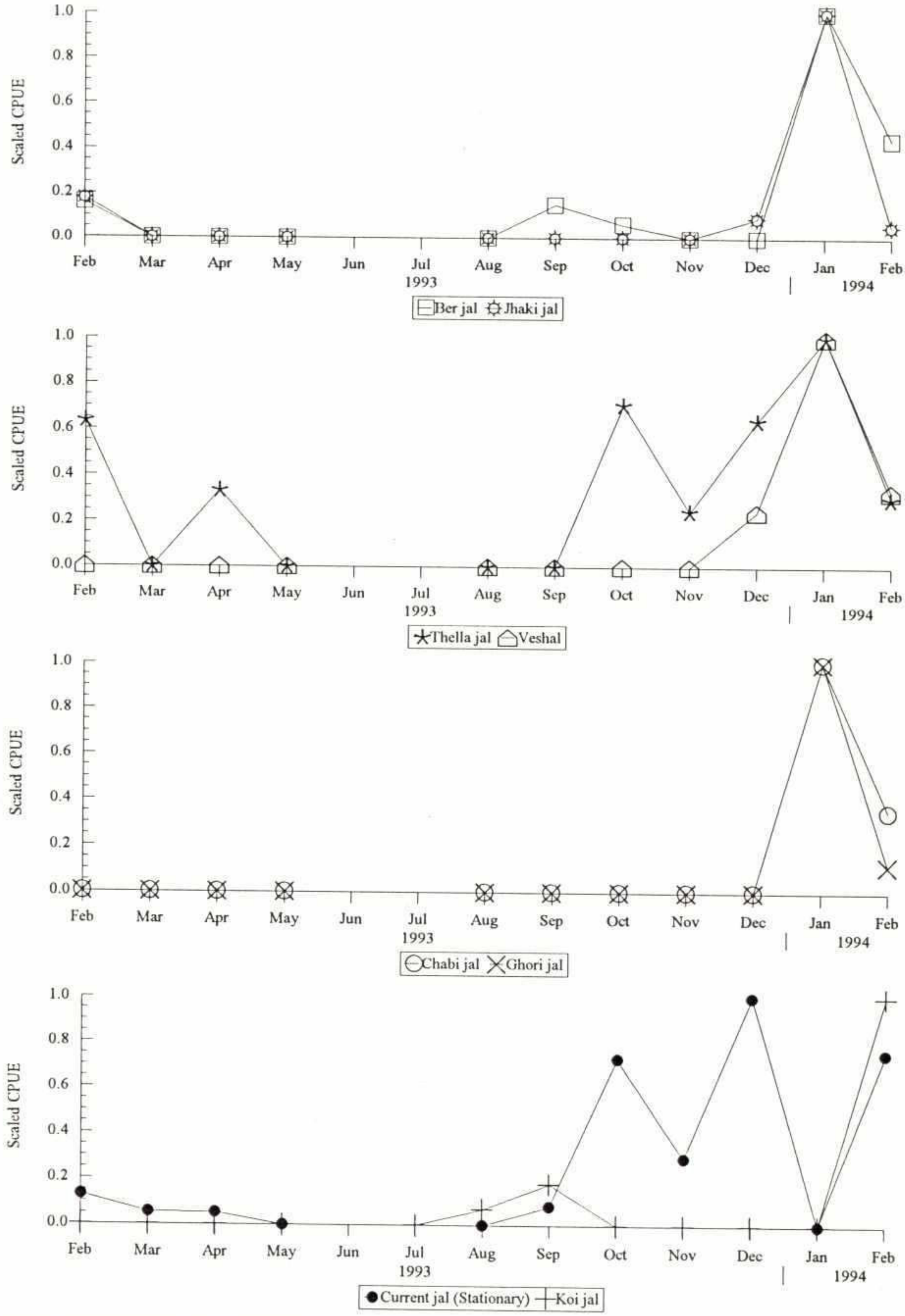

Note: No fishing observed in June and July 1993

**Figure 6.13 Total monthly fishing effort per hectare of floodplain by dominant gears: Patasinga *Beel* (site NE04, inside MIP)**




Note: No fishing observed in June and July 1993

**Figure 6.14 Scaled CPUE of dominant gears: Patasinga *Beel* (site NE04, inside MIP)**




Notes: 1. Scaled CPUE are values of CPUE expressed as a proportion (decimal) of the maximum monthly value recorded
2. No fishing observed in June and July 1993

8(07)

## 6.3 Leased *Beel* Fisheries

Because of the intensive fishing carried out during winter on leased perennial *beel*, a different method for catch assessment was adopted. Teams of two or three fisheries biologists were permanently stationed in leaseholders' fishing camps, where they measured the total daily catch of each gear type before fish were auctioned, and analysed sub-samples of the catch to obtain daily catch compositions of each gear type. On Patasinga *Beel* where subsistence fishing was tolerated and where some unauthorised fishing occurred, daily catch rates and effort of these gears were also monitored. On both Patasinga and Baghalkuri *Beel*, leaseholders offered full cooperation to FAP 17 monitoring teams. Although leaseholders did not keep records of their catch, they did keep daily records of the income generated by the sale of fish. Records of the daily value of the catch were made available to FAP 17. Details of overall cost and income from leased *beel* fisheries together with information of catch shares allocated to fishermen have been documented separately[14]. Monitoring of fishing activities continued up to the completion of the FAP 17 study at the end of February 1994. Leaseholder operations continued a little longer however, up to mid-March when the first heavy rains occurred.

### 6.3.1 Hakaluki *Haor:* Baghalkuri *Beel*

Fishing by the leaseholder commenced on the 23 December 1993 but daily monitoring of the catch started on 3 January 1994. To obtain daily catch estimates for the unsampled period, regression and correlation analyses were used on daily catch values against weight (Fig. 6.15). Using the regression equation shown in Figure 6.15 daily catch values for the unsampled period were converted to daily catch weight. Catch composition during the unsampled period was derived from the mean catch composition of the first week sampled.

From October onwards when water levels dropped and the banks of the *beel* emerged, the leaseholder's guards prohibited fishing in the *beel*. When leaseholder fishing commenced in late December, the *beel* was heavily guarded and no subsistence fishing was allowed. Total daily catches fluctuated depending on catch rates and effort of prevailing dominant gears but there was a clear downward trend until about mid-February when catches stabilised at about 200-250 kg/day (Fig. 6.16). No fishing occurred on the 28th January and 22 February due to a religious festival and bad weather respectively. Peak daily catches were recorded during the start of fishing operations in December and in mid-January when one large *katha* was harvested. Daily catch values followed the same pattern as daily catches. Peak values at the

**Figure 6.15 Relationship between daily catch value and weight from Baghalkuri Beel in Hakaluki Haor, January - February 1994**

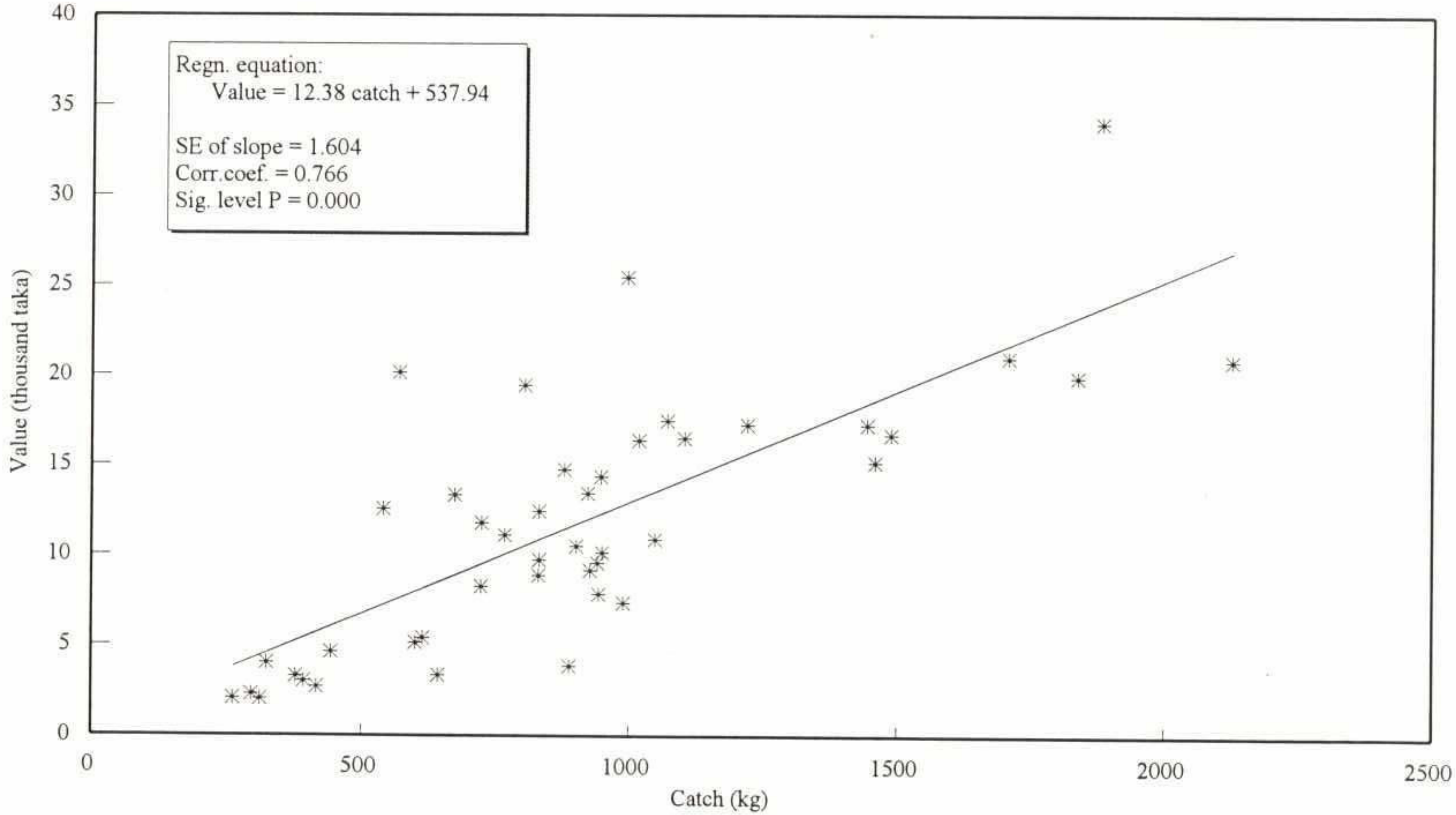





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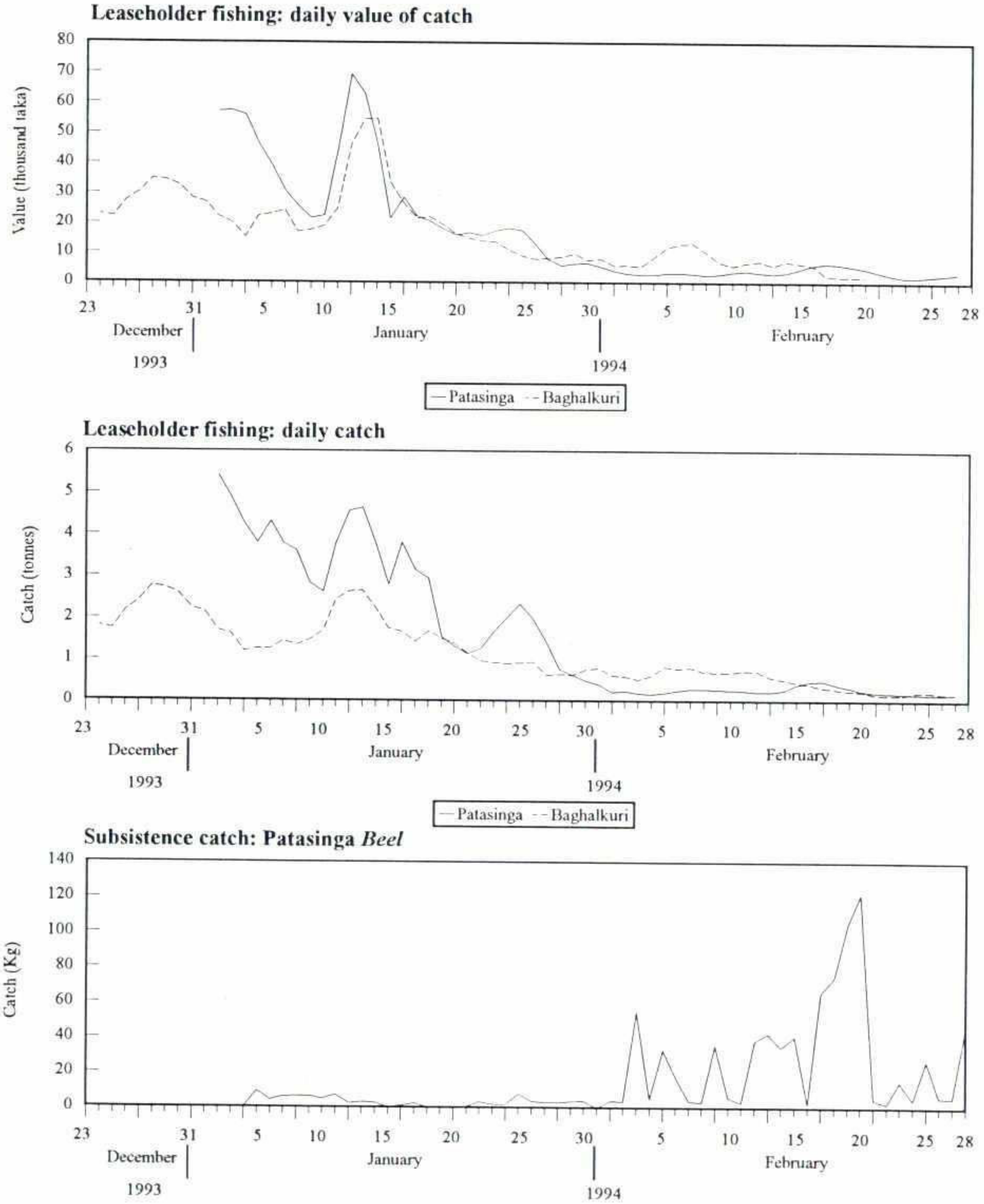
**Figure 6.16 Variation in daily catch and catch value from leaseholder fishing in Patasinga and Baghalkuri *beel***




Notes: 1. A three point running average was used for leaseholder catch and value data
2. No subsistence fishing was allowed on Baghalkuri *Beel*
3. Subsistence catch does not include estimated night fishing catch of 1182 kg for February 1994

start of fishing and in mid-January were due not only to increased catches but also to changes in catch composition (Fig. 6.16). More larger and higher value fish were caught during these periods. The total catch from leaseholder fishing between December and February was 77.2 tonnes which when divided by the area of the *beel* resulted in a catch per unit area of 181 kg/ha.

The *beel* was fished up to 5 January by *ber jal* only which ranged in number from 2 to 6 nets per day and varied in mesh size depending on the species targeted. There were 3 *katha* in the *jalmahal.* One *katha* was harvested during early January and a second in mid-January when they contributed between 17% and 66% of daily catches (Fig. 6.17). As water levels dropped in January up to 5 *dora/bosta jal* (drag nets) started fishing and accounted initially for about 10% to 15% of daily catches, dropping to between 2% and 5% by the end of the month. Daily catch contributions made by *ber jal* remained high throughout January when, in the absence of *katha* fishing, they usually provided more than 90% of the catch. As water levels dropped in late January and February, small-scale gears such as *thella jal* and *current jal* were used and occasionally *jhaki jal*, *uttar jal* and fishing by hand. In February, *thella* increased their share of daily catches up to 20% to 30%, while *ber jal* provided between 50% to 75%. A third *katha* was harvested on 1 February but provided only 28% of the catch. This *katha* was smaller than those harvested during the previous month. The drainage canal of the *beel* was fished by 6 to 10 *deal* traps set along a *bana* (barrier fence). Daily catches were relatively low (< 1%) and fishing stopped in early February when the canal was again dammed to prevent floodwaters entering the *beel* from the Juri River. Water levels gradually decreased in February due to evaporation and seepage.

Fishing effort by *ber jal* remained reasonably stable throughout the survey period but catch rates dropped quickly during the first weeks' fishing and more gradually through January and February as fish stocks were depleted (Figs 6.18 and 6.19). Fishing effort by *dora jal* was high in January and decreased slightly in February when wide daily fluctuations were recorded. Catch rates were highest during the first week of fishing in mid-January but decreased considerably to stabilise at a low level throughout February. Fishing effort by *current jal* and *thella jal* peaked during the first two weeks of February but catch rates remained fairly stable throughout the month. Daily percentage catch of dominant species are shown in Figure 6.20. *Guizza* was the most important species, comprising between 20% to 30% of daily catches throughout January and February. In contrast, *chapila*, *kabashi* and *kani pabda* were more abundant during early stages of fishing while mrigel was more abundant later.

Figure 6.17 Percentage daily catch of dominant gears used on Baghalkuri *Beel*, December 1993 - February 1994

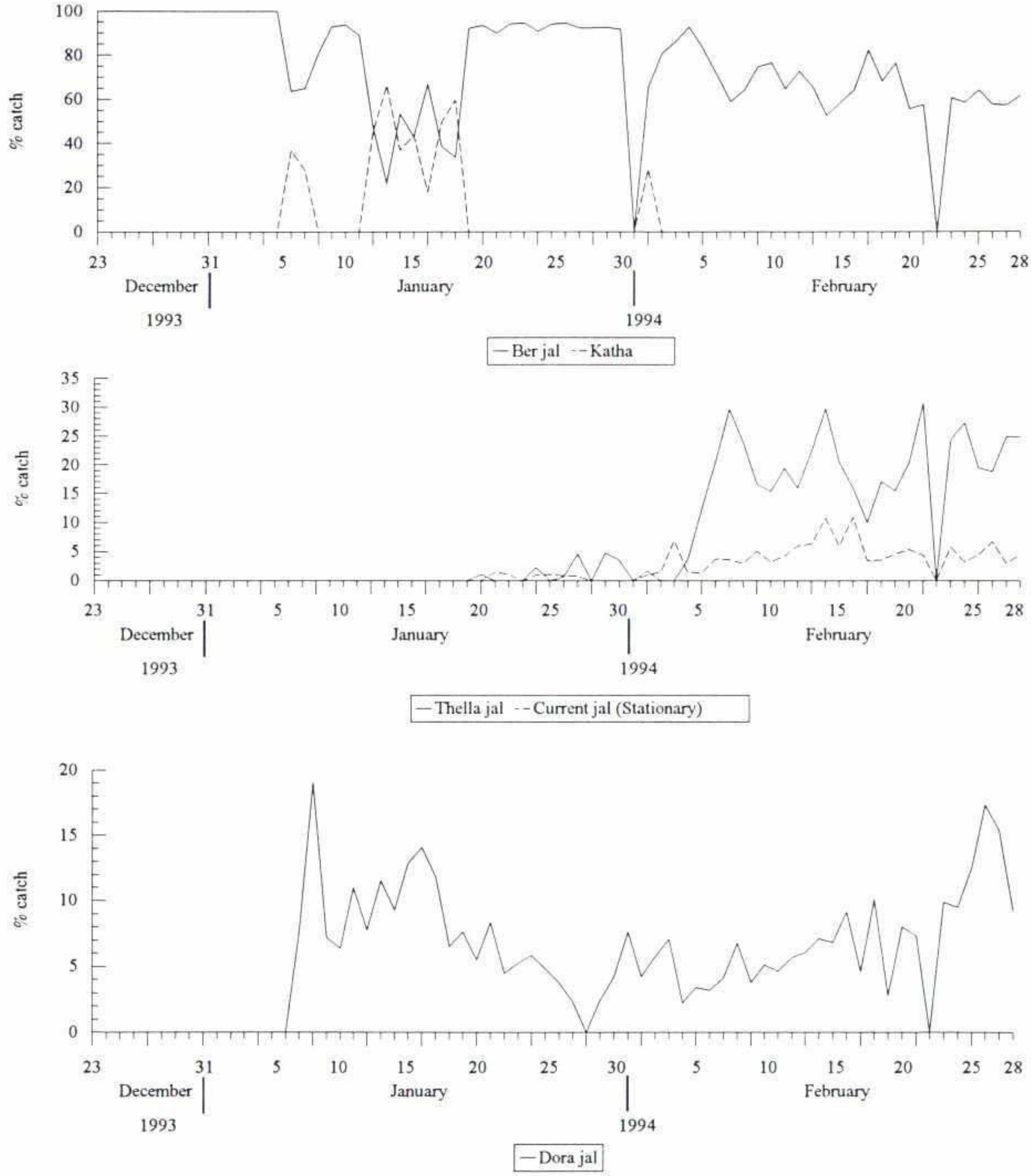


**Figure 6.18 Variation in daily fishing effort by dominant gears on Baghalkuri *Beel*, December 1993 - February 1994**

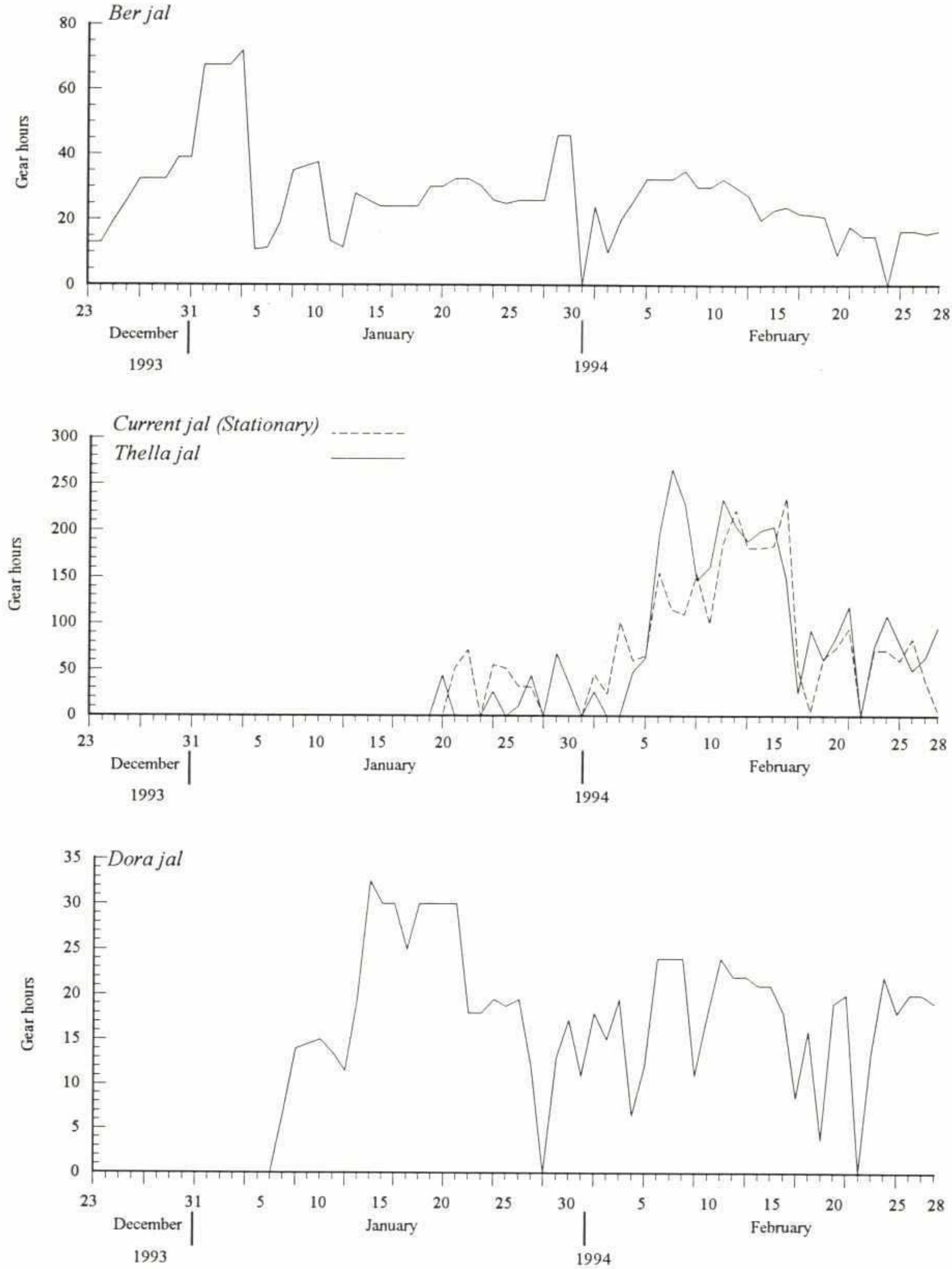


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**Figure 6.19 Variation in daily catch rates of dominant gears used on Baghalkuri *Beel*, December 1993 - February 1994**

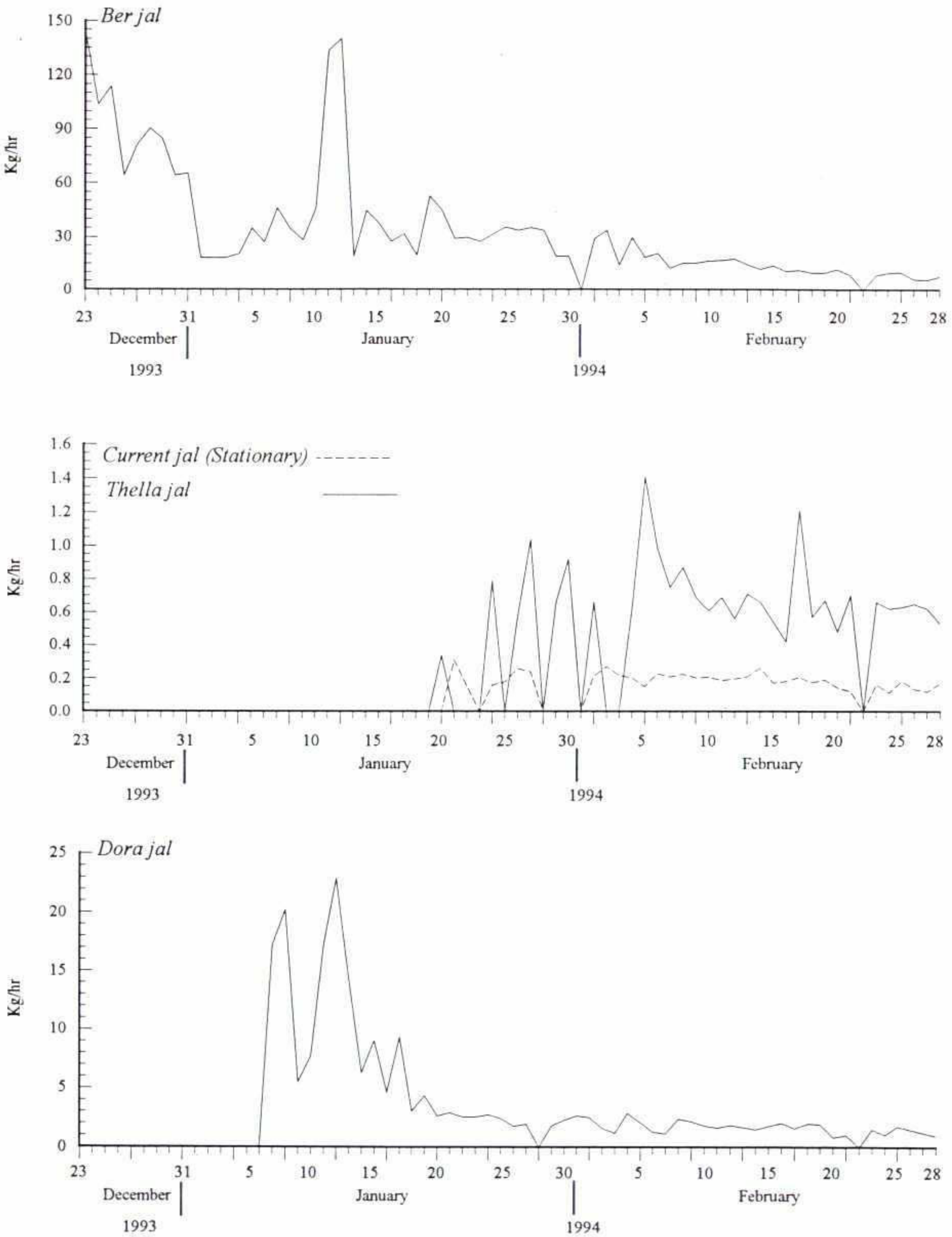
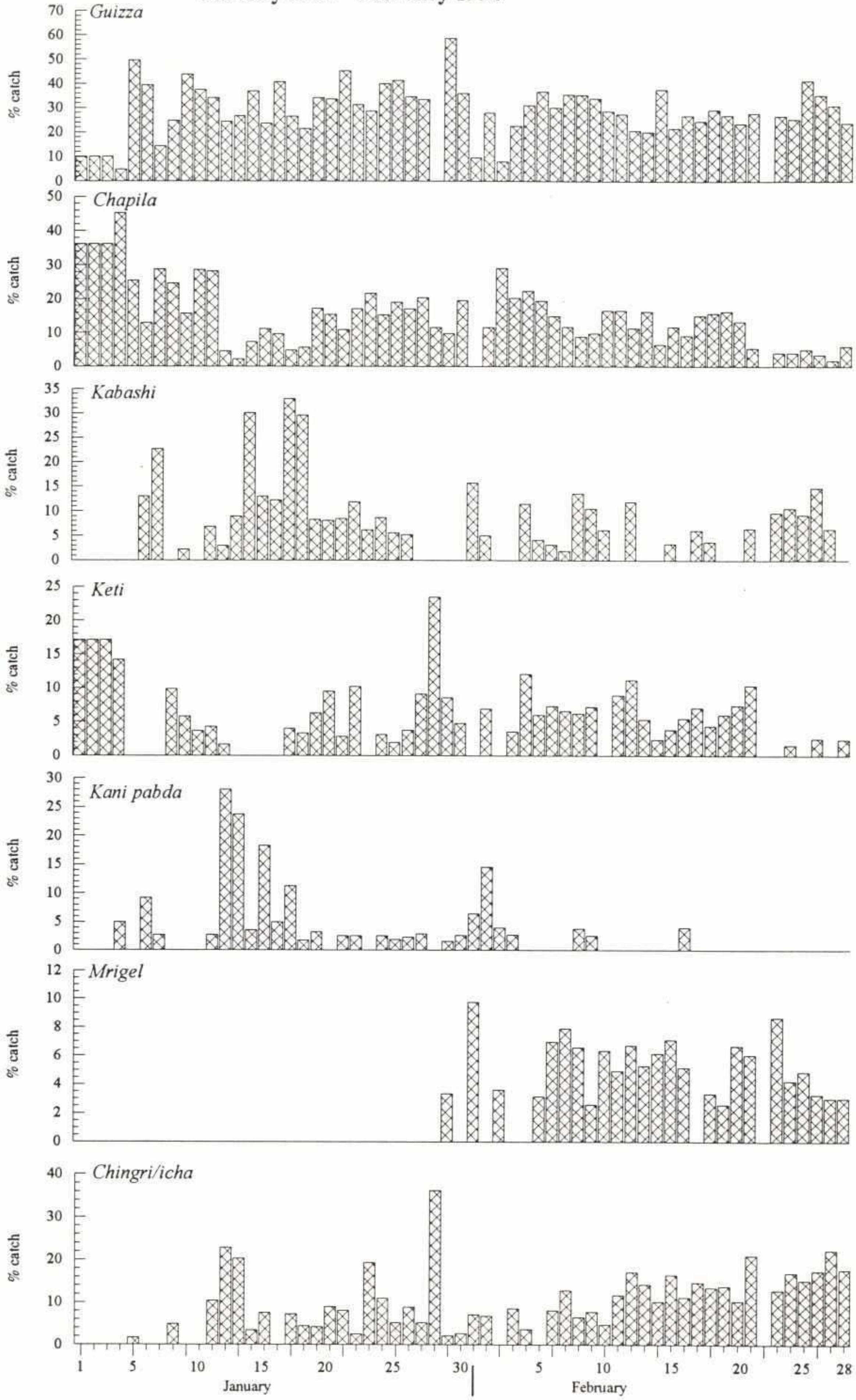


**Figure 6.20 Variation in daily catch compositions in Baghalkuri *Beel*, January 1994 - February 1994**



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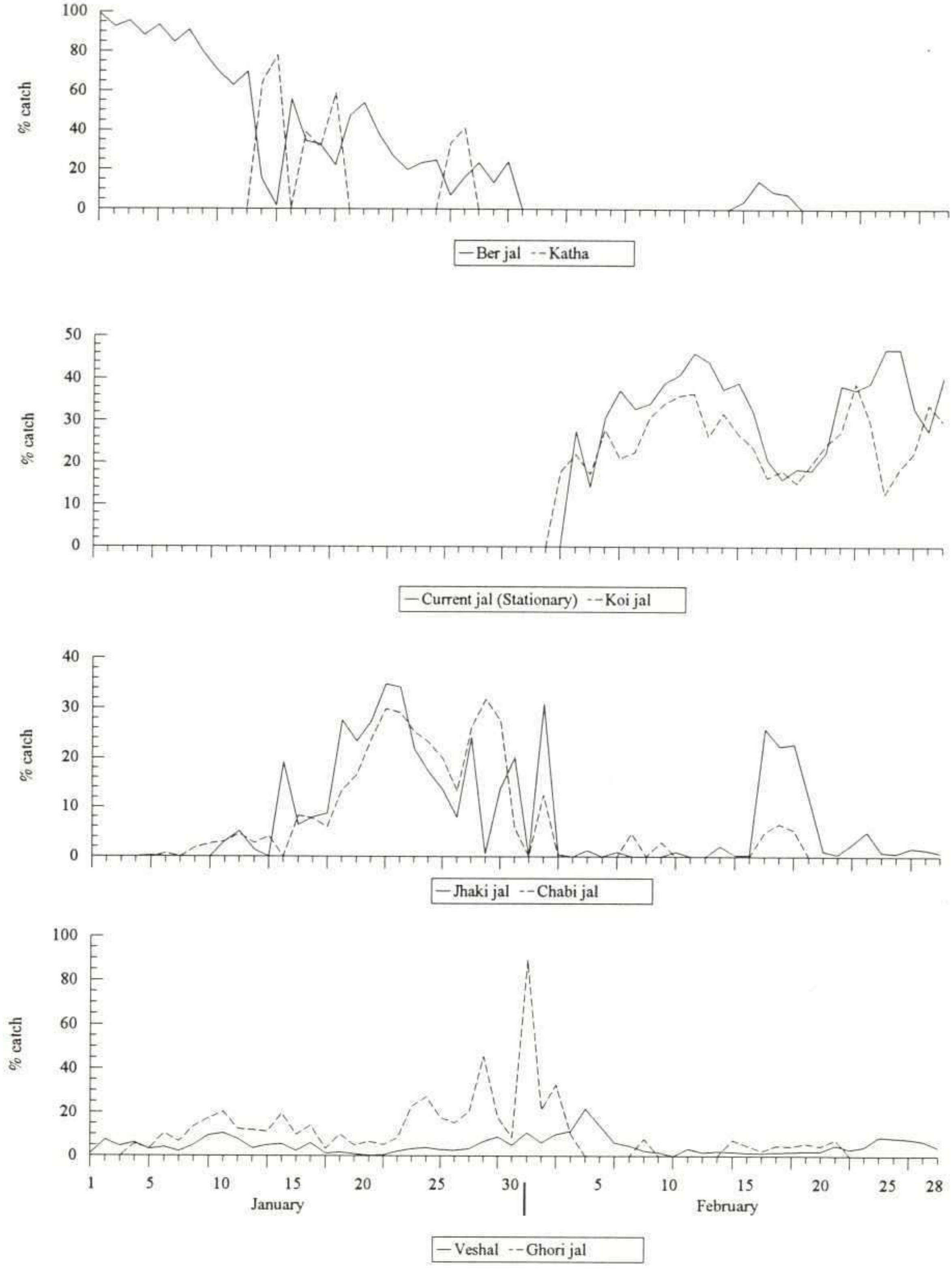
### 6.3.2 MIP: Patasinga *Beel*

Leaseholder fishing started on 1 January 1994 but fishing activities on the *jalmahal* were controlled to varying degrees from October onwards. Daily catches followed the same general pattern as those from Baghalkuri *Beel*. Catches were very high during the first week of fishing and again in mid-January when a single large *katha* was harvested (Fig. 6.16). At this time daily catches fluctuated widely but there was a clear downward trend with time until they stabilised at about 200-250 kg/ha from mid-February onwards. Variation in daily catch values followed broadly the same pattern as daily catches. Peak values at the start of fishing and in mid-January were related not only to the size of catch but also the catch composition. Both were periods when larger, higher value species such as carp and catfish were more abundant in catches. In contrast to Baghalkuri *Beel*, subsistence fishing occurred on Patasinga *Beel* despite the presence of leaseholders' guards. A variety of gears was used, the most important of which were *thella jal* used in daytime and *current jal* and *daun* at night. The total catch from the *beel* during the period of leaseholder control (January and February) was estimated at 97.1 tonnes which was equivalent to a catch per unit area of 450 kg/ha. Leaseholder fishing accounted for 95 tonnes which was 98% of the total catch. The remaining 2% was caught by subsistence fisheries, mainly *current jal*, most of which operated in February when water levels were low (Fig. 6.16).

A total of 19 *ber jal* was used on the *beel* during the initial fishing operations. At this time *ber jal* provided about 90% of daily catches but this dropped to between 20% to 50% during the second half of January (Fig. 6.21). In February *ber jal* were hardly used at all and were replaced first by *chabi jal* and very large *jhaki jal*. Change in gear use was in response to decreasing water levels which were controlled to a large extent by the leaseholder. However, the entry of irrigation water from the southern area of the catchment resulted in water level increases of up to 0.4 m. The leaseholder complained that such increases made it more difficult to harvest the *beel*. In reality, the increases in water level served to protect fish partially from over-exploitation. The fishing patterns seen on Patasinga *Beel* were clearly different from those on Baghalkuri and could be attributed to the greater intensity of harvesting of the regulated *beel*. This was also seen on the drainage canals of the two *beel*. On Patasinga *ghori jal* and *veshal* fished almost every day and on some occasions made considerable contributions to total daily catches. This contests with the rather hight fishing effort by *deal* traps set on the drainage canal of Baghalkuri.

**Figure 6.21 Percentage daily catch of dominant gears used on Patasinga *Beel*, January - February 1994**




Note: For *current jal* and *koi jal*, additional catches of 593.60 kg and 573.80 kg respectively, were estimated from night fishing in February 1994. These were not included in graph

Initial fishing effort by *ber jal* was up to four times higher on Patasinga *Beel* than on Baghalkuri but the duration of this fishing heavy pressure was much shorter, lasting only 3 weeks in January (Fig. 6.22). It was then replaced by equally heavy fishing by large *jhaki jal* and *chabi jal*. These gears were not used on Baghalkuri *Beel* but gill nets were used on both *beel* and fishing effort by these was about six times higher on Patasinga *Beel* during February.

Daily catch rates of *ber jal* decreased substantially during the first three days fishing from 140 kg to about 20 kg (Fig. 6.23). They decreased further in mid-January but increased again, with some fluctuation, towards the end of the month. Compared with Baghalkuri *Beel*, catch rates were generally lower in Patasinga probably due to the higher fishing effort applied to a smaller areas of water. Catch rates of *jhaki jal* and *chabi jal* were relatively stable in January but lower in February on the few days these gears were used. Gill net catch rates fluted widely in February and showed no consistent decrease which in surprising given the amount of total fishing effort applied by different gears. For both *current jal* and *koi jal* catch rates generally varied inversely to the amount of effort applied. Catch rates of *current jal* were higher than *koi jal* and were slightly higher than *current jal* used in Baghalkuri *Beel* in February which suggests that fish densities were higher at this in Patasinga despite the very high fishing pressure previously exerted.

Catches were dominated by ayre during January and mid-February while stocks of fish such as *chapila*, *karfu* and to a lesser degree *mrigel*, were depleted during the initial stage of harvesting (Fig. 6.24). Species which evaded capture in January, but which were taken from the shallow waters and mud during February, included *taki*, *shingi* and *bheda*. So clear a sequential change in catch composition with time was not seen on Baghalkuri *Beel*, probably because of the lower fishing effort over a wider expanse of water.

**Figure 6.22 Variation in daily fishing effort by dominant gears on Patasinga *Beel*, January - February 1994**

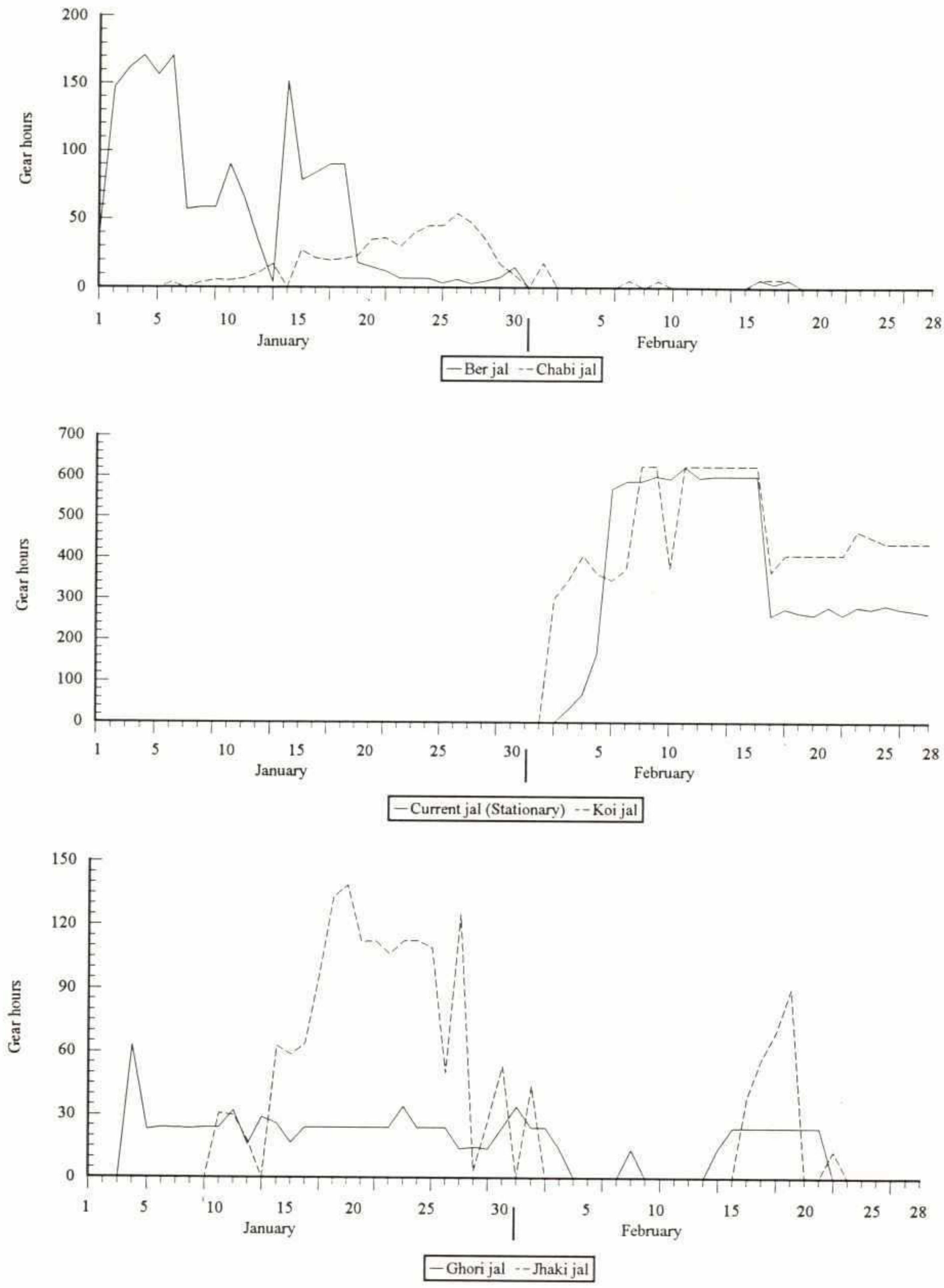


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**Figure 6.23 Variation in daily catch rates of dominant gears used on Patasinga *Beel*, January - February 1994**

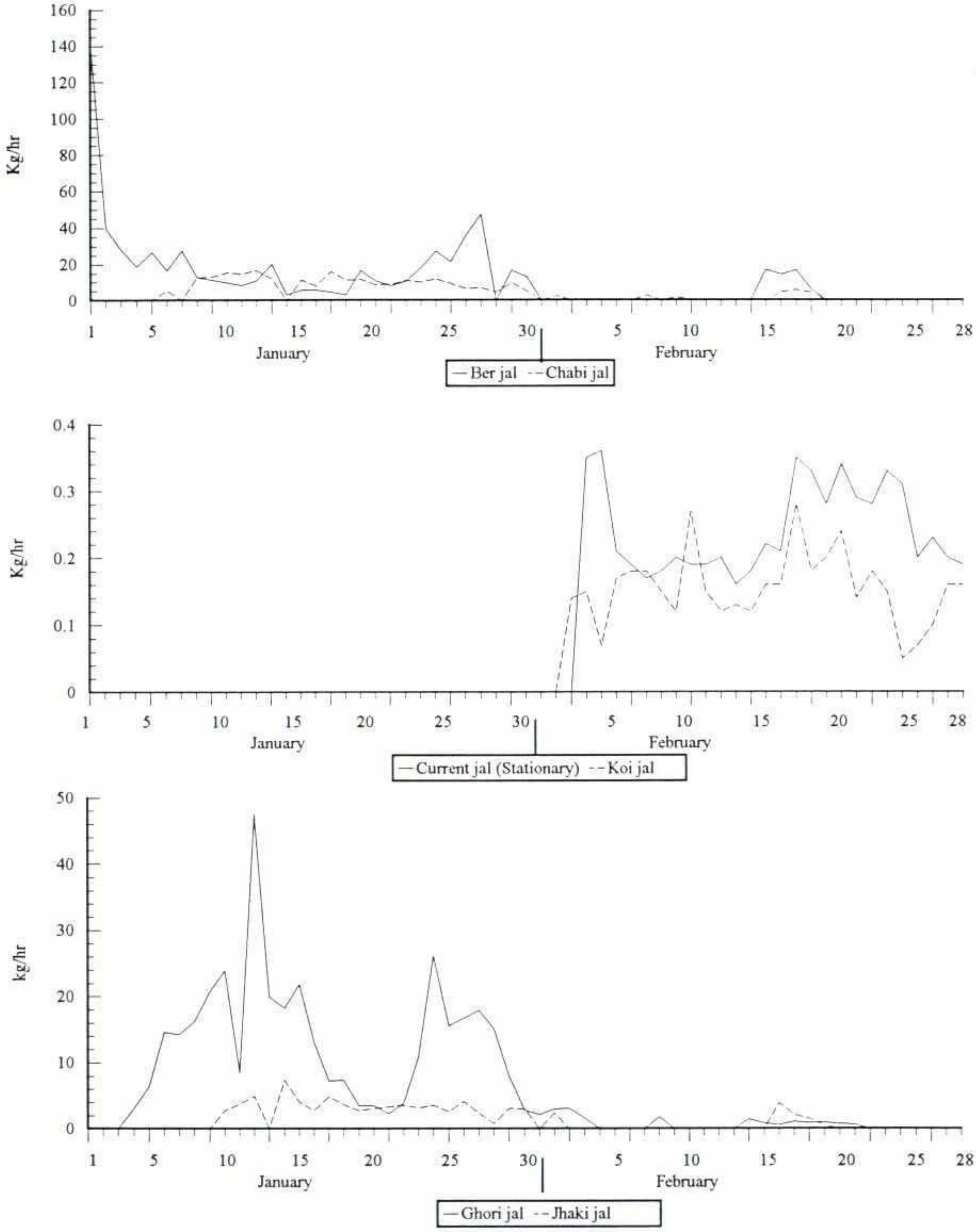
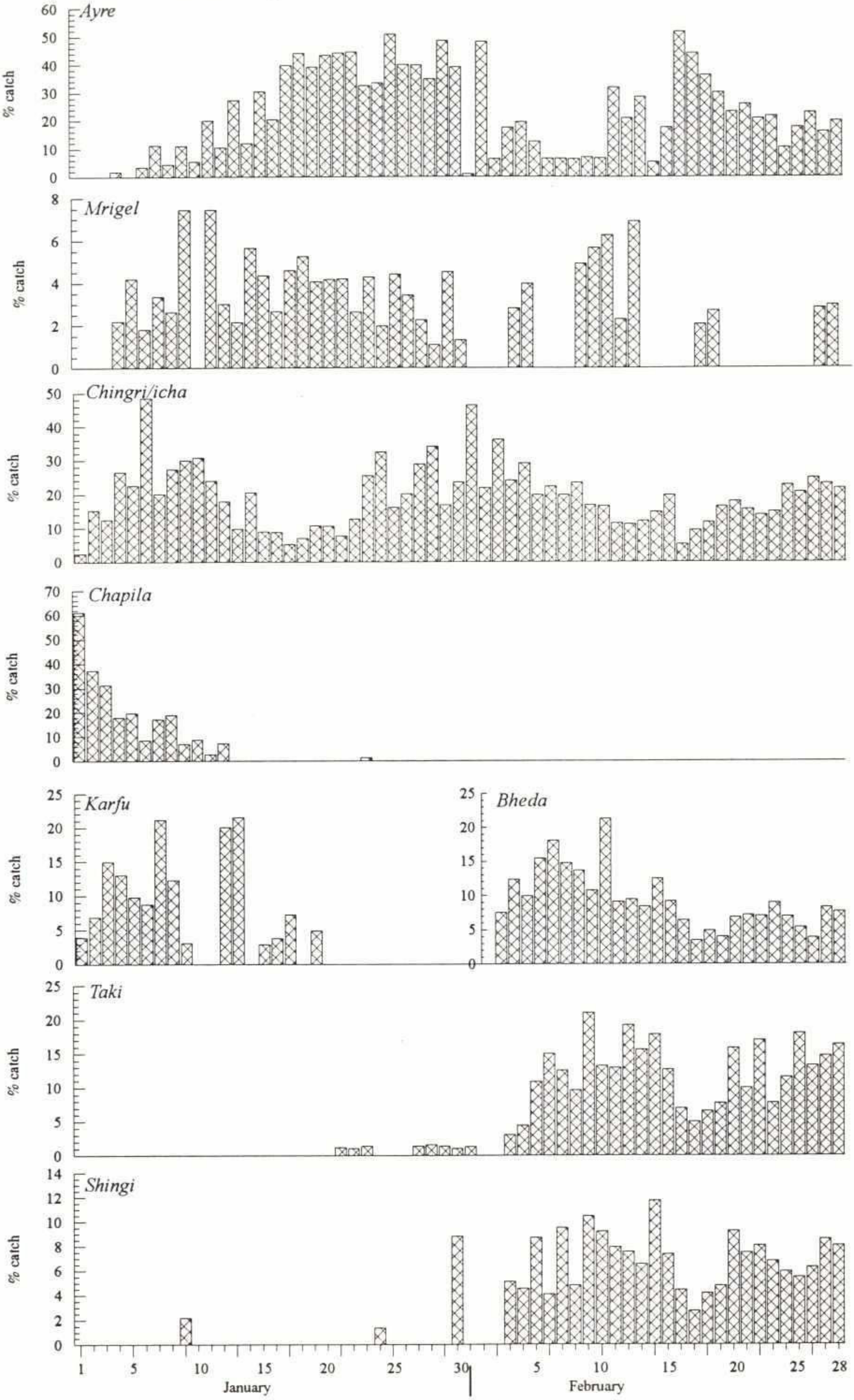


**Figure 6.24 Variation in daily catch compostion in Patasinga *Beel*, January - February 1994**



## 6.4 Statistical Comparison of Catch Rates and Catches from the MIP and Hakaluki *Haor*

Statistical analyses of seasonally pooled catch rates of gears used on floodplains and *beel* inside and outside the MIP were carried out following the method described in the Draft Final Report, Appendix 3. The underlying assumption of this method was that, once differences in catchabilities between gears were accounted for, any further differences in catch rates inside and outside the MIP were due solely to differences in fish densities.

At the MIP sites, more than 93% of the total catch per hectare for the period March 1993 to February 1994, excluding *katha* and *kua*, was taken by 8 gears. At sites on Hakaluki *Haor*, more than 94% of the total catch per hectare over the same period was taken by 6 gears. In all, 9 gears were initially selected for the statistical analysis of catch rates. Five gears appeared in both lists: *ber jal*, *thella jal*, *jhaki jal*, *current jal* and *daun*. *Ber jal* took 49% of the catch per hectare in the MIP and 59% at the outside sites. Unfortunately, an initial inspection of catch rates by gear inside and outside revealed that the use of *ber jal* was virtually restricted to seasons 4 and 5, so they were quite inappropriate for use in an analysis comparing catch rates across all seasons. Removing *ber jal* catch rate data left a total of 951 individual catch rate observations for use in the analysis. Gears used are listed in Table 6.9.

Even with *ber jal* deleted, comparison of the seasonally pooled catch rates by gear between inside and outside sites still indicated some failures in the assumptions of the statistical analysis, with some notable discrepancies between observed and predicted catch rates, particularly for *thella jal* in season 2 at outside sites and *daun* in season 1 at outside sites, though there were only three catch rate observations in this latter case.

Parameter estimates measuring the seasonal differences in underlying density of fish at the inside and outside sites indicated a lower density at the inside sites in seasons 1, 2 and 3, and higher densities at the inside sites in season 4 and 5. Only the individual comparisons for seasons 1 and 5 were statistically significant at the 5% level when considered individually; the others were far from significant.

Total annual catches per hectare by the 8 gears were higher at the inside sites than at the outside sites (Table 6.9). Estimates of standardised effort per hectare, summed across all 8 gears and seasons, were derived from the statistical analysis. For the inside sites, the total standardised effort (measured in *thella jal* hours per hectare) was 51.4, compared with 35.0 for the outside sites.

**Table 6.9 Statistical comparison of the total catch per hectare from floodplain and *beel* in the MIP and Hakaluki *Haor*, March 1993 - February 1994**

| | | SEASON | | | | | | | | | | | | | | | TOTAL | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mar - Apr | | | May - June | | | July - Sept | | | Oct - Nov | | | Dec - Feb | | | | | |
| | | 1 | | | 2 | | | 3 | | | 4 | | | 5 | | | | | |
| GEAR | | Obs | Pred | Pred Out | Obs | Pred | Pred Out | Obs | Pred | Pred Out | Obs | Pred | Pred Out | Obs | Pred | Pred Out | Obs | Pred | Pred Out |
| OUTSIDE | *Thella jal* | 1.6 | 3.0 | | 5.2 | 3.4 | | 5.2 | 4.1 | | 1.6 | 1.3 | | 3.5 | 3.8 | | 17.2 | 15.5 | |
| | *Current jal* (Stationary) | 0.2 | 0.2 | | 0.2 | 0.3 | | 1.9 | 1.8 | | 0.8 | 0.9 | | 1.1 | 0.9 | | 4.2 | 4.2 | |
| | *Daun* | 0.4 | 0.1 | | 0.0 | 0.0 | | 0.9 | 0.9 | | 0.4 | 0.4 | | 0.0 | 0.0 | | 1.8 | 1.5 | |
| | *Jhaki jal* | 0.6 | 0.6 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.3 | 0.3 | | 1.7 | 2.9 | | 2.5 | 3.7 | |
| | *Dora jal* | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.6 | 0.6 | | 6.7 | 6.7 | | 7.3 | 7.3 | |
| TOTAL | | 2.8 | 3.9 | | 5.5 | 3.7 | | 8.0 | 6.8 | | 3.7 | 3.4 | | 13.0 | 14.3 | | 32.9 | 32.2 | |
| STD ERR | | | 1.5 | | | 1.7 | | | 1.1 | | | 0.8 | | | 0.7 | | | 2.7 | |
| INSIDE | *Thella jal* | 0.6 | 0.3 | 0.6 | 10.1 | 12.5 | 18.9 | 5.3 | 5.7 | 5.9 | 6.4 | 6.5 | 6.0 | 9.1 | 8.7 | 4.8 | 31.5 | 33.7 | 36.3 |
| | *Current jal* (Stationary) | 0.3 | 0.2 | 0.5 | 0.4 | 0.1 | 0.2 | 1.5 | 1.7 | 1.7 | 1.1 | 0.7 | 0.6 | 1.4 | 1.7 | 1.0 | 4.7 | 4.4 | 3.9 |
| | *Daun* | 0.2 | 0.2 | 0.5 | 1.7 | 1.7 | 2.6 | 2.5 | 2.4 | 2.5 | 1.0 | 1.0 | 1.0 | 1.4 | 1.4 | 1.2 | 6.6 | 6.7 | 7.7 |
| | *Jhaki jal* | 0.2 | 0.2 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 0.5 | 0.5 | 0.3 | 0.8 | 0.8 | 0.7 |
| | *Ghori jal* | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.0 | 2.0 | 1.1 | 2.0 | 2.0 | 1.1 |
| | *Veshal* | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.3 | 0.2 | 0.4 | 0.4 | 0.2 |
| TOTAL | | 1.2 | 0.9 | 1.9 | 12.2 | 14.3 | 21.7 | 9.3 | 9.8 | 10.1 | 8.6 | 8.4 | 7.7 | 14.7 | 14.6 | 8.5 | 46.1 | 48.0 | 49.9 |
| STD ERR | | | 0.2 | 0.4 | | 4.2 | 9.5 | | 1.4 | 1.6 | | 1.7 | 2.2 | | 0.5 | 2.4 | | 4.8 | 10.2 |

Note: Obs = observed; Pred = predicted

To allow for this difference in effort, estimates of the total annual catch per kilometre at inside sites, based on the observed effort pattern by gear at the inside sites, were calculated using both the predicted densities at inside and outside sites. The results are shown in Table 6.9. The predicted total catch per hectare using the inside densities was 48.0 (s.e. 4.8) while the corresponding predicted figure using the outside densities was 49.9 (s.e 10.2). It appears that the differences in catch rates detected in the statistical analysis balanced out over the year so that there was no overall significant difference between total catches.

Statistical analysis revealed significantly lower fish densities in the MIP between March and April 1993 and higher densities between December and February 1994. This can be explained in terms of embankment cuts and differences in topography between study areas. In 1992, the year prior to study, river levels were lower than in 1993 and no cuts in embankments were made; fish therefore had little chance to move into the MIP from external rivers. The lower fish densities found in the MIP during the early part of 1993 reflects the previous year's condition; the adverse impact of the MIP on fish abundance has thus been identified and confirmed statistically in at least one season. Lower densities were also recorded in the MIP from July to September but these were not significantly different from those in Hakaluki *Haor*. At this time of year the many of fish species which entered the MIP through cuts in embankments began to breed and grow and it was only in later in the year, during winter, when they made major contributions to the catch (see Section 6.5). In winter significantly higher densities of fish in the MIP could be attributed to the important contributions made by migratory species which entered through breaches in embankments and also to the greater concentrating effect of Patasinga *Beel* which had a larger catchment area than Baghalkuri *Beel* on Hakaluki *Haor*.

## 6.5 Biodiversity and Catch Composition

### 6.5.1 Species richness

Between March 1993 and February 1994, a total of 90 species was recorded from floodplain and *beel* on Hakaluki *Haor* (Table 6.10). This compare with 87 species found in the MIP during the same period, a slight reduction in species diversity of 3%. In Table 6.10 species have been divided into three categories of habitat preference as defined in Section 5.4.1.

**Table 6.10 Total annual number of fish species, classified by habitat preference, recorded from floodplains and *beel* in the MIP and Hakaluki *Haor*, March 1993 - February 1994**

| Site name | Site code | In/Out MIP | Number of species | | | Total |
|---|---|---|---|---|---|---|
| | | | Riverine | Migratory | Floodplain resident | |
| Gobindapur Floodplain | NE10 | Out | 8 | 16 | 41 | 65 |
| Tekuni Floodplain | NE08 | Out | 17 | 18 | 35 | 70 |
| Tekuni/Baghalkuri *Beel* | NE09/21 | Out | 14 | 20 | 41 | 75 |
| Average | | Out | 13 | 18 | 39 | 70 |
| Baraimabad Floodplain | NE05 | In | 12 | 14 | 41 | 67 |
| Islampur Floodplain | NE02 | In | 10 | 16 | 40 | 66 |
| Patasinga *Beel* | NE04 | In | 11 | 19 | 41 | 71 |
| Average | | In | 11 | 16 | 41 | 68 |

Data from individual sites showed that on the large perennial *beel* the number of riverine and migratory species was 14% lower inside the MIP (30 species) than that from Hakaluki (34 species). Larger reductions were seen in riverine species (21%) than migratory fish (5%). On lower floodplains at Islampur in the MIP, numbers of riverine species were 41% lower than those at Tekuni but numbers of migratory species were only slightly lower (11%). On higher floodplains at Baraimabad, numbers of migratory species were again slightly lower (13%) than in Hakaluki *Haor* at Gobindapur but the number of riverine species was 33% higher. This may have been due partly to the southerly location of the site which was situated at the maximum distance within the *haor* away from the Kushiyara River, probably the main source of riverine species.

The diversity of floodplain resident species was very similar between the MIP and Hakaluki *Haor*. The only detectable difference was the slightly lower number of species on Tekuni floodplains compared with other areas of Hakaluki *Haor* and the MIP.

### 6.5.2 Catch composition

Percentage contributions made by riverine, migratory and floodplain resident species to annual catches from floodplains and *beel* are shown in Table 6.11. Riverine species made negligible contributions at all sites except Tekuni floodplain where they accounted for 5% of the catch. Migratory species provided the bulk (65%) of the catch from the unregulated perennial *beel*, 28% on low floodplains and 7% on high floodplains where prawns dominated catches. In comparison, migratory species accounted for only 41% of the catch from Patasinga *Beel* inside the MIP, 10% on low floodplains and 8% on high floodplains where again prawns predominated. Floodplain resident species accounted for between 23% to 28% of catches from Hakaluki *Haor* compared with a substantially higher range, 46% to 53% from the MIP.

**Table 6.11 Percentage contribution of riverine, migratory and floodplain resident species to the total annual catches from floodplains and *beel* in the MIP Hakaluki *Haor*, March 1993 - February 1994**

| Site name | Site code | In/Out MIP | % Total annual catch | | | |
|---|---|---|---|---|---|---|
| | | | Riverine fish | Migratory fish | Floodplain resident | Prawns |
| Gobindapur Floodplain | NE10 | Out | 0.2 | 6.7 | 22.8 | 70.3 |
| Tekuni Floodplain | NE08 | Out | 5.4 | 27.9 | 26.1 | 40.6 |
| Tekuni/Baghalkuri *Beel* | NE09/21 | Out | 0.6 | 64.9 | 28.1 | 6.4 |
| Baraimabad Floodplain | NE05 | In | 1.0 | 7.6 | 45.5 | 45.9 |
| Islampur Floodplain | NE02 | In | 0.6 | 10.0 | 53.2 | 36.2 |
| Patasinga *Beel* | NE04 | In | 0.6 | 41.4 | 36.3 | 21.7 |

Examination of catch compositions from individual floodplain and *beel* sampling sites revealed that the main differences between the MIP and Hakaluki *Haor* in terms of riverine and migratory fish were a 24% reduction in the catch contribution of migratory fish on perennial *beel* in the MIP, an 18% reduction from its low floodplains and a 5% reduction in river species again from its low floodplains. Prawns accounted for 46% (85 kg/ha) of the catch from high floodplains surrounding villages in the MIP and 22% (113 kg/ha) from perennial *beel*, compared with 70% (109 kg/ha) and 6% (12 kg/ha) respectively from the same habitats in Hakaluki *Haor*. On the higher floodplains *thella jal* captured of most of the prawns: 71 kg/ha in the MIP and 106 kg/ha on Hakaluki *Haor*. Annual fishing effort expended by *thella* per hectare of floodplain was 26% higher in the MIP (109 gear hours/ha) than on Hakaluki (81 gear hours/ha) which implies that prawns were more abundant on unregulated floodplains. Since the prawns were not identified during the present study, it is not known whether they were migratory or floodplain residents. Other FAP 17 studies on fish hatchling movements by passive drift in rivers found juvenile prawn to be a major component of the catch. This suggests that there is widespread breeding on the floodplain by some species.

Percentage contribution to annual catches made by individual dominant species are shown in Table 6.12. Dominant riverine species made contributions only on the Tekuni floodplain, where two species, *kachki* and *ghaura*, contributed about 3% of the annual catch. This site was the closest to the Kushiyara River from where riverine species originated and therefore the low abundance of this group at other sites on Hakaluki *Haor* suggests that there was a very localised lateral migration from river to floodplain by this group of fish.

The compositions of dominant migratory species were similar on high floodplains inside and outside the MIP. Three species were found at each site, two of which, *guizza* and *chapila* were common to both unregulated and regulated sites where they accounted for 3% and 4% of the catch respectively. The two other species were *catla* which provided about 2% of the Baraimabad catch and *kalbaus* which also comprised 2% of the catch from Gobindapur floodplain. In contrast, catch compositions of dominant migratory species were very different on low floodplains inside and outside the MIP. At Tekuni, 8 dominant species provided 27% of the catch, the most abundant of which were the catfish, *ayre*, *guizza*, *golsha tengra* and *kabashi*. At Islampur floodplains inside the MIP only 2 dominant species occurred, *chapila* (4%) and *boal* (1%). Catch compositions of dominant migratory species were also very different in regulated and unregulated *beel*. In Tekuni/Baghalkuri *Beel* 8 dominant species accounted for 61% of the catch whereas on the regulated Patasinga *Beel*, 6 species provided 31%. Two species in particular predominated on the unregulated *beel*, *guizza* and *chapila*, which comprised 27% and 21% of the catch. A smaller catfish, *kabashi*, was the third most abundant species, forming 6% of the catch. Other species included 2 major carps, *mrigel* and *rui* and also *fulchela*, *katari* and *boal*. On Patasinga *Beel*, *ayre* and *chapila* were the most abundant species, comprising 14% and 9% of the annual catch. Other dominant species included 3 major carps, *catla*, *mrigel* and *rui* and the catfish *boal*. Reasons for the clear distributional difference between the two closely related catfish, *ayre* and *guizza*, remain unclear.

The compositions of dominant floodplain resident species were similar on high floodplains inside and outside the MIP. At Gobindapur, 10 species comprised 18% of the catch of which *chanda* formed 4%, while all others comprised 2% or less. At Baraimabad, inside the MIP, 8 dominant species accounted for 36% of the catch. The most abundant species were again

**Table 6.12 Percentage contribution (by weight) to the total annual catch by dominant species from floodplains and beel in the MIP and Hakaluki Haor, March 1993 – February 1994**

| Habitat | Species name | | MIP | | | Hakaluki Haor | | |
|---|---|---|---|---|---|---|---|---|
| | | | Baraimbad Floodplain | Islampur Floodplain | Patasinga *Beel* | Gobindapur Floodplain | Tekuni Floodplain | Tekuni/ Baghalkuri Beel |
| Preference | Scientific | Bengali | NE05 | NE02 | NE04 | NE10 | NE08 | NE09/21 |
| Riverine | *Corica soborna* | *Kachki* | – | – | – | – | 2.2 | – |
| | *Clupisoma garua* | *Ghaura* | – | – | – | – | 1.1 | – |
| Subtotal | | | – | – | – | – | 3.3 | – |
| Migratory | *Aorichthys aor* | *Ayre* | – | – | 16.1 | – | 5.0 | – |
| | *Aorichthys seenghala* | *Guizza* | 1.2 | – | – | 1.6 | 4.7 | 26.9 |
| | *Mystus bleekeri* | *Golsha tengra* | – | – | 1.0 | – | 4.0 | – |
| | *Mystus cavasius* | *Kabashi* | – | – | – | – | 8.2 | 6.2 |
| | *Catla catla* | *Catla* | 1.6 | – | 1.7 | – | – | – |
| | *Cirrhinus mrigala* | *Mrigel* | – | – | 2.8 | – | – | 2.0 |
| | *Labeo calbasu* | *Kalbaus* | – | – | – | 1.5 | – | – |
| | *Labeo rohita* | *Rui* | – | – | 1.3 | – | – | 1.3 |
| | *Salmostoma bacaila* | *Katari* | – | – | – | – | – | 1.8 |
| | *Salmostoma phulo* | *Fulchela* | – | – | – | – | 1.4 | 1.4 |
| | *Gudusia chapra* | *Chapila* | 3.0 | 4.1 | 11.4 | 1.9 | 1.8 | 20.5 |
| | *Wallagu attu* | *Boal* | – | 1.1 | 3.5 | – | – | 1.3 |
| | *Pellona ditchela* | *Chouka* | – | – | – | – | 1.7 | – |
| Subtotal | | | 5.9 | 5.3 | 37.8 | 4.9 | 26.9 | 61.4 |
| Floodplain Resident | *Mystus vittatus* | *Tengra* | – | 3.4 | 1.8 | 1.2 | 1.4 | 2.3 |
| | *Colisa fasciatus* | *Khalisha* | 1.5 | – | – | – | – | – |
| | *Cyprinus carpio* | *Karfu* | – | – | 6.6 | – | – | – |
| | *Osteobrama cotio cotio* | *Keti* | – | – | – | – | – | 6.3 |
| | *Puntius chola* | *Chala puti* | 2.5 | 3.3 | 1.6 | 1.8 | – | – |
| | *Puntius conchonius* | *Canchan puti* | – | – | – | 1.7 | 3.7 | – |
| | *Puntius sophore* | *Puti* | 3.1 | 3.3 | 2.3 | 2.4 | – | 1.2 |
| | *Amblypharyngodon mola* | *Mola* | – | 1.4 | – | – | – | – |
| | *Glossogobius giurus* | *Bailla* | 4.9 | – | 2.0 | 1.4 | 2.7 | 3.2 |
| | *Channa marulius* | *Gajar* | – | – | 3.2 | – | – | 1.2 |
| | *Channa punctatus* | *Taki* | 4.8 | 7.2 | 2.1 | 1.5 | – | – |
| | *Heteropneustes fossilis* | *Shingi* | – | 1.2 | 1.3 | – | – | – |
| | *Macrognathus pancalus* | *Guchi* | – | – | 1.1 | – | 2.4 | – |
| | *Mastacembelus armatus* | *Baral baim* | – | – | – | – | 3.6 | – |
| | *Nandus nandus* | *Bheda* | – | – | 1.2 | – | – | – |
| | *Ompok bimaculatus* | *Kani pabda* | – | – | – | – | – | 4.5 |
| | *Notopterus notopterus* | *Foli* | 2.6 | 5.7 | 5.7 | 1.3 | 3.5 | 1.5 |
| | *Chanda baculis* | *Chanda* | 7.4 | 13.6 | 1.2 | 4.0 | 2.2 | 2.2 |
| | *Chanda nama* | *Nama chanda* | 9.2 | 2.9 | – | 1.8 | – | 1.7 |
| | *Chanda ranga* | *Lal chanda* | – | 3.6 | – | 1.0 | 1.3 | – |
| Subtotal | | | 36.0 | 45.5 | 30.0 | 18.1 | 20.8 | 24.1 |
| Other | *Prawn spp.* | *Chingri/Icha* | 45.9 | 36.2 | 21.7 | 70.3 | 40.5 | 6.4 |
| Subtotal | | | 45.9 | 36.2 | 21.7 | 70.3 | 40.5 | 6.4 |
| Grand total | | | 87.7 | 86.9 | 89.5 | 93.3 | 91.5 | 91.9 |

Notes: 1. Dominant species are those species contributing 1% or more by weight to the total annual catch

2. Shaded values highlight the most important species (>4%)

3. See text for definitions of habitat preference categories (Section 5.4.1)

*chanda* (*C. baculis* and *C. nama*) which formed 17% of the catch, *taki* and *bailla*, both of which comprised 5%. Of the 8 dominant species found at Baraimabad, 7 also occurred at Gobindapur but in lower abundance.

The compositions of dominant floodplain residents from low floodplains differed markedly between sites inside and outside the MIP. Outside the MIP, 8 species accounted for 21% of the catch and inside it 10 species comprised 46%. Only 4 species were common to both sites. These included 2 species of *chanda* (*C. baculis* and *C. nama*), *foli* and *tengra*, all of which were more abundant in the MIP. Other important species more abundant inside the MIP included *taki*, *puti* and *chala puti*.

On perennial *beel* catch compositions of dominant floodplain residents also differed greatly inside and outside the MIP. On Tekuni/Baghalkuri *Beel* there were 9 dominant species comprising 24% of the catch and at Patasinga *Beel* there were 11 species comprising 42%; only 5 dominant species were common to both sites. These included *tengra*, *puti*, *bailla*, *gajar* and *foli*. The most abundant species at Tekuni/Baghalkuri were *keti* (6%) and *kani pabda* (5%) whereas at Patasinga *Beel*, *bheda*, *foli*, *shingi*, *karfu* and *taki* predominated. *Karfu* were mainly adult fish which probably escaped from flooded ponds within the MIP.

Prawns formed the most important component of floodplain catches inside and outside the MIP. On high floodplains of Hakaluki *Haor* they accounted for 70% of the total annual catch while in the MIP they comprised 46%. These are the highest catch contributions recorded by FAP 17 from floodplains throughout the country. On lower floodplains prawns accounted for 41% and 36% of catches from outside and inside the MIP respectively. The lower percentage catch on these floodplains was probably the result of lower fishing effort because of the greater difficulty in catching prawns in deeper waters. In perennial *beel*, prawns were less abundant in catches than on floodplains. On Tekuni/Baghalkuri *Beel* they accounted for only 6% of the catch compared with 16% from Patasinga *Beel*. Unfortunately, because of taxonomic difficulties, prawns were rarely identified in the field but samples were sent routinely to the Marine Science Institute at Chittagong for identification. Results 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 of its life cycle. FAP 17 studies on the movements of fish hatchlings using fine-meshed drift nets, however, have shown that juvenile prawns form an important component of the catch in the North East Region and in other parts of Bangladesh which suggests widespread spawning inland by some species.

The results from analyses of catch compositions revealed that the fish community structure inside the MIP had been disrupted compared with that in Hakaluki *Haor* despite cuts made in embankments which allowed greater movement of fish between rivers and floodplains. Not only were there fewer riverine species but migratory species were also less abundant inside the MIP. In addition, there were major differences in the composition of floodplain resident species with species such as *taki* and *shingi* which are adapted for adverse environmental conditions, being more abundant in catches from the MIP. There is evidence that fishing effort was generally higher inside the MIP than on Hakaluki *Haor*, particularly during the winter when Patasinga *Beel* and other smaller *beel* were intensively fished by leaseholders. The long term impact of such heavy fishing pressure in not known but it seems likely that it would have a detrimental impact on the sustainability of local fish resources. The situation in the MIP is complicated by the intermittent nature of cuts in embankments. In at least four years out of the last decade, the project remained structurally secure and prevented or greatly reduced movements of fish between rivers and floodplains during the pre-monsoon and monsoon seasons. In other years embankments cuts were made thus allowing fish to enter the system. In addition, in at least seven years the project has been drained below the design level of 4.1 m PWD by a regulator not included in the original project design, probably to facilitate a greater harvest from *beel* fisheries such as Patasinga. This practice, when combined with the effects of fall flood control during drier years, must have a very harmful impact on fisheries of the MIP.

## 6.6 Fish Migrations

Seasonal movements of fish were identified from changes in monthly catch compositions (Tables 6.13 and 6.14; Tables I-VI, Appendix 3); temporal and spatial changes in the distributions of important individual species, and changes in monthly species numbers and catch contributions of riverine, migratory and floodplain resident fish. Where available, additional data on the average size (weight) of fish and their reproductive state (Table 6.15) were used to determine whether fish were adults or juvenile and whether movements were primarily for growth, breeding or both.

### 6.6.1 Hakaluki *Haor*

The total numbers of fish species recorded each month from floodplains and *beel* of Hakaluki *Haor* remained remarkably stable for most of the year apart from a slight decrease between May and July (Fig. 6.25). This decrease probably resulted from the reduced size of the sampled catch since no fishing was observed on low floodplains and *beel* in June and July, rather than an actual decrease in species diversity of fish populations. When total species numbers were divided into numbers of species in different groups of fish, greater seasonality was seen.

Numbers of riverine species gradually dropped from February to May 1993 coinciding with the decline in *beel* fishing activities. Diversity remained at a minimum until July after which there was a slight increase in August. Numbers of species remained fairly stable until November when a sharp rise was recorded followed by an equally sharp fall in December after which numbers held steady until February. The rapid increase in species number in October occurred on deeper floodplains (NE08) only and indicated a concentration and movement through this area of riverine species returning to the Juri and Kushiyara rivers.

Seasonal variation in numbers of migratory species followed a different pattern to that of riverine species. Numbers dropped from March to reach a minimum in May after which there was a progressive increase until January 1994. Slight peaks in numbers in October and January coincided with the drawdown and the start of leaseholder fishing in *beel* respectively. Numbers of floodplain resident species fluctuated between April and July but remained very stable in other months.

Data in Table 6.13 show that several riverine species overwintered in the *beel*. Those recorded in two or three months between February and April included *gharpoia*, *ghaura*, *kachki*, *gutum* (*N. maydelli*), *balichata*, *gang tengra* and *rani*. Of these *gharpoia*, *ghaura* and *kachki* were most abundant. Information on breeding conditions indicate that *kachki* was in peak breeding condition on floodplains and *beel* in March while *ghaura* was not (Table 6.15). As fishing activities in *beel* decreased from February to April, catch contributions made by riverine species also dropped considerably (Fig. 6.26). Several migratory species also overwintered in the *beel*, the more abundant of which included *chapila*, *guizza*, *golsha tengra*, *kabashi*, *raik*, *fulchela*, *bacha* and *batasi*. Data on the reproductive state of migratory species found on Hakaluki *Haor* were limited. A reasonable sample size was obtained for *chapila*, however, and results revealed that this species was in peak breeding condition in March and April whilst some fish were also ripe or ripe running in February.

**Table 6.13 Monthly catch composition (% by weight) from floodplains/beel: Hakaluki Haor (sites NE10+NE08+NE09/21)**

| Species Code | Habitat Preference | Scientific name: Scientific | Scientific name: Bengali | Year: 1993 Feb | Mar | April | May | June | July | Aug | Sep | Oct | Nov | Dec | Year: 1994 Jan | Feb | Total annual catch (Mar'93 – Feb'94) Kg | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 186 | Riverine | *Rita rita* | *Rita* | | | | | | | | 0.103 | | | | | | 1.370 | 0.001 |
| 17 | | *Barilius barila* | *Barali* | | | | | | | | | | 0.008 | | | | 0.530 | 0.001 |
| 59 | | *Crossocheilus latius* | *Kalabata* | 0.106 | | | | | | | | | 0.168 | 0.001 | | | 11.128 | 0.011 |
| 139 | | *Nemacheilus botia* | *Balichata* | 0.173 | 0.679 | | | | | | | | 0.323 | 0.280 | 0.181 | 0.024 | 172.075 | 0.167 |
| 941 | | *Neoeucirrhichthys maydelli* | *Gutum* | 1.971 | 0.431 | 0.064 | 0.075 | | 0.015 | | | | 0.221 | | 0.040 | 0.224 | 69.101 | 0.067 |
| 198 | | *Somileptes gongota* | *Gharpoia* | 5.690 | 2.536 | 0.011 | | | | | | 0.127 | 0.112 | 0.025 | 0.006 | 0.009 | 56.960 | 0.055 |
| 28 | | *Botia dario* | *Rani* | 0.056 | 0.016 | | | 0.215 | 0.065 | 0.180 | 0.008 | | 0.323 | | 0.001 | | 40.091 | 0.039 |
| 29 | | *Botia lohachata* | *Putul* | | | | | 0.052 | | | | | | | | | 2.170 | 0.002 |
| 89 | | *Hilsa ilisha* | *Ilish* | | | | 1.928 | | | 0.124 | 0.434 | | | | | | 13.226 | 0.013 |
| 58 | | *Corica soborna* | *Kachki* | 0.038 | 1.425 | 0.007 | | | 0.008 | | | 0.010 | 3.625 | 0.027 | 0.080 | 0.156 | 318.554 | 0.310 |
| 92 | | *Hyporhampus gaimardi* | *Ek thota* | | | | | | | | | | 0.331 | 0.139 | 0.152 | 0.294 | 156.077 | 0.152 |
| 185 | | *Rhinomugil corsula* | *Khorsula* | | | | | | | | | | | | | 0.003 | 0.450 | 0.0004 |
| 923 | | *Sicamugil cascasia* | *Bata* | | | | | | | | | | 0.335 | | | | 21.860 | 0.021 |
| 163 | | *Pisodonophis boro* | *Kharu* | 0.080 | | | | | | | | | | | | | | |
| 2 | | *Ailia coila* | *Kajuli* | | | | | | | 0.086 | | 0.014 | 0.052 | | | | 7.634 | 0.007 |
| 51 | | *Clupisoma garua* | *Ghaura* | 0.796 | 3.008 | | | | | 1.331 | 2.989 | 0.460 | 0.126 | | | | 164.292 | 0.160 |
| 52 | | *Clupisoma naziri* | *Muri bacha* | | | | | 0.040 | | 0.023 | 0.067 | | | | | | 3.589 | 0.003 |
| 74 | | *Erethistes pussilus* | *Kutakanti* | | | | | | | | | | 0.004 | | | 0.004 | 0.736 | 0.001 |
| 81 | | *Gagata youssoufi* | *Gang tengra* | 0.168 | 0.017 | 0.021 | | | | 0.022 | | 0.003 | 0.657 | 0.015 | | | 47.711 | 0.046 |
| 87 | | *Hara hara* | *Kutakanti* | | | | | | | | | | 0.012 | 0.012 | 0.008 | 0.002 | 6.973 | 0.007 |
| | Subtotal | | | 9.077 | 8.111 | 0.103 | 2.003 | 0.307 | 0.088 | 1.766 | 3.602 | 0.614 | 6.295 | 0.499 | 0.467 | 0.717 | 1094.527 | 1.065 |
| 7 | Migratory | *Anguilla bengalensis* | *Bamosh* | | 0.012 | | | | | | | | | | | | 0.165 | 0.0002 |
| 130 | | *Aorichthys aor* | *Ayre* | 0.568 | | | | 0.218 | 0.340 | 0.923 | 0.643 | 13.815 | 2.584 | 1.379 | 0.916 | 0.201 | 1376.292 | 1.339 |
| 135 | | *Aorichthys seenghala* | *Guizza* | | 0.652 | 5.495 | | 0.313 | 2.276 | 1.648 | 13.609 | 16.881 | 0.052 | 23.014 | 28.651 | 28.432 | 22026.736 | 21.438 |
| 24 | | *Batasio batasio* | *Tengra* | | 0.013 | | | | | | | | | | | | 0.181 | 0.0002 |
| 131 | | *Mystus bleekeri* | *Golsha tengra* | 1.095 | 1.085 | 3.926 | | 0.374 | 0.041 | 0.074 | 2.085 | 0.834 | 1.778 | 1.384 | 0.455 | 0.274 | 801.442 | 0.780 |
| 132 | | *Mystus cavasius* | *Kabashi* | 3.232 | 1.530 | 0.736 | 2.629 | 0.056 | 0.114 | 0.474 | 2.309 | 29.445 | 0.785 | 0.729 | 9.033 | 5.632 | 5879.640 | 5.722 |
| 134 | | *Mystus menoda* | *Ghagla* | | | | | | | 0.144 | | 0.023 | 0.206 | | 0.002 | | 21.537 | 0.021 |
| 32 | | *Catla catla* | *Catla* | | | | | | | | | | | 0.057 | 0.011 | | 16.710 | 0.016 |
| 47 | | *Cirrhinus mrigala* | *Mrigel* | | | | | | | 0.729 | | 0.030 | | 1.705 | 1.907 | 3.116 | 1634.708 | 1.591 |
| 48 | | *Cirrhinus reba* | *Raik* | 0.477 | 0.923 | 0.120 | | | | 0.186 | 0.453 | 0.126 | 0.162 | 0.938 | 0.713 | 1.377 | 734.512 | 0.715 |
| 100 | | *Labeo bata* | *Bata* | | | | | | | | | | 0.009 | | | | 0.596 | 0.001 |
| 101 | | *Labeo boga* | *Bhangan* | | 0.011 | | | | | | 0.170 | | 0.281 | | | | 20.748 | 0.020 |
| 102 | | *Labeo calbasu* | *Kalbaus* | | | | | | 0.227 | 2.722 | 6.317 | 0.264 | 0.925 | 0.133 | 1.014 | 0.035 | 751.732 | 0.732 |
| 104 | | *Labeo gonius* | *Goni* | | | | | | 0.017 | | 0.282 | 0.646 | | 0.189 | 0.065 | 0.070 | 101.625 | 0.099 |
| 107 | | *Labeo rohita* | *Rui* | | | | | | 0.103 | | | 0.440 | | 1.752 | 1.256 | 0.819 | 1040.466 | 1.013 |
| 188 | | *Salmostoma bacaila* | *Katari* | | | | | | | | | 0.036 | 0.489 | 2.477 | 1.382 | 2.101 | 1435.179 | 1.397 |
| 189 | | *Salmostoma phulo* | *Fulchela* | 0.302 | 0.009 | 0.351 | 0.407 | 0.017 | 0.069 | 0.0001 | 0.411 | 0.243 | 2.632 | 0.965 | 1.295 | 2.800 | 1330.774 | 1.295 |
| 154 | | *Securicula gora* | *Chora chela* | | | | | | | | | 0.141 | | | | | 4.344 | 0.004 |
| 86 | | *Gudusia chapra* | *Chapila* | 18.864 | 6.375 | 0.299 | 2.981 | 0.051 | 0.285 | 1.400 | 5.266 | 5.101 | 1.699 | 31.128 | 17.963 | 13.389 | 16671.063 | 16.225 |
| 76 | | *Eutropiichthys vacha* | *Bacha* | | 0.236 | 0.135 | 0.894 | | | 0.038 | 0.982 | 0.117 | | | | | 25.018 | 0.024 |
| 169 | | *Pseudeutropius atherinoides* | *Batasi* | 0.028 | 0.615 | 0.047 | | | | 0.0001 | 0.112 | | | | 0.549 | 0.114 | 265.034 | 0.258 |
| 209 | | *Wallagu attu* | *Boal* | | | 3.065 | | | | | | 0.854 | 0.252 | 0.702 | 1.314 | 1.502 | 1015.818 | 0.989 |
| 144 | | *Notopterus chitala* | *Chital* | | | | | | | | | | | | 0.004 | | 1.900 | 0.002 |
| 161 | | *Pellona ditchela* | *Chouka* | | | | | | 0.016 | | 0.324 | 0.031 | 2.993 | 0.117 | 0.025 | | 236.638 | 0.230 |
| | Subtotal | | | 24.566 | 11.459 | 14.174 | 6.911 | 1.028 | 3.486 | 8.338 | 32.962 | 69.026 | 14.847 | 66.669 | 66.555 | 59.862 | 55392.858 | 53.912 |
| 6 | Floodplain | *Anabas testudineus* | *Koi* | | | 0.066 | | | | | | | | | | | 1.180 | 0.001 |
| 136 | resident | *Mystus tengara* | *Bajari tengra* | | 0.082 | 0.485 | | 0.004 | | 0.141 | 0.021 | | 0.118 | 0.365 | 0.110 | 0.008 | 150.213 | 0.146 |
| 137 | | *Mystus vittatus* | *Tengra* | 0.282 | 0.283 | 2.533 | 0.223 | 1.337 | 1.336 | 0.649 | 1.466 | 0.385 | 0.326 | 2.680 | 2.178 | 3.205 | 2151.190 | 2.094 |
| 942 | | *Rama chandramara* | *Laia* | | | | | | | | | | 0.023 | | 0.00001 | | 1.514 | 0.001 |
| 55 | | *Colisa fasciatus* | *Khalisha* | 1.420 | 0.071 | 0.172 | 6.939 | 0.069 | | | 0.175 | | | | | | 16.376 | 0.016 |



(Cont.)

**Table 6.13 Monthly catch composition (% by weight) from floodplains/beel: Hakaluki Haor (sites NE10+NE08+NE09/21)**

| Species Code | Habitat Preference | Scientific name: Scientific | Scientific name: Bengali | Year: 1993 Feb | Mar | April | May | June | July | Aug | Sep | Oct | Nov | Dec | Year: 1994 Jan | Feb | Total annual catch (Mar'93 – Feb'94) Kg | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 211 | | *Colisa labiosus* | *Khalisha* | 0.867 | 0.110 | 0.438 | 2.191 | 0.035 | – | 0.0001 | – | – | – | – | – | – | 13.076 | 0.013 |
| 57 | | *Colisa sota* | *Khalisha* | 0.618 | 0.021 | 0.032 | – | 0.084 | 0.016 | – | – | – | – | – | – | – | 4.706 | 0.005 |
| 210 | | *Xenentodon cancila* | *Kaikka* | 0.073 | 3.069 | 0.949 | 0.557 | 0.018 | 0.037 | – | 0.021 | 0.117 | 0.150 | 0.485 | 0.508 | 1.290 | 570.488 | 0.555 |
| 62 | | *Cyprinus carpio* | *Karfu* | – | – | – | – | – | – | – | – | 0.952 | – | – | – | – | 29.339 | 0.029 |
| 187 | | *Osteobrama cotio cotio* | *Keti* | 0.961 | 1.210 | 0.606 | 0.873 | 0.586 | 0.592 | 1.066 | 0.900 | 0.065 | 0.267 | 8.280 | 5.499 | 6.170 | 5101.684 | 4.965 |
| 174 | | *Puntius chola* | *Chala puti* | 1.160 | 0.256 | 1.622 | 0.668 | 0.767 | 1.744 | 2.340 | 0.642 | 0.877 | 0.550 | 1.247 | 0.479 | 1.379 | 930.244 | 0.905 |
| 175 | | *Puntius conchonius* | *Canchan puti* | 0.965 | 14.239 | 12.551 | 8.439 | 2.789 | 0.410 | 0.056 | 0.547 | 1.942 | 0.321 | 0.154 | 0.157 | 0.703 | 845.657 | 0.823 |
| 176 | | *Puntius gelius* | *Giliputi* | 0.159 | 1.755 | 0.446 | 1.646 | 0.038 | 0.042 | 0.119 | 0.587 | 0.028 | 0.231 | 0.014 | 0.024 | 0.038 | 84.864 | 0.083 |
| 177 | | *Puntius guganio* | *Mola puti* | – | – | – | – | – | – | – | 0.322 | 0.008 | 0.006 | – | – | – | 4.902 | 0.005 |
| 178 | | *Puntius phutunio* | *Phutani puti* | – | – | 0.059 | – | 0.045 | – | – | – | – | 0.025 | – | 0.004 | – | 6.250 | 0.006 |
| 180 | | *Puntius sophore* | *Puti* | 3.220 | 0.011 | 0.807 | 1.099 | 0.726 | 0.923 | 1.271 | 4.132 | 3.390 | 1.211 | 1.403 | 0.680 | 2.631 | 1299.124 | 1.264 |
| 181 | | *Puntius terio* | *Teri punti* | 0.077 | 0.522 | 0.087 | – | 0.127 | 0.028 | – | 0.220 | 0.016 | 0.060 | – | – | – | 22.218 | 0.022 |
| 212 | | *Puntius ticto* | *Tit puti* | 0.047 | 0.039 | 1.633 | – | – | – | – | – | – | – | – | – | – | 29.691 | 0.029 |
| 4 | | *Amblypharyngodon microlepis* | *Mola* | 0.243 | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 5 | | *Amblypharyngodon mola* | *Mola* | 0.053 | 0.033 | 0.318 | 3.894 | 0.448 | 0.050 | 0.622 | 1.668 | 0.152 | 0.079 | 0.477 | 0.240 | 0.272 | 330.316 | 0.321 |
| 68 | | *Danio devario* | *Chebli* | – | – | 0.026 | – | – | – | – | – | – | – | – | – | – | 0.470 | 0.0005 |
| 75 | | *Esomus danricus* | *Darkina* | 0.162 | – | 0.065 | 0.859 | 0.033 | – | – | – | – | 0.040 | 0.005 | – | – | 7.104 | 0.007 |
| 182 | | *Rasbora daniconius* | *Darkina* | – | – | 0.027 | – | – | – | – | – | – | 0.027 | – | – | – | 2.257 | 0.002 |
| 83 | | *Glossogobius giurus* | *Bailla* | 3.888 | 1.141 | 0.670 | 3.854 | 2.646 | 2.009 | 0.230 | 1.135 | 0.507 | 4.130 | 5.142 | 2.698 | 2.532 | 3089.050 | 3.006 |
| 91 | | *Hypophthalmichthys molitrix* | *Silver carp* | – | – | – | – | – | – | – | – | 6.457 | – | – | 0.001 | 0.006 | 200.002 | 0.195 |
| 43 | | *Chela cachius* | *Chep chela* | – | – | – | – | – | – | 0.0002 | – | – | – | 0.0001 | – | – | 0.029 | 0.00003 |
| 110 | | *Lepidocephalus guntea* | *Gutum* | 2.673 | 0.347 | 1.222 | – | 0.131 | – | 0.0003 | 0.002 | 0.014 | 0.004 | 0.053 | 0.009 | – | 47.852 | 0.047 |
| 217 | | *Lepidocephalus thermalis* | *Puiya* | – | – | – | – | – | – | – | – | – | – | 0.043 | 0.008 | – | 12.514 | 0.012 |
| 9 | | *Aplocheilus panchax* | *Kanpona* | – | – | – | – | – | – | 0.00002 | – | – | – | 0.0003 | – | – | 0.057 | 0.0001 |
| 39 | | *Channa marulius* | *Gajar* | – | – | – | – | – | – | – | 0.181 | – | 0.095 | 0.364 | 0.661 | 4.577 | 977.417 | 0.951 |
| 41 | | *Channa punctatus* | *Taki* | 13.363 | 0.576 | 2.143 | 2.853 | 0.693 | 0.052 | 0.489 | 4.583 | 1.056 | 0.195 | 0.116 | 0.002 | 0.004 | 233.122 | 0.227 |
| 42 | | *Channa striatus* | *Shol* | – | – | 1.066 | – | – | – | – | – | – | – | 0.040 | 0.022 | 0.066 | 46.040 | 0.045 |
| 49 | | *Clarias batrachus* | *Magur* | – | 0.046 | – | – | 0.017 | – | 0.030 | – | 0.058 | – | – | – | 0.002 | 4.706 | 0.005 |
| 151 | | *Oreochromis nilotica* | *Nilotica* | – | – | – | – | – | – | – | – | – | – | – | 0.001 | – | 0.500 | 0.0005 |
| 88 | | *Heteropneustes fossilis* | *Shingi* | 1.285 | 0.246 | 0.099 | – | 0.109 | 0.028 | 0.407 | 0.164 | 0.387 | 0.037 | 0.003 | 0.013 | 0.0003 | 51.123 | 0.050 |
| 121 | | *Macrognathus aculeatus* | *Tara baim* | 0.394 | 3.626 | 0.199 | – | 0.097 | – | 0.143 | – | 0.056 | – | – | – | 0.002 | 67.852 | 0.066 |
| 123 | | *Macrognathus pancalus* | *Guchi* | 13.766 | 11.043 | 5.351 | 5.481 | 0.018 | 0.067 | – | 0.011 | 1.784 | 0.236 | 0.130 | 0.000 | 0.071 | 368.949 | 0.359 |
| 122 | | *Mastacembelus armatus* | *Baral baim* | 5.964 | 1.023 | 19.845 | 15.429 | 0.025 | – | 0.115 | 13.849 | 4.387 | 1.325 | 0.373 | 0.052 | 0.087 | 908.788 | 0.884 |
| 138 | | *Nandus nandus* | *Bheda* | 0.252 | – | 0.046 | – | 0.008 | – | 0.154 | – | 0.403 | – | 0.007 | 0.013 | 0.011 | 28.867 | 0.028 |
| 15 | | *Badis badis* | *Napit koi* | 0.096 | 0.006 | 0.071 | 0.365 | 1.624 | 0.152 | 0.049 | 0.014 | – | – | 0.000 | – | – | 75.139 | 0.073 |
| 147 | | *Ompok bimaculatus* | *Kani pabda* | – | – | – | 1.051 | 0.112 | – | 0.232 | 0.329 | 0.080 | – | 1.364 | 6.895 | 2.261 | 3609.303 | 3.513 |
| 148 | | *Ompok pabda* | *Madhu pabda* | – | 0.010 | 0.738 | – | – | – | 1.088 | – | – | 0.187 | – | – | 0.017 | 76.106 | 0.074 |
| 145 | | *Notopterus notopterus* | *Foli* | – | – | – | – | 0.202 | 0.239 | 2.824 | 4.205 | 1.168 | 5.668 | 2.095 | 1.457 | 0.552 | 1750.040 | 1.703 |
| 203 | | *Tetraodon cutcutia* | *Potka* | 0.159 | 0.592 | 0.458 | – | 0.150 | 0.014 | 0.049 | 0.066 | – | 0.920 | 0.491 | 0.292 | 0.057 | 324.814 | 0.316 |
| 33 | | *Chaca chaca* | *Cheka* | – | – | 0.146 | – | 0.091 | – | 0.012 | 0.001 | – | – | 0.011 | 0.003 | – | 10.700 | 0.010 |
| 35 | | *Chanda baculis* | *Chanda* | 0.375 | 0.175 | 0.153 | 0.371 | 2.583 | 1.427 | 3.934 | 12.671 | 0.416 | 3.748 | 3.089 | 2.157 | 1.390 | 2517.816 | 2.450 |
| 36 | | *Chanda nama* | *Nama chanda* | 0.465 | 0.076 | 0.159 | 1.013 | 1.572 | 0.786 | 2.782 | 0.951 | 0.102 | 0.983 | 2.276 | 1.437 | 2.013 | 1662.107 | 1.618 |
| 37 | | *Chanda ranga* | *Lal chanda* | 1.572 | 2.239 | 0.504 | 3.757 | 1.763 | 0.481 | 0.436 | 1.004 | 0.016 | 1.866 | 0.107 | 0.060 | 0.016 | 334.327 | 0.325 |
| | Subtotal | | | 54.562 | 42.844 | 55.793 | 61.562 | 18.948 | 10.430 | 19.237 | 49.865 | 24.820 | 22.829 | 30.815 | 25.660 | 29.358 | 28000.083 | 27.251 |
| 998 | Others | Unidentified fish | | 1.209 | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 120 | | *Macrobrachium rosenbergii* | *Golda* | – | – | – | – | – | – | – | – | – | – | – | 0.465 | – | 202.276 | 0.197 |
| 931 | | Prawn spp. | *Chingri/Icha* | 10.585 | 37.584 | 29.928 | 29.524 | 79.716 | 85.995 | 70.658 | 13.570 | 5.539 | 56.027 | 2.016 | 6.847 | 10.062 | 18056.135 | 17.573 |
| 207 | | *Trionyx gangeticus* | *Kachhim* | – | – | – | – | – | – | – | – | – | – | – | 0.004 | – | 1.800 | 0.002 |
| | Subtotal | | | 11.794 | 37.584 | 29.928 | 29.524 | 79.716 | 85.995 | 70.658 | 13.570 | 5.539 | 56.027 | 2.016 | 7.316 | 10.062 | 18260.211 | 17.772 |
| | Grand total | | | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 102747.685 | 100 |

Note: – denotes zero catch

**Table 6.14 Monthly catch composition (% by weight) from combined floodplains/beel: inside MIP (sites NE05+NE02+NE04)**

| Species Code | Habitat preference | Species name: Scientific | Species name: Bengali | Year: 1993 Feb | Mar | April | May | June | July | Aug | Sep | Oct | Nov | Dec | Year: 1994 Jan | Feb | Total annual catch (Mar'93 - Feb'94) Kg | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 99 | Riverine | *Labeo angra* | *Angrot* | - | - | - | - | - | - | - | 0.005 | - | - | - | - | - | 0.232 | 0.0002 |
| 59 | | *Crossocheilus latius* | *Kalabata* | - | - | - | - | - | - | 0.103 | - | - | - | - | 0.014 | - | 16.270 | 0.012 |
| 139 | | *Nemacheilus botia* | *Balichata* | 0.010 | - | - | 0.064 | - | - | - | - | - | - | 0.004 | 0.166 | 0.119 | 160.216 | 0.117 |
| 941 | | *Neoeucirrhichthys maydelli* | *Gutum* | 0.003 | 0.056 | 0.027 | 0.027 | - | 0.025 | - | 0.002 | - | - | 0.024 | - | - | 4.053 | 0.003 |
| 198 | | *Somileptes gongota* | *Gharpoia* | - | - | - | - | - | - | - | - | - | - | - | - | 0.0003 | 0.026 | 0.00002 |
| 28 | | *Botia dario* | *Rani* | - | - | - | - | - | 0.109 | - | 0.191 | - | - | - | 0.014 | 0.001 | 25.337 | 0.019 |
| 29 | | *Botia lohachata* | *Putul* | - | - | - | - | - | - | - | 0.061 | - | - | - | - | - | 2.700 | 0.002 |
| 89 | | *Hilsa ilisha* | *Ilish* | - | - | - | - | 0.050 | 0.488 | 0.029 | 1.883 | 0.101 | - | - | - | - | 114.314 | 0.084 |
| 8 | | *Anodontostoma chacunda* | *Koi puti* | - | - | - | - | - | - | - | - | - | - | - | - | 0.041 | 3.849 | 0.003 |
| 85 | | *Gonialosa manmina* | *Goni chapila* | - | - | - | - | - | - | - | - | - | - | 0.210 | 0.416 | - | 377.160 | 0.276 |
| 58 | | *Corica soborna* | *Kachki* | - | - | - | - | - | - | - | 0.003 | 0.147 | 0.308 | 0.360 | 0.042 | - | 83.255 | 0.061 |
| 922 | | *Liza sp* | *Bata* | - | - | - | - | - | - | - | - | - | - | - | - | 0.039 | 3.664 | 0.003 |
| 185 | | *Rhinomugil corsula* | *Khorsula* | - | - | - | - | - | - | - | - | 0.015 | - | 0.082 | - | - | 5.983 | 0.004 |
| 923 | | *Sicamugil cascasia* | *Bata* | - | - | - | - | - | - | 0.065 | 0.014 | - | - | - | - | - | 3.370 | 0.002 |
| 163 | | *Pisodonophis boro* | *Kharu* | - | - | - | - | - | 0.050 | - | - | - | - | - | - | - | 2.045 | 0.001 |
| 2 | | *Ailia coila* | *Kajuli* | - | - | - | - | - | 0.958 | 0.102 | 0.026 | - | - | - | - | - | 44.616 | 0.033 |
| 51 | | *Clupisoma garua* | *Ghaura* | - | - | - | - | 0.638 | 0.112 | 0.270 | 0.135 | - | - | - | - | - | 39.233 | 0.029 |
| 16 | | *Bagarius bagarius* | *Baghair* | - | - | - | - | - | - | - | - | - | 0.021 | - | - | - | 0.926 | 0.001 |
| 45 | | *Chelonodon fluviatilis* | *Potka* | - | - | - | - | - | - | - | - | - | - | - | - | 0.039 | 3.644 | 0.003 |
| | Subtotal | | | 0.014 | 0.056 | 0.027 | 0.091 | 0.688 | 1.742 | 0.570 | 2.319 | 0.263 | 0.329 | 0.679 | 0.651 | 0.238 | 890.893 | 0.651 |
| 130 | Migratory | *Aorichthys aor* | *Ayre* | - | - | - | - | 0.484 | 0.193 | - | 0.001 | 0.581 | 0.011 | 0.159 | 17.816 | 21.881 | 17765.657 | 12.986 |
| 135 | | *Aorichthys seenghala* | *Guizza* | 1.560 | - | - | - | 0.176 | 0.827 | 1.782 | 2.369 | 1.019 | 0.207 | 0.025 | 0.166 | - | 460.500 | 0.337 |
| 131 | | *Mystus bleekeri* | *Golsha tengra* | 0.008 | 1.571 | 2.189 | 0.011 | 0.600 | 0.876 | 0.907 | 0.368 | 0.193 | 0.096 | 0.008 | 1.259 | 0.042 | 1248.588 | 0.913 |
| 132 | | *Mystus cavasius* | *Kabashi* | - | - | 1.906 | - | 0.200 | 0.070 | 0.922 | 0.419 | 0.036 | - | 0.078 | 0.554 | 0.107 | 578.362 | 0.423 |
| 134 | | *Mystus menoda* | *Ghagla* | - | - | - | - | - | - | 0.162 | - | 0.093 | - | - | - | - | 14.701 | 0.011 |
| 32 | | *Catla catla* | *Catla* | - | - | - | - | - | - | - | 5.819 | - | - | 0.628 | 2.085 | - | 2123.312 | 1.552 |
| 47 | | *Cirrhinus mrigala* | *Mrigel* | - | - | - | - | - | - | - | 2.677 | 0.689 | 0.475 | 0.052 | 2.948 | 3.916 | 3154.218 | 2.306 |
| 48 | | *Cirrhinus reba* | *Raik* | - | - | - | - | - | - | - | 0.043 | 0.022 | - | 0.090 | 0.175 | 0.008 | 163.149 | 0.119 |
| 101 | | *Labeo boga* | *Bhangan* | - | - | - | - | - | - | 0.025 | - | - | - | - | - | - | 1.050 | 0.001 |
| 102 | | *Labeo calbasu* | *Kalbaus* | - | - | - | - | 0.118 | 0.349 | - | 2.603 | 0.756 | 1.615 | 0.018 | 1.048 | 0.016 | 1187.714 | 0.868 |
| 104 | | *Labeo gonius* | *Goni* | 0.720 | - | - | - | 0.409 | 0.079 | - | 0.209 | - | - | - | 0.700 | 0.630 | 697.239 | 0.510 |
| 105 | | *Labeo nandina* | *Nandina* | - | - | - | - | - | - | - | - | - | - | 0.003 | - | - | 0.201 | 0.0001 |
| 107 | | *Labeo rohita* | *Rui* | - | - | - | - | - | 0.011 | - | 0.063 | - | 1.495 | - | 1.617 | 0.018 | 1488.352 | 1.088 |
| 188 | | *Salmostoma bacaila* | *Katari* | - | - | - | - | - | 0.541 | - | 0.179 | - | 0.001 | 0.149 | 0.684 | 0.053 | 643.479 | 0.470 |
| 189 | | *Salmostoma phulo* | *Fulchela* | 0.134 | - | - | - | 0.794 | 0.790 | 1.216 | 2.318 | 0.089 | 0.114 | 0.494 | 0.706 | 0.152 | 882.232 | 0.645 |
| 86 | | *Gudusia chapra* | *Chapila* | - | - | - | - | 0.565 | 5.338 | 2.976 | 12.737 | 4.943 | 2.127 | 10.434 | 13.043 | 0.033 | 13479.610 | 9.853 |
| 76 | | *Eutropiichthys vacha* | *Bacha* | - | - | - | - | 0.044 | 0.091 | - | 0.116 | - | - | - | - | - | 10.028 | 0.007 |
| 169 | | *Pseudeutropius atherinoides* | *Batasi* | - | - | - | - | - | - | - | - | - | - | 0.028 | 0.088 | - | 78.594 | 0.057 |
| 209 | | *Wallagu attu* | *Boal* | 0.787 | - | - | - | - | - | 0.857 | 1.191 | 2.441 | - | - | 4.158 | 0.849 | 4020.867 | 2.939 |
| 142 | | *Nemacheilus scaturigina* | *Dari* | - | - | - | - | - | - | - | - | - | - | 0.028 | 0.011 | - | 10.862 | 0.008 |
| 161 | | *Pellona ditchela* | *Chouka* | - | - | - | - | - | - | - | - | - | 0.010 | 0.037 | 0.016 | - | 16.998 | 0.012 |
| | | | | 3.209 | 1.571 | 4.095 | 0.011 | 3.391 | 9.164 | 8.846 | 31.112 | 10.861 | 6.151 | 12.232 | 47.072 | 27.705 | 48025.713 | 35.105 |
| 6 | Floodplain | *Anabas testudineus* | *Koi* | 0.116 | - | - | 0.059 | 0.060 | 0.046 | 0.087 | 0.112 | 0.005 | - | - | 0.068 | 0.626 | 134.358 | 0.098 |
| 136 | Resident | *Mystus tengara* | *Bajari tengra* | 0.777 | - | - | - | 0.661 | 0.493 | 0.242 | 0.043 | - | - | 0.014 | 0.207 | 0.100 | 242.004 | 0.177 |
| 137 | | *Mystus vittatus* | *Tengra* | 0.093 | 2.115 | 0.308 | 0.114 | 2.197 | 5.078 | 2.067 | 4.629 | 1.664 | 0.260 | 3.123 | 1.669 | 2.069 | 2558.921 | 1.870 |
| 942 | | *Rama chandramara* | *Laia* | - | - | - | - | 0.130 | 0.025 | - | 0.001 | - | - | - | - | - | 4.592 | 0.003 |
| 55 | | *Colisa fasciatus* | *Khalisha* | 1.255 | 1.189 | 0.740 | 3.189 | 0.018 | 0.562 | 0.641 | 0.364 | 0.053 | 0.083 | 0.140 | 0.260 | 0.191 | 498.160 | 0.364 |
| 211 | | *Colisa labiosus* | *Khalisha* | 0.097 | 0.534 | 0.176 | 0.456 | 0.362 | 0.390 | 0.726 | 0.404 | 0.004 | - | - | - | - | 99.649 | 0.073 |



(Cont.)

Table 6.14 Monthly catch composition (% by weight) from combined floodplains/beel: inside MIP (sites NE05+NE02+NE04)

| Species Code | Habitat preference | Species name | | Year: 1993 | | | | | | | | | | | Year: 1994 | | Total annual catch (Mar'93 – Feb'94) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Scientific | Bengali | Feb | Mar | April | May | June | July | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Kg | % |
| 57 | | *Colisa sota* | *Khalisha* | 0.175 | 0.429 | 0.586 | 1.753 | 1.009 | 0.753 | 0.046 | 0.014 | - | 0.001 | - | - | - | 153.965 | 0.113 |
| 210 | | *Xenentodon cancila* | *Kaikka* | 0.957 | - | - | 0.020 | 1.560 | 1.340 | 0.547 | 0.741 | 0.153 | - | 0.484 | 0.467 | 0.022 | 605.954 | 0.443 |
| 62 | | *Cyprinus carpio* | *Karfu* | - | - | - | - | - | 0.260 | - | 1.557 | - | - | - | 8.257 | - | 7324.353 | 5.354 |
| 187 | | *Osteobrama cotio cotio* | *Keti* | - | - | - | - | 0.131 | 0.017 | 0.030 | 0.002 | 0.098 | - | 0.119 | 0.281 | - | 267.399 | 0.195 |
| 174 | | *Puntius chola* | *Chala puti* | 0.844 | 2.636 | 3.114 | 2.292 | 6.007 | 3.612 | 0.318 | 3.551 | 2.864 | 0.404 | 3.507 | 1.001 | 5.823 | 2500.989 | 1.828 |
| 175 | | *Puntius conchonius* | *Canchan puti* | 0.004 | 0.069 | 0.908 | - | 1.891 | 0.011 | 0.125 | 0.332 | 0.185 | 0.005 | 0.158 | 0.123 | - | 208.603 | 0.152 |
| 173 | | *Puntius cosuatis* | *Kosuati* | - | - | - | - | - | - | - | - | 0.0003 | - | - | 0.003 | - | 2.418 | 0.002 |
| 176 | | *Puntius gelius* | *Giliputi* | 0.028 | - | - | 0.170 | 0.612 | 0.734 | 0.733 | 0.269 | 0.031 | 0.072 | 0.045 | 0.118 | 0.023 | 211.760 | 0.155 |
| 177 | | *Puntius guganio* | *Mola puti* | - | - | - | - | - | - | 0.020 | - | - | - | - | - | - | 0.844 | 0.001 |
| 178 | | *Puntius phutunio* | *Phutani puti* | 0.061 | 0.225 | 0.073 | 1.312 | 0.322 | - | - | 0.029 | 0.001 | 0.003 | 0.0001 | - | - | 78.235 | 0.057 |
| 179 | | *Puntius sarana* | *Sarputi* | - | - | - | - | - | - | - | - | - | - | 0.031 | - | - | 1.817 | 0.001 |
| 180 | | *Puntius sophore* | *Puti* | 13.136 | 27.701 | 0.230 | 0.052 | 8.161 | 4.059 | 1.656 | 3.465 | 4.584 | 2.092 | 5.038 | 1.830 | 3.378 | 3338.430 | 2.440 |
| 181 | | *Puntius terio* | *Teri punti* | 0.130 | 0.225 | 0.018 | - | 0.085 | 0.114 | 0.185 | 0.080 | 0.131 | 0.091 | 0.256 | 0.091 | 0.096 | 137.357 | 0.100 |
| 212 | | *Puntius ticto* | *Tit puti* | 0.076 | - | - | 0.046 | - | 0.057 | - | 0.001 | - | - | 0.001 | 0.0003 | - | 5.068 | 0.004 |
| 4 | | *Amblypharyngodon microlepis* | *Mola* | 0.035 | - | - | - | - | - | - | - | - | - | - | - | - | | - |
| 5 | | *Amblypharyngodon mola* | *Mola* | 0.117 | 0.196 | 0.009 | 0.033 | 2.416 | 1.288 | 1.453 | 2.286 | 0.710 | 0.004 | 0.420 | 0.857 | 0.066 | 1124.737 | 0.822 |
| 75 | | *Esomus danricus* | *Darkina* | 0.373 | - | - | 0.017 | 0.016 | - | - | - | - | 0.067 | 0.056 | 0.0003 | - | 7.802 | 0.006 |
| 182 | | *Rasbora daniconius* | *Darkina* | 0.300 | 0.222 | 0.282 | 0.065 | - | 0.038 | - | 0.073 | 0.026 | 0.252 | - | 0.011 | - | 32.258 | 0.024 |
| 83 | | *Glossogobius giurus* | *Bailla* | 2.363 | 0.362 | 0.413 | 0.055 | 0.481 | 1.769 | 1.756 | 0.358 | 1.980 | 11.426 | 2.076 | 2.015 | 1.532 | 2874.994 | 2.101 |
| 91 | | *Hypophthalmichthys molitrix* | *Silver carp* | - | - | - | - | - | 1.025 | - | - | - | - | - | 0.002 | - | 43.344 | 0.032 |
| 110 | | *Lepidocephalus guntea* | *Gutum* | 2.896 | 1.507 | 1.480 | 0.535 | 0.011 | 0.122 | 0.044 | - | 0.044 | 0.002 | 0.503 | 0.534 | 0.429 | 584.700 | 0.427 |
| 9 | | *Aplocheilus panchax* | *Kanpona* | 0.002 | - | - | - | - | - | - | - | - | - | - | - | - | | - |
| 39 | | *Channa marulius* | *Gajar* | 11.013 | 4.734 | - | - | 1.248 | - | - | 0.777 | 0.489 | 0.211 | - | 3.693 | 2.092 | 3560.885 | 2.603 |
| 41 | | *Channa punctatus* | *Taki* | 7.742 | 14.052 | 13.563 | 7.145 | 12.410 | 4.650 | 5.265 | 8.475 | 5.834 | 3.096 | 1.461 | 0.665 | 10.865 | 3882.237 | 2.838 |
| 42 | | *Channa striatus* | *Shol* | 1.042 | - | - | - | - | - | 0.398 | - | 3.324 | 2.442 | - | 0.200 | 0.121 | 588.393 | 0.430 |
| 49 | | *Clarias batrachus* | *Magur* | 0.776 | - | - | 0.168 | 1.252 | 1.336 | 0.345 | 0.270 | 0.065 | - | 0.045 | 0.215 | 0.861 | 401.272 | 0.293 |
| 88 | | *Heteropneustes fossilis* | *Shingi* | 0.892 | 2.647 | 8.169 | 1.006 | 0.756 | 1.885 | 1.570 | 0.999 | 0.116 | 0.032 | 0.682 | 0.660 | 7.538 | 1638.559 | 1.198 |
| 121 | | *Macrognathus aculeatus* | *Tara baim* | 0.036 | - | 0.138 | - | 0.081 | 0.518 | - | - | - | - | - | 0.046 | 0.406 | 102.051 | 0.075 |
| 123 | | *Macrognathus pancalus* | *Guchi* | 5.591 | 1.105 | 0.772 | 0.383 | 0.663 | 0.876 | - | 0.219 | 0.223 | 0.218 | 1.138 | 0.897 | 3.334 | 1281.716 | 0.937 |
| 122 | | *Mastacembelus armatus* | *Baral baim* | 0.287 | - | 0.265 | 0.024 | 0.807 | - | 1.274 | 1.695 | 0.622 | 0.006 | 0.611 | 0.443 | 0.216 | 649.833 | 0.475 |
| 138 | | *Nandus nandus* | *Bheda* | 0.909 | 15.032 | 0.574 | 0.204 | 0.303 | 0.254 | 0.243 | 0.535 | 0.195 | 0.013 | 1.863 | 0.273 | 9.723 | 1362.922 | 0.996 |
| 15 | | *Badis badis* | *Napit koi* | 0.057 | 0.084 | 0.201 | 0.534 | 0.160 | 0.038 | 0.273 | 0.053 | 0.112 | 0.877 | 0.033 | 0.045 | 0.001 | 136.981 | 0.100 |
| 149 | | *Ophisternon bengalense* | *Bamosh* | - | - | - | - | - | - | - | - | - | - | 0.088 | 0.606 | 0.523 | 585.466 | 0.428 |
| 147 | | *Ompok bimaculatus* | *Kani pabda* | - | - | - | - | - | 0.015 | 0.010 | - | - | - | - | - | - | 1.008 | 0.001 |
| 148 | | *Ompok pabda* | *Madhu pabda* | - | - | - | - | - | - | - | 0.031 | - | - | - | 0.238 | 0.001 | 210.647 | 0.154 |
| 145 | | *Notopterus notopterus* | *Foli* | 0.744 | 3.286 | - | 0.523 | 1.359 | 1.212 | 14.077 | 10.213 | 4.631 | 4.031 | 0.583 | 5.822 | 5.202 | 7360.400 | 5.380 |
| 203 | | *Tetraodon cutcutia* | *Potka* | 2.233 | - | 1.363 | 1.221 | 0.931 | 0.602 | 0.272 | 0.094 | 0.113 | 0.112 | 0.157 | 0.513 | 0.039 | 611.576 | 0.447 |
| 33 | | *Chaca chaca* | *Cheka* | 0.349 | - | - | - | - | 0.028 | - | 0.091 | 0.002 | - | 0.147 | 0.299 | 0.615 | 333.699 | 0.244 |
| 35 | | *Chanda baculis* | *Chanda* | 5.564 | 4.321 | 0.366 | 0.052 | 25.857 | 14.420 | 24.796 | 6.010 | 2.878 | 1.459 | 5.844 | 0.900 | 0.265 | 4072.573 | 2.977 |
| 36 | | *Chanda nama* | *Nama chanda* | 0.504 | - | 0.016 | - | 2.295 | 1.370 | 12.477 | 8.877 | 7.659 | 1.169 | 1.681 | 0.844 | 0.220 | 2591.388 | 1.894 |
| 37 | | *Chanda ranga* | *Lal chanda* | 7.883 | 0.480 | 0.453 | 1.636 | 3.515 | 8.280 | 1.031 | 0.161 | 0.235 | 0.115 | 0.101 | 0.031 | - | 628.512 | 0.459 |
| | Subtotal | | | 69.454 | 83.150 | 34.217 | 23.063 | 77.763 | 57.273 | 72.706 | 56.808 | 39.026 | 28.541 | 30.403 | 34.184 | 56.375 | 53042.829 | 38.772 |
| 931 | Others | Prawn spp. | *Chingri/Icha* | 27.255 | 15.222 | 61.660 | 76.833 | 18.157 | 31.820 | 17.878 | 9.745 | 49.849 | 64.978 | 56.684 | 18.090 | 15.266 | 34808.038 | 25.443 |
| 945 | | *Crab sp* | *Kakra* | 0.067 | - | - | - | - | - | - | 0.013 | - | - | - | - | - | 0.576 | 0.0004 |
| 113 | | *Machrob. birmanicus* | *Chingri thengua* | - | - | - | - | - | - | - | - | - | - | - | - | 0.414 | 38.900 | 0.028 |
| | Subtotal | | | 27.322 | 15.222 | 61.660 | 76.833 | 18.157 | 31.820 | 17.878 | 9.758 | 49.849 | 64.978 | 56.684 | 18.090 | 15.680 | 34847.514 | 25.472 |
| | Grand total | | | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 136806.961 | 100 |

Note: – denotes zero catch

**LEGEND**

| | |
|---|---|
| Peak season >50% fish ripe, ripe running, spent | (black) |
| 20–50% fish ripe, ripe running, spent | (dark grey) |
| <20% fish ripe, ripe running, spent | (light grey) |
| 0% fish ripe, ripe running, spent | (white box) |
| No data | |

Note: Numbers quoted are numbers of fish examined

## Table 6.15 Breeding seasons of selected fish inside and outside the MIP, February 1993 – February 1994

| Habitat | Species name | | Inside/ | Year: 1993 | | | | | | | | | | | Year: 1994 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Preference | Scientific | Bengali | Outside MIP | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb |
| Riverine species | *Botia dario* | *Rani* | Inside (floodplain+beel) | | | | | | | | 1 | 1 | | | | |
| | | | Outside (rivers) | | | | | | 23 | 18 | 8 | 6 | 1 | 3 | 1 | |
| | | | Outside (floodplain+beel) | | | | | | | 2 | 1 | 2 | 1 | | | |
| | *Corica soborna* | *Kachki* | Inside (floodplain+beel) | 2 | 1 | | | | 5 | | 3 | 8 | 6 | 8 | | |
| | | | Outside (rivers) | 38 | 41 | | 2 | | 10 | 1 | 4 | 4 | 1 | 5 | | |
| | | | Outside (floodplain+beel) | | 178 | | | | 1 | 1 | | | 3 | | | |
| | *Clupisoma garua* | *Ghaura* | Inside (floodplain+beel) | | | | | | | | 1 | 1 | | | | |
| | | | Outside (rivers) | 2 | 6 | | | | | 1 | 1 | 1 | 4 | | | |
| | | | Outside (floodplain+beel) | 1 | 1 | | | | | 7 | 2 | 6 | | | | |
| | *Clupisoma naziri* | *Muri Bacha* | Outside (rivers) | 3 | 3 | | | | | | | | | | | |
| Migratory species | *Aorichthys aor* | *Ayre* | Inside (floodplain+beel) | | | | | | 1 | | | 1 | | | | |
| | | | Outside (rivers) | | 1 | | | | | 1 | 1 | 1 | 1 | | | |
| | | | Outside (floodplain+beel) | 1 | | | | | 1 | | | 5 | | 1 | | 2 |
| | *Aorichthys seenghala* | *Guizza* | Outside (floodplain+beel) | | | | | | | | | | | | | 16 |
| | *Mystus cavasius* | *Kabashi* | Inside (floodplain+beel) | | | 1 | | 1 | 4 | 6 | 1 | 1 | 9 | 1 | 1 | 1 |
| | | | Outside (rivers) | | | 1 | 2 | | 7 | 7 | 9 | 3 | 7 | 35 | 19 | 31 |
| | | | Outside (floodplain+beel) | | | | | 5 | 4 | 6 | 1 | 8 | | | 15 | 32 |
| | *Catla catla* | *Catla* | Inside (floodplain+beel) | | | | | | | | | | | 10 | | |
| | *Salmostoma bacaila* | *Katari* | Inside (floodplain+beel) | 3 | 1 | | | | 1 | | | | | 2 | 4 | |
| | | | Outside (rivers) | 12 | 42 | 3 | | | 1 | | | 2 | 1 | | | |
| | | | Outside (floodplain+beel) | | | | | | | | | 1 | | 2 | 7 | 7 |
| | *Gudusia chapra* | *Chapila* | Inside (floodplain+beel) | | | | | | 11 | | 5 | 2 | | 1 | 12 | |
| | | | Outside (rivers) | 1 | 14 | | 1 | | 1 | 1 | 5 | 6 | 2 | 2 | 3 | |
| | | | Outside (floodplain+beel) | 102 | 14 | 7 | | 3 | 5 | 10 | 9 | 5 | 1 | 3 | 43 | 17 |
| | *Eutropiichthys vacha* | *Bacha* | Outside (rivers) | 103 | 8 | 3 | | | | | | | | | | |
| | | | Outside (floodplain+beel) | | 1 | 2 | | | | | | | | | | |
| | *Wallagu attu* | *Boal* | Inside (floodplain+beel) | | 1 | | | | | | | 3 | | | | |
| | | | Outside (rivers) | | | | | | | | | | | 2 | | |
| | | | Outside (floodplain+beel) | | | | | | | | | | | | | 2 |

LEGEND

| | |
|---|---|
| Peak season >50% fish ripe, ripe running, spent | |
| 20–50% fish ripe, ripe running, spent | |
| <20% fish ripe, ripe running, spent | |
| 0% fish ripe, ripe running, spent | |
| No data | |

Note: Numbers quoted are numbers of fish examined

**Table 6.15 (Continued)**

| Habitat Preference | Species name: Scientific | Species name: Bengali | Inside/ Outside MIP | 1993 Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | 1994 Jan | Feb |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Floodplain resident species | *Mystus vittatus* | *Tengra* | Inside (floodplain + beel) | 5 | 1 | 1 | | 7 | 30 | 23 | 11 | 4 | | 7 | 28 | 34 |
| | | | Outside (rivers) | 7 | 9 | | | | 2 | | | 1 | 7 | 23 | 11 | 25 |
| | | | Outside (floodplain + beel) | 1 | 5 | | | 27 | 14 | 8 | 10 | 5 | 4 | 3 | 3 | 9 |
| | *Colisa fasciatus* | *Khalisha* | Inside (floodplain + beel) | 1 | | | | | 3 | 3 | 1 | 1 | | 1 | 1 | 1 |
| | *Osteobrama cotio cotio* | *Keti* | Inside (floodplain + beel) | | | | | | 1 | | 1 | | | 2 | | |
| | | | Outside (rivers) | | | | 3 | | 6 | 3 | 1 | 2 | 2 | 3 | | |
| | | | Outside (floodplain + beel) | | | 1 | | 2 | 4 | 5 | 5 | 1 | | | 8 | 25 |
| | *Puntius conchonius* | *Canchan puti* | Inside (floodplain + beel) | | | | | 3 | 1 | 3 | 1 | 1 | | | | |
| | | | Outside (rivers) | | | | | 4 | 2 | 7 | 3 | 3 | 1 | | | |
| | | | Outside (floodplain + beel) | | | | | | 3 | 1 | 4 | 2 | | 3 | 2 | 7 |
| | *Puntius sophore* | *Puti* | Inside (floodplain + beel) | 4 | 3 | 2 | | 4 | 16 | 5 | 10 | 2 | 1 | 7 | 6 | 26 |
| | | | Outside (rivers) | 9 | 5 | | 2 | 3 | 1 | | | | | | | 2 |
| | | | Outside (floodplain + beel) | 3 | | | | 2 | 1 | 5 | 9 | 8 | 1 | 1 | 28 | 31 |
| | *Amblypharygodon mola* | *Mola* | Inside (floodplain + beel) | | | | | 5 | | 2 | 3 | 7 | | | 7 | 1 |
| | | | Outside (rivers) | | | | | | 7 | 4 | | 4 | | | | |
| | | | Outside (floodplain + beel) | | | | | | | 3 | 2 | 2 | | | | 1 |
| | *Glossogobius giurus* | *Bailla* | Inside (floodplain + beel) | 1 | 13 | 2 | | | 8 | 1 | 2 | 3 | 7 | | 3 | 5 |
| | | | Outside (rivers) | 30 | 32 | 3 | 1 | 2 | 8 | 15 | 14 | 8 | 4 | 4 | | 1 |
| | | | Outside (floodplain + beel) | 8 | 23 | 1 | 3 | 2 | 4 | 5 | 2 | 1 | 2 | 1 | 3 | 2 |
| | *Lepidocephalus guntea* | *Gutum* | Inside (floodplain + beel) | 61 | 1 | 6 | 1 | | 1 | 1 | | 1 | | 1 | 16 | 8 |
| | | | Outside (rivers) | 14 | 18 | 3 | 4 | | | 2 | | | | | | |
| | | | Outside (floodplain + beel) | 6 | 1 | 1 | | 2 | | 3 | 3 | | | | | |
| | *Channa punctatus* | *Taki* | Inside (floodplain + beel) | 9 | 4 | 2 | | 1 | 9 | 10 | 6 | 5 | 2 | 6 | 1 | 37 |
| | | | Outside (rivers) | 4 | 3 | | | | | 1 | | | | | | |
| | | | Outside (floodplain + beel) | 3 | | 1 | | 5 | 2 | 7 | | 2 | 1 | 1 | | |
| | *Heteropneustes fossilis* | *Shingi* | Inside (floodplain + beel) | 25 | | 13 | 1 | | 13 | 10 | 6 | 1 | | 1 | 16 | 39 |
| | | | Outside (rivers) | | | | | | 4 | | | | 1 | | | |
| | | | Outside (floodplain + beel) | | 1 | | | 2 | 1 | 5 | 3 | 2 | 1 | 1 | | |
| | *Macrognathus pancalus* | *Guchi* | Inside (floodplain + beel) | 22 | 1 | 1 | 3 | 1 | 5 | | 2 | 1 | 3 | 1 | 52 | 20 |
| | | | Outside (rivers) | 32 | 139 | 17 | 21 | 2 | 3 | 26 | 16 | 10 | 9 | 3 | | 1 |
| | | | Outside (floodplain + beel) | 11 | 3 | 1 | | | 1 | 6 | 5 | 4 | | 1 | | |
| | *Chanda nama* | *Nama chanda* | Inside (floodplain + beel) | 17 | 7 | 1 | | 1 | 2 | 5 | 5 | 7 | 2 | 3 | 2 | |
| | | | Outside (rivers) | 4 | 3 | | 9 | | 3 | 2 | 4 | 2 | | | 1 | 1 |
| | | | Outside (floodplain + beel) | 25 | 6 | | 1 | 9 | 4 | 3 | 8 | 1 | 3 | | 7 | 1 |

**Figure 6.25 Seasonal variation in the number of riverine, migratory and floodplain resident fish species from floodplains and *beel* in Hakaluki *Haor* (sites NE08+NE10+NE09/21)**

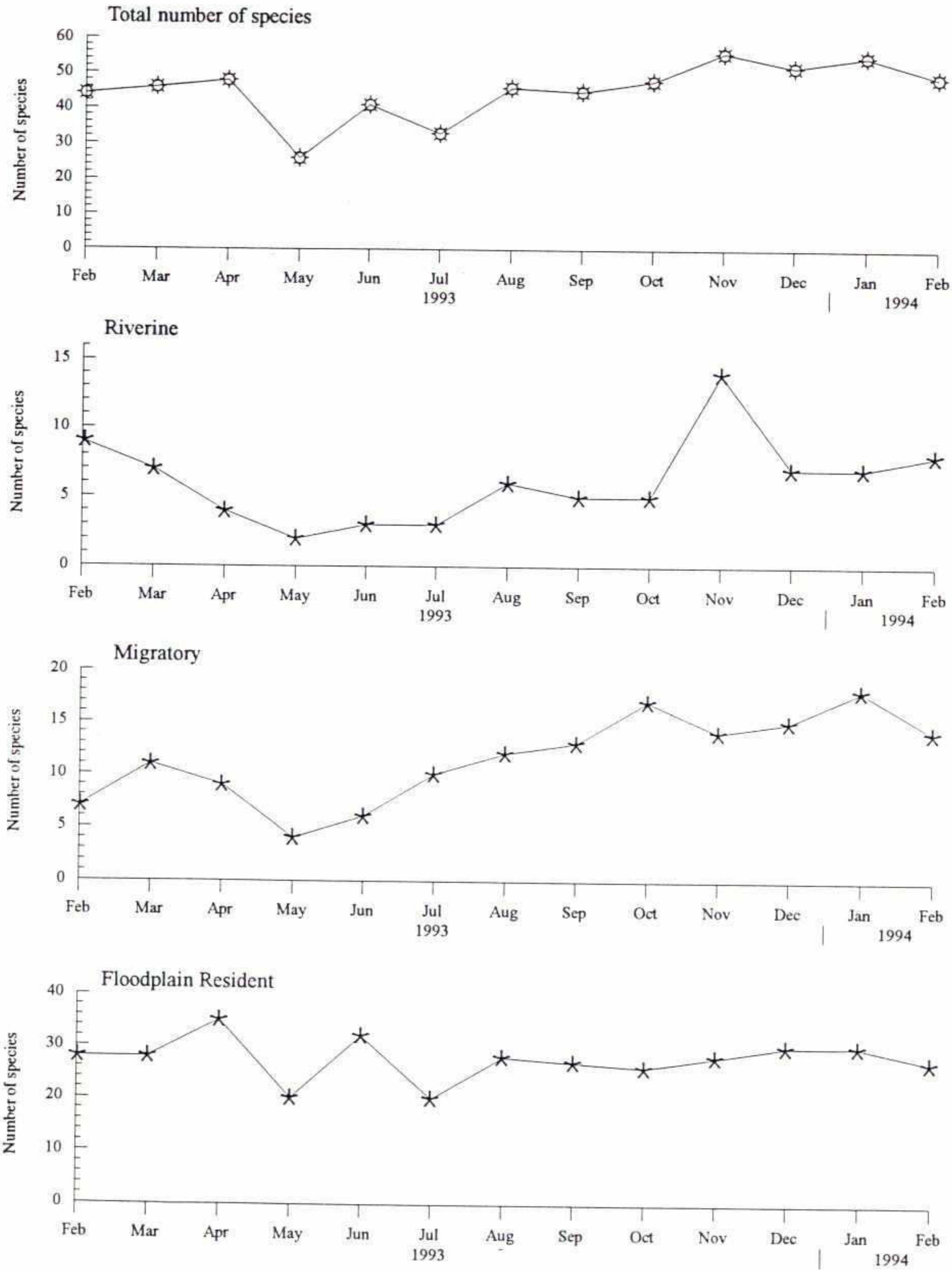
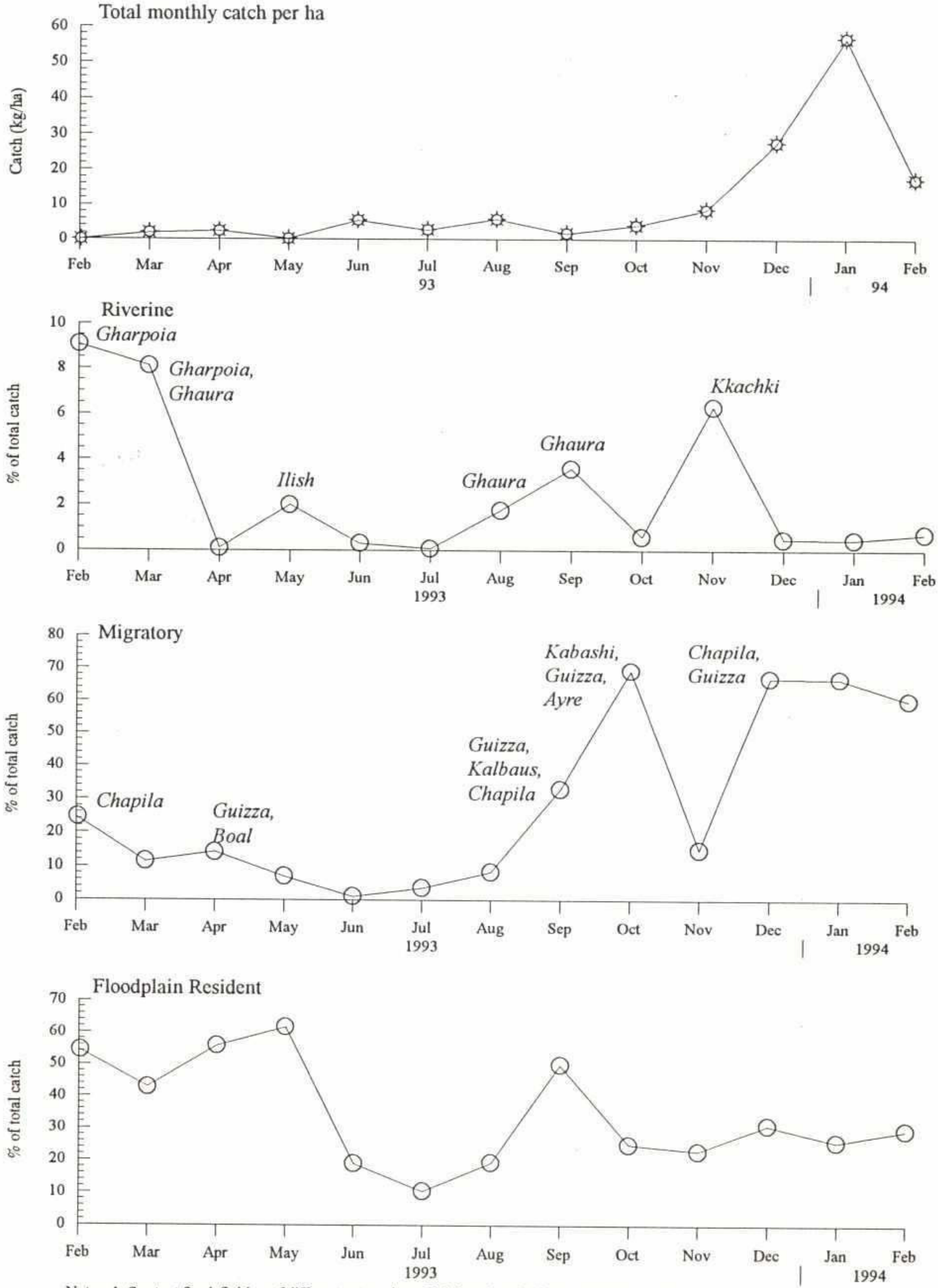


**Figure 6.26 Percentage total monthly catch of riverine, migratory and floodplain resident groups of fish from floodplains and *beel* in Hakaluki *Haor* (sites NE10+NE08+NE09/21)**




Notes: 1. See text for definition of different categories of fish based on habitat preference (Section 5.4.1)
2. Dominant species are shown for peak relative abundances of riverine and migratory fish

In May water levels in the Kushiyara and Juri rivers increased substantially and resulted in the inundation of floodplains. Only one new riverine species, *ilish* (adults), was recorded at this time and no new migratory species. In June there was little evidence of any major ingress by riverine and migratory species but it should be noted that fishing was observed only on the high floodplains on the southern boundary of the *haor* in this month, and therefore possible migrations of fish from the Kushiyara River to floodplains and *beel* further north could not be detected. In July 4 new migratory species were recorded on high floodplains at Gobindapur. One was a clupeid, *chouka*, and the others were juvenile carp *kalbaus* (83 g/ indiv.), *rui* (15 g/indiv.) and *goni* (11 g/indiv.). The two major carps, *kalbaus* and *rui*, probably entered the *haor* as hatchlings from the Kushiyara since other FAP 17 studies found no evidence of breeding in the *haor* but there was the possibility of breeding grounds on its feeder river system on the Juri/Continella where a very small number of hatchlings were found in July.[15]

As fishing resumed on deeper floodplains and *beel* in August a further 7 new riverine and migratory species appeared in catches. These included adult *kajuli*, *ghaura*, *gang tengra* and *raik* and juvenile *mrigel* (450 g), *batasi* and *ghagla*. No further major increase in numbers of new riverine and migratory species occurred until November when 7 new riverine species were recorded in low abundance in the remaining waters on Tekuni floodplain. These species probably entered the floodplains and *beel* earlier in the year but went undetected because of the absence of fishing. Although only 3 new migratory species appeared in catches during September and October, the contribution made to monthly catches by this group of fish increased considerably to reach a peak of 69% in October. The most abundant species were *chapila*, *guizza*, *ayre* and *kabashi* which occurred as adults and juveniles, and *kalbaus*, found only as juveniles of the year (43-325 g). During the winter period between December and February, numerous riverine and migratory remained in Baghalkuri *Beel*. Riverine species were fewer in number and lower in abundance than migratory species which accounted for between 60% and 67% of monthly catches. The most abundant migratory species in winter included *guizza*, *chapila*, *kabashi*, *mrigel*, *katari* and *boal*.

### 6.6.2 Manu Irrigation Project

In February 1993 only 2 riverine and 5 migratory species were found on floodplains and *beel* in the MIP (Table 6.14). In mid-February sluice gates on Khorodari *Khal* were closed in response to rapidly rising water levels in the Kushiyara River. Catch composition data from floodplains and *beel* were examined separately for each fortnightly survey in February and compared with results of surveys undertaken during a training programme for fisheries biologists in January 1993 (Table 6.16). No riverine species and only one migratory species, *golsha tengra*, were found in January. This species is capable of surviving throughout the year in *beel* such as Patasinga. During the first survey in February, 5 species were recorded: *balichata*, *guizza*, *goni*, *fulchela* and *boal*. Average individual weights indicated that *guizza*, *boal* and *goni* were adults. All species except *guizza* were also found in Khorodari *Khal* during the same period and it therefore seems highly likely that they entered the MIP by upstream migration against rainfall runoff draining into the Kushiyara. Only one new species, *gutum* (*N. maydelli*), was recorded during the second survey in February by which time sluice gates were closed, preventing entry of floodwaters, fish and fish hatchlings. Between March and May, numbers of riverine and migratory species remained very low with usually only 2 or 3 species per month being recorded (Fig. 6.27). In part, the reduction in diversity from February could be attributed to the low fishing effort and smaller size of observed and measured catches which were therefore more likely to miss uncommon species. No fishing at all was seen on deeper floodplains of Islampur between February and April 1993.

**Table 6.16 Riverine and migratory species on floodplains and *beel* of the MIP, January and February 1993**

| Habitat Preference | Species name | | January | February | |
|---|---|---|---|---|---|
| | Scientific | Bengali | | 1st Survey | 2nd Survey |
| Riverine | *Nemacheilus botia* | *Balichata* | | x | |
| | *Neoeucirrhichthys maydelli* | *Gutum* | | | x |
| Migratory | *Aorichthys seenghala* | *Guizza* | | x | |
| | *Mystus bleekeri* | *Golsha tengra* | x | | x |
| | *Labeo gonius* | *Goni* | | x | |
| | *Salmostoma phulo* | *Fulchela* | | x | x |
| | *Wallagu attu* | *Boal* | | x | |

Note: x denotes presence and blank denotes absence of species

In early June several cuts were made along the southern and western Manu embankment which resulted in extensive flooding of the MIP by the Manu River. Results of surveys carried out in June showed that 7 migratory and 2 riverine species entered during the initial ingress of river floodwaters. These included *ilish*, *ghaura*, *ayre*, *guizza*, *kabashi*, *kalbaus*, *goni*, *fulchela*, *chapila* and *bacha*. None was particularly abundant and together all comprised only 4% of the monthly catch (Fig. 6.28). *Ilish*, *goni*, *ghaura* and *kabashi* were adults but the others were juveniles. Mean weights per individual of *ayre* and *guizza* were 63 g and

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**Figure 6.27 Seasonal variation in the number of riverine, migratory and floodplain resident fish species from floodplains and *beel* in the MIP (sites NE05+ +NE02+NE04)**

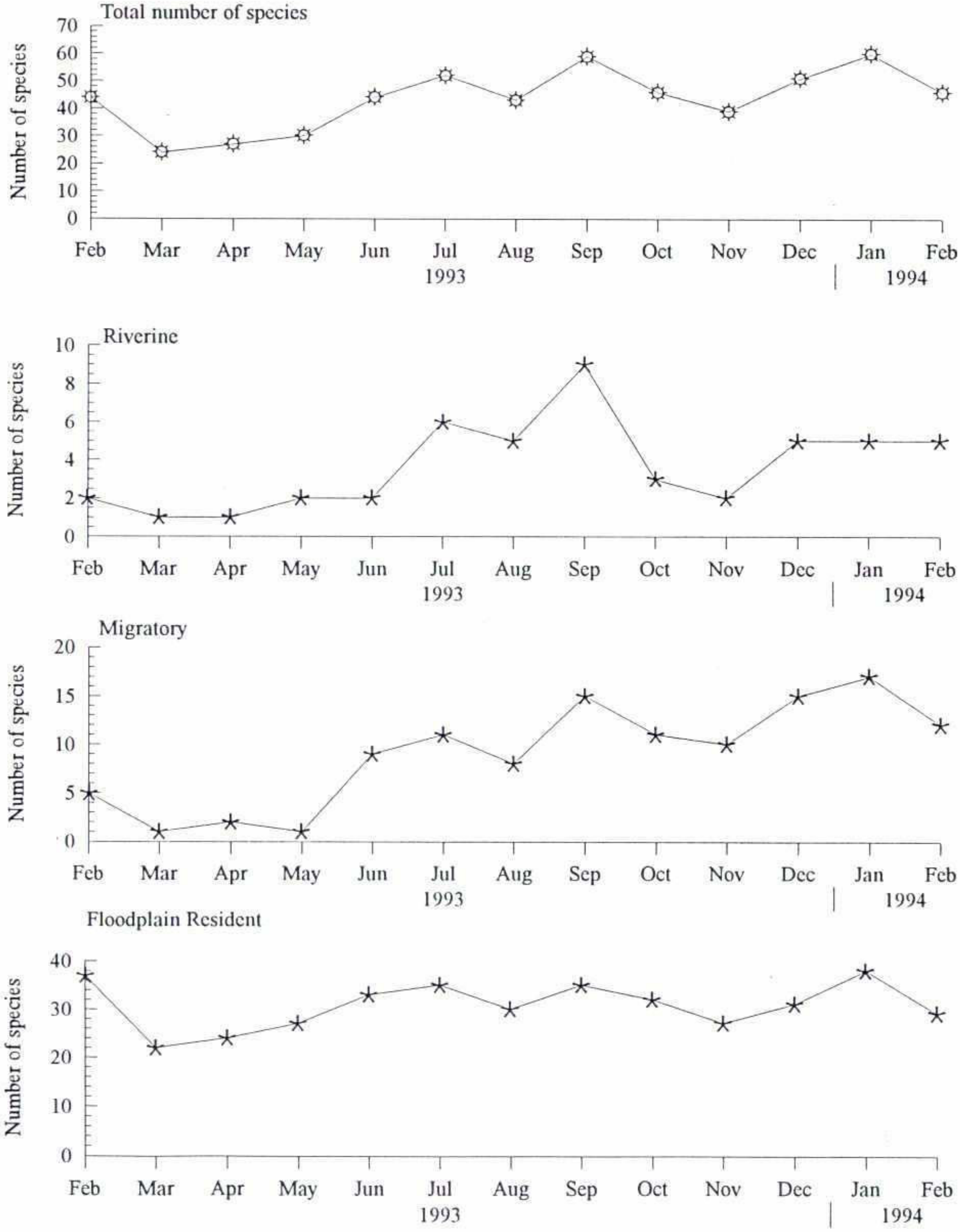
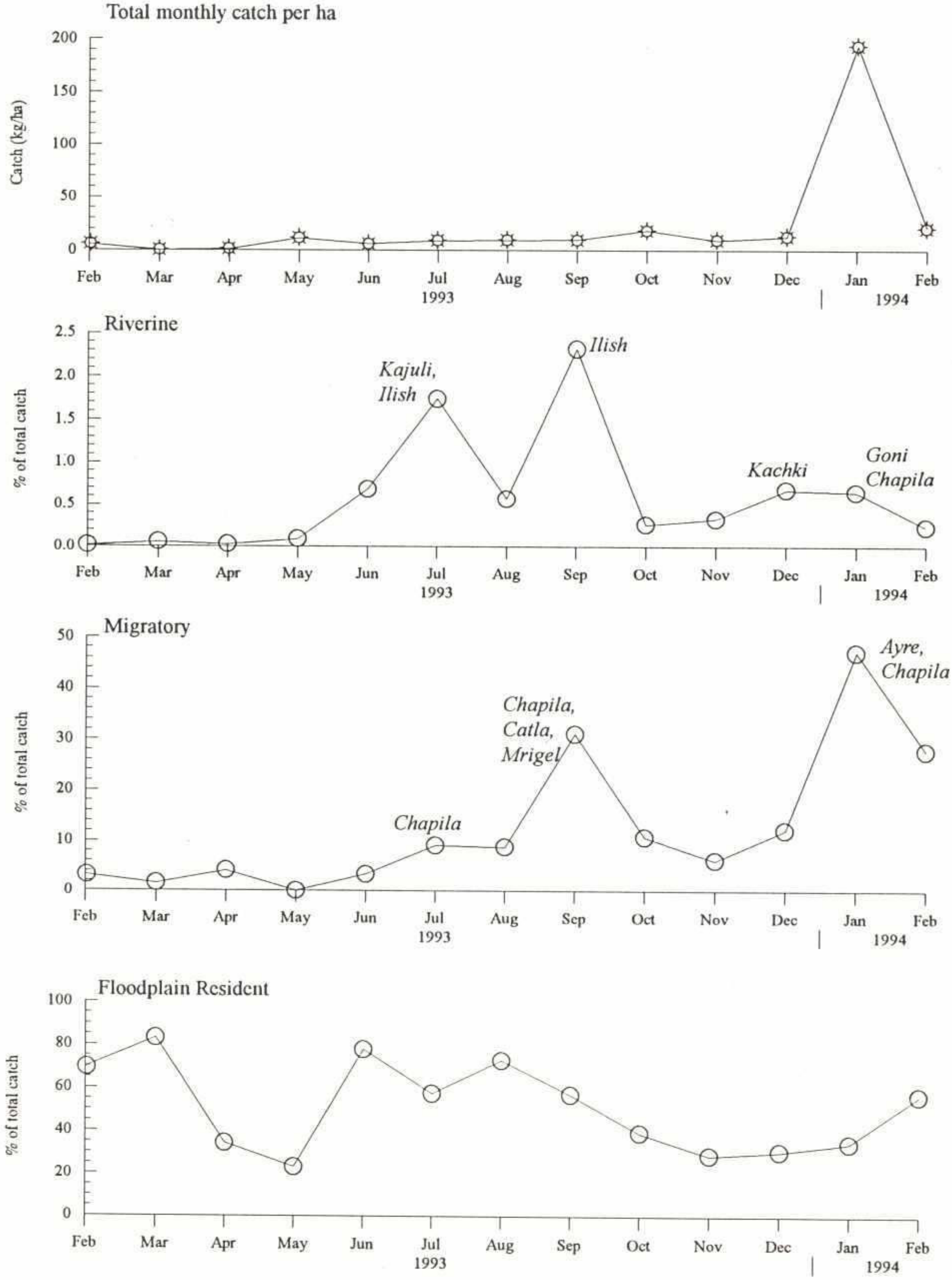


**Figure 6.28 Percentage total monthly catch of riverine, migratory and floodplain resident groups of fish from floodplains and *beel* in the MIP (sites NE05+NE02+NE04)**




Notes: 1. See text for definition of different categories of fish based on habitat preference (Section 5.4.1)
2. Dominant species are shown for peak relative abundances of riverine and migratory fish

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61 g respectively while *chapila* entered as fry of 1 g to 2 g per individual. In July and August, floodwaters at first receded but rose again as Manu River levels once more increased resulting in further flooding in the MIP. During this period 5 new riverine and 5 migratory species appeared in catches, the most abundant of which were *kajuli*, *boal* and *katari*. Catches of *kajuli* comprised both adults and juveniles (2 g) while *boal* were large juveniles (485 g) and *katari* were adults (7 g). In July, *rui* fry (1 g/indiv.) were found in catches. These may have escaped from flooded ponds or may have been wild hatchlings swept into the MIP from the Manu River. Other FAP 17 studies on movements of fish hatchlings by passive downstream drift showed that major carp hatchlings were present in low numbers in the Manu River at Moulvibazar in late July and mid-August. This provided evidence of breeding grounds in upper reaches of Manu River system.[15]

In September, 6 new riverine and migratory species appeared in catches. The most abundant included the major carps, *catla* and *mrigel*. These species occurred as both small fry (7-9 g) and larger juveniles (*catla*: 1-2 g; *mrigel*: 0.5 kg) which again may have been wild fish or cultured fish which escaped from ponds in the MIP. In this month both diversities and catch contributions of riverine and migratory species reached peak monsoon levels. Migratory species provided 31% of the catch while riverine species were rather scarce comprising only 2%. In addition to *catla* and *mrigel*, other more abundant species included *chapila*, *kalbaus*, *guizza*, *fulchela* and *ilish*. From October the diversity and catch contributions of riverine species declined whereas those of migratory species first dropped then increased considerably during leased fishing of Patasinga *Beel* when a peak of 17 migratory species accounted for a maximum monthly share of the catch of 47% in January 1994. In February a total of 18 riverine and migratory species provided 28% of the catch. This compares with a total of 7 riverine and migratory which accounted for only 3% of the catch in the same month in the previous year. The difference in catch composition between years could be attributed to differences the structural security of the MIP and in flooding patterns. In 1992/93, flood levels were lower; consequently no breaches in embankments were made and the opportunity for fish to migrate from rivers to floodplains was thus greatly reduced.

# 7 TOTAL CATCH FROM MIP AND HAKALUKI *HAOR*

## 7.1 Integrated Catches

To obtain annual catch estimates from the total area of the MIP and Hakaluki *Haor*, it was necessary first to extrapolate catch estimates from site level to larger areas. The selection criterion determining the limits of extrapolation in both areas was the same; the 9.6 m PWD contour which was derived from the 30 ft contour on 4" to the mile topographical maps (see Figs 2.1 and 2.6). In the absence of detailed hydrological information on flooding patterns in Hakaluki *Haor*, extrapolation procedures were based on area elevation curves of the extrapolation areas and individual sampled sites. Any attempt to estimate the total annual catch from these larger areas must be based on site estimates which cover the full range of land elevations occurring in the larger areas. Ideally, the total sampled area should exhibit the same or very similar area elevation curve as the extrapolation area. In practise however, this is difficult to achieve because of the widespread, small-scale topographical variability which generally results in a range of land heights sampled within a single floodplain site. This does not present a serious problem if individual sites represent a certain defined range of elevations within the extrapolation area. For the MIP and Hakaluki *Haor*, annual CPUA values derived from sampled sites and applied to different ranges of elevations within the extrapolation area are presented in Tables 7.1 and 7.2 respectively.

**Table 7.1 Total annual catch from floodplains and *beel* of the MIP, March 1993 - February 1994**

| Site Code | Mean (50%) elevation (m PWD) | Annual yield (kg/ha) | Extrapolation area | | | Total annual catch | |
|---|---|---|---|---|---|---|---|
| | | | Elevation (m PWD) | Area | | (tonnes) | % |
| | | | | (ha) | % | | |
| NE04 | < 4.5 | 512 | < 4.5 | 453 | 2 | 232 | 10 |
| NE02 | < 6.9 (<6.9 - 7.5) | 77 | 4.5 - 6.5 | 3,695 | 19 | 285 | 13 |
| NE05 | 7.0 (6.6 - 8.1) | 185 | 6.5 - 8.1 | 8,810 | 45 | 1,630 | 74 |
| NE04 (Location C) | 7.5 | 10 | 8.1 - 9.6 | 6,639 | 34 | 66 | 3 |
| Total | | | | 19,597 | | 2,213 | 100 |

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**Table 7.2 Total annual catch from floodplains and *beel* of Hakaluki *Haor*, March 1993 -February 1994**

| Site Code | Mean elevation (m PWD) | Annual yield (kg/ha) | Extrapolation area | | | Total annual catch | |
|---|---|---|---|---|---|---|---|
| | | | Elevation (m PWD) | Area | | (tonnes) | % |
| | | | | (ha) | % | | |
| NE09/21 | < 4.5 | 193 | < 4.5 | 2,590 | 11 | 500 | 15 |
| NE08 | 6.3 (4.5-7.1) | 115 | 4.5 - 8.1 | 9,917 | 43 | 1,140 | 35 |
| NE10 | 8.5 (8.1 - 9.5) | 155 | 8.1 - 9.6 | 10,556 | 46 | 1,638 | 50 |
| Total | | | | 23,073 | 100 | 3,278 | 100 |

The catch from Patasinga *Beel* (NE04) was applied to 453 ha of perennial *beel*, 216 ha of which was covered by the *beel* itself. The area of perennial water was estimated from satellite imagery data taken in December 1988 and March 1989 combined with a knowledge of the distribution of *jalmahals* where leased fisheries were active between December 1993 and February 1994. The highest land elevation range (8.1 - 9.6 m PWD) was not covered in the original site areas but, after embankments were breached in June, each site area was extended to obtain separate estimates of monthly catches from flooded areas on site margins. Fortnightly records of the flood extent mapped during fisheries surveys indicated that land between 8.1 m and 9.6 m PWD initially flooded in mid-June because of the embankment cuts and dried out again in mid-September. An estimate of the catch from this higher land was obtained from a survey of the village shoreline along Antehari village to the west of Patasinga *Beel* (NE04, extended location C) where the mean elevation was 7.5 m PWD and ranged from 6.9 m to 8.1 m PWD. The range was apparently slightly below the land heights of the extrapolation area but flooding duration was similar. The total catch from a 3 month flood season in this area was 10 kg/ha.

The estimated total annual catch from floodplains and *beel* in the MIP was 2,213 tonnes. When this catch was divided by the extrapolation area of 19,597 ha, it resulted in a catch per unit area of 113 kg/ha. Assuming an average on-site fish price of 25 taka/kg, the total annual MIP catch had an on-site value of 55 million taka and was equivalent to the annual consumption of about 303,000 people at an average per capita consumption rate of 20 g per day. This was about twice the population of the MIP.

The greatest proportion of the catch (74%) was taken from elevations ranging from about 6.5 m to 8.0 m PWD which covered a mix of lowland, medium low and medium highland bordering villages (see Fig. 2.2). The deeper seasonal offshore waters provided 13% of the total catch while the perennial *beel* accounted for only 10%. The distribution of the catch from the MIP in 1993/94 was probably typical of those years when embankments were cut causing deeper and more extensive flooding. It is not known whether the same distribution would be found in drier years when embankments were not cut and when the extent of the flood did not cover most village shorelines (see Fig. 3.7).

On Hakaluki *Haor*, the estimated annual catch from floodplains and *beel* was 3,278 tonnes which was equivalent to an annual catch per unit area of 142 kg/ha. The distribution of the catch across different land heights was similar to that recorded in the MIP. High floodplains adjacent to villages provided 50% of the total catch while deeper perennial *beel* which supported leased fisheries provided only 15% of the annual catch. The remainder of the catch (34%) was taken on land of intermediate elevation, often some distance from the nearest village.

The results reveal the great importance of fishing activities undertaken outside the better known leased *beel* fisheries of the North East Region. This has significant implications for the formulation of future fisheries management and development strategies under existing and proposed flood control developments. This issue is discussed further in Section 8.

The total floodplain/*beel* catch of 2,213 tonnes from the MIP also included the catch from a network of about 140 km of small canals which covered the area. These were sampled as an integral part of floodplain sites. Larger canals, however, were treated separately and estimates of catch were obtained from sampling sites on Khorodari *Khal* and Akali *Gang*. The respective yields from each canal were 4.07 t/km and 1.75 t/km. The higher catch from Khorodari was representative of an estimated 10 km of canal and the Akali *Gang* catch was assumed to represent a further 54 km of canal. By applying respective catch rates to total canal lengths, an annual canal catch of 136 tonnes was obtained. This estimate should be regarded as tentative since no measure of variability in catch was obtained for the length of canal represented by the sampled catches. All lengths of canals were estimated from satellite images, topographical maps and engineering maps.

On Hakaluki *Haor* drainage canals were also sampled as part of the floodplain catch but the larger water courses such as the river system were not sampled other than along the downstream reach draining the *haor*. The catch from this site would be expected to be higher than upstream reaches on the floodplain and therefore could not be used for extrapolation purposes.

Contribution to total annual catches made by dominant gears in the MIP and Hakaluki *Haor* were very similar (Table 7.3 and Table 1, Appendix 4). *Thella jal* was the most important gear in both areas, providing 41% of the MIP catch and 45% from Hakaluki. *Ber jal* was the second most important gear in both areas followed by *daun* in the MIP and *current jal* in Hakaluki *Haor*. The main differences between areas was the absence of *dora jal* (drag nets) in the MIP and the increased catch of *daun* and *dhor jal* in this area. The results reveal the great importance of the small-scale gear, *thella jal* which was used in shallow waters around villages by subsistence and part-time fishermen.

**Table 7.3 Annual catch by dominant gears from MIP and Hakaluki *Haor*, March 1993 - February 1994**

| Gear name | MIP | | Hakaluki *Haor* | |
|---|---|---|---|---|
| | Catch (tonnes) | % | Catch (tonnes) | % |
| *Thella jal* | 899 | 41 | 1491 | 45 |
| *Ber jal* | 770 | 35 | 921 | 28 |
| *Current jal* (Stationary) | 126 | 6 | 188 | 6 |
| *Daun* | 154 | 7 | 73 | 2 |
| *Dhor jal* | 58 | 3 | - | - |
| *Koi jal* | 42 | 2 | 36 | 1 |
| *Jhaki jal* | 47 | 2 | 119 | 4 |
| *Katha* | 32 | 1 | 51 | 2 |
| *Ghori jal* | - | - | - | - |
| *Veshal* | - | - | 83 | 3 |
| *Deal* trap | - | - | 61 | 2 |
| *Dora jal* | | | 182 | 6 |
| Others | 85 | 3 | 73 | 2 |
| Total | 2213 | 100 | 3278 | 100 |

Notes: 1. Dominant gears are those which comprised 1% or more of annual catch
2. - denotes catch <1%, blank denotes gear absent

The most important component of catches were prawns which accounted for 41% from the MIP (918 t) and 50% (1,646 t) from Hakaluki *Haor* (Table 7.4). These were captured mainly by *thella jal* operated in shallow waters in the vicinity of villages in both the MIP and Hakaluki *Haor* (see Section 6.5.2 for details). Riverine species made very little contribution (2% or less) to catches from both areas while migratory species comprised 23% of the catch from Hakaluki compared with only 12% from the MIP. Conversely, floodplain resident fish accounted for more of the catch from the MIP (46%) than from Hakaluki (25%).

**Table 7.4 Percentage contributions of riverine, migratory and floodplain resident fish and prawns to the total extrapolated catch from the MIP and Hakaluki *Haor*, March 1993 - February 1994**

| Habitat Preference | MIP | | Hakaluki *Haor* | |
|---|---|---|---|---|
| | Catch (tonnes) | % | Catch (tonnes) | % |
| Riverine | 20 | 1 | 68 | 2 |
| Migratory | 259 | 12 | 752 | 23 |
| Floodplain resident | 1016 | 46 | 812 | 25 |
| Prawns | 918 | 41 | 1646 | 50 |
| Total | 2213 | 100 | 3278 | 100 |

The most abundant migratory species in Hakaluki *Haor* were four catfish, *guizza*, *kabashi*, *ayre* and *golsha tengra* and one clupeid, *chapila* (Table 7.5 and Table 2, Appendix 4). A total of 11 floodplain resident species each provided between 1% and 3% of the catch. No single species predominated. Several dominant species were closely related e.g. 3 species of *puti*, 2 species of *chanda* and 2 *baim* species were *ayre*, *guizza*, *chapila* and the major carp, *catla*. The carp probably included a high proportion of escapees from flooded ponds within the MIP as well as wild fish. Compared with Hakaluki *Haor* the relative abundances of catfish species such as *guizza*, *kabashi* and *golsha tengra* were lower while that of *chapila* was about the same. In the MIP there was a less equitable distribution of the catch between different species. A few floodplain resident species were particularly abundant, notably 2 species of *chanda* which together comprised 15%, *taki* (5%) and *bailla* (4%). The high abundance of a few species in the MIP may have been a longer term response to flood control and high fishing pressure during winter (see Section 6.3). The over drainage of *beel* in winter and intensive fishing in the remaining shallow water would favour species adapted to harsh environmental conditions; among other things, severe oxygen depletion.

Seasonal variations in catch were different in the two study areas (Fig. 7.1). On Hakaluki *Haor* catches fluctuated more than in the MIP and three peaks were recorded in June, August and November. In the MIP an early peak was recorded in May when floodplain inundation first occurred. Catches then dropped temporarily but rose again to maintain a stable peak between August and October.

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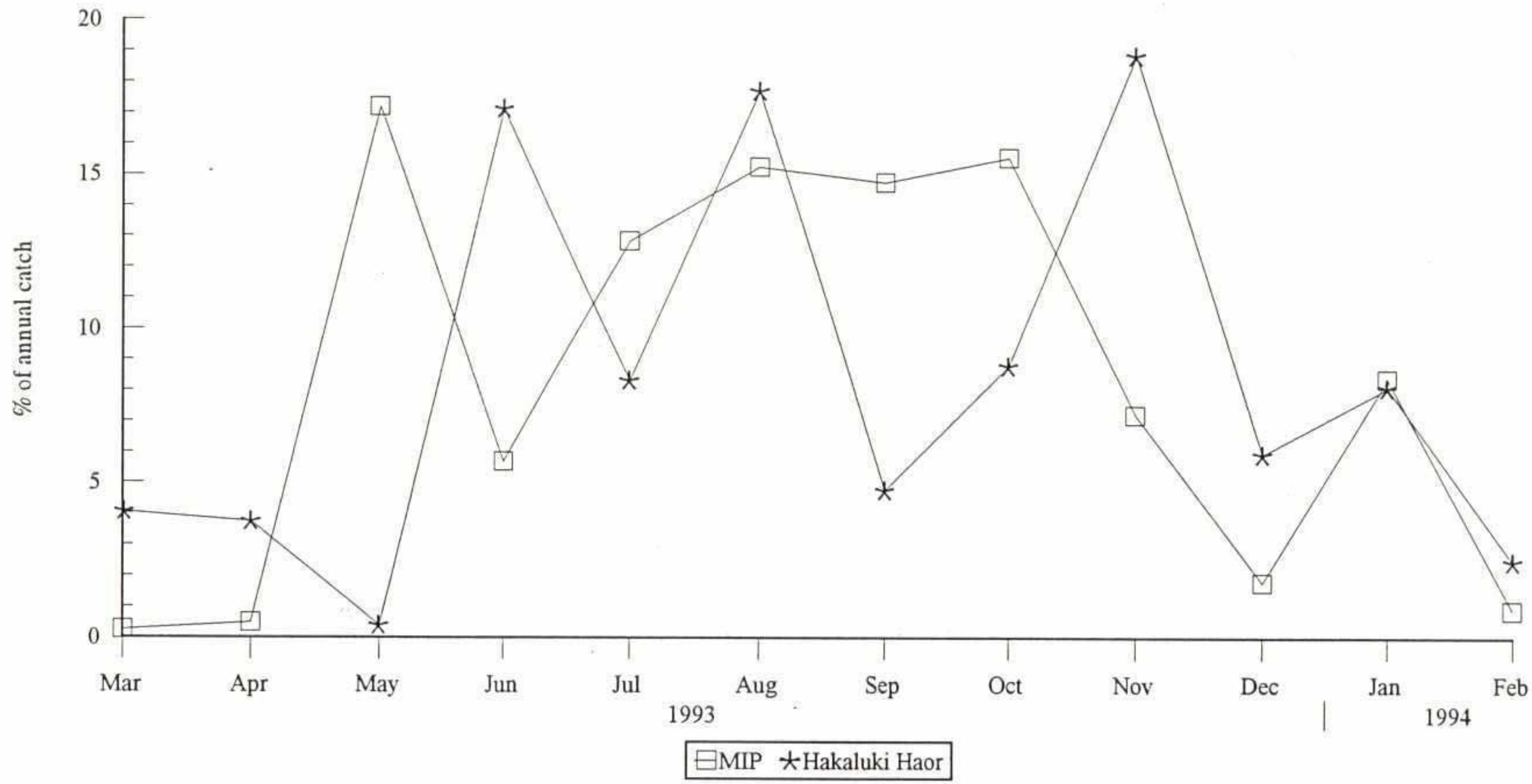
**Table 7.5 Total annual catch of dominant species from the MIP and Hakaluki Haor, March 1993 – February 1994**

| Habitat Preference | Species name | | MIP | | Hakaluki Haor | |
|---|---|---|---|---|---|---|
| | Scientific | Bengali | Tonnes | % | Tonnes | % |
| Migratory | *Aorichthys aor* | *Ayre* | 40.1 | 1.8 | 64.9 | 2.0 |
| | *Aorichthys seenghala* | *Guizza* | 23.1 | 1.0 | 214.9 | 6.6 |
| | *Mystus bleekeri* | *Golsha tengra* | – | – | 50.7 | 1.5 |
| | *Mystus cavasius* | *Kabashi* | – | – | 127.6 | 3.9 |
| | *Catla catla* | *Catla* | 31.2 | 1.4 | – | – |
| | *Gudusia chapra* | *Chapila* | 89.0 | 4.0 | 153.7 | 4.7 |
| Subtotal | | | 183.4 | 8.3 | 611.8 | 18.7 |
| Floodplain Resident | *Mystus vittatus* | *Tengra* | 34.7 | 1.6 | 46.8 | 1.4 |
| | *Colisa fasciatus* | *Khalisha* | 25.9 | 1.2 | – | – |
| | *Cyprinus carpio* | *Karfu* | – | – | – | – |
| | *Osteobrama cotio cotio* | *Keti* | – | – | 47.8 | 1.5 |
| | *Puntius chola* | *Chala puti* | 54.9 | 2.5 | 40.0 | 1.2 |
| | *Puntius conchonius* | *Canchan puti* | – | – | 71.4 | 2.2 |
| | *Puntius sophore* | *Puti* | 65.0 | 2.9 | 51.9 | 1.6 |
| | *Glossogobius giurus* | *Bailla* | 85.2 | 3.9 | 71.1 | 2.2 |
| | *Channa punctatus* | *Taki* | 113.8 | 5.1 | – | – |
| | *Macrognathus pancalus* | *Guchi* | – | – | 36.9 | 1.1 |
| | *Mastacembelus armatus* | *Baral baim* | – | – | 45.4 | 1.4 |
| | *Nandus nandus* | *Bheda* | – | – | – | – |
| | *Notopterus notopterus* | *Foli* | 75.2 | 3.4 | 69.0 | 2.1 |
| | *Chanda baculis* | *Chanda* | 167.4 | 7.6 | 101.7 | 3.1 |
| | *Chanda nama* | *Nama chanda* | 164.2 | 7.4 | 44.8 | 1.4 |
| | *Chanda ranga* | *Lal chanda* | 25.7 | 1.2 | – | – |
| Subtotal | | | 811.8 | 36.7 | 626.9 | 19.1 |
| Other | Prawn spp. | *Chingri/Icha* | 917.8 | 41.5 | 1644.9 | 50.2 |
| Subtotal | | | 917.8 | 41.5 | 1644.9 | 50.2 |
| Grand total | | | 1913.0 | 86.4 | 2883.6 | 88.0 |

Notes: 1. Dominant species are those which comprised 1% or more of the annual catch
2. – denotes zero catch

**Figure 7.1 Comparison of seasonal variation in the size of catch from MIP and Hakaluki *Haor*, March 1993 - February 1994**



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### 7.2 Previous Estimates

No systematic quantitative catch assessment surveys have been carried out previously in the MIP. As part of the BWDB Systems Rehabilitation Project (SRP), however, a feasibility study on the MIP[4] used information from the Thana Fisheries Office and its own brief socioeconomic surveys to obtain an estimate of the total catch in 1992 (Table 7.6). The methods used to obtain various estimates of yield per unit area from different habitats were not specified in the report.

**Table 7.6 Estimated annual catch from capture fisheries in the MIP in 1992 (Halcrow, 1992)**

| Habitat | Area (ha) | Yield (kg/ha) | Total estimated | |
|---|---|---|---|---|
| | | | tonnes | % |
| Rivers/Channels | 383 | 75 | 28.7 | 7 |
| *Beel/haor* | 616 | 162 | 99.8 | 24 |
| Floodplains | 11,620 | 25 | 290.5 | 69 |
| Total | | | 419.0 | 100 |

Source: Halcrow (1993)[5]

During the study undertaken by FAP 6, estimates of annual catch were made for 1992 and 1993 using catch information gathered mainly by interviews with fishermen i.e. secondary data sources (Table 7.7).

**Table 7.7 Estimated annual catch from capture fisheries in the MIP during 1992 and 1993 (FAP 6, 1994)**

| | Season/Habitat | Year: 1992<br>May '92 - Apr '93 | Year: 1993<br>May '93 - Apr '94 |
|---|---|---|---|
| Production (tonnes) | Monsoon floodplain | 313.5 | 571.9 |
| | Dry season *beel* | 23.3 | 229.1 |
| | Total | 336.7 | 801.0 |
| Yield (kg/ha) | Monsoon floodplain | 30.7 | 56.1 |
| | Dry season *beel* | 28.0 | 275.0 |

Source: FAP 6 (1994)[3]

FAP 6 reported an annual catch from the MIP of 337 tonnes which is reasonably similar to the estimate of 419 tonnes reported by the SRP feasibility study. In the higher flood year of 1993, FAP 6 estimated the total catch from the MIP to be 801 tonnes. This compares with the present FAP 17 estimate of 2,213 tonnes from floodplains and *beel* which is almost three times higher. The dry season *beel* estimate was based on an annual catch from Patasinga *Beel* of 275 kg/ha applied to a total *beel* area 833 ha. This area included 56 *beel* of which 49 were less than 20 ha and 35 less than 10 ha. These *beel* did not have catchment areas equivalent to Patasinga *Beel* into which drained much of the south and south east area of MIP and therefore should not be expected to produce the same yield during the dry season. From measurements of total daily catches during the winter (January - February 1994) and fortnightly surveys of fishing activities (night and day) during the monsoon, the present study estimated that the annual catch of Patasinga *Beel* was 512 kg/ha, about twice as high on the FAP 6 estimate. This yield rate was then applied to 453 ha which covered only the larger perennial *beel* in the MIP. Catches from smaller *beel* were included as part of catch estimates from intermediate elevation floodplains. Thus, the FAP 6 study underestimated the catch per unit area of Patasinga *Beel* but overestimated the area to which it should be applied. Consequently, the difference between FAP 6 and FAP 17 total catch estimates from *beel* was reduced: 229 t and 307 t respectively.

Floodplain catch estimates reported by FAP 6 were based on household survey techniques to obtain estimates of the number of units of six major gear types operating in the MIP. Estimates of the average number of days fished each month by each gear type were also obtained. No details, however, were provided of precise methods employed in the design of surveys or the multiplication factors used to obtain estimates of total numbers of each gear unit used in the total MIP area. Daily catch rates of each gear type were obtained by interviews with fishermen but again no details were provided on monthly sample sizes or variability in catch rate estimates of each gear.

Estimates of annual catch by gears used on floodplains obtained by FAP 6 and the present study are compared in Table 7.8. The total floodplain catch estimated by FAP 17 (1,981 t) was 3.5 times higher than that reported by FAP 6 (571 t). It is clear from Table 7.7 that the FAP 6 study grossly underestimated the catch from *thella jal* and *ber jal* fisheries. These two fisheries accounted for 78% (1,544 t) of the catch from floodplains compared with 39% (225 t) estimated by FAP 6. The FAP 6 estimate of floodplain catch also ignored fishing outside the period June to October, whereas the FAP 17 data showed that 29% of floodplain catches were taken from March to May and November to December totalling 580 t. FAP 6 also omitted catches from gears other than the six types shown in Table 7.6. FAP 17 data showed that a further 124 t of fish were captured by these gears in 1993.

**Table 7.8 Comparison of the annual catch by gear from the MIP obtained by FAP 6 and FAP 17 surveys, 1993 - 1994**

| | FAP 6 catch | | FAP 17 catch | |
|---|---|---|---|---|
| Gear | tonnes | % | tonnes | % |
| *Thella jal* | 93 | 16 | 877 | 44 |
| *Ber jal* | 132 | 23 | 667 | 34 |
| *Gill nets* | 202 | 35 | 151 | 8 |
| *Hook and line* | 119 | 21 | 154 | 8 |
| *Veshal* | 17 | 3 | 8 | < 1 |
| *Uttar jal* | 8 | 2 | - | - |
| Others | - | - | 124 | 6 |
| Total | 571 | 100 | 1,981 | 100 |

Detailed comparison of the results of two concomitant fisheries assessment surveys of the MIP thus showed that the techniques used by FAP 6, which were based largely on secondary data, grossly underestimated the magnitude of the floodplain fisheries of the MIP. The underestimation resulted from the selection of too few gears on which to base annual catches; too short an assumed fishing season - only 5 months instead of 9 - and too few gear units of the major contributors to the catch.

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# 8 FUTURE FLOOD CONTROL PROPOSALS IN THE MIP

## 8.1 BWDB Systems Rehabilitation Project, 1993

As part of a broader national programme known as the BWDB Systems Rehabilitation Project (SRP) supported financially by the EC to rehabilitate flood control projects which, for various reasons, do not function as planned, the MIP was studied in 1992[4].

The study concluded that the main reasons why the MIP did not function as planned was that embankments along the Manu River and deforestation of its upper catchment had increased annual river flood levels. These higher river levels caused flooding of villages outside the embankment and threatened Moulvibazar town, the Manu River barrage and river embankments. People outside the embankment cut it to reduce flooding of their homes from the Manu River causing crop damage, reducing cropping intensities and damaging the canal irrigation system of the MIP.

The study also attributed increased flooding to the opening of Kashimpur sluice gates during March and April to benefit capture fisheries. The evidence presented to support this was that water levels inside and outside the gates were the same during periods of rising river levels. Examination of such water level data from 1983 to 1993, however, showed clearly that levels inside were lower than those outside for all years where data were available except 1988 and 1989 (see Fig. 3.9). It is therefore quite incorrect to attribute flooding at this time of year to sluice gate opening for the benefit of capture fisheries. On the contrary, in 1988 and 1989 water levels inside the MIP were drained below the original design level of 4.1 m PWD during January to April. This was achieved by opening the 3-vent sluice gate whose base is at a height of 1.4 m PWD. The main reason for reducing water levels at this time below the target of 4.1 m PWD was to drain leased fisheries in Khorodari *Khal* and Patasinga *Beel* so these *jalmahals* could be fished out almost completely. This practice is very damaging for fisheries since it results in the severe reduction or elimination of winter fish broodstock which form the basis of sustainable capture fisheries. The construction of the 3-vent sluice gate was not planned in the original project design of the MIP but was installed later for reasons which apparently remain undocumented. The drainage of inside water levels below the recommended height of 4.1 m PWD also occurred in 1987 and 1985. When this occurred in 1988 and 1989 water levels inside and outside the MIP were almost the same during March and most of April but at this time inside levels did not exceed the design level of 4.1 m PWD. It is likely that in these years, *jalmahals* were fished out and sluice gates kept open to allow river waters to enter to refill canals and *beel* to the design level of 4.1 m PWD, after which they were again closed to prevent further river flooding. The damage to fisheries caused by the 3-vent sluice gate is discussed further in Section 9 when various methods of mitigating damage to capture fisheries are examined.

Another reason put forward by the study for the poor performance of the MIP and its failure to achieve the predicted increase in agricultural production was the high percentage (60-70%) of land owned by large, absentee landlords who had little interest in maximising cropping intensities and crop yields. Consequently, a large proportion of land is kept fallow and irrigation facilities not utilized. This type of composition within the farming community must raise questions about the original target beneficiaries of MIP and query the justification for the expensive project costing 74 million US$, in terms of assisting poorer sections of the rural community.

On the basis of their findings the SRP study recommended that the MIP should be fully rehabilitated. This involved several components, the most important of which are listed below.

a) Repair and improvement in embankments including the construction of an all weather access road along the western Manu embankment up to Kashimpur pump station.

b) Repair of primary and secondary irrigation and drainage structures including Kashimpur sluice gates (6-vent and 3-vent) and rehabilitation of Kashimpur pump station.

c) Improvement in the drainage and irrigation system by excavation of canals and repair of structures.

It was concluded that rehabilitation measures would result in increased agricultural production and have no impact on fisheries. The annual catch from capture fisheries of the MIP was estimated to be 419 t in 1992. Two crucial conditions were placed on project implementation. The first was that detailed designs for embankment improvements should be postponed until a regional solution to reduce peak flows in the Manu River were identified and approved. The second condition was that the public and local Government authorities agree to prevent further embankment cutting.

The assumption made by the SRP study that rehabilitation measures would have no impact (negative or positive) on capture fisheries is incorrect. Repair and improvement of the 3-vent sluice gate at Kashimpur linked with excavation of the main drainage canal, Khorodari *Khal*, would increase the capability to drain the most important *beel*, Patasinga, and the canal itself. This has happened in previous years and there is no reason to suppose it would not happen in future since the main purpose of the 3-vent sluice is to drain water from the MIP during winter to below levels recommended in the original design of the project. If rehabilitation were to proceed it would be possible to drain Patasinga *Beel* completely. This would have catastrophic consequences for the capture fisheries of the MIP which the present FAP 17 study estimated to be 2,213 t for 1993 with an on-site value of 55 million taka assuming a price of 25 tk/kg. This amount of fish is sufficient to feed about 303,000 people at the current national average daily consumption rate of 20 g, more than twice the population of the MIP.

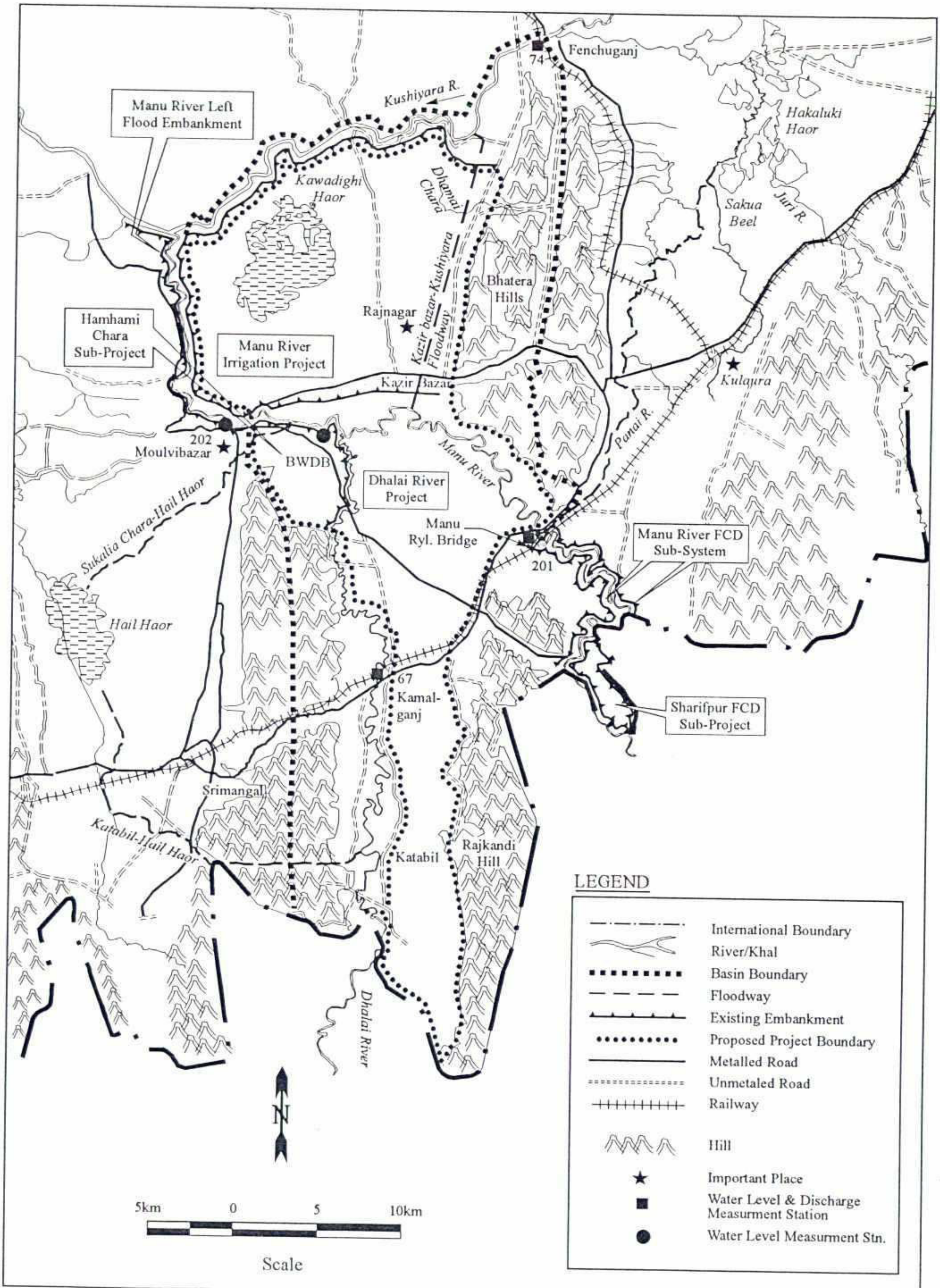
## 8.2 FAP 6: Manu River Improvement Project

This project aimed to solve the problem of flooding of the Manu River which has increased in recent years and was reported to be caused by embankment of the river and possibly increased local rainfall. Increased river flooding threatened Moulvibazar town, the Sylhet-Dhaka road, Manu River barrage and embankments of the MIP. It was thus considered by FAP 6 to be the greatest water management problem in the area[2].

After examining several possible engineering options to reduce flood levels in the Manu River, FAP 6 proposed that the most cost effective approach was to construct a 32 km channel to divert peak flows from the river into Hakaluki *Haor* (Fig. 8.1). It was also proposed to embank the Dhalai River, a tributary of the Manu, for a distance of 27 km along its right bank.

The potential benefits of flood alleviation included protection of the town of Moulvibazar and the main Dhaka-Sylhet highway, and increased rice production from the MIP. These benefits were derived, however, at the expense of fisheries and wetlands in both Hakaluki *Haor* and the MIP. It was predicted that the diversion of Manu floodwaters would cause rapid siltation in Hakaluki *Haor*, starting at the receiving locations in Sakua *Beel* in the south of the *haor*. It was anticipated that siltation would both decrease biodiversity of the fauna (including fish) and flora of the *haor* by raising land heights and destroy the perennial *beel*. FAP 6 acknowledged that Hakaluki *Haor* was a wetland of international importance.

## Figure 8.1 Manu River Basin




Source: FAP 6 (1993)[2]

It was also recognised that there may be conflict between project beneficiaries i.e. those people living in the Manu basin threatened by high floods and people living in the Hakaluki *Haor* area where flooding would increase. It was accepted that people adversely affected by the proposed diversion might jeopardise the success of the project.

The situation that has developed in the Manu River basin during the previous decade is very similar to that seen in the lower Atrai basin of the North West Region, despite substantial differences in the physical nature of the basins and their natural flooding patterns. In both basins, rivers have been embanked to control floods without due regard to the impact on areas, especially downstream, outside project locations. This has resulted in social inequities, usually between people outside flood controlled areas and those inside. In the North West Region, FAP 2 recognised the need for a different water management approach and advocated partial flood protection for low-lying flood prone areas. This was called the "Green River" Project[16]. It predicted that agricultural advantage would be gained from deepwater rice on lowland and HYV *t. aman* on highland with the added benefit from capture fisheries from lowland.

From a fisheries perspective, there is a need to reassess some of the options examined initially by FAP 6. It was accepted by both FAP 6 and the SRP studies that confinement of the Manu River within flood control embankments, possibly in conjunction with changes in catchment use and rainfall, have resulted in increased river flood levels. The simplest and most obvious solution to the problem is therefore to adopt a basin-wide management approach and to reappraise critically the need for flood control embankments along the Manu. Since the original flood pathway of the river included Kawadighi *Haor* inside the MIP on its right bank and Hail *Haor* on its left bank, one engineering solution might be to convert the Manu embankment of the MIP into a submersible, partial flood control embankment and at the same time divert part of the peak flow into Hail *Haor*. Carried out together the effect on each receiving area would be reduced. Diversion of floodwaters into Hail *Haor* could follow two routes simultaneously, one from Dhalai River, a tributary of the Manu, via the Bilas Chara, a small river draining into Hail *Haor* near Srimongal and the other from the Manu itself at the Manu barrage via the Sukalia Chara which runs through Moulvibazar town before entering Hail *Haor* (Fig. 8.1). By combining a number of options, the effect of any one in terms of increased discharge and water levels, would be reduced. This may thus avoid the need for major canal works in Moulvibazar town which was the main reason why FAP 6 did not recommend this option. FAP 6 also considered an option, viewed in isolation, of removing the Manu embankment of the MIP. It was rejected outright because it effectively involved abandoning attempts to pump floodwaters from the MIP to achieve flood levels originally anticipated in the project design. This decision needs careful reconsideration taking into account the present FAP 17 estimates of the size and value of capture fisheries in the MIP.

In addition to the alternative engineering approaches suggested above there should also be a detailed reappraisal of the need for full flood control embankments along the upper reaches of the Manu and Dhalai rivers and identification of areas where there is a need for afforestation programmes to reduce soil erosion and consequent silt loads in these rivers.

Under the development scenario above, there would be a great opportunity to undertake capture fisheries mitigation measures in Kawadighi *Haor* which could be combined with fisheries conservation and management programmes to ensure sustainable exploitation of a very important regional fisheries resource. Details of such measures are presented in Section 9.

## 9 RECOMMENDED MITIGATION MEASURES

Several mitigation measures are listed below. The first eight concern the MIP directly and are recommended for consideration in the short or near term. The others involve broad institutional development, mainly within BWDB/WARPO, and are therefore of a longer term nature.

Formulation of the mitigation measures listed below drew a distinction between mitigation, i.e. measures to reduce losses to capture fisheries caused by flood control, and compensation, i.e. measures to replace such losses by culture-based techniques. Only mitigation measures are listed below. This does not imply, however, that aquaculture developments should not be encouraged. Indeed, the ODA has supported work in various aspects of fish culture in Bangladesh for many years, covering activities such as pond culture, cage culture, rice-fish culture and open-water stocking of floodplains. Many of these techniques could be developed further inside and outside areas of controlled flooding. In the MIP such developments should concentrate efforts in areas of high land to avoid the risk of seasonal flooding.

The recommended mitigation measures question a principal rationale of full flood control: to convert low-lying wetlands to drier land where deepwater rice can be replaced with HYV *t. aman*. Experience in Bangladesh has shown that most flood control projects have failed, for one reason or another, to achieve this objective. The MIP is no exception and in this case the reason is repeated embankment cuts made by local people. An alternative approach, and one which has been advocated already by the North West Regional Study (FAP 2) based on partial flood control on lowlands to allow the production of *b. aman* or transplanted deepwater rice, would seem a more sensible option in areas where full flood control has resulted in social inequities. This approach would cause considerably less damage to capture fisheries providing that measures were taken to allow fish movements between rivers and floodplains during the pre-monsoon. One measure has already been implemented recently by FAP 6 which involved the construction of a fish pass at Kashimpur sluice gates. The project is currently in its first year of study[9].

1 Establishment of partial flood control in the MIP

Lowering the full flood control embankment along the right bank of the Manu River to provide partial flood protection of winter rice would substantially increase fisheries production by allowing migratory species to enter floodplains and *beel* of the MIP. The construction of submersible embankments, when carried out in conjunction with diversion of peak flows from the Manu and its tributary, the Dhalai, into Hail *Haor*, would also lower river flood levels. In this way, greater protection would be afforded against increasing flood levels which currently threaten homesteads immediately outside the Manu embankment, the town of Moulvibazar, the main Dhaka-Sylhet highway and the Manu River barrage (see mitigation measure No. 2 and Section 8.2).

2 Diversion of Manu and Dhalai rivers into Hail *Haor*

Diversions of peak flows from the Manu and Dhalai rivers into Hail *Haor* will a) reduce dangerously high flood levels in the Manu River, b) re-establish flooding in Hail *Haor* from its natural feeder river, the Manu and c) avoid the need to divert Manu floodwaters to Hakaluki *Haor* where increased siltation would cause ecological damage including damage to capture fisheries.

3 Redesign Kashimpur 3-vent sluice gate

The Kashimpur 3-vent sluice gate was not included in the original design of the MIP. Its sill level (1.4 m PWD) is substantially lower than that of the approved 6-vent Kashimpur sluice gate (4.1 m PWD). The low sill level of the 3-vent gate allows perennial *beel* and *khal* to be drained almost dry to allow fish to be harvested completely by leaseholders of adjacent *jalmahals* including important fisheries of Patasinga *Beel* and Khorodari *Khal*. This practise has a very damaging impact on capture fisheries by killing most of the overwintering broodstock for short-term gain by a few individuals controlling *jalmahal*. For sustainable development of capture fisheries of the MIP, the sill level of the sluice should be raised to the agreed design level of 4.1 m PWD. This will ensure that dry season water bodies are protected from over-drainage and will allow various fisheries conservation and development measures to be introduced (see mitigation measures Nos 5 and 6).

4 Construction of regulators on the Kushiyara embankment

Two new regulators should be constructed on the existing full flood control embankment along the Kushiyara River to increase the movement of fish between the river and floodplains/*beel* of the MIP and to increase the supply of fish hatchlings, especially those of major carps, by passive drift in river floodwaters. Investigations wild be needed to select the best sites for the regulators but, provisionally, *khal* near Kapina and Chail *beel* look promising. This mitigation measure is designed to increase fish production from the MIP by increased recruitment of adults, juveniles and fish hatchlings from the Kushiyara system.

5 Fisheries conservation: *beel* management in the MIP

In a series of staged developments, Patasinga *Beel* in Kawadighi *Haor* should be transformed into a fish sanctuary for the conservation of broodstock fish which provide the biological basis of sustainable fisheries from the surrounding floodplains and smaller *beel* within the MIP. The first stage should be to ensure that the *jalmahal* of Patasinga *Beel* is leased for a minimum of three years and no fishing undertaken during the dry seasons until the third and final year of the lease. The leaseholder should also be obligated to construct new large *katha* during the first dry season and to maintain and renew the *katha*, if necessary, each year. In the longer term, steps should be taken to prohibit fishing in the *beel* area containing very large *katha*. The installation of large *katha* should automatically prevent fishing by gears such as gill nets, seine nets, drag nets and cast nets and make it difficult to use other gears such as hooks.

6 Fisheries conservation: prohibited fishing zones at regulators

Flood control structures which block or delay movements of fish in canals, thereby increasing their susceptibility to capture, should be classified as prohibited fishing zones. Fishing form the structure itself and from a set distance upstream or downstream should be made illegal. Distances will vary depending on the size, nature and location of the structure and regulated canal but as an example fishing at Kashimpur sluice gates and fish pass should be prohibited at the structures themselves and for a distance of 10 km along Khorodari *Khal* inside the MIP, including the side *khal*, Magura *Gang* with connects Patasinga *Beel* with Khorodari *Khal*.

7 Fisheries conservation: protection of river (*duar*) fisheries

Studies carried out by FAP 17[17] and FAP 6[8] have demonstrated the great importance of river *duar* (scour holes) as winter refuges for large species of fish, particularly catfish and major carps. *Duar* are presently included in riverine *jalmahal* where they are intensively fished by leaseholders during the dry season. FAP 6 has recommended prohibition of fishing *duar* during the dry season and the establishment of river patrols by DoF to enforce protective fisheries regulations. FAP 17 results support this measure as a means of conserving important overwintering broodstock of high value species which form the basis of both riverine and floodplains fisheries. Protection of *duar* in the Kushiyara River should result in the long term increase in fish production from the MIP and Hakaluki *Haor*.

8 Habitat rehabilitation and protection

Siltation of perennial *beel* is reported to have reduced water depths and flooded areas during the dry season in the MIP and in Hakaluki *Haor*. *Beel* excavation programmes should therefore be established to counter the adverse effects of further siltation by river floodwaters. Patasinga *Beel* in the MIP should be selected as a pilot project to demonstrate the benefits to capture fisheries of excavation work linked with protection of dry season water levels (mitigation measure no. 3) and conservation of overwintering fish broodstock (mitigation measure no. 5). The excavation should deepen the *beel* by 1 to 2 metres and the excavated material should be used for flood proofing measures by local communities around the *beel* and for the construction of fisheries conservation infrastructure e.g. guardhouse and visitor centre. An afforestation programme should be established along the *beel* margin to increase cover by flood resistant trees such as *hizal*, one of the many benefits of which would be a local supply of branches for the construction of large *katha* within the *beel*.

9. Monitoring biodiversity

A national capability to provide systematic quantitative information on geographical variations in diversity of aquatic resources of Bangladesh should be established. This measure is designed to enhance knowledge of fish, shrimp and prawn diversity and to identify environmental problems, including flood control, linked with reductions in biodiversity. This information can then be considered at the project identification and planning stage of future developments which impact on aquatic resources. The measure should involve the strengthening of institutions such as DoF and FRI through training in a) fish taxonomics b) procedures for the establishment of fish reference collections c) methods for planning and implementing field surveys and sample collections and d) data analysis. It is anticipated that there would be a need to assist institutions in the design and implementation of national field surveys and sample collections.

10. Strengthening of technical assessment and planning capabilities of BWDB/WARPO

There is a need to establish within BWDB/WARPO a multidisciplinary technical assessment unit comprising expertise from fisheries, agriculture, environment, 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. The eventual siting of the assessment unit would depend on the future roles of BWDB and WARPO.

11. Establishment of national database on FCD/I projects

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.

12. Improvement of data collection by BWDB

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.

13. Establishment of water-user groups

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.

14. Training within BWDB

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

15. Development of flood modelling techniques

There is a need to continue the development of flood modelling techniques using the MIKE11 hydrodynamic model. The SWMC and FAP 19 are currently active in this field but require future support, both financial and technical, to continue to make progress. The work would require detailed field surveys to improve basic topographical information.

## 10 FUTURE RESEARCH REQUIREMENTS

FAP 17 investigations provided quantitative baseline data on several aspects of freshwater fisheries in various regions of Bangladesh. Because of the widespread nature of sampling effort and the relative short duration of field data collection (13-19 months) it was not possible to obtain a detailed understanding of the ecology, biology or population dynamics and movements of even the few most important floodplain fish in relation to changes in flooding patterns. It is therefore important to use the baseline data of FAP 17 as a foundation for further longer term fisheries studies which should provide both greater detail and scope of research activities.

Several areas requiring further research, some basic but most adaptive, are listed below. Many of these are relevant not only to the MIP and Hakaluki *Haor* but also to other regions of Bangladesh. The research topics below are not listed in order of priority.

1. Investigation of the biology and ecology of selected fish and prawn species dominating floodplain catches inside and outside flood controlled areas. Information collected should include data on age, breeding biology, feeding habits and micro-distributions in relation to seasonal changes in flooding and the distribution of aquatic vegetation including deepwater rice. The study should also include detailed limnological investigations which examine plankton, macroinvertebrates and water quality, particularly nutrient levels. This study will provide an understanding of the overall functioning of the dominant fish and prawn community.

2. Stock assessment using length frequency analysis and ageing techniques to obtain information on the population dynamics of selected species of fish and prawns dominating floodplain catches. This study will provide information on growth, mortality and the status of stocks and allow predictions to be made of the effects on fisheries of further increases in fishing pressure. The current status of the stocks of these species is not known.

3. Establishment of catch assessment surveys to obtain estimates of fish densities and yield per unit area of floodplain/*beel*. These data, when collected over a period of at least five years and linked with a concomitant set of quantitative data on flooding patterns, will provide the first rational basis for the development of a quantitative

floodplain fisheries model. This can then be used as a predictive tool to advise on fisheries management and development.

4. Investigation of the movements of fish and prawns between river and regulated floodplains/*beel*. This study has already started as a pilot project by FAP 6 to monitor the movements of fish and prawns through a newly constructed fish pass at Kashimpur sluice gates in the MIP.

5. Investigation of the movements by passive downstream drift of fish and prawn hatchlings between rivers and floodplains in relation to seasonal changes in river discharge. This study is needed to assess the impacts of both partial and full flood control on the annual supply of hatchlings of major carps and many other species of fish.

6. Investigation of the impact of water regulators on the survival and movement by passive downstream drift of fish and prawn larvae in relation to seasonal changes in river discharge. This study has particular relevance to Kashimpur sluice gates of the MIP.

7. 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 measure No. 11).

8. 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. 7 above) to provide quantitative management advice on the operation of various types of regulator.

9. 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 or universities.

10. Integration of biological information derived from research studies (numbers 4-9) and flood modelling techniques to improve the predictive capability of impact assessments of flood control projects and assist in the design of future water regulator structures. This work requires institutional collaboration between fisheries research organisations and hydrodynamic modelling specialists such as the SWMC, Dhaka.

11. Identification of possible spawning grounds of major carps in the North East Region and investigation of upstream breeding migrations in these rivers.

12. Assessment of the impact of FCD/I projects on the diversity of fish and prawns. Standardised systematic, intensive sampling is required to record not only the more common species but also the numerous rarer species which may be more vulnerable to the adverse impacts of flood control.

# REFERENCES

**Reference No.**


1. ACE (1971). Manu River Project. Definite Project Report. Associated Consulting Engineering Ltd., Dhaka. Report to Water and Power Development Authority, Government of Bangladesh, October 1971. 3 Volumes.

2. FAP 6 (1993). Manu River Improvement Project. Draft Final Report. Report submitted to Government of Bangladesh, Flood Plan Coordination Organisation, FAP. December 1994.

3. FAP 6 (1994). Project Monitoring Programme. Manu River FCDI Project (1992-1994). Draft Final Report. Report submitted to Government of Bangladesh, Flood Plan Coordination Organisation, FAP. November 1994.

4. FAP 6 (1994). Fisheries Specialist Study, Volume 1 Main Report. Northeast Regional Water Management Project. Report submitted to Government of Bangladesh, Flood Plan Coordination Organisation, FAP. November 1994.

5. Halcrow (1993). Feasibility Report. Manu River Rehabilitation Project. BWDB Systems Rehabilitation Project, Sir William Halcrow and Partners Ltd, BCEOM and DHU Consultants. Report submitted to Government of Bangladesh, BWDB. February 1993.

6. FAP 6 (1992). Regional Water Resources Development Status. Draft Thematic Study. Regional Water Resources Development Status. Report submitted to Government of Bangladesh, Flood Plan Coordination Organisation, FAP, July 1992.

7. FAP 17 (1994). Draft Final Report, Supporting Volume No. 17. Village Studies. Manu Irrigation Project and Hakaluki Haor. Report submitted to Government of Bangladesh, Flood Plan Coordination Organisation, FAP.

8. FAP 6 (1994). Fisheries Management Programme. Pre-feasibility Study, Final Report. Northeast Regional Water Management Project. Report submitted to Government of Bangladesh, Flood Plan Coordination Organisation, FAP. November 1994.

9. FAP 6 (1994). Fishpass Pilot Project, Implementation Plan. Report submitted to Government of Bangladesh, Flood Plan Coordination Organisation, FAP. November 1994.

10. BRRI/ODA (1989). Deepwater Rice Project, Phase Two. Final Report submitted to Government of Bangladesh and UK Overseas Development Administration, May 1989.

11. Whitton, B. A. and Rother, J. A. (1988). Environmental features of deepwater rice fields in Bangladesh during the flood season. In: Proceedings of the 1987 International Deepwater Rice Workshop, Bangkok, Thailand. International Rice Research Institute, Manila, Philippines. p. 47-54.

12. FAP 17 (1994). Draft Final Report, Supporting Volume No. 7. Fisheries Studies. Chalan Beel Polder B. Report submitted to Government of Bangladesh, Flood Plan Coordination Organisation, FAP.

13. FAP 17 (1994). Draft Final Report, Supporting Volume No. 2. Fisheries Studies. Satla-Bagda Polder 1. Report submitted to Government of Bangladesh, Flood Plan Coordination Organisation, FAP.

14. FAP 17 (1994). Draft Final Report, Supporting Volume No. 21. Special Studies. Fisheries Leasing and Access in the North East Region. Report submitted to Government of Bangladesh, Flood Plan Coordination Organisation, FAP.

15. FAP 17 (1994). Draft Final Report, Supporting Volume No. 11. Fisheries Studies. Movements of Fish Hatchlings. Report submitted to Government of Bangladesh, Flood Plan Coordination Organisation, FAP.

16. FAP 2 (1993). The Regional Plan. Final Report of the North West Regional Study. Report submitted to Government of Bangladesh, Flood Plan Coordination Organisation, Flood Action Plan. January 1993.

17. FAP 17 (1994). Draft Final Report, Supporting Volume No. 9. Fisheries Studies. Shanghair Haor Project and Dekker Haor. Report submitted to Government of Bangladesh, Flood Plan Coordination Organisation, FAP.

# 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 |

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## 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, 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.

# APPENDIX 2

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**Table I, Appendix 2 Monthly catch composition (% by weight) from the Juri River: outside MIP (site NE07)**

| Species Code | Habitat Preference | Species name: Scientific | Species name: Bengali | Year: 1993 Feb | Mar | April | May | June | July | Aug | Sep | Oct | Nov | Dec | Year: 1994 Jan | Feb | Total annual catch (Mar'93 – Feb'94) Kg | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 133 | Riverine | *Mystus gulio* | *Nuna tengra* | - | - | - | - | - | - | - | - | - | - | - | 0.136 | 0.033 | 3.586 | 0.014 |
| 186 | | *Rita rita* | *Rita* | 0.157 | - | - | - | 7.788 | 0.307 | 2.562 | 2.258 | 1.096 | - | 0.137 | - | - | 185.884 | 0.714 |
| 13 | | *Aspidoparia morar* | *Piali* | 0.361 | 0.893 | 0.045 | - | 0.064 | - | - | 0.006 | - | - | - | - | - | 17.665 | 0.068 |
| 59 | | *Crossocheilus latius* | *Kalabata* | 0.175 | - | - | - | - | 0.057 | 0.024 | 0.067 | 0.243 | 1.021 | 0.011 | 0.007 | - | 49.713 | 0.191 |
| 139 | | *Nemacheilus botia* | *Balichata* | 3.115 | 2.742 | 0.081 | 0.228 | 0.201 | 0.116 | 0.247 | 0.066 | 0.017 | 1.905 | 0.088 | 0.631 | 0.399 | 154.371 | 0.593 |
| 941 | | *Neoeucirrhichthys maydelli* | *Gutum* | 0.713 | 0.463 | 0.011 | 0.172 | - | 0.193 | - | - | 0.001 | 0.039 | - | - | - | 12.852 | 0.049 |
| 198 | | *Somileptes gongota* | *Gharpoia* | 3.569 | 0.933 | 0.046 | - | 0.564 | - | 0.014 | 0.056 | 0.113 | 2.650 | 0.071 | 0.302 | 3.348 | 221.109 | 0.849 |
| 28 | | *Botia dario* | *Rani* | 0.119 | 0.097 | 0.025 | 0.995 | 1.694 | 5.735 | 13.311 | 1.212 | 0.406 | 0.512 | 0.208 | - | - | 323.836 | 1.244 |
| 29 | | *Botia lohachata* | *Putul* | - | - | - | - | - | 0.203 | 0.007 | - | - | - | 0.005 | - | - | 2.257 | 0.009 |
| 89 | | *Hilsa ilisha* | *Ilish* | - | 0.173 | 2.707 | - | - | 1.076 | 2.000 | 3.118 | 0.268 | - | - | - | - | 278.928 | 1.071 |
| 85 | | *Gonialosa manmina* | *Goni chapila* | 0.078 | - | - | - | - | - | - | - | - | - | - | - | - | | - |
| 58 | | *Corica soborna* | *Kachki* | 0.341 | 0.206 | - | 0.038 | 0.081 | 1.150 | 0.027 | 0.157 | 1.174 | 0.202 | 0.001 | - | - | 70.851 | 0.272 |
| 30 | | *Brachygobius nunus* | *Nunabailla* | - | 0.010 | | - | - | - | - | - | - | - | - | - | - | 0.178 | 0.001 |
| 92 | | *Hyporhampus gaimardi* | *Ek thota* | - | - | - | 0.010 | - | 0.269 | 0.003 | - | 0.001 | - | - | - | - | 2.909 | 0.011 |
| 126 | | *Liza subviridis* | *Bata* | - | - | - | - | 0.022 | - | - | - | - | - | - | - | - | 0.050 | 0.0002 |
| 922 | | *Liza sp* | *Bata* | - | - | - | - | - | - | - | - | - | - | 0.042 | - | - | 0.627 | 0.002 |
| 185 | | *Rhinomugil corsula* | *Khorsula* | 0.224 | - | - | - | 0.011 | - | - | - | - | - | - | - | - | 0.025 | 0.0001 |
| 923 | | *Sicamugil cascasia* | *Bata* | - | - | 0.0004 | 0.195 | 0.081 | - | 0.017 | 0.043 | 0.091 | 3.463 | 0.051 | - | - | 133.735 | 0.514 |
| 163 | | *Pisodonophis boro* | *Kharu* | 0.322 | 0.341 | 0.103 | - | - | - | - | - | - | 0.495 | - | - | - | 27.947 | 0.107 |
| 2 | | *Ailia coila* | *Kajuli* | 0.361 | 0.070 | 0.237 | - | - | 1.026 | 9.821 | 0.120 | 5.578 | 0.042 | 0.545 | 0.024 | 0.008 | 353.781 | 1.359 |
| 3 | | *Ailia punctata* | *Kajuli* | 0.146 | 0.036 | - | - | - | - | - | - | 0.123 | - | - | - | - | 4.920 | 0.019 |
| 51 | | *Clupisoma garua* | *Ghaura* | 0.947 | - | 0.520 | - | 0.798 | 0.717 | 0.640 | 0.475 | 1.893 | 0.105 | 0.214 | - | - | 129.444 | 0.497 |
| 52 | | *Clupisoma naziri* | *Muri bacha* | 0.828 | 0.114 | 0.062 | - | 0.203 | 0.050 | 0.486 | 0.021 | 0.730 | 0.010 | - | - | - | 38.100 | 0.146 |
| 16 | | *Bagarius bagarius* | *Baghair* | - | - | - | - | 0.066 | 1.649 | - | 0.927 | 0.475 | - | - | 0.598 | 1.739 | 130.945 | 0.503 |
| 74 | | *Erethistes pussilus* | *Kutakanti* | 0.541 | 0.191 | 0.009 | - | 0.033 | 0.154 | 0.021 | 0.009 | 0.003 | 0.596 | - | - | - | 27.882 | 0.107 |
| 77 | | *Gagata cenia* | *Kauwa* | 1.328 | - | 0.001 | - | - | 0.123 | - | - | - | 0.039 | 0.093 | 0.020 | - | 4.507 | 0.017 |
| 80 | | *Gagata viridescens* | *Gang tengra* | 0.060 | 0.101 | - | - | 0.265 | 3.114 | - | 0.002 | 0.140 | - | - | - | - | 39.405 | 0.151 |
| 81 | | *Gagata youssoufi* | *Gang tengra* | 0.234 | 1.724 | 0.212 | 0.761 | 0.837 | 2.120 | 4.445 | 0.399 | 1.539 | 1.314 | 0.038 | 0.051 | - | 241.433 | 0.927 |
| 87 | | *Hara hara* | *Kutakanti* | - | - | - | - | - | - | - | - | 0.015 | - | 0.079 | 0.026 | 0.003 | 2.280 | 0.009 |
| 95 | | *Johnius coitor* | *Koitor* | - | - | - | - | - | - | - | 0.648 | 0.087 | - | - | - | - | 29.527 | 0.113 |
| | Subtotal | | | 13.618 | 8.092 | 4.061 | 2.399 | 12.709 | 18.060 | 33.624 | 9.585 | 13.994 | 12.391 | 1.583 | 1.795 | 5.529 | 2488.747 | 9.559 |
| 130 | Migratory | *Aorichthys aor* | *Ayre* | 0.102 | - | 0.022 | 0.581 | 1.690 | 2.399 | 3.295 | 3.129 | 7.937 | - | 2.211 | 0.752 | 0.055 | 527.615 | 2.027 |
| 135 | | *Aorichthys seenghala* | *Guizza* | - | 0.100 | 0.047 | 4.118 | 1.200 | 1.031 | 2.461 | 3.874 | 12.152 | 0.091 | 1.655 | 2.627 | 3.155 | 818.484 | 3.144 |
| 24 | | *Batasio batasio* | *Tengra* | 0.040 | - | 0.004 | - | - | - | 0.114 | 0.071 | - | 0.007 | - | 0.061 | - | 5.943 | 0.023 |
| 131 | | *Mystus bleekeri* | *Golsha tengra* | 1.931 | 1.662 | 0.050 | 2.940 | - | 1.730 | 3.787 | 0.434 | 0.738 | 5.740 | 10.448 | 5.525 | 6.336 | 802.905 | 3.084 |
| 132 | | *Mystus cavasius* | *Kabashi* | 2.433 | 2.785 | 0.621 | 2.056 | 2.811 | 2.644 | 2.683 | 5.918 | 4.919 | 6.430 | 18.998 | 36.672 | 37.623 | 2833.203 | 10.882 |
| 134 | | *Mystus menoda* | *Ghagla* | - | - | - | - | 0.083 | - | - | - | - | - | 0.498 | 2.376 | 0.212 | 60.240 | 0.231 |
| 32 | | *Catla catla* | *Catla* | - | - | - | - | - | - | 3.600 | 1.449 | - | - | - | - | - | 104.380 | 0.401 |
| 47 | | *Cirrhinus mrigala* | *Mrigel* | - | - | - | - | - | 0.160 | - | 0.776 | 11.442 | - | - | - | 0.009 | 432.347 | 1.661 |
| 48 | | *Cirrhinus reba* | *Raik* | 0.123 | 0.478 | 0.407 | 5.562 | - | 1.388 | 0.153 | - | 0.319 | 2.788 | 0.104 | 1.063 | 0.777 | 227.751 | 0.875 |
| 100 | | *Labeo bata* | *Bata* | - | - | - | - | - | - | - | - | 0.110 | - | 0.115 | - | - | 5.539 | 0.021 |
| 101 | | *Labeo boga* | *Bhangan* | 0.052 | 2.153 | - | - | - | 0.629 | - | - | 0.606 | 1.284 | 0.050 | - | - | 112.717 | 0.433 |
| 102 | | *Labeo calbasu* | *Kalbaus* | - | - | - | - | 0.160 | 1.655 | 0.362 | 22.917 | 7.340 | - | 4.393 | 4.148 | 0.094 | 1363.572 | 5.238 |
| 104 | | *Labeo gonius* | *Goni* | - | - | - | - | - | 0.036 | - | - | - | - | - | - | 0.047 | 1.650 | 0.006 |
| 107 | | *Labeo rohita* | *Rui* | - | - | - | - | 0.107 | 0.457 | 9.408 | - | - | - | - | - | - | 123.082 | 0.473 |
| 188 | | *Salmostoma bacaila* | *Katari* | 2.679 | 1.385 | 0.206 | - | - | 0.391 | 0.102 | - | 0.260 | 0.086 | 0.026 | 0.082 | 0.893 | 75.864 | 0.291 |
| 189 | | *Salmostoma phulo* | *Fulchela* | 1.540 | 1.295 | 0.007 | 0.613 | 3.392 | 6.123 | 0.467 | 0.612 | 0.717 | 1.310 | 0.078 | - | 2.023 | 257.361 | 0.989 |
| 86 | | *Gudusia chapra* | *Chapila* | 0.107 | 0.327 | - | 0.293 | 3.562 | 5.461 | 0.218 | 1.344 | 3.041 | 1.784 | 0.224 | - | - | 303.957 | 1.168 |
| 76 | | *Eutropiichthys vacha* | *Bacha* | 1.462 | 0.152 | 1.041 | 0.591 | 0.064 | - | - | 0.556 | 2.365 | 0.120 | - | - | - | 155.176 | 0.596 |
| 169 | | *Pseudeutropius atherinoides* | *Batasi* | 0.051 | 0.230 | 0.007 | 0.072 | 0.053 | - | - | - | 0.001 | 0.039 | 0.048 | 0.120 | 1.551 | 51.749 | 0.199 |
| 209 | | *Wallagu attu* | *Boal* | 5.915 | - | 44.780 | - | - | - | - | - | - | 1.153 | 0.517 | 10.430 | 6.378 | 2133.993 | 8.197 |
| 142 | | *Nemacheilus scaturigina* | *Dari* | - | - | 0.054 | - | - | 0.245 | 0.024 | - | - | - | 0.327 | - | - | 9.721 | 0.037 |
| 161 | | *Pellona ditchela* | *Chouka* | - | - | - | - | - | - | - | - | 0.047 | 1.745 | - | - | - | 65.409 | 0.251 |
| | Subtotal | | | 16.433 | 10.567 | 47.248 | 16.826 | 13.121 | 24.347 | 26.672 | 41.077 | 51.994 | 22.574 | 39.691 | 63.856 | 59.151 | 10472.658 | 40.226 |



(Cont.)

**Table I, Appendix 2 Monthly catch composition (% by weight) from the Juri River: outside MIP (site NE07)**

| Species Code | Habitat Preference | Species name: Scientific | Species name: Bengali | Year: 1993 Feb | Mar | April | May | June | July | Aug | Sep | Oct | Nov | Dec | Year: 1994 Jan | Feb | Total annual catch (Mar'93 – Feb'94) Kg | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | Floodplain | *Anabas testudineus* | *Koi* | – | – | – | 0.072 | – | – | – | – | – | – | – | – | – | 0.401 | 0.002 |
| 136 | Resident | *Mystus tengara* | *Bajari tengra* | – | 0.176 | 0.003 | – | – | – | – | – | – | 0.060 | 0.354 | – | 0.010 | 10.899 | 0.042 |
| 137 | | *Mystus vittatus* | *Tengra* | 0.700 | 0.319 | 0.132 | 0.721 | – | 0.861 | – | 0.003 | 0.079 | 4.311 | 5.591 | 0.733 | 12.323 | 618.183 | 2.374 |
| 942 | | *Rama chandramara* | *Laia* | 0.018 | – | – | – | – | – | – | – | – | – | – | 0.003 | – | 0.051 | 0.0002 |
| 55 | | *Colisa fasciatus* | *Khalisha* | – | – | 0.030 | – | – | – | – | – | – | – | 0.753 | – | – | 12.306 | 0.047 |
| 211 | | *Colisa labiosus* | *Khalisha* | 0.144 | 0.098 | – | 0.015 | – | 0.024 | – | – | – | – | – | – | – | 2.045 | 0.008 |
| 56 | | *Colisa lalia* | *Lal khalisha* | – | 0.049 | – | – | – | – | – | – | – | – | – | – | – | 0.845 | 0.003 |
| 57 | | *Colisa sota* | *Khalisha* | 0.038 | – | 0.0004 | – | – | 0.012 | 0.007 | – | – | – | 0.343 | – | – | 5.300 | 0.020 |
| 210 | | *Xenentodon cancila* | *Kaikka* | 0.937 | 2.418 | 0.285 | 1.699 | 1.898 | 0.735 | – | 0.087 | 0.105 | 0.297 | 0.300 | 0.545 | 0.379 | 117.983 | 0.453 |
| 60 | | *Ctenopharyngodon idellus* | *Gheso carp* | – | – | – | – | 0.267 | – | – | 4.414 | – | – | – | – | – | 180.985 | 0.695 |
| 187 | | *Osteobrama cotio cotio* | *Keti* | 1.664 | 1.425 | 0.246 | 1.477 | 0.158 | 1.294 | 0.317 | 0.053 | 0.243 | 2.104 | 0.429 | 0.071 | 0.318 | 164.025 | 0.630 |
| 174 | | *Puntius chola* | *Chala puti* | 0.201 | 0.184 | 1.649 | 6.060 | 2.219 | 2.017 | 0.213 | – | 0.846 | 2.191 | 2.835 | 0.273 | 4.358 | 404.392 | 1.553 |
| 175 | | *Puntius conchonius* | *Canchan puti* | 1.387 | 1.084 | 3.231 | 28.089 | 29.863 | 2.916 | 2.609 | 1.154 | 0.720 | 1.965 | 1.714 | 0.031 | – | 600.268 | 2.306 |
| 176 | | *Puntius gelius* | *Giliputi* | 0.325 | 0.559 | 0.022 | 1.730 | 0.234 | 0.014 | – | 0.004 | 0.006 | 0.021 | 0.394 | – | – | 27.841 | 0.107 |
| 178 | | *Puntius phutunio* | *Phutani puti* | – | 0.007 | 0.019 | – | – | – | – | – | – | – | 0.008 | – | – | 0.971 | 0.004 |
| 180 | | *Puntius sophore* | *Puti* | 1.046 | 0.447 | 0.212 | 1.737 | 7.111 | 0.668 | 0.213 | – | – | – | 0.238 | 0.395 | 1.205 | 95.853 | 0.368 |
| 181 | | *Puntius terio* | *Teri punti* | – | 1.063 | – | – | – | – | 0.003 | 0.003 | 0.004 | – | 0.005 | – | – | 18.865 | 0.072 |
| 212 | | *Puntius ticto* | *Tit puti* | 0.195 | – | – | – | – | – | 0.003 | 0.002 | 0.005 | 0.014 | – | – | – | 0.799 | 0.003 |
| 5 | | *Amblypharyngodon mola* | *Mola* | 0.039 | 1.078 | – | 0.411 | 0.828 | 0.444 | 0.017 | 0.002 | 0.070 | 0.116 | – | – | – | 34.487 | 0.132 |
| 68 | | *Danio devario* | *Chebli* | – | – | – | – | – | 0.010 | – | – | – | – | – | – | – | 0.099 | 0.0004 |
| 75 | | *Esomus danricus* | *Darkina* | – | 0.075 | 0.247 | 0.061 | – | – | – | – | – | – | – | – | – | 11.060 | 0.042 |
| 182 | | *Rasbora daniconius* | *Darkina* | – | 0.507 | – | – | – | – | – | – | – | – | – | – | – | 8.821 | 0.034 |
| 83 | | *Glossogobius giurus* | *Bailla* | 4.525 | 4.690 | 0.306 | 0.472 | 3.232 | 2.350 | 5.359 | 8.275 | 1.515 | 11.892 | 0.548 | 0.090 | 1.959 | 1083.865 | 4.163 |
| 91 | | *Hypophthalmichthys molitrix* | *Silver carp* | – | – | – | – | – | 0.182 | – | 20.492 | 13.748 | – | – | – | – | 1318.272 | 5.064 |
| 43 | | *Chela cachius* | *Chep chela* | – | 0.013 | – | 0.130 | 0.079 | – | – | – | – | – | – | – | – | 1.128 | 0.004 |
| 109 | | *Lepidocephalus berdmorei* | *Puiya* | – | – | – | – | – | – | – | – | – | – | – | – | 0.005 | 0.124 | 0.0005 |
| 110 | | *Lepidocephalus guntea* | *Gutum* | 1.895 | 2.105 | 0.179 | 0.830 | 0.363 | – | 0.093 | 0.043 | 0.001 | 0.106 | 0.301 | – | – | 60.160 | 0.231 |
| 9 | | *Aplocheilus panchax* | *Kanpona* | – | – | – | 0.038 | – | – | – | – | – | – | – | – | – | 0.209 | 0.001 |
| 39 | | *Channa marulius* | *Gajar* | – | – | – | – | – | – | – | – | – | – | 6.113 | 1.536 | 0.427 | 132.581 | 0.509 |
| 41 | | *Channa punctatus* | *Taki* | 4.377 | 6.966 | 0.004 | 0.531 | – | 0.012 | 0.057 | – | – | – | 2.210 | 0.031 | 0.052 | 159.926 | 0.614 |
| 49 | | *Clarias batrachus* | *Magur* | – | – | 0.001 | – | – | – | – | – | – | – | – | – | – | 0.043 | 0.0002 |
| 88 | | *Heteropneustes fossilis* | *Shingi* | 0.678 | – | – | – | – | 0.017 | 0.028 | – | – | 0.027 | – | – | – | 1.508 | 0.006 |
| 121 | | *Macrognathus aculeatus* | *Tara baim* | 4.530 | 1.667 | 0.067 | 0.021 | – | 1.209 | 0.403 | 0.074 | 0.093 | – | – | – | – | 55.444 | 0.213 |
| 123 | | *Macrognathus pancalus* | *Guchi* | 6.018 | 17.731 | 2.817 | 12.764 | 0.340 | 0.374 | 3.864 | 0.954 | 0.221 | 2.590 | 1.981 | 0.091 | 0.245 | 719.027 | 2.762 |
| 122 | | *Mastacembelus armatus* | *Baral baim* | 14.909 | 9.449 | 1.635 | 5.434 | 0.630 | 4.824 | 13.569 | 7.776 | 11.167 | 16.398 | 7.062 | 5.163 | 5.690 | 2146.673 | 8.245 |
| 138 | | *Nandus nandus* | *Bheda* | – | – | 0.040 | – | 0.477 | 0.017 | 0.009 | – | 0.039 | 0.018 | – | 0.202 | 0.036 | 9.883 | 0.038 |
| 15 | | *Badis badis* | *Napit koi* | – | 0.013 | 0.004 | 0.015 | – | 0.012 | 0.007 | – | 0.0003 | – | – | – | – | 0.653 | 0.003 |
| 147 | | *Ompok bimaculatus* | *Kani pabda* | 0.234 | 0.005 | – | – | 0.281 | 0.201 | 0.464 | – | – | – | – | 1.263 | 0.922 | 58.783 | 0.226 |
| 148 | | *Ompok pabda* | *Madhu pabda* | – | – | – | – | – | – | – | – | – | – | 0.580 | – | – | 8.590 | 0.033 |
| 145 | | *Notopterus notopterus* | *Foli* | 3.118 | – | – | – | 0.403 | 3.892 | 1.475 | 0.400 | 0.836 | 0.190 | 7.470 | 6.403 | 1.054 | 377.833 | 1.451 |
| 203 | | *Tetraodon cutcutia* | *Potka* | – | 0.003 | – | 0.561 | 0.553 | 0.326 | 0.044 | – | – | 0.128 | 0.224 | – | – | 16.380 | 0.063 |
| 33 | | *Chaca chaca* | *Cheka* | 1.004 | 0.016 | – | – | – | – | – | – | – | – | – | 0.149 | 0.0003 | 3.219 | 0.012 |
| 35 | | *Chanda baculis* | *Chanda* | 0.300 | 2.186 | 0.317 | 3.766 | 8.786 | 1.916 | 0.845 | 0.425 | 0.457 | 12.022 | 0.775 | 0.266 | 0.274 | 618.689 | 2.376 |
| 36 | | *Chanda nama* | *Nama chanda* | 0.521 | 0.283 | 0.222 | 2.261 | 1.702 | 2.277 | 0.058 | 0.605 | 0.271 | 1.012 | 0.191 | 0.007 | 0.325 | 137.055 | 0.526 |
| 37 | | *Chanda ranga* | *Lal chanda* | 0.532 | 3.401 | 0.099 | 3.537 | 5.587 | 0.353 | 0.007 | 0.064 | 0.024 | 0.231 | – | 0.021 | 0.025 | 112.276 | 0.431 |
| | Subtotal | | | 49.331 | 58.017 | 11.764 | 72.428 | 65.010 | 26.955 | 29.664 | 44.828 | 30.450 | 55.691 | 40.417 | 17.271 | 29.608 | 9338.800 | 35.871 |
| 998 | Others | Unidentified fish | | 0.058 | 0.010 | – | – | – | – | – | – | – | – | – | – | – | 0.174 | 0.001 |
| 120 | | *Macrobrachium rosenbergii* | *Golda* | – | – | – | – | – | – | – | – | – | – | – | 5.438 | 3.471 | 202.233 | 0.777 |
| 931 | | Prawn spp. | *Chingri/Icha* | 20.558 | 23.313 | 5.196 | 8.346 | 9.158 | 30.637 | 9.729 | 4.509 | 3.387 | 7.411 | 18.306 | 11.639 | 2.239 | 2243.991 | 8.619 |
| 945 | | *Crab sp* | *Kakra* | – | – | 0.500 | – | – | – | 0.310 | – | 0.173 | 0.036 | – | – | – | 30.283 | 0.116 |
| 946 | | *Turtle* | *Dur kasim* | – | – | 31.231 | – | – | – | – | – | – | 1.897 | – | – | – | 1257.726 | 4.831 |
| | Subtotal | | | 20.616 | 23.323 | 36.926 | 8.346 | 9.158 | 30.637 | 10.039 | 4.509 | 3.560 | 9.345 | 18.306 | 17.077 | 5.710 | 3734.407 | 14.344 |
| | Grand total | | | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 26034.612 | 100 |

Note: – denotes zero catch

**Table II, Appendix 2 Monthly catch composition (% by weight) from Khorodari Khal: inside MIP (site NE01)**

| Species Code | Habitat Preference | Species name: Scientific | Species name: Bengali | Year: 1993 Feb | Mar | April | May | July | Aug | Sep | Oct | Nov | Dec | Year: 1994 Jan | Feb | Total annual catch (Mar'93 – Feb'94) Kg | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 59 | Riverine | *Crossocheilus latius* | *Kalabata* | – | – | – | – | 0.112 | – | – | 0.018 | – | – | – | – | 0.238 | 0.001 |
| 139 | | *Nemacheilus botia* | *Balichata* | 0.160 | 0.123 | 0.104 | – | 0.022 | – | – | – | – | 0.139 | 0.007 | 0.089 | 8.089 | 0.049 |
| 941 | | *Neoeucirrhichthys maydelli* | *Gutum* | 0.173 | 0.424 | 1.681 | – | – | – | – | – | 0.039 | – | – | 0.246 | 24.970 | 0.152 |
| 198 | | *Somileptes gongota* | *Gharpoia* | 0.079 | 0.471 | – | – | – | – | – | – | 0.371 | 0.314 | – | 0.097 | 26.047 | 0.158 |
| 28 | | *Botia dario* | *Rani* | – | – | – | – | 1.617 | – | – | 0.778 | 0.889 | 0.002 | – | 0.161 | 37.560 | 0.228 |
| 29 | | *Botia lohachata* | *Putul* | – | – | – | – | 4.995 | – | – | – | – | – | – | – | 3.345 | 0.020 |
| 89 | | *Hilsa ilisha* | *Ilish* | – | – | – | – | 1.259 | 1.131 | 1.978 | 0.260 | 0.115 | – | – | – | 17.121 | 0.104 |
| 85 | | *Gonialosa manmina* | *Goni chapila* | – | – | – | – | – | – | – | – | – | 0.214 | – | – | 7.359 | 0.045 |
| 58 | | *Corica soborna* | *Kachki* | 0.019 | 0.031 | – | – | 0.509 | – | – | 0.627 | 0.154 | 0.485 | 0.047 | 0.035 | 30.217 | 0.183 |
| 185 | | *Rhinomugil corsula* | *Khorsula* | – | 0.023 | – | – | – | – | – | – | – | – | – | – | 0.125 | 0.001 |
| 923 | | *Sicamugil cascasia* | *Bata* | – | – | 0.020 | – | 1.640 | – | – | – | – | – | 0.096 | – | 5.964 | 0.036 |
| 163 | | *Pisodonophis boro* | *Kharu* | 1.017 | 0.134 | 0.147 | 0.679 | – | – | – | – | – | 0.483 | 0.043 | – | 24.660 | 0.150 |
| 3 | | *Ailia punctata* | *Kajuli* | 0.010 | – | – | – | – | – | – | – | – | – | – | – | | – |
| 51 | | *Clupisoma garua* | *Ghaura* | – | – | – | – | – | – | 0.170 | 0.680 | 1.257 | – | – | – | 45.220 | 0.274 |
| 74 | | *Erethistes pussilus* | *Kutakanti* | – | 0.014 | – | – | 0.012 | – | – | – | 0.079 | – | – | – | 2.496 | 0.015 |
| 81 | | *Gagata youssoufi* | *Gang tengra* | – | – | – | – | 0.034 | – | – | – | – | – | – | – | 0.023 | 0.0001 |
| | Subtotal | | | 1.457 | 1.221 | 1.952 | 0.679 | 10.200 | 1.131 | 2.148 | 2.363 | 2.903 | 1.637 | 0.192 | 0.627 | 233.434 | 1.416 |
| 7 | Migratory | *Anguilla bengalensis* | *Bamosh* | • | – | – | – | – | – | – | – | – | – | 0.025 | – | 1.212 | 0.007 |
| 130 | | *Aorichthys aor* | *Ayre* | – | – | – | – | 0.360 | 2.695 | – | – | 0.098 | – | 3.289 | – | 170.430 | 1.034 |
| 135 | | *Aorichthys seenghala* | *Guizza* | – | – | – | – | – | 3.448 | 11.771 | 0.660 | 0.002 | 0.778 | 7.585 | 0.444 | 456.754 | 2.771 |
| 131 | | *Mystus bleekeri* | *Golsha tengra* | 0.666 | 0.023 | – | – | 1.322 | 1.755 | 0.104 | – | 3.649 | 0.558 | 0.175 | 2.154 | 175.827 | 1.067 |
| 132 | | *Mystus cavasius* | *Kabashi* | 0.243 | 1.562 | – | – | 6.997 | 2.654 | – | – | 7.059 | 0.904 | 1.202 | 3.582 | 375.974 | 2.281 |
| 134 | | *Mystus menoda* | *Ghagla* | – | – | – | – | – | – | – | – | – | – | 0.010 | – | 0.500 | 0.003 |
| 32 | | *Catla catla* | *Catla* | – | – | – | – | – | – | – | – | – | – | 2.845 | – | 137.400 | 0.834 |
| 47 | | *Cirrhinus mrigala* | *Mrigel* | – | – | – | – | – | – | – | 4.327 | 0.042 | – | 0.021 | – | 40.927 | 0.248 |
| 48 | | *Cirrhinus reba* | *Raik* | – | – | – | – | – | – | – | 0.194 | – | 0.678 | – | 0.159 | 27.198 | 0.165 |
| 101 | | *Labeo boga* | *Bhangan* | – | – | – | – | 2.836 | – | – | – | – | – | – | – | 1.899 | 0.012 |
| 102 | | *Labeo calbasu* | *Kalbaus* | – | – | – | – | 2.755 | 0.944 | 7.250 | 9.626 | – | 0.070 | 10.470 | – | 624.027 | 3.786 |
| 104 | | *Labeo gonius* | *Goni* | 6.946 | 5.904 | – | – | – | – | – | – | – | 1.636 | 1.995 | 1.257 | 201.663 | 1.224 |
| 107 | | *Labeo rohita* | *Rui* | – | – | – | – | – | – | – | – | – | 8.512 | 24.419 | – | 1471.514 | 8.928 |
| 188 | | *Salmostoma bacaila* | *Katari* | 0.811 | 0.224 | 0.067 | – | 0.172 | – | – | 0.095 | 0.251 | 0.167 | 0.012 | 0.175 | 19.291 | 0.117 |
| 189 | | *Salmostoma phulo* | *Fulchela* | 0.827 | 0.245 | 0.434 | – | 0.284 | 0.434 | – | 2.268 | 7.504 | 2.356 | 1.273 | 5.376 | 473.890 | 2.875 |
| 86 | | *Gudusia chapra* | *Chapila* | 0.032 | – | – | – | 0.639 | 0.219 | – | 13.903 | 44.084 | 27.109 | 1.551 | 1.326 | 2501.743 | 15.179 |
| 76 | | *Eutropiichthys vacha* | *Bacha* | – | – | – | – | 2.410 | 3.359 | – | – | – | – | – | – | 12.040 | 0.073 |
| 169 | | *Pseudeutropius atherinoides* | *Batasi* | 0.020 | 0.025 | – | – | 0.217 | – | – | 0.175 | 0.060 | – | 0.037 | 0.020 | 5.759 | 0.035 |
| 209 | | *Wallagu attu* | *Boal* | 1.554 | 22.897 | – | – | – | – | – | 1.801 | 0.385 | 18.641 | 9.906 | 11.718 | 1430.432 | 8.679 |
| 144 | | *Notopterus chitala* | *Chital* | – | – | – | – | – | – | – | – | – | – | 0.306 | – | 14.800 | 0.090 |
| 161 | | *Pellona ditchela* | *Chouka* | – | – | – | – | – | – | – | – | – | 0.682 | – | – | 23.435 | 0.142 |
| | Subtotal | | | 11.099 | 30.881 | 0.501 | – | 17.990 | 15.509 | 19.125 | 33.049 | 63.133 | 62.091 | 65.121 | 26.213 | 8166.715 | 49.552 |
| 6 | Floodplain | *Anabas testudineus* | *Koi* | – | – | – | 0.120 | – | – | – | 0.199 | – | – | – | – | 2.433 | 0.015 |
| 136 | Resident | *Mystus tengara* | *Bajari tengra* | 5.607 | 0.026 | 0.358 | – | – | – | – | – | – | – | 0.121 | 0.946 | 22.786 | 0.138 |
| 137 | | *Mystus vittatus* | *Tengra* | 1.851 | 0.045 | 0.157 | – | – | – | 0.365 | 0.326 | 0.207 | 1.265 | 0.688 | 10.297 | 229.899 | 1.395 |
| 942 | | *Rama chandramara* | *Laia* | 0.043 | – | – | – | – | – | – | – | 0.043 | 0.025 | 0.021 | – | 3.197 | 0.019 |
| 55 | | *Colisa fasciatus* | *Khalisha* | 0.529 | 0.212 | 4.873 | 5.430 | 0.508 | – | – | – | – | – | 0.015 | 0.281 | 88.155 | 0.535 |
| 211 | | *Colisa labiosus* | *Khalisha* | 0.194 | 0.081 | 4.024 | 0.596 | 0.066 | 0.326 | – | – | 0.037 | – | – | – | 49.263 | 0.299 |
| 57 | | *Colisa sota* | *Khalisha* | 0.183 | 0.081 | – | 0.199 | – | 0.217 | – | – | – | – | – | – | 2.197 | 0.013 |
| 210 | | *Xenentodon cancila* | *Kaikka* | 1.848 | 0.025 | 0.344 | 2.231 | 0.027 | – | – | 0.272 | 0.027 | 0.018 | 0.069 | – | 23.215 | 0.141 |
| 62 | | *Cyprinus carpio* | *Karfu* | – | 1.988 | – | – | – | – | 19.572 | 2.384 | – | – | 17.966 | – | 967.888 | 5.873 |



(Cont.)

## Table II, Appendix 2 Monthly catch composition (% by weight) from Khorodari Khal: inside MIP (site NE01)

| Species Code | Habitat Preference | Species name: Scientific | Species name: Bengali | Year: 1993 Feb | Mar | April | May | July | Aug | Sep | Oct | Nov | Dec | Year: 1994 Jan | Feb | Total annual catch (Mar'93 – Feb'94) Kg | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 187 | | *Osteobrama cotio cotio* | *Keti* | 0.487 | 0.176 | – | 0.199 | 0.657 | 0.168 | 0.077 | 0.229 | 0.959 | 2.686 | 0.002 | 0.055 | 127.844 | 0.776 |
| 174 | | *Puntius chola* | *Chala puti* | 1.505 | 1.408 | 0.657 | 9.835 | 4.017 | 0.236 | 0.026 | 0.252 | 1.714 | 2.416 | 0.601 | 0.999 | 252.337 | 1.531 |
| 175 | | *Puntius conchonius* | *Canchan puti* | – | 0.320 | 1.919 | 5.006 | 3.930 | – | – | 2.747 | 0.016 | 0.096 | – | – | 80.662 | 0.489 |
| 176 | | *Puntius gelius* | *Giliputi* | 1.162 | 0.251 | 1.095 | 3.191 | 0.808 | 0.217 | – | 0.146 | 0.050 | 2.211 | 0.065 | 0.499 | 120.513 | 0.731 |
| 177 | | *Puntius guganio* | *Mola puti* | – | – | – | – | – | – | – | – | – | 0.007 | – | – | 0.235 | 0.001 |
| 178 | | *Puntius phutunio* | *Phutani puti* | 0.002 | 0.020 | 0.212 | 0.732 | – | – | – | – | 0.098 | – | – | – | 9.401 | 0.057 |
| 180 | | *Puntius sophore* | *Puti* | 5.036 | 0.518 | 5.786 | 0.753 | 5.531 | 0.910 | – | – | 0.076 | 0.994 | 0.556 | 1.683 | 162.159 | 0.984 |
| 181 | | *Puntius terio* | *Teri punti* | 0.083 | 0.079 | 2.457 | 2.563 | 0.136 | – | – | 0.394 | 0.471 | 0.046 | 0.003 | 0.197 | 63.400 | 0.385 |
| 212 | | *Puntius ticto* | *Tit puti* | 0.519 | 0.087 | 0.339 | 0.154 | 0.052 | – | – | 0.082 | – | 0.022 | – | 0.105 | 7.950 | 0.048 |
| 5 | | *Amblypharyngodon mola* | *Mola* | 0.158 | 0.128 | 0.334 | 1.332 | 1.789 | 1.086 | 0.074 | 1.108 | – | 0.149 | 0.003 | – | 31.561 | 0.191 |
| 68 | | *Danio devario* | *Chebli* | – | – | – | – | 0.199 | – | – | – | – | – | – | – | 0.133 | 0.001 |
| 75 | | *Esomus danricus* | *Darkina* | 0.077 | – | – | 0.008 | – | – | – | – | – | – | – | 0.035 | 0.525 | 0.003 |
| 182 | | *Rasbora daniconius* | *Darkina* | 0.142 | 0.197 | 4.471 | 0.008 | – | – | – | 0.103 | – | – | – | – | 50.211 | 0.305 |
| 83 | | *Glossogobius giurus* | *Bailla* | 1.548 | 2.454 | 0.374 | 0.025 | 1.822 | – | 0.128 | 0.194 | 0.122 | 0.861 | 0.525 | 1.079 | 94.229 | 0.572 |
| 91 | | *Hypophthalmichthys molitrix* | *Silver carp* | – | – | – | – | – | – | – | 14.378 | – | – | – | – | 128.411 | 0.779 |
| 43 | | *Chela cachius* | *Chep chela* | – | – | – | – | – | – | – | – | 0.118 | – | – | – | 3.615 | 0.022 |
| 110 | | *Lepidocephalus guntea* | *Gutum* | 1.298 | 0.530 | 4.952 | – | 0.122 | – | – | – | – | – | 0.187 | 0.116 | 66.937 | 0.406 |
| 9 | | *Aplocheilus panchax* | *Kanpona* | – | – | – | 0.100 | – | – | – | – | – | – | – | – | 0.543 | 0.003 |
| 39 | | *Channa marulius* | *Gajar* | 8.243 | 2.980 | – | – | – | 2.335 | 10.081 | – | 7.496 | 1.266 | 2.673 | 0.234 | 464.248 | 2.817 |
| 41 | | *Channa punctatus* | *Taki* | 8.817 | 0.133 | 24.734 | 0.137 | 2.209 | 21.708 | 15.812 | 8.602 | 0.971 | 0.071 | 0.095 | 2.557 | 540.614 | 3.280 |
| 42 | | *Channa striatus* | *Shol* | 0.340 | – | – | – | – | 1.745 | 2.210 | – | – | – | – | – | 13.123 | 0.080 |
| 49 | | *Clarias batrachus* | *Magur* | – | – | – | – | – | 0.664 | 0.311 | – | – | – | – | – | 3.144 | 0.019 |
| 88 | | *Heteropneustes fossilis* | *Shingi* | 1.028 | 0.053 | 0.905 | – | 1.056 | 0.357 | 1.059 | 0.078 | – | 0.103 | 0.042 | 0.615 | 30.219 | 0.183 |
| 123 | | *Macrognathus pancalus* | *Guchi* | 3.180 | 1.514 | 1.126 | 9.575 | 0.113 | – | – | 0.006 | 0.007 | 0.339 | 0.004 | – | 84.732 | 0.514 |
| 122 | | *Mastacembelus armatus* | *Baral baim* | 0.452 | 1.477 | 6.545 | – | 0.052 | 2.176 | 6.111 | 13.294 | 1.528 | 0.816 | 0.068 | – | 303.535 | 1.842 |
| 138 | | *Nandus nandus* | *Bheda* | 0.404 | 0.017 | 1.364 | 13.819 | 2.367 | 0.810 | 1.450 | 0.194 | 1.340 | – | 0.010 | 0.142 | 144.595 | 0.877 |
| 15 | | *Badis badis* | *Napit koi* | 0.098 | 0.031 | 0.287 | 0.008 | 0.040 | – | – | – | – | 0.007 | 0.011 | – | 4.140 | 0.025 |
| 149 | | *Ophisternon bengalense* | *Bamosh* | – | – | – | – | – | – | – | – | – | 0.015 | – | – | 0.507 | 0.003 |
| 147 | | *Ompok bimaculatus* | *Kani pabda* | 0.086 | – | – | – | – | – | – | – | – | – | 0.102 | – | 4.907 | 0.030 |
| 148 | | *Ompok pabda* | *Madhu pabda* | – | – | – | – | – | 0.258 | – | – | – | 0.005 | – | – | 0.957 | 0.006 |
| 145 | | *Notopterus notopterus* | *Foli* | 0.298 | 1.238 | 0.434 | 6.732 | 0.308 | 1.549 | 3.078 | 2.598 | 0.683 | 0.085 | 2.788 | 0.019 | 245.807 | 1.491 |
| 203 | | *Tetraodon cutcutia* | *Potka* | 2.181 | 0.319 | 6.037 | 2.719 | – | – | – | 0.253 | – | – | – | – | 83.872 | 0.509 |
| 33 | | *Chaca chaca* | *Cheka* | – | – | – | – | – | – | – | 1.040 | – | – | – | – | 9.284 | 0.056 |
| 35 | | *Chanda baculis* | *Chanda* | 2.127 | 1.689 | 1.528 | 0.339 | 16.210 | 0.947 | 0.043 | 4.415 | 2.412 | 5.358 | 0.197 | 1.245 | 365.340 | 2.217 |
| 36 | | *Chanda nama* | *Nama chanda* | 0.110 | 0.362 | 0.147 | 0.154 | 0.679 | 0.651 | 0.186 | 4.337 | 12.017 | 8.924 | 1.632 | 9.424 | 928.988 | 5.637 |
| 37 | | *Chanda ranga* | *Lalchanda* | 2.511 | 3.016 | 6.824 | 11.716 | 0.554 | 0.760 | 0.074 | 1.248 | 0.027 | 0.049 | – | 0.123 | 172.080 | 1.044 |
| | Subtotal | | | 52.145 | 21.453 | 82.286 | 77.680 | 43.250 | 37.120 | 60.657 | 58.879 | 30.422 | 27.832 | 28.444 | 30.650 | 5989.791 | 36.343 |
| 931 | Others | Prawn spp. | *Chingri/Icha* | 35.297 | 46.444 | 15.261 | 21.640 | 28.558 | 46.239 | 18.070 | 5.708 | 3.540 | 8.438 | 5.815 | 42.510 | 2070.612 | 12.564 |
| 207 | | *Trionyx gangeticus* | *Kachhim* | – | – | – | – | – | – | – | – | – | – | 0.427 | – | 20.600 | 0.125 |
| | Subtotal | | | 35.297 | 46.444 | 15.261 | 21.640 | 28.558 | 46.239 | 18.070 | 5.708 | 3.540 | 8.438 | 6.241 | 42.510 | 2091.212 | 12.689 |
| | Grand total | | | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 16481.152 | 100 |

Notes: 1. No fishing activities were observed in June 1993

2. – denotes zero catch

## Table III, Appendix 2 Monthly catch composition (% by weight) from Akali Gang: inside MIP (site NE03)

| Species Code | Habitat Preference | Species name | | Year: 1993 | | | | | | | Total annual catch (Mar'93 – Feb'94) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Scientific | Bengali | Feb | Mar | April | May | Oct | Nov | Dec | Kg | % |
| 139 | Riverine | *Nemacheilus botia* | *Balichata* | – | – | – | 0.077 | 0.019 | – | – | 0.540 | 0.012 |
| 941 | | *Neoeucirrhichthys maydelli* | *Gutum* | 0.724 | – | 0.563 | 0.182 | – | 0.043 | 0.026 | 2.448 | 0.055 |
| 198 | | *Somileptes gongota* | *Gharpoia* | – | – | – | – | – | – | 0.022 | 0.160 | 0.004 |
| 28 | | *Botia dario* | *Rani* | – | – | – | – | 0.117 | – | – | 1.140 | 0.026 |
| 89 | | *Hilsa ilisha* | *Ilish* | – | – | – | – | 0.096 | 0.315 | – | 7.092 | 0.159 |
| 58 | | *Corica soborna* | *Kachki* | – | – | – | – | 8.162 | 47.251 | 0.723 | 1010.283 | 22.639 |
| 30 | | *Brachygobius nunus* | *Nunabailla* | – | – | – | – | – | 0.041 | 0.004 | 0.825 | 0.018 |
| 163 | | *Pisodonophis boro* | *Kharu* | – | – | – | – | – | – | 0.101 | 0.721 | 0.016 |
| 81 | | *Gagata youssoufi* | *Gang tengra* | – | – | – | – | 0.008 | – | – | 0.076 | 0.002 |
| | Subtotal | | | 0.724 | – | 0.563 | 0.259 | 8.401 | 47.649 | 0.876 | 1023.285 | 22.930 |
| 130 | Migratory | *Aorichthys aor* | *Ayre* | – | – | – | – | 0.283 | – | – | 2.757 | 0.062 |
| 135 | | *Aorichthys seenghala* | *Guizza* | – | 2.077 | – | – | 0.391 | 0.088 | – | 10.841 | 0.243 |
| 131 | | *Mystus bleekeri* | *Golsha tengra* | 0.276 | – | – | – | 0.081 | 0.108 | 1.535 | 13.863 | 0.311 |
| 132 | | *Mystus cavasius* | *Kabashi* | – | 0.542 | – | – | 0.573 | – | 0.263 | 8.848 | 0.198 |
| 134 | | *Mystus menoda* | *Ghagla* | – | – | – | – | 0.706 | – | – | 6.877 | 0.154 |
| 47 | | *Cirrhinus mrigala* | *Mrigel* | – | – | – | – | 4.798 | 0.273 | – | 52.111 | 1.168 |
| 104 | | *Labeo gonius* | *Goni* | – | – | – | – | – | – | 0.334 | 2.384 | 0.053 |
| 188 | | *Salmostoma bacaila* | *Katari* | – | 0.093 | – | – | – | – | 0.069 | 0.729 | 0.016 |
| 189 | | *Salmostoma phulo* | *Fulchela* | – | 3.830 | – | – | 0.400 | 0.527 | 0.402 | 26.874 | 0.602 |
| 86 | | *Gudusia chapra* | *Chapila* | – | – | – | – | 2.528 | 5.488 | 0.854 | 138.245 | 3.098 |
| 169 | | *Pseudeutropius atherinoides* | *Batasi* | – | – | – | – | – | 0.027 | – | 0.535 | 0.012 |
| 161 | | *Pellona ditchela* | *Chouka* | – | – | – | – | 0.045 | 0.018 | – | 0.787 | 0.018 |
| | Subtotal | | | 0.276 | 6.542 | – | – | 9.804 | 6.529 | 3.456 | 264.851 | 5.935 |
| 6 | Floodplain | *Anabas testudineus* | *Koi* | 0.578 | – | – | 0.088 | – | – | – | 0.402 | 0.009 |
| 136 | Resident | *Mystus tengara* | *Bajari tengra* | 0.316 | – | – | 0.198 | 0.012 | – | 0.110 | 1.796 | 0.040 |
| 137 | | *Mystus vittatus* | *Tengra* | – | 0.423 | 1.075 | 0.795 | – | 0.122 | 3.863 | 35.801 | 0.802 |
| 55 | | *Colisa fasciatus* | *Khalisha* | 1.997 | – | 0.848 | 1.387 | 0.012 | – | – | 7.309 | 0.164 |
| 211 | | *Colisa labiosus* | *Khalisha* | 0.776 | – | 1.514 | 1.062 | – | – | – | 6.415 | 0.144 |
| 57 | | *Colisa sota* | *Khalisha* | – | 0.146 | 0.063 | 0.211 | – | – | – | 1.398 | 0.031 |
| 210 | | *Xenentodon cancila* | *Kaikka* | – | – | – | 0.409 | 0.094 | 0.136 | 0.022 | 5.604 | 0.126 |
| 187 | | *Osteobrama cotio cotio* | *Keti* | 0.017 | – | – | – | 0.031 | 0.364 | – | 7.429 | 0.166 |
| 174 | | *Puntius chola* | *Chala puti* | 0.207 | 1.689 | – | – | 4.197 | 1.579 | 6.468 | 122.324 | 2.741 |
| 175 | | *Puntius conchonius* | *Canchan puti* | 0.365 | – | 1.043 | – | 0.253 | 0.362 | 0.141 | 11.664 | 0.261 |
| 173 | | *Puntius cosuatis* | *Kosuati* | – | – | 0.049 | – | – | – | – | 0.051 | 0.001 |

(Cont.)

Table III, Appendix 2 Monthly catch composition (% by weight) from Akali Gang: inside MIP (site NE03)

| Species Code | Habitat Preference | Species name: Scientific | Species name: Bengali | Year: 1993 Feb | Mar | April | May | Oct | Nov | Dec | Total annual catch (Mar'93 – Feb'94) Kg | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 176 | | *Puntius gelius* | *Giliputi* | 0.130 | – | – | 0.329 | – | 0.107 | 0.188 | 4.934 | 0.111 |
| 177 | | *Puntius guganio* | *Mola puti* | – | – | – | – | 0.012 | 0.036 | – | 0.828 | 0.019 |
| 178 | | *Puntius phutunio* | *Phutani puti* | – | – | 0.126 | 0.521 | 0.004 | – | – | 2.536 | 0.057 |
| 180 | | *Puntius sophore* | *Puti* | 1.820 | 7.199 | 3.860 | 0.166 | 3.291 | 4.435 | 4.840 | 176.712 | 3.960 |
| 181 | | *Puntius terio* | *Teri punti* | – | – | 2.814 | 3.855 | 0.094 | 0.013 | 0.118 | 22.484 | 0.504 |
| 212 | | *Puntius ticto* | *Tit puti* | – | – | 0.146 | – | – | – | 0.140 | 1.152 | 0.026 |
| 5 | | *Amblypharygodon mola* | *Mola* | – | 0.397 | 1.876 | – | 0.045 | 0.253 | 0.015 | 8.494 | 0.190 |
| 75 | | *Esomus danricus* | *Darkina* | – | – | – | 0.061 | – | 0.070 | 0.077 | 2.188 | 0.049 |
| 182 | | *Rasbora daniconius* | *Darkina* | 0.558 | – | 3.940 | 0.414 | 0.100 | 0.498 | 0.395 | 19.568 | 0.438 |
| 83 | | *Glossogobius giurus* | *Bailla* | 1.190 | 10.746 | 2.058 | 1.452 | 7.803 | 2.638 | 2.494 | 181.755 | 4.073 |
| 110 | | *Lepidocephalus guntea* | *Gutum* | 0.112 | 3.203 | 4.541 | 1.256 | 0.105 | 0.179 | 3.892 | 50.991 | 1.143 |
| 9 | | *Aplocheilus panchax* | *Kanpona* | – | – | – | 0.637 | – | – | – | 2.895 | 0.065 |
| 39 | | *Channa marulius* | *Gajar* | – | – | – | – | 13.131 | 0.581 | – | 139.378 | 3.123 |
| 41 | | *Channa punctatus* | *Taki* | 11.367 | 17.640 | 7.426 | 0.993 | 0.732 | 0.627 | 9.391 | 143.884 | 3.224 |
| 49 | | *Clarias batrachus* | *Magur* | 1.337 | – | – | – | – | – | – | – | – |
| 88 | | *Heteropneustes fossilis* | *Shingi* | 0.569 | 0.225 | – | 0.365 | 0.324 | 0.083 | 1.335 | 16.554 | 0.371 |
| 121 | | *Macrognathus aculeatus* | *Tara baim* | – | – | – | – | – | – | 0.083 | 0.593 | 0.013 |
| 123 | | *Macrognathus pancalus* | *Guchi* | 0.138 | 4.547 | 3.686 | 2.228 | 1.437 | 0.212 | 3.710 | 70.261 | 1.574 |
| 122 | | *Mastacembelus armatus* | *Baral baim* | – | 3.068 | – | – | 0.756 | – | 0.253 | 17.023 | 0.381 |
| 138 | | *Nandus nandus* | *Bheda* | – | 9.135 | – | 0.055 | 1.688 | 0.035 | 0.206 | 42.214 | 0.946 |
| 15 | | *Badis badis* | *Napit koi* | – | – | – | 1.323 | 0.027 | 0.080 | 0.023 | 7.995 | 0.179 |
| 145 | | *Notopterus notopterus* | *Foli* | – | – | – | 0.307 | – | – | 0.463 | 4.701 | 0.105 |
| 203 | | *Tetraodon cutcutia* | *Potka* | – | – | 0.938 | 0.498 | 0.175 | 0.063 | 0.006 | 6.240 | 0.140 |
| 33 | | *Chaca chaca* | *Cheka* | – | – | – | – | – | – | 14.334 | 102.333 | 2.293 |
| 35 | | *Chanda baculis* | *Chanda* | 0.983 | 1.023 | 0.244 | 0.088 | 1.300 | 1.414 | 0.657 | 48.336 | 1.083 |
| 36 | | *Chanda nama* | *Nama chanda* | – | 0.957 | – | – | 1.642 | 4.272 | 3.079 | 124.108 | 2.781 |
| 37 | | *Chanda ranga* | *Lal chanda* | 0.697 | 0.264 | 1.786 | 9.893 | 0.184 | 0.243 | 0.265 | 55.940 | 1.254 |
| | Subtotal | | | 23.157 | 60.662 | 38.032 | 28.590 | 37.449 | 18.401 | 56.566 | 1454.290 | 32.588 |
| 931 | Others | Prawn spp. | *Chingri/Icha* | 75.842 | 32.796 | 61.404 | 71.030 | 44.346 | 27.420 | 39.101 | 1719.625 | 38.534 |
| 945 | | *Crab sp* | *Kakra* | – | – | – | 0.120 | – | – | – | 0.547 | 0.012 |
| | Subtotal | | | 75.842 | 32.796 | 61.404 | 71.150 | 44.346 | 27.420 | 39.101 | 1720.172 | 38.546 |
| | Grand total | | | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 4462.598 | 100 |

Notes : 1. No fishing activities were observed from June to September 1993 and in January and February 1994

2. – denotes zero catch

**Table IV, Appendix 2 Monthly catch composition (% by weight) form the Kushiyara River: outside MIP (site NE06)**

| Species Code | Habitat Preference | Species name: Scientific | Species name: Bengali | Year: 1993 Feb | Mar | April | May | June | July | Aug | Sep | Oct | Nov | Dec | Year: 1994 Jan | Feb | Total annual catch (Mar'93 – Feb'94) Kg | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 133 | Riverine | *Mystus gulio* | *Nuna tengra* | | | | | | | | | | | | 0.529 | | 19.675 | 0.043 |
| 186 | | *Rita rita* | *Rita* | 0.321 | 1.193 | 1.471 | 28.302 | 0.828 | 3.099 | 10.694 | 7.053 | 1.821 | 4.250 | 0.065 | 0.273 | | 1803.805 | 3.908 |
| 99 | | *Labeo angra* | *Angrot* | | | | | | | | 0.086 | | | | | | 4.462 | 0.010 |
| 106 | | *Labeo pangusia* | *Longu* | | | | | | | | | | 1.150 | 0.240 | | | 42.964 | 0.093 |
| 13 | | *Aspidoparia morar* | *Piali* | 0.009 | 0.216 | | | | | 0.199 | 0.073 | 0.715 | 0.035 | | 0.035 | | 91.719 | 0.199 |
| 17 | | *Barilius barila* | *Barali* | | | | | | | | 0.113 | 0.083 | | | | | 14.146 | 0.031 |
| 59 | | *Crossocheilus latius* | *Kalabata* | 0.007 | 0.043 | | | | 0.049 | 0.037 | 0.117 | 1.630 | 0.529 | 0.101 | 0.155 | 0.174 | 206.659 | 0.448 |
| 139 | | *Nemacheilus botia* | *Balichata* | 0.076 | 0.317 | 0.589 | 0.587 | 0.015 | 0.117 | 0.104 | 0.029 | 0.033 | | 0.030 | 0.030 | 0.012 | 52.853 | 0.115 |
| 942 | | *Rama chandramara* | *Lala* | | | | | | 0.002 | 0.003 | 0.003 | 0.001 | | | | | 0.377 | 0.001 |
| 198 | | *Somileptes gongota* | *Gharpoia* | 0.022 | | | | | | | | | 0.387 | 0.115 | | 0.151 | 21.983 | 0.048 |
| 28 | | *Botia dario* | *Rani* | 0.429 | 1.446 | 0.444 | 0.421 | 0.329 | 9.096 | 0.440 | 0.605 | 0.991 | 0.699 | 0.553 | 0.660 | 0.067 | 489.430 | 1.060 |
| 29 | | *Botia lohachata* | *Putul* | | | | | | 0.248 | 0.129 | 0.014 | 0.077 | 0.039 | | | | 18.844 | 0.041 |
| 89 | | *Hilsa ilisha* | *Ilish* | | 10.741 | 14.451 | 32.499 | 83.109 | 49.351 | 54.064 | 30.691 | 1.539 | 0.449 | | | 0.366 | 8801.356 | 19.069 |
| 85 | | *Gonialosa manmina* | *Goni chapila* | 0.087 | 0.036 | | | | | | | | | | | | 1.292 | 0.003 |
| 58 | | *Corica soborna* | *Kachki* | 1.144 | 1.146 | | 0.100 | 0.014 | 0.032 | 0.307 | | 2.554 | 0.393 | 0.295 | | | 331.365 | 0.718 |
| 964 | | *Dermogenys pusillus* | *Ke thota* | | | | | | 0.001 | 0.001 | | | | | | | 0.034 | 0.0001 |
| 92 | | *Hyporhampus gaimardi* | *Ek thota* | | | | | | | | | | | 0.001 | | | 0.029 | 0.0001 |
| 185 | | *Rhinomugil corsula* | *Khorsula* | | | | | 0.008 | 0.466 | | 0.500 | 0.114 | | 0.391 | | | 58.589 | 0.127 |
| 931 | | *Prawn spp.* | *Chingri/Icha* | 0.478 | 16.547 | 10.796 | 5.144 | 0.550 | 1.627 | 1.390 | 2.875 | 2.063 | 10.608 | 3.974 | 5.303 | 1.054 | 2125.966 | 4.606 |
| 163 | | *Pisodonophis boro* | *Kharu* | 0.075 | 0.195 | 0.025 | | | | | 0.012 | | | | | | 8.302 | 0.018 |
| 2 | | *Ailia coila* | *Kajuli* | 4.487 | 5.806 | 9.197 | 0.021 | | 2.464 | 0.527 | 3.770 | 13.700 | 12.213 | 2.457 | 4.169 | 16.635 | 3416.871 | 7.403 |
| 3 | | *Ailia punctata* | *Kajuli* | 0.008 | 4.630 | | 0.012 | 0.003 | 0.204 | 0.358 | 0.017 | 1.360 | 0.188 | 0.016 | | | 326.411 | 0.707 |
| 51 | | *Clupisoma garua* | *Ghaura* | 18.153 | 6.691 | 4.828 | 1.679 | 0.122 | 2.109 | 0.581 | 6.797 | 7.894 | 24.643 | 6.526 | 2.374 | 0.179 | 2670.118 | 5.785 |
| 52 | | *Clupisoma naziri* | *Muri bacha* | 7.197 | 0.570 | 0.397 | 0.017 | 0.062 | 2.861 | 0.352 | 0.298 | 3.867 | 0.364 | | 0.097 | | 525.037 | 1.138 |
| 16 | | *Bagarius bagarius* | *Baghair* | | | | | | 0.034 | 10.447 | 2.884 | 0.434 | 3.268 | 0.470 | 1.432 | 0.631 | 689.526 | 1.494 |
| 74 | | *Erethistes pussilus* | *Kutakanti* | 0.014 | 0.033 | | | | 0.004 | 0.022 | 0.008 | | 0.016 | | | | 2.834 | 0.006 |
| 77 | | *Gagata cenia* | *Kauwa* | 0.140 | 0.238 | 0.364 | 0.018 | | 0.044 | 0.065 | 0.022 | 0.012 | 0.013 | | | | 23.846 | 0.052 |
| 80 | | *Gagata viridescens* | *Gang tengra* | | 0.404 | 0.857 | 0.073 | | 0.043 | | 0.041 | 0.072 | | | | | 48.457 | 0.105 |
| 81 | | *Gagata youssoufi* | *Gang tengra* | 1.884 | 2.234 | 5.287 | 0.893 | 0.032 | 2.468 | 4.754 | 0.892 | 13.662 | 0.738 | 0.946 | 0.334 | 11.014 | 2386.761 | 5.171 |
| 87 | | *Hara hara* | *Kutakanti* | | | | | | | | 0.008 | 0.056 | | 0.084 | 0.032 | | 9.543 | 0.021 |
| 95 | | *Johnius coitor* | *Koitor* | 0.380 | 0.188 | | 0.462 | | | | 0.097 | 0.060 | 0.171 | 0.285 | | | 41.326 | 0.090 |
| 155 | | *Pama pama* | *Poa* | | | | | | | | 0.216 | | | | 0.034 | 0.026 | 13.511 | 0.029 |
| | Subtotal | | | 34.911 | 52.670 | 48.707 | 70.227 | 85.072 | 74.320 | 84.474 | 57.221 | 52.739 | 60.156 | 16.548 | 15.458 | 30.306 | 24248.041 | 52.536 |
| 130 | Migratory | *Aorichthys aor* | *Ayre* | 5.026 | 0.117 | | | | 0.442 | 2.760 | 0.663 | | 0.410 | 1.379 | 1.213 | 1.920 | 306.426 | 0.664 |
| 135 | | *Aorichthys seenghala* | *Guizza* | 1.849 | 0.402 | 2.249 | 1.626 | | 0.036 | 1.064 | 4.212 | 2.930 | | 2.981 | 6.874 | 4.199 | 1172.026 | 2.539 |
| 24 | | *Batasio batasio* | *Tengra* | 0.009 | 0.005 | | | | | | 0.031 | 0.030 | 0.085 | 0.014 | 0.011 | | 8.281 | 0.018 |
| 131 | | *Mystus bleekeri* | *Golsha tengra* | 0.399 | 0.017 | 0.014 | 0.249 | 0.023 | 0.281 | | 0.033 | 0.998 | 11.466 | 0.659 | 6.092 | 3.008 | 852.316 | 1.847 |
| 132 | | *Mystus cavasius* | *Kabashi* | 0.994 | 0.623 | 2.220 | | 0.045 | 0.978 | 0.070 | 1.660 | 10.874 | 9.593 | 41.602 | 43.467 | 25.774 | 5470.678 | 11.853 |
| 134 | | *Mystus menoda* | *Ghagla* | | | | | | | | | | | | 0.670 | 0.174 | 32.446 | 0.070 |
| 32 | | *Catla catla* | *Catla* | | | | | | | | 7.878 | | | | | | 407.717 | 0.883 |
| 48 | | *Cirrhinus reba* | *Raik* | 0.151 | 5.296 | 5.362 | 0.619 | 0.189 | 2.371 | | | 0.064 | | 0.132 | 0.165 | 0.680 | 445.627 | 0.966 |
| 100 | | *Labeo bata* | *Bata* | | | | | | 0.954 | | 0.105 | 0.514 | | 0.044 | | | 78.984 | 0.171 |
| 101 | | *Labeo boga* | *Bhangan* | 0.090 | | | | | 0.753 | 0.030 | 0.078 | 1.251 | 1.096 | | 0.155 | | 187.498 | 0.406 |
| 102 | | *Labeo calbasu* | *Kalbaus* | | | | 0.009 | 9.326 | 1.861 | 5.879 | 4.822 | 0.565 | 0.698 | | 2.452 | | 957.972 | 2.076 |
| 104 | | *Labeo gonius* | *Goni* | | | | | | | | | | | | 0.030 | | 1.129 | 0.002 |
| 107 | | *Labeo rohita* | *Rui* | | | | | 0.013 | 3.768 | | 12.294 | | | | | | 718.123 | 1.556 |
| 44 | | *Chela laubuca* | *Kash khaira* | | | | | | | | | | | 0.008 | | | 0.210 | 0.0005 |
| 188 | | *Salmostoma bacaila* | *Katari* | 0.123 | 2.056 | 0.098 | 0.020 | 0.003 | 2.460 | 0.030 | 0.057 | 2.359 | 0.097 | 0.081 | 0.164 | 0.515 | 405.397 | 0.878 |
| 189 | | *Salmostoma phulo* | *Fulchela* | 1.099 | 17.376 | 0.327 | 4.023 | 0.402 | 2.199 | 0.239 | 0.588 | 7.510 | 0.939 | 0.379 | 0.031 | 4.102 | 1798.648 | 3.897 |
| 154 | | *Securicula gora* | *Chora chela* | | 0.123 | 0.074 | | | | | 0.182 | 0.793 | | | 0.098 | | 99.121 | 0.215 |
| 86 | | *Gudusia chapra* | *Chapila* | 0.007 | 0.586 | 0.064 | 0.193 | 0.118 | 1.869 | 0.392 | 3.066 | 7.616 | 2.605 | 1.567 | 0.181 | 0.352 | 1155.910 | 2.504 |
| 76 | | *Eutropiichthys vacha* | *Bacha* | 19.131 | 2.907 | 7.692 | 2.623 | 0.062 | 0.340 | 0.042 | 1.149 | 2.770 | 0.613 | | 1.214 | 12.799 | 1327.400 | 2.876 |
| 169 | | *Pseudeutropius atherinoides* | *Batasi* | 0.012 | 0.147 | 0.052 | 0.035 | | 0.099 | 0.030 | 0.008 | 0.115 | | 0.438 | 2.208 | 1.826 | 195.207 | 0.423 |
| 944 | | *Ompok pabo* | *Pabda* | | | | | | | | 0.021 | | | | | | 1.071 | 0.002 |
| 209 | | *Wallagu attu* | *Boal* | 27.474 | | | | | | 0.008 | 0.006 | | 0.517 | 5.806 | 8.076 | 3.298 | 620.488 | 1.344 |
| 144 | | *Notopterus chitala* | *Chital* | | | | | | | | | | | 11.028 | | | 305.416 | 0.662 |
| 142 | | *Nemacheilus scaturigina* | *Dari* | | | | 0.147 | | 0.016 | 0.023 | | | 0.043 | | | | 5.612 | 0.012 |
| 161 | | *Pellona ditchela* | *Chouka* | | | | | | | | | 0.006 | 0.092 | 0.062 | | | 5.201 | 0.011 |
| | Subtotal | | | 56.364 | 29.656 | 18.150 | 9.543 | 10.181 | 18.426 | 10.567 | 36.847 | 38.393 | 28.253 | 66.179 | 73.092 | 58.646 | 16558.904 | 35.877 |



(Cont.)

**Table IV, Appendix 2 Monthly catch composition (% by weight) form the Kushiyara River: outside MIP (site NE06)**

| Species Code | Habitat Preference | Species name: Scientific | Species name: Bengali | Year: 1993 Feb | Mar | April | May | June | July | Aug | Sep | Oct | Nov | Dec | Year: 1994 Jan | Feb | Total annual catch (Mar'93 – Feb'94) Kg | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | Floodplain | *Anabas testudineus* | *Koi* | – | – | – | | – | – | – | 0.097 | – | – | – | – | – | 5.040 | 0.011 |
| 136 | Resident | *Mystus tengara* | *Bajari tengra* | | 0.058 | 0.034 | 0.005 | – | | – | – | | – | – | – | – | 3.066 | 0.007 |
| 137 | | *Mystus vittatus* | *Tengra* | – | 0.098 | 1.419 | 0.261 | – | 0.065 | | – | 0.006 | – | – | 0.727 | 0.127 | 80.109 | 0.174 |
| 923 | | *Sicamugil cascasia* | *Bata* | 0.009 | 0.427 | – | 0.011 | – | 0.156 | 0.002 | 0.007 | 2.163 | 4.074 | 0.516 | 0.015 | 0.179 | 388.463 | 0.842 |
| 55 | | *Colisa fasciatus* | *Khalisha* | – | 0.060 | 0.036 | 0.013 | – | – | 0.003 | – | – | – | – | – | – | 3.471 | 0.008 |
| 211 | | *Colisa labiosus* | *Khalisha* | – | 0.026 | 0.039 | 0.027 | – | – | | – | – | – | – | – | – | 2.529 | 0.005 |
| 56 | | *Colisa lalia* | *Lal khalisha* | | – | – | 0.027 | – | – | – | – | – | – | – | – | – | 0.591 | 0.001 |
| 57 | | *Colisa sota* | *Khalisha* | 0.001 | 0.014 | 0.013 | 0.059 | – | 0.001 | 0.001 | 0.0004 | 0.001 | – | – | – | – | 2.350 | 0.005 |
| 210 | | *Xenentodon cancila* | *Kaikka* | 0.008 | 0.552 | 0.310 | 0.351 | 0.047 | 0.428 | 0.038 | 0.005 | 0.091 | 0.158 | – | 0.033 | 0.008 | 63.662 | 0.138 |
| 187 | | *Osteobrama cotio cotio* | *Keti* | 0.206 | 0.295 | 0.900 | 0.292 | 0.034 | 0.145 | 0.006 | 0.068 | 1.186 | 0.272 | 0.907 | 0.533 | 0.847 | 257.748 | 0.558 |
| 174 | | *Puntius chola* | *Chala puti* | – | 0.632 | 0.420 | 0.521 | 0.058 | 0.356 | – | – | 0.032 | – | 0.236 | 0.340 | 0.158 | 83.985 | 0.182 |
| 175 | | *Puntius conchonius* | *Canchan puti* | – | 0.755 | 0.787 | 3.183 | 1.854 | 0.616 | 0.879 | 0.081 | 0.050 | – | – | – | – | 231.019 | 0.501 |
| 176 | | *Puntius gelius* | *Gilliputi* | 0.019 | 0.066 | 0.058 | 0.061 | – | 0.034 | 0.054 | 0.004 | 0.0004 | 0.003 | 0.035 | – | – | 8.816 | 0.019 |
| 178 | | *Puntius phutunio* | *Phutani puti* | 0.005 | – | – | 0.027 | – | – | – | 0.003 | 0.0004 | – | – | – | – | 0.785 | 0.002 |
| 180 | | *Puntius sophore* | *Puti* | 0.005 | 0.345 | 0.334 | 1.158 | 0.264 | 0.137 | 0.059 | 0.027 | – | – | 0.031 | 0.114 | 0.076 | 70.360 | 0.152 |
| 181 | | *Puntius terio* | *Teri punti* | – | 0.016 | – | 0.066 | – | 0.002 | 0.011 | 0.011 | – | – | – | 0.034 | – | 4.268 | 0.009 |
| 212 | | *Puntius ticto* | *Tit puti* | – | 0.234 | 0.114 | 0.010 | – | – | – | – | 0.005 | – | | – | – | 12.094 | 0.026 |
| 4 | | *Amblypharyngodon microlepis* | *Mola* | 0.005 | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 5 | | *Amblypharyngodon mola* | *Mola* | – | 0.082 | 0.130 | 0.551 | 0.076 | 0.146 | 0.173 | 0.010 | 0.016 | – | – | 0.005 | – | 31.567 | 0.068 |
| 68 | | *Danio devario* | *Chebli* | – | – | – | – | – | – | 0.046 | 0.007 | 0.004 | – | – | 0.010 | – | 2.428 | 0.005 |
| 75 | | *Esomus danricus* | *Darkina* | – | – | 0.002 | 0.079 | – | 0.002 | 0.004 | 0.002 | 0.001 | – | – | – | – | 2.114 | 0.005 |
| 182 | | *Rasbora daniconius* | *Darkina* | – | – | – | – | – | 0.002 | 0.030 | 0.004 | 0.001 | – | – | – | – | 1.188 | 0.003 |
| 83 | | *Glossogobius giurus* | *Bailla* | 0.069 | 0.705 | 0.221 | 1.717 | 0.094 | 0.332 | 0.490 | 0.088 | 0.197 | 0.159 | 0.028 | 0.055 | 0.890 | 164.368 | 0.356 |
| 91 | | *Hypophthalmichthys molitrix* | *Silver carp* | – | – | – | – | – | – | – | 0.586 | 1.301 | – | – | – | – | 161.329 | 0.350 |
| 43 | | *Chela cachius* | *Chep chela* | – | 0.072 | 0.009 | 0.014 | – | – | | 0.008 | 0.006 | – | – | – | – | 4.161 | 0.009 |
| 110 | | *Lepidocephalus guntea* | *Gutum* | – | 0.147 | 0.286 | 0.621 | – | 0.148 | 0.013 | 0.720 | – | – | 0.158 | – | 0.002 | 71.642 | 0.155 |
| 9 | | *Aplocheilus panchax* | *Kanpona* | – | – | – | 0.374 | 0.002 | 0.001 | 0.005 | 0.003 | 0.0004 | – | – | – | – | 8.685 | 0.019 |
| 39 | | *Channa marulius* | *Gajar* | – | | – | – | – | – | – | – | – | – | 0.188 | 0.183 | – | 12.011 | 0.026 |
| 41 | | *Channa punctatus* | *Taki* | 0.008 | | – | 0.141 | | 0.003 | 0.186 | 0.082 | 0.035 | 0.690 | 0.107 | – | 0.121 | 46.222 | 0.100 |
| 88 | | *Heteropneustes fossilis* | *Shingi* | – | – | – | – | – | 0.680 | 0.007 | – | – | – | – | – | 0.003 | 15.005 | 0.033 |
| 121 | | *Macrognathus aculeatus* | *Tara baim* | – | 0.123 | 0.074 | – | 0.021 | – | – | – | – | – | – | – | – | 7.070 | 0.015 |
| 123 | | *Macrognathus pancalus* | *Guchi* | 0.017 | 0.416 | 0.653 | 3.544 | 0.002 | 0.084 | 0.136 | 0.921 | 0.069 | 0.333 | 0.148 | 0.142 | 0.082 | 194.044 | 0.420 |
| 122 | | *Mastacembelus armatus* | *Baral baim* | 7.616 | 6.443 | 2.489 | 1.054 | 0.148 | – | 0.175 | 2.449 | 1.994 | 1.763 | 12.790 | 4.192 | 7.292 | 1538.760 | 3.334 |
| 138 | | *Nandus nandus* | *Bheda* | – | – | 0.011 | 0.034 | – | 0.062 | – | – | – | – | 0.021 | 0.041 | – | 4.449 | 0.010 |
| 15 | | *Badis badis* | *Napit koi* | – | – | – | 0.392 | – | 0.002 | 0.013 | 0.003 | | – | – | – | – | 9.206 | 0.020 |
| 147 | | *Ompok bimaculatus* | *Kani pabda* | – | – | – | – | – | – | – | 0.083 | – | – | – | 0.977 | 0.025 | 41.725 | 0.090 |
| 148 | | *Ompok pabda* | *Madhu pabda* | 0.028 | 0.594 | 0.211 | – | – | – | | – | – | – | 0.033 | – | – | 27.762 | 0.060 |
| 145 | | *Notopterus notopterus* | *Foli* | – | – | – | | 0.021 | – | 0.163 | 0.006 | 0.199 | – | 0.258 | 2.216 | 0.139 | 121.340 | 0.263 |
| 203 | | *Tetraodon cutcutia* | *Potka* | 0.018 | – | – | 0.083 | 0.010 | 0.088 | 0.145 | 0.001 | 0.002 | 0.073 | | 0.117 | – | 15.187 | 0.033 |
| 33 | | *Chaca chaca* | *Cheka* | – | – | – | 0.273 | – | – | – | – | – | 1.380 | | 0.077 | – | 52.474 | 0.114 |
| 35 | | *Chanda baculis* | *Chanda* | – | 1.562 | 0.256 | 0.982 | 0.769 | 3.020 | 1.846 | 0.225 | 1.316 | 1.809 | 0.272 | 0.072 | 0.023 | 442.421 | 0.959 |
| 36 | | *Chanda nama* | *Nama chanda* | 0.017 | 0.019 | 0.036 | 0.781 | 0.400 | 0.564 | 0.193 | 0.063 | 0.141 | 0.876 | 1.111 | 0.004 | – | 126.828 | 0.275 |
| 37 | | *Chanda ranga* | *Lal chanda* | 0.014 | 0.007 | 0.200 | 3.316 | 0.924 | 0.168 | 0.280 | 0.055 | 0.035 | – | – | 0.040 | 0.001 | 130.939 | 0.284 |
| 214 | | *Oryzias melastigma* | *Kanpona* | – | – | – | 0.053 | – | – | – | – | – | – | – | – | – | 1.183 | 0.003 |
| | Subtotal | | | 8.042 | 13.746 | 9.042 | 20.080 | 4.724 | 7.242 | 4.957 | 5.620 | 8.852 | 11.590 | 16.838 | 9.926 | 9.971 | 4452.464 | 9.647 |
| 998 | Others | Unidentified fish | | 0.578 | – | – | – | – | – | – | – | – | – | – | – | – | | – |
| 120 | | *Macrobrachium rosenbergii* | *Golda* | – | – | – | – | – | – | | – | – | | – | 1.523 | 1.060 | 102.475 | 0.222 |
| 941 | | *Neoeucirrhichthys maydelli* | *Gutum* | 0.103 | 3.927 | – | 0.108 | 0.022 | 0.012 | | – | | | – | – | 0.015 | 145.841 | 0.316 |
| 945 | | *Crab sp* | *Kakra* | – | – | – | – | – | – | – | 0.310 | 0.015 | – | – | – | – | 17.593 | 0.038 |
| 168 | | *Potamon* | *Kakra* | – | – | – | 0.040 | – | – | – | – | – | – | – | | – | 0.882 | 0.002 |
| 207 | | *Trionyx gangeticus* | *Kachhim* | – | – | – | – | – | – | – | – | – | – | 0.433 | – | – | 11.999 | 0.026 |
| 946 | | *Turtle* | *Dur kasim* | – | – | 24.100 | – | – | – | – | – | – | – | – | – | – | 616.827 | 1.336 |
| | Subtotal | | | 0.682 | 3.927 | 24.100 | 0.147 | 0.022 | 0.012 | – | 0.310 | 0.015 | – | 0.433 | 1.523 | 1.075 | 895.617 | 1.940 |
| | Grand total | | | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 46155.022 | 100 |

Note: – denotes zero catch

# APPENDIX 3

## Table I, Appendix 3 Monthly catch composition (% by weight) from Gobindapur floodplain: Hakaluki Haor (site NE10)

| Species Code | Habitat Preference | Species name: Scientific | Species name: Bengali | Year: 1993 Feb | Mar | April | May | June | July | Aug | Sep | Oct | Nov | Dec | Total annual catch (Mar'93 – Feb'94) Kg | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 941 | Riverine | *Neoeucirrhichthys maydelli* | *Gutum* | - | - | 1.061 | 0.100 | - | 0.015 | - | - | - | - | - | 1.140 | 0.009 |
| 198 | | *Somileptes gongota* | *Gharpoia* | - | 3.512 | - | - | - | - | - | - | - | - | - | 1.193 | 0.010 |
| 28 | | *Botia dario* | *Rani* | - | - | - | - | 0.215 | 0.065 | 0.189 | 0.015 | - | - | - | 18.408 | 0.151 |
| 29 | | *Botia lohachata* | *Putul* | - | - | - | - | 0.052 | - | - | - | - | - | - | 2.170 | 0.018 |
| 89 | | *Hilsa ilisha* | *Ilish* | - | - | - | - | - | - | 0.027 | - | - | - | - | 1.138 | 0.009 |
| 58 | | *Corica soborna* | *Kachki* | - | - | - | - | - | 0.008 | - | - | - | - | 0.006 | 0.163 | 0.001 |
| 2 | | *Ailia coila* | *Kajuli* | - | - | - | - | - | - | 0.088 | - | - | - | - | 3.706 | 0.030 |
| 52 | | *Clupisoma naziri* | *Muri bacha* | - | - | - | - | 0.040 | - | - | - | - | - | - | 1.658 | 0.014 |
| | Subtotal | | | - | 3.512 | 1.061 | 0.100 | 0.307 | 0.088 | 0.304 | 0.015 | - | - | 0.006 | 29.576 | 0.242 |
| 130 | Migratory | *Aorichthys aor* | *Ayre* | - | - | - | - | 0.218 | 0.340 | 0.010 | 0.415 | 0.160 | - | - | 20.676 | 0.170 |
| 135 | | *Aorichthys seenghala* | *Guizza* | - | - | - | - | 0.313 | 2.276 | 0.860 | 7.251 | 6.519 | - | - | 196.822 | 1.614 |
| 131 | | *Mystus bleekeri* | *Golsha tengra* | 1.267 | - | - | - | 0.374 | 0.041 | 0.051 | 0.275 | 0.670 | - | 0.570 | 25.896 | 0.212 |
| 132 | | *Mystus cavasius* | *Kabashi* | 1.115 | - | - | - | 0.056 | 0.114 | 0.358 | 0.636 | - | - | - | 24.522 | 0.201 |
| 134 | | *Mystus menoda* | *Ghagla* | - | - | - | - | - | - | 0.152 | - | - | - | - | 6.418 | 0.053 |
| 47 | | *Cirrhinus mrigala* | *Mrigel* | - | - | - | - | - | - | 0.767 | - | - | - | - | 32.366 | 0.265 |
| 48 | | *Cirrhinus reba* | *Raik* | - | - | - | - | - | - | 0.110 | - | - | - | - | 4.628 | 0.038 |
| 102 | | *Labeo calbasu* | *Kalbaus* | - | - | - | - | - | 0.227 | 2.866 | 6.981 | - | - | - | 178.029 | 1.460 |
| 104 | | *Labeo gonius* | *Goni* | - | - | - | - | - | 0.017 | - | 0.498 | 2.313 | - | - | 20.692 | 0.170 |
| 107 | | *Labeo rohita* | *Rui* | - | - | - | - | - | 0.103 | - | - | 1.889 | - | - | 15.647 | 0.128 |
| 188 | | *Salmostoma bacaila* | *Katari* | - | - | - | - | - | - | - | - | 0.156 | - | - | 1.122 | 0.009 |
| 189 | | *Salmostoma phulo* | *Fulchela* | - | 0.377 | 6.442 | 0.547 | 0.017 | 0.069 | 0.0001 | 0.725 | 1.004 | 0.618 | 6.257 | 24.679 | 0.202 |
| 86 | | *Gudusia chapra* | *Chapila* | - | - | - | - | 0.051 | 0.285 | 1.273 | 3.836 | 18.811 | 2.750 | 0.784 | 227.498 | 1.865 |
| 169 | | *Pseudeutropius atherinoides* | *Batasi* | - | 1.504 | 0.971 | - | - | - | 0.0001 | 0.197 | - | - | - | 2.701 | 0.022 |
| 209 | | *Wallagu attu* | *Boal* | - | - | - | - | - | - | - | - | 3.662 | - | - | 26.295 | 0.216 |
| 161 | | *Pellona ditchela* | *Chouka* | - | - | - | - | - | 0.016 | - | 0.571 | - | - | - | 4.613 | 0.038 |
| | Subtotal | | | 2.381 | 1.881 | 7.413 | 0.547 | 1.028 | 3.486 | 6.447 | 21.386 | 35.184 | 3.367 | 7.611 | 812.604 | 6.662 |
| 6 | Floodplain | *Anabas testudineus* | *Koi* | - | - | 1.628 | - | - | - | - | - | - | - | - | 1.180 | 0.010 |
| 136 | Resident | *Mystus tengara* | *Bajari tengra* | - | - | - | - | 0.004 | - | 0.148 | 0.038 | - | - | - | 6.699 | 0.055 |
| 137 | | *Mystus vittatus* | *Tengra* | 0.438 | - | 1.377 | 0.299 | 1.337 | 1.336 | 0.684 | 2.586 | 1.314 | - | 3.810 | 144.538 | 1.185 |
| 55 | | *Colisa fasciatus* | *Khalisha* | 4.141 | 3.011 | 1.672 | 9.317 | 0.069 | - | - | 0.308 | - | - | - | 14.515 | 0.119 |
| 211 | | *Colisa labiosus* | *Khalisha* | 2.555 | 4.642 | 1.873 | 2.942 | 0.035 | - | 0.0001 | - | - | - | - | 6.615 | 0.054 |
| 57 | | *Colisa sota* | *Khalisha* | 1.821 | 0.877 | - | - | 0.084 | 0.016 | - | - | - | - | - | 4.142 | 0.034 |
| 210 | | *Xenentodon cancila* | *Kaikka* | 0.215 | - | 0.324 | 0.747 | 0.018 | 0.037 | - | 0.038 | 0.501 | - | - | 6.201 | 0.051 |
| 62 | | *Cyprinus carpio* | *Karfu* | - | - | - | - | - | - | - | - | 4.086 | - | - | 29.339 | 0.241 |
| 187 | | *Osteobrama cotio cotio* | *Keti* | - | 0.503 | 4.470 | 0.348 | 0.586 | 0.592 | 1.116 | 1.338 | 0.235 | 0.618 | - | 99.325 | 0.814 |
| 174 | | *Puntius chola* | *Chala puti* | 3.333 | 0.627 | 7.760 | 0.896 | 0.767 | 1.744 | 2.464 | 0.869 | 3.575 | 9.742 | 2.705 | 216.846 | 1.778 |
| 175 | | *Puntius conchonius* | *Canchan puti* | 0.129 | 0.503 | 6.993 | 11.332 | 2.789 | 0.410 | 0.059 | 0.964 | 8.332 | - | 1.388 | 209.239 | 1.715 |
| 176 | | *Puntius gelius* | *Giliputi* | - | - | - | 2.211 | 0.038 | 0.042 | 0.126 | 1.034 | 0.107 | - | 0.507 | 18.327 | 0.150 |

(Cont.)

## Table I, Appendix 3 Monthly catch composition (% by weight) from Gobindapur floodplain: Hakaluki Haor (site NE10)

| Species Code | Habitat Preference | Species name: Scientific | Species name: Bengali | Year: 1993 Feb | Mar | April | May | June | July | Aug | Sep | Oct | Nov | Dec | Total annual catch (Mar'93 – Feb'94) Kg | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 177 | | *Puntius guganio* | *Mola puti* | – | – | – | – | – | – | – | 0.567 | 0.036 | – | – | 4.524 | 0.037 |
| 178 | | *Puntius phutunio* | *Phutani puti* | – | – | – | – | 0.045 | – | – | – | – | – | – | 1.901 | 0.016 |
| 180 | | *Puntius sophore* | *Puti* | 7.735 | – | 13.847 | 1.475 | 0.726 | 0.923 | 1.322 | 7.198 | 14.427 | 17.193 | 9.515 | 288.958 | 2.369 |
| 181 | | *Puntius terio* | *Teri punti* | – | – | – | – | 0.127 | 0.028 | – | 0.388 | 0.070 | – | – | 9.262 | 0.076 |
| 212 | | *Puntius ticto* | *Tit puti* | 0.022 | 1.381 | 2.591 | – | – | – | – | – | – | – | – | 2.347 | 0.019 |
| 4 | | *Amblypharygodon microlepis* | *Mola* | 0.716 | – | – | – | – | – | – | – | – | – | – | – | – |
| 5 | | *Amblypharygodon mola* | *Mola* | – | 1.381 | 6.005 | 5.228 | 0.448 | 0.050 | 0.655 | 2.941 | 0.650 | 1.651 | 9.695 | 90.518 | 0.742 |
| 68 | | *Danio devario* | *Chebli* | – | – | 0.648 | – | – | – | – | – | – | – | – | 0.470 | 0.004 |
| 75 | | *Esomus danricus* | *Darkina* | 0.476 | – | 1.433 | 1.154 | 0.033 | – | – | – | – | – | 1.550 | 4.363 | 0.036 |
| 83 | | *Glossogobius giurus* | *Bailla* | 4.293 | 1.584 | – | 5.175 | 2.646 | 2.009 | 0.242 | 0.557 | 0.446 | 1.651 | 1.290 | 175.063 | 1.435 |
| 43 | | *Chela cachius* | *Chep chela* | – | – | – | – | – | – | 0.0002 | – | – | – | 0.032 | 0.029 | 0.0002 |
| 110 | | *Lepidocephalus guntea* | *Gutum* | 6.132 | 0.877 | 16.635 | – | 0.131 | – | 0.0003 | 0.003 | 0.062 | – | 0.313 | 18.524 | 0.152 |
| 9 | | *Aplocheilus panchax* | *Kanpona* | – | – | – | – | – | – | 0.00002 | – | – | – | 0.006 | 0.005 | 0.00004 |
| 39 | | *Channa marulius* | *Gajar* | – | – | – | – | – | – | – | 0.318 | – | – | – | 2.394 | 0.020 |
| 41 | | *Channa punctatus* | *Taki* | 33.096 | 1.148 | 8.787 | 3.831 | 0.693 | 0.052 | 0.515 | 8.083 | 4.175 | 15.657 | 24.901 | 177.372 | 1.454 |
| 42 | | *Channa striatus* | *Shol* | – | – | – | – | – | – | – | – | – | – | 0.603 | 0.420 | 0.003 |
| 49 | | *Clarias batrachus* | *Magur* | – | 1.955 | – | – | 0.017 | – | 0.031 | – | 0.247 | – | – | 4.481 | 0.037 |
| 88 | | *Heteropneustes fossilis* | *Shingi* | 3.785 | 10.400 | 2.429 | – | 0.109 | 0.028 | 0.429 | – | 1.661 | 3.300 | 0.784 | 42.642 | 0.350 |
| 121 | | *Macrognathus aculeatus* | *Tara baim* | 1.159 | – | – | – | 0.097 | – | 0.111 | – | 0.052 | – | – | 9.089 | 0.075 |
| 123 | | *Macrognathus pancalus* | *Guchi* | 9.928 | 4.910 | 7.476 | 7.360 | 0.018 | 0.067 | – | 0.020 | 7.237 | 5.363 | 3.625 | 72.133 | 0.591 |
| 122 | | *Mastacembelus armatus* | *Baral baim* | – | – | – | – | 0.025 | – | 0.121 | 0.735 | – | – | – | 11.654 | 0.096 |
| 138 | | *Nandus nandus* | *Bheda* | – | – | 1.134 | – | 0.008 | – | 0.162 | – | 0.845 | – | 2.005 | 15.447 | 0.127 |
| 15 | | *Badis badis* | *Napit koi* | 0.284 | 0.250 | 0.492 | 0.490 | 1.624 | 0.152 | 0.052 | 0.024 | – | – | 0.125 | 74.230 | 0.609 |
| 147 | | *Ompok bimaculatus* | *Kani pabda* | – | – | – | – | 0.112 | – | 0.068 | – | – | – | – | 7.560 | 0.062 |
| 145 | | *Notopterus notopterus* | *Foli* | – | – | – | – | 0.202 | 0.239 | 2.973 | 1.673 | 1.368 | – | 0.281 | 161.345 | 1.323 |
| 203 | | *Tetraodon cutcutia* | *Potka* | – | – | – | – | 0.150 | 0.014 | 0.052 | 0.116 | – | – | – | 9.609 | 0.079 |
| 33 | | *Chaca chaca* | *Cheka* | – | – | – | – | 0.091 | – | 0.013 | 0.002 | – | – | – | 4.348 | 0.036 |
| 35 | | *Chanda baculis* | *Chanda* | – | 0.250 | 0.486 | 0.498 | 2.583 | 1.427 | 4.134 | 22.316 | 1.013 | – | – | 487.240 | 3.995 |
| 36 | | *Chanda nama* | *Nama chanda* | – | – | 0.244 | 1.360 | 1.572 | 0.786 | 2.929 | 1.678 | 0.325 | 0.205 | 0.063 | 221.516 | 1.816 |
| 37 | | *Chanda ranga* | *Lal chanda* | 2.855 | 3.135 | – | 5.045 | 1.763 | 0.481 | 0.459 | 1.770 | 0.039 | – | 1.097 | 122.020 | 1.000 |
| | Subtotal | | | 83.112 | 37.434 | 88.303 | 59.710 | 18.948 | 10.430 | 18.861 | 55.564 | 50.801 | 55.380 | 64.294 | 2776.430 | 22.763 |
| 931 | Other | Prawn spp. | *Chingri/Icha* | 14.507 | 57.174 | 3.221 | 39.643 | 79.716 | 85.995 | 74.387 | 23.034 | 14.014 | 41.252 | 28.090 | 8578.749 | 70.333 |
| | Subtotal | | | 14.507 | 57.174 | 3.221 | 39.643 | 79.716 | 85.995 | 74.387 | 23.034 | 14.014 | 41.252 | 28.090 | 8578.749 | 70.333 |
| | Grand total | | | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 12197.359 | 100 |

Notes: 1. No fishing activities were observed in January and February 1994

2. – denotes zero catch

**Table II, Appendix 3 Monthly catch composition (% by weight) from Tekuni floodplain: Hakaluki Haor (site NE08)**

| Species Code | Habitat Preference | Species name: Scientific | Species name: Bengali | Year: 1993 Feb | Mar | April | May | Aug | Sep | Oct | Nov | Dec | Total annual catch (Mar'93 – Feb'94) Kg | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 186 | Riverine | *Rita rita* | *Rita* | - | - | - | - | - | 0.252 | - | - | - | 1.370 | 0.012 |
| 17 | | *Barilius barila* | *Barali* | - | - | - | - | - | - | - | 0.009 | - | 0.530 | 0.005 |
| 59 | | *Crossocheilus latius* | *Kalabata* | - | - | - | - | - | - | - | 0.181 | 0.031 | 11.128 | 0.098 |
| 139 | | *Nemacheilus botia* | *Balichata* | - | 0.745 | - | - | - | - | - | 0.349 | 1.533 | 39.572 | 0.347 |
| 941 | | *Neoeucirrhichthys maydelli* | *Gutum* | - | 0.218 | 0.026 | - | - | - | - | 0.239 | - | 17.442 | 0.153 |
| 198 | | *Somileptes gongota* | *Gharpoia* | 7.737 | 2.708 | - | - | - | - | 0.198 | 0.121 | 0.908 | 50.519 | 0.443 |
| 28 | | *Botia dario* | *Rani* | - | - | - | - | - | - | - | 0.240 | - | 14.465 | 0.127 |
| 89 | | *Hilsa ilisha* | *Ilish* | - | - | - | 7.554 | - | 1.058 | - | - | - | 7.721 | 0.068 |
| 58 | | *Corica soborna* | *Kachki* | - | 1.617 | 0.012 | - | - | - | 0.018 | 3.847 | 0.308 | 254.772 | 2.233 |
| 92 | | *Hyporhampus gaimardi* | *Ek thota* | - | - | - | - | - | - | - | 0.358 | - | 21.603 | 0.189 |
| 923 | | *Sicamugil cascasia* | *Bata* | - | - | - | - | - | - | - | 0.362 | - | 21.860 | 0.192 |
| 2 | | *Ailia coila* | *Kajuli* | - | - | - | - | - | - | 0.021 | 0.056 | - | 3.787 | 0.033 |
| 51 | | *Clupisoma garua* | *Ghaura* | 1.577 | 2.954 | - | - | 29.166 | 7.284 | 0.201 | 0.136 | - | 121.227 | 1.063 |
| 52 | | *Clupisoma naziri* | *Muri bacha* | - | - | - | - | - | 0.164 | - | - | - | 0.894 | 0.008 |
| 74 | | *Erethistes pussilus* | *Kutakanti* | - | - | - | - | - | - | - | 0.004 | - | 0.253 | 0.002 |
| 81 | | *Gagata youssoufi* | *Gang tengra* | 0.182 | 0.019 | 0.023 | - | - | - | - | 0.711 | 0.530 | 46.503 | 0.408 |
| 87 | | *Hara hara* | *Kutakanti* | - | - | - | - | - | - | - | 0.013 | - | 0.755 | 0.007 |
| | Subtotal | | | 9.497 | 8.260 | 0.061 | 7.554 | 29.166 | 8.757 | 0.438 | 6.626 | 3.309 | 614.401 | 5.385 |
| 7 | Migratory | *Anguilla bengalensis* | *Bamosh* | - | 0.013 | - | - | - | - | - | - | - | 0.165 | 0.001 |
| 130 | | *Aorichthys aor* | *Ayre* | 1.125 | - | - | - | - | 0.994 | 21.197 | 2.425 | 5.778 | 571.682 | 5.011 |
| 135 | | *Aorichthys seenghala* | *Guizza* | - | 0.740 | 1.373 | - | 22.396 | 17.622 | 21.770 | - | - | 540.307 | 4.736 |
| 24 | | *Batasio batasio* | *Tengra* | - | 0.014 | - | - | - | - | - | - | - | 0.181 | 0.002 |
| 131 | | *Mystus bleekeri* | *Golsha tengra* | 3.428 | 1.124 | 6.822 | - | - | 4.700 | 0.900 | 1.339 | 41.529 | 452.503 | 3.966 |
| 132 | | *Mystus cavasius* | *Kabashi* | 6.985 | 1.331 | 1.137 | 10.300 | 4.948 | 4.749 | 45.701 | 0.137 | 5.070 | 932.385 | 8.172 |
| 134 | | *Mystus menoda* | *Ghagla* | - | - | - | - | - | - | - | 0.223 | - | 13.422 | 0.118 |
| 48 | | *Cirrhinus reba* | *Raik* | 0.948 | 0.323 | - | - | - | 1.104 | - | - | - | 10.092 | 0.088 |
| 100 | | *Labeo bata* | *Bata* | - | - | - | - | - | - | - | 0.010 | - | 0.596 | 0.005 |
| 101 | | *Labeo boga* | *Bhangan* | - | 0.012 | - | - | - | 0.413 | - | 0.304 | - | 20.748 | 0.182 |
| 102 | | *Labeo calbasu* | *Kalbaus* | - | - | - | - | - | 5.748 | 0.076 | 0.131 | - | 40.559 | 0.356 |
| 188 | | *Salmostoma bacaila* | *Katari* | - | - | - | - | - | - | - | 0.087 | 0.176 | 6.295 | 0.055 |
| 189 | | *Salmostoma phulo* | *Fulchela* | - | - | 0.156 | - | - | - | 0.015 | 2.617 | 0.884 | 164.976 | 1.446 |
| 154 | | *Securicula gora* | *Chora chela* | - | - | - | - | - | - | 0.089 | - | - | 1.614 | 0.014 |
| 86 | | *Gudusia chapra* | *Chapila* | 36.046 | 4.733 | 0.007 | 11.676 | - | 7.533 | 0.785 | 1.422 | 0.343 | 206.012 | 1.806 |
| 76 | | *Eutropiichthys vacha* | *Bacha* | - | 0.038 | - | 3.504 | - | 2.394 | 0.075 | - | - | 15.779 | 0.138 |
| 169 | | *Pseudeutropius atherinoides* | *Batasi* | - | 0.657 | 0.013 | - | - | - | - | - | - | 8.436 | 0.074 |
| 161 | | *Pellona ditchela* | *Chouka* | - | - | - | - | - | - | 0.053 | 3.238 | - | 196.296 | 1.721 |
| | Subtotal | | | 48.531 | 8.986 | 9.508 | 25.480 | 27.344 | 45.256 | 90.659 | 11.932 | 53.779 | 3182.048 | 27.891 |

(Cont.)



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Table II, Appendix 3 Monthly catch composition (% by weight) from Tekuni floodplain: Hakaluki Haor (site NE08)

| Species Code | Habitat Preference | Species name: Scientific | Species name: Bengali | Year: 1993 Feb | Mar | April | May | Aug | Sep | Oct | Nov | Dec | Total annual catch (Mar'93 – Feb'94) Kg | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 136 | Floodplain | *Mystus tengara* | *Bajari tengra* | – | 0.092 | 0.849 | – | – | – | – | – | – | 9.822 | 0.086 |
| 137 | Resident | *Mystus vittatus* | *Tengra* | – | 0.321 | 4.258 | – | – | – | 0.055 | 0.353 | 14.834 | 157.633 | 1.382 |
| 942 | | *Rama chandramara* | *Laia* | – | – | – | – | – | – | – | 0.025 | – | 1.511 | 0.013 |
| 55 | | *Colisa fasciatus* | *Khalisha* | – | – | 0.156 | – | – | – | – | – | – | 1.587 | 0.014 |
| 211 | | *Colisa labiosus* | *Khalisha* | – | – | 0.553 | – | – | – | – | – | – | 5.639 | 0.049 |
| 57 | | *Colisa sota* | *Khalisha* | – | – | 0.025 | – | – | – | – | – | – | 0.251 | 0.002 |
| 210 | | *Xenentodon cancila* | *Kaikka* | – | 3.459 | 1.565 | – | – | – | – | 0.006 | – | 60.030 | 0.526 |
| 187 | | *Osteobrama cotio cotio* | *Keti* | 2.375 | 0.353 | 0.677 | 2.404 | – | 0.346 | 0.009 | 0.270 | 0.013 | 30.377 | 0.266 |
| 174 | | *Puntius chola* | *Chala puti* | – | 0.273 | 2.253 | – | – | 0.364 | 0.066 | 0.460 | 1.756 | 67.754 | 0.594 |
| 175 | | *Puntius conchonius* | *Canchan puti* | 1.098 | 14.955 | 21.189 | – | – | – | – | 0.197 | 0.463 | 419.574 | 3.678 |
| 176 | | *Puntius gelius* | *Giliputi* | – | 1.985 | 0.678 | – | – | – | 0.006 | 0.124 | 0.013 | 39.690 | 0.348 |
| 177 | | *Puntius guganio* | *Mola puti* | – | – | – | – | – | – | – | 0.006 | – | 0.378 | 0.003 |
| 178 | | *Puntius phutunio* | *Phutani puti* | – | – | 0.046 | – | – | – | – | – | – | 0.472 | 0.004 |
| 180 | | *Puntius sophore* | *Puti* | 0.315 | 0.012 | 0.427 | – | – | 0.124 | 0.021 | 1.087 | 0.087 | 71.666 | 0.628 |
| 181 | | *Puntius terio* | *Teri punti* | – | 0.132 | 0.153 | – | – | – | – | 0.065 | – | 7.132 | 0.063 |
| 212 | | *Puntius ticto* | *Tit puti* | – | 0.007 | 2.664 | – | – | – | – | – | – | 27.227 | 0.239 |
| 5 | | *Amblypharygodon mola* | *Mola* | – | – | 0.118 | – | – | – | – | 0.006 | – | 1.560 | 0.014 |
| 182 | | *Rasbora daniconius* | *Darkina* | – | – | 0.035 | – | – | – | – | – | – | 0.361 | 0.003 |
| 83 | | *Glossogobius giurus* | *Bailla* | 5.181 | 1.135 | 1.095 | – | – | 1.997 | 0.384 | 4.223 | 2.353 | 312.072 | 2.735 |
| 110 | | *Lepidocephalus guntea* | *Gutum* | – | 0.349 | 0.929 | – | – | – | – | – | 0.158 | 14.807 | 0.130 |
| 9 | | *Aplocheilus panchax* | *Kanpona* | – | – | – | – | – | – | – | – | 0.009 | 0.052 | 0.0005 |
| 41 | | *Channa punctatus* | *Taki* | – | 0.623 | 0.035 | – | – | – | 0.141 | – | 0.891 | 16.071 | 0.141 |
| 88 | | *Heteropneustes fossilis* | *Shingi* | – | – | – | – | – | 0.399 | – | 0.013 | – | 2.941 | 0.026 |
| 121 | | *Macrognathus aculeatus* | *Tara baim* | – | 4.113 | 0.059 | – | – | – | – | – | – | 52.592 | 0.461 |
| 123 | | *Macrognathus pancalus* | *Guchi* | 5.042 | 11.402 | 8.748 | – | – | – | 0.152 | 0.157 | 4.222 | 270.464 | 2.371 |
| 122 | | *Mastacembelus armatus* | *Baral baim* | 26.036 | 1.103 | 0.701 | 60.444 | – | 32.732 | 3.478 | 1.380 | 7.874 | 408.168 | 3.578 |
| 138 | | *Nandus nandus* | *Bheda* | – | – | – | – | – | – | 0.176 | – | – | 3.194 | 0.028 |
| 15 | | *Badis badis* | *Napit koi* | – | – | 0.078 | – | – | – | – | – | – | 0.792 | 0.007 |
| 147 | | *Ompok bimaculatus* | *Kani pabda* | – | – | – | 4.119 | – | 0.802 | – | – | – | 5.438 | 0.048 |
| 148 | | *Ompok pabda* | *Madhu pabda* | – | 0.011 | 1.262 | – | 43.490 | – | – | – | – | 61.312 | 0.537 |
| 145 | | *Notopterus notopterus* | *Foli* | – | – | – | – | – | 7.935 | 0.422 | 5.606 | 1.558 | 398.279 | 3.491 |
| 203 | | *Tetraodon cutcutia* | *Potka* | – | 0.441 | 0.663 | – | – | – | – | 0.952 | – | 69.759 | 0.611 |
| 35 | | *Chanda baculis* | *Chanda* | 0.875 | 0.154 | 0.153 | – | – | 0.044 | 0.276 | 3.935 | 0.720 | 250.423 | 2.195 |
| 36 | | *Chanda nama* | *Nama chanda* | – | 0.082 | 0.208 | – | – | – | 0.044 | 0.965 | 0.297 | 63.909 | 0.560 |
| 37 | | *Chanda ranga* | *Lal chanda* | 0.174 | 2.425 | 0.736 | – | – | – | 0.012 | 1.884 | 0.273 | 153.611 | 1.346 |
| | Subtotal | | | 41.096 | 43.427 | 50.312 | 66.967 | 43.490 | 44.744 | 5.239 | 21.715 | 35.520 | 2986.548 | 26.177 |
| 931 | Others | Prawn spp. | *Chingri/Icha* | 0.875 | 39.327 | 40.119 | – | – | 1.242 | 3.663 | 59.726 | 7.391 | 4625.864 | 40.546 |
| | Subtotal | | | 0.875 | 39.327 | 40.119 | – | – | 1.242 | 3.663 | 59.726 | 7.391 | 4625.864 | 40.546 |
| | Grand total | | | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 11408.861 | 100 |

Notes: 1. No fishing activities were observed from June to July 1993 and January to February 1994

2. – denotes zero catch

**Table III, Appendix 3 Monthly catch composition (% by weight) from Tekuni/Baghalkuri Beel: Hakaluki Haor (site NE09/21)**

| Species Code | Habitat Preference | Species name: Scientific | Species name: Bengali | Year: 1993 Feb | Mar | April | Aug | Sep | Oct | Nov | Dec | Year: 1994 Jan | Feb | Total annual catch (Mar'93 – Feb'94) Kg | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 59 | Riverine | *Crossocheilus latius* | *Kalabata* | 0.206 | - | - | - | - | - | - | - | - | - | - | - |
| 139 | | *Nemacheilus botia* | *Balichata* | 0.336 | 0.237 | - | - | - | - | - | 0.244 | 0.181 | 0.024 | 132.503 | 0.167 |
| 941 | | *Neoeucirrhichthys maydelli* | *Gutum* | 3.838 | 2.518 | 0.017 | - | - | - | - | - | 0.040 | 0.224 | 50.519 | 0.064 |
| 198 | | *Somileptes gongota* | *Gharpoia* | 8.867 | 0.700 | 0.029 | - | - | 0.055 | - | - | 0.006 | 0.009 | 5.248 | 0.007 |
| 28 | | *Botia dario* | *Rani* | 0.110 | 0.164 | - | - | - | - | 1.490 | - | 0.001 | - | 7.218 | 0.009 |
| 89 | | *Hilsa ilisha* | *Ilish* | - | - | - | 3.913 | - | - | - | - | - | - | 4.367 | 0.006 |
| 58 | | *Corica soborna* | *Kachki* | 0.075 | - | - | - | - | - | 1.020 | 0.019 | 0.080 | 0.156 | 63.619 | 0.080 |
| 92 | | *Hyporhampus gaimardi* | *Ek thota* | - | - | - | - | - | - | - | 0.143 | 0.152 | 0.294 | 134.474 | 0.170 |
| 185 | | *Rhinomugil corsula* | *Khorsula* | - | - | - | - | - | - | - | - | - | 0.003 | 0.450 | 0.001 |
| 163 | | *Pisodonophis boro* | *Kharu* | 0.155 | - | - | - | - | - | - | - | - | - | - | - |
| 2 | | *Ailia coila* | *Kajuli* | - | - | - | 0.100 | - | 0.005 | - | - | - | - | 0.141 | 0.0002 |
| 51 | | *Clupisoma garua* | *Ghaura* | 1.098 | 4.265 | - | 23.959 | - | 1.940 | - | - | - | - | 43.065 | 0.054 |
| 52 | | *Clupisoma naziri* | *Muri bacha* | - | - | - | 0.929 | - | - | - | - | - | - | 1.037 | 0.001 |
| 74 | | *Erethistes pussilus* | *Kutakanti* | - | - | - | - | - | - | - | - | - | 0.004 | 0.483 | 0.001 |
| 81 | | *Gagata youssoufi* | *Gang tengra* | 0.275 | - | 0.020 | 0.878 | - | 0.017 | - | - | - | - | 1.208 | 0.002 |
| 87 | | *Hara hara* | *Kutakanti* | - | - | - | - | - | - | - | 0.013 | 0.008 | 0.002 | 6.218 | 0.008 |
| | Subtotal | | | 14.960 | 7.884 | 0.066 | 29.779 | - | 2.017 | 2.510 | 0.419 | 0.467 | 0.717 | 450.550 | 0.569 |
| 130 | Migratory | *Aorichthys aor* | *Ayre* | 0.784 | - | - | 36.377 | - | 7.128 | 5.031 | 1.256 | 0.916 | 0.201 | 783.934 | 0.991 |
| 135 | | *Aorichthys seenghala* | *Guizza* | - | - | 12.138 | 10.788 | 100.000 | 14.197 | 0.760 | 23.759 | 28.651 | 28.432 | 21289.607 | 26.901 |
| 131 | | *Mystus bleekeri* | *Golsha tengra* | 0.314 | 0.995 | 0.074 | 1.004 | - | 0.830 | 7.942 | 0.225 | 0.455 | 0.274 | 323.043 | 0.408 |
| 132 | | *Mystus cavasius* | *Kabashi* | 3.557 | 3.759 | 0.223 | 0.401 | - | 13.891 | 9.672 | 0.606 | 9.033 | 5.632 | 4922.733 | 6.220 |
| 134 | | *Mystus menoda* | *Ghagla* | - | - | - | - | - | 0.128 | - | - | 0.002 | - | 1.697 | 0.002 |
| 32 | | *Catla catla* | *Catla* | - | - | - | - | - | - | - | 0.059 | 0.011 | - | 16.710 | 0.021 |
| 47 | | *Cirrhinus mrigala* | *Mrigel* | - | - | - | - | - | 0.168 | - | 1.760 | 1.907 | 3.116 | 1602.342 | 2.025 |
| 48 | | *Cirrhinus reba* | *Raik* | 0.659 | 6.730 | 0.310 | 3.262 | - | 0.715 | 2.381 | 0.969 | 0.713 | 1.377 | 719.792 | 0.910 |
| 102 | | *Labeo calbasu* | *Kalbaus* | - | - | - | - | - | 1.242 | 11.802 | 0.138 | 1.014 | 0.035 | 533.144 | 0.674 |
| 104 | | *Labeo gonius* | *Goni* | - | - | - | - | - | 0.609 | - | 0.195 | 0.065 | 0.070 | 80.933 | 0.102 |
| 107 | | *Labeo rohita* | *Rui* | - | - | - | - | - | - | - | 1.809 | 1.256 | 0.819 | 1024.819 | 1.295 |
| 188 | | *Salmostoma bacaila* | *Katari* | - | - | - | - | - | - | 6.001 | 2.552 | 1.382 | 2.101 | 1427.762 | 1.804 |
| 189 | | *Salmostoma phulo* | *Fulchela* | 0.589 | - | - | - | - | - | 3.061 | 0.950 | 1.295 | 2.800 | 1141.119 | 1.442 |
| 154 | | *Securicula gora* | *Chora chela* | - | - | - | - | - | 0.503 | - | - | - | - | 2.730 | 0.003 |
| 86 | | *Gudusia chapra* | *Chapila* | 26.422 | 23.223 | 0.760 | 7.576 | - | 1.435 | 5.341 | 32.122 | 17.963 | 13.389 | 16237.553 | 20.517 |
| 76 | | *Eutropiichthys vacha* | *Bacha* | - | 2.133 | 0.349 | 1.505 | - | 0.413 | - | - | - | - | 9.239 | 0.012 |
| 169 | | *Pseudeutropius atherinoides* | *Batasi* | 0.055 | - | - | - | - | - | - | - | 0.549 | 0.114 | 253.897 | 0.321 |
| 209 | | *Wallagu attu* | *Boal* | - | - | 7.898 | - | - | - | 3.701 | 0.725 | 1.314 | 1.502 | 989.523 | 1.250 |
| 144 | | *Notopterus chitala* | *Chital* | - | - | - | - | - | - | - | - | 0.004 | - | 1.900 | 0.002 |
| 161 | | *Pellona ditchela* | *Chouka* | - | - | - | - | - | - | - | 0.121 | 0.025 | - | 35.729 | 0.045 |
| | Subtotal | | | 32.379 | 36.840 | 21.752 | 60.914 | 100.000 | 41.259 | 55.691 | 67.244 | 66.555 | 59.862 | 51398.206 | 64.945 |
| 136 | Floodplain | *Mystus tengara* | *Bajari tengra* | - | - | - | - | - | - | 1.730 | 0.377 | 0.110 | 0.008 | 133.692 | 0.169 |
| 137 | resident | *Mystus vittatus* | *Tengra* | 0.259 | - | 0.115 | - | - | 0.261 | - | 2.325 | 2.178 | 3.205 | 1849.019 | 2.336 |
| 942 | | *Rama chandramara* | *Laia* | - | - | - | - | - | - | - | - | 0.00001 | - | 0.003 | 0.000004 |
| 55 | | *Colisa fasciatus* | *Khalisha* | 0.027 | - | 0.040 | - | - | - | - | - | - | - | 0.274 | 0.0003 |
| 211 | | *Colisa labiosus* | *Khalisha* | - | - | 0.119 | - | - | - | - | - | - | - | 0.822 | 0.001 |
| 57 | | *Colisa sota* | *Khalisha* | - | - | 0.045 | - | - | - | - | - | - | - | 0.313 | 0.0004 |
| 210 | | *Xenentodon cancila* | *Kaikka* | - | 0.205 | 0.107 | - | - | - | 2.121 | 0.501 | 0.508 | 1.290 | 504.257 | 0.637 |

(Cont.)

**Table III, Appendix 3 Monthly catch composition (% by weight) from Tekuni/Baghalkuri Beel: Hakaluki Haor (site NE09/21)**

| Species Code | Habitat Preference | Species name: Scientific | Species name: Bengali | Year: 1993 Feb | Mar | April | Aug | Sep | Oct | Nov | Dec | Year: 1994 Jan | Feb | Total annual catch (Mar'93 – Feb'94) Kg | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 187 | | *Osteobrama cotio cotio* | *Keti* | 1.193 | 9.346 | 0.097 | 0.252 | – | 0.025 | 0.190 | 8.547 | 5.499 | 6.170 | 4971.982 | 6.282 |
| 174 | | *Puntius chola* | *Chala puti* | 0.055 | – | 0.051 | – | – | 0.027 | 0.730 | 1.227 | 0.479 | 1.379 | 645.644 | 0.816 |
| 175 | | *Puntius conchonius* | *Canchan puti* | 1.480 | 11.012 | 0.420 | – | – | – | 2.040 | 0.141 | 0.157 | 0.703 | 216.844 | 0.274 |
| 176 | | *Puntius gelius* | *Giliputi* | 0.310 | 0.056 | 0.153 | – | – | – | 1.700 | 0.013 | 0.024 | 0.038 | 26.847 | 0.034 |
| 178 | | *Puntius phutunio* | *Phutani puti* | – | – | 0.085 | – | – | – | 0.370 | – | 0.004 | – | 3.877 | 0.005 |
| 180 | | *Puntius sophore* | *Puti* | 1.066 | – | – | 0.626 | – | 0.080 | 1.080 | 1.413 | 0.680 | 2.631 | 938.500 | 1.186 |
| 181 | | *Puntius terio* | *Teri punti* | 0.149 | 4.282 | | – | – | – | – | – | – | – | 5.824 | 0.007 |
| 212 | | *Puntius ticto* | *Tit puti* | 0.078 | – | 0.017 | – | – | – | – | – | – | – | 0.117 | 0.0001 |
| 5 | | *Amblypharyngodon mola* | *Mola* | 0.103 | – | 0.017 | – | – | – | 0.900 | 0.459 | 0.240 | 0.272 | 238.238 | 0.301 |
| 75 | | *Esomus danricus* | *Darkina* | – | – | 0.017 | – | – | – | 0.590 | – | – | – | 2.741 | 0.003 |
| 182 | | *Rasbora daniconius* | *Darkina* | – | – | 0.017 | – | – | – | 0.400 | – | – | – | 1.896 | 0.002 |
| 83 | | *Glossogobius giurus* | *Bailla* | 3.251 | 1.079 | 0.113 | – | – | 0.999 | 3.141 | 5.235 | 2.698 | 2.532 | 2601.915 | 3.288 |
| 91 | | *Hypophthalmichthys molitrix* | *Silver carp* | – | – | – | – | – | 36.656 | – | – | 0.001 | 0.006 | 200.002 | 0.253 |
| 110 | | *Lepidocephalus guntea* | *Gutum* | 1.152 | 0.201 | 0.040 | – | – | – | 0.060 | 0.049 | 0.009 | – | 14.521 | 0.018 |
| 217 | | *Lepidocephalus thermalis* | *Puiya* | – | – | – | – | – | – | – | 0.044 | 0.008 | – | 12.514 | 0.016 |
| 39 | | *Channa marulius* | *Gajar* | – | – | – | – | – | – | 1.400 | 0.376 | 0.661 | 4.577 | 975.023 | 1.232 |
| 41 | | *Channa punctatus* | *Taki* | 4.138 | – | 4.550 | – | – | – | 1.100 | 0.010 | 0.002 | 0.004 | 39.679 | 0.050 |
| 42 | | *Channa striatus* | *Shol* | – | – | 2.747 | – | – | – | – | 0.040 | 0.022 | 0.066 | 45.620 | 0.058 |
| 49 | | *Clarias batrachus* | *Magur* | – | – | – | – | – | – | – | – | – | 0.002 | 0.225 | 0.0003 |
| 151 | | *Oreochromis nilotica* | *Nilotica* | – | – | – | – | – | – | – | – | 0.001 | – | 0.500 | 0.001 |
| 88 | | *Heteropneustes fossilis* | *Shingi* | – | – | – | – | – | – | – | – | 0.013 | 0.0003 | 5.540 | 0.007 |
| 121 | | *Macrognathus aculeatus* | *Tara baim* | – | – | 0.426 | 1.505 | – | 0.247 | – | – | – | 0.002 | 6.171 | 0.008 |
| 123 | | *Macrognathus pancalus* | *Guchi* | 18.799 | 9.243 | 0.129 | – | – | 0.041 | 0.730 | – | 0.0003 | 0.071 | 26.352 | 0.033 |
| 122 | | *Mastacembelus armatus* | *Baral baim* | 4.166 | 0.529 | 50.103 | – | – | 13.237 | 0.730 | 0.157 | 0.052 | 0.087 | 488.966 | 0.618 |
| 138 | | *Nandus nandus* | *Bheda* | 0.491 | – | – | – | – | 0.579 | – | – | 0.013 | 0.011 | 10.226 | 0.013 |
| 15 | | *Badis badis* | *Napit koi* | – | – | 0.017 | – | – | – | – | – | – | – | 0.117 | 0.0001 |
| 147 | | *Ompok bimaculatus* | *Kani pabda* | – | – | – | 6.648 | – | 0.452 | – | 1.408 | 6.895 | 2.261 | 3596.305 | 4.544 |
| 148 | | *Ompok pabda* | *Madhu pabda* | – | – | 0.045 | – | – | – | 2.751 | – | – | 0.017 | 14.794 | 0.019 |
| 145 | | *Notopterus notopterus* | *Foli* | – | – | – | – | – | 3.406 | 7.141 | 2.116 | 1.457 | 0.552 | 1190.416 | 1.504 |
| 203 | | *Tetraodon cutcutia* | *Potka* | 0.310 | 2.150 | 0.204 | – | – | – | 0.590 | 0.507 | 0.292 | 0.057 | 245.446 | 0.310 |
| 33 | | *Chaca chaca* | *Cheka* | – | – | 0.376 | – | – | – | – | 0.011 | 0.003 | – | 6.352 | 0.008 |
| 35 | | *Chanda baculis* | *Chanda* | 0.480 | 0.350 | 0.117 | 0.276 | – | 0.099 | 1.630 | 3.168 | 2.157 | 1.390 | 1780.153 | 2.249 |
| 36 | | *Chanda nama* | *Nama chanda* | 0.905 | 0.037 | 0.079 | – | – | – | 1.320 | 2.341 | 1.437 | 2.013 | 1376.682 | 1.740 |
| 37 | | *Chanda ranga* | *Lal chanda* | 1.124 | 0.288 | 0.215 | – | – | – | 1.840 | 0.099 | 0.060 | 0.016 | 58.696 | 0.074 |
| | Subtotal | | | 39.537 | 38.777 | 60.459 | 9.307 | – | 56.108 | 34.287 | 30.565 | 25.660 | 29.358 | 22237.105 | 28.098 |
| 998 | Others | Unidentified fish | | 2.354 | – | – | – | – | – | – | – | – | – | – | – |
| 120 | | *Macrobrachium rosenbergii* | *Golda* | – | – | – | – | – | – | – | – | 0.465 | – | 202.276 | 0.256 |
| 931 | | Prawn spp. | *Chingri/Icha* | 10.770 | 16.498 | 17.723 | – | – | 0.617 | 7.512 | 1.772 | 6.847 | 10.062 | 4851.522 | 6.130 |
| 207 | | *Trionyx gangeticus* | *Kachhim* | – | – | – | – | – | – | – | – | 0.004 | – | 1.800 | 0.002 |
| | Subtotal | | | 13.124 | 16.498 | 17.723 | – | – | 0.617 | 7.512 | 1.772 | 7.316 | 10.062 | 5055.598 | 6.388 |
| | Grand total | | | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 79141.461 | 100 |

Notes
1. No fishing activities were observed from May to July 1993
2. – denotes zero catch

Table IV, Appendix 3 Monthly catch composition (% by weight) from Baraimabad floodplain: MIP (site NE05)

| Species | Habitat | Species name | | Year: 1993 | | | | | | | | | | | Total annual catch (Mar'93 – Feb'94) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Code | Preference | Scientific | Bengali | Feb | Mar | April | May | June | July | Aug | Sep | Oct | Nov | Dec | Kg | % |
| 59 | Riverine | Crossocheilus latius | *Kalabata* | – | – | – | – | – | – | 0.190 | – | – | – | – | 4.39 | 0.032 |
| 139 | | *Nemacheilus botia* | *Balichata* | – | – | – | 0.117 | – | – | – | – | – | – | – | 3.284 | 0.024 |
| 941 | | *Neoeucirrhichthys maydelli* | *Gutum* | 0.051 | 0.157 | 0.149 | – | – | 0.053 | – | – | – | – | – | 1.221 | 0.009 |
| 28 | | *Botia dario* | *Rani* | – | – | – | – | – | 0.214 | – | 0.390 | – | – | – | 12.558 | 0.090 |
| 89 | | *Hilsa ilisha* | *Ilish* | – | – | – | – | – | – | – | 1.174 | – | – | – | 25.495 | 0.183 |
| 58 | | *Corica soborna* | *Kachki* | – | – | – | – | – | – | – | – | 0.304 | 0.081 | 0.001 | 9.058 | 0.065 |
| 185 | | *Rhinomugil corsula* | *Khorsula* | – | – | – | – | – | – | – | – | 0.045 | – | 2.292 | 5.983 | 0.043 |
| 923 | | *Sicamugil cascasia* | *Bata* | – | – | – | – | – | – | 0.120 | – | – | – | – | 2.762 | 0.020 |
| 163 | | *Pisodonophis boro* | *Kharu* | – | – | – | – | – | 0.107 | – | – | – | – | – | 2.045 | 0.015 |
| 2 | | *Ailia coila* | *Kajuli* | – | – | – | – | – | 2.047 | 0.188 | – | – | – | – | 43.476 | 0.313 |
| 51 | | *Clupisoma garua* | *Ghaura* | – | – | – | – | 2.527 | 0.239 | 0.338 | – | – | – | – | 29.593 | 0.213 |
| 16 | | *Bagarius bagarius* | *Baghair* | – | – | – | – | – | – | – | – | – | 0.097 | – | 0.926 | 0.007 |
| | Subtotal | | | 0.051 | 0.157 | 0.149 | 0.117 | 2.527 | 2.660 | 0.835 | 1.564 | 0.349 | 0.178 | 2.293 | 140.791 | 1.013 |
| 130 | Migratory | *Aorichthys aor* | *Ayre* | – | – | – | – | – | 0.174 | – | – | 0.519 | 0.049 | – | 17.937 | 0.129 |
| 135 | | *Aorichthys seenghala* | *Guizza* | – | – | – | – | 0.594 | 1.651 | 3.276 | 1.192 | 1.231 | – | – | 170.781 | 1.229 |
| 131 | | *Mystus bleekeri* | *Golsha tengra* | – | – | 6.817 | – | 0.316 | 0.312 | 0.082 | – | – | 0.438 | 0.229 | 20.316 | 0.146 |
| 132 | | *Mystus cavasius* | *Kabashi* | – | – | – | – | 0.628 | 0.131 | 0.216 | 0.054 | – | – | 1.974 | 17.055 | 0.123 |
| 32 | | *Catla catla* | *Catla* | – | – | – | – | – | – | – | 10.457 | – | – | – | 227.039 | 1.633 |
| 47 | | *Cirrhinus mrigala* | *Mrigel* | – | – | – | – | – | – | – | 0.623 | – | – | – | 13.52 | 0.097 |
| 48 | | *Cirrhinus reba* | *Raik* | – | – | – | – | – | – | – | 0.082 | 0.068 | – | – | 3.631 | 0.026 |
| 102 | | *Labeo calbasu* | *Kalbaus* | – | – | – | – | – | 0.225 | – | 1.517 | – | – | – | 37.225 | 0.268 |
| 104 | | *Labeo gonius* | *Goni* | – | – | – | – | – | 0.169 | – | – | – | – | – | 3.237 | 0.023 |
| 107 | | *Labeo rohita* | *Rui* | – | – | – | – | – | 0.024 | – | – | – | – | – | 0.462 | 0.003 |
| 188 | | *Salmostoma bacaila* | *Katari* | – | – | – | – | – | – | – | 0.339 | – | – | – | 7.363 | 0.053 |
| 189 | | *Salmostoma phulo* | *Fulchela* | 0.087 | – | – | – | – | 0.302 | 1.333 | 3.703 | 0.126 | – | 0.060 | 120.555 | 0.867 |
| 86 | | *Gudusia chapra* | *Chapila* | – | – | – | – | 0.014 | 0.053 | 1.011 | 11.718 | 4.552 | 1.081 | 0.919 | 415.366 | 2.988 |
| 76 | | *Eutropiichthys vacha* | *Bacha* | – | – | – | – | – | – | – | 0.054 | – | – | – | 1.167 | 0.008 |
| | Subtotal | | | 0.087 | – | 6.817 | – | 1.552 | 3.041 | 5.919 | 29.738 | 6.495 | 1.567 | 3.182 | 1055.654 | 7.594 |
| 6 | Floodplain | *Anabas testudineus* | *Koi* | – | – | – | – | 0.204 | 0.063 | – | 0.028 | 0.016 | – | – | 3.638 | 0.026 |
| 136 | Resident | *Mystus tengara* | *Bajari tengra* | – | – | – | – | 0.056 | 0.245 | 0.125 | – | – | – | – | 7.94 | 0.057 |
| 137 | | *Mystus vittatus* | *Tengra* | 0.325 | 0.862 | 0.750 | – | 1.345 | 1.969 | – | 0.386 | 0.580 | – | 15.765 | 104.723 | 0.753 |
| 942 | | *Rama chandramara* | *Laia* | – | – | – | – | – | 0.053 | – | – | – | – | – | 1.022 | 0.007 |
| 55 | | *Colisa fasciatus* | *Khalisha* | 4.305 | 3.309 | 1.590 | 5.625 | 0.014 | 0.194 | 1.046 | 0.652 | 0.118 | 0.146 | 0.862 | 209.285 | 1.506 |
| 211 | | *Colisa labiosus* | *Khalisha* | 1.423 | 1.486 | 0.967 | 0.761 | 0.310 | 0.610 | 1.152 | 0.823 | – | – | – | 81.112 | 0.583 |
| 57 | | *Colisa sota* | *Khalisha* | 0.919 | 1.193 | 1.550 | 1.644 | 0.406 | 1.608 | 0.063 | – | – | – | – | 82.933 | 0.597 |
| 210 | | *Xenentodon cancila* | *Kaikka* | 0.058 | – | – | – | 0.042 | 0.107 | 0.266 | 1.125 | 0.325 | – | – | 41.788 | 0.301 |
| 62 | | *Cyprinus carpio* | *Karfu* | – | – | – | – | – | 0.046 | – | 0.795 | – | – | – | 18.131 | 0.130 |
| 187 | | *Osteobrama cotio cotio* | *Keti* | – | – | – | – | 0.037 | – | 0.054 | – | 0.293 | – | – | 9.493 | 0.068 |
| 174 | | *Puntius chola* | *Chala puti* | 0.837 | 4.891 | 15.981 | 2.678 | 6.298 | 2.438 | 0.150 | 0.825 | 4.666 | 1.114 | 6.830 | 353.796 | 2.545 |
| 175 | | *Puntius conchonius* | *Canchan puti* | – | 0.193 | 4.025 | – | 0.823 | 0.013 | 0.028 | 0.553 | 0.478 | – | 0.092 | 35.184 | 0.253 |

(Cont.)



220

Table IV, Appendix 3 Monthly catch composition (% by weight) from Baraimabad floodplain: MIP (site NE05)

| Species Code | Habitat Preference | Species name: Scientific | Species name: Bengali | Year: 1993 Feb | Mar | April | May | June | July | Aug | Sep | Oct | Nov | Dec | Total annual catch (Mar'93 – Feb'94) Kg | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 176 | | *Puntius gelius* | *Giliputi* | 0.063 | – | – | 0.311 | 0.126 | 0.390 | 0.742 | 0.518 | 0.017 | – | 0.002 | 45.882 | 0.330 |
| 177 | | *Puntius guganio* | *Mola puti* | – | – | – | – | – | – | 0.010 | – | – | – | – | 0.229 | 0.002 |
| 178 | | *Puntius phutunio* | *Phutani puti* | 0.174 | 0.626 | 0.049 | 2.359 | 0.021 | – | – | 0.059 | – | – | – | 67.963 | 0.489 |
| 180 | | *Puntius sophore* | *Puti* | 10.560 | 30.401 | – | – | 3.156 | 4.362 | 2.123 | 2.264 | 6.492 | 0.776 | 12.467 | 428.077 | 3.079 |
| 181 | | *Puntius terio* | *Teri punti* | 0.080 | 0.626 | 0.100 | – | 0.337 | 0.149 | 0.340 | 0.133 | 0.208 | 0.347 | – | 25.23 | 0.181 |
| 212 | | *Puntius ticto* | *Tit puti* | 0.051 | – | – | 0.084 | – | 0.121 | – | – | – | – | – | 4.671 | 0.034 |
| 4 | | *Amblypharygodon microlepis* | *Mola* | 0.521 | – | – | – | – | – | – | – | – | – | – | – | – |
| 5 | | *Amblypharygodon mola* | *Mola* | 1.686 | 0.546 | 0.049 | – | 0.281 | 0.457 | 1.526 | 2.995 | – | – | – | 111.237 | 0.800 |
| 75 | | *Esomus danricus* | *Darkina* | – | – | – | – | 0.063 | – | – | – | – | 0.307 | 1.575 | 6.622 | 0.048 |
| 182 | | *Rasbora daniconius* | *Darkina* | 0.468 | 0.617 | 1.550 | 0.119 | – | 0.080 | – | – | 0.070 | – | – | 8.356 | 0.060 |
| 83 | | *Glossogobius giurus* | *Bailla* | 1.281 | 1.007 | 1.127 | 0.042 | 1.565 | 3.779 | 2.936 | 0.241 | 2.303 | 47.487 | 0.278 | 674.191 | 4.850 |
| 110 | | *Lepidocephalus guntea* | *Gutum* | 9.409 | 4.194 | 8.137 | 0.025 | 0.042 | 0.261 | 0.082 | – | 0.092 | – | 2.935 | 25.222 | 0.181 |
| 9 | | *Aplocheilus panchax* | *Kanpona* | 0.029 | – | – | – | – | – | – | – | – | – | – | – | – |
| 39 | | *Channa marulius* | *Gajar* | – | – | – | – | 4.938 | – | – | – | – | – | – | 33.656 | 0.242 |
| 41 | | *Channa punctatus* | *Taki* | 34.995 | – | 1.150 | 1.323 | 46.859 | 4.252 | 1.053 | 7.533 | 1.364 | 0.225 | 3.562 | 673.386 | 4.844 |
| 42 | | *Channa striatus* | *Shol* | – | – | – | – | – | – | – | – | 0.176 | – | – | 4.791 | 0.034 |
| 49 | | *Clarias batrachus* | *Magur* | – | – | – | 0.206 | 4.705 | 0.615 | 0.115 | 0.249 | – | – | 1.261 | 60.287 | 0.434 |
| 88 | | *Heteropneustes fossilis* | *Shingi* | 1.964 | 2.589 | 2.169 | – | 1.870 | 1.780 | 0.662 | 0.304 | 0.161 | 0.146 | 9.172 | 96.502 | 0.694 |
| 121 | | *Macrognathus aculeatus* | *Tara baim* | – | – | – | – | 0.285 | 1.070 | – | – | – | – | – | 22.392 | 0.161 |
| 123 | | *Macrognathus pancalus* | *Guchi* | 0.569 | 3.074 | 0.100 | 0.667 | 1.099 | 1.113 | – | 0.160 | 0.354 | 0.486 | 0.547 | 67.948 | 0.489 |
| 122 | | *Mastacembelus armatus* | *Baral baim* | – | – | – | – | 1.571 | – | 0.118 | 0.469 | 0.063 | – | – | 25.34 | 0.182 |
| 138 | | *Nandus nandus* | *Bheda* | – | – | – | 0.238 | 0.210 | 0.345 | – | 0.376 | 0.506 | – | – | 36.663 | 0.264 |
| 15 | | *Badis badis* | *Napit koi* | 0.202 | 0.234 | 0.049 | 0.630 | 0.042 | 0.080 | 0.468 | 0.078 | 0.162 | 3.242 | 0.002 | 67.462 | 0.485 |
| 147 | | *Ompok bimaculatus* | *Kani pabda* | – | – | – | – | – | 0.031 | 0.018 | – | – | – | – | 1.008 | 0.007 |
| 148 | | *Ompok pabda* | *Madhu pabda* | – | – | – | – | – | – | – | 0.062 | – | – | – | 1.354 | 0.010 |
| 145 | | *Notopterus notopterus* | *Foli* | – | – | – | – | 1.441 | 1.857 | 1.702 | 11.658 | 0.647 | 0.597 | – | 361.108 | 2.598 |
| 203 | | *Tetraodon cutcutia* | *Potka* | – | – | – | 2.237 | 0.140 | 0.428 | 0.386 | 0.191 | 0.333 | – | – | 94.068 | 0.677 |
| 33 | | *Chaca chaca* | *Cheka* | – | – | – | – | – | 0.059 | – | – | 0.008 | – | 0.259 | 1.88 | 0.014 |
| 35 | | *Chanda baculis* | *Chanda* | 0.174 | 0.312 | 1.860 | – | 2.423 | 4.114 | 30.774 | 6.719 | 2.636 | 0.383 | 0.194 | 1029.81 | 7.408 |
| 36 | | *Chanda nama* | *Nama chanda* | 0.087 | – | – | – | 0.281 | 1.250 | 15.212 | 15.885 | 20.050 | 0.541 | 0.146 | 1274.98 | 9.172 |
| 37 | | *Chanda ranga* | *Lal chanda* | 0.784 | 1.335 | 0.200 | 1.553 | 0.470 | 1.764 | 1.675 | 0.286 | 0.134 | 0.049 | 0.321 | 131.01 | 0.942 |
| | Subtotal | | | 70.962 | 57.493 | 41.402 | 20.502 | 81.461 | 35.701 | 62.823 | 55.365 | 42.251 | 55.846 | 56.269 | 6330.383 | 45.539 |
| 931 | Others | Prawn spp. | *Chingri/Icha* | 27.887 | 42.350 | 51.632 | 79.381 | 14.460 | 58.596 | 30.422 | 13.332 | 50.904 | 42.409 | 38.256 | 6374.30 | 45.855 |
| 945 | | *Crab sp* | *Kakra* | 1.013 | – | – | – | – | – | – | – | – | – | – | – | – |
| | Subtotal | | | 28.900 | 42.350 | 51.632 | 79.381 | 14.460 | 58.596 | 30.422 | 13.332 | 50.904 | 42.409 | 38.256 | 6374.307 | 45.855 |
| | Grand total | | | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 13901.135 | 100 |

Notes : 1. No fishing activities were observed in January and February 1994

2. – denotes zero catch

**Table V, Appendix 3 Monthly catch composition (% by weight) from Islampur floodplain: MIP (site NE02)**

| Species Code | Habitat Preference | Species name: Scientific | Species name: Bengali | Year: 1993 May | June | July | Aug | Sep | Oct | Nov | Dec | Total annual catch (Mar'93 – Feb'94) Kg | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 99 | Riverine | Labeo angra | *Angrot* | – | – | – | – | 0.014 | – | – | – | 0.232 | 0.002 |
| 941 | | *Neoeucirrhichthys maydelli* | *Gutum* | 0.061 | – | – | – | 0.004 | – | – | – | 1.464 | 0.012 |
| 28 | | *Botia dario* | *Rani* | – | – | 0.017 | – | – | – | – | – | 0.361 | 0.003 |
| 29 | | *Botia lohachata* | *Putul* | – | – | – | – | 0.158 | – | – | – | 2.700 | 0.021 |
| 89 | | *Hilsa ilisha* | *Ilish* | – | 0.066 | 0.918 | 0.068 | 1.215 | – | – | – | 43.327 | 0.343 |
| 85 | | *Gonialosa manmina* | *Goni chapila* | – | – | – | – | – | – | – | 1.210 | 1.844 | 0.015 |
| 58 | | *Corica soborna* | *Kachki* | – | – | – | – | 0.007 | 0.234 | 0.493 | 0.175 | 11.185 | 0.089 |
| 923 | | *Sicamugil cascasia* | *Bata* | – | – | – | – | 0.035 | – | – | – | 0.608 | 0.005 |
| 2 | | *Ailia coila* | *Kajuli* | – | – | – | – | 0.067 | – | – | – | 1.140 | 0.009 |
| 51 | | *Clupisoma garua* | *Ghaura* | – | – | – | 0.202 | 0.169 | – | – | – | 6.580 | 0.052 |
| | Subtotal | | | 0.061 | 0.066 | 0.934 | 0.270 | 1.668 | 0.234 | 0.493 | 1.385 | 69.441 | 0.550 |
| 130 | Migratory | *Aorichthys aor* | *Ayre* | – | 0.647 | 0.210 | – | 0.002 | – | – | – | 17.656 | 0.140 |
| 135 | | *Aorichthys seenghala* | *Guizza* | – | 0.035 | 0.101 | – | 3.692 | – | – | – | 66.181 | 0.525 |
| 131 | | *Mystus bleekeri* | *Golsha tengra* | 0.025 | 0.697 | 1.372 | 1.885 | 0.581 | – | – | – | 88.658 | 0.703 |
| 132 | | *Mystus cavasius* | *Kabashi* | – | 0.056 | 0.015 | 1.879 | 0.487 | – | – | – | 43.982 | 0.349 |
| 134 | | *Mystus menoda* | *Ghagla* | – | – | – | 0.380 | – | – | – | – | 6.903 | 0.055 |
| 32 | | *Catla catla* | *Catla* | – | – | – | – | 1.778 | – | – | – | 30.480 | 0.242 |
| 47 | | *Cirrhinus mrigala* | *Mrigel* | – | – | – | – | 6.124 | – | – | – | 104.965 | 0.832 |
| 101 | | *Labeo boga* | *Bhangan* | – | – | – | 0.058 | – | – | – | – | 1.050 | 0.008 |
| 102 | | *Labeo calbasu* | *Kalbaus* | – | 0.158 | 0.458 | – | 4.799 | – | – | – | 95.396 | 0.756 |
| 104 | | *Labeo gonius* | *Goni* | – | 0.547 | – | – | 0.540 | – | – | – | 20.286 | 0.161 |
| 107 | | *Labeo rohita* | *Rui* | – | – | – | – | 0.164 | – | – | – | 2.808 | 0.022 |
| 188 | | *Salmostoma bacaila* | *Katari* | – | – | 1.017 | – | 0.034 | – | – | – | 22.663 | 0.180 |
| 189 | | *Salmostoma phulo* | *Fulchela* | – | 1.063 | 1.219 | 1.147 | 1.249 | 0.021 | 0.194 | 0.992 | 95.546 | 0.757 |
| 86 | | *Gudusia chapra* | *Chapila* | – | 0.752 | 9.990 | 5.667 | 6.069 | 0.212 | 3.698 | 6.170 | 521.125 | 4.130 |
| 76 | | *Eutropiichthys vacha* | *Bacha* | – | 0.059 | 0.171 | – | 0.230 | – | – | – | 8.861 | 0.070 |
| 209 | | *Wallagu attu* | *Boal* | – | – | – | 2.001 | 3.075 | 10.083 | – | – | 143.890 | 1.140 |
| | Subtotal | | | 0.025 | 4.013 | 14.554 | 13.017 | 28.825 | 10.316 | 3.892 | 7.162 | 1270.450 | 10.069 |
| 6 | Floodplain resident | *Anabas testudineus* | *Koi* | 0.133 | 0.011 | 0.031 | 0.202 | 0.253 | – | – | – | 11.925 | 0.095 |
| 136 | | *Mystus tengara* | *Bajari tengra* | – | 0.866 | 0.711 | 0.408 | 0.053 | – | – | – | 41.220 | 0.327 |
| 137 | | *Mystus vittatus* | *Tengra* | 0.258 | 2.484 | 7.816 | 4.829 | 5.144 | 4.000 | – | – | 423.366 | 3.355 |
| 942 | | *Rama chandramara* | *Laia* | – | 0.174 | – | – | 0.003 | – | – | – | 3.570 | 0.028 |
| 55 | | *Colisa fasciatus* | *Khalisha* | 0.271 | 0.020 | 0.886 | 0.169 | 0.115 | 0.075 | 0.083 | 0.742 | 33.972 | 0.269 |
| 211 | | *Colisa labiosus* | *Khalisha* | 0.093 | 0.379 | 0.196 | 0.231 | – | 0.059 | – | – | 18.537 | 0.147 |
| 57 | | *Colisa sota* | *Khalisha* | 1.940 | 1.213 | – | 0.029 | 0.035 | – | – | – | 69.616 | 0.552 |
| 210 | | *Xenentodon cancila* | *Kaikka* | 0.045 | 2.073 | 2.425 | 0.940 | 0.488 | – | – | – | 120.923 | 0.958 |
| 62 | | *Cyprinus carpio* | *Karfu* | – | – | 0.448 | – | 3.013 | – | – | – | 61.357 | 0.486 |
| 187 | | *Osteobrama cotio cotio* | *Keti* | – | 0.163 | 0.032 | – | 0.004 | 0.035 | – | – | 4.249 | 0.034 |



(Cont.)

**Table V, Appendix 3 Monthly catch composition (% by weight) from Islampur floodplain: MIP (site NE02)**

| Species Code | Habitat Preference | Species name: Scientific | Species name: Bengali | Year: 1993 May | June | July | Aug | Sep | Oct | Nov | Dec | Total annual catch (Mar'93 – Feb'94) Kg | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 174 | | *Puntius chola* | *Chala puti* | 1.883 | 5.909 | 4.645 | 0.552 | 8.061 | 0.021 | – | 2.316 | 414.582 | 3.286 |
| 175 | | *Puntius conchonius* | *Canchan puti* | – | 2.252 | 0.010 | 0.257 | 0.143 | 0.243 | – | – | 54.054 | 0.428 |
| 173 | | *Puntius cosuatis* | *Kosuati* | – | – | – | – | – | 0.005 | – | – | 0.026 | 0.0002 |
| 176 | | *Puntius gelius* | *Giliputi* | – | 0.776 | 1.037 | 0.770 | 0.037 | 0.080 | 0.139 | 0.374 | 56.475 | 0.448 |
| 177 | | *Puntius guganio* | *Mola puti* | – | – | – | 0.034 | – | – | – | – | 0.615 | 0.005 |
| 178 | | *Puntius phutunio* | *Phutani puti* | 0.055 | 0.424 | – | – | – | 0.012 | 0.005 | 0.005 | 9.953 | 0.079 |
| 180 | | *Puntius sophore* | *Puti* | 0.118 | 9.854 | 3.791 | 1.171 | 6.041 | – | – | 3.482 | 413.776 | 3.279 |
| 181 | | *Puntius terio* | *Teri punti* | – | – | 0.083 | – | 0.038 | 0.091 | 0.009 | 0.836 | 4.400 | 0.035 |
| 212 | | *Puntius ticto* | *Tit puti* | – | – | – | – | 0.003 | – | – | – | 0.054 | 0.0004 |
| 5 | | *Amblypharygodon mola* | *Mola* | 0.075 | 3.138 | 2.020 | 1.456 | 2.108 | 0.017 | 0.009 | 0.010 | 171.715 | 1.361 |
| 75 | | *Esomus danricus* | *Darkina* | 0.040 | – | – | – | – | – | – | – | 0.899 | 0.007 |
| 182 | | *Rasbora daniconius* | *Darkina* | – | – | – | – | 0.189 | 0.050 | – | – | 3.512 | 0.028 |
| 83 | | *Glossogobius giurus* | *Bailla* | 0.068 | 0.114 | – | 0.371 | 0.504 | 1.427 | 0.141 | 2.129 | 32.954 | 0.261 |
| 91 | | *Hypophthalmichthys molitrix* | *Silver carp* | – | – | 1.927 | – | – | – | – | – | 41.844 | 0.332 |
| 110 | | *Lepidocephalus guntea* | *Gutum* | 1.182 | – | – | – | – | – | – | – | 26.825 | 0.213 |
| 39 | | *Channa marulius* | *Gajar* | – | – | – | – | 2.006 | – | – | – | 34.383 | 0.273 |
| 41 | | *Channa punctatus* | *Taki* | 12.641 | 0.763 | 5.000 | 10.688 | 8.188 | 30.015 | – | – | 908.728 | 7.202 |
| 42 | | *Channa striatus* | *Shol* | – | – | – | 0.930 | – | 2.195 | – | – | 28.840 | 0.229 |
| 49 | | *Clarias batrachus* | *Magur* | – | 0.084 | 1.971 | 0.660 | 0.365 | – | – | – | 62.761 | 0.497 |
| 88 | | *Heteropneustes fossilis* | *Shingi* | 1.623 | 0.379 | 1.977 | 2.557 | 1.112 | 0.271 | – | 0.852 | 155.744 | 1.234 |
| 121 | | *Macrognathus aculeatus* | *Tara baim* | – | 0.012 | 0.033 | – | – | – | – | – | 0.950 | 0.008 |
| 123 | | *Macrognathus pancalus* | *Guchi* | 0.042 | 0.516 | 0.668 | – | 0.211 | 0.372 | – | – | 31.512 | 0.250 |
| 122 | | *Mastacembelus armatus* | *Baral baim* | – | 0.548 | – | 0.470 | 3.783 | 4.739 | 0.014 | 0.015 | 110.483 | 0.876 |
| 138 | | *Nandus nandus* | *Bheda* | 0.138 | 0.334 | 0.173 | 0.569 | 0.883 | 0.101 | – | – | 39.662 | 0.314 |
| 15 | | *Badis badis* | *Napit koi* | 0.430 | 0.199 | – | 0.043 | 0.038 | 0.077 | 0.099 | 0.422 | 18.197 | 0.144 |
| 145 | | *Notopterus notopterus* | *Foli* | 1.057 | 1.331 | 0.643 | 27.182 | 8.957 | 1.499 | – | – | 720.841 | 5.713 |
| 203 | | *Tetraodon cutcutia* | *Potka* | – | 1.198 | 0.756 | 0.144 | – | 0.019 | 0.207 | 1.121 | 48.987 | 0.388 |
| 35 | | *Chanda baculis* | *Chanda* | 0.118 | 33.779 | 23.494 | 18.831 | 6.630 | 1.959 | 2.492 | 5.381 | 1716.878 | 13.607 |
| 36 | | *Chanda nama* | *Nama chanda* | – | 2.975 | 1.477 | 9.821 | 2.780 | 1.585 | 2.015 | 0.546 | 366.674 | 2.906 |
| 37 | | *Chanda ranga* | *Lal chanda* | 1.786 | 4.544 | 14.017 | 0.282 | 0.053 | 0.392 | 0.168 | 0.185 | 448.157 | 3.552 |
| | Subtotal | | | 23.993 | 76.512 | 76.265 | 83.596 | 61.237 | 49.337 | 5.379 | 18.417 | 6713.216 | 53.206 |
| 931 | Other | Prawn spp. | *Chingri/Icha* | 75.920 | 19.407 | 8.245 | 3.116 | 8.269 | 40.113 | 90.235 | 73.036 | 4564.264 | 36.174 |
| | Subtotal | | | 75.920 | 19.407 | 8.245 | 3.116 | 8.269 | 40.113 | 90.235 | 73.036 | 4564.264 | 36.174 |
| | Grand total | | | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 12617.371 | 100 |

Notes: 1. No fishing activities were observed from February to April 1993 and from January to February 1994

2. – denotes zero catch

Table VI, Appendix 3 Monthly catch composition (% by weight) from Patasinga Beel: MIP (site NE04)

| Species Code | Habitat Preference | Species name: Scientific | Species name: Bengali | Year: 1993 Feb | Mar | April | May | Aug | Sep | Oct | Nov | Dec | Year: 1994 Jan | Feb | Total annual catch (Mar'93 – Feb'94) Kg | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 59 | Riverine | *Crossocheilus latius* | *Kalabata* | – | – | – | – | – | – | – | – | – | 0.014 | – | 11.880 | 0.011 |
| 139 | | *Nemacheilus botia* | *Balichata* | 0.011 | – | – | – | – | – | – | – | 0.004 | 0.166 | 0.119 | 156.932 | 0.142 |
| 941 | | *Neoeucirrhichthys maydelli* | *Gutum* | – | – | – | – | – | – | – | – | 0.025 | – | – | 1.368 | 0.001 |
| 198 | | *Somileptes gongota* | *Gharpoia* | – | – | – | – | – | – | – | – | – | – | 0.0003 | 0.026 | 0.00002 |
| 28 | | *Botia dario* | *Rani* | – | – | – | – | – | – | – | – | – | 0.014 | 0.001 | 12.418 | 0.011 |
| 89 | | *Hilsa ilisha* | *Ilish* | – | – | – | – | – | 6.853 | 0.166 | – | – | – | – | 45.492 | 0.041 |
| 8 | | *Anodontostoma chacunda* | *Koi puti* | – | – | – | – | – | – | – | – | – | – | 0.041 | 3.849 | 0.003 |
| 85 | | *Gonialosa manmina* | *Goni chapila* | – | – | – | – | – | – | – | – | 0.190 | 0.416 | – | 375.316 | 0.340 |
| 58 | | *Corica soborna* | *Kachki* | – | – | – | – | – | – | 0.054 | 0.210 | 0.379 | 0.042 | – | 63.012 | 0.057 |
| 922 | | *Liza sp* | *Bata* | – | – | – | – | – | – | – | – | – | – | 0.039 | 3.664 | 0.003 |
| 51 | | *Clupisoma garua* | *Ghaura* | – | – | – | – | – | 0.566 | – | – | – | – | – | 3.060 | 0.003 |
| 45 | | *Chelonodon fluviatilis* | *Potka* | – | – | – | – | – | – | – | – | – | – | 0.039 | 3.644 | 0.003 |
| | Subtotal | | | 0.011 | – | – | – | – | 7.419 | 0.220 | 0.210 | 0.598 | 0.651 | 0.238 | 680.661 | 0.617 |
| 130 | Migratory | *Aorichthys aor* | *Ayre* | – | – | – | – | – | – | 0.676 | – | 0.170 | 17.816 | 21.881 | 17730.064 | 16.076 |
| 135 | | *Aorichthys seenghala* | *Guizza* | 1.671 | – | – | – | – | 2.901 | 1.014 | 0.616 | 0.027 | 0.166 | – | 223.538 | 0.203 |
| 131 | | *Mystus bleekeri* | *Golsha tengra* | 0.008 | 2.453 | 1.160 | – | 1.986 | 1.173 | 0.317 | – | – | 1.259 | 0.042 | 1139.614 | 1.033 |
| 132 | | *Mystus cavasius* | *Kabashi* | – | – | 2.330 | – | – | 1.671 | 0.059 | – | 0.008 | 0.554 | 0.107 | 517.325 | 0.469 |
| 134 | | *Mystus menoda* | *Ghagla* | – | – | – | – | – | – | 0.153 | – | – | – | – | 7.798 | 0.007 |
| 32 | | *Catla catla* | *Catla* | – | – | – | – | – | – | – | – | 0.670 | 2.085 | – | 1865.793 | 1.692 |
| 47 | | *Cirrhinus mrigala* | *Mrigel* | – | – | – | – | – | – | 1.131 | 1.413 | 0.055 | 2.948 | 3.916 | 3035.733 | 2.753 |
| 48 | | *Cirrhinus reba* | *Raik* | – | – | – | – | – | 0.020 | – | – | 0.096 | 0.175 | 0.008 | 159.518 | 0.145 |
| 102 | | *Labeo calbasu* | *Kalbaus* | – | – | – | – | – | – | 1.242 | 4.804 | 0.020 | 1.048 | 0.016 | 1055.093 | 0.957 |
| 104 | | *Labeo gonius* | *Goni* | 0.771 | – | – | – | – | – | – | – | – | 0.700 | 0.630 | 673.716 | 0.611 |
| 105 | | *Labeo nandina* | *Nandina* | – | – | – | – | – | – | – | – | 0.004 | – | – | 0.201 | 0.0002 |
| 107 | | *Labeo rohita* | *Rui* | – | – | – | – | – | – | – | 4.450 | – | 1.617 | 0.018 | 1485.082 | 1.347 |
| 188 | | *Salmostoma bacaila* | *Katari* | – | – | – | – | – | – | – | 0.004 | 0.159 | 0.684 | 0.053 | 613.453 | 0.556 |
| 189 | | *Salmostoma phulo* | *Fulchela* | 0.138 | – | – | – | – | 0.148 | 0.076 | 0.084 | 0.497 | 0.706 | 0.152 | 666.131 | 0.604 |
| 86 | | *Gudusia chapra* | *Chapila* | – | – | – | – | – | 37.985 | 5.656 | 0.731 | 10.917 | 13.043 | 0.033 | 12543.119 | 11.373 |
| 169 | | *Pseudeutropius atherinoides* | *Batasi* | – | – | – | – | – | – | – | – | 0.030 | 0.088 | – | 78.594 | 0.071 |
| 209 | | *Wallagu attu* | *Boal* | 0.843 | – | – | – | – | – | 2.933 | – | – | 4.158 | 0.849 | 3876.977 | 3.515 |
| 142 | | *Nemacheilus scaturigina* | *Dari* | – | – | – | – | – | – | – | – | 0.030 | 0.011 | – | 10.862 | 0.010 |
| 161 | | *Pellona ditchela* | *Chouka* | – | – | – | – | – | – | – | 0.030 | 0.040 | 0.016 | – | 16.998 | 0.015 |
| | Subtotal | | | 3.431 | 2.453 | 3.490 | – | 1.986 | 43.898 | 13.257 | 12.132 | 12.720 | 47.072 | 27.705 | 45699.609 | 41.436 |
| 6 | Floodplain | *Anabas testudineus* | *Koi* | 0.124 | – | – | – | – | – | – | – | – | 0.068 | 0.626 | 118.795 | 0.108 |
| 136 | Resident | *Mystus tengara* | *Bajari tengra* | 0.832 | – | – | – | – | 0.187 | – | – | 0.015 | 0.207 | 0.100 | 192.844 | 0.175 |
| 137 | | *Mystus vittatus* | *Tengra* | 0.077 | 2.818 | 0.209 | – | – | 20.046 | 1.995 | 0.774 | 2.727 | 1.669 | 2.069 | 2030.832 | 1.841 |
| 55 | | *Colisa fasciatus* | *Khalisha* | 1.038 | – | 0.552 | – | – | – | 0.016 | 0.041 | 0.096 | 0.260 | 0.191 | 254.903 | 0.231 |
| 211 | | *Colisa labiosus* | *Khalisha* | 0.003 | – | – | – | – | – | – | – | – | – | – | | |
| 57 | | *Colisa sota* | *Khalisha* | 0.122 | – | 0.372 | – | – | – | – | 0.002 | – | – | – | 1.416 | 0.001 |
| 210 | | *Xenentodon cancila* | *Kaikka* | 1.021 | – | – | – | – | – | 0.077 | – | 0.516 | 0.467 | 0.022 | 443.243 | 0.402 |
| 62 | | *Cyprinus carpio* | *Karfu* | – | – | – | – | – | – | – | – | – | 8.257 | – | 7244.865 | 6.569 |

(Cont.)

## Table VI, Appendix 3 Monthly catch composition (% by weight) from Patasinga Beel: MIP (site NE04)

| Species Code | Habitat Preference | Species name: Scientific | Species name: Bengali | Year: 1993 Feb | Mar | April | May | Aug | Sep | Oct | Nov | Dec | Year: 1994 Jan | Feb | Total annual catch (Mar'93 – Feb'94) Kg | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 187 | | *Osteobrama cotio cotio* | *Keti* | – | – | – | – | – | – | – | – | 0.127 | 0.281 | – | 253.657 | 0.230 |
| 174 | | *Puntius chola* | *Chala puti* | 0.844 | 1.370 | 0.254 | – | – | 0.202 | 2.202 | 0.475 | 3.413 | 1.001 | 5.823 | 1732.611 | 1.571 |
| 175 | | *Puntius conchonius* | *Canchan puti* | 0.004 | – | 0.216 | – | – | 0.042 | 0.022 | 0.015 | 0.165 | 0.123 | – | 119.365 | 0.108 |
| 173 | | *Puntius cosuatis* | *Kosuati* | – | – | – | – | – | – | – | – | – | 0.003 | – | 2.392 | 0.002 |
| 176 | | *Puntius gelius* | *Giliputi* | 0.026 | – | – | – | – | – | 0.033 | 0.032 | 0.037 | 0.118 | 0.023 | 109.403 | 0.099 |
| 178 | | *Puntius phutunio* | *Phutani puti* | 0.053 | – | 0.078 | – | – | – | – | 0.002 | – | – | – | 0.319 | 0.0003 |
| 179 | | *Puntius sarana* | *Sarputi* | – | – | – | – | – | – | – | – | 0.034 | – | – | 1.817 | 0.002 |
| 180 | | *Puntius sophore* | *Puti* | 13.319 | 26.187 | 0.281 | – | – | 0.118 | 4.050 | 5.718 | 4.798 | 1.830 | 3.378 | 2496.577 | 2.264 |
| 181 | | *Puntius terio* | *Teri punti* | 0.133 | – | – | – | – | – | 0.094 | 0.032 | 0.250 | 0.091 | 0.096 | 107.727 | 0.098 |
| 212 | | *Puntius ticto* | *Tit puti* | 0.078 | – | – | – | – | – | – | – | 0.001 | 0.0003 | – | 0.343 | 0.0003 |
| 5 | | *Amblypharyngodon mola* | *Mola* | 0.006 | – | – | – | – | – | 1.165 | – | 0.447 | 0.857 | 0.066 | 841.785 | 0.763 |
| 75 | | *Esomus danricus* | *Darkina* | 0.400 | – | – | – | – | – | – | – | – | 0.0003 | – | 0.281 | 0.0003 |
| 182 | | *Rasbora daniconius* | *Darkina* | 0.288 | – | – | – | – | – | – | 0.749 | – | 0.011 | – | 20.390 | 0.018 |
| 83 | | *Glossogobius giurus* | *Bailla* | 2.439 | – | 0.255 | 0.161 | – | 0.363 | 1.866 | 2.834 | 2.144 | 2.015 | 1.532 | 2167.849 | 1.966 |
| 91 | | *Hypophthalmichthys molitrix* | *Silver carp* | – | – | – | – | – | – | – | – | – | 0.002 | – | 1.500 | 0.001 |
| 110 | | *Lepidocephalus guntea* | *Gutum* | 2.433 | – | – | – | – | – | 0.022 | 0.007 | 0.424 | 0.534 | 0.429 | 532.653 | 0.483 |
| 39 | | *Channa marulius* | *Gajar* | 11.795 | 7.389 | – | – | – | – | 0.803 | 0.627 | – | 3.693 | 2.092 | 3492.846 | 3.167 |
| 41 | | *Channa punctatus* | *Taki* | 5.806 | 21.937 | 16.322 | 65.567 | 4.163 | 13.175 | 5.650 | 9.066 | 1.422 | 0.665 | 10.865 | 2300.123 | 2.086 |
| 42 | | *Channa striatus* | *Shol* | 1.116 | – | – | – | – | – | 5.131 | 7.266 | – | 0.200 | 0.121 | 554.762 | 0.503 |
| 49 | | *Clarias batrachus* | *Magur* | 0.831 | – | – | 4.344 | – | 0.053 | 0.106 | – | – | 0.215 | 0.861 | 278.224 | 0.252 |
| 88 | | *Heteropneustes fossilis* | *Shingi* | 0.816 | 2.680 | 9.503 | 22.566 | 4.099 | 3.434 | 0.075 | – | 0.353 | 0.660 | 7.538 | 1386.313 | 1.257 |
| 121 | | *Macrognathus aculeatus* | *Tara baim* | 0.038 | – | 0.169 | – | – | – | – | – | – | 0.046 | 0.406 | 78.709 | 0.071 |
| 123 | | *Macrognathus pancalus* | *Guchi* | 5.947 | – | 0.921 | – | – | 0.480 | 0.136 | 0.331 | 1.192 | 0.897 | 3.334 | 1182.256 | 1.072 |
| 122 | | *Mastacembelus armatus* | *Baral baim* | 0.307 | – | 0.324 | 1.890 | 35.868 | – | 0.482 | – | 0.651 | 0.443 | 0.216 | 514.010 | 0.466 |
| 138 | | *Nandus nandus* | *Bheda* | 0.974 | 23.466 | 0.701 | 1.046 | – | 0.072 | 0.038 | 0.039 | 1.987 | 0.273 | 9.723 | 1286.597 | 1.167 |
| 15 | | *Badis badis* | *Napit koi* | 0.047 | – | 0.235 | – | – | – | 0.088 | 0.364 | 0.023 | 0.045 | 0.001 | 51.322 | 0.047 |
| 149 | | *Ophisternon bengalense* | *Bamosh* | – | – | – | – | – | – | – | – | 0.094 | 0.606 | 0.523 | 585.466 | 0.531 |
| 148 | | *Ompok pabda* | *Madhu pabda* | – | – | – | – | – | – | – | – | – | 0.238 | 0.001 | 209.293 | 0.190 |
| 145 | | *Notopterus notopterus* | *Foli* | 0.797 | 5.130 | – | 4.426 | 53.884 | 8.392 | 7.099 | 11.605 | 0.621 | 5.822 | 5.202 | 6278.451 | 5.693 |
| 203 | | *Tetraodon cutcutia* | *Potka* | 2.391 | – | 1.666 | – | – | – | 0.005 | 0.060 | 0.136 | 0.513 | 0.039 | 468.521 | 0.425 |
| 33 | | *Chaca chaca* | *Cheka* | 0.374 | – | – | – | – | 0.746 | – | – | 0.147 | 0.299 | 0.615 | 331.819 | 0.301 |
| 35 | | *Chanda baculis* | *Chanda* | 5.947 | 6.570 | 0.034 | – | – | 1.194 | 3.105 | 0.793 | 6.073 | 0.900 | 0.265 | 1325.877 | 1.202 |
| 36 | | *Chanda nama* | *Nama chanda* | 0.534 | – | 0.019 | – | – | 0.059 | 1.670 | 0.458 | 1.771 | 0.844 | 0.220 | 949.729 | 0.861 |
| 37 | | *Chanda ranga* | *Lal chanda* | 8.387 | – | 0.510 | – | – | – | 0.272 | 0.090 | 0.090 | 0.031 | – | 49.345 | 0.045 |
| | Subtotal | | | 69.347 | 97.548 | 32.621 | 100.000 | 98.014 | 48.563 | 36.200 | 41.378 | 29.752 | 34.184 | 56.375 | 39999.230 | 36.268 |
| 931 | Others | Prawn spp. | *Chingri/Icha* | 27.210 | – | 63.888 | – | – | 0.013 | 50.322 | 46.279 | 56.929 | 18.090 | 15.266 | 23869.467 | 21.643 |
| 945 | | *Crab sp* | *Kakra* | – | – | – | – | – | 0.107 | – | – | – | – | – | 0.576 | 0.001 |
| 113 | | *Machrob. birmanicus* | *Chingri thengua* | – | – | – | – | – | – | – | – | – | – | 0.414 | 38.900 | 0.035 |
| | Subtotal | | | 27.210 | – | 63.888 | – | – | 0.120 | 50.322 | 46.279 | 56.929 | 18.090 | 15.680 | 23908.943 | 21.679 |
| | Grand total | | | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 110288.455 | 100 |

Notes:
1. No fishing activities were observed from June to July 1993
2. – denotes zero catch

# APPENDIX 4

**Table I, Appendix 4 Annual catch by gear from extrapolation areas in the MIP and Hakaluki Haor, March 1993 – February 1994**

| | MIP | | Hakaluki Haor | |
|---|---|---|---|---|
| Gear name | Catch (tonnes) | % | Catch (tonnes) | % |
| *Thella jal* | 899.07 | 40.63 | 1491.17 | 45.49 |
| *Ber jal* | 770.20 | 34.80 | 920.66 | 28.09 |
| *Current jal (Stationary)* | 126.01 | 5.69 | 187.95 | 5.73 |
| *Dora jal* | – | – | 182.38 | 5.56 |
| *Jhaki jal* | 47.19 | 2.13 | 119.37 | 3.64 |
| *Veshal* | 17.84 | 0.81 | 82.60 | 2.52 |
| *Daun* | 153.64 | 6.94 | 72.87 | 2.22 |
| *Deal trap* | 0.04 | 0.002 | 61.33 | 1.87 |
| *Katha* | 32.21 | 1.46 | 50.72 | 1.55 |
| *Koi jal* | 42.06 | 1.90 | 35.94 | 1.10 |
| *Doiar trap* | 21.98 | 0.99 | 24.83 | 0.76 |
| Net/Basket+Dewatering | – | – | 18.95 | 0.58 |
| *Sip* | – | – | 9.35 | 0.29 |
| Hand fishing | 3.81 | 0.17 | 5.93 | 0.18 |
| *Dhor jal* | 57.94 | 2.62 | 5.26 | 0.16 |
| By hand/Dewatering | 2.39 | 0.11 | 4.87 | 0.15 |
| *Kua* | 0.17 | 0.01 | 2.41 | 0.07 |
| *Urani* | 2.14 | 0.10 | 0.82 | 0.03 |
| *Uttar jal* | – | – | 0.30 | 0.01 |
| *Boat Katha* | – | – | 0.28 | 0.01 |
| *Ghori jal* | 18.95 | 0.86 | – | – |
| *Chabi jal* | 11.67 | 0.53 | – | – |
| *Dara jal* | 3.16 | 0.14 | – | – |
| *Ucha* | 2.28 | 0.10 | – | – |
| *Tui* | 0.23 | 0.01 | – | – |
| *Polo* | 0.03 | 0.001 | – | – |
| *Par jal* | – | – | – | – |

Note: – denotes zero catch

**Table II, Appendix 4 Annual catch composition from extrapolation areas in the MIP and Hakaluki Haor, March 1993 – February 1994**

| Habitat Preference | Species name | | MIP | | Hakaluki | |
|---|---|---|---|---|---|---|
| | Scientific | Bengali | Catch (tonnes) | % | Catch (tonnes) | % |
| Riverine | *Ailia coila* | *Kajuli* | 5.13 | 0.23 | 0.88 | 0.03 |
| | *Sicamugil cascasia* | *Bata* | 0.34 | 0.02 | 2.18 | 0.07 |
| | *Liza sp* | *Bata* | 0.01 | 0.0004 | – | – |
| | *Labeo angra* | *Angrot* | 0.01 | 0.0002 | – | – |
| | *Somileptes gongota* | *Gharpoia* | 0.0001 | 0.000002 | 5.24 | 0.16 |
| | *Hyporhampus gaimardi* | *Ek thota* | – | – | 3.01 | 0.09 |
| | *Rita rita* | *Rita* | – | – | 0.14 | 0.0042 |
| | *Hilsa ilisha* | *Ilish* | 4.06 | 0.18 | 0.95 | 0.03 |
| | *Bagarius bagarius* | *Baghair* | 0.11 | 0.0049 | – | – |
| | *Hara hara* | *Kutakanti* | – | – | 0.12 | 0.004 |
| | *Pisodonophis boro* | *Kharu* | 0.24 | 0.01 | – | – |
| | *Gonialosa manmina* | *Goni chapila* | 0.83 | 0.04 | – | – |
| | *Botia lohachata* | *Putul* | 0.06 | 0.003 | 0.29 | 0.01 |
| | *Gagata youssoufi* | *Gang tengra* | – | – | 4.66 | 0.14 |
| | *Clupisoma naziri* | *Muri bacha* | – | – | 0.32 | 0.01 |
| | *Chelonodon fluviatilis* | *Potka* | 0.01 | 0.0004 | – | – |
| | *Anodontostoma chacunda* | *Koi puti* | 0.01 | 0.0004 | – | – |
| | *Erethistes pussilus* | *Kutakanti* | – | – | 0.03 | 0.0009 |
| | *Barilius barila* | *Barali* | – | – | 0.05 | 0.0016 |
| | *Crossocheilus latius* | *Kalabata* | 0.54 | 0.02 | 1.11 | 0.03 |
| | *Nemacheilus botia* | *Balichata* | 0.72 | 0.03 | 4.79 | 0.15 |
| | *Corica soborna* | *Kachki* | 1.45 | 0.07 | 25.88 | 0.79 |
| | *Rhinomugil corsula* | *Khorsula* | 0.70 | 0.03 | 0.0030 | 0.0001 |
| | *Neoeucirrhichthys maydelli* | *Gutum* | 0.18 | 0.01 | 2.21 | 0.07 |
| | *Botia dario* | *Rani* | 1.51 | 0.07 | 3.96 | 0.12 |
| | *Clupisoma garua* | *Ghaura* | 3.71 | 0.17 | 12.39 | 0.38 |
| Subtotal | | | 19.60 | 0.89 | 68.21 | 2.08 |
| Migratory | *Labeo rohita* | *Rui* | 3.24 | 0.15 | 8.58 | 0.26 |
| | *Notopterus chitala* | *Chital* | – | – | 0.01 | 0.0004 |
| | *Aorichthys aor* | *Ayre* | 40.11 | 1.81 | 64.85 | 1.98 |
| | *Nemacheilus scaturigina* | *Dari* | 0.02 | 0.001 | – | – |
| | *Anguilla bengalensis* | *Bamosh* | – | – | 0.02 | 0.0005 |
| | *Catla catla* | *Catla* | 31.24 | 1.41 | 0.11 | 0.0032 |
| | *Salmostoma phulo* | *Fulchela* | 18.47 | 0.83 | 27.01 | 0.82 |
| | *Aorichthys seenghala* | *Guizza* | 23.10 | 1.04 | 214.92 | 6.56 |
| | *Cirrhinus mrigala* | *Mrigel* | 10.34 | 0.47 | 14.47 | 0.44 |
| | *Mystus menoda* | *Ghagla* | 0.21 | 0.01 | 2.21 | 0.07 |
| | *Eutropiichthys vacha* | *Bacha* | 0.34 | 0.02 | 1.64 | 0.05 |
| | *Mystus cavasius* | *Kabashi* | 7.46 | 0.34 | 127.56 | 3.89 |
| | *Pellona ditchela* | *Chouka* | 0.04 | 0.002 | 20.46 | 0.62 |
| | *Labeo bata* | *Bata* | – | – | 0.06 | 0.002 |
| | *Gudusia chapra* | *Chapila* | 88.99 | 4.02 | 153.72 | 4.69 |
| | *Labeo boga* | *Bhangan* | 0.02 | 0.0011 | 2.07 | 0.06 |
| | *Cirrhinus reba* | *Raik* | 0.76 | 0.03 | 6.18 | 0.19 |
| | *Labeo calbasu* | *Kalbaus* | 8.84 | 0.40 | 31.33 | 0.96 |
| | *Pseudeutropius atherinoides* | *Batasi* | 0.17 | 0.01 | 2.81 | 0.09 |
| | *Labeo gonius* | *Goni* | 2.26 | 0.10 | 3.29 | 0.10 |
| | *Securicula gora* | *Chora chela* | – | – | 0.18 | 0.01 |
| | *Labeo nandina* | *Nandina* | 0.0005 | 0.00002 | – | – |
| | *Salmostoma bacaila* | *Katari* | 2.67 | 0.12 | 9.80 | 0.30 |
| | *Wallagu attu* | *Boal* | 11.70 | 0.53 | 9.78 | 0.30 |
| | *Batasio batasio* | *Tengra* | – | – | 0.02 | 0.0005 |
| | *Mystus bleekeri* | *Golsha tengra* | 9.10 | 0.41 | 50.73 | 1.55 |
| Subtotal | | | 259.06 | 11.71 | 751.81 | 22.94 |
| Floodplain Resident | *Nandus nandus* | *Bheda* | 8.01 | 0.36 | 2.46 | 0.08 |
| | *Puntius cosuatis* | *Kosuati* | 0.01 | 0.0003 | – | – |
| | *Chaca chaca* | *Cheka* | 0.92 | 0.04 | 0.62 | 0.02 |
| | *Puntius chola* | *Chala puti* | 54.94 | 2.48 | 39.97 | 1.22 |
| | *Macrognathus aculeatus* | *Tara baim* | 2.91 | 0.13 | 6.51 | 0.20 |
| | *Puntius conchonius* | *Canchan puti* | 5.66 | 0.26 | 71.39 | 2.18 |
| | *Macrognathus pancalus* | *Guchi* | 12.68 | 0.57 | 36.88 | 1.13 |

Note: – denotes zero catch



(Cont.)

**Table II, Appendix 4 Annual catch composition from extrapolation areas in the MIP and Hakaluki Haor, March 1993 – February 1994**

| Habitat | Species name | | MIP | | Hakaluki | |
|---|---|---|---|---|---|---|
| Preference | Scientific | Bengali | Catch (tonnes) | % | Catch (tonnes) | % |
| | *Puntius gelius* | *Giliputi* | 7.24 | 0.33 | 6.60 | 0.20 |
| | *Chanda baculis* | *Chanda* | 167.40 | 7.56 | 101.70 | 3.10 |
| | *Puntius guganio* | *Mola puti* | 0.04 | 0.002 | 0.65 | 0.02 |
| | *Chanda ranga* | *Lal chanda* | 25.68 | 1.16 | 32.11 | 0.98 |
| | *Puntius phutunio* | *Phutani puti* | 8.20 | 0.37 | 0.33 | 0.01 |
| | *Mystus tengara* | *Bajari tengra* | 2.28 | 0.10 | 2.73 | 0.08 |
| | *Puntius sarana* | *Sarputi* | 0.004 | 0.0002 | – | – |
| | *Colisa fasciatus* | *Khalisha* | 25.86 | 1.17 | 2.11 | 0.06 |
| | *Puntius sophore* | *Puti* | 64.98 | 2.94 | 51.90 | 1.58 |
| | *Heteropneustes fossilis* | *Shingi* | 20.04 | 0.91 | 6.06 | 0.18 |
| | *Puntius terio* | *Teri punti* | 3.65 | 0.16 | 1.99 | 0.06 |
| | *Notopterus notopterus* | *Foli* | 75.20 | 3.40 | 68.99 | 2.10 |
| | *Rasbora daniconius* | *Darkina* | 1.10 | 0.05 | 0.05 | 0.0015 |
| | *Ompok pabda* | *Madhu pabda* | 0.60 | 0.03 | 6.22 | 0.19 |
| | *Badis badis* | *Napit koi* | 8.47 | 0.38 | 10.05 | 0.31 |
| | *Oreochromis nilotica* | *Nilotica* | – | – | 0.003 | 0.0001 |
| | *Aplocheilus panchax* | *Kanpona* | – | – | 0.007 | 0.0002 |
| | *Glossogobius giurus* | *Bailla* | 85.17 | 3.85 | 71.13 | 2.17 |
| | *Osteobrama cotio cotio* | *Keti* | 1.74 | 0.08 | 47.79 | 1.46 |
| | *Esomus danricus* | *Darkina* | 0.80 | 0.04 | 0.60 | 0.02 |
| | *Danio devario* | *Chebli* | – | – | 0.06 | 0.002 |
| | *Mastacembelus armatus* | *Baral baim* | 6.78 | 0.31 | 45.44 | 1.39 |
| | *Cyprinus carpio* | *Karfu* | 18.75 | 0.85 | 3.94 | 0.12 |
| | *Chanda nama* | *Nama chanda* | 164.15 | 7.42 | 44.83 | 1.37 |
| | *Clarias batrachus* | *Magur* | 9.32 | 0.42 | 0.60 | 0.02 |
| | *Mystus vittatus* | *Tengra* | 34.68 | 1.57 | 46.84 | 1.43 |
| | *Tetraodon cutcutia* | *Potka* | 13.73 | 0.62 | 9.81 | 0.30 |
| | *Channa punctatus* | *Taki* | 113.76 | 5.14 | 25.68 | 0.78 |
| | *Anabas testudineus* | *Koi* | 0.95 | 0.04 | 0.16 | 0.005 |
| | *Ophisternon bengalense* | *Bamosh* | 1.23 | 0.06 | – | – |
| | *Colisa sota* | *Khalisha* | 11.33 | 0.51 | 0.58 | 0.02 |
| | *Chela cachius* | *Chep chela* | – | – | 0.003 | 0.0001 |
| | *Xenentodon cancila* | *Kaikka* | 8.56 | 0.39 | 10.02 | 0.31 |
| | *Lepidocephalus guntea* | *Gutum* | 4.68 | 0.21 | 4.06 | 0.12 |
| | *Colisa labiosus* | *Khalisha* | 9.93 | 0.45 | 1.46 | 0.04 |
| | *Channa marulius* | *Gajar* | 12.07 | 0.55 | 6.48 | 0.20 |
| | *Puntius ticto* | *Tit puti* | 0.57 | 0.03 | 3.04 | 0.09 |
| | *Channa striatus* | *Shol* | 2.38 | 0.11 | 0.34 | 0.01 |
| | *Lepidocephalus thermalis* | *Puiya* | – | – | 0.08 | 0.002 |
| | *Hypophthalmichthys molitrix* | *Silver carp* | 0.95 | 0.04 | 1.26 | 0.04 |
| | *Rama chandramara* | *Laia* | 0.20 | 0.01 | 0.15 | 0.005 |
| | *Ompok bimaculatus* | *Kani pabda* | 0.16 | 0.01 | 24.28 | 0.74 |
| | *Amblypharyngodon mola* | *Mola* | 18.74 | 0.85 | 13.82 | 0.42 |
| Subtotal | | | 1016.50 | 45.93 | 811.77 | 24.76 |
| Others | *Machrob. birmanicus* | *Chingri thengua* | 0.08 | 0.004 | – | – |
| | *Macrobrachium rosenbergii* | *Golda* | – | – | 1.28 | 0.04 |
| | *Prawn spp.* | Chingri/Icha | 917.76 | 41.47 | 1644.93 | 50.18 |
| | *Trionyx gangeticus* | *Kachhim* | – | – | 0.01 | 0.0004 |
| | *Crab sp* | *Kakra* | 0.001 | 0.00005 | – | – |
| Subtotal | | | 917.84 | 41.47 | 1646.22 | 50.22 |
| Grand total | | | 2213 | 100 | 3278 | 100 |

Note: – denotes zero catch