MACH

Management of Aquatic Ecosystems through Community Husbandry

Baseline Report on Fisheries, Vegetation, Wildlife and Household Protein Consumption

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A project of the Government of Bangladesh
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Project Partners:
Winrock International
Bangladesh Centre for Advanced Studies (BCAS)
Center for Natural Resource Studies (CNRS)
CARITAS Bangladesh

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List Of Acronyms And Abbreviations

NGO: Non-Governmental Organization
BCAS: Bangladesh Center for Advanced Studies
CARITAS:
USAID: United States Agency for International Development
CNRS: Center for Natural Resource Studies
MACH: Management of Aquatic Ecosystem through Community Husbandry
RRA: Rapid Rural Appraisal
CPUA: Catch per Unit Area
CPUE: Catch per Unit of Effort
IUCN: The World Conservation Union International Union of Conservation Nature

Executive Summary

Management of Aquatic Ecosystem through Community Husbandry (MACH) began mobilization and inception in October 1998 with financial assistance from USAID. Winrock International with Center for Natural Resource Studies (CNRS), Bangladesh Center for Advanced Studies (BCAS) and CARITAS field activities began in *Hail Haor* at *Moulvibazar* and *Turag-Bangshai* floodplain at *Gazipur* and *Tangail* in April 1999. Activities in the *Kongshaw-Malijhi* basin at *Sherpur*, the third site, was not begun until June of 2000.

The overall goal of the MACH project is to " *Promote ecologically sound management of floodplain resources (fisheries and other wetland products) for the sustainable supply of food to the poor of Bangladesh*".

The Center for Natural Resource Studies (CNRS), a partner for implementing the project has a large role in project impact monitoring.

This report concentrates on the baseline description for fisheries, wildlife and vegetation of the floodplains of two of three MACH sites. The baseline has been considered for a year from the inception of the project field activities. The report includes the baseline conditions of the Hail Haor and Turag-Bangshi floodplains. The baseline for the Malijhee-Kongshow basin will be included after the completion of 1 year of baseline sampling

There are eight monitoring locations in Hail Haor and eight monitoring locations in the Turag-Bangshi site. The locations have been selected for the fisheries monitoring considering spatial variation, habitat and fisher community dependence. Consideration has been given to the hydrological and inundation regime while selecting monitoring locations. During the baseline study, the following parameters have been monitored; Fishing gear type and number, length, height, width and mesh. Fisher type, sex, age, village and distance from fishing ground. Fishing start time, end time, duration of fishing, species by number and weight and fishing rights Considering the complexity of the fishing practice and to portray the real world scenario regarding fish catch assessment a comprehensive sampling protocol has been designed and data have been gathered accordingly. The protocol includes sampling intensity, selection and sampling of the operated gears, spatial and temporal coverage of the observed gears and the counting of the operated gear within the monitoring locations/habitats.

Data has been analyzed considering season, fishing gears, fishing intensity and duration of fishing, Catch per Unit of Effort (CPUE), Catch per Unit of Area (CPUA), catch composition and species diversity.

Findings show that there are professional, seasonal professional and subsistence fishers in both the sites. There are also different types of access to the water body for fishing. Turag-Bangshi site is functionally open access with a few exceptions in the kathas and pagars. In Hail haor more than 50% of resource is open access and the rest is limited access and access against payment.

There are 13 types of gears used within Hail Haor and 10 gear types outside. There are 26 types of gear used in the Turag-Bangshi site.

The intensity of fishing varies from season to season and for the fisher category. It is evident that the "current jal" is the most heavily operated gear in all the monitoring locations. But it is also noticed that the "current jal" is either not operated or rarely operated in the canals and rivers. The Scoop net is more popular among the subsistence fisher and mostly operated in the floodplain or in the shallower region of the habitat.

Fishing duration or the operational hours of fishing varies considerably among the gears and sites and fisher types. It is not practical to standardize the fishing hour to incorporate into the CPUE. But these have direct affect

in estimating the catch and thereby see the trend or measure the changes of the impacts. The operational hour of the common gears has been recorded to consider the same during impact monitoring of the project interventions.

Total catch from monitoring locations/habitats has been estimated. Catch per unit of Area (CPUA) has also been estimated at 164 kg/hectare/year within the hail haor and 308 Kg/hectare/year out side the hail haor. It reveals the importance of the connectivity of the water body. Hail haor was connected to the Kushiara river system before closing the Kamarkhali and Shakha Borak River two decades back. MACH has conducted a feasibility study on reconnecting the system considering biological, socio-economic and technical aspects.

CPUA for the Turag site has been estimated at 51 Kg/hectare/year.
Because of the absence of historical trend data for fish catch for the project sites, such things as catch per unit of area will likely be highly variable from year to year irregardless of MACH interventions. The project has attempted to gather data in as robust a fashion as possible. Because of the high variability, depending on the hydrologic year, MACH attempted to use a "control" to hopefully be able see trends in the data.

Catch per unit of effort (CPUE) of the commonly operated gears has been estimated and findings show wider variation among gears, habitats and over months.

The Catch composition both by species and by grouping (Guild) of species is represented in the report. The composition shows a dominance of small fish. Dominance of small fish reveals over fishing with fine mesh and scarcity of broodfish. Another feature of the catch composition is the abundance of prawn in the catch of Hail Haor. Prawn can survive in the hash dry season. The fact that there is a dominant prawn in the catch might indicate that they are surviving in the smaller areas of water during the dry season whereas the fish species are doing poorly. The scenario is a bit different in the Turag-Bangshi.

Detrimental fishing practices such as dewatering is very common in Hail Haor. Out of 40-monitored beels 39 were found dewatered in 1999. Pagar katha fisheries are there both in the Turag and Hail Site. Fortunately dewatering is not prevailing in the Turag site. The reason to dewater on such a large scale probably due to revenue oriented leasing system and lack of environmental consideration by the lease. The law in this case is also not being enforced.

Species diversity for the habitats, locations (zonal) and regions has been determined from the observation of the species throughout the year. Monthly and seasonal abundance of the species has also been recorded A total of 68 and 79 species has been recorded in within and outside the Hail haor respectively. A total of 83 fish species has been recorded in Turag-Bangshi site.

In the Hail Haor site, 490 households have been selected from 14 villages while 280 households have been selected from 8 villages in Turag-Bangshi site for household consumption monitoring. In both the sites, 35 sample households have been selected from each village for household monitoring. Data are being collected by local enumerators (Resident Monitors) at a certain interval from each of the households through measuring and monitoring of fish brought in the households for consumption. Data collection from households began in September 1999 in Hail Haor and from October 1999 in Turag-Bangshi site. Land holding size of each household has also been differentiated prior to selecting the household sample from the villages Fish consumption has been documented along with other consumed protein including meat, egg, milk and pulse Overall fish consumption for the Hial haor site per household per day is about 46g while over 26g for Turag-Bangshi site. November-December and October-November has been found most fish consumed months for Hail haor and Turag-Bangshi site respectively.

Wildlife of MACH Project sites has been surveyed following transect-quadrate method. Transects covering different habitats have been drawn both for Hail haor and *Turag-Bangshi* site. Occurrence of *amphibia, reptilia, mammals* and *avifauna* have been recorded through interviewing local people like fishers, boatman, forest wood

collectors and many other professionals who are active in that area about the wildlife and their diversity and reviewing the relevant literature. Survey has been conducted during Wet season (March-August) and dry season (September-February) to cover the whole year. A total of 165 wildlife has been found in the hail haor site while 144 in the Turag-Bangshi. A cumulative total of 196 wildlife including *amphibia, reptilia, mammals* and *avifauna* have been recorded at two MACH sites.

Natural resources of both aquatic and terrestrial are very complex and dynamic. The various factors and the interaction of the fisher and the resource user are of utmost importance for the soundness of the project site. This report is to establish a base line scenario and benchmarks to use for measuring the possible changes due to the project intervention.

This report presents following sections;

Section A: Fish Catch
Section B: Household Protein Consumption
Section C: Wildlife
Section D: Vegetation

Section A

Fish Catch

1. Introduction

The aquatic and terrestrial ecosystem of Bangladesh supports a rich diversity of flora and fauna providing food, employment and other economic benefits. MACH has been developed to implement community approaches to natural resources management, habitat restoration and the conservation of floodplain aquatic ecosystems. The GOB program began in October 1998 with financial assistance from USAID. The NGOs Winrock International, CNRS, BCAS and CARITAS are implementing the project at three different floodplain ecosystems—the Hail Haor basin in Moulvibazar (March 1999), the Turag-Bangshi basin in Gazipur and Tangail district (April 1999) and in the Kongshaw-Malijhi basin in Sherpur (August 2000).

This document seeks to establish baseline data for the fisheries, household protein consumption, wildlife and vegetation of the floodplains by providing the results of a year's work at the Hail Haor and Turag-Bangshi floodplain sites. The results for the fieldwork at the Malijhee-Khangsa basin will be presented in November 2001.

1.1 Goals and Objectives

The overall goal of the MACH project is to promote ecologically sound management of floodplain resources for the sustainable supply of food to the poor of Bangladesh.

Specific objectives of the projects are:

- To maintain or recover the selected natural floodplain ecosystem and associated fisheries
- To promote community and local government systems of co-management of floodplain resources
- To promote equitable access by the local population to the natural resources of the floodplain
- To identify alternative income generating activities that will result in reducing the ecological impact on the floodplain fisheries
- To raise awareness at the community and government levels of the importance and potential of natural floodplain processes in order to secure food and income for the poor people of Bangladesh

2. Methodology

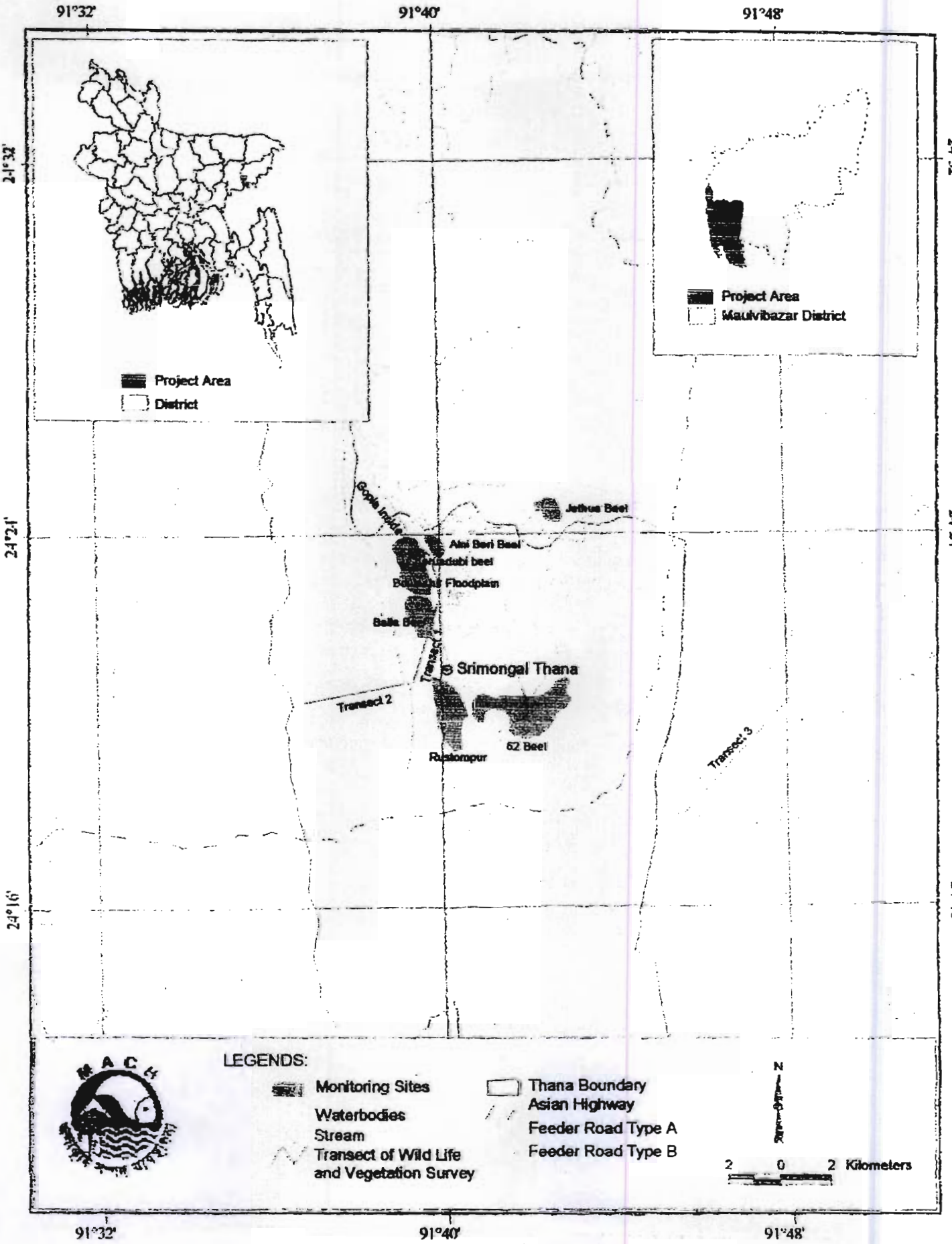
In order to establish a baseline understanding of fishery yield and species diversity a comprehensive fish catch assessment program was developed and implemented. To portray the fisheries scenario and to develop a measurable fisheries baseline database various parameters were considered; habitat stratification, monitoring site selection, data collection protocols and standardization of catch efforts were different analytical tools utilized in the survey and in this report. Data was also collected through fish catch assessment monitoring and for this purpose a structured questionnaire was developed and used (Appendix 1).

2.1 Habitat Stratification

Biological productivity is a function of the ecological condition of the habitat which is governed by the landscape and hydrological regime of the area. The spatial and temporal variation in the project areas is high and fishing and gear techniques vary considerably at the different habitat locations. In order to portray a fish catch scenario that represents the project area the habitats have been stratified into rivers, canals, beels and floodplains. The selection criteria also included the geographical distribution over the project site, water flow, inundation regime and biological zone of the area. The baseline conditions will be used in some cases to measure parameter changes after appropriate interventions and future implementation of fisheries management. The changes expected will be both local (in a specific habitat) and global (throughout the project site areas). Accordingly a number of locations and habitats were selected and are being monitored. Both a "test" area inside the project and a control area outside the project have been identified and monitoring will continue in both.

Map - 1

Fish Catch Monitoring Locations in Hail Haor Site



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2.2 Monitoring Site Selection

A wetland inventory and resource mapping exercise was conducted by MACH in Hail Haor and the Turag-Bangshi project sites in April 1999. The monitoring sites were selected using the findings of the wetland inventory and the criteria mentioned in the previous section. Potential intervention sites for impact monitoring were chosen by the MACH project and by a Participatory Community Planning group made up of local people. These sites are Jethua Beel, 62-Beel Complex, Balla Bell and the Rustompur floodplain in the Hail Haor basin and Mokash Beel North, Mokash Beel South, Kali-daha Beel, Mokash Khal, Aowla Beel, and Aowla Khal in the Turag-Bangshi study area.

2.2.1 Hail Haor

Hail Haor is a large basin bounded by hills in the south, east and west. During the wet season about 12,490 hectares in the basin are flooded. During the dry season less than 2,000 hectares are underwater although during some very dry years only about 500 hectares remain underwater. The Gopla is the only river draining the basin. The results of the wetland inventory and resource mapping show that there are different types of water bodies in Hail Haor. These include beels, canals, rivers and seasonally inundated floodplains. The beel is the predominant water body type in the Hail Haor basin with 131 spread over the area. Most of the perennial beels are located in the center of the Haor, the deepest part, while seasonal beels are located mostly in and around the raised ridge of the basin. According to local fishermen and villagers, fish production varies among the beels depending on location and physical features with a trend towards higher production in the deeper perennial beels and the perennial Gopla River.

In order to ensure spatial and habitat representation, data have been collected from eight locations (Map 1) within the Haor. In selecting the monitored sites emphasis was also put on potential future intervention sites. The Hail Haor basin is functionally isolated from the source river Kushyiara due to the closure of the Kamarkhali Canal. This effectively blocks the migration of riverine species into the Hail Haor system. In order to compare species diversity both within and outside of the Hail Haor site fish catch data was also collected from six monitoring locations outside the Haor. The monitoring locations with their different types of habitats are presented in Table 1. Fish catch monitoring started within Hail Haor in April 1999 while monitoring outside the area started in June 1999.

Another way to eliminate some of the hydrological variability from year to year is to establish and monitor a control site outside the area where interventions are not likely to have an impact.

Table 1: Location, Area and Habitat Types of the Monitoring Sites at the Hail Haor Site

Locations Within Hail Haor			Locations Outside Hail Haor		
Monitoring Locations	Sampling Areas (ha)	Habitat Types	Monitoring Locations	Sampling Areas (ha)	Habitat Types
Jethua Beel	67.95	beel, canal, floodplain	Gopla River (at Shamshergonj)	32.41	river
Gopla River	41.23	river	Boro Haor	67.91	canal, beel
Boulashir	234.38	floodplain	Shakha Borak Canal	4.58	river
Cheruadubi Beel	30.40	beel	Kushiyara River	22.13	river
Alni Beri Beel	49.65	beel	Beezna River	14.11	river
62-Beel Complex	419.48	beel, floodplain	Kamarkhali Canal	8.83	canal
Rustompur Beel Complex	221.73	beel, canal, floodplain			
Balla Beel	159.09	beel, floodplain			

2.2.2 Turag-Bangshi Site

The Turag-Bangshi site is ecologically different from the Hail Haor site. The site includes a reach of river Turag and Bangshi (Turag and Bangshi is the same river having different names at reaches) and the associated floodplains on both sides of the river including beels. The site area is a part of Modhupur tract having Sal forest in and around. The Beel floodplain complex has Hijol (wetland tree) abundance on the land and water interface.

In the Turag-Bangshi site four different types of habitats were examined—rivers, beels, floodplains and canals. A total of 23 beels, located on both sides of the rivers Turag and Bangshi, were identified through a Rapid Rural Appraisal during April 1999. A total of eight monitoring sites were selected covering these four different types of habitats (Table 2) (Map 4). Fish catch-monitoring data have been collected from the selected water bodies since May 1999.

Table 2: Location of Monitoring Sites in Turag-Bangshi with Area

Sites	Locations	Sampling Areas (ha)	Habitat
1	Mokash Beel (South)	100	beel
2	Floodplain (Mokash Beel North)	100	floodplain
3	Kali-daha Beel	50	beel
4	Mokash Khal/Solhati Khal	0.70	canal
5	Turag-Bangshi River Section	14	river
6	Aowla Khal	1.02	canal
7	Aowla Beel	100	beel
8	Bangshi River Section	17	river

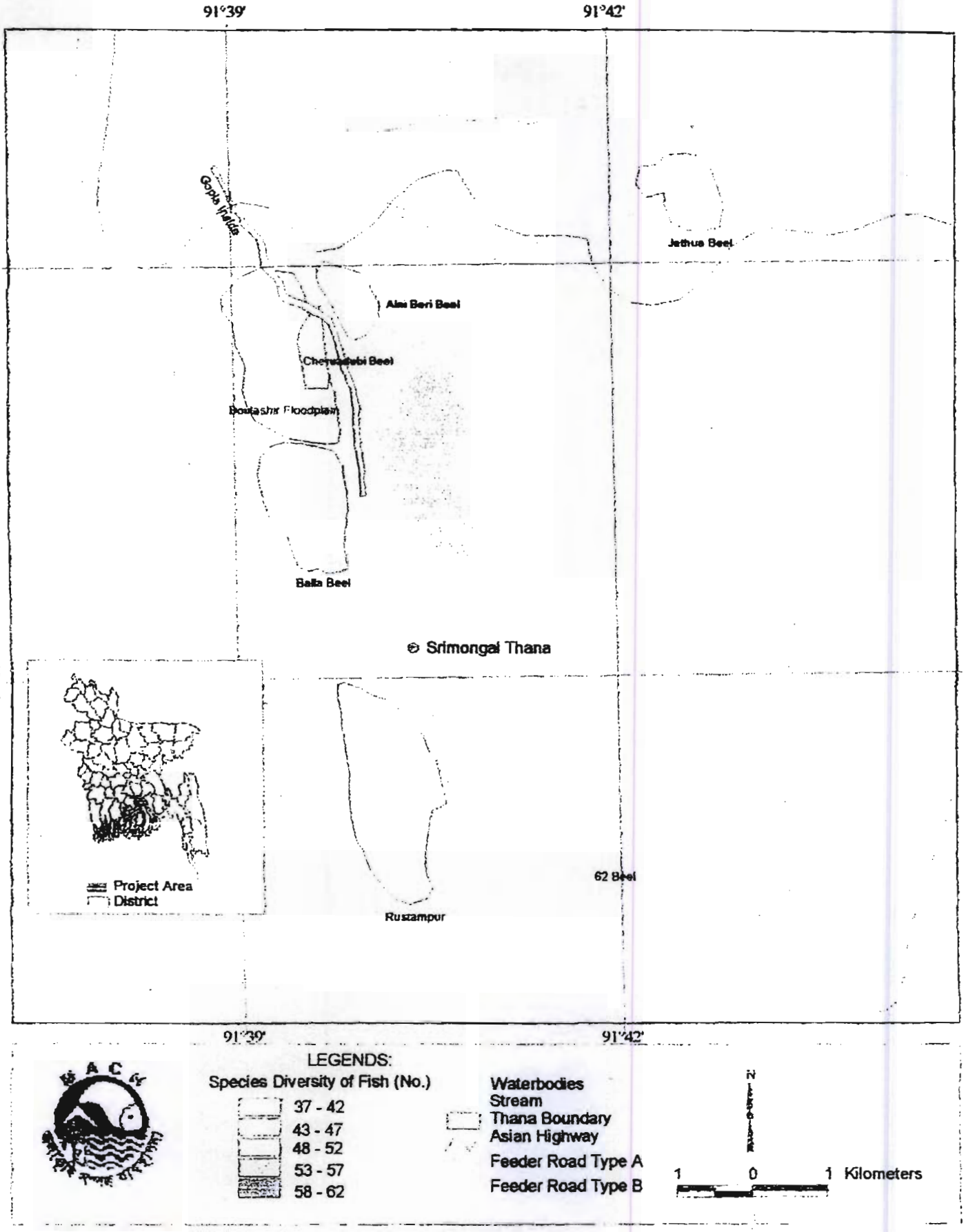
2.3 Sampling Protocol

Floodplain fisheries, with their spatial and temporal variations in fish and water abundance, are as complex and dynamic as the fishing practices. The type of fishing gear used affects a fisher's catch within a specific habitat. A sample unit was considered to be one set of gear used for a catch attempt. The effectiveness of the fishers and their motivations are also significant in setting parameters for recording sample units. The selection of sample fishing units while recording catch data is crucial and it requires the judgement of the fisheries biologist. Accordingly, attempts have been made to be consistent so that the best possible estimates can be made from the collected data.

To offset any bias from the spatial distribution of fishing gear used the field biologist collected data from different locations at the monitoring sites. For each gear type at least three fishing units were monitored. If there were more than 30 fishing units of one particular gear type operating in a day data was collected from not less than 10 percent of the operating fishing units. Irrespective of catch data from individual fishing gear use all fishing units in operation were counted during the catch monitoring day. This is the effort for that day. At the end of the day a list of fishing units by gear type was prepared. In order to accommodate for possible temporal variations in a single month the sampling intensity was set at a 10 day interval and accordingly data was collected three times a month from the selected sites. Gear of the same type with differing dimensions were standardized in the survey to 100 feet.

Map - 3

Species Richness at Different Locations in Hail Haor Site



LEGENDS:

Species Diversity of Fish (No.)

- 37 - 42
- 43 - 47
- 48 - 52
- 53 - 57
- 58 - 62

Waterbodies
Stream
Thana Boundary
Asian Highway
Feeder Road Type A
Feeder Road Type B

1 0 1 Kilometers

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2.4 Monitoring Parameters

Fish catch assessment monitoring collects data on fishing intensity, species diversity, catch composition, fishers by category and fishing gear. The data gathered on these parameters will act as a benchmark for future measures, for floodplain production and for information on fisheries bio-diversity. The terminology may be defined as follows:

Fishing gear and fishers:

- fishing gear type and number, net area and mesh size
- fishers type, sex, age, village and distance from fishing ground

Time and duration of fishing:

- fishing starting and ending times
- probable fishing duration

Fish catch:

- species by number and weight

Fishing rights:

- the fisher's access to the fishing ground

2.5 Data Analysis

The fish catch can vary spatially, temporally and on the basis of the ecological condition of the habitat. In order to incorporate these variations and to monitor parameters the collected data has been analyzed on the basis of the monitoring locations, monitoring habitats, types of gear, types of fishers and seasonal variation. As stated above, fishing intensity, duration of fishing, total catch, catch by species, and the number of species with their abundance have been analyzed. In addition, the Catch per Unit of Effort (CPUE) and the Catch per Unit Area (CPUA) have been determined. Formulas and definitions are provided below.

Seasonal variation: For the study the year was divided into four seasons. These are Pre-Monsoon (April-June), Monsoon (July-Sept.), Post-Monsoon (Oct.-Dec.) and Dry (Jan.-March).

Fishing gear: The types of fishing gear found in operation during the monitoring year were recorded with their dimensions. Current and Ber Jal Gear of the same type with differing dimensions were standardized to 100 feet to include in the analysis for Catch per Unit of Effort (CPUE).

Fishing intensity and duration of fishing: Fishing intensity describes the amount of gear used relative to the amount of gear available during the monitored day. This has been calculated from an average of three sampling days. Gear numbers of all types are counted and then extrapolated for that month. Fishing duration was recorded for all the operated gear and the average duration of fishing was calculated for each specific gear type

Catch per Unit of Effort (CPUE): The average catch in kilograms per gear per hour of operation. A number was recorded for each gear type and location. One hour is the standard unit of time used.

Catch per Unit of Area (CPUA): The total catch of all gear per unit area over a year extrapolated from sample data.

Catch composition: The catch composition was analyzed in percentage for the obtained species and the total catch of a specific habitat.

Species diversity: The observed species diversity for each monitoring location and their habitats is considered as the α diversity. The zonal species diversity is considered as the β diversity (e.g. either Hail Haor or Turag-Bangshi). Different biodiversity indices have been calculated using species frequency and an appropriate formula. γ diversity represents species diversity within a region; e.g. the Northeast region of Bangladesh.

Biodiversity Indices: Biodiversity indices measure the abundance of species and their individuals and their contribution to a biological community. They also express the number of species and individuals present in terms of probability.

3. Hail Haor Fisheries

3.1 Fishing

3.1.1 Fisher Types

Hail Haor, a natural depression, is an important habitat for fish, wildlife and birds. There are 64 villages around the Haor and the population is largely dependent on fish and plants. Fish is the most harvested resource of the Haor. Hundreds of villagers fish there with different abilities and motivations. The MACH project's Rapid Rural Appraisal findings reveal twenty fisher-dominated villages, but people from all the surrounding villages fish in the Haor.

As per standard practice we have divided fishers into three groups. They are Professional Fishers, who depend on fishing year-round for their livelihood, seasonal Professional Fishers who only fish during a part of the year and Subsistence Fishers who mostly fish for their own consumption. These are the three categories generally used in Bangladesh to define the fishing community. During fish catch assessment monitoring information on the fisher's village, age, sex, etc. was also collected.

However, differentiating fisher type among the different fisher categories is often difficult. Indigenous fishers are easily identifiable as professional but the Muslim fishers have a mixture of professions. They often fish continuously, sometimes as much as six to eight months a year, but a substantial part of their earnings may also come from farming. In the Hail Haor area almost all fishers sell a portion of the catch in order to pay for the use of the beel. Because of this, determining whether the fisher works as a professional, for subsistence or seasonally is difficult. Subsistence fishers are generally not willing to pay money to catch fish and they usually work with a scoop or current Jal net and concentrate themselves at the periphery of the water body. The dominance of the Professional Fisher in the monitored data could be due to the reasons mentioned above.

The professional fishers' dominance in the table below is possibly a reflection of the complexity of defining the fisher's type. A similar demarcation of fisher type will be maintained during future impact monitoring.

Table 3: Fisher Type Distribution by Season at the Hail Haor Site

Season	Inside Hail Haor						Outside Hail Haor					
	Professional		Seasonal Professional		Subsistence		Professional		Seasonal Professional		Subsistence	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Pre-monsoon	463	90.78	2	0.39	45	8.82	0	0	0	0	0	0
Monsoon	561	96.39	1	0.17	20	3.44	298	87.91	4	1.18	37	10.91
Post-monsoon	1010	98.44	1	0.10	15	1.46	499	75.95	0	0	158	24.05
Dry	124	88.57	0	0	16	1.43	145	79.67	0	0	37	20.33
Year	**2158**	**95.57**	**4**	**0.18**	**96**	**4.5**	**942**	**79.97**	**4**	**0.34**	**232**	**19.69**

3.1.2 Fishing Rights

There are various fishing rights and arrangements in the project area as there are throughout the country. Fishing rights and arrangements are crucial for harvesting and for the status of the fisheries in the area. It is also a factor determining local people's accessibility to the system for their livelihood. At leased and subleased water bodies fishers pay for access but among the monitored fishers the highest percentage (58%) said they enjoy free access to water bodies. These are fishing grounds either not leased out or partially leased out during certain times of the year. This fact implies that even the lessee recognizes a tradition of open access to water bodies. The second highest percentage of fisher (39 %) sub-leases accesses to the water body. The arrangement is to pay a fee according to gear used for a certain period of unit time. The data indicates that over 2 % fish at water bodies that they themselves lease. Outside the Hail Haor site it was found that 65 % of the fishers enjoy free access to water bodies, 31 % of the fishers pay money to a lessee and only 1 % fish at water bodies leased by themselves

The access arrangements vary on the gear type, habitat type and over the seasons. Appendix 19 shows the access arrangement of commonly used gears over the habitats and seasons. Thela Jal has free access over the habitats and seasons The Current jal has free access during pre-monsoon and mostly free (75%) during the monsoon While the free access of Current Jal is limited to 16% and 33% during the post-monsoon and dry season respectively. Throughout the year the Current Jal enjoys 41% free access and 58% under subleasing arrangement. The Veshal has limited free access and either lease or sublease arrangements. Suta Jal is mostly sublease and few free access.

The analysis of fishing access by habitat shows that floodplain and river are mostly free access. Thela and few current enjoys free access to beel and all other gears access in the beel is either lease or sub lease. The Veshal access in to the river mostly subleasing (Appendix 19).

Table 4. Percentage Distribution of Fishing Rights at the Hail Haor Site

Fishing Rights	Inside Hail Haor (%)	Outside Hail Haor (%)
Leased	2.37	1.09
Sub-leased	38.67	31.39
Open Access	58.3	65.49
Own water body	0.07	0
No restriction for consumption	0.37	0
Private but not leased	0.22	0

3.2 Fishing Gear

Gear type and use vary throughout the country. Knowing the different types of gear is important in understanding the fish harvest system and to estimate and extrapolate the fish catch assessment for each area. To determine the CPUE, gear identification and standardization are essential. Within Hail Haor 16 types of gears were recorded while outside the area 27 types were found (Appendix 2). According to the mode of operation, dimension and structure of the gear, they may be categorized as seine nets, gill nets, push nets, cast nets, lift nets, traps, hooks, spears, etc. In an average a long-line had over 800 hooks in the Hail Haor site

Table 5: Percentage Distribution of Gear Observed Inside Hail Haor (April '99-March '00)

Gear	Total Observed	%
Veshal/Khara	206	0.44
Ber Jal	152	0.32
Thela/Afa Jal	775	1.65
Current Jal	20824	44.29
Suta Jal	7122	15.15
Long-line/Khati Barshi (units)	763	1.62
Traps	16999	36.15
Others	178	0.38
Total	**47019**	**100.00**

Table 6: Distribution of Fish Catch by Gear Inside Hail Haor (April '99-March '00)

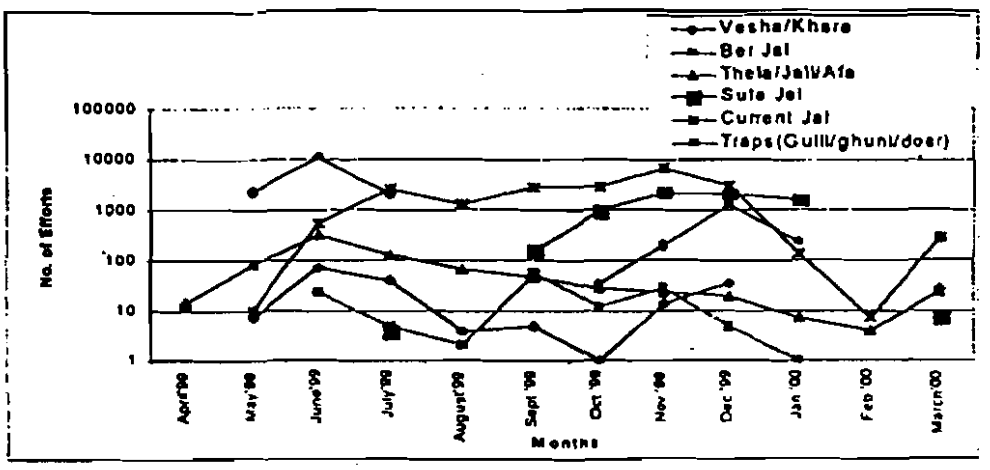
Gear	Total Catch (kg.)	%
Veshal/Khara	10200.26	5.15
Ber Jal	29152.78	14.73
Thela/Afa Jal	18283.66	9.24
Current Jal	74014.14	37.41
Suta Jal	15975.48	8.07
Long-line/Khati Barshi	40778.30	20.61
Traps	7435.70	3.76
Others	2021.32	1.02
Total	**197861.64**	**100.00**

3.3 Fishing Effort

Fishing effort is the means through which fish are caught. A fishing effort is one attempt by any amount of fishers using one set of gear. Dewatering was found to be a means of fishing in the Hail Haor area but hand picking as a fishing method was not considered. Effort is standardized to one hour for use in the extrapolation. Fish yields can be estimated by finding the standard effort catch and the number of different types of efforts (gears) operated in the unit time. Knowing the intensity of effort and the duration of fishing is essential for estimating yield/unit area/unit time.

3.3.1 Fishing Intensity

Fishing intensity at the monitoring sites varied according to season and gear used. During the different seasons the water level and habitat types change and the intensity of the use of the different gear types varies. The Current Jal is the most common gear used at all sites compared to other gear types (Appendix 3). Within a habitat the number and type of gear also varies over time. This is understandable as the efficacy of gear depends on the inundation level. For example, use of the Current Jal increases as the water increases and continues to



grow until the Post-Monsoon period while during the Dry season this type of net is used much less. Overall observed fishing efforts over months in Hail Haor is shown in Figure 1. The monthly variations in fishing intensity and among different habitats and seasons are shown in Appendix 3.

Figure 1: Fishing Efforts Observed By Month in Hail Haor

3.3.2 Fishing Duration

The use of fishing gears and operation time depends mainly on habitat type, water depth, type of fishermen, and abundance of fish and species. Fishing duration is directly related to the CPUE and CPUA. Fishing effort was therefore standardized to one hour, instead of one day, in order to more accurately reflect these two formulas. Catches may be the same from day to day regardless of how many hours the fishers worked.

3.4 Fish Catch

Catch can be shown in various ways as shown in Tables 6-9 and Figure 2 and 3. We have assessed catch in terms of gear (Table 6), seasonality (Table 7), on an area basis as Catch Per Unit Area (Table 8-9) and on a Gear and habitat basis as Catch Per Unit Effort (Figure 2) and catch composition (Figure 3).
Seasonal variation is shown in Table 7 where the data show that over 90% of the fish caught are captured in the Monsoon and Post-monsoon periods.

Table 7: Seasonal Fish Catch by Habitat at the Hail Haor Site (%)

Season	Month	Beel	Flood-plain	River	Canal	All Habitats
	April '99	0.27	0.00	0.33	0.00	0.59
	May	0.03	0.38	0.20	0.00	0.61
	June	1.47	1.11	0.72	0.01	3.31
Pre-monsoon		**1.77**	**1.49**	**1.24**	**0.01**	**4.51**
	July	0.49	7.77	0.85	0.15	9.25
	August	1.60	4.52	0.66	0.24	7.03
	September	13.71	9.06	0.52	0.74	24.03
Monsoon		**15.80**	**21.36**	**2.03**	**1.13**	**40.31**
	October	11.74	4.60	0.51	0.29	17.13
	November	12.31	7.29	0.86	0.50	20.95
	December	6.45	4.33	1.69	0.83	13.30
Post-monsoon		**30.49**	**15.41**	**3.05**	**1.61**	**50.56**
	January '00	0.39	1.19	0.08	0.00	1.66
	February	0.15	0.00	0.00	0.00	0.15
	March	0.48	0.30	1.14	0.88	2.79
Dry		**1.02**	**1.49**	**1.22**	**0.88**	**4.61**
All Seasons	**All Months**	**49.08**	**39.75**	**7.54**	**3.63**	**100.00**

3.4.1 Katha Fisheries

Kathas are brush piles used as a shelter or microhabitat within the existing habitat. They are normally used as a harvesting device. Fishers deposit brush piles (kathas) within the deeper sections of a river or beel in order to attract fish for cover and food. Kathas help develop periphyton, or food for substrate feeders. A katha acts as a fish accumulation point and thus provides better yields; it increases habitat quality and accordingly increases production. In an area where fishers want to secure sanctuaries they are also used as a fish protection device Observers should take care to note whether kathas are present before extrapolating data as the habitat increase and higher yield are limited to the area where brush piles are provided and not to the total habitat. However al. the habitats are affected by using the katha as sanctuary for brood stock.

Trees branches are used for the brush pile material. Water tolerant trees such as Hijol, Korach and Shaora ar preferred trees for kathas although there is some reservation among professional fishers towards using th Shaora tree. Branches of other trees including bamboo are also used because these swamp trees are expensiv and not available everywhere. Brush piles are usually placed during the Post-Monsoon season, preferabl before the bulk of the water begins to recede. Kathas are usually wet harvested on a monthly basis.

Harvests from kathas in the monitoring sites and locations have been included in the data when estimating th catch of the water body/habitat/locations.

During the baseline monitoring year 16 kathas harvests were observed in Hail Haor. The total number of kath observations was 28 because some were harvested more than once. The total area of observed kathas was 1.6 ha. and the total harvest was 2829 kg. This represents an average katha yield of 1704 kg/ha.

3.4.2 Pagar Fisheries

Pagars are deep depressions or holes within the beels; sometimes they are referred to as kuas. Naturally deep or artificial pagars attract fish during the dry season. They are common and sometimes kathas are deposited in the pagars. Pagars, if managed as sanctuaries, could enhance the recruitment of beel resident fish species. As with the katha fisheries, the catches from the pagars of the respective habitats and locations have been incorporated while estimating catch rates.

During the monitoring period, 6 pagar catches were recorded in Hail Haor while 42 pagars were identified. A total of 26 species have been recorded at pagars that are common beel resident fish species. The total catch rate was 1347 kg/ha.

3.4.3 CPUA

CPUA, or Catch Per Unit Area measures total catch over a specified area. In this case the monitored habitats. CPUA depends directly on the intensity of fishing as well as on fishing duration. The production, and subsequently the catch, depend on many variables of which the more important are:

- The extent and duration of flooding during a given year
- Residual water levels during the Dry season that are directly related to hold-over stock
- The timing of flooding that impacts breeding and migration/recruitment

The CPUAs at the monitored locations of the study were recorded on a seasonal basis. The data (Tables 8 and 9) shows that the highest CPUA is during the Post-Monsoon season. Catches are low during the Pre-Monsoon season and then increase as the flood waters rise. The catch peaks during the Post-Monsoon and then declines during the Dry season. It is relevant to mention that the Dry season is the most dynamic period for fish species As floodwaters recede migratory and beel resident species become trapped in depressions and are then more vulnerable to fishing activities. As a result, competition is high and fish are more exposed to predation as the water level drops further due to irrigation or reduced supply. The reduction in dry season water ultimately results in the reduction of parent stock and there can be a risk of depleting species below replaceable levels Anecdotal information suggests that this is the case for many species.

Table 8: Catch Per Unit of Area (kg/ha) Habitats Within Hail Haor

Location	Season				
	Pre-Monsoon (Apr-Jun)	Mousoon (Jul-Sep)	Post-Monsoon (Oct-Dec)	Dry (Jan-Mar)	Yearly
Jethua Beel	13.37	62.81	26.41	10.22	112.80
Gopla River (Beel)	59.53	97.52	146.49	90.00	393.64
Boulashir Floodplain	11.20	24.00	24.37	10.24	69.82
Cheruadubi Beel	-	18.80	131.46	128.06	278.31
Alni Beri Beel	22.56	23.47	79.85	14.50	140.39
62-Beel Complex	3.35	115.43	128.28	1.05	248.12
Rustompur Beel Complex	-	58.18	100.68	-	158.87
Balla Beel	2.59	17.55	14.85	0.58	35.57
Weighted Average					163.95

Table 9: Catch per Unit of Area (kg/ha) for Habitats Outside Hail Haor

Location	Season				
	Pre-Monsoon (Apr-Jun)	Monsoon (Jul-Sep)	Post-Monsoon (Oct-Dec)	Dry (Jan-Mar)	Yearly
Gopla River (at Shamshergonj)	-	61.71	192.96	133.15	387.81
Boro Haor	-	8.01	26.05	139.85	173.91
Shakha Borak Canal	-	5.25	11.90	0.34	17.49
Kushiyara River	-	31.88	46.66	19.66	98.19
Beezna River	-	135.32	66.08	77.68	279.08
Kamarkhali Canal	-	56.18	792.92	11.16	860.27

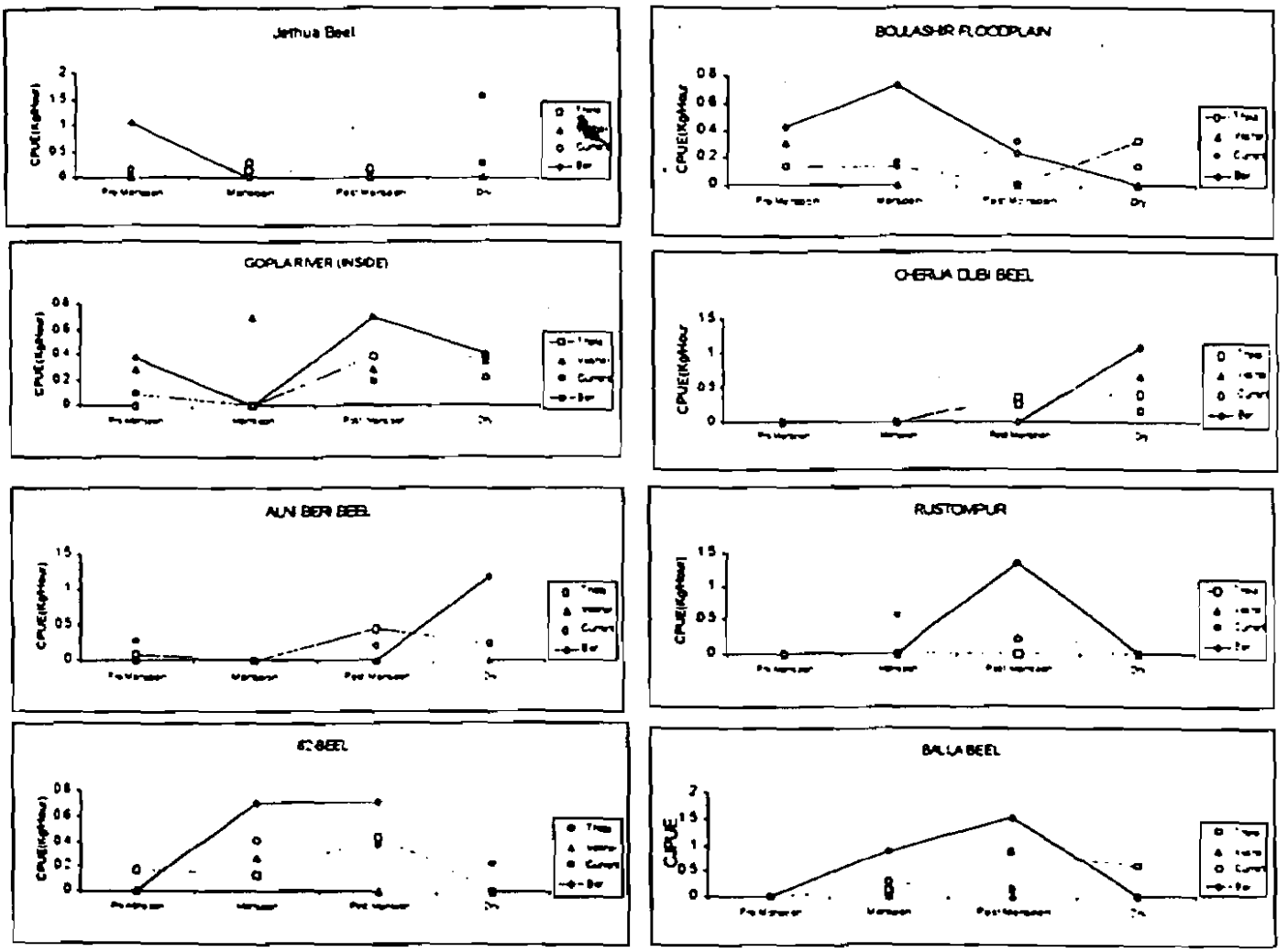
Table 7 and Table 8 show the CPUAs for different monitoring locations by season for both inside and outside the Hail Haor site. Among the monitored locations inside the Hail Haor, the Gopla River accounts for the highest catch. Map 2 also shows the CPUA for Hail Haor. Among the beels, Cheruadubi Beel yielded the highest CPUA. This is most likely because at this site the floods arrive earlier than at other beels and they stay longer than at any other beel.

Comparison between data taken from inside and outside Hail Haor shows that fish catches are fewer inside the basin. Outside the area, the monitoring location is an open system and catch representation comes more from the canals and rivers. It is interesting to note that the catch at Kamarkhali Canal is higher than at the source river Kushiyara. This is due to the use of the canals and secondary rivers as migratory channels between the Haor system and the main river.

3.4.4 CPUE

Catch per Unit of Effort (CPUE) is an important indicator of fisheries yield/production. Care has to be taken regarding effort or gear standardization. In this instance the effort has been standardized for gear size wherever necessary. Current Jal and Ber Jal gear have been standardized for size and the individual unit of gear has been defined as a unit effort. The CPUE was calculated as catch in kilograms per gear used for one hour by month at monitoring locations. Operational hours of the efforts under the monitoring period have been recorded

Figure 2: CPUE of Common Gears Used in Hail Haor



In an earlier section it is mentioned that out of the fishing gear observed at monitoring sites, the CPUE of the most commonly observed gear in Hail Haor site—Ber Jal, Thela Jal, Veshal Jal, Current Jal, Suta Jal, Long-line and Trap—have been estimated. Monthly variation is shown among the CPUEs of commonly used gears (Appendix 5). Figure 2 shows seasonal variation in CPUE of commonly used gears inside the Hail Hoar area.

3.4.5 Catch Composition

Catch data has been analyzed to determine the contribution of different species to the catch. There are 68 fish species inside Hail Haor and 79 outside Hail Haor recorded with their abundance in numbers and biomass. Appendices 7 and 8 present catch composition per habitat and the list of species observed. For a better understanding of the different species, a table grouping together closely linked species is found in Appendix 15.

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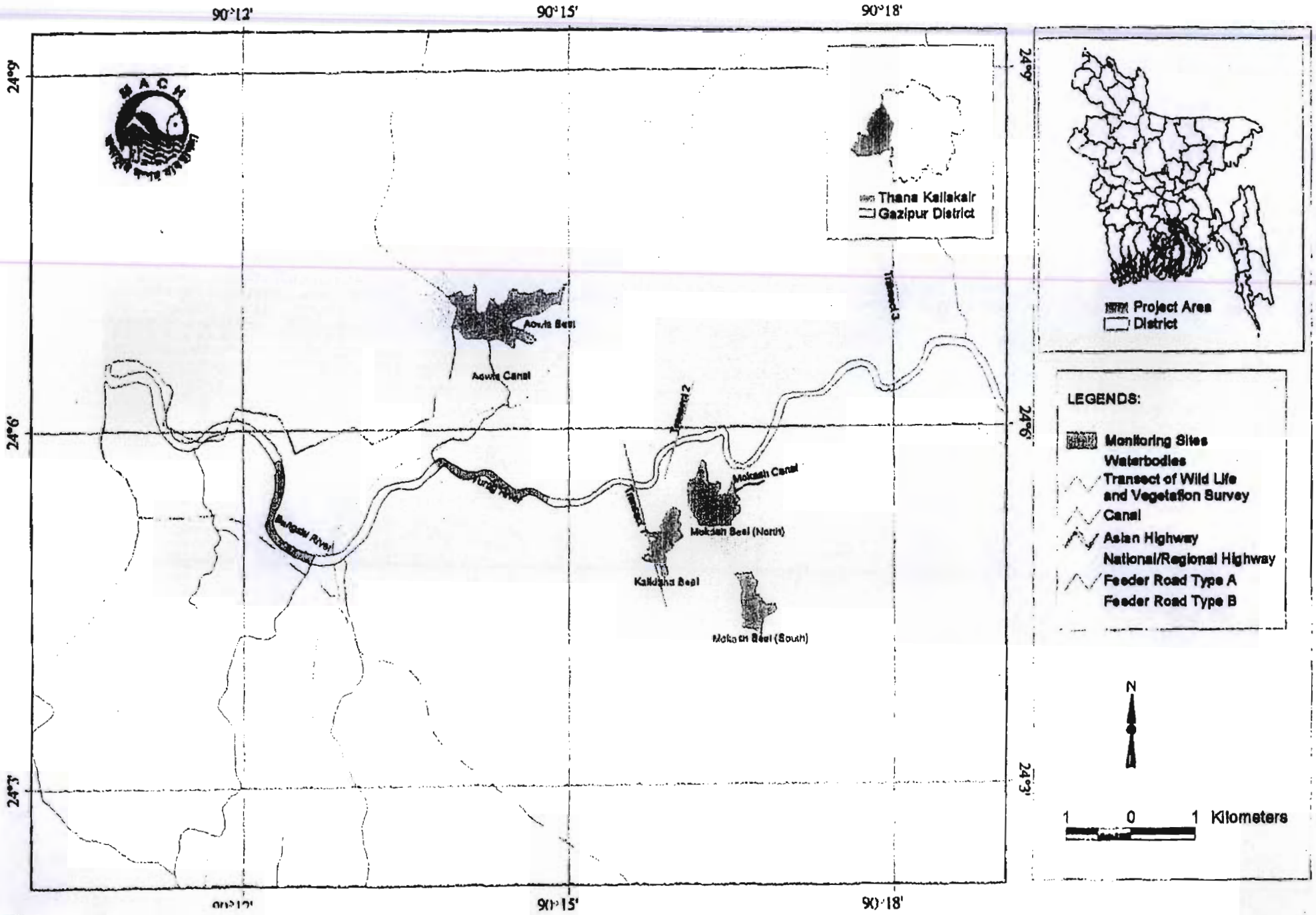
Map - 4

Fish Catch Monitoring Locations in Turag - Bangshi Site



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The contribution of each catch on the basis of their guild and percentage in different habitats and seasons is shown in Appendix 6.

Catch composition according to habitat is shown in Figure 3. The contribution of small fishes and prawn dominates inside the Hail Haor area whereas outside the basin small fish contribute less. The contribution of small shrimp is higher in the beels during the Dry season. Quantity in terms of number and weight of fish caught is the indicator of the abundance of different species in the monitoring sites. Data show that small fish dominate in terms of quantity in kilograms as well as in number caught. It is worth mentioning that there is a remarkable variation in species composition between the earlier study (DOF 1983-84) and the present study. In the earlier study, Major Carp (Rui, Kalibaush, Ghainnna, Catla, Mrigal and Common Carp) were 4.29% of the catch composition while in the present study they only represent an average of 0.24 % in the Hail Haor. Outside the Hail Haor area the survey found that an average of 8.3 % of the catch was Major Carp (Appendix 6). This is confirmed by DOF catch statistics that show a continuing decline in the carp fishery as well as anecdotal information from older fishers who make similar complaints. This reflects the importance of connectivity and the recruitment of riverine hatchlings into the area.

3.4.6 Species Diversity

Species diversity for the specific habitats and monitoring locations was calculated by observing species found in the fish catch on different observation days. In the Hail Haor, all the water bodies are connected during the wet season. During the dry season, water recedes from the basin and the remaining water accumulates in localized depressions. Monitoring locations were selected and delineated as discussed earlier considering these and other factors.

Species diversity at the different monitoring locations—beel, floodplain, river, and canal habitats—was recorded throughout the year and α diversity has been shown in Table 10 and Map 3. The seasonal variation in species diversity among the habitats is shown in Table 11. The different habitats over the season show higher diversity during the Monsoon and Post-Monsoon periods. While the habitat preference for many fish species is not rigid there are a few species that live exclusively in the beels and a few that keep only to the rivers with a number of species exploiting both habitats. Appendices 16 and 17 show the habitat preference of the observed fish species inside and outside the Hail Haor basin Perennial beels, as shown in Table 11, show the widest diversity of species for all habitats.

The β diversity is the zonal diversity and has been calculated for a project site that includes different habitats and spatial distribution over the entire project area. β diversity for within Hail Haor site is 68; for outside the Haor it is 79. The species diversity of the region is referred to as γ diversity. In this study the north central region of Bangladesh is one of the γ diversity.

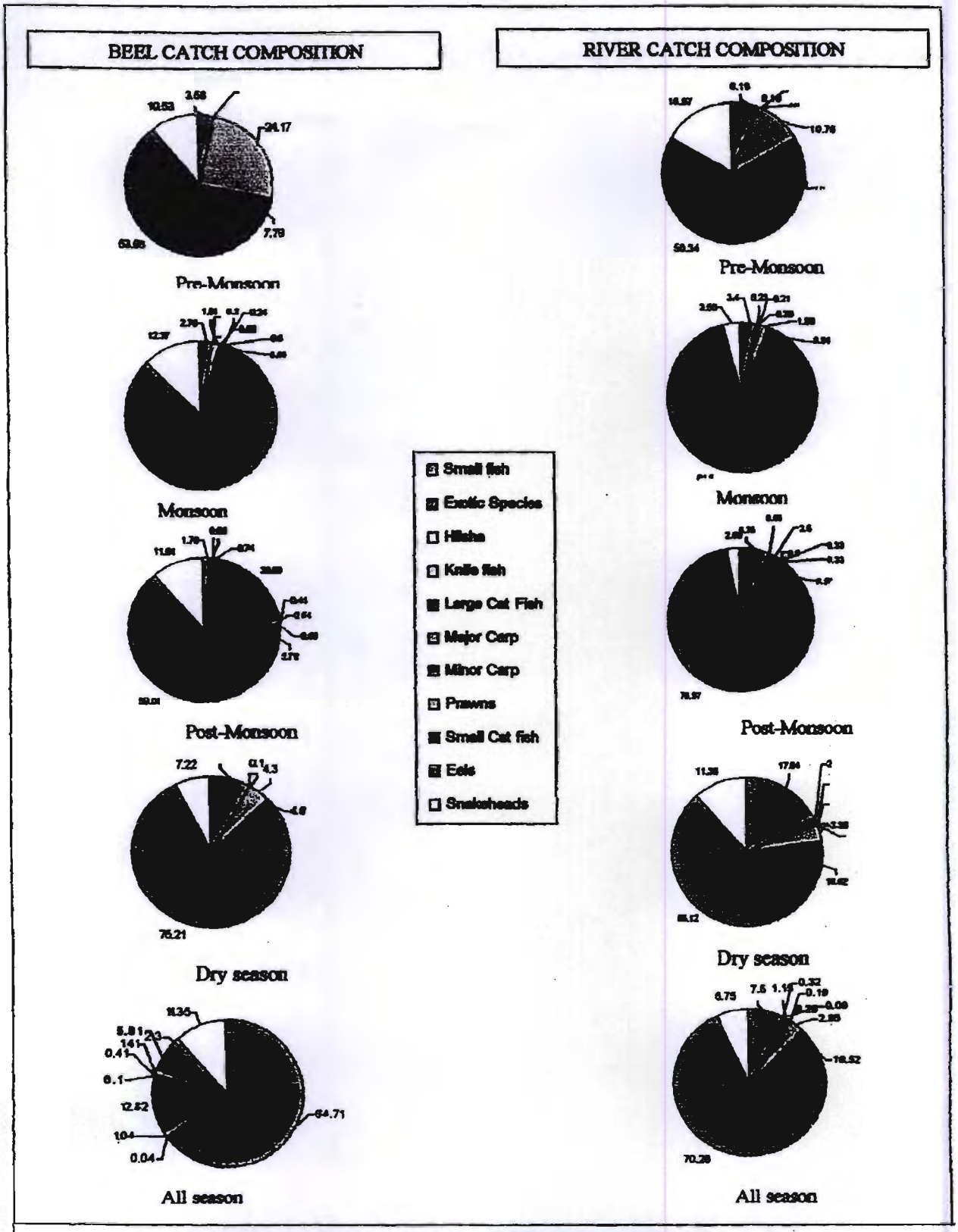

Figure 3: Percentage distribution of Beel and River Catch Composition of Hail Haor

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Species Richness at Different Monitoring Locations in Turag-Banshi Site

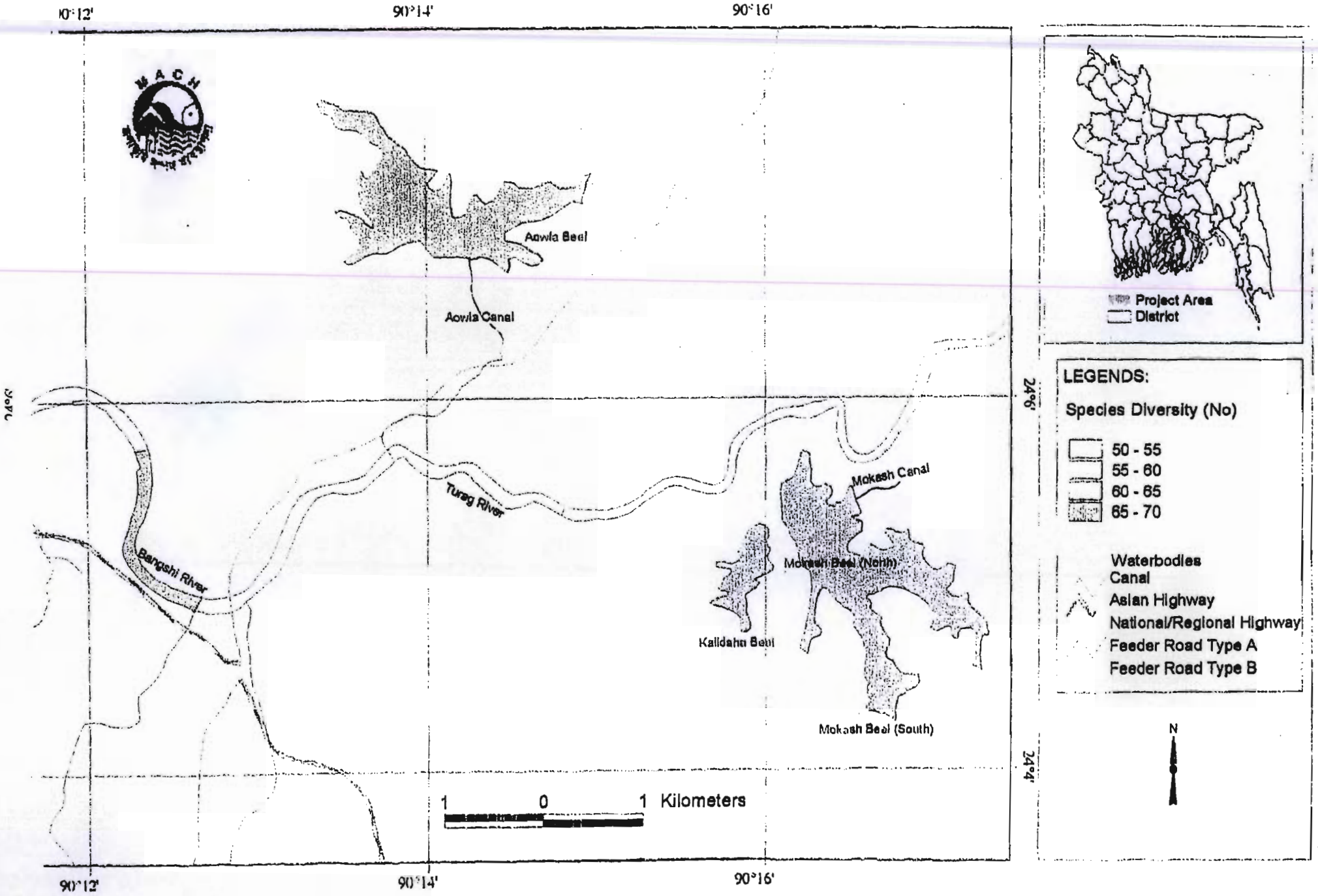

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Table 10: α Diversity by Monitoring Location

Location	Diversity (# of fish species)
Inside Hail Haor	
Jethua Beel	37
Gopla River	53
Boulashir Floodplain	50
Cheruadubi Beel	39
62-Beel Complex	55
Alni Beri Beel	39
Rustompur Beel Complex	49
Balla Beel	39
Outside Hail Haor	
Gopla River (at Shamsherganj)	62
Boro Haor	57
Shakhaborak River	30
Kushiyara River	58
Beezna Canal	56
Kamarkhali Canal	64

Table 11: Seasonal Variation in Species Diversity Within and Outside the Hail Haor Site

Month	Within Hail Haor					Outside Hail Haor				
	Beel	Flood-plain	River	Canal	All	Beel	Flood-plain	River	Canal	All
Pre-Monsoon	36	43	41	3	48	0	0	0	9	9
Monsoon	43	49	34	27	54	0	0	70	56	73
Post Monsoon	53	44	42	33	58	0	0	68	64	73
Dry Season	33	30	31	27	41	25	6	50	41	62
Year	58	57	53	41	68	25	6	75	70	79

3.4.7 Species Diversity Indices

In a natural harmonic situation and without human interference, diverse and complex ecosystems are likely to be more stable and able to recover from disruptions. A healthy, robust ecosystem is characterized by a large number of species none of which are over-represented in terms of individuals. A number of indices are used to describe species diversity of a habitat. Species diversity indices usually employ measures of the number of species present and the number of individuals per species in relation to the community of the observed water bodies/habitats/locations. Since these measures also imply the probability of encountering an individual of a given species, they express the number of species present in terms of probability. In other words the index is a ratio of the contribution of a species to the community. There are number of biodiversity indices used by biologists but none are wholly objective or accurate. However they provide a tool to better understand a

community and the species within that community. Simpson's Index is the oldest and most simple, which is expressed as:

$D = 1 - \Sigma(p_i)^2$

D = Simpson's Index of Diversity (values from 0 to 1)

p_i = proportion of individuals of species *i* in the community

Simpson's Index says that the probability of randomly picking two organisms of different species is 1 minus the probability of picking two organisms of the same species. The probability of picking an organism is therefore the proportion of the organism in the community. Accordingly, the probability of randomly picking two organisms is the joint probability $(p_i)^2$. The difficulty with Simpson's Index is that it gives little weight to rare species.

The Shannon-Weiner Index factors in species individuals. It uses the following formula:

$H = \Sigma(p_i)(\ln p_i)$

H = Shannon-Weiner Index of Diversity

p_i = proportion of individuals of species *i* in the community

A theoretical maximum evenness (H_{max}) can be calculated using the following formula:

$H_{max} = -S\ (1/S \ln_2 1/S) = \ln S$

Where S = number of species in the community

Equitability (J) can then be calculated as the ratio of observed diversity (H) to H_{max}.

$J = H/H_{max}$

As mentioned earlier the dominance of a certain species means an imbalance and an unhealthy abundance of individuals of that species in the community. This could also be a reflection of the vulnerability of other species in that habitat. From this indication a thorough investigation could be initiated and measures undertaken to protect that specific species. For example, if the number of individuals of a certain species is low then the evenness index shall show a low figure compared to the occurrence of individuals of the other species in the habitat. It could indicate that certain species are under pressure of a nature that could eradicate that species from the habitat. Care should be taken in this regard, as the indices are calculated using the number of individuals and not the biomass.

Indices typically measure the number of species occurring in each of two communities to be compared and the total number of species occurring in both communities. Jaccard's Similarity Coefficient has been used to measure these similarities using the following formula.

$I = j/a+b-j$

I = Jaccard's similarity coefficient

j = The number of species occurring in both communities

a = The number of species occurring in community a

b = The number of species occurring in community b

Table 12: Species Diversity Indices Within the Hail Haor Site

	Jethua Beel	Gopla River	Boulashir Floodplain	Cherua-dubi Beel	62-Beel	Alni Beri Beel	Rust-ompur	Balla Beel	Cumulative Species #
Species Richness	37	53	50	39	55	39	49	39	68
Simpson's Index	0.81	0.91	0.91	0.93	0.88	0.90	0.89	0.90	
Shannon-Weiner	1.92	0.68	0.71	0.80	0.66	0.74	0.70	0.75	

Table 13: Jaccard's Similarity Indices of Hail Haor

	Jethua Beel	Gopla River	Boulashir Floodplain	Cherua-dubi Beel	62-Beel Complex	Alni Beri Beel	Rust-ompur	Balla Beel
Jethua Beel		0.67	0.74	0.81	0.64	0.85	0.76	0.73
Gopla River	0.67		0.78	0.7	0.74	0.74	0.82	0.70
Boulashir Floodplain	0.74	0.78		0.78	0.71	0.67	0.79	0.67
Cheruadubi Beel	0.81	0.70	0.78		0.65	0.86	0.76	0.59
62-Beel Complex	0.64	0.74	0.71	0.65		0.62	0.73	0.68
Alni Beri Beel	0.85	0.74	0.67	0.86	0.62		0.76	0.73
Rustompur Beel Complex	0.76	0.82	0.79	0.76	0.73	0.76		0.76
Balla Beel	0.73	0.70	0.67	0.59	0.68	0.73	0.76	

Diversity Indices and similarity indices were calculated using the pooled species data from each monitoring locations (Tables 12 and 13). The indices can be seen as an indicator for measuring the impact of project interventions.

4. Turag-Bangshi Fisheries

4.1 Fishing

There are professional, seasonal professional and subsistence fishers in the Turag-Bangshi site. The intensity of fishing under the various categories varies seasonally. It is evident from Table 14 that professional fishers dominate among those monitored. Current Jal owners make up the largest group and they fish throughout the year. The Current Jal nets are passive gear; the fisher drops the net in the water and returns after some time to pull it back out. While the fish are finding their way into the net some fishers may engage themselves in other work. However, these fishers are considered professional for the purpose of the impact monitoring of the fisheries.

In general the access to the water bodies in the Turag-Bangshi site is open; there are no leased beels. Outside of the Monsoon season there is limited access to privately owned water bodies, the pagars and the kathas (see below) but during the Monsoon season access to all of these, except for the kathas, is open.

Table 14: Percentage Distribution of Fisher Type at Turag-Bangshi Site by Season

Seasons	Professional		Seasonal Professional		Subsistence	
	No.	%	No.	%	No.	%
Pre-Monsoon	62	89.86	7	10.14	0	0.0
Monsoon	134	65.35	11	5.37	60	29.27
Post-Monsoon	374	55.33	61	9.02	241	35.65
Dry	433	76.50	2	0.35	131	23.14
All Seasons	**1003**	**66.16**	**81**	**5.34**	**432**	**28.50**

4.2 Fishing Gear

Fishing gears observed in use at the Turag-Bangshi site are shown in Table 15. There are 26 total kinds of gear used at the site; a list is found in Appendix 9.

4.3 Fishing Effort/Intensity

The efforts for all the different kinds of gear have been recorded to estimate the total catch Efforts of commonly used gears are shown in Appendix 10. It is clear that the Current Jal dominates but overall the efforts of the different gears over the habitats and season vary. Figure 4 shows the monthly variation of efforts for the commonly used gears in this site over the monitoring location and months. In an average around 300 hooks were observed per long-line in this site.

As mentioned earlier in this report the operational period for any gear is crucial to the amount of catch. The duration of fishing has been recorded and standardized to a one hour's catch time to calculate the CPUE. An extrapolated catch for the projected hour of fishing has been taken to estimate the CPUA. It is important to consider the operational time when considering the overall catch from a habitat. The operational hours for commonly used gears has been recorded for different habitats over the months (Appendix 11). The duration

of fishing with the Current Jal gear is highest probably because it is passive gear. Active gears are used less frequently and for less time.

Table 15: Percentage Distribution of Gear Observed in Turag-Bangshi (April '99-March '00)

Gears	Total Observed	%
Veshal/Khara	15	0.24
Berjal/Kathi Jal	60	0.98
Moi/Dore/Moshari Jal	642	10.45
Thela Jal/Jali	176	2.87
Dharma Jal	490	7.98
Jhaki Jal	228	3.71
Current Jal	2970	48.36
Hatborshi/Gara Borshi	344	5.60
Long-line/Kathi Borshi (units)	19	0.31
Guli/Guni (Trap)	1089	17.73
Others	109	1.77
Total	**6142**	**100.00**

Table 16: Percentage Distribution of Catch by Gear in Turag-Bangshi (April '99-March '00)

Gear	Total Catch (kg.)	%
Veshal/Khara	97.26	0.50
Berjal/Kathi Jal	5048.52	25.74
Moi/Dore/Moshari Jal	2669.11	13.61
Thela Jal/Jali	632.60	3.23
Dharma Jal	1816.68	9.26
Jhaki Jal	1261.48	6.43
Current Jal	5123.12	26.12
Hatborshi/Gara Borshi	1372.28	7.00
Long-line/Kathi Borshi	247.97	1.26
Guli/Guni (Trap)	910.10	4.64
Others	431.84	2.20
Total	**19610.96**	**100.00**

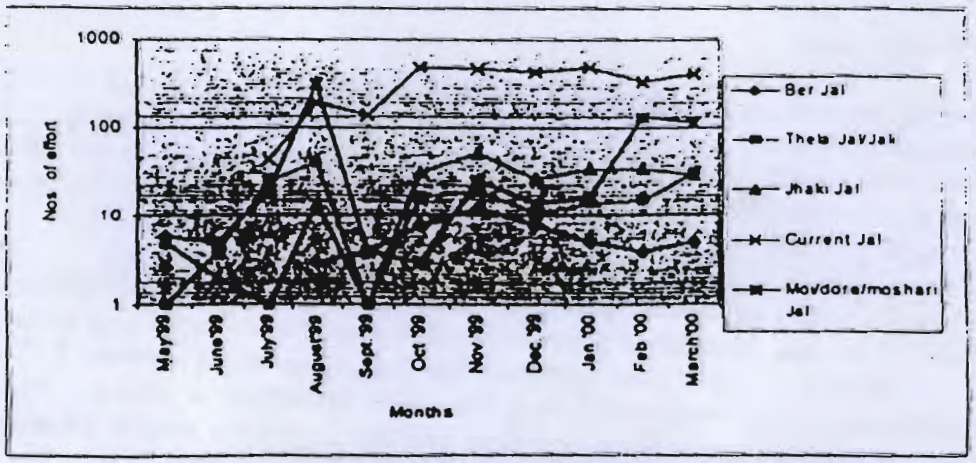

Figure 4: Fishing Efforts By Month in Turag-Bangshi

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Map - 5 Catch per Unit of Area (Kg/hectare) at Different Monitoring Locations in Turag-Banshi Site

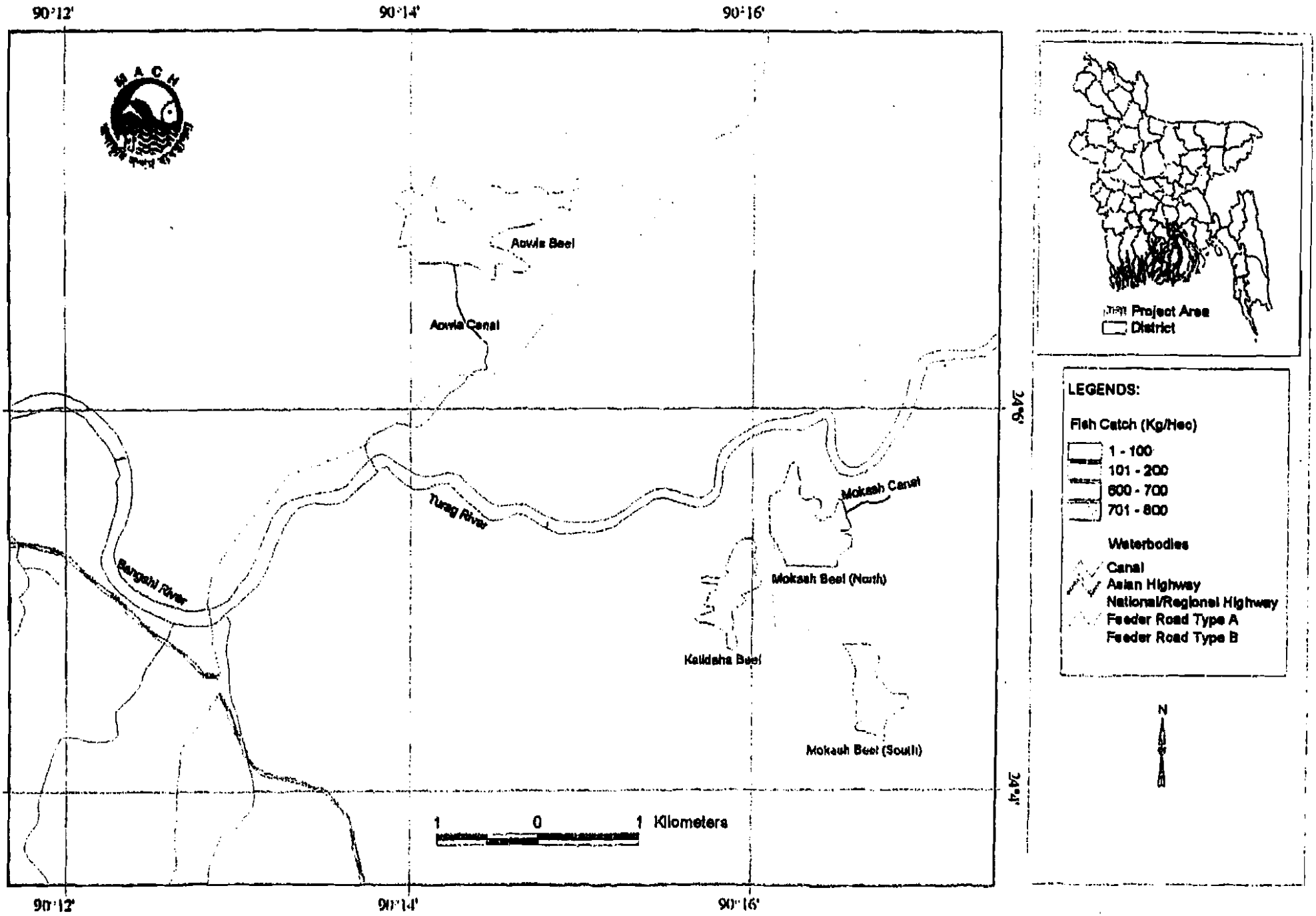

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Table 17: Seasonal Fish Catch by Habitat at the Turag-Bangshi Site (%)

Season	Months	Beel	Flood-plain	River	Canal	All Habitats
	April '99	0	0	0	0	0
	May	0	0	0.70	0	0.70
	June	0.44	0	0.58	0	1.02
Pre-monsoon		0.44	0.00	1.29	0	1.73
	July	2.69	0.98	0.07	0.32	4.06
	August	4.27	0.70	0.37	0.37	5.71
	September	6.73	0.51	0.32	0.04	7.59
Monsoon		13.69	2.20	0.76	0.72	17.37
	October	15.65	1.94	3.14	2.14	22.87
	November	16.68	3.62	3.14	2.21	25.65
	December	3.02	2.22	2.33	0.41	7.98
Post Monsoon		35.35	7.77	8.61	4.76	56.50
	January '00	3.57	2.80	1.16	0.14	7.67
	February	3.14	0.70	1.75	0.20	5.80
	March	4.54	2.46	3.84	0.10	10.94
Dry		11.25	5.97	6.76	0.44	24.41
All Months		60.72	15.94	17.42	5.93	100.00

4.4 Fish Catch

4.4.1 Estimated Fish Catch (kg)

The estimated fish catch in kilograms observed in the different habitats is presented in Appendix 12. The Katha and pagar catches are included. It shows that the fish catch varied among the habitats over the months. Monthly fish catch by habitat is shown in Table 17. Monitoring results show that the catch has wide monthly variation Such large variation in monthly catches may be related to fish migration facilities, the flooding and inundation regimes, the types of habitats and their linkages. Analyses of findings for the monitoring period show that the peak catches were observed in October and November.

4.4.2 CPUA

The CPUA has been estimated for all monitoring locations (Table 18 and Map 5). In terms of season, the Post-Monsoon catch is the highest while in terms of habitat the canal yield is remarkably higher than the others It is relevant to mention that the canals are migratory channels where fish tend to accumulate. Canal catch is usually not expressed per hectare but per kilometer. The canal catch depends on habitats connected to the canal. If a canal is connected to a productive habitat and is a main channel for the migration to and from that habitat then the canal catch will be higher. The intensity of fishing except Current Jal is also higher in the canal which will raise the catch quantity (Appendix 10).

Table 18: Catch Per Unit of Area (kg/ha) in Different Locations and Habitats at the Turag-Bangshi Site

Location	Season				
	Pre-Monsoon (Apr-June)	Monsoon (Jul-Sep)	Post-Monsoon (Oct-Dec)	Dry season (Jan-Mar)	All Seasons
Mokash Beel (south)		4.41	28.05	7.45	39.91
Mokash Beel (north)		4.31	15.25	11.70	31.25
Kaliadaha Beel	1.72	10.08	30.32	13.48	55.60
Mokash Khal (canal)		67.69	574.31	122.38	764.39
Turag River	18.04	3.01	76.52	35.72	133.43
Aowla Khal (canal)		92.92	534.86		627.78
Aowla Beel		17.39	26.11	7.87	51.36
Bangshi River		6.27	35.55	48.57	90.38
Weighted Average					51.24

4.4.3 CPUE

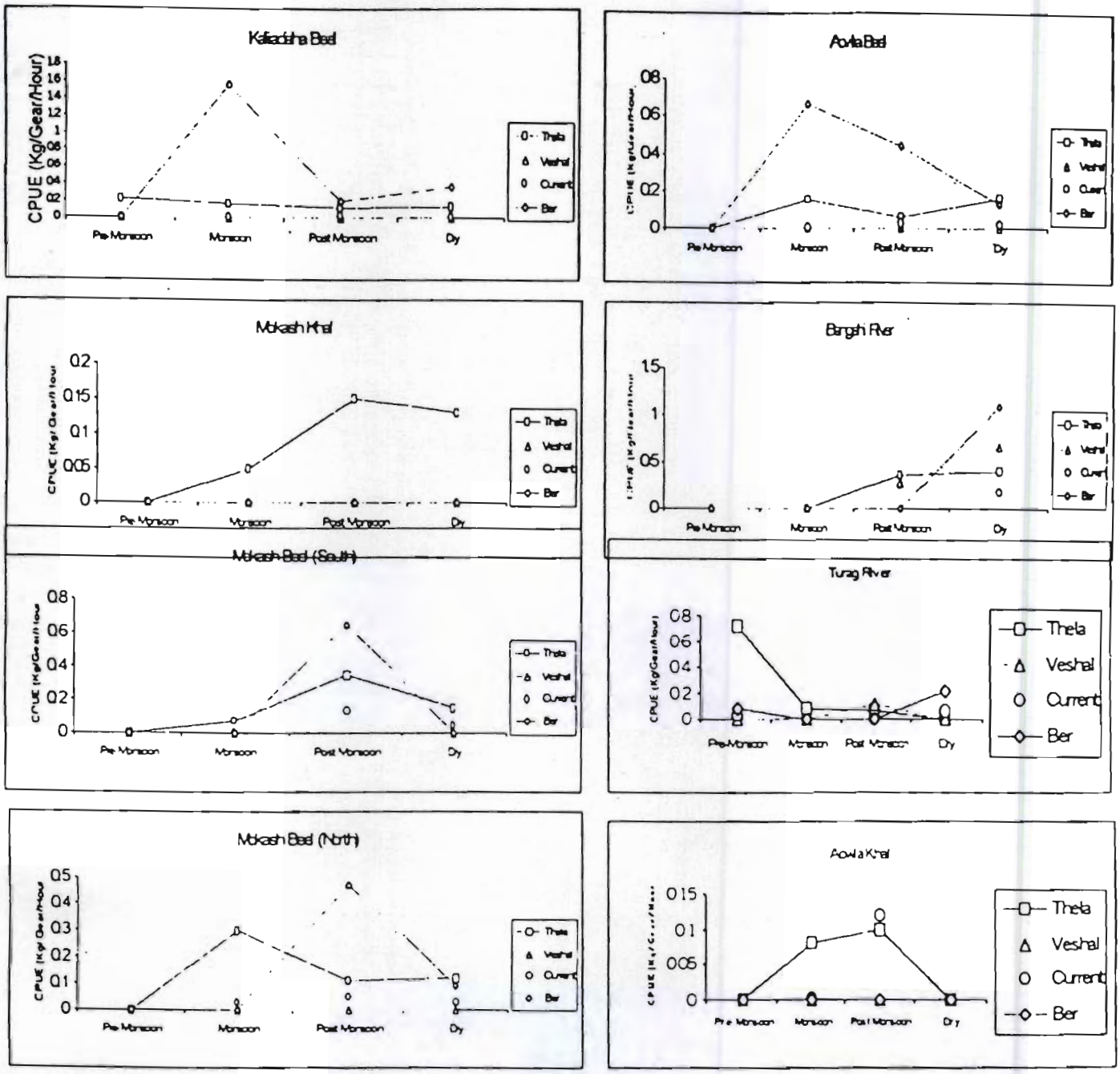
The CPUE has been calculated following the same principle and formula as the Hail Haor survey. The CPUE has been considered on an hourly catch basis. Effort bas been standardized to one hour's catch from the recorded catch and operation time. The duration of fishing using various gears over different habitats and months were recorded and will be used during impact monitoring to produce a realistic scenario of fishing pressure. Appendix 13 shows the CPUE for commonly used gears over months, seasons and habitats. Figure 5 shows the seasonal catch ability of common gears in different habitats.

4.4.4 Catch Composition

The relative abundance in kilograms of the overall estimated catch at the monitoring sites is shown in Appendices 12 and 14 by species and guild respectively. The data shows that 83 species were observed during the monitoring period and that the highest catches were observed during the Post-Monsoon and the Dry season months in the beels and in the floodplain. Fewer species were observed in the Pre-Monsoon months. This is most likely due to lower water levels and the delay of the arrival of the Monsoon rains in 1999 and the consequent drying up of most of the beels. Figure 6 shows the catch composition in the beels and river areas over the seasons. The small fish and prawn catches also vary seasonally. As mentioned earlier the prawns can more easily survive in a harsher environment and can dominate when the habitat is functionally segregated. The dominance of small fish, however, reveals the fishing pressure and the lack of a proper environment for the fish. The bigger fish, which need more than a year to mature and

spawn, fail to escape the tremendous fishing pressure. The small fish spawn yearly and can sustain their numbers better during relatively intense fishing pressure. It should be taken into consideration that the abundance of smaller fish does not mean an overall increase in their numbers but rather a better survival strategy and adaptation.

Figure 5: CPUE of Common Gears Used in Turag-Bangshi



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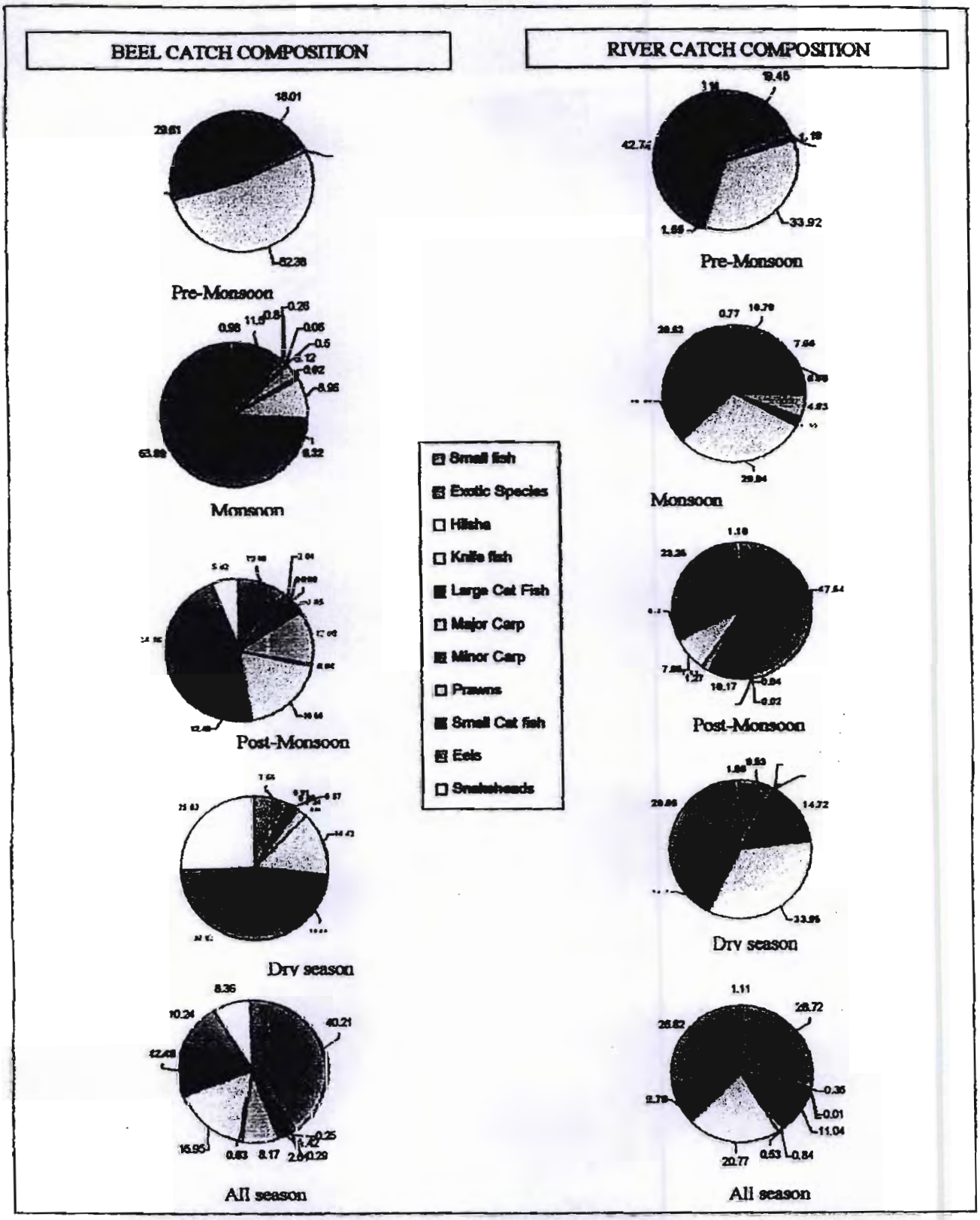

Figure 6: Percentage distribution of Beel and River Catch Composition of Turag-Banshi

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4.4.5 Species Diversity

The species diversity of the habitat was recorded in the different monitoring locations. In the Turag-Bangshi site there are eight monitoring locations including beels with associated floodplains and connecting canals and rivers. Beels, associated floodplains and connecting canals are interconnected closely for a longer period of the year. Species richness was analyzed for the Turag-Bangshi site. Mokash Beel, including the floodplain and Mokash Canal, are considered a primary unit. Aowla Beel, and the Turag and Bangshi Rivers are also considered to be primary units. The species diversity of the primary unit is the α diversity. Table 19 gives the α diversity of the Turag-Bangshi site. β diversity is the overall zonal diversity of a particular site; the observed species richness of the Turag-Bangshi was recorded as 83 different species (Map 6). The regional diversity, γ, is the species richness of the region. Table 20 shows the monthly and seasonal variation in species diversity over the habitats. Habitat preferences of the observed species in the Turag-Bangshi site has been shown in Appendix 18.

Table 19: α Diversity by Monitoring Location of Turag-Bangshi Site

Location	Diversity
Mokash Beel	70
Turag River	54
Aowla Beel	66
Bangshi River	67

Table 20: Seasonal Variation in Species Diversity Within the Habitats at Turag-Bangshi

Season	Month	Beel	Floodplain	River	Canal	All Habitats
	April	0	0	0	0	0
	May	0	0	26	0	26
	June	9	0	16	0	19
Pre-Monsoon		**9**	**0**	**27**	**0**	**28**
	July	29	12	12	23	37
	August	47	33	44	23	60
	September	37	12	26	8	47
Monsoon		**56**	**36**	**49**	**35**	**69**
	October	48	31	43	26	63
	November	54	44	40	38	68
	December	42	36	32	20	51
Post Monsoon		**59**	**47**	**56**	**46**	**75**
	January	36	26	26	12	46
	February	24	16	26	11	37
	March	36	26	28	10	45
Dry		**45**	**32**	**38**	**15**	**56**
All Season		**68**	**58**	**73**	**53**	**83**

Species richness and various indices have been calculated to understand the health of the environment to support local species. The species richness shows the number of species occurrences while the indices shows the evenness and the contribution of the individuals of the species to the community. The importance of species

indices, analyzing indices and habitat similarity exercises has been discussed in the previous section of this report. Previous data does not exist, unfortunately, but the project will be generating data which will provide sufficient background data to evaluate trends. The habitat similarity for the Turag-Bangshi site (Table 22) was also analyzed as it had been done for the Hail Haor site. The findings of the present study can be used as a benchmark to measure any changes due to project intervention or natural causes. Table 21 shows different indices values for monitoring locations of the Turag-Bangshi site.

Table 21: Species Diversity Indices at the Turag-Bangshi Site

	Mokash Beel (South)	Mokash Beel (North)	Kalida-ha Beel	Mokash Khal	Turag River	Bangshi River	Aowla Khal	Aowla Beel
Species Richness	56	58	60	39	54	50	60	67
Simpson's Index	0.83	0.71	0.76	0.77	0.80	0.78	0.67	0.64
Shanon Equality	0.58	0.51	0.54	0.60	0.53	0.54	0.42	0.45

Table 22: Jaccard's Similarity Indices of Turag-Bangshi Site

	Mokash Beel (South)	Mokash Beel (North)	Kaliadaha Beel	Mokash Khal	Turag River	Aowla Khal	Aowla Beel	Bangshi River
Mokash Beel (South)		0.81	0.84	0.67	0.72	0.77	0.81	0.64
Mokash Beel (North)	0.81		0.76	0.64	0.67	0.69	0.76	0.67
Kaliadaha Beel	0.84	0.76		0.57	0.63	0.67	0.79	0.67
Mokash Khal	0.67	0.64	0.57		0.60	0.71	0.55	0.54
Tutag River	0.72	0.67	0.63	0.60		0.79	0.70	0.68
Aowla Khal	0.77	0.69	0.67	0.71	0.79		0.67	0.65
Aowla Beel	0.81	0.76	0.79	0.55	0.70	0.67		0.67
Bangshi River	0.64	0.67	0.67	0.54	0.68	0.65	0.67	

5. Special Features

5.1 Fishing by Dewatering

Fishing by dewatering refers to the removal of the water from a water body and the harvesting of every fisl from that habitat. The process is illegal but popular to a fisher/lessee since fishing by dewatering increases shor term profit. However, it is extremely detrimental to the quality of the habitat because it reduces or eliminate the brood stock. Furthermore, the damage is not limited to the specific habitat but can affect the entire beel floodplain complex.

Dewatering reduces productivity and biodiversity and this is one of the main problems in the management c open water fisheries throughout Bangladesh and specifically in the Hail Haor basin. But data collection on th practice is difficult and even risky. As the practice is illegal, the fisher/lessee may not allow recording of th harvest. During the last season, in one instance, the fisher/lessee at one dewatered water body physicall harassed fieldworkers. Unfortunately, at the Hail Haor site, fishing by dewatering is practiced at nearly all th beels; at Turag-Bangshi the practice does not occur as there are no leased out beels.

Section B

Household Protein Consumption

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1. Introduction

The goal of the MACH project is to provide ecologically healthy management of wetland resources (i.e. fisheries and other wetland products) to provide a sustainable supply of food to the rural poor. Baseline biodiversity monitoring of fisheries, vegetation, birds and wildlife is being conducted at the project sites. In addition to biodiversity monitoring, fish and other protein consumption at the household level have been monitored from sample households in selected villages in the MACH project sites of Hail Haor and Turag-Bangshi.

2. Methodology

In the Hail Haor site, 490 households were selected from 14 villages while 280 households were selected from eight villages in the Turag-Bangshi site for household consumption monitoring. In both the sites, 35 sample households were selected arbitrarily from each village for household monitoring. Data was collected by local Resident Monitors for an interval of three days from each of the households. The interviewees in each household were women, since they tend to be the family cooks. All major sources of protein—fish, meat, eggs, milk an dpulses were monitored and collected. The enumerators weighed items on portable scales provided by the project. Data collection from households began in September 1999 in Hail Haor and October 1999 at the Turag-Bangshi site.

3. Findings

3.1 Hail Haor Site

3.1.1 Per Capita Fish Consumption

Fish consumption by household was found to vary by land size, village and month. Table 24 shows the fish and other protein consumption at the Hail Haor site. The per capita fish consumption in Hail Haor was found to be higher than the national figure of 32.9 grams per capita (Table 2.1, Natural And Extent Of Malnutrition In Bangladesh, Bangladesh National Nutrition Survey, 1995-96). The average per capita fish consumption by the sample households in 14 villages from September 1999 to May 2000 was 46 g. Table 24 shows that per capita fish consumption ranged from 50 g among the landless families to 51.50g among the landowning farmers. The likely reason for the higher fish consumption in the area than the national average is the proximity of the villages around the Hail Haor basin resources.

Baseline household survey data shows that 68.23% of the sample households were engaged in commercial fishing and 16 % in subsistence fishing (Table 3.19 of Baseline Socioeconomic Survey, MACH) . Additionally the price of fish in the local markets is comparatively lower.

There are differences in the quantity of fish consumed by households of different land size classes. Data shows that the families of poorer households consumed less protein during the nine month study period compared with the wealthier farm families. However, consumption of eggs was found to be higher among the landless households at the Hail Haor site.

Eggs and milk were consumed in higher quantities by small farmers compared to other classes. This was possibly because, as shown below, the small farmers owned considerably more cattle and poultry birds. The data shows that 79 % of small farm households owned cattle, 69 %, the highest percentage, owned chickens and 60%, also the highest percentage, owned ducks among all classes (Table 3.33 of the MACH project's Baseline Socioeconomic Survey).

Among the different sources of protein fish was found to be the major contributor per capita at 45.98g, followed by pulses at 12g, milk at 6.55g, meat at 4.78g and finally eggs at 0.06g.

Table 24: Per Capita Fish and Protein Consumption by Land Holding Class in Hail Haor Sept'99 to May'00

Class	Fish (g)	Meat (g)	Egg (#)	Milk (g)	Pulses (g)
Landless	44.98	4.43	0.06	3.90	11.46
Marginal farmers	45.92	4.79	0.07	8.82	12.61
Small farmers	46.62	5.00	0.07	14.32	13.54
Medium farmers	49.02	6.74	0.11	8.66	11.96
Large farmers	51.50	4.44	0.03	5.98	12.29
All Households	**45.98**	**4.78**	**0.06**	**6.55**	**12.00**

3.1.2 Village Comparisons

The sample villages at the Hail Haor site are located in proximity to the wetlands of the Hail Haor basin. Data was analyzed to assess the availability of fish and other protein food consumption in the different villages by the sample households. Table 25 gives data on the per capita consumption of various protein food items by village. Per capita fish consumption was found to vary between 24g to 57g.

The lowest fish consumption was found in Bade Alisha village. The reasons for this may be the more distant location of the village from Hail Haor as well as lower involvement in fishing compared to other villages (only 34% involved in commercial fishing). Most of the villagers are blacksmiths by profession in Bade Alisha village. The highest per capita fish consumption was observed in Pashim Varaura village. The reasons for higher consumption in this village might be the closer location of the village to the Hail Haor site and that the sample households are exclusively fishers. There is a daily fish market near the village and the villagers can easily purchase fish.

The majority of the sample households in the villages of Shuilpur, Mirzapur Namapara, Lalbagh, Pashim Varaura, Hazipur, Baruna Maigarhati, Baruna Barobari and Baruna are involved in commercial fishing and accordingly fish consumption was found to be higher in these villages. Most of the sample households in Bobasara village are engaged in subsistence fishing, the villagers have almost year-round access to Jethua Beel and the adjacent floodplains.

The consumption of dry fish was common in all the sample villages. A higher consumption of dry fish was recorded in Baruna Maigarhati village where overall fish consumption was found to be less compared to other villages (Table 25) except Bada Alisha village. Although 100% of the sample households are involved in commercial fishing in Baruna Maigarhati the reason for the low consumption of fish there is not known.

Table 25: Per Capita Fish and Other Protein Consumption by Village in Hail Haor Sept'99 to May'00

Village	Fish (g)	Meat (g)	Egg (#)	Pulse (g)	Milk (g)
Shuilpur	51.07	6.78	0.03	7.45	3.66
Mirzapur Namapara	47.60	4.82	0.05	6.68	4.04
Boulashir Namapara	48.91	1.73	0.03	11.70	14.32
Vimshi Namapara	45.77	0.85	0.05	18.89	12.18
Bade Alisha	23.87	1.99	0.03	17.44	1.18
Rustompur	40.18	1.32	0.02	20.85	9.20
Dighapara	39.57	1.75	0.03	13.96	4.39
Lalbag	53.50	9.91	0.08	5.63	1.09
Pashim Varaura	57.47	8.77	0.08	10.10	1.00
Hazipur	51.88	2.78	0.05	6.20	9.37
Baruna Maigarhati	34.24	11.55	0.02	11.60	5.44
Baruna Borobari	49.16	3.54	0.01	12.61	2.43
Uttar Baruna	52.85	7.44	0.02	6.99	1.56
Bobasara	52.68	4.90	0.02	8.33	11.05
All Villages	**45.98**	**4.78**	**0.06**	**6.55**	**12.00**

Consumption of meat was found highest in villages that are located closer to the larger towns and where most of the households are Muslims. Table 25 above shows per capita meat consumption in the surveyed villages. The highest consumption of meat was found in Baruna Maigarhati. People there reported that beef traders live in their village and that the traders often sell beef locally at a cheaper price.

Table 25 also shows that more eggs were consumed in Mirzapur Namapara, Vimshi Namapara, Lalbag, Hazipur and Pashim Varaura, all villages located nearer to the Hail Haor basin where many villagers are able to raise ducks. Per capita consumption of milk was found to be highest in villages where the households are dependent on agriculture in addition to fishing. These villages include Boulashir Namapara, Vimshi Namapara and Bobasara.

A higher consumption of pulses was found in the sample groups with more Hindus who prefer vegetables and pulses over animal protein, particularly meat. Hindus observe several days or weeks in a year when it is forbidden by religion to eat meat or eggs. The predominantly Hindu villages include Boulashir Namapara, Vimshi Namapara, Bade Alisha, Dighapara, Rustompur and Baruna Barobari. Consumption of pulses was found to be high in these villages compared to other villages where Muslims are dominant.

3.1.3 Comparisons by Month

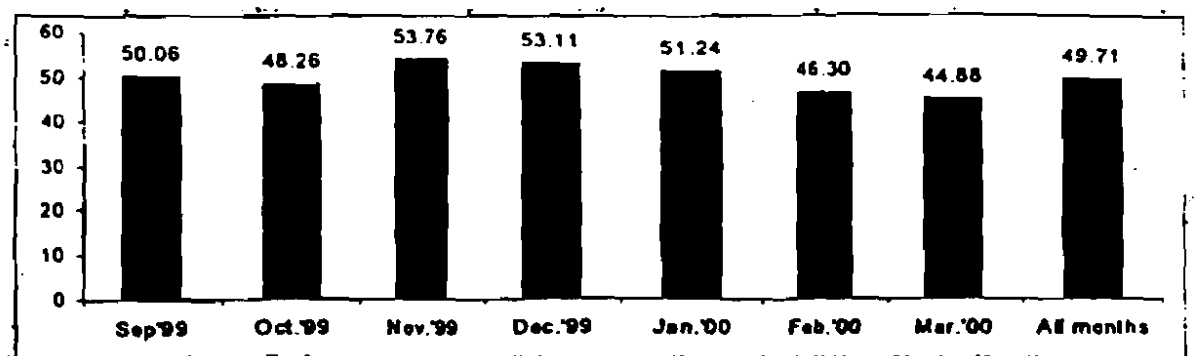

Figure 7 : Average per capita fish consumption (g) in Hail Haor Site by Months

Fish availability and consumption is influenced by seasonal variations in the water regime and fish production. Figure 8 shows per capita fish consumption by months. Higher per capita fish consumption was recorded during the late or Post-Monsoon months that coincide with the recession of floodwaters and the Dry season major fish catch in the beels and canals (Figure 7).

The consumption rate began to decrease from January (51g) and this continued up to May (45 g). During September the consumption was high (50 g) but dipped in October'99 (48g). Less fishing in October may be due to the rice harvest. MACH socioeconomic survey, shows that there are 64% land less, 18.5 % marginal, 9% small, 6% medium and over 2 % large landholding households among the sampled households (Appendix 20).

Table 26: Percentage Distribution of Consumed Fish by Source in Hail Haor Site

Land Holding	Sources of Consumed Fish (%)		
	Caught	Bought	Gift
Landless	32.44	65.34	2.21
Marginal farmers	34.05	63.48	2.48
Small farmers	26.09	71.82	2.10
Medium farmers	29.69	68.79	1.52
Large farmers	26.49	72.38	1.13
All Classes	**31.56**	**66.30**	**2.14**

3.1.4 Sources of Consumed Fish

The fish consumed in the sample households were mainly from three sources. They were caught by members of the households themselves, they were bought from markets or they were received as gifts from relatives or neighbors. Table 26 shows sources of consumed fish by household and land holding in the Hail Haor site.

A surprising finding is that most fish consumed by the sampled households are purchased either from markets or from fishers who sometimes sell their entire catch and then buy other fish for family consumption. Total fish consumed by the households for the period from September to May was about 66 % purchased and about 32 % caught. About 2 % of consumed fish were obtained from neighbors or relatives as a gift. A similar trend was observed among all social classes of households. However, among the landless and marginal farm families, the amount of fish caught was found to be higher than in other social classes

3.1.5 Species Composition Of Consumed Fish

The total amount of fish consumed by the households at the Hail Haor site during the nine month monitoring period are categorized into 13 groups according to fish type (Table 27) Data shows that the small fish group ranked first and accounted for 58 % of the total fish consumed in 14 sample villages. Snakeheads were found to be the second highest consumed species and formed 14 % of the consumed fish by weight. Small catfish ranked the third highest at 653kg while major carp constituted only 3 % of the consumed fish in Hail Haor. Dry fish consumption was found to be much higher in Hail Haor (284 kg: 4 %) and ranked fourth.

Table 27: Species Group Composition of Consumed Fish in Hail Haor Site

Species group	Total Consumed Fish in Hail Haor Site	
	Weight (kg)	%
Small fish	4,256.68	58.24
Snakeheads	1,031.82	14.12
Small catfish	653.14	8.94
Dry fish	283.68	3.88
Prawns	258.30	3.53
Major carps	201.33	2.75
Exotic fish	141.52	1.94
Hilsha	137.41	1.88
Large catfish	116.67	1.60
Eels	92.85	1.27
Minor carps	78.11	1.07
Knife fish	56.81	0.78
Others	1.18	0.02
Total	**7,309.49**	**100**

3.2 Turag-Bangshi Site

Per capita fish consumption rate in Turag-Bangshi was found to be lower than in Hail Haor. Table 28 shows the fish and other protein food consumption in the sample villages in Turag-Bangshi site. On an average per capita fish consumption was found to be 25 g. The highest consumption of 30 g was found among the landless families and the lowest of 25 g was found among the large farm families

The overall consumption of other protein sources—meat, eggs, pulses and milk—was found to be higher in Turag-Bangshi than in Hail Haor (Table 28). In addition to fish, it was found that the landless families in Turag Bangshi consumed slightly more eggs than other family classes. The fish catch in the Turag-Bangshi site is significantly lower than Hail Haor and is the likely cause of lower consumption.

Table 28: Per Capita Fish and Protein Consumption by Land Holding Classes in Turag-Bangshi Oct'99 to April'00

Class	Fish (g)	Meat (g)	Egg (#)	Milk (g)	Pulses (g)
Landless	30.06	6.65	0.05	12.71	13.87
Marginal farmers	28.79	10.47	0.04	17.35	15.33
Small farmers	28.34	8.37	0.04	15.37	16.47
Medium farmers	29.84	13.30	0.04	32.19	16.98
Large farmers	25.30	10.42	0.03	28.05	14.38
All Households	**25.26**	**8.64**	**0.04**	**17.07**	**14.83**

3.2.1 Village Comparisons

The average per capita consumption of fish and other protein foods varied by villages in Turag-Bangshi. Tab 29 shows that the lowest per capita fish consumption of 17 g was recorded in Taltoli village and the highest 34 g in Kaliadoho. The higher consumption of fish in Kaliadoho village is due to its location between the Tur River and Mokesh Beel where villagers are closer to fishers. In Taltoli village the majority of households we

involved in crop farming and subsistence fishing. The majority of the villagers are also Hindu and avoid fish at certain religious occasions. Consumption of dry fish was the highest in Majukhan village.

Table 29: Per Capita Fish and Protein Consumption by Village in Turag-Bangshi Oct'99 to April'00

Village	Fish (g)	Meat (g)	Egg (#)	Milk (g)	Pulses (g)
Majukhan	22.92	7.08	0.08	7.70	17.49
Taltoli	17.57	3.47	0.02	15.20	25.30
Bashtoli	25.28	14.79	0.04	19.26	18.54
Kaliadoho	32.67	12.12	0.03	9.67	16.37
Sholhati	28.22	3.32	0.04	16.91	17.53
Gopinpur	20.25	3.75	0.01	13.23	8.59
Boroibari	24.35	10.37	0.04	13.10	0.52
Medi Ashulai	37.44	13.62	0.08	23.06	35.50
All Villages	**25.26**	**8.64**	**0.04**	**17.07**	**14.83**

3.2.2 Comparisons by Month

The highest consumption of fish was recorded in September; the trend declined overall from that point. In

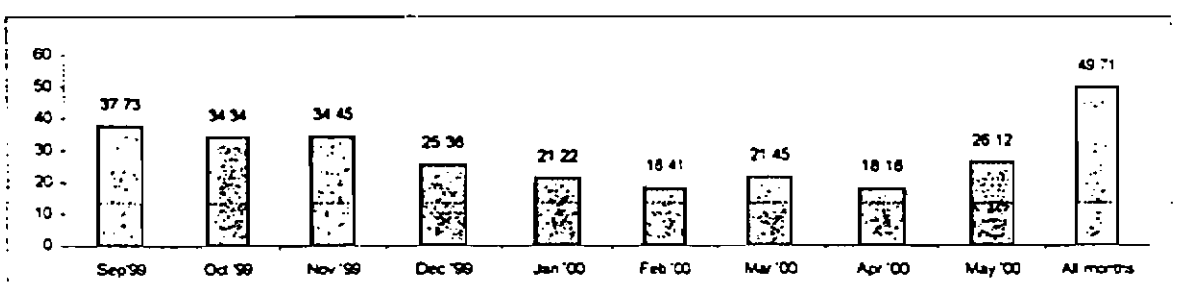

Figure 8: Per capita fish consumption (g) in Turag-Bangshal by months

general, less fish were consumed during the Dry season, from February to May of 2000.

3.2.3 Sources of Consumed Fish

Table 30 shows the percentages of the sources of consumed fish The amount of market purchased fish was found to be higher in Turag-Bangshi than in Hail Haor. The findings show that the households of the poorer classes tend to catch more fish than the households of the more wealthier families while the wealthier households buy more than their poorer neighbors.

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Table 30: Percentage Distribution of Consumed Fish by Source in Turag-Bangshi Site

Classes	Sources of Consumed Fish (%)		
	Caught	Bought	Gift
Landless	31.54	63.49	3.95
Marginal farmers	26.00	69.54	3.58
Small farmers	20.31	75.93	3.49
Medium farmers	17.21	79.50	2.61
Large farmers	17.16	75.83	5.72
All Classes	**27.11**	**69.08**	**3.81**

3.2.4 Species Composition Of Consumed Fish

The total amount of fish consumed by the households at the Turag-Bangshi site during the nine month monitoring period are categorized into 13 groups according to fish type (Table 31). The data shows that the small fish group ranked at the top and accounted for 48 % of the consumed fish. Exotic carps and other exotic species (13 %) were found to rank second in consumption followed by major carps (12 %), small prawns (8%), eels (5%) and catfish. Dry fish consumption was low (7kg: 0.53%) in Turag-Bangshi. It should be noted that all exotics and most major carps are from fish ponds rather than the open water.

Table 31: Species Group Composition of Consumed Fish in Turag-Bangshi

Species group	Consumed Fish in Turag-Bangshi	
	Weight (g)	%
Small fish	603.68	48.24
Exotic fish	159.23	12.73
Major carps	149.74	11.97
Prawns	102.95	8.23
Eels	63.65	5.09
Small catfish	51.39	4.11
Snakeheads	48.44	3.85
Large catfish	36.89	2.95
Hilsha	17.84	1.43
Minor carps	7.15	0.57
Dry fish	6.62	0.53
Knife fish	3.40	0.27
Others	0.37	0.03
Total	**1,251.38**	**100**

Section C

Wildlife

1. Introduction

MACH is working with local communities to manage their natural resources in order to provide them with a sustainable supply of wetland products. Baseline studies have been conducted in order to determine the existing environmental and social situations to allow the project to better serve the needs of the project communitites. Additonally these reports will the project to measure changes brought about as a result of project interventions.

Vertabrate wildlife (Birds, Mammals, Reptiles and Amphibians) are a part of that environment. The major emphasis of the baseline studie has been on the resource most important in people's lifes- in the case of Bangladesh wetlands that is the repective fisheries. A very limited wildlife survey has been conducted to gain information particularly on birds and wildlife present at project sites. MACH-CNRS is responsible for developing a quanitative baseline for wildlife by indicating presence or absence of species surveyed.

1.1 Goal and Objectives

The goal of the survey is to develop a qualitative baseline data set on the animal species present within the project area during the baseline year. Specific objectives are as follows:

- List the available species of *Amphibia, Reptilia, Aves* and *Mammalia* in the project area
- Prepare a list of threatened (Critically Endangered, Threatened and Vulnerable) species found at the project sites according to the IUCN-Bangladesh Red Data Book
-

2. Methodology

The following methods were used for recording presence, for identification and for gathering information. Presence or absence was determined in both general surveys and transects during the two major seasons, winter (dry) and summer (wet).

- Transect lines were drawn across the observed habitats
- Plot counting to enumerate the density of amphibians and slow moving reptilian species
- Dropping counts for mammals and predatory birds
- Flashing for nocturnal birds
- Photography, call, and trap collection of specimens for taxonomic confirmation
- Block counting for fast moving reptiles, birds and mammals
- Interviews with local people such as fishers, boatman, forest wood collectors and other professionals

An assesment of habitat types was conducted at each of the sites. Transects were designated covering all Hail Haor including beels, paddy fields, the homestead areas and riparian vegetation. Additional information that will be presented in the watershed planning document was collected on areas in the surrounding watershed including lemon gardens, tea gardens, natural forest, rubber plantations and forest plantations and natural forest. A transect from the main landing east of Beri beel to a palm tree at Bhunabir included two types of habitats—beel and paddy field. Transect 2 (from Foyzabad hill's Wood bridge to Bridge on paved road in Bhunabir) included the homestead areas, riparian areas, lemon gardens and tea gardens and Transect 3 (from West of Magurchhara Khasia-punji to the south of #10 section of Burburi-chhara tea garden) contained the rubber plantations, natural forest and forest plantations (Map 1). At the Turag-Bangshi site, three transects were drawn

covering all the major habitats viz. Beel, River, Floodplain, Sal forest, Riparian zone, Paddy field and settlements. Transect 1 covers from Bastali Village (North of Turag River) to West of Sinabaha bazar. Transect 2 covers from west of Baraibari bazar to Kalidaha bridge. Transect 3 covers from Boalia village to Turag riverside.

3. Findings

During the first visit (3-5 October 1999) to the Cheruadubi Beel, Balla Beel and Fuainna Beel of the Hail Haor basin, a total of 97 species including five Amphibians, 18 Reptilians, 17 Mammalians and 56 Birds were recorded (Appendix 21). The wet season survey was conducted during 17-24 April 2000. 129 species consisting of five Amphibians, 17 Reptilian, 88 Birds and 19 Mammalian species were recorded during that survey (Appendix 22). A total of 165 species was observed at the Hail Haor site during the year survey.

In the Turag-Bangshi site the dry season survey was conducted during 25-28 January 2000. 116 species were observed including five Amphibian, 14 Reptilian, 83 Birds and 14 Mammalian (Appendix 23). The wet season data was collected during 18-20 May 2000 and six Amphibian, 16 Reptilian, 72 Birds and 16 Mammalian species were observed (Appendix 24).

The cumulative species diversity of wildlife of the sites has been arranged counting each species only one time in a common table (Appendix 25). There are 165 different species present at the Hail Haor site while at the Turag-Bangshi site there are 144. A cumilative total of 196 wildlife species including reptilian, amphibian, mammalian and birds, were observed (Table 32) at the two MACH sites.

Table 32 : Vertebrate Wildlife of Hail Haor and Turag-Bangshi Site

Organism		Hail Haor			Turag-Bangshi			Cumulative
		Dry	Wet	Total	Dry	Wet	Total	
Wildlife	Reptilian	18	17	20	14	16	16	20
	Amphibian	5	5	5	5	6	6	7
	Mammalian	17	19	21	14	16	20	24
	Birds	57	88	119	83	72	102	145
Total		**97**	**129**	**165**	**116**	**110**	**144**	**196**

A total of 26 species of threatend non-fish vertebrate species were identified at the sites as shown in Table 33 These included critically endangered (CR), endangered (EN) and vulnerable species as 2, 13 and 11 respectively.

Table 33: Threatened wildlife Species Identified at MACH Sites

Common English Name	Scientific Name	Hail Haor Site	Turag-Bangshi Site	Status
Birds				
Jungle nightjar	Coprimulgus indicus		Y	EN
Brown fish owl	Bubozeylonensis	Y		EN
Amphibians				
Frog	Microhyla ornata		Y	VU
Reptilia				
Common Vine Snake	Ahaetulla nasatus	Y	Y	VU
Softshell Turtle	Aspideretes humm	Y		EN
Banded Krait	Bungarus fasciatus	Y	Y	EN
Wall Lizard	Gekko gekko	Y	Y	VU
Brahminy Terrapin	Hardella thurgi	Y	Y	EN
Asian Tortoise	Kachuga smithi	Y		EN
Monocellate Cobra	Naja kaothia	Y	Y	VU
Binocellate Cobra	Naja naja	Y	Y	EN
Rat Snake	Ptyas mucosus	Y	Y	VU
Rock python	Python molurus	Y		EN
Bengal Lizard	Varanus bengalensis	Y	Y	VU
Mammalians				
Asiatic Jackal	Canis aureus	Y	Y	VU
Fishing Cat	Felis viverrina	Y		EN
Common Mongoose	Herpestes edwardsi	Y	Y	VU
Hoolock Gibbon	Hylobates hoolock	Y		CR
Porcupine	Hystrix indica	Y	Y	EN
Rufoustailed Hare	Lepus nigricollis	Y	Y	EN
Common Otter	Lutra lutra	Y	Y	CR
Rhesus Macaque	Macaca mulata	Y		VU
Freshwater Dolphin	Platanista gangetica		Y	EN
Large Civet	Virerra zibetha	Y	Y	EN
Small Civet	Viverricula indica	Y	Y	VU
Bengal fox	Vulpes bengalensis	Y	Y	VU

Section D

Vegetation

1. Introduction

MACH Project has been working since early 1999 to enhance the aquatic resources at three project sites in Bangladesh—the Hail Haor site in Srimongol, the Turag-Bangshi site in Kaliakoir and the Sherpur site in Sherpur district. The natural resources of wetland vegetation provides food, forage, housing materials and other valuable resources. A vegetation survey is therefore important to know the status of these resources. Since the abundance and variety of vegetation vary with the seasons this survey was conducted once in the Dry season and again during the Monsoon season. In order to establish a baseline for vegetation species diversity, surveys were conducted in the three sites. In this report the Hail Haor and Turag-Bangshi site results are included; the Sherpur results will be added at a later date.

2. Methodology

Data was collected by direct field observation and by interviews with the local people. Quadrate qualitative (for aquatic vegetation) and quadrate quantitative (for terrestrial vegetation) methods were also used in this survey. After visiting the field, transects were drawn based on vegetation diversity, occurrence and habitat types. The vegetation was studied in the varying sized quadrates. For the aquatic and terrestrial vegetation study $2m^2$ and $4m^2$ quadrates from each transect were examined. For aquatic vegetation, type, habitat, cover and use were examined while for terrestrial vegetation, density, frequency, abundance, relative density, relative frequency, relative abundance and important value index were studied.

3. Findings

3.1 Hail Haor Site

In the Hail Haor site 84 species (Appendix 26) of vegetation were observed during the Dry Season from 1 November 99 to 30 November 99. Among the total species 53 genus and 26 families were observed during this period.

In the Wet season 86 species (Appendix 27) of vegetation were observed; among these 11 species are dominant. These are *Oryza rufippgon, Hygroryza aristata, Eichbornia crossipes, Psendo raphis sp, Nympaea sp, Nelumtro nucifera, Monochoria hastata, Hydrilla verticillata, Najas graminea, Ceratophyllum sp and Utricularin auria*. Among these hydrophytes local people use 17 varieties; three for fish food (*Hydrialla, Najas, Azolla*), six for cattle food (Jhoradhan, Paura, Arail, Jarmoni, Chatiogol, Choto Chesra), two for bio-fertilizer (Jarmoni, Futki) and one for their own consumption (Padma, Shapla, Shingrai). The Hindu community uses leaves and flowers from the Padma for their festival and Jarmonifana, locally called Dal, is used for katha fishing.

A total of 107 species has been recorded in the Hail Haor site through out the year. (Appendix 28)

Table 34 : Types of Vegetation Observed in Hail Haor

Sl. No.	Types of Vegetation	Dry Season	Wet Season
1.	Free floating	6	5
2.	Floating leaved	7	8
3.	Submerged floating	8	5
4.	Rooted submerged	5	6
5.	Rooted emergent	58	59
	Total species observed	84	86

3.2 Turag-Bangshi Site

A total of 20 species (Appendix 29) of vegetation under 14 families were observed during the vegetation survey during the Dry season in two beels, Mokash and Kaliadha.

During the Wet season a total of 39 species (Appendix 30) of aquatic vegetation were observed in three beels. In the Mokash Beel, 31 species were from 21 genus and 12 families. In Kaliadha Beel there were 31 different species from 25 genus and 16 families and in Aowla Beel there were 22 species from 16 genus and 12 families.

A total of 52 hydrophytes has been recorded in Turag_Bangshi site (Appendix 31)

Table 35 : Types of Vegetation Observed in Turag-Bangshi

Sl. No.	Types of Vegetation	Dry Season	Wet Season
1.	Free floaters	5	2
2.	Floating leaved	3	4
3.	Submerged floating	1	3
4.	Rooted submerged	4	6
5.	Rooted emergent	7	25
	Total species observed	**20**	**40**

4. Terrestrial Vegetation Status

For the research on riparian vegetation at each site two surveys were conducted during two seasons—the Dry season (from November to January) and the Monsoon season (from June to August). At the Hail Haor site surveys were conducted 1-27 November 1999 and 18-31 July 2000 At the Turag-Bangshi site surveys were conducted 22-27 January 2000 and 5-9 September 2000.
A total of 55 terrestrial vegetation species (Appendix 32) has been recorded in Hail Haor site and 63 species has been recorded in Turag-Bangshi site (Appendix 33).

5. Discussion

It is clear that the number of species observed during the Wet season is lower than during the winter season. It can also be said that during the Winter, the dominant species is the grass *Echinochloa stagnina* (Paura) while during the Wet season the dominant species is *Hydrilla kerticillate* (Kata Shaola), a submerged hydrophyte From this information it is clear that sufficient water and temperature are essential for hydrophytes

Appendices

Apppendix 1

MACH

Date ☐☐ ☐☐ ☐☐

M M D D Y Y

Fish Catch Monitoring Form

Habitat ☐

1. Information about Gear and Fishermen type:

1.1 Gear: 1.2 No. of Gear: 1.3 Length (m): ☐☐☐ ☐☐

1.4 Width (m): ☐☐ 1.5 Diameter (m): ☐☐ ☐☐ 1.6 Mesh size (mm): ☐☐

1.7 Fishermen type: ☐ 1.8 Involve person 1.9 Villages: _____

Age	Sex	Age	Sex

1.10 Distance from village to habitat (km): ☐☐ ☐☐

1.11 Total number of this type of gear operated today: ☐☐

2. Fishing time:

2.1 Fishing began at: ☐☐ ☐☐ 2.2 Time spent for present catch: ☐☐ ☐☐

2.3 Expected to end at: ☐☐ ☐☐ 2.4 Expected fishing hour: ☐☐ ☐☐

3 Species, number and weight of caught fish (g).

Species	Number	Weight	Species	Number	Weight

Total weight (sample) [in case of sub-sample]: ☐☐☐☐☐☐

5. Fishing rights (code): ☐☐ Name of Enumerator: _____

Appendix 2 - List of Observed Gears at Hail Haor

Local Name	Inside Hail Haor	Outside Hail Haor
Veshal/Khara	✓	✓
Ber Jal	✓	✓
Gamcha		✓
Thela Jal /Jali	✓	✓
Dharma Jal		✓
Jhaki Jal	✓	✓
Current Jal	✓	✓
Koch	✓	✓
Kathi Borshi	✓	
Doar	✓	
Hat Borshi		✓
Guli/Ghuni	✓	✓
Gara Borshi		✓
Polo		✓
Jhuri		✓
Hatani	✓	✓
Dewatering	✓	✓
Bana/Bara		✓
Nouka Shecha		✓
Daon Borshi/Longline	✓	✓
Taki Jal	✓	✓
Suta Jal	✓	✓
Uthal Jal		✓
Lauya Jal		✓
Hogra		✓
Afa Jal	✓	
Faron	✓	✓
Chonga		✓
Chalun		✓
Uka/Fuka		✓

Appendix 3 – Average Commonly Fishing Efforts (observations/day) at Hail Haor

Months	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Jan	Feb	March
Inside Hail Haor												
Jethua Beel												
Veshal/Khara			0	0	2	1	0	0	0	0	0	0
Ber Jal			1	0	0	0	0	0	0	0	0	0
Thela Jal			0	2	0	0	0	0	2	3	2	1
Current Jal			14	64	91	110	59	17	8	0	4	4
Guli/Guni			5	48	0	0	0	28	66	0	0	0
Suta Jal			0	0	0	0	30	27	0	0	0	3
Gopla river (Inside Hail Haor)												
Veshal/Khara	0	4	7	7	0	0	1	3	12	0	0	9
Ber Jal	6	0	0	0	1	0	0	1	0	0	0	1
Thela Jal	0	0	2	0	0	0	0	3	0	0	0	5
Current Jal	0	0	0	0	0	7	64	4	0	20	0	0
Guli/Guni	0	0	0	0	0	0	0	0	0	0	0	0
Suta Jal	0	0	0	0	0	130	0	0	0	0	0	0
Boulashir Floodplain												
Veshal/Khara		0	1	0	0	0	0	0	0	0	0	0
Ber Jal		0	2	2	0	2	1	1	0	0	0	0
Thela Jal		10	7	13	4	5	0	0	0	4	0	1
Current Jal		3	21	63	78	68	88	166	148	72	0	35
Guli/Guni		570	471	123	0	0	0	0	12	145	0	93
Suta Jal		0	0	0	95	10	166	125	72	0	0	0
Cheruadubi Beel												
Veshal/Khara						0	0	0	2	0	0	1
Ber Jal						0	0	0	0	1	0	0
Thela Jal						0	0	1	4	0	0	2
Current Jal						0	0	9	20	30	0	49
Guli/Guni						0	0	0	0	0	0	0
Suta Jal						0	80	146	116	0	0	0
Alni Beri Beel												
Veshal/Khara	0	0	0	0	0	0	0	0	0	0	0	0
Ber Jal	0	0	0	0	0	0	0	0	0	0	0	2
Thela Jal	5	0	0	0	0	0	0	3	1	0	0	1
Current Jal	0	0	24	0	0	0	0	19	200	0	0	11
Guli/Guni	0	0	0	0	0	0	0	0	0	0	0	0
Suta Jal	0	0	0	0	0	0	19	0	100	0	0	0
62- Beel												
Veshal/Khara		0	0	3	0	1	0	0	0	0	0	0
Ber Jal		0	0	0	0	11	2	4	1	0	0	0
Thela Jal		4	8	1	0	1	0	1	1	0	0	0
Current Jal		0	0	383	429	341	376	814	176	18	0	0
Guli/Guni		0	517	253	0	0	0	0	107	96	0	0
Suta Jal		0	2	0	0	64	162	129	64	0	0	0
Rustompur												
Veshal/Khara				0	0	0	0	3	2	0	0	0

Ber Jal				0	0	0	1	1	0	0	0	0
Thela Jal				0	0	0	0	0	0	0	0	0
Current Jal				0	0	246	115	446	319	0	0	0
Guli/Guni				0	0	0	10	42	140	0	0	0
Suta Jal				0	0	171	28	152	120	0	0	0
Bala Beel												
Veshal/Khara			0	0	0	0	0	0	0			0
Ber Jal			0	0	1	0	0	1	0			0
Thela Jal			0	4	5	0	0	1	1			1
Current Jal			0	0	20	25	24	14	218			0
Outside Hail Haor												
Gopla River (Shamshergonj)												
Veshal/Khara	0	4	7	7	0	0	1	3	12	0	0	9
Ber Jal	6	0	0	0	1	0	0	1	0	0	0	1
Thela Jal	0	0	2	0	0	0	0	3	0	0	0	5
Jhaki Jal	0	0	0	0	0	0	0	0	1	0	0	1
Current Jal	0	0	0	0	0	7	64	4	0	20	0	0
Boro Haor												
Veshal/Khara			0	0	0	16	3	1	0	0	0	0
Ber Jal			0	0	0	0	0	0	0	0	0	0
Thela Jal			0	0	0	1	0	0	1	1	3	2
Jhaki Jal			0	0	0	0	0	0	0	0	0	0
Current Jal			0	0	0	0	0	0	0	0	0	99
Shaborak Canal												
Veshal/Khara					0	0	0	0	0	0	0	0
Ber Jal					0	0	0	0	0	0	0	0
Thela Jal					0	2	1	0	0	0	0	0
Jhaki Jal					1	0	3	0	0	0	0	0
Current Jal					0	0	0	0	0	0	0	0
Kushiara River												
Veshal/Khara				6	5	3	3	2	0	0	0	0
Ber Jal				0	0	0	0	0	0	0	0	0
Thela Jal				0	0	1	2	0	0	0	0	0
Jhaki Jal				2	2	2	3	2	1	0	3	2
Current Jal				0	0	0	0	1	0	0	0	0
Beezna												
Veshal/Khara				4	8	6	4	2	4	3	1	1
Ber Jal				0	0	0	0	0	0	0	0	1
Thela Jal				0	1	0	1	1	0	1	0	3
Jhaki Jal				2	2	4	3	3	0	1	2	2
Current Jal				0	0	0	0	0	0	0	0	0
Kamarkhali Canal												
Veshal/Khara				0	1	2	3	2	0	0	0	0
Ber Jal				0	0	0	0	1	0	0	0	0
Thela Jal				2	4	2	9	2	1	0	0	1
Jhaki Jal				1	8	7	11	10	1	0	0	0
Current Jal				0	0	0	0	0	0	0	0	0

Appendix 4 - Average Fishing Hours of Major Gear by Month, Season and Habitat in Hail Haor Site

Season	Month	Within Hail Haor						Outside Hail Haor				
		Thela	Veshal	Current	Ber	Guli/ Ghuni	Suta Jal	Thela	Veshal	Current	Ber	Jhaki
Beel												
	Apr-99	4.5	0	0	0	0	0	0	0	0	0	0
	May-99	7	0	0	0	0	0	0	0	0	0	0
	Jun-99	0	0	8.08	3.5	9.28	13	0	0	0	0	0
Pre-Monsoon		5.75	0	8.08	3.5	9.28	13	0	0	0	0	0
	Jul-99	0	0	0	0	0	0	0	0	0	0	0
	Aug-99	0	0	9.25	7	0	0	0	0	0	0	0
	Sep-99	10	14.5	7.89	11.95	0	10.19	0	0	0	0	0
Monsoon		10	14.5	8.04	11.50	0	10.19	0	0	0	0	0
	Oct-99	0	0	8.43	10.75	0	12.15	0	0	0	0	0
	Nov-99	8.64	12	11.36	10.8	0	13.23	0	0	0	0	0
	Dec-99	8.17	0	16.46	9.83	21.50	16.32	0	0	0	0	0
Post Monsoon		8.47	12	12.01	10.67	21.50	14.05	0	0	0	0	0
	Jan-00	3.5	0	17.33	12	0	0	0	0	0	0	0
	Feb-00	4.5	0	8	0	0	0	0	0	0	0	0
	Mar-00	8.06	24	13.4	6	0	0	8.75	0	22.65	0	0
Dry		6.39	24.00	14.11	9	0	0	8.75	0	22.65	0	0
Floodplain												
	Apr-99	0	0	0	0	0	0	0	0	0	0	0
	May-99	3.94	0	18.25	0	19.63	0	0	0	0	0	0
	Jun-99	4.34	9.88	10.56	7	10.56	0	0	0	0	0	0
Pre-Monsoon		4.28	9.88	11.20	7	11.07	0	0	0	0	0	0
	Jul-99	4.11	12.38	9.13	5.25	11.52	0	0	0	0	0	0
	Aug-99	4.46	0	11.55	0	0	9.50	0	0	0	0	0
	Sep-99	1.84	12.5	8.6	10.11	0	14	0	0	0	0	0
Monsoon		3.97	12 40	9.64	9.03	11.52	11.72	0	0	0	0	0
	Oct-99	0	0	9.82	8	12	10.83	0	0	0	0	0
	Nov-99	7	24	9 32	11	10 58	10.26	0	0	0	0	0
	Dec-99	3 21	0	12 64	0	15.46	20 07	0	0	0	0	0
Post Monsoon		3.97	24	10.18	9	13.90	12.79	0	0	0	0	0
	Jan-00	6	0	20.50	0	23	0	0	0	0	0	0
	Feb-00	0	0	0	0	0	0	0	0	0	0	0
	Mar-00	2.5	0	7.21	7	13.81	9.00	0	0	17.5	0	0
Dry		4.83	0	12 53	7			0	0	17.5	0	0
River												
	Apr-99	0	0	0	5	0	0	0	0	0	0	0
	May-99	0	16	0	0	0	0	0	0	0	0	0

Season	Month	Within Hail Haor						Outside Hail Haor				
		Thela	Veshal	Current	Ber	Guli/ Ghuni	Suta Jal	Thela	Veshal	Current	Ber	Jhaki
	Jun-99	6.11	11.29	0	0	0	0	0	0	0	0	0
Pre-Monsoon		6.11	11.90	0	5	0	0	0	0	0	0	0
	Jul-99	0	13.89	0	0	0	0	6.00	11.19	0	0	6.83
	Aug-99	0	0	0	9	0	0	2.17	11.15	0	0	9
	Sep-99	0	0	12	0	0	7	6	13.01	0	0	8.15
Monsoon		0	13.89	12	9	0	7	4.36	13.53	0	0	8.24
	Oct-99	0	11	13	0	0	0	3.25	17.21	0	5	7.81
	Nov-99	9.3	15.86	13	10	0	0	4.54	19.72	6	8	8.45
	Dec-99	0	21.59	0	0	0	0	5	14.10	0	6.5	8.13
Post Monsoon		9.3	19.48	13.00	10	0	0	4.26	17.97	6	6.80	6.00
	Jan-00	0	0	5.75	0	0	0	4.75	19.20	0	0	8.95
	Feb-00	0	0	0	0	0	0	0	8.42	0	0	7.11
	Mar-00	8	20.03	0	8.75	0	0	3.14	8.47	0	10	6.64
Dry		8	20.03	5.75	8.75	0	0	3.43	13.18	0	10	7.51
Canal												
	Apr-99	0	0	0	0	0	0	0	0	0	0	0
	May-99	0	0	0	0	0	0	0	0	0	0	0
	Jun-99	0	0	0	0	6	0	12	12	0	0	0
Pre-Monsoon		0	0	0	0	6	0	12	12	0	0	0
	Jul-99	0	7.03	0	0	0	0	2	0	0	0	2
	Aug-99	0	12	0	0	0	0	3.75	14.58	4	0	4.85
	Sep-99	0	17.75	0	0	0	10	5.13	13.69	0	0	7.16
Monsoon		0	15.83	0	0	0	10	4.17	13.93	4	0	6.07
	Oct-99	0	0	0	0	0	9	4.44	14.25	0	0	4.21
	Nov-99	0	22.38	0	9	0	18	15.33	18.23	0	6	5.38
	Dec-99	0	14.33	11.67	0	0	24.5	5.06	0	0	0	3.5
Post Monsoon		0	17.55	11.67	9	0	19	8.18	15.87	0	6	4.82
	Jan-00	0	0	0	0	0	0	0	0	0	0	0
	Feb-00	0	0	0	0	0	0	0	0	0	0	0
	Mar-00	6	24	24	0	0	0	0	0	0	0	0
Dry		6	24	24	0	0	0	0	0	0	0	0

Appendix 5 - CPUE of Most Commonly Used Gears in Hail Haor Site

Season	Month	Within Hail Haor						Outside Hail Haor				
		Thela	Veshal	Current	Ber	Guli/ Ghuni	Suta Jal	Thela	Veshal	Current	Ber	Jhaki
Beel												
	Apr-99	0.41	0	0	0	0	0	0	0	0	0	0
	May-99	0.47	0	0	0	0	0	0	0	0	0	0
	Jun-99	0	0	0.19	3.68	0.06	0.67	0	0	0	0	0
Pre-Monsoon		0.44	0	0.19	3.68	0.06	0.67	0	0	0	0	0
	Jul-99	0	0	0	0	0	0	0	0	0	0	0
	Aug-99	0	0	0.16	6.61	0	0	0	0	0	0	0
	Sep-99	0.7	3.42	0.26	7.22	0	0.18	0	0	0	0	0
Monsoon		0.70	3.42	0.24	7.13	0	0.18	0	0	0	0	0
	Oct-99	0	0	0.13	7.49	0	0.15	0	0	0	0	0
	Nov-99	4.36	0.49	0.16	8.7	0	0.18	0	0	0	0	0
	Dec-99	2.26	0	0.17	6.87	0.28	0.16	0	0	0	0	0
Post Monsoon		3.60	0.49	0.16	8.12	0.28	0.16	0	0	0	0	0
	Jan-00	1.1	0	0.22	13.05	0	0	0	0	0	0	0
	Feb-00	1.12	0	2.76	0	0	0	0	0	0	0	0
	Mar-00	3.31	0.13	0.1	9.43	0	0	2.89	0	0.22	0	0
Dry		2.37	0.13	0.29	11.24	0	0	2.89	0	0.22	0	0
Floodplain												
	Apr-99	0	0	0	0	0	0	0	0	0	0	0
	May-99	0.61	0	0.07	0	0.01	0	0	0	0	0	0
	Jun-99	0.52	2.96	0.16	3.27	0.06	0	0	0	0	0	0
Pre-Monsoon		0.54	2.96	0.16	3.27	0.06	0	0	0	0	0	0
	Jul-99	0.45	3.54	0.16	3.07	0.02	0	0	0	0	0	0
	Aug-99	0.58	0	0.2	0	0	0.07	0	0	0	0	0
	Sep-99	0.34	2.59	0.2	9.42	0	0.07	0	0	0	0	0
Monsoon		0.46	3.35	0.18	8.01	0.02	0.07	0	0	0	0	0
	Oct-99	0	0	0.13	5.56	0	0.10	0	0	0	0	0
	Nov-99	1.09	7.8	0.24	3.41	0.13	0.22	0	0	0	0	0
	Dec-99	0.53	0	0.21	0	0.07	0.28	0	0	0	0	0
Post Monsoon		0.64	7.80	0.19	4.84	0.08	0.18	0	0	0	0	0
	Jan-00	1.11	0	0.28	0	0.12	0	0	0	0	0	0
	Feb-00	0	0	0	0	0	0	0	0	0	0	0
	Mar-00	2.2	0	0.09	6.38	0.04	0.84	0	0	0.1	0	0
Dry		1.47	0	0.15	6.38	0.06	0.84	0	0	0.10	0	0
River												
	Apr-99	0	0	0	1.85	0	0	0	0	0	0	0
	May-99	0	0.4	0	0	0	0	0	0	0	0	0
	Jun-99	0.52	4.04	0	0	0	0	0	0	0	0	0
Pre-Monsoon		0.52	3.57	0	1.85	0	0	0	0	0	0	0
	Jul-99	0	9.26	0	0	0	0	0.04	1.73	0	0	2.61

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Season	Month	Within Hail Haor						Outside Hail Haor				
		Thela	Veshal	Current	Ber	Guli/ Ghuni	Suta Jal	Thela	Veshal	Current	Ber	Jhaki
	Aug-99	0	0	0	4.41	0	0	0.4	1.74	0	0	1.32
	Sep-99	0	0	0.17	0	0	0.13	0.25	1.65	0	0	0.97
Monsoon		0	9.26	0.17	4.41	0	0.13	0.26	1.76	0	0	1.31
	Oct-99	0	4.05	0.2	0	0	0	0.41	2.68	0	4.48	0.88
	Nov-99	3.87	4.65	0.28	6.78	0	0	1.03	4.57	0.17	2.79	1.8
	Dec-99	0	6	0	0	0	0	1.01	3.46	0	6.17	1.21
Post Monsoon		3.87	5.53	0.24	6.78	0	0	0.87	3.63	0.17	4.48	1.38
	Jan-00	0	0	0.15	0	0	0	0.98	4.87	0	0	3.2
	Feb-00	0	0	0	0	0	0	0	1.89	0	0	1.19
	Mar-00	2.6	7.3	0	3.19	0	0	0.52	1.37	0	3.55	1.54
Dry		2.60	7.30	0.15	3.19	0	0	0.60	3.03	0	3.55	1.98
Canal												
	Apr-99	0	0	0	0	0	0	0	0	0	0	0
	May-99	0	0	0	0	0	0	0	0	0	0	0
	Jun-99	0	0	0	0	0.06	0	0	6.27	0	0	0
Pre-Monsoon		0	0	0	0	0.06	0	0	6.27	0	0	0
	Jul-99	0	0	0	0	0	0	0.1	0	0	0	0.1
	Aug-99	0	3.84	0	0	0	0	0.19	1.38	0.16	0	0.36
	Sep-99	0	3.84	0	0	0	0.61	0.21	2.5	0	0	0.61
Monsoon		0	3.84	0	0	0	0.61	0.19	2.19	0.16	0	0.49
	Oct-99	0	0	0	0	0	0.07	0.41	3.22	0	0	1.47
	Nov-99	0	3.36	0	12.96	0	0.39	2.19	18.51	0	18.14	3.88
	Dec-99	0	4.58	0.24	0	0	0.14	0.78	0	0	0	0.48
Post Monsoon		0	4.09	0.24	12.96	0	0.14	1.07	9.45	0	18.14	2.73
	Jan-00	0	0	0	0	0	0	0.83	0	0	0	0
	Feb-00	0	0	0	0	0	0	1.64	0	0	0	0
	Mar-00	1.25	15.97	0.18	0	0	0	1.71	0	0	0	0
Dry		1.25	15.97	0.18	0	0	0	1.53	0	0	0	0

Appendix 6 - Catch Composition (%) by Habitat and Season in Hail Haor

	Snakeheads	Eels	Major Carp	Large Catfish	Minor Carp	Prawns	Small Catfish	Small Fish
:thin Hail Haor								
e-Monsoon								
el	10.53	3.58	-	-	-	24.17	7.79	53.93
ɔodplain	29.18	8.56	-	0.19	-	4.09	6.74	51.22
ver	16..97	6.19	-	0.19	0.04	10.76	15.51	50.34
nal	0.61	16.34	-	-	-	-	3.31	93.69
onsoon								
el	12.37	2.76	0.24	0.08	0.20	0.60	5.69	76.25
ɔodplain	13.33	4.64	0.07	0.21	0.05	1.80	5.99	73.65
ver	3.56	3.40	0.21	0.38	-	1.88	8.84	81.50
nal	12.79	2.70	-	-	-	2.26	10.02	72.10
st Monsoon								
el	11.01	1.79	0.54	20.59	0.06	0.41	5.79	59.01
ɔodplain	6.76	1.00	0.05	12.96	0.02	0.37	5.88	72.74
ver	2.89	6.75	0.33	2.50	0.60	0.33	9.57	76.97
nal	18.82	2.16	0.33	3.21	-	0.15	19.10	56.11
y								
el	7.22	8.36	-	-	-	4.30	4.80	75.21
oodplain	2.27	0.62	-	-	-	1.33	6.07	89.70
ver	11.36	17.54	-	-	-	3.36	10.62	55.12
anal	15..23	15.38	-	-	-	0.59	12.18	56.62
utside Hail Haor								
re-Monsoon								
eel	-	-	-	-	-	-	-	-
oodplain	-	-	-	-	-	-	-	-
ver	-	-	-	-	-	-	-	-
anal	-	-	-	1.79	-	-	2.85	95.35
lonsoon								
eel	-	-	-	-	-	-	-	-
loodplain	-	-	-	-	-	-	-	-
ver	1.72	8.26	3.42	4.37	1.00	2.01	12.83	60.27
anal	0.72	2.87	15.33	6.92	13.88	1.61	4.27	52.22
ost Monsoon								
eel	-	-	-	-	-	-	-	-
loodplain	-	-	-	-	-	-	-	-
iver	6.55	9.95	5.10	4.49	1.11	1.54	10.71	59.99
anal	3.30	4.64	15.53	19.11	0.57	1.01	20.34	34.48
ry								
eel	32.34	0.79	5.71	14.55	-	0.50	10.32	34.68
loodplain	19.93	-	9.72	-	-	-	6.90	63.45
iver	1.47	2.70	0.86	5.23	-	3.08	26.55	60.11
anal	23.95	4.66	12.56	24.14	0.43	0.16	11.64	20.10

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Appendix 7 - Estimated Catch by Species in Hail Haor by Habitat Type

Sl #	Species Name	Total Number	Weight(Kg)	(%)
Beel				
1	Khalisha	1228405	14380.38	14.81
2	Meni/Bheda	412465	13079.06	13.47
3	Boal	15233	12448.03	12.82
4	Jat Puti	1734813	12022.6	12.38
5	Koi	168765	8796.66	9.06
6	Taki	283937	8600.98	8.86
7	Mola	3626957	6420.14	6.61
8	Tengra	394757	2883.79	2.97
9	Shing	102742	2162.35	2.23
10	Shol	26892	1918.72	1.98
11	Kaikla	235828	1652.21	1.70
12	Lal Khalisha	387294	1513.41	1.56
13	Tara Baim	88716	1420.98	1.46
14	Gura Echa	2244036	1280.28	1.32
15	Chuna Khalisha	592169	1227.51	1.26
16	Dankina	545860	1130.65	1.16
17	Foli	12197	1014.41	1.05
18	Guchi Baim	213593	783.46	0.81
19	Gol Chanda	459665	407.75	0.42
20	Magur	4364	384.3	0.40
21	Jhili Puti	329494	335.47	0.35
22	Tit Puti	150698	331.27	0.34
23	Ranga Chanda	640026	300.61	0.31
24	Gojar	2038	292.39	0.30
25	Cheng	40152	212.55	0.22
26	Kalibaush	1769	190.19	0.20
27	Tepa	28198	186.74	0.19
28	Kanchan Puti	29941	166.14	0.17
29	Golsa/Kabasi Tengra	18325	157.3	0.16
30	Kali/Napti Koi	168467	156.08	0.16

BEST AVAILABLE COPY

#	Species Name	Total Number	Weight(Kg)	(%)
	Rui	977	153.67	0.16
	Chela	82584	140.14	0.14
	Gutum	49818	124.69	0.13
	Lamba Chanda	125136	113.19	0.12
	Goinna	1227	97.16	0.10
	Thengua Echa	80191	83.87	0.09
	Bele	8483	74.54	0.08
	Futani Puti	131801	67.49	0.07
	Reckha Kholisha	56585	67.1	0.07
	Mrigel	793	57.46	0.06
	Elong	589	49.41	0.05
	Kani Pabda	3269	42.82	0.04
	Sheild Kholisha	20910	33.48	0.03
	Chep Chela	16761	28.06	0.03
	Potka	2515	26.08	0.03
	Kuicha	50	23.33	0.02
	Telapia	200	19.76	0.02
	Thai Shor Puti	62	10.08	0.01
	Chaka/Gangina/Kaouak	114	10.06	0.01
	Boro Baim	483	8.95	0.01
	Chola Puti	1700	8.44	0.01
	Grass Carp	10	4.39	0.01
	Dimua/Kathalia Echa	2970	1.47	0.00
	Bajri Tengra	120	1.44	0.00
	Naftani	111	0.82	0.00
	Chapila	135	0.72	0.00
	Madhu Pabda/Pabda	30	0.48	0.00
	Tin Chokha	186	0.09	0.00
otal		14775606	97105.61	100.0
loodplain				
	Jat Puti	2088115	11865.93	15.09
	Meni/Bheda	455731	11479.36	14.60
	Khalisha	1324756	11268.07	14.33
	Mola	2898633	8228.22	10.46

BEST AVAILABLE COPY

Sl #	Species Name	Total Number	Weight(Kg)	(%)
5	Koi	233368	6796.35	8.64
6	Taki	1015550	5702.66	7.25
7	Boal	5306	3802.46	4.84
8	Shol	304112	2485.29	3.16
9	Chuna Khalisha	1067502	2228.74	2.83
10	Shing	252376	2195.96	2.79
11	Tengra	300024	1758.14	2.24
12	Guchi Baim	343338	1488.48	1.89
13	Lal Khalisha	437663	1183.63	1.51
14	Gura Echa	2442073	958.49	1.22
15	Dankina	434979	613.76	0.78
16	Tara Baim	55150	610.15	0.78
17	Gutum	186973	556.49	0.71
18	Magur	10374	549.8	0.70
19	Tit Puti	308521	541.6	0.69
20	Kaikla	67879	501.43	0.64
21	Ranga Chanda	1375670	490.83	0.62
22	Cheng	890703	412.22	0.52
23	Chela	55348	359.53	0.46
24	Gol Chanda	228295	267.99	0.34
25	Jhili Puti	428500	263.15	0.34
26	Air	310	243.04	0.31
27	Boro Baim	6746	231.5	0.29
28	Kuicha	636	207.63	0.26
29	Foli	3585	154.12	0.20
30	Kanchan Puti	55179	152.9	0.19
31	Reekha Kholisha	108563	137.73	0.18
32	Kani Pabda	11760	131.48	0.17
33	Lamba Chanda	137256	126.7	0.16
34	Kali/Napti Koi	89997	124.49	0.16
35	Futani Puti	265990	103.62	0.13
36	Tepa	16431	83.83	0.11
37	Thengua Echa	145113	75.91	0.10
38	Bele	5727	42.55	0.05

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Sl #	Species Names	Total Number	Weight (Kg)	(%)
39	Chaka/Gangina/Kaouak	217	41.57	0.05
40	Mrigel	360	30.69	0.04
41	Vangra	4294	20.57	0.03
42	Gojar	244	20.4	0.03
43	Thai Shor Puti	85	16.14	0.02
44	Kalibaush	155	15.53	0.02
45	Madhu Pabda/Pabda	372	14.2	0.02
46	Potka	720	14.16	0.02
47	Golsa/Kabasi Tengra	1909	10.95	0.01
48	Kachki	26102	9.8	0.01
49	Chep Chela	9105	7.83	0.01
50	Goinna	62	7.65	0.01
51	Sheild Kholisha	4086	7.04	0.01
52	Tin Chokha	2028	2.92	0.00
53	Boiragi Echa	2614	1.76	0.00
54	Naftani	72	0.74	0.00
55	Kecho Bime	103	0.2	0.00
56	Gora Gutum /Ganga Sha	103	0.15	0.00
57	Ghaura	31	0.06	0.00
Total		**18110894**	**78646.58**	**100.0**
River				
1	Jat Puti	797690	3942.71	26.41
2	Meni/Bheda	180818	2048.97	13.73
3	Tengra	336135	1285.93	8.62
4	Mola	537189	887.04	5.94
5	Guchi Baim	186233	680	4.56
6	Kaikla	108891	634.34	4.25
7	Taki	44933	602.9	4.04
8	Koi	13600	550.36	3.69
9	Tara Baim	48219	420.52	2.82
10	Gura Echa	1995489	373.4	2.50
11	Gojar	1847	337.32	2.26
12	Tit Puti	256208	323.22	2.17
13	Gol Chanda	540709	301.46	2.02

BEST AVAILABLE COPY

Sl #	Species Name	Total Number	Weight(Kg)	(%)
14	Chela	160619	294.99	1.98
15	Khalisha	31552	233.58	1.57
16	Tepa	30149	205.82	1.38
17	Chuna Khalisha	159543	180.26	1.21
18	Boal	311	171.02	1.15
19	Ranga Chanda	382610	160.86	1.08
20	Shing	12160	122.38	0.82
21	Jhili Puti	119329	120.57	0.81
22	Lal Khalisha	39169	120.15	0.81
23	Bele	29488	108.81	0.73
24	Gutum	33613	89.93	0.60
25	Golsa/Kabasi Tengra	12398	71.35	0.48
26	Thengua Echa	85768	66.91	0.45
27	Dankina	25915	65.15	0.44
28	Futani Puti	133027	61.64	0.41
29	Lamba Chanda	116918	54.14	0.36
30	Kanchan Puti	26199	51	0.34
31	Thai Shor Puti	2501	48.23	0.32
32	Bajri Tengra	8571	45.08	0.30
33	Shol	166	44.16	0.30
34	Kali/Napti Koi	29721	41.65	0.28
35	Magur	593	38.35	0.26
36	Goinna	478	37.15	0.25
37	Cheng	1911	23.91	0.16
38	Mrigel	147	14.93	0.10
39	Boro Baim	199	13.47	0.09
40	Foli	321	13.33	0.09
41	Chola Puti	985	11.22	0.08
42	Kalibaush	150	8.4	0.06
43	Kuicha	57	5.43	0.04
44	Rui	31	4.77	0.03
45	Chaka/Gangina/Kaouak	21	3.35	0.02
46	Tin Chokha	1000	1.98	0.01
47	Kani Pabda	182	1.77	0.01

Sl #	Species Name	Total Number	Weight (Kg)	(%)
48	Madhu Pabda/Pabda	42	1.48	0.01
49	Rani	41	0.53	0.00
50	Bacha	20	0.4	0.00
51	Chep Chela	150	0.31	0.00
52	Naftani	20	0.12	0.00
53	Narkeli Chela	31	0.05	0.00
Total		**6494067**	**14926.81**	**100.0**
Canal				
1	Meni/Bheda	38848	1191.38	16.59
2	Taki	25223	1020.87	14.21
3	Koi	16912	957.26	13.33
4	Jat Puti	168659	939.14	13.08
5	Khalisha	45553	598.15	8.33
6	Tengra	68141	509.11	7.09
7	Shing	12584	500.75	6.97
8	Guchi Baim	32584	206.59	2.88
9	Tara Baim	10415	182.02	2.53
10	Mola	390688	175.57	2.44
11	Kaikla	27217	146.79	2.04
12	Gutum	43265	102.93	1.43
13	Boal	83	102.51	1.43
14	Dankina	22145	83.06	1.16
15	Shol	491	79.94	1.11
16	Gura Echa	98229	55.08	0.77
17	Ranga Chanda	137668	44.38	0.62
18	Lal Khalisha	10576	32.69	0.46
19	Tit Puti	31094	32.19	0.45
20	Cheng	5162	30.13	0.42
21	Gora Gutum/ Ganga Sha	5146	30.85	0.43
22	Magur	259	26.53	0.37
23	Tepa	2990	20.04	0.28
24	Gojar	107	19.85	0.28
25	Chuna Khalisha	12755	15.66	0.22

BEST AVAILABLE COPY

Sl #	Species Name	Total Number	Weight(Kg)	(%)
26	Gol Chanda	19504	12.92	0.18
27	Thengua Echa	9021	10.76	0.15
28	Kani Pabda	713	8.56	0.12
29	Kalibaush	31	7.58	0.11
30	Kuicha	21	6.61	0.09
31	Foli	162	6.17	0.09
32	Bele	567	5.82	0.08
33	Jhili Puti	9021	3.88	0.05
34	Chela	1510	3.00	0.04
35	Mrigel	81	2.87	0.04
36	Futani Puti	5146	2.57	0.04
37	Kanchan Puti	340	2.42	0.03
38	Lamba Chanda	2938	2.38	0.03
39	Kali/Napti Koi	2140	2.14	0.03
40	Boro Baim	155	0.78	0.01
41	Golsa/Kabasi Tengra	720	0.72	0.01
Total		1258864	7182.62	100.0

Appendix 8 - Fish Species Observed Inside and Outside of Hail Haor

Inside Hail Haor	Outside Hail Haor	Both
Telapia	Dhela	Jat Puti
Grass Carp	Poa	Kanchan Puti
Narkeli Chela	Peali	Tit Puti
Naftani	Bagha Air	Jhili Puti
Elong	Batasi	Futani Puti
Boiragi Echa	Baspata/Kazuli	Chola Puti
Sheild Kholisha	Baghaura	Thai Shor Puti
Potka	Rita	Mola
-	Hilsha	Chela
-	Catla	Chep Chela
-	Miror Carp	Ranga Chanda
-	Golda Echa	Lamba Chanda
-	Gang Tengra	Gol Chanda
-	Buth Koi /Bali Chata/Balit	Chapila
-	Tengra (Batasio)	Khalisha
-	Senia (Eusufi)	Lal Khalisha
-	Moa	Chuna Khalisha
-	Raiya	Dankina
-	Gongi	Meni/Bheda
-	-	Koi
-	-	Kali/Napti Koi
-	-	Bele
-	-	Rani
-	-	Kachki
-	-	Kaikla
-	-	Gutum
-	-	Tin Chokha
-	-	Boro Baim
-	-	Guchi Baim
-	-	Tara Baim
-	-	Kuicha
-	-	Taki
-	-	Shol
-	-	Gojar
-	-	Cheng
-	-	Vangra
-	-	Goinna
-	-	Air
-	-	Bajri Tengra
-	-	Golsa/Kabasi Tengra
-	-	Tengra
-	-	Bacha
-	-	Boal
-	-	Kani Pabda
-	-	Madhu Pabda

BEST AVAILABLE COPY

Inside Hail Haor	Outside Hail Haor	Both
-	-	Chaka/Gangina
-	-	Shing
-	-	Magur
-	-	Foli
-	-	Rui
-	-	Mrigel
-	-	Kalibaush
-	-	Gura Echa
-	-	Ghaura
-	-	Tepa
-	-	Dimua/Kathalia Echa
-	-	Thengua Echa
-	-	Reckha Kholisha
-	-	Kecho Bime
8 Species	19 Species	60 Species

BEST AVAILABLE COPY

Appendix 9 - List of Gears Observed in Turag-Bangshi

Sl #	Gear Type	Sl #	Gear Type
1	Veshal/Khara	15	Dewatering
2	Ber Jal	16	Daon Borshi/Longline
3	Moi Jal	17	Fash Jal
4	Thela Jal/Jali	18	Suta Jal
5	Dharma Jal	19	Uthal Jal
6	Jhaki Jal	20	Dhore Jal
7	Current Jal	21	Lauya Jal
8	Kathi Jal	22	Gomi Jal
9	Koch	23	Mashari Jal
10	Hat Borshi	24	Chata
11	Kathi Borshi	25	Chalun
12	Gara Borshi	26	Ram Jal
13	Guli/Ghuni		
14	Hatani		

Appendix 10 - Average Fishing Efforts Observed in a Day at Turag-Bangshi Site

Months	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March
Mokesh Beel (South)												
Moi Jal				5	0	0	0	0	1	1	0	0
Ber Jal				0	0	0	1	1	1	0	0	0
Thela Jal				0	7	0	1	1	1	3	2	2
Jhaki Jal				0	0	0	0	0	0	1	0	1
Current Jal				10	15	7	47	52	33	36	30	35
Dhore Jal				0	0	0	0	0	0	0	0	0
Mokesh Beel (North)												
Moi Jal	0		0	5	1	1	0	1	1	1	0	0
Ber Jal	0		0	0	0	0	1	1	1	0	0	1
Thela Jal	0		0	0	1	1	2	1	1	1	2	3
Jhaki Jal	0		0	0	0	0	0	1	0	3	2	1
Current Jal	0		0	0	6	0	85	36	49	36	34	35
Dhore Jal	0		0	0	75	0	0	1	0	0	0	0
Kaliadaha												
Moi Jal			0	0	0	0	0	0	0	0	0	0
Ber Jal			0	0	0	1	1	0	0	1	1	1
Thela Jal			2	4	2	0	1	1	3	1	2	3
Jhaki Jal			0	0	1	0	1	0	0	1	0	0
Current Jal			0	6	12	5	10	27	31	41	28	0
Dhore Jal			0	2	1	0	0	0	1	0	0	0
Mokesh Khal												
Moi Jal	0		0	0	1	1	0	0	0	0	0	0
Ber Jal	0		0	0	0	0	0	0	0	0	0	0
Thela Jal	0		0	1	0	0	0	1	0	1	0	0
Jhaki Jal	0		0	0	1	0	2	7	7	2	4	2
Current Jal	0		0	0	0	0	0	0	0	0	0	0
Dhore Jal	0		0	1	0	0	1	1	0	0	0	0
Turag River												
Moi Jal	0		2	1	1	0	0	1	2	2	2	2
Ber Jal	2		1	0	0	0	0	0	0	1	1	0
Thela Jal	1		0	1	0	0	1	1	0	0	0	0
Jhaki Jal	2		1	0	1	0	1	3	1	0	3	3
Current Jal	1		0	0	0	0	0	0	0	0	2	1
Dhore Jal	0		0	0	0	0	0	1	1	0	0	0
Alowla Khal												
Moi Jal				0	1	0	0	0	0			
Ber Jal				0	0	0	0	0	0			
Thela Jal				2	0	0	0	1	0			
Jhaki Jal				0	1	0	2	3	0			
Current Jal				0	2	0	0	1	0			
Dhore Jal				2	0	0	1	4	0			
Aowla Beel												
Moi Jal				0	0	0	0	1	1	1	1	1
Ber Jal				0	1	1	1	2	0	1	0	1

Thela Jal		4	2	0	1	2	0	0	1	2
Jhaki Jal		0	0	0	0	1	1	2	4	5
Current Jal		11	24	37	15	18	29	40	38	21
Dhore Jal		1	0	0	0	0	0	0	0	0
Bangshi River										
Moi Jal	0	0	1	0	0	2	2	2	2	3
Ber Jal	0	0	0	0	0	0	1	1	1	0
Thela Jal	0	1	1	0	0	0	0	0	0	0
Jhaki Jal	0	1	2	1	6	3	1	3	2	1
Current Jal	0	0	0	0	0	0	0	0	0	0
Dhore Jal	0	0	0	0	1	0	0	0	0	0

Appendix 11 - Average Fishing Hours of Major Gear by Month, Season and Habitat in Turag-Bangshi

Season	Month	Thela	Moi Jal	Dhore Jal	Current	Ber	Jhaki
Beel							
	Apr-99	0	0	0	0	0	0
	May-99	0	0	0	0	0	0
	Jun-99	5.75	0	0	0	0	0
Pre-Monsoon		5.75	0	0	0	0	0
	Jul-99	3.00	7.50	2.83	13.47	0	0
	Aug-99	2.70	0	3.50	9.35	5.00	2.00
	Sep-99	0	0	0	8.93	7.25	0
Monsoon		2.84	7.50	3	9.90	6.50	2.00
	Oct-99	1.54	0	0	5.36	4.92	4.00
	Nov-99	2.50	2	0	5.46	5.33	3.00
	Dec-99	2.14	4	2	4.50	4.25	3.00
Post Monsoon		2.10	3.33	2	5.10	4.97	3.25
	Jan-00	2.60	3.75	0	4.57	5.33	3.25
	Feb-00	2.19	4	0	4.15	5.00	3.48
	Mar-00	1.97	3.69	0	4.07	3.69	3.07
Dry		2.19	3.91	0	4.28	4.47	3.24
Floodplain							
	Apr-99	0	0	0	0	0	0
	May-99	0	0	0	0	0	0
	Jun-99	0	0	0	0	0	0
Pre-Monsoon		0	0	0	0	0	0
	Jul-99	0	8.38	0	0	0	0
	Aug-99	3.67	7.17	4	8.50	0	0
	Sep-99	1.00	6.50	0	0	0	0
Monsoon		3.00	7.56	4	8.50	0	0
	Oct-99	2.13	0	0	5.82	5.00	0
	Nov-99	2.00	6	3	6.17	4.50	3.00
	Dec-99	1.00	4	0	4.67	3.00	0
Post Monsoon		1.92	5	3	5.44	4.25	3.00
	Jan-00	3.00	5	0	6.14	0	5.14
	Feb-00	3.00	0	0	4.10	0	5.75
	Mar-00	1.77	0	0	3.52	1.00	2.75
Dry		2.22	5	0	4.43	1.00	4.96
River							
	Apr-99	0	0	0	0	0	0
	May-99	4.00	0	0	16.67	15.83	12.07
	Jun-99	0	4.85	0	0	6.67	5.50
Pre-Monsoon		4.00	4.85	0	16.67	12.40	10.19
	Jul-99	2.17	5.67	0	0	0	1.33
	Aug-99	3.00	9.67	0	0	0	3.08
	Sep-99	0	0	0	0	0	2.50
Monsoon		2.44	8.67	0	0	0	2.79
	Oct-99	1.75	0	6	0	0	5.50
	Nov-99	3.00	3.92	0.92	0	0	3.90

Thela Jal		4	2	0	1	2	0	0	1	2
Jhaki Jal		0	0	0	0	1	1	2	4	5
Current Jal		11	24	37	15	18	29	40	38	21
Dhore Jal		1	0	0	0	0	0	0	0	0
Bangshi River										
Moi Jal	0	0	1	0	0	2	2	2	2	3
Ber Jal	0	0	0	0	0	0	1	1	1	0
Thela Jal	0	1	1	0	0	0	0	0	0	0
Jhaki Jal	0	1	2	1	6	3	1	3	2	1
Current Jal	0	0	0	0	0	0	0	0	0	0
Dhore Jal	0	0	0	0	1	0	0	0	0	0

Appendix 11 - Average Fishing Hours of Major Gear by Month, Season and Habitat in Turag-Bangshi

Season	Month	Thela	Moi Jal	Dhore Jal	Current	Ber	Jhaki
Beel							
	Apr-99	0	0	0	0	0	0
	May-99	0	0	0	0	0	0
	Jun-99	5.75	0	0	0	0	0
Pre-Monsoon		5.75	0	0	0	0	0
	Jul-99	3.00	7.50	2.83	13.47	0	0
	Aug-99	2.70	0	3.50	9.35	5.00	2.00
	Sep-99	0	0	0	8.93	7.25	0
Monsoon		2.84	7.50	3	9.90	6.50	2.00
	Oct-99	1.54	0	0	5.36	4.92	4.00
	Nov-99	2.50	2	0	5.46	5.33	3.00
	Dec-99	2.14	4	2	4.50	4.25	3.00
Post Monsoon		2.10	3.33	2	5.10	4.97	3.25
	Jan-00	2.60	3.75	0	4.57	5.33	3.25
	Feb-00	2.19	4	0	4.15	5.00	3.48
	Mar-00	1.97	3.69	0	4.07	3.69	3.07
Dry		2.19	3.91	0	4.28	4.47	3.24
Floodplain							
	Apr-99	0	0	0	0	0	0
	May-99	0	0	0	0	0	0
	Jun-99	0	0	0	0	0	0
Pre-Monsoon		0	0	0	0	0	0
	Jul-99	0	8.38	0	0	0	0
	Aug-99	3.67	7.17	4	8.50	0	0
	Sep-99	1.00	6.50	0	0	0	0
Monsoon		3.00	7.56	4	8.50	0	0
	Oct-99	2.13	0	0	5.82	5.00	0
	Nov-99	2.00	6	3	6.17	4.50	3.00
	Dec-99	1.00	4	0	4.67	3.00	0
Post Monsoon		1.92	5	3	5.44	4.25	3.00
	Jan-00	3.00	5	0	6.14	0	5.14
	Feb-00	3.00	0	0	4.10	0	5.75
	Mar-00	1.77	0	0	3.52	1.00	2.75
Dry		2.22	5	0	4.43	1.00	4.96
River							
	Apr-99	0	0	0	0	0	0
	May-99	4.00	0	0	16.67	15.83	12.07
	Jun-99	0	4.85	0	0	6.67	5.50
Pre-Monsoon		4.00	4.85	0	16.67	12.40	10.19
	Jul-99	2.17	5.67	0	0	0	1.33
	Aug-99	3.00	9.67	0	0	0	3.08
	Sep-99	0	0	0	0	0	2.50
Monsoon		2.44	8.67	0	0	0	2.79
	Oct-99	1.75	0	6	0	0	5.50
	Nov-99	3.00	3.92	0.92	0	0	3.90

Season	Month	Thela	Moi Jal	Dhore Jal	Current	Ber	Jhaki
	Dec-99	0	4.86	4.50	0	2.75	5.33
Post Monsoon		2.17	4.42	2.65	0	2.75	4.71
	Jan-00	0	3.75	0	0	4.00	2.70
	Feb-00	0	4.17	0	1.00	5.17	3.27
	Mar-00	0	4.32	0	3.00	0	2.82
Dry		0	4.09	0	2.00	4.70	3.01
Canal							
	Apr-99	0	0	0	0	0	0
	May-99	0	0	0	0	0	0
	Jun-99	0	0	0	0	0	0
Pre-Monsoon		0	0	0	0	0	0
	Jul-99	5.75	0	6	0	0	0
	Aug-99	0	8.50	0	12.50	0	4.33
	Sep-99	0	4	0	0	0	0
Monsoon		5.75	7	6	12.50	0	4.33
	Oct-99	0	0	0.50	0	0	1.97
	Nov-99	1.69	0	5.63	1.08	0	2.89
	Dec-99	0	0	0	0	0	2.44
Post Monsoon		1.69	0	3.92	1.08	0	2.58
	Jan-00	2.00	0	0	0	0	2.21
	Feb-00	0	0	0	0	0	3.00
	Mar-00	0	0	0	0	0	1.81
Dry		2.00	0	0	0	0	2.44

Appendix 12 – Estimated Catch by Species in Turag-Bangshi Site

Sl. #	Species Name	Total Number	% by Number	Weight (Kg)	% by Weight
1	Mrigel	25641	0.26	4516.69	15.54
2	Gura Echa	4258455	43.09	3357.66	11.55
3	Boro Baim	38004	0.38	3355.48	11.54
4	Jat Puti	225390	2.28	1664.24	5.73
5	Kaikla	56906	0.58	1504.01	5.17
6	Tengra	138946	1.41	1492.47	5.13
7	Chapila	1234660	12.49	1414.89	4.87
8	Taki	38891	0.39	1176.47	4.05
9	Tatkini	65214	0.66	995.56	3.43
10	Guchi Baim	102719	1.04	849.65	2.92
11	Tara Baim	47676	0.48	762.64	2.62
12	Bele	192814	1.95	740.29	2.55
13	Lamba Chanda	1480186	14.98	718.44	2.47
14	Tit Puti	157588	1.59	495.9	1.71
15	Air	4985	0.05	492.12	1.69
16	Catla	1233	0.01	481.57	1.66
17	Chola Puti	45193	0.46	480.82	1.65
18	Shing	34173	0.35	409.22	1.41
19	Golsa/Kabasi Tengra	25277	0.26	340.01	1.17
20	Satka Chingri	146913	1.49	316.05	1.09
21	Chela	450080	4.55	314.53	1.08
22	Rani	70147	0.71	287.83	0.99
23	Ruta	10776	0.11	241.85	0.83
24	Ranga Chanda	209874	2.12	234.54	0.81
25	Gol Chanda	234634	2.37	202.65	0.7
26	Potka	49888	0.50	200.44	0.69
27	Rui	1790	0.02	157.79	0.54
28	Gutum	44387	0.45	149.8	0.52
29	Lal Khalisha	39007	0.39	143.67	0.49
30	Kalibaush	745	0.01	138.45	0.48
31	Ghaura	4662	0.05	133.1	0.46
32	Shol	1386	0.01	127.28	0.44
33	Koi	4025	0.04	111.09	0.38
34	Chuna Khalisha	126528	1.28	100.15	0.34
35	Comon Carp/Karfu	85	0.00	86.5	0.3
36	Mola	83987	0.85	75.11	0.26

Sl. #	Species Name	Total Number	% by Number	Weight (Kg)	% by Weight
37	Thai Shor Puti	274	0.00	63.46	0.22
38	Bagha Puti	10792	0.11	53.93	0.19
39	Cheng	5508	0.06	49.56	0.17
40	Baspata/Kazuli	9995	0.10	48.31	0.17
41	Madhu Pabda/Pabda	5199	0.05	48	0.17
42	Boal	46	0.00	46.87	0.16
43	Magur	267	0.00	38.55	0.13
44	Bagha Air	293	0.00	35.65	0.12
45	Hilsha	16128	0.16	35.51	0.12
46	Khalla/Kharshulla	1283	0.01	32.72	0.11
47	Foli	453	0.00	32.31	0.11
48	Silver Carp	120	0.00	30.84	0.11
49	Khalisha	6273	0.06	30.12	0.1
50	Kanchan Puti	4248	0.04	25.63	0.09
51	Kachki	41349	0.42	21.87	0.08
52	Dhela	19942	0.20	21.05	0.07
53	Shar Puti	147	0.00	19.56	0.07
54	Tepa	3934	0.04	19.3	0.07
55	Kali/Napti Koi	24141	0.24	18.45	0.06
56	Chaka/Ganginak/Kaoua	10204	0.10	16.97	0.06
57	Dankina	30343	0.31	14.3	0.05
58	Golda Echa	1519	0.02	11.16	0.04
59	Peali	174	0.00	10.19	0.04
60	Silong	131	0.00	9.96	0.03
61	Buth Koi/Bali/ Chata	2436	0.02	9.33	0.03
62	Guzi air/Guzkata	42	0.00	9.1	0.03
63	Gora Gutum/Ganga Sha	829	0.01	5.59	0.02
64	Gugri Bila	8336	0.08	5.1	0.02
65	Bacha	152	0.00	4.32	0.02
66	Dimua/Kathalia Echa	4784	0.05	4.17	0.01
67	Jhili Puti	5349	0.05	4.17	0.01
68	Fesha	265	0.00	4.01	0.01
69	GangChela/Ghlora Che	913	0.01	3.97	0.01
70	Chep Chela	5470	0.06	3.64	0.01
71	Poa	31	0.00	3.32	0.01
72	Tin Chokha	4164	0.04	3.06	0.01
73	Peashi	1061	0.01	2.23	0.01

S.N.	Species Name	[illegible]	[illegible]	[illegible]	[illegible]
74	Nayan bali	1187	0.01	1.85	0.01
75	Kuicha	29	0.00	1.23	0
76	Batasi	530	0.01	1.05	0
77	Futani Puti	195	0.00	0.88	0
78	Kani Pabda	29	0.00	0.42	0
79	Vangra	53	0.00	0.31	0
80	Narkeli Chela	118	0.00	0.28	0
81	Telapia	10	0.00	0.11	0
82	Naftani	16	0.00	0.03	0
83	Putul	8	0.00	0.02	0
Total		9881635	100.00	29071.41	100

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Appendix 13 - CPUE of Most Commonly Used Gears in Turag-Bangshi

Season	Month	Thela	Moi Jal	Dhore Jal	Current	Ber	Jhaki
Beel							
	Apr-99	0	0	0	0	0	0
	May-99	0	0	0	0	0	0
	Jun-99	1.20	0	0	0	0	0
Pre-Monsoon		1.20	0	0	0	0	0
	Jul-99	0.45	1.1380	1.3077	0.03	0	0
	Aug-99	0.45	0	0.6560	0.02	3.22	0.12
	Sep-99	0	0	0	0.01	7.28	0
Monsoon		0.45	1.1380	1.1448	0.02	5.93	0.12
	Oct-99	0.43	0	0	0.09	3.07	0.36
	Nov-99	0.30	0.1550	0	0.02	2.37	0.34
	Dec-99	0.27	5.4990	0.2700	0.02	1.59	0.73
Post Monsoon		0.33	3.7177	0.2700	0.04	2.58	0.44
	Jan-00	0.21	2.3903	0	0.01	2.28	0.79
	Feb-00	0.42	3.0010	0	0.01	0.78	0.75
	Mar-00	0.28	1.3627	0	0.02	0.80	0.55
Dry		0.30	2.0813	0	0.02	1.35	0.68
Floodplain							
	Apr-99	0	0	0	0	0	0
	May-99	0	0	0	0	0	0
	Jun-99	0	0	0	0	0	0
Pre-Monsoon		0	0	0	0	0	0
	Jul-99	0	1.2370	0	0	0	0
	Aug-99	0.86	2.4770	0.0016	0.04	0	0
	Sep-99	0.35	2.027	0	0	0	0
Monsoon		0.74	1.8259	0.0016	0.04	0	0
	Oct-99	0.18	0	0	0.03	0.77	0
	Nov-99	0.08	2.9280	0.2270	0.05	2.75	0.42
	Dec-99	0.15	2.3270	0	0.03	0.70	0
Post Monsoon		0.16	2.6275	0.2270	0.04	1.74	0.42
	Jan-00	0.21	6.583	0	0.02	0	1.01
	Feb-00	0.20	0	0	0.01	0	0.73
	Mar-00	0.28	0	0	0.02	0.09	0.70
Dry		0.25	6.5830	0	0.02	0.09	0.87
River							
	Apr-99	0	0	0	0	0	0
	May-99	2.86	0	0	0.23	1.49	0.36
	Jun-99	0	1.0056	0	0	0.78	0
Pre-Monsoon		2.86	1.0056	0	0.23	1.23	0.27
	Jul-99	0.17	0.4370	0	0	0	0
	Aug-99	0.08	1.4873	0	0	0	0.22
	Sep-99	0	0	0	0	0	0.26
Monsoon		0.14	1.2248	0	0	0	0.20
	Oct-99	0.10	0	0.1420	0	0	0.78
	Nov-99	0.25	1.6608	0.3560	0	0	0.49

Season	Month	Thela	Moi Jal	Dhore Jal	Current	Ber	Jhaki
	Dec-99	0	2.4941	0.5620	0	0.31	0.61
Post Monsoon		0.15	2.1095	0.3544	0	0.31	0.62
	Jan-00	0	0.7587	0	0	0.77	0.28
	Feb-00	0	0.6898	0	0.01	1.18	0.29
	Mar-00	0	1.2371	0	0.17	0	0.33
Dry		0	0.8931	0	0.03	1.01	0.30
Canal							
	Apr-99	0	0	0	0	0	0
	May-99	0	0	0	0	0	0
	Jun-99	0	0	0	0	0	0
Pre-Monsoon		0	0	0	0		0
	Jul-99	0.38	0	0 4330	0	0	0
	Aug-99	0	1.9610	0	0.01	0	0.70
	Sep-99	0	0 24	0	0	0	0
Monsoon		0.38	1.3873	0.4330	0.01		0.70
	Oct-99	0	0	0 1615	0	0	0.29
	Nov-99	0 21	0	1 2910	0.13	0	0.56
	Dec-99	0	0	0	0	0	0 37
Post Monsoon		0.21	0	0 9145	0.13		0.45
	Jan-00	0.26	0	0	0	0	0.39
	Feb-00	0	0	0	0	0	0 38
	Mar-00	0	0	0	0	0	0 23
Dry		0 26	0	0	0		0 35

Appendix 14 - Catch Composition (%) by Habitat and Season in Turag-Bangshi

Season	Snakehead	Koi	Major Carp	Large Catfish	Minor Carp	Feeding Fish	Small Catfish	Small Fish
Pre-Monsoon								
Beel	-	18.01	-	-	-	52.38	-	29.61
Floodplain	-	-	-	-	-	-	-	-
River	1.14	19.451	-	-	1.19	33.92	1.54	42.74
Canal	-	-	-	-	-	-	-	-
Monsoon								
Beel	0.98	11.50	3.12	0.50	0.62	8.96	9.32	63.89
Floodplain	1.34	23.83	-	1.78	-	50.21	7.19	14.92
River	0.77	10.79	4.93	6.88	2.35	29.94	15.96	20.52
Canal	0.62	8.69	3.24	0.50	0.04	28.34	2.91	55.28
Post Monsoon								
Beel	5.82	10.48	12.08	3.05	0.84	18.68	12.49	34.16
Floodplain	6.00	24.39	8.22	9.16	3.97	3.35	9.26	35.64
River	1.18	47.54	1.27	10.17	0.69	7.65	8.20	23.25
Canal	2.35	36.20	10.33	2.44	4.41	2.54	3.05	38.66
Dry								
Beel	25.63	7.66	2.35	0.69	-	14.43	16.84	30.82
Floodplain	16.25	6.42	1.33	3.25	-	18.20	25.06	29.50
River	1.06	8.53	-	14.72	-	33.95	12.70	29.05
Canal	11.65	3.32	-	-	1.62	2.51	12.13	68.77

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Appendix 15 - Grouping (Guild) of the Commonly Observed Fish Species

Species Name	Scientific Name
Small Fish	
Jat Puti	*Puntius sophore*
Kanchan Puti	*Puntius conchonius*
Tit Puti	*Puntius ticto*
Jhili Puti	*Puntius gelius*
Futani Puti	*Puntius phutunio*
Teri Puti	*Puntius terio*
Mola Puti	*Puntius guganio*
Shar Puti	*Puntius sarana*
Chola Puti	*Puntius chola*
Bagha Puti	*Puntius stigma*
Mola	*Amblypharyngodon mola*
Dhela	*Amblypharyngodon microlepis*
Chela	*Oxygaster pholo*
Chep Chela	*Chela laubuca*
Ranga Chanda	*Chanda ranga*
Lamba Chanda	*Chanda nama*
Gol Chanda	*Chanda baculis*
Chapila	*Gudusia chapra*
Khalisha	*Colisa fasciatus*
Lal Khalisha	*Colisa lalius*
Chuna Khalisha	*Colisa labiosa*
Dankina	*Rasbora daniconius*
Meni/Bheda	*Nandus nandus*
Koi	*Anabas testudineus*
Kali/Napti Koi	*Badis badis*
Bele	*Glossogobius giuris*
Rani	*Botia dario*
Kachki	*Corica soborna*
Kaikla	*Xenentodon cancila*
Poa	*Pama pama*
Gutum	*Lepiodocephalus guntea*
Khalla/Kharshulla	*Mugil corsula*
Peali	*Aspidoparia morar*
Tin Chokha	*Aplocheilus panchax*
Fesha	*Raconda russeliana*
Nandil	*Labeo nandina*
Narkeli Chela	*Oxygaster bacalia*
Naftani	*Ctenops nobilis*
Kakra	*Crab sp.*
Tepa	*Tetraodon cutcutia*
Buth Koi/Bali Chata/Balitora	*Nemachilus botia*
Anju	*Danio rerio*
Putul	*Botia lohachata*
Koral /Vetki	*Lates calcarifer*
Elong	

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Species Name	Scientific Name
Lakka	*Polynemus indicus*
Gora Gutum/Ganga Shagor	
Ful Chela	*Salmostoma phulo*
Gar Koia	
Gugri Bila	
Black Carp	*Mylopharyngodon pisceus*
Velikura	
Reckha Kholisha	
Sheild Kholisha	*Colisa labiosus*
Potka	*Tetraodon patoca*
Moa	*Rohtee cotio*
Raiya	
Nayan bali	
GangChela/Ghora Chel	
Gura Fishes	
Peashi	*Aspidoparia jaya*
Mamoli Chapila	
Kechi Khalla	*Mugil cascasia*
Swapan jhuri	
Major Carp	
Rui	*Labeo rohita*
Catla	*Catla catla*
Mrigel	*Cirrhinus mrigala*
Kalibaush	*Labeo calbasu*
Minor Carp	
Bata	*Labeo bata*
Vangra	*Labeo boga*
Goinna	*Labeo gonius*
Tatkini	*Crossocheilus latius*
Raek	*Cirrhinus reba*
Small Catfish	
Batasi	*Pseudentropious atherrinoides*
Bajri Tengra	*Mystus tengara*
Golsa/Kabasi Tengra	*Mystus cavasius*
Tengra	*Mystus vittatus*
Bacha	*Eutropiichthys vacha*
Baspata/Kazuli	*Danio devario*
Silong	*Silonia silondia*
Gang Magur	*Plotosus canius*
Kani Pabda	*Ompok bimaculatus*
Madhu Pabda/Pabda	*Ompok pabda*
Chaka/Gangina/Kaouakata/Ghorakata	*Chaca chaca*
Shing	*Heteropneustes fossilis*
Magur	*Clarius batrachus*
Ghaura	*Clupisoma garua*

Species Name	Scientific Name
Gang Tengra	*Gagata viridescens*
Tengra (Batasio)	*Batasio batasio*
Senia (Eusufi)	*Gagata cenia*
Gongi	
Large Catfish	
Air	*Mystus aor*
Guzi air/Guzkata	*Mystus seenghala*
Bagha Air	*Bagarius bagarius*
Boal	*Wallago attu*
Baghaura	
Rita	*Rita rita*
Pangas	*Pangasius pangasius*
Eels	
Boro Baim	*Mastacembelus armatus*
Guchi Baim	*Mastacembelus pancalus*
Tara Baim	*Macrognathus aculeatus*
Kuicha	*Cuchia cuchia*
Kecho Bime	*Ophichthys boro*
Snakeheads	
Taki	*Channa punctatus*
Shol	*Channa striatus*
Gojar	*Channa marulius*
Cheng	*Channa gachua*
Prawn	
Gura Echa	*Macrobrachium lamrrei*
Golda Echa	*Macrobrachium rosenbergii*
Satka Chingri	*Macrobrachium*
Dimua/Kathalia Echa	
Thengua Echa	*Macrobrachium birmanicus*
Boiragi Echa	
Exotic	
Thai Shor Puti	*Puntius gonionotus*
Nailotika	*Oreochromis niloticus*
African Magur	*Clarias gariepinus*
Telapia	*Oreochromis (Telapia) mossambicus*
Silver Carp	*Hypophthalmichthys molitrix*
Grass Carp	*Ctenopharyngodon idellus*
Mirror Carp	*Cyprinus carpio specularis*
Common Carp/Karfu	*Cyprinus carpio communis*
Bighead Carp	*Aristichthys nobilis*
Knife Fish	
Chital	*Notopterus chitala*

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Species Name	Scientific Name
Foli	*Notopterus notopterus*
Dry Fish	
Dry Fish	
Rocket	
Loitka	
Hilsha	
Hilsha	*Tenualosa ilisha*

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Appendix 16 – Species and Habitat Preference Within Hail Haor

Sl. #	Species Name	Habitat Preference
1	Jat Puti	Beel Resident
2	Kanchan Puti	Beel Resident
3	Tit Puti	Beel Resident
4	Jhili Puti	Beel Resident
5	Futani Puti	Beel Resident
6	Chola Puti	Beel Resident
7	Mola	Beel Resident
8	Chela	Beel Resident
9	Chep Chela	Beel Resident
10	Ranga Chanda	Beel Resident
11	Lamba Chanda	Beel Resident
12	Gol Chanda	Beel Resident
13	Chapila	Beel Resident
14	Khalisha	Beel Resident
15	Lal Khalisha	Beel Resident
16	Chuna Khalisha	Beel Resident
17	Dankina	Beel Resident
18	Meni/Bheda	Beel Resident
19	Koi	Beel Resident
20	Kali/Napti Koi	Beel Resident
21	Bele	Beel Resident
22	Rani	Beel Resident
23	Kaikla	Beel Resident
24	Gutum	Beel Resident
25	Tin Chokha	Beel Resident
26	Boro Baim	Beel Resident
27	Guchi Baim	Beel Resident
28	Tara Baim	Beel Resident
29	Kuicha	Beel Resident
30	Taki	Beel Resident
31	Shol	Beel Resident
32	Gojar	Beel Resident
33	Cheng	Beel Resident
34	Bajri Tengra	Beel Resident
35	Tengra	Beel Resident
36	Kani Pabda	Beel Resident
37	Shing	Beel Resident
38	Magur	Beel Resident
39	Foli	Beel Resident
40	Gura Echa	Beel Resident
41	Naftani	Beel Resident
42	Boiragi Echa	Beel Resident
43	Reckha Kholisha	Beel Resident
44	Sheild Kholisha	Beel Resident
45	Thai Shor Puti	Exotics

Sl. #	Species Name	Habitat Preference
46	Telapia	Exotics
47	Grass Carp	Exotics
48	Vangra	Migratory
49	Goinna	Migratory
50	Madhu Pabda/Pabda	Migratory
51	Tepa	Migratory
52	Elong	Migratory
53	Gora Gutum/Ganga Sha	Migratory
54	Golsa/Kabasi Tengra	Migratory
55	Rui	Migratory
56	Mrigel	Migratory
57	Kalibaush	Migratory
58	Narkeli Chela	Migratory
59	Dimua/Kathalia Echa	Migratory
60	Thengua Echa	Migratory
61	Kachki	Riverine
62	Air	Riverine
63	Bacha	Riverine
64	Boal	Riverine
65	Chaka/Gangina/Kaouak	Riverine
66	Ghaura	Riverine
67	Kecho Bime	Unknown
68	Potka	Unknown

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Appendix 17 - Species and Habitat Preference Outside Hail Haor

SL #	Species Name	Habitat Preference
1	Jat Puti	Beel Resident
2	Kanchan Puti	Beel Resident
3	Tit Puti	Beel Resident
4	Jhili Puti	Beel Resident
5	Futani Puti	Beel Resident
6	Chola Puti	Beel Resident
7	Mola	Beel Resident
8	Dhela	Beel Resident
9	Chela	Beel Resident
10	Chep Chela	Beel Resident
11	Ranga Chanda	Beel Resident
12	Lamba Chanda	Beel Resident
13	Gol Chanda	Beel Resident
14	Chapila	Beel Resident
15	Khalisha	Beel Resident
16	Lal Khalisha	Beel Resident
17	Chuna Khalisha	Beel Resident
18	Dankina	Beel Resident
19	Meni/Bheda	Beel Resident
20	Koi	Beel Resident
21	Kali/Napti Koi	Beel Resident
22	Bele	Beel Resident
23	Rani	Beel Resident
24	Kaikla	Beel Resident
25	Gutum	Beel Resident
26	Tin Chokha	Beel Resident
27	Boro Baim	Beel Resident
28	Guchi Baim	Beel Resident
29	Tara Baim	Beel Resident
30	Kuicha	Beel Resident
31	Taki	Beel Resident
32	Shol	Beel Resident
33	Gojar	Beel Resident
34	Cheng	Beel Resident
35	Bajri Tengra	Beel Resident
36	Tengra	Beel Resident
37	Kani Pabda	Beel Resident
38	Shing	Beel Resident
39	Magur	Beel Resident
40	Foli	Beel Resident
41	Gura Echa	Beel Resident
42	Buth Koi/Bali Chata/	Beel Resident
43	Tengra (Batasio)	Beel Resident
44	Reckha Kholisha	Beel Resident
45	Thai Shor Puti	Exotics

Sl. #	Species Name	Habitat Preference
46	Miror Carp	Exotics
47	Vangra	Migratory
48	Goinna	Migratory
49	Madhu Pabda/Pabda	Migratory
50	Tepa	Migratory
51	Gora Gutum/Ganga Sha	Migratory
52	Golsa/Kabasi Tengra	Migratory
53	Rui	Migratory
54	Catla	Migratory
55	Mrigel	Migratory
56	Kalibaush	Migratory
57	Golda Echa	Migratory
58	Dimua/Kathalia Echa	Migratory
59	Thengua Echa	Migratory
60	Kachki	Riverine
61	Poa	Riverine
62	Peali	Riverine
63	Air	Riverine
64	Bagha Air	Riverine
65	Batasi	Riverine
66	Bacha	Riverine
67	Boal	Riverine
68	Baghaura	Riverine
69	Rita	Riverine
70	Chaka/Gangina/Kaouak	Riverine
71	Hilsha	Riverine
72	Ghaura	Riverine
73	Gang Tengra	Riverine
74	Baspata/Kazuli	Riverine
75	Kecho Bime	Unknown
76	Senia (Eusufi)	Unknown
77	Moa	Unknown
78	Raiya	Unknown
79	Gongi	Unknown

Appendix 18 - Species Name and Habitat Preference in Turag-Bangshi Site

Sl. #	Species Name	Habitat Preference
1	Jat Puti	Beel Resident
2	Kanchan Puti	Beel Resident
3	Tit Puti	Beel Resident
4	Jhili Puti	Beel Resident
5	Futani Puti	Beel Resident
6	Chola Puti	Beel Resident
7	Bagha Puti	Beel Resident
8	Mola	Beel Resident
9	Dhela	Beel Resident
10	Chela	Beel Resident
11	Chep Chela	Beel Resident
12	Ranga Chanda	Beel Resident
13	Lamba Chanda	Beel Resident
14	Gol Chanda	Beel Resident
15	Chapila	Beel Resident
16	Khalisha	Beel Resident
17	Lal Khalisha	Beel Resident
18	Chuna Khalisha	Beel Resident
19	Dankina	Beel Resident
20	Koi	Beel Resident
21	Kali/Naptu Koi	Beel Resident
22	Bele	Beel Resident
23	Rani	Beel Resident
24	Kaikla	Beel Resident
25	Gutum	Beel Resident
26	Tin Chokha	Beel Resident
27	Boro Baim	Beel Resident
28	Guchi Baim	Beel Resident
29	Tara Baim	Beel Resident
30	Kuicha	Beel Resident
31	Taki	Beel Resident
32	Shol	Beel Resident
33	Cheng	Beel Resident
34	Tengra	Beel Resident
35	Kani Pabda	Beel Resident
36	Shing	Beel Resident
37	Magur	Beel Resident
38	Foli	Beel Resident
39	Gura Echa	Beel Resident
40	Naftani	Beel Resident
41	Buth Koi/Bali Chata/	Beel Resident
42	Satka Chingri	Beel Resident
43	Putul	Beel Resident
44	Gugri Bila	Beel Resident
45	Thai Shor Puti	Exotics

Sl. #	Species Name	Habitat Preference
46	Telapia	Exotics
47	Silver Carp	Exotics
48	Comon Carp/Karfu	Exotics
49	Vangra	Migratory
50	Tatkini	Migratory
51	Madhu Pabda/Pabda	Migratory
52	Tepa	Migratory
53	Gora Gutum/Ganga Sha	Migratory
54	Golsa/Kabasi Tengra	Migratory
55	Rui	Migratory
56	Catla	Migratory
57	Mrigel	Migratory
58	Kalibaush	Migratory
59	Golda/Echa	Migratory
60	Narkeli Chela	Migratory
61	Dimua/Kathalia Echa	Migratory
62	Shar Puti	Migratory
63	Kachki	Riverine
64	Poa	Riverine
65	Khalla/Kharshulla	Riverine
66	Peali	Riverine
67	Fesha	Riverine
68	Air	Riverine
69	Guzi air/Guzkata	Riverine
70	Bagha Air	Riverine
71	Batasi	Riverine
72	Bacha	Riverine
73	Boal	Riverine
74	Rita	Riverine
75	Silong	Riverine
76	Chaka/Gangina/Kaouak	Riverine
77	Hilsha	Riverine
78	Ghaura	Riverine
79	GangChela/Ghora Chel	Riverine
80	Peashi	Riverine
81	Baspata/Kazuli	Riverine
82	Potka	Unknown
83	Nayan bali	Unknown

Appendix-19

Table 1: Fishing Access by Gear and Season in Hail Haor

Season	EnglishName	Leased	No Restriction	Open Access	Own	Sub-Leased	Total
PreMonsoon	Veshal/Khara	14	0	13	0	0	27
	Ber Jal	0	1	10	2	0	13
	Thela Jal /Jali	0	1	58	0	0	59
	Current Jul	0	0	30	0	0	30
	Suta Jal	0	0	1	0	0	1
Overall		14	2	112	2	0	130
Monsoon	Veshal/Khara	9	0	1	0	9	19
	Ber Jal	0	0	8	0	13	21
	Thela Jal /Jali	0	0	24	0	0	24
	Current Jul	1	0	88	0	28	117
	Suta Jal	0	0	6	0	9	15
Overall		10	0	127	0	59	196
PostMonsoon	Veshal/Khara	0	0		0	36	36
	Ber Jal	1	0	10	0	22	33
	Thela Jal /Jali	0	0	33	0	2	35
	Jhaki Jal	0	0	2	0	0	2
	Current Jul	2	0	36	0	181	219
	Suta Jal	2	0	5	0	77	84
Overall		5	0	86	0	318	409
DrySeason	Veshal/Khara	0	0		0	18	18
	Ber Jal	0	0	1	0	4	5
	Thela Jal /Jali	0	0	29	0	0	29
	Jhaki Jal	0	0	1	0	0	1
	Current Jul	2	0	5	0	15	22
	Suta Jal	0	0	1	0	0	1
Overall		2	0	37	0	37	76

Table 2: Fishing Access by Gear and Habitat in Hail Haor site

Habitat	Gear Name	Leased	No Restriction	Open Access	Own	Sub-leased	Total
Beel	Veshal/Khara	0	0	0	0	3	3
	Ber Jal	0	0	9	0	31	40
	Thela Jal /Jali	0	1	40	0	1	42
	Current Jul	5	0	23	0	157	185
	Suta Jal	2	0	2	0	64	68
Overall		7	1	74	0	256	338
Floodplain	Veshal/Khara	2	0	3	0	5	10
	Ber Jal	1	0	14	2	7	24
	Thela Jal /Jali	0	0	80	0	1	81
	Current Jul	0	0	132	0	62	194
	Suta Jal	0	0	8	0	18	26
Overall		3	0	237	2	93	335
River	Veshal/Khara	21	0	11	0	41	73
	Ber Jal	0	1	4	0	1	6
	Thela Jal /Jali	0	0	23	0	0	23
	Jhaki Jal	0	0	3	0	0	3
	Current Jul	0	0	4	0	0	4
	Suta Jal	0	0	2	0	0	2
Overall		21	1	47	0	42	111
Canal	Veshal/Khara	0	0	0	0	14	14
	Ber Jal	0	0	2	0	0	2
	Thela Jal /Jali	0	0	1	0	0	1
	Current Jul	0	0	0	0	5	5
	Suta Jal	0	0	1	0	4	5
Overall		0	0	4	0	23	27

Table 1: Distribution of HHs by Land Holding Size in Hail Haor

	Landless		Marginal		Small		Medium		Large		Total	
Village Name	No	(%)	No	(%)	No	(%)	No	(%)	No	(%)	No	(%)
Uttar Baruna	21	60.00	4	11.43	3	8.57	4	11.43	3	8.57	35	100.00
Baruna (Borobari)	22	62.86	7	20.00	2	5.71	3	8.57	1	2.86	35	100.00
Baruna (Migherhati)	27	77.14	7	20.00	0	0.00	1	2.86	0	0.00	35	100.00
Hazipur	21	60.00	7	20.00	3	8.57	3	8.57	1	2.86	35	100.00
Paschim Varaura	21	60.00	10	28.57	2	5.71	2	5.71	0	0.00	35	100.00
Lalbag	17	48.57	8	22.86	6	17.14	4	11.43	0	0.00	35	100.00
Dighapara	25	71.43	6	17.14	3	8.57	1	2.86	0	0.00	35	100.00
Rustompur	26	74.29	3	8.57	3	8.57	1	2.86	2	5.71	35	100.00
Bade Alisha	16	45.71	8	22.86	6	17.14	4	11.43	1	2.86	35	100.00
Vimshi (Namapara)	25	71.43	5	14.29	5	14.29	0	0.00	0	0.00	35	100.00
Boulashir	21	60.00	6	17.14	5	14.29	3	8.57	0	0.00	35	100.00
Mirzapur	24	68.57	5	14.29	3	8.57	1	2.86	2	5.71	35	100.00
Shoilpur	25	71.43	8	22.86	1	2.86	1	2.86	0	0.00	35	100.00
TOTAL	291	63.96	84	18.46	42	9.23	28	6.15	10	2.20	455	100.00

Table 2: Distribution of HHs by Land Holding Size in Turag Bangshi

	Landless		Marginal		Small		Medium		Large		Total	
Village Name	No	(%)	No	(%)	No	(%)	No	(%)	No	(%)	No	(%)
Majhukhan	20	57.14	13	37.14	2	5.71	0	0.00	0	0.00	35	100.00
Taltoli	17	48.57	10	28.57	3	8.57	4	11.43	1	2.86	35	100.00
Bastoli	19	54.29	8	22.86	3	8.57	3	8.57	2	5.71	35	100.00
Kaliadaho	19	54.29	5	14.29	5	14.29	4	11.43	2	5.71	35	100.00
Sholhati	17	48.57	11	31.43	5	14.29	1	2.86	1	2.86	35	100.00
Gopinpur	17	48.57	9	25.71	2	5.71	6	17.14	1	2.86	35	100.00
Boroi Bari	26	74.29	7	20.00	0	0.00	2	5.71	0	0.00	35	100.00
Medi Ashulia	24	68.57	5	14.29	0	0.00	5	14.29	1	2.86	35	100.00
TOTAL	159	56.79	68	24.29	20	7.14	25	8.93	8	2.86	280	100.00

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Appendix-21

Table1: List of Wildlife Species in Different Areas of Hail Haor During the Winter Season (3-5 October 1999)

Common Name	Scientific Name	Cheruadubi Beel	Balla Beel	Poainna Beel	Overall Haor Area
Amphibia					
Bull Frog	*Rana tigerina*	x	✓	✓	✓
Common Toad	*Bufo melanostictus*	x	✓	✓	✓
Cricket Frog	*Rana limnocharis*	✓	✓	✓	✓
Skipper Frog	*Rana cyanophlyctis*	✓	✓	✓	✓
Tree Frog	*Rana temporalis*	x	x	✓	✓
Reptilia					
Checkered Keelback	*Xenochrophis piscator*	✓	✓	✓	✓
Olive Keelback	*Atretium schistosum*	✓	✓	✓	✓
Common Worm Snake	*Typhlina bramina*	x	x	✓	✓
Rat Snake	*Ptyas mucosus*	x	x	✓	✓
Banded Krait	*Bungarus fasciatus*	x	x	✓	✓
Monocellate Cobra	*Naja kaouthia*	x	x	✓	✓
Binocellate Cobra	*Naja naja*	x	✓	✓	✓
Common Smooth Water Snake	*Enhydris enhydris*	✓	✓	✓	✓
Common Vine Snake	*Ahaetulla nasutus*	x	x	✓	✓
Bengal Monitor	*Varanus bengalensis*	x	✓	✓	✓
Common Skink	*Mabuya carinata*	x	x	✓	✓
House Lizard	*Hemidactylus brookii*	x	x	✓	✓
Common Garden Lizard	*Calotes versicolor*	x	x	✓	✓
Wall Lizard	*Gekko gecko*	x	x	x	✓
Peacock Softshell Turtle	*Aspideretes hurum*		✓	✓	✓
Indian Roofed Turtle	*Kachuga tecta*	✓	✓	✓	✓
Brown Roofed Turtle	*Kachuga smithii*	x	x	✓	x
Brahminy River Turtle	*Hardella thurjii*	✓	✓	✓	✓
Mammalia					
Asiatic Jackal	*Canis aureus*	x	x	✓	✓
Bengal Fox	*Vulpes bengalensis*	x	✓	✓	✓
Grey Musk Shrew	*Suncus murinus*	x	x	✓	✓
Flying Fox	*Pteropus giganteus*	x	x	x	✓
Indian Pipistrelle	*Pipistrellus coromandra*	x	x	x	✓
False Vampire	*Megaderma lyra*	x	x	x	✓
Indian Porcupine	*Hystrix indica*	x	x	x	✓
Common Otter	*Lutra lutra*	✓	✓	✓	✓
Small Indian Civet	*Viverricula indica*	x	x	x	✓
Large Indian Civet	*Viverra zibetha*	x	x	x	✓
Fishing Cat	*Felis viverrina*	x	x	✓	✓
Small Indian Mongoose	*Herpestes auropunctatus*	x	✓	✓	✓

Common Name	Scientific Name	Chernadubi Beel	Balu Beel	Tamura Beel	Overall Haor Area
Common Mongoose	*Herpestes edwardsi*	x	✓	✓	✓
House Mouse	*Mus musculus*	x	x	✓	✓
Bandicoot Rat	*Bandicota indica*	x	x	✓	✓
Indian Field Mouse	*Mus booduga*	x	x	✓	✓
Common House Rat	*Rattus rattus*	x	x	x	✓

Table 2: List of Bird Species in Different Areas of Hail Haor During the Winter Season (3-5 October 1999)

Common Name	Scientific Name
Asian Koel	*Eudynamys scolopacea*
Asian Openbill	*Anastomus oscitans*
Asian Palm Swift	*Cypsiurus balasiensis*
Asian Pied Starling	*Sturnus contra*
Bank Myna	*Acridotheres ginginianus*
Barn Swallow	*Hirundo rustica*
Baya Weaver	*Ploceus philippinus*
Black Drongo	*Dicrurus macrocercus*
Black Kite	*Milvus migrans*
Brahminy Kite	*Haliastur indus*
Bronzewinged Jacana	*Metopidius indicus*
Chestnut Headed Bee Eater	*Merops leschenaulti*
Citrine Wagtail	*Motacilla citreola*
Clamorous Reed-Warbler	*Acrocephalus stentoreus*
Common Kingfisher	*Alcedo atthis*
Common Myna	*Acridotheres tristis*
Common Sandpiper	*Actitis hypoleucos*
Common Snipe	*Gallinago gallinago*
Common Stonechat	*Sexicola torquata*
Common Tailbird	*Orthotomus sutorius*
Dasky Warbler	*Phylloscopus fuscatus*
Eastern Marsh Harrier	*Circus spilonotus*
Eurasian Hoopoe	*Upupa epops*
Great Egret	*Casmerodius albus*
Green Sandpiper	*Tringa ochropus*
Grey Heron	*Ardea cincrea*
House Crow	*Corvus splendens*
House Sparrow	*Passer domesticus*
Indian Black Headed Munia	*Lonchura malacca*
Intermediate Egret	*Egretta intermedia*
Lesser Spotted Eagle	*Aquilla pomarina*
Little Egret	*Egretta garzetta*
Marsh Sandpiper	*Tringa stagnatilis*
Pacific Golden Plover	*Pluvialis fulva*

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Common Name	Scientific Name
Pied Cuckoo	*Clamator jacobinus*
Pied Harrier	*Circus melanoleucos*
Pied Kingfisher	*Ceryle rudis*
Pintail Snipe	*Gallinago stenura*
Plain Prinia	*Prinia inornata*
Plaintive Cuckoo	*Cacomantis passerinus*
Pond Heron	*Ardeola grayii*
Red-Collared Dove	*Streptopelia tranquebarica*
Rock Dove	*Columba livia*
Scaly Breasted Munia	*Lonchura punctulata*
Spotted Dove	*Streptopelia chinensis*
Spotted Redshank	*Tringa erythropus*
Striated Prinia	*Prinia criniger*
Temminck's Stint	*Calidris temminklii*
White Wagtail	*Motacilla alba*
White-Rumped Vulture	*Gyps bengalensis*
White-Throated Kingfisher	*Halcyon smyrnensis*
Wood Sandpiper	*Tringa glareola*
Yellow Bittern	*Ixobrychus sinensis*
Yellow Wagtail	*Motacilla flava*
Yellow-Breasted Bunting	*Emberiza aureola*
Zitting Cisticola	*Cisticola juncidis*

Appendix –22

Table1: List of Wildlife Species in Different Areas of Hail Haor During the Summer Season (April 17-24, 2000)

Common Name	Scientific Name	Transect-1	Transect-2	Transect-3
Amphibia				
Bull Frog	*Rana tigerina*	✓	x	x
Common Toad	*Bufo melanostictus*	✓	✓	✓
Cricket Frog	*Rana limnocharis*	✓	x	x
Skipper Frog	*Rana cyanophlyctis*	✓	✓	x
Tree Frog	*Rana temporalis*	x	✓	✓
Reptilia				
Banded Krait	*Bungarus fasciatus*	x	x	✓
Bengal Monitor	*Varanus bengalensis*	✓	✓	✓
Binocellate Cobra	*Naja naja*	x	✓	✓
Brahminy River Turtle	*Hardella thurjii*	✓	x	x
Checkered Keelback	*Xenocrophis piscator*	✓	x	x
Common Garden Lizard	*Calotes versicolor*	x	✓	✓
Common Skink	*Mabuya carinata*	x	✓	✓
Common Smooth Water Snake	*Enhydris enhydris*	✓	x	x
Common Vine Snake	*Ahaetulla nasutus*	x	✓	✓
Common Worm Snake	*Typhlina bramina*	x	✓	✓
House Lizard	*Hemidactylus brookii*	x	✓	x
Indian Roofed Turtle	*Kachuga tecta*	✓	x	x
Olive Keelback	*Atretium schistosum*	✓	x	x
Rat Snake	*Ptyas mucosus*	x	✓	✓
Rock Python	*Python molurus*	x	x	✓
Spotted Lizard	*Hemidactylus frenatus*	x	✓	x
Wall Lizard	*Gekko gecko*	x	✓	✓
Mammalia				
Asiatic Jackal	*Vulpes bengalensis*	x	✓	✓
Bandicoot Rat	*Bandicota indica*	✓	✓	x
Black Giant Squirrel	*Ratufa bicolor*	x	x	✓
Common House Rat	*Rattus rattus*	✓	✓	x
Common Mongoose	*Herpestes edwardsi*	✓	✓	✓
Common Otter	*Lutra lutra*	✓	x	x
Fishing Cat	*Felis viverrina*	✓	x	✓
Flying Fox	*Pteropus giganteus*	x	✓	✓
Grey Musk Shrew	*Suncus murinus*	✓	✓	x
Hoolocka Gibbon	*Hylobates hoolock*	x	x	✓
House Mouse	*Mus musculus*	✓	x	x
Indian Field Mouse	*Mus booduga*	✓	✓	x
Indian Pipistrelle	*Pipistrellus coromandra*	x	✓	x
Indian Porcupine	*Hystrix indica*	x	✓	✓
Large Indian Civet	*Viverra zibetha*	x	✓	✓
Rhesus Macaque	*Macaca mulata*	x	x	✓
Rufoustailed Hare	*Lepus nigricollis*	x	✓	✓

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Common Name	Scientific Name	Transect-1	Transect-2	Transect-3
Small Indian Civet	*Viverricula indica*	x	✓	✓
Small Indian Mongoose	*Herpestes auropunctatus*	✓	✓	✓
Avifaunal				
Abbott's Babber	*Trichastoma abbotti*	x	✓	✓
Ashy Woodswallow	*Artamus fuscus*	x	✓	✓
Asian Koel	*Eudynamys scolopacea*	x	✓	x
Barn Owl	*Tyto alba*	✓	✓	x
Baya Weaver	*Ploceus philippinus*	✓	✓	x
Black Drongo	*Dicrurus macrocercus*	✓	✓	✓
Black-Shouldered Kite	*Elanus caeruleus*	✓	✓	✓
Black-Hooded Oriole	*Oriolus xanthornus*	x	✓	✓
Blackheaded Yellow Bulbul	*Pycnonotus melanicterus*	x	x	✓
Blue Rock Pigeon	*Colomba livia*	✓	✓	✓
Blue Throated Barbet	*Megalaima asiatica*	x	✓	✓
Brahminy Kite	*Haliastur indus*	✓	✓	x
Brainfever	*Cuculus varius*	x	✓	✓
Bronzed Drongo	*Dicrurus aeneus*	x	✓	✓
Bronzewinged Jacana	*Metopidius indicus*	✓	x	x
Brown Fish Owl	*Bubo zeylonensis*	✓	x	✓
Bush Lark	*Mirafra assamica*	✓	x	x
Cattle Egret	*Bubulcus ibis*	✓	✓	x
Common Iora	*Aegithina tiphia*	x	✓	✓
Common Kingfisher	*Alcedo atthis*	✓	✓	✓
Common Myna	*Acridotheres tristis*	✓	✓	✓
Common Swallow	*Hirundo rustica*	✓	x	x
Crow Pheasant	*Centropus sinensis*	✓	✓	✓
Emerald Dove	*Chalcophas indica*	x	✓	✓
Green Bee Eater	*Merops orientalis*	✓	✓	✓
Grey Tit	*Parus major*	x	✓	✓
Grey Wagtail	*Motacilla caspica*	✓	✓	x
Greyheaded Fishing Eagle	*Ichthyophaga ichthyaetus*	✓	x	x
Greyheaded Myna	*Sturnus malabaricus*	x	✓	✓
Hill Myna	*Gracula religiosa*	x	x	✓
Hoopoe	*Upupa epops*	✓	✓	x
House Crow	*Corvus splendens*	✓	✓	✓
House Sparrow	*Passer domesticus*	✓	✓	✓
Indian Ring Dove	*Streptopelia decaocta*	✓	✓	✓
Indian Roller	*Coracias benghalensis*	x	✓	✓
Intermediate Egret	*Egretta intermedia*	✓	x	x
Jungle Crow	*Corvus macrorhynchos*	✓	✓	✓
Jungle Myna	*Acridotheres fuscus*	x	✓	✓
Large Egret	*Egretta alba*	✓	x	x
Large Greenbilled Malkoha	*Rhopodytes tristis*	x	x	✓
Large Whistling Teal	*Dendrocygna bicolor*	✓	x	x
Lesser Golden Backed	*Dinopium benghalense*	x	✓	✓

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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Woodpecker				
Lesser Racket-tailed Drongo	*Dicrurus remifer*	x	x	✓
Lesser Whistling Teal	*Dendrocygna javanica*	✓	x	x
Lineated Barbet	*Megalaima lineata*	x	✓	✓
Little Cormorant	*Phalacrocorax niger*	✓	x	x
Little Egret	*Egretta garzetta*	✓	✓	✓
Little Greba	*Podiceps ruficollis*	✓	x	x
Little Spiderhunter	*Arachnothera Iangirostris*	x	✓	✓
Magpie Robin	*Copsychus saularis*	x	✓	✓
Moorhen	*Gallinula chloropus*	✓	x	x
Night Heron	*Nycticorax nycticorax*	✓	✓	x
Orange-breasted Green Pigeon	*Treron bicincta*	x	✓	✓
Paddyfield Pipit	*Anthus novaeseelandiae*	✓	x	x
Pariah Kite	*Milvus migrans*	✓	✓	✓
Pawl Swift	*Cypsiurus parvus*	✓	✓	x
Pied Crested Cuckoo	*Clamator jacobinus*	x	✓	✓
Pied Myna	*Sturnus contra*	✓	✓	✓
Pied Wagtail	*Motacilla alba*	✓	✓	x
Plaintive Cuckoo	*Cacomantis passerinus*	x	✓	✓
Pompadour Pigeon	*Treron pompadora*	x	✓	✓
Pond Heron	*Ardeola grayii*	✓	✓	✓
Purple Sunbird	*Nectarinia asiatica*	x	✓	✓
Purplerumped Sunbird	*Nectarinia zeylonica*	x	✓	✓
Quaker Babbler	*Alcippe poioicephala*	x	✓	✓
Rafous Woodpecker	*Micropternus brachyurus*	x	✓	✓
Red Turtle Dove	*Streptopelia tranquebarica*	✓	✓	✓
Redbreasted Parakeet	*Psittacula alexandri*	x	✓	✓
Redvented Bulbul	*Pycnonotus cafer*	✓	✓	✓
Redwattled Lapwing	*Vanellus indicus*	✓	✓	x
Redwhiskered Bulbul	*Pycnonotus jocosus*	x	✓	✓
Roseringed Parakeet	*Psittacula krameri*	x	✓	✓
Shama	*Copoychus malabaricus*	x	x	✓
Silverbill Munia	*Lonchura malabarica*	✓	✓	✓
Small Minivet	*Pericrocotus peregrinus*	x	✓	✓
Spotted Dove	*Streptopelia chinensis*	✓	✓	✓
Spotted Munia	*Lonchura subundulata*	✓	✓	✓
Spotted Owlet	*Athene brama*	✓	✓	x
Tailor Bird	*Orthotomus sutorius*	x	✓	✓
Tickell's Babbler	*Trichastoma tickelli*	x	✓	✓
Tickell's Flowerpicker	*Dicaeum erythrorhynchos*	x	✓	✓
Tree Pie	*Dendrocitta vagabunda*	x	✓	✓
Whitebreasted Kingfisher	*Halcyon smyrnensis*	✓	✓	x
Whitebreasted Waterhen	*Amaurornis phoenicurus*	✓	✓	x
Whitethroated Fantail	*Rapidura albicollis*	x	✓	✓

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Common Name	Scientific Name	Transect-1	Transect-2	Transect-3
Flycatcher				
Yellow Bittern	*Ixobrychus sinensis*	✓	✓	x
Yellow-footed Green Pigeon	*Treron phoenicoptera*	x	✓	✓
Yellowfronted Pied Woodpecker	*Picoides mahrattensins*	x	✓	✓

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Appendix-23 List of Wildlife Species in Turag-Bangshi During the Winter Season

Common Name	Scientific Name	Kaliadaha Beel	Mokash Beel	Turag River	Overall Wetland Area
Amphibia					
Bull Frog	*Rana tigerina*	✓	✓	-	✓
Common Toad	*Bufo melanostictus*	✓	✓	-	✓
Cricket Frog	*Rana limnocharis*	✓	✓	-	✓
Skipper Frog	*Rana cyanophlyctis*	✓	✓	-	✓
Tree Frog	*Rana temporalis*	-	-	-	✓
Reptilia					
Bengal Monitor	*Varanus bengalensis*	✓	-	-	✓
Binocellate Cobra	*Naja naja*	-	-	-	✓
Brahminy River Turtle	*Hardella thurjii*	-	✓	-	✓
Checkered Keelback	*Xenochrophis piscator*	✓	✓	✓	✓
Common Garden Lizard	*Calotes versicolor*	-	-	-	✓
Common Roof Turtle	*Kachuga tecta*	-	✓	-	✓
Common Skink	*Mabuya carinata*	-	-	-	✓
Common Vine Snake	*Ahaetulla nasutus*	-	-	-	✓
Common Worm Snake	*Typhlina bramina*	-	-	-	✓
House Lizard	*Hemidactylus brookii*	-	-	-	✓
Monocellate Cobra	*Naja kaouthia*	-	✓	-	✓
Olive Keelback	*Atretium schistosum*	✓	✓	-	✓
Rat Snake	*Ptyas mucosus*	-	-	-	✓
Wall Lizard	*Gekko gecko*	-	-	-	✓
Mammalia					
Bandicoot Rat	*Bandicota indica*	-	-	-	✓
Common House Rat	*Rattus rattus*	-	-	-	✓
Common Mongoose	*Herpestes edwardsi*	-	-	-	✓
Common Otter	*Lutra lutra*	✓	✓	-	✓
Flying Fox	*Pteropus giganteus*	-	✓	-	✓
Freshwater Dolphin	*Platanista gangetica*	-	-	✓	✓
Grey Musk Shrew	*Suncus murinus*	-	-	-	✓
House Mouse	*Mus musculus*	-	-	-	✓
Indian Field Mouse	*Mus booduga*	✓	✓	-	✓
Irrawasy Squirrel	*Callosciurus pygerythrus*	-	-	-	✓
Jackal	*Canis aureus*	✓	✓	-	✓
Large Indian Civet	*Viverra zibetha*	-	-	-	✓
Mole Rat	*Bandicota bengalensis*	✓	✓	-	✓
Small Indian Civet	*Viverricula indica*	-	-	-	✓
Avifaunal					
Abbott's Babbler	*Trichastoma abbotti*	-	-	-	✓

Common Name	Scientific Name	Kaliadaha Beel	Mokash Beel	Turag River	Overall Wetland Area
Ashy Woodswallow	*Artamus fuscus*	✓	✓	-	✓
Asian Koel	*Eudynamys scolopacea*	-	-	-	✓
Bank Myna	*Acridotheres ginginianus*				
Barn Owl	*Tyto alba*	✓	✓	-	✓
Baya Weaver	*Ploceus philippinus*	-	-	-	✓
Black Drongo	*Dicrurus macrocercus*	✓	✓	✓	✓
Black-Hooded Oriole	*Oriolus xanthornus*	-	-	-	✓
Long-Tailed Shrike	*Lanius schach*	✓	✓	✓	✓
Blue Rock Pigeon	*Columba livia*	-	✓	-	✓
Blue-tailed Bee-eater	*Merops philippinus*				
Brahminy Kite	*Haliastur indus*	✓	✓	✓	✓
Brainfever	*Cuculus varius*	-	-	-	✓
Bronzewinged Jacana	*Metopidius indicus*	✓	✓	-	✓
Brown Fish Owl	*Bubo zeylonensis*	✓	-	-	✓
Brown Shrike	*Lanius cristatus*	-	✓	-	✓
Bush Lark	*Mirafra assamica*	-	✓	-	✓
Cattle Egret	*Bubulcus ibis*	✓	✓	✓	✓
Chestnut Bittern	*Ixobrychus cinnamomeus*	✓	✓	-	✓
Common Iora	*Aegithina tiphia*	-	-	-	✓
Common Myna	*Acridotheres tristis*	✓	✓	✓	✓
Common Sandpiper	*Actitis hypoleucos*				
Common Silverbill	*Lonchura malabarica*	-	-	-	✓
Common Swallow	*Hirundo rustica*	✓	✓	✓	✓
Common Wood Shrike	*Tephrodornis pondicerianus*	-	-	-	✓
Crimsonbreasted Barbet	*Megalaima haemacephala*	-	-	-	✓
Crow Pheasant	*Centropus sinensis*	✓	✓	-	✓
Fantail Snape	*Gallinago gallinago*	✓	✓	-	✓
Great Egret	*Casmerodius albus*				
Green Bee-Eater	*Merops orientalis*	-	-	✓	✓
Greenshank	*Tringa nebularia*	✓	✓	-	-
Greheaded Myna	*Sturnus malabaricus*	-	-	-	✓
Grey Tit	*Parus major*	-	-	-	✓
Greyheaded Fishing Eagle	*Ichthyophaga ichthyaetus*	✓	✓	-	✓
Hoopoe	*Upupa epops*	✓	✓	✓	✓
House Crow	*Corvus splendens*	✓	✓	✓	✓
House Sparrow	*Passer domesticus*	✓	✓	✓	✓
Indian Cuckoo	*Cuclus micropterus*	-	✓	-	✓
Intermediate Egret	*Egretta intermedia*	✓	✓	-	✓

Common Name	Scientific Name	Kaliadaha Beel	Mokash Beel	Turag River	Overall Wetland Area
Jungle Babbler	*Turdoides striatus*	✓	✓	-	✓
Jungle Crow	*Corvus macrorhynchos*	✓	✓	✓	✓
Jungle Myna	*Acridotheres fuscus*	✓	✓	-	✓
Kestrel	*Falco tinnunculus*	-	-	-	✓
Large Hawk-Cuckoo	*Hierococcyx sparverioides*				
Lesser Goldenbacked Woodpecker	*Dinopium benghalense*	-	-	-	✓
Little Cormorant	*Phalacrocorax niger*	✓	✓	-	✓
Little Egret	*Egretta garzetta*	✓	✓	-	✓
Little Grebe	*Podiceps ruficollis*	✓	✓	-	✓
Longtailed Nightjar	*Caprimulgus macrurus*	-	-	-	✓
Magpie Robin	*Copsychus saularis*	✓	✓	✓	✓
Night Heron	*Nycticorax nycticorax*	-	-	-	✓
Paddyfield Pipit	*Anthus novaeseelandiae*	✓	✓	-	✓
Palm Swift	*Cypsiurus parvus*	✓	✓	✓	✓
Pied Kingfisher	*Ceryle rudis*	✓	✓	✓	✓
Pied Myna	*Sturnus contra*	✓	✓	✓	✓
Pied Wagtail	*Motacilla alba*	✓	✓	✓	✓
Pintail Snipe	*Gallinago stenura*	✓	✓	-	✓
Plain Sand Martin	*Riparia paludicola*	✓	✓	✓	✓
Pond Heron	*Ardeola grayii*	✓	✓	-	✓
Purple Sunbird	*Nectarinia asiatica*	-	-	-	✓
Purplerumped Sunbird	*Nectarinia zeylonica*	-	-	-	✓
Quaker Babbler	*Alcippe poioicephala*	-	-	-	✓
Red Turtle Dove	*Streptopelia tranquebarica*	-	-	-	✓
Redbreasted Flycatcher	*Muscicapaparva*	✓	-	-	✓
Redvented Bulbul	*Pycnonotus cafer*	✓	✓	✓	✓
Roseringed Parakeet	*Psittacula krameri*	-	-	-	✓
Rufous Woodpecker	*Micropternus brachyurus*	-	-	-	✓
Shikra	*Accipiter badius*	-	✓	-	✓
Small Kingfisher	*Alcedo atthis*	✓	✓	✓	✓
Spotted Dove	*Streptopelia chinensis*	-	-	-	✓
Spotted Owlet	*Athene brama*	✓	✓	✓	✓
Tailor Bird	*Orthotomus sutorius*	-	-	-	✓
Tibetan Shrike	*Lanius tephronotus*	-	✓	-	✓
Tickell's Flowerpecker	*Dicaeum erythrorhynchos*	-	-	-	✓

Common Name	Scientific Name	Kaliadaha Beel	Mokash Beel	Turag River	Overall Wetland Area
Tree Pie	*Dendrocitta vagabunda*	-	-	-	✓
Whitebreasted Kingfisher	*Halcyon smyrnensis*	✓	✓	✓	✓
Whitebreasted Waterhen	*Amaurornis phoenicurus*	✓	✓	✓	✓
Whitebrowed Fantail Flycatcher	*Rhipidura albicollis*	-	-	-	✓
Wiretailed Swallow	*Hirundo smithii*	✓	✓	-	✓
Wryneck	*Jynx torquilla*	-	-	-	✓
Yellow Bittern	*Ixobrychus sinensis*	-	-	-	✓
Yellowfronted Pied Woodpecker	*Picoides mahrattensis*	-	-	-	✓

Appendix 24 - List of Wildlife Species in Turag-Bangshi During the Summer Season

Common Name	Scientific Name	Transect-1	Transect-2	Transect-3
Amphibia				
Bull Frog	*Rana tigerina*	✓	✓	✓
Common Toad	*Bufo melanostictus*	✓	✓	✓
Cricket Frog	*Rana limnocharis*	✓	x	✓
Frog	*Microhyla ornata*	✓	✓	x
Skipper Frog	*Rana cyanophlyctis*	✓	x	✓
Tree Frog	*Rana temporalis*	x	✓	x
Reptilia				
Banded Krait	*Bungarus fasciatus*	x	✓	x
Bengal Cobra	*Naja naja kauothia*	x	✓	x
Bengal Monitor	*Varamus bengalensis*	-	✓	✓
Brahminy River Turtle	*Hardella thurjii*	x	x	✓
Checkered Keelback	*Xenocrophis piscator*	x	✓	✓
Common Cobra	*naja naja naja*	✓	x	x
Common Garden Lizard	*Calotes versicolor*	x	✓	x
Common Skink	*Mabuya carinata*	x	✓	x
Common Smooth Water Snake	*Enhydris enhydris*	✓	✓	✓
Common Vine Snake	*Ahaetulla nasutus*	x	✓	x
Common Worm Snake	*Typhlina bramina*	x	✓	x
House Lizard	*Hemidactylus brooki*	x	✓	x
Indian Roofed Turtle	*Kachuga tecta*	x	x	✓
Olive Keelback	*Atretium schistosum*	✓	✓	✓
Rat Snake	*Ptyas mucosus*	-	✓	
Wall Lizard	*Gekko gecko*	-	✓	✓
Mammalia				
Asiatic Jackal	*Vulpes bengalensis*	✓	✓	x
Bandicoot Rat	*Bandicota indica*	✓	✓	x
Common House Rat	*Rattus rattus*	✓	✓	x
Common Mongoose	*Herpestes edwardsi*	✓	x	x
Common Otter	*Lutra lutra*	✓	x	✓
Flying Fox	*Pteropus giganteus*	✓	x	✓
Grey Musk Shrew	*Suncus murinus*	x	✓	x
House Mouse	*Mus musculus*	x	✓	x
Indian Field Mouse	*Mus booduga*	✓	✓	x
Indian Pipistrelle	*Pipistrellus coromandra*	✓	x	✓
Indian Porcupine	*Hystrix indica*	✓	x	x
Irrawady Squiral	*Callosciurus pygerythrus*	✓	x	x
Large Indian Civet	*Viverra zibetha*	✓	✓	x
Rufoustailed Hare	*Lepus nigricollis*	✓	x	x
Small Indian Civet	*Viverricula indica*	✓	✓	x
Small Indian Mongoose	*Herpestes auropunctatus*	✓	✓	x
Avifaunal				
Abbott's Babber	*Trichastoma abbotti*	✓	✓	x
Ashy Woodswallow	*Artamus fuscus*	✓	✓	x

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Common Name	Scientific Name	Transect-1	Transect-2	Transect-3
Asian Koel	*Eudynamys scolopacea*	✓	✓	x
Asian Palm Swift	*Cypsiurus balasiensis*			
Barn Owl	*Tyto alba*	x	✓	x
Baya Weaver	*Ploceus philippinus*	✓	✓	x
Black Drongo	*Dicrurus macrocercus*	✓	✓	✓
Black-Shouldered Kite	*Elanus caeruleus*	✓	✓	x
Black-Hooded Oriole	*Oriolus xanthornus*	✓	✓	x
Blue Rock Pigeon	*Colomba livia*	x	✓	x
Brahminy Kite	*Haliastur indus*	x	✓	✓
Brainfever	*Cuculus varius*	✓	✓	x
Brown Fish owl	*Bubo zeylonensis*	✓	✓	✓
Bush Lark	*Mirafra assamica*	✓	✓	✓
Cattle Egret	*Bubulcus ibis*	✓	✓	✓
Common Iora	*Aegithina tiphia*	✓	✓	x
Common Kingfisher	*Alcedo atthis*	✓	✓	✓
Common Myna	*Acridotheres tristis*	✓	✓	x
Crow Pheasant	*Centropus sinensis*	x	✓	x
Green Bee Eater	*Merops orientalis*	✓	✓	x
Grey Tit	*Parus major*	✓	✓	x
Greyheaded Fishing Eagle	*Ichthuophaga ichthyaetus*	x	✓	✓
Greyheaded Myna	*Sturnus malabaricus*	✓	✓	x
Hoopoe	*Upupa epops*	✓	✓	x
House Crow	*Corvus splendens*	✓	✓	✓
House Sparrow	*Passer domesticus*	✓	✓	x
Indian Ring Dove	*Streptopelia decaocta*	x	✓	x
Indian Roller	*Coracias benghalensis*	✓	✓	x
Intermediate Egret	*Egretta intermedia*	x	x	✓
Jungle Crow	*Corvus macrorhynchos*	✓	✓	✓
Jungle Myna	*Acridotheres fuscus*	✓	✓	x
Jungle Nightjar	*Caprimulgus indicus*	✓	✓	x
Large Whistling Teal	*Dendrocygna bicolor*	✓	✓	x
Lesser Coucal	*Centropus bengalensis*			
Lesser Golden Backed Woodpecker	*Dinopium benghalense*	✓	✓	x
Lesser Whistling Teal	*Dendrocygna javanica*	✓	✓	✓
Lineated Barbet	*Megalaima lineata*	✓	x	x
Little Cormorant	*Phalacrocorax niger*	✓	x	✓
Little Egret	*Egretta garzetta*	✓	x	✓
Little Grebe	*Podiceps ruficollis*	✓	x	✓
Magpie Robin	*Copsychus saularis*	✓	✓	x
Night Heron	*Nycticorax nycticorax*	x	✓	✓
Orange-breasted Green Pigeon	*Treron bicincta*	✓	✓	x
Paddyfield Pipit	*Anthus novaeseelandiae*	✓	✓	x
Pawl Swift	*Cypsiurus parvus*	✓	✓	x
Pied Crested Cuckoo	*Clamator jacobinus*	✓	✓	x
Pied Kingfisher	*Ceryle rudis*	✓	x	✓

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Common Name	Scientific Name	Transect 1	Transect 2	Transect 3
Pied Myna	*Sturnus contra*	✓	✓	x
Pond Heron	*Ardeola grayii*	✓	✓	✓
Purple Sunbird	*Nectarinia asiatica*	✓	✓	x
Purplerumped Sunbird	*Nectarinia zeylonica*	✓	✓	x
Quaker Babbler	*Alcippe potoicephala*	✓	x	x
Red Turtle Dove	*Streptopelia tranquebarica*	x	✓	x
Redvented Bulbul	*Pycnonotus cafer*	✓	✓	x
Redwattled Lapwing	*Vanellus indicus*	✓	✓	x
Rofous Turtle Dove	*Streptopelia orientalis*	✓	✓	x
Roseringed Parakeet	*Psittacula krameri*	✓	✓	x
Small Minivet	*Pericrocotus peregrinus*	✓	x	x
Spotted Dove	*Streptopelia chinensis*	x	✓	x
Spotted Munia	*Lonchura subundulata*	✓	✓	x
Spotted Owlet	*Athene brama*	x	✓	x
Tailor Bird	*Orthotomus sutorius*	✓	✓	x
Tickell's Babbler	*Trichastoma tickelli*	✓	✓	x
Tickell's Flowerpicker	*Dicaeum erythrorhynchos*	✓	✓	x
Tree Pie	*Dendrocitta vagabunda*	✓	✓	x
White browed Wagtail	*Motacilla maderaspatensis*			
Whitebreasted Kingfisher	*Halcyon smyrnensis*	✓	✓	✓
Whitebreasted Waterhen	*Amaurornis phoenicurus*	✓	✓	✓
Whitethroated Fantail Flycatcher	*Rapidura albicollis*	✓	x	x
Yellow Bittern	*Ixobrychus sinensis*	✓	✓	
Yellow-footed Green Pigeon	*Treron phoenicoptera*	✓	✓	x
Yellowfronted Pied Woodpecker	*Picoides mahrattensins*	✓	✓	x

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Appendix 25 - Cumulative Occurrence of Wildlife at the Hail Haor and Turag-Bangshi Sites

Common Name	Scientific Name
Amphibia	
Bull Frog	*Rana tigerina*
Common Toad	*Bufo melanostictus*
Cricket Frog	*Rana limnocharis*
Frog	*Microhyla ornata*
Skipper Frog	*Rana cyanophlyctis*
Tree Frog	*Rana temporalis*
Reptilia	
Banded Krait	*Bungarus fasciatus*
Bengal Monitor	*Varanus bengalensis*
Binocellate Cobra	*Naja naja*
Brahminy River Turtle	*Hardella thurjii*
Brown Roofed Turtle	*Kachuga smithii*
Checkered Keelback	*Xenochrophis piscator*
Common Skink	*Mabuya carinata*
Common Smooth Water Snake	*Enhydris enhydris*
Common Vine Snake	*Ahaetulla nasutus*
Common Worm Snake	*Typhlina bramina*
Garden Lizard	*Calotes versicolor*
House Lizard	*Hemidactylus brooki*
Monocellate Cobra	*Naja kaouthia*
Olive Keelback	*Atretium schistosum*
Peacock Softshell Turtle	*Aspideretes hurum*
Rat Snake	*Ptyas mucosus*
Rock Python	*Python molurus*
Roofed Terrapin	*Kachuga tecta*
Spotted Lizard	*Hemidactylus frenatus*
Wall Lizard	*Gekko gekko*
Mammalia	
Asiatic Jackal	*Canis aureus*
Asiatic Jackal	*Vulpes bengalensis*
Bandicoot Rat	*Bandicota indica*
Black Giant Squirrel	*Ratufa bicolor*
Common House Rat	*Rattus rattus*
Common Mongoose	*Herpestes edwardsi*
Common Otter	*Lutra lutra*
False Vampire	*Megaderma lyra*
Fishing Cat	*Felis viverrina*
Flying Fox	*Pteropus giganteus*
Freshwater Dolphin	*Platanista gangetica*
Grey Musk Shrew	*Suncus murinus*
Hoolocka Gibbon	*Hylobates hoolock*
House Mouse	*Mus musculus*

Common Name	Scientific Name
Indian Field Mouse	*Mus booduga*
Indian Pipistrelle	*Pipistrellus coromandra*
Indian Porcupine	*Hystrix indica*
Irrawady Squiral	*Callosciurus pygerythrus*
Large Indian Civet	*Virerra zibetha*
Mole Rat	*Bandicota bengalensis*
Rhesus Macaque	*Macaca mulata*
Rufoustailed Hare	*Lepus nigricollis*
Small Indian Civet	*Viverricula indica*
Small Indian Mongoose	*Herpestes auropunctatus*
Avifaunal	
Abbott's Babbler	*Trichastoma abbotti*
Ashy Woodswallow	*Artamus fuscus*
Asian Koel	*Eudynamys scolopacea*
Asian Openbill	*Anastomus oscitans*
Asian Palm Swift	*Cypsiurus balasiensis*
Asian Pied Starling	*Sturnus contra*
Bank Myna	*Acridotheres ginginianus*
Barn Owl	*Tyto alba*
Baya Weaver	*Ploceus philippinus*
Black Drongo	*Dicrurus macrocercus*
Black Kite	*Milvus migrans*
Black-Shouldered Kite	*Elanus caeruleus*
Black-Hooded Oriole	*Oriolus xanthornus*
Long-Tailed Shrike	*Lanius schach*
Black-Crested Bulbul	*Pycnonotus melanicterus*
Blue Throated Barbet	*Megalaima asiatica*
Blue-tailed Bee-eater	*Merops philippinus*
Brahminy Kite	*Haliastur indus*
Brainfever	*Cuculus varius*
Bronzed Drongo	*Dicrurus aeneus*
Bronzewinged Jacana	*Metopidius indicus*
Brown Fish Owl	*Bubo zeylonensis*
Brown Shrike	*Lanius cristatus*
Bush Lark	*Mirafra assamica*
Cattle Egret	*Bubulcus ibis*
Chestnut Bittern	*Ixobrychus cinnamomeus*
Chestnut Headed Bee Eater	*Merops leschenaulti*
Citrine Wagtail	*Motacilla citreola*
Clamorous Reed-Warbler	*Aerocephalus stentoreus*
Common Iora	*Aegithina tiphia*
Common Kingfisher	*Alcedo atthis*
Common Myna	*Acridotheres tristis*
Common Sandpiper	*Actitis hypoleucos*
Common Snipe	*Gallinago gallinago*
Common Stonechat	*Sexicola torquata*
Common Swallow	*Hirundo rustica*

Common Name	Scientific Name
Common Wood Shrike	*Tephrodornis pondicerianus*
Crimsonbreasted Barbet	*Megalaima haemacephala*
Crow Pheasant	*Centropus sinensis*
Dasky Warbler	*Phylloscopus fuscatus*
Eastern Marsh-Harrier	*Circus spilonotus*
Emerald Dove	*Chalcophas indica*
Great Egret	*Casmerodius albus*
Green Bee Eater	*Merops orientalis*
Green Sandpiper	*Tringa ochropus*
Greenshank	*Tringa nebularia*
Greheaded Myna	*Sturnus malabaricus*
Grey Heron	*Ardea cincrea*
Grey Tit	*Parus major*
Grey Wagtail	*Motacilla caspica*
Greyheaded Fishing Eagle	*Ichthyophaga ichthyaetus*
Hill Myna	*Gracula religiosa*
Hoopoe	*Upupa epops*
House Crow	*Corvus splendens*
House Sparrow	*Passer domesticus*
Indian Black Headed Munia	*Lonchura malacca*
Indian Cuckoo	*Cuclus micropterus*
Indian Ring Dove	*Streptopelia decaocta*
Indian Roller	*Coracias benghalensis*
Intermediate Egret	*Egretta intermedia*
Jungle Babbler	*Turdoides striatus*
Jungle Crow	*Corvus macrorhynchos*
Jungle Myna	*Acridotheres fuscus*
Jungle Nightjar	*Caprimulgus indicus*
Kestrel	*Falco tinnunculus*
Large Egret	*Egretta alba*
Large Greenbilled Malkoha	*Rhopodytes tristis*
Large Hawk-Cuckoo	*Hierococcyx sparverioides*
Large Whistling Teal	*Dendrocygna bicolor*
Lesser Coucal	*Centropus bengalensis*
Lesser Golden Backed Woodpecker	*Dinopium benghalense*
Lesser Racket-tailed Drongo	*Dicrurus remifer*
Lesser Spotted Eagle	*Aquilla pomarina*
Lesser Whistling Teal	*Dendrocygna javanica*
Lineated Barbet	*Megalaima lineata*
Little Cormorant	*Phalacrocorax niger*
Little Egret	*Egretta garzetta*
Little Grebe	*Podiceps ruficollis*
Little Spiderhunter	*Arachnothera langirostris*
Longtailed Nightjar	*Caprimulgus macrurus*
Magpie Robin	*Copsychus saularis*
Marsh Sandpiper	*Tringa stagnatilis*
Moorhen	*Gallinula chloropus*

Common Name	Scientific Name
Night Heron	*Nycticorax nycticorax*
Orange-breasted Green Pigeon	*Treron bicincta*
Pacific Golden Plover	*Pluvialis fulva*
Paddyfield Pipit	*Anthus novaeseelandiae*
Pawl Swift	*Cypsiurus parvus*
Pied Crested Cuckoo	*Clamator jacobinus*
Pied Harrier	*Circus melanoleucos*
Pied Kingfisher	*Ceryle rudis*
Pintail Snipe	*Gallinago stenura*
Plain Prinia	*Prinia inornata*
Plain Sand Martin	*Riparia paludicola*
Plaintive Cuckoo	*Cacomantis passerinus*
Pompadour Pigeon	*Treron pompadora*
Pond Heron	*Ardeola grayii*
Purple Sunbird	*Nectarinia asiatica*
Purplerumped Sunbird	*Nectarinia zeylonica*
Quaker Babbler	*Alcippe poioicephala*
Rafous Woodpecker	*Micropternus brachyurus*
Red Turtle Dove	*Streptopelia tranquebarica*
Redbreasted Flycatcher	*Muscicapa parva*
Redbreasted Parakeet	*Psittacula alexandri*
Redvented Bulbul	*Pycnonotus cafer*
Redwattled Lapwing	*Vanellus indicus*
Redwhiskered Bulbul	*Pycnonotus jocosus*
Rock Dove	*Columba livia*
Rofous Turtle Dove	*Streptopelia orientalis*
Roseringed Parakeet	*Psittacula krameri*
Scaly Breasted Munia	*Lonchura punctulata*
Shama	*Copoychus malabaricus*
Shikra	*Accipiter badius*
Silverbill Munia	*Lonchura malabarica*
Small Minivet	*Pericrocotus peregrinus*
Spotted Dove	*Streptopelia chinensis*
Spotted Munia	*Lonchura subundulata*
Spotted Owlet	*Athene brama*
Spotted Redshank	*Tringa erythropus*
Striated Prinia	*Prinia criniger*
Tailor Bird	*Orthotomus sutorius*
Temminck's Stint	*Calidris temminklii*
Tibetan Shrike	*Lanius tephronotus*
Tickell's Babbler	*Trichastoma tickelli*
Tickell's Flowerpicker	*Dicaeum erythrorhynchos*
Tree Pie	*Dendrocitta vagabunda*
White browed Wagtail	*Motacilla maderaspatensis*
White rumped Vulture	*Gyps bengalensis*
White Wagtail	*Motacilla alba*
Whitebreasted Waterhen	*Amaurornis phoenicurus*

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Common Name	Scientific Name
Whitebreasted Waterhen	*Amaurornis phoenicurus*
Whitebrowed Fantail Flycatcher	*Rhipidura albicollis*
White-throated Kingfisher	*Halcyon smyrnensis*
Wiretailed Swallow	*Hirundo smithii*
Wood Sandpiper	*Tringa glareola*
Wryneck	*Jynx torquilla*
Yellow Bittern	*Ixobrychus minutus*
Yellow Bittern	*Ixobrychus sinensis*
Yellow Breasted Bunting	*Emberiza aureola*
Yellow Wagtail	*Motacilla flava*
Yellow-footed Green Pigeon	*Treron phoenicoptera*
Yellowfronted Pied Woodpecker	*Picoides mahrattensins*
Zitting Cisticola	*Cisticola juncidis*

Appendix 26 - List of Observed Hydrophyte Species in the Hail Haor During the Dry Season (11.1.99 to 11.30.99)

SL.	Scientific Name	Local Name	Family	Use
1	*Alternanthera philoxeroides*	Helencha	Amaranthaceae	FV
2	*Aeschynomene sp*	Shola/Vatshola	Leguminosae	OR
3	*Alternanthera sessilis*	Haicha/Sachishak	Amaranthaceae	FV
4	*Aponogeton appendiculatus*	Baithapata	Aponogetonaceae	OT
5	*Aponogeton sp.*	Ghechu	Aponogetonaceae	OT
6	*Axonopus compressur*	Ghash	Gramineae	OT
7	*Azolla pinnata*	Kutipana	Salviniaceae	OT
8	*Blyxa sp.*	Pani Ghash	Hydrocharitaceae	OT
9	*Cyperus tagetum*	Chati Hogla	Cyperaceae	FP
10	*Ceratophyllum sp.*	Biral Lazur	Ceratophyllaceae	OT
11	*Ceratopteris sp*	Fern		OT
12	*Chrysopogon aciculatus*	Premkata/Chokata	Gramineae	FP
13	*Cynodon dactylon*	Durba/Boro Durba Ghash	Gramineae	FP
14	*Cyperus rotundus*	Mutha Ghash	Cyperaceae	FPFP
15	*Cyperus sp.*	Ghash	Cyperaceae	FP
16	*Cyperus tenuispica*	Ghash	Cyperaceae	FP
17	*Dentella repens*	Bhui Pat/Noricha Ghash	Rubiaceae	OT
18	*Desodium sp*	Ghash	Leguminosae	OR
19	*Digitaria sp.*	Loitta	Gramineae	OT
20	*Eichhornia crassipes*	Kachuripana	Pontederiaceae	FP
21	*Echinochloa sp.*	Tandera Ghash	Gramineae	FP
22	*Echinochloa stagnina*	Paura/Paura Ghash	Gramineae	FP
23	*Eclipta sp*	Kella Ghash	Compositae	OT
24	*Elatine sp.*	Ghash	Elatinaceae	OT
25	*Eleocharis chaetaria*	Chesra Ghash	Cyperaceae	OR
26	*Eleocharis dulcis*	Boro Chesra Ghash	Cyperaceae	OT
27	*Eleusina indica*	Chapra, Ghash	Gramineae	OT
28	*Enhydra fluctuans*	Helencha	Compositae	FV
29	*Eriocaulon setaceum*	Chesra	Cyperaceae	FP
30	*Euryale ferox*	Fokol	Nymphaeaceae	FS
31	*Evolvulus sp*	Lata/Babni Lata	Convolvulaceae	OT
32	*Fimbristylis miliacea*	Chatki Ghash	Cyperaceae	FP
33	*Hemarthria protensa*	Chailla	Gramineae	FP
34	*Hydrilla verticillata*	Ichadurki/Kata Shaola	Hydrocharitaceae	OT
35	*Hygrorhyza aristata*	Futi/Futki Ghash	Gramineae	OT
36	*Ipomoea aquatica*	Kolmi Shak	Convolvulaceae	FV
37	*Ipomoea fistulosa*	Deyokolum	Convolvulaceae	FV
38	*Limnophila cana*	Panichapra	Scrophulariaceae	OR
39	*Limnophila heterophylla*	Panichapra	Scrophulariaceae	OT
40	*Limnophila sessiliflora*	Panichapra	Scrophulariaceae	OT
41	*Limnophila sp.*	Panichapra	Scrophulariaceae	OT
42	*Ludwigia abscendens*	Keshordam/Panichapra/Mulcha	Onagraceae	OT
43	*Ludwigia repens*	Keshordam/Panichapra/Panidoga	Onagraceae	OT

Sl.	Scientific Name	Local Name	Family	Use
44	*Mersilea quadrifoliata*	Amrail Shak	Mersileaceae	OT
45	*Mikania cordata*	Zermani/Japanilata	Compositae	OT
46	*Monochoria hastata*	Kechuro	Pontederiaceae	FP
47	*Myriophyllum sp*	Shaola	Haloraceae	OT
48	*Nymphoides indica*	Zinari Gach	Menyanthaceae	OT
49	*Nymphaea pubescens*	Sada Shapla	Nymphaeaceae	OR
50	*Najas graminea*	Shaola/Gura Shasla	Najadaceae	OT
51	*Najas sp.*	Shaola/Gura Shasla	Najadaceae	OT
52	*Nelumbo nucifera*	Pahdo	Nymphaeaceae	FS
53	*Nymphaea nouchali*	Shapla	Nymphaeaceae	OR
54	*Nymphaea rubra*	Lal Shapla	Nymphaeaceae	OR
55	*Nymphoides cristatum*	Zinari Gach/Chandmala	Menyanthaceae	OT
56	*Oryza rufipogon*	Jhoradhan	Gramineae	FP
57	*Oryza sp*	Dhan	Gramineae	FS
58	*Ottelia alismoides*	Gangkola/ Panikola/Mamakola	Hydrocharitaceae	FS
59	*Phragmites karka*	Khagra	Gramineae	OR
60	*Phyllanthus sp.*	Sitka/Sitki	Euphorbiaceae	OT
61	*Phyllanthus sp.*	Pishae	Euphorbiaceae	M
62	*Pistia stratiotes*	Topapana	Araceae	OT
63	*Polygonum barbatum*	Boro Kokra/Bishkatali	Polygonaceae	OT
64	*Polygonum glabrum*	Lal Kokra/Bishkatali	Polygonaceae	OT
65	*Polygonum lanatum*	Shada Kokra	Polygonaceae	OT
66	*Polygonum pedunculare*	Lal Kokra/Bishkatali	Polygonaceae	OT
67	*Polygonum stagninum*	Lal Kokra/Bishkatali	Polygonaceae	OT
68	*Polygonum tomentosum*	Boro Kokra/Bishkatali	Polygonaceae	OT
69	*Pseudoraphis brunoninan*	Dudherail/Erali Ghash	Gramineae	FP
70	*Pseudoraphis sp.*	Erail/Erali Ghash	Gramineae	FP
71	*Pseudoraphis spinescens*	Bagh Erail/Erali Ghash	Gramineae	FP
72	*Rottboelia sp.*	Ghash	Gramineae	OT
73	*Salvinia cucullata*	Kutipana/Idurkani	Salviniaceae	OT
74	*Salvinia natans*	Tetulapana	Salviniaceae	OT
75	*Schoenoplectus articulatus*	Choto Chesra	Cyperaceae	FP
76	*Sporobolus sp.*	Jabri Ghash	Gramineae	OT
77	*Trapa bispinosa*	Shingrai/Panifol	Trapaceae	FS
78	*Trapa maximowiczii*	Shingrai/Panifol	Trapaceae	FS
79	*Utricularia aurea*	Shaola/Chotojhanji	Lentibulariaceae	OT
80	*Utricularia exoleata*	Shaola/Chotojhanji	Lentibulariaceae	OT
81	*Utricularia inflexa*	Shaola	Lentibulariaceae	OTOT
82	*Utricularia sp*	Shaola/Chotojhanji	Lentibulariaceae	OT
83	*Utricularia stellaris*	Shaola/Chotojhanji	Lentibulariaceae	OT
84	*Vallisnaria spiralis*	Patashaola	Hydrocharitaceae	OT

* An aquatic fern, free floating (habit) in nature.

Appendix 27 - List of Observed Hydrophyte Species in the Hail Haor During the Wet Season (8.5.2000 to 8.17.2000)

SL	Scientific Name	Local Name	Family	Use
1	*Alternanthera philoxeroides*	Shechishak	Amaranthaceae	FV
2	*Aeschynomene aspera*	Vat Shaola	Leguminosae	FB
3	*Alternanthera sessilis*	Haicha/Sachishak	Amaranthaceae	FV
4	*Aponogeton appendiculatus*	Baithapata	Aponogetonaceae	OT
5	*Aponogeton sp.*	Baithapata	Aponogetonaceae	OT
6	*Axonopus affinis*	Chaptapata	Gramineae	FP
7	*Azolla pinnata*	Kutipana	Salviniaceae	FT
8	*Blyxa japonica*	Shaola	Hydrocharitraceae	OT
9	*Ceratophyllum desmersum*	Biral Lazur	Ceratophyllaceae	OT
10	*Ceratophyllum sp.*	Shaola	Ceratophyllaceae	OT
11	*Ceratopteris chauctroides*		Pteridophyta	OT
12	*Colocasia esculenta*	Kochu	Araceae	FV
13	*Cynodon dactylon*	Durba/Boro Durba Ghash	Gramineae	FP
14	*Cyperus rotang*	Ful Ghash	Cyperaceae	FP
15	*Cyperus rotundus*	Ful Ghash	Cyperaceae	FP
16	*Cyperus sp.*	Ful Ghash	Cyperaceae	FP
17	*Cyperus tagetum*	Chatiogol	Cyperaceae	FP
18	*Dopatrium junceum*	Pani Ghash	Scrophulariaceae	OT
19	*Echinochloa crussgalli*	Paura	Gramineae	FP
20	*Echinochloa sp.*	Tandera	Gramineae	FP
21	*Eclipta prostata*	Helencha	Compositae	OT
22	*Eichhornia crassipes*	Kochuripana/Jarmoni	Pontederiaceae	FP
23	*Enhydra fluctuans*	Helencha	Compositae	FV
24	*Enhydra sp.*	Helencha	Compositae	FV
25	*Eriocaulon acutangula*	Boro Chesra	Cyperaceae	OT
26	*Fimbristylis miliacea*	Chatki Ghash	Cyperaceae	FP
27	*Fimbristylis scaberrima*	Ful Ghash	Cyperaceae	FP
28	*Fimbristylis sp.*	Ghash	Cyperaceae	FP
29	*Hemarthia protensa*	Chailla	Gramineae	FP
30	*Hydrilla verticillata*	Ichadurki/Kata Shaola	Hydrocharitraceae	FP
31	*Hygroryza aristata*	Futki	Gramineae	FP
32	*Ipomoea aquatica*	Kolmi Shak	Convolvulaceae	FV
33	*Ipomoea fistulosa*	Deyokolum	Convolvulaceae	FV
34	*Kyllinga melanosperma*	Ful Ghash	Cyperaceae	FP
35	*Lemnophila heterophylla*	Panichapra	Scrophulariaceae	OT
36	*Limnophila sessiliflora*	Panichapra	Scrophulariaceae	OT
37	*Limnophila sp.*	Panichapra	Scrophulariaceae	OT
38	*Limnopoa meeboldies*	Bamnidopra	Gramineae	FP
39	*Lindernia rotundifolia*	Pani Ghash	Scrophulariaceae	OT
40	*Lindernia sp.*	Pani Ghash	Scrophulariaceae	OT
41	*Lippia geminata*		Verbenaceae	OT
42	*Ludwigia abscendens*	Panichapra/Paniaga	Onagraceae	OT
43	*Ludwigia repens*	Keshordam/Panichapra/Panidoga	Onagraceae	OT
44	*Melochia corchori folia*	Tikiokra	Sterculiaceae	OT

Sl.	Scientific Name	Local Name	Family	Use
45	*Mersilea minuta*	Amrail Shak	Mersileaceae	OT
46	*Monochoria hastata*	Kechur	Pontederiaceae	FP
47	*Myriophyllum sp.*	Pani Ghash	Haloraceae	OT
48	*Myriophyllum sp.*	Gach Shaola	Haloraceae	OT
49	*Najas graminea*	Shaola/Gura Shaola	Najadaceae	OT
50	*Najas sp.*	Shaola/Gura Shaola	Najadaceae	OT
51	*Nelumbo nucifera*	Padma	Nymphaeaceae	FF
52	*Nitella sp.*	Shaola	Algae (BGA)	OT
53	*Nymphaea nouchali*	Shapla	Nymphaeaceae	FV
54	*Nymphaea pubescens*	Sada Shapla	Nymphaeaceae	FV
55	*Nymphaea stellata*	Nil Shapla	Nymphaeaceae	FV
56	*Nymphoides cristatum*	Zinari/Chandmala	Menyanthaceae	OT
57	*Nymphoides indicum*	Zinari/Panchuli	Menyanthaceae	OT
58	*Oryza rufipogon*	Jhoradhan	Gramineae	FP
59	*Oryza sp*	Dhan	Gramineae	FS
60	*Ottelia alismoides*	Gangkola/Panikola	Hydrocharitraceae	FS
61	*Pesicaria ocreocarpa*	Lal Kukra	Polygonaceae	OT
62	*Panicum paludosum*	Baksha/Ful Ghash	Gramineae	FP
63	*Paspalum conjugatum*	Ful Ghash/Dadkuri	Gramineae	FP
64	*Paspalum scrobiculatum*	Panigoicha	Gramineae	FP
65	*Pesicaria dribotoma*	Lal Kukra	Polygonaceae	OT
66	*Pistia stratiotes*	Topapana	Araceae	OT
67	*Polygonum glabrum*	Lal Kokra/Bishkatali	Polygonaceae	OT
68	*Polygonum lanatum*	Sada Kokra	Polygonaceae	OT
69	*Polygonum pedunculare*	Lal Kokra/Bishkatali	Polygonaceae	OT
70	*Polygonum tomentosum*	Boro Kokra/Bishkatali	Polygonaceae	OT
71	*Pseudoraphis brunoninan*	Erali Ghash	Gramineae	FP
72	*Pseudoraphis spinescens*	Bagh Erail/Erali Ghash	Gramineae	FP
73	*Pycreus straming*	Chesra	Cyperaceae	FP
74	*Sacciolepis interrupta*	Ghash	Gramineae	FP
75	*Sagitteria guyanensis*	Pani Khechur	Allsmataceae	FP
76	*Salvinia cucullata*	Idurkani/Gura Shaola	Salviniaceae	OT
77	*Salvinia natans*	Tetulapana	Salviniaceae	OT
78	*Schoenoplectus articulatus*	Choto Chesra	Cyperaceae	FP
79	*Sporobolus airroides*	Ful Ghash	Gramineae	FP
80	*Sporobolus holvulus*	Ful Ghash	Gramineae	FP
81	*Trapa bispinosa*	Shingrai	Trapaceae	FF
82	*Utricularia aurea*	Bicha Shaola	Lentibulariaceae	OT
83	*Utricularia exoleata*	Shaola/Chotojhanji	Lentibulariaceae	OT
84	*Utricularia sp.*	Shaola/Chotojhanji	Lentibulariaceae	OT
85	*Vallisnaria spiralis*	Patashaola, Pattera	Limnaceae	OT

Use Code

Code	Use
B	Beverages
BF	Bio-fertilizer
BG	Bio-Gas
C	Ceremonial
D	Dyes
FB	Fiber/Thatching/Wickerwork
FF	Food: Fruit and Nut
FP	Feed Plant/Forage
FS	Food: Starch/Cereal
FU	Fuel
FV	Food: Vegetable
IU	Industrial Use
M	Medicinal/Narcotic/Poison
OR	Ornamental/Hedge
OT	Other Use
PA	Pollution abatement
SF	Spice/Flavors
TS	Timber/Structure

Appendix 28 - Total Hydrophyte Species Observed at Hail Haor

Sl.	Scientific Name	Local Name	Family
1	*Alternanthera philoxeroides*	Shechishak	Amaranthaceae
2	*Aeschynomene aspera*	Vat Shaola	Leguminosae
3	*Alternanthera sessilis*	Haicha/Sachishak	Amaranthaceae
4	*Aponogeton appendiculatus*	Baithapata	Aponogetonaceae
5	*Aponogeton sp.*	Baithapata	Aponogetonaceae
6	*Axonopus affinis*	Chaptapata	Gramineae
7	*Axonopus compressur*	Ghash	Gramineae
8	*Azolla pinnata*	Kutipana	Salviniaceae
9	*Blyxa japonica*	Shaola	Hydrocharitraceae
10	*Ceratophyllum desmersum*	Biral Lazur	Ceratophyllaceae
11	*Ceratophyllum sp.*	Shaola	Ceratophyllaceae
12	*Ceratopteris chauctroides*		Pteridophyta
13	*Colocasia esculenta*	Kochu	Araceae
14	*Cynodon dactylon*	Durba/Boro Durba Ghash	Gramineae
15	*Cyperus rotang*	Ful Ghash	Cyperaceae
16	*Cyperus rotundus*	Ful Ghash	Cyperaceae
17	*Cyperus sp.*	Ful Ghash	Cyperaceae
18	*Cyperus tagetum*	Chatiogol	Cyperaceae
19	*Cyperus tenuispica*	Ghash	Cyperaceae
20	*Dentella repens*	Bhui Pat/Noricha Ghash	Rubiaceae
21	*Desodium sp*	Ghash	Leguminosae
22	*Digitaria sp.*	Loitta	Gramineae
23	*Dopatrium junceum*	Pani Ghash	Scrophulariaceae
24	*Echinochloa crussgalli*	Paura	Gramineae
25	*Echinochloa sp.*	Tandera	Gramineae
26	*Echinochloa stagnina*	Paura/Paura Ghash	Gramineae
27	*Eclipta prostata*	Helencha	Compositae
28	*Eclipta sp*	Kella Ghash	Compositae
29	*Eichhornia crassipes*	Kochuripana/Jarmoni	Pontederiaceae
30	*Elatine sp.*	Ghash	Elatinaceae
31	*Eleocharis dulcis*	Boro Chesra Ghash	Cyperaceae
32	*Eleusina indica*	Chapra, Ghash	Gramineae
33	*Enhydra fluctuans*	Helencha	Compositae
34	*Enhydra sp.*	Helencha	Compositae
35	*Eriocaulon acutangula*	Boro Chesra	Cyperaceae
36	*Euryale ferox*	Fokol	Nymphaeaceae
37	*Evolvulus sp*	Lata/Babni Lata	Convolvulaceae
38	*Fimbristylis miliacea*	Chatki Ghash	Cyperaceae
39	*Fimbristylis scaberrima*	Ful Ghash	Cyperaceae
40	*Fimbristylis sp.*	Ghash	Cyperaceae
41	*Hemarthia protensa*	Chailla	Gramineae
42	*Hydrilla verticillata*	Ichadurki/Kata Shaola	Hydrocharitraceae
43	*Hygroryza aristata*	Futki	Gramineae
44	*Ipomoea aquatica*	Kolmi Shak	Convolvulaceae

Sl.	Scientific Name	Local Name	Family
45	*Ipomoea fistulosa*	Deyokolum	Convolvulaceae
46	*Kyllinga melanosperma*	Ful Ghash	Cyperaceae
47	*Lemnophila heterophylla*	Panichapra	Scrophulariaceae
48	*Limnophila cana*	Panichapra	Scrophulariaceae
49	*Limnophila sessiliflora*	Panichapra	Scrophulariaceae
50	*Limnophila sp.*	Panichapra	Scrophulariaceae
51	*Limnopoa meeboldies*	Bamnidopra	Gramineae
52	*Lindernia rotundifolia*	Pani Ghash	Scrophulariaceae
53	*Lindernia sp.*	Pani Ghash	Scrophulariaceae
54	*Lippia geminata*		Verbenaceae
55	*Ludwigia abscendens*	Panichapra/Paniaga	Onagraceae
56	*Ludwigia repens*	Keshordam/Panichapra/Panidoga	Onagraceae
57	*Melochia corchori folia*	Tikiokra	Sterculiaceae
58	*Mersilea minuta*	Amrail Shak	Mersileaceae
59	*Mikania cordata*	Zermani/Japanilata	Compositae
60	*Monochoria hastata*	Kechur	Pontederiaceae
61	*Myriophyllum sp.*	Pani Ghash	Haloraceae
62	*Myriophyllum sp.*	Gach Shaola	Haloraceae
63	*Najas graminea*	Shaola/Gura Shaola	Najadaceae
64	*Najas sp.*	Shaola/Gura Shaola	Najadaceae
65	*Nelumbo nucifera*	Padma	Nymphaeaceae
66	*Nitella sp.*	Shaola	Algae (BGA)
67	*Nymphaea nouchali*	Shapla	Nymphaeaceae
68	*Nymphaea pubescens*	Sada Shapla	Nymphaeaceae
69	*Nymphaea rubra*	Lal Shapla	Nymphaeaceae
70	*Nymphaea stellata*	Nil Shapla	Nymphaeaceae
71	*Nymphoides cristatum*	Zinari/Chandmala	Menyanthaceae
72	*Nymphoides indicum*	Zinari/Panchuli	Menyanthaceae
73	*Oryza rufipogon*	Jhoradhan	Gramineae
74	*Oryza sp*	Dhan	Gramineae
75	*Ottelia alismoides*	Gangkola/Panikola	Hydrocharitraceae
76	*Pesicaria ocreocarpa*	Lal Kukra	Polygonaceae
77	*Panicum paludosum*	Baksha/Ful Ghash	Gramineae
78	*Paspalum conjugatum*	Ful Ghash/Dadkuri	Gramineae
79	*Paspalum scrobiculatum*	Panigoicha	Gramineae
80	*Pesicaria dribotoma*	Lal Kukra	Polygonaceae
81	*Phragmites karka*	Khagra	Gramineae
82	*Phyllanthus sp.*	Sitka/Sitki	Euphorbiaceae
83	*Pistia stratiotes*	Topapana	Araceae
84	*Polygonum glabrum*	Lal Kokra/Bishkatali	Polygonaceae
85	*Polygonum lanatum*	Sada Kokra	Polygonaceae
86	*Polygonum pedunculare*	Lal Kokra/Bishkatali	Polygonaceae
87	*Polygonum tomeniosum*	Boro Kokra/Bishkatali	Polygonaceae
88	*Pseudoraphis brunoninan*	Erali Ghash	Gramineae
89	*Pseudoraphis spinescens*	Bagh Erail/Erali Ghash	Gramineae
90	*Pycreus straming*	Chesra	Cyperaceae
91	*Rottboelia sp.*	Ghash	Gramineae
92	*Sacciolepis interrupta*	Ghash	Gramineae

Sl.	Scientific Name	Local Name	Family
93	*Sagitteria guyanensis*	Pani Khechur	Allsmataceae
94	*Salvinia cucullata*	Idurkani/Gura Shaola	Salviniaceae
95	*Salvinia natans*	Tetulapana	Salviniaceae
96	*Schoenoplectus articulatus*	Choto Chesra	Cyperaceae
97	*Schoenoplectus articulatus*	Choto Chesra	Cyperaceae
98	*Sporobolus airroides*	Ful Ghash	Gramineae
99	*Sporobolus holvulus*	Ful Ghash	Gramineae
100	*Trapa bispinosa*	Shingrai	Trapaceae
101	*Trapa maximowiczii*	Shingrai/Panifol	Trapaceae
102	*Utricularia aurea*	Bicha Shaola	Lentibulariaceae
103	*Utricularia exoleata*	Shaola/Chotojhanji	Lentibulariaceae
104	*Utricularia inflexa*	Shaola	Lentibulariaceae
105	*Utricularia sp.*	Shaola/Chotojhanji	Lentibulariaceae
106	*Utricularia stellaris*	Shaola/Chotojhanji	Lentibulariaceae
107	*Vallisnaria spiralis*	Patashaola, Pattera	Limnaceae

Appendix 29 - List of Observed Hydrophyte Species in Turag-Bangshi Site During the Dry Season (1.23.00 to 1.27.00)

Sl.	Scientific Name	Local Name	Family	Makash	Kaliadah
1	*Aponogeton natures*	Ghechu	Aponogetonaecae	✓	
2	*Azolla pinnata*	Kutipana	Salviniaceae	✓	
3	*Ceratophyllum demersum*	Ichadurki	Ceratophyllaceae	✓	
4	*Chara sp.*	Shaola	Characeae	✓	
5	*Cyperus difformis*	Vadal Ghash	Cyperaceae		✓
6	*Eichhornia oraslipes*	Pana	Pontederiacene	✓	
7	Eleocharis dulcis	Chenchur/ Panichaise	Cyperaceae	✓	
8	*Fimbristylis miliacea*	Chula Ghash	Cyperaceae	✓	
9	*Hydrilla verticillata*	Ichadurki/Kata Shaola	Hydrocharitaece	✓	
10	*Limna minor*	Khudipara	Limnaceae	✓	
11	*Ludwigia repens*	Keshordam/Panichapra/ Panidoga	Oragraceae	✓	
12	*Nymphoides indica*	Pana	Nymphacaceae	✓	
13	*Nymphoides cristata*	Pana	Nymphacaceae	✓	
14	*Pistia stratiotes*	Topapana	Araceae	✓	
15	*Potemo geton sp.*	Ichadurki	Potemogetoraceae	✓	
16	*Sagittaria sagittifolia*	Kochu	Alismataceae	✓	
17	*Satrinia nature*	Tetulapana	Araceae	✓	✓
18	*Scirpus supinus*	Chancher Ghash	Cyperaceae	✓	
19	*Trapa bispinosa*	Nikna	Trapaceae	✓	✓
20	*Vallisneria spiralis*	Pattera	Hydrocharitaceae	✓	✓

*Green algae submerged in nature.

Appendix 30 - List of Observed Hydrophyte Species at Turag-Bangshi Site During the Wet Season

Sl.	Scientific Name	Local Name	Family	Makash	Kaliadah	Aowla
1	*Aeschynomene indica*	Vat Shola	Leguminosae	-	✓	✓
2	*Certopteris sp.**	Shaola	Pleriphyta	-	✓	-
3	*Cyperus cephalotes*	Moisha Numba	Cyperaceae	-	✓	-
4	*Dopatrium junceum*	Shaola	Polygonaceae	✓	-	-
5	*Echinochloa crussgalli*	Ghash	Gramineae	✓	✓	✓
6	*Echinochloa sp.*	Dal Ghash	Gramineae	-	-	✓
7	*Echinochloa stagnina*	Mayna Dal	Gramineae	✓	✓	✓
8	*Eichhornia crassipes*	Kochuripana/ Jarmoni	Pontederiaeae	✓	✓	✓
9	*Eriocaulon acatangula*	Boro Chesra	Cyperaceae	-	✓	-
10	*Hydrilla verticillata*	Ichadurki/Kata Shaola	Hydrocharitaceae	✓	✓	✓
11	*Hygroryza aristata*	Futki	Gramineae	✓	✓	✓
12	*Ipomoea aquatica*	Kolmi Shak	Convalvalaceae	✓	✓	✓
13	*Ipomoea fistulosa*	Dholkolmi	Convalvalaceae	✓	✓	✓
14	*Limnophila heterophylla*	Gach Shaola	Scrophulariaceae	-	✓	-
15	*Limnopoa mubolidii*	Ghash	Gramineae	✓	✓	✓
16	*Ludwigia abscendens*	Keshordam/Pani-chapra	Onagraceae	✓	✓	✓
17	*Ludwigia repens*	Keshordam/Pani-chapra/Panidoga	Onagraceae	✓	✓	✓
18	*Melochia corchorifolia*	Shaola	Sterculiaceae	-	-	✓
19	*Monochoria hastata*	Khechur	Pontederiaceae	✓	✓	✓
20	*Myriophyllum sp.*	Shaola	Haloraceae	-	✓	-
21	*Nymphaea pubescens*	Shapla	Nymphaeaceae	✓	✓	✓
22	*Najas graminea*	Shaola/Gura Shaola	Limnocharitaceae	✓	✓	-
23	*Najas sp*	Shaola/Gura Shasla	Limnocharitaceae	✓	✓	-
24	*Nechamandra alternifolia*	Ichadurki	Hydrocharitaceae	✓	✓	-
25	*Nymphaea nouchali*	Shapla	Nymphaeaceae	-	-	✓
26	*Nymphoides indicum*	Zinargach	Menyenthaceae	✓	✓	-
27	*Ottelia alismoides*	Gangkola/ Panikola	Hydrocharitaceae	✓	✓	-
28	*Potemogeton mucronatus*	Shaola	Limnocharitaceae	✓	✓	-
29	*Panicum paludosum*	Baksha/Ful Ghash	Gramineae	✓	✓	✓
30	*Phragmites karka*	Khagra	Gramineae	✓	-	-

Sl.	Scientific Name	Local Name	Family	Makash	Kaliadah	Aowia
31	*Pistia stratiotes*	Topapana	Araceae	✓	✓	✓
32	*Potamogeton octandrus*	Shaola	Pontederiacea e	✓	✓	-
33	*Potamogeton sp.*	Shaola	Pontederiacea e	✓	-	-
34	*Pseudoraphis brunoninan*	Erali Ghash	Gramineae	✓	✓	✓
35	*Pseudoraphis spinescens*	Arail	Gramineae	✓	✓	✓
36	*Saccharum sp.*	Boronol	Gramineae	✓	-	-
37	*Saccharum sp.*	Chatrajungle	Gramineae	✓	✓	-
38	*Saccharum spontaneum*	Kaissha	Gramineae	✓	-	✓
39	*Vallisneria spirales*	Pattera	Limnaceae	✓	✓	-

* An aquaticfern submerged in nature.

Appendix 31 - Total Hydrophyte Species Observed at Turag-Bangshi

Sl.	Scientific Name	Local Name	Family
1	*Aeschynomene indica*	Vat Shola	Leguminosae
2	*Aponogeton natans*	Ghechu	Aponogetonaceae
3	*Azolla pinnata*	Katipana	Salviniaceae
4	*Ceratophyllum demersum*	Ichadurki	Ceratophyllaceae
5	*Certopteris sp.* *	Shaola	Pleriphyta
6	*Chara sp.*	Shaola	Characeae
7	*Cyperus cephalotes*	Moisha Numba	Cyperaceae
8	*Cyperus difformis*	Vadal Ghash	Cyperaceae
9	*Dopatrium junceum*	Shaola	Polygonaceae
10	*Echinochloa crussgalli*	Ghash	Gramineae
11	*Echinochloa sp.*	Dal Ghash	Gramineae
12	*Echinochloa stagnina*	Mayna Dal	Gramineae
13	*Eichhornia crassipes*	Kochuripana/Jarmoni	Pontederiaeae
14	*Eriocaulon acatangula*	Boro Chesra	Cyperaceae
15	*Fimbristylis milliacea*	Chula Ghash	Cyperaceae
16	*Hydrilla verticillata*	Ichadurki/Kata Shaola	Hydrocharitaceae
17	*Hygroryza aristata*	Futki	Gramineae
18	*Ipomoea aquatica*	Kolmi Shak	Convalvalaceae
19	*Ipomoea fistulosa*	Dholkolmi	Convalvalaceae
20	*Limna minor*	Khudipana	Limnaceae
21	*Limnophila heterophylla*	Gach Shaola	Scro phulariaceae
22	*Limnopoa mubolidii*	Ghash	Gramineae
23	*Ludwigia abscendens*	Keshordam/Panichapra	Onagraceae
24	*Ludwigia repens*	Keshordam/Panichapra/Panidoga	Onagraceae
25	*Melochia corchorifolia*	Shaola	Sterculiaceae
26	*Monochoria hastata*	Khechur	Pontederiaceae
27	*Myriophyllum sp*	Shaola	Haloraceae
28	*Nymphaea pubescens*	Shapla	Nymphaeaceae
29	*Najas graminea*	Shaola/Gura Shaola	Limnocharitaceae
30	*Najas sp*	Shaola/Gura Shasla	Limnocharitaceae
31	*Nechamandra alternifolia*	Ichadurki	Hydrocharitaceae
32	*Nymphaea nouchali*	Shapla	Nymphaeaceae
33	*Nymphoides cristata*	Para	Gentianaceae
34	*Nymphoides indicum*	Zinargach	Menyenthaceae
35	*Ottelia alismoides*	Gangkola/Panikola	Hydrocharitaceae
36	*Potamogeton mucronatus*	Shaola	Limnocharitaceae
37	*Panicum paludosum*	Baksha/Ful Ghash	Gramineae
38	*Phragmites karka*	Khagra	Gramineae
39	*Pistia stratiotes*	Topapana	Araceae
40	*Potamogeton octandrus*	Shaola	Pontederiaceae
41	*Potamogeton sp.*	Shaola	Pontederiaceae
42	*Potamogeton sp.*	Ichadurki	Potamogetonaceae
43	*Pseudoraphis brunoninan*	Erali Ghash	Gramineae
44	*Pseudoraphis spinescens*	Arail	Gramineae

Sl.	Scientific Name	Local Name	Family
45	*Saccharum sp.*	Boronol	Gramineae
46	*Saccharum sp.*	Chatrajungle	Gramineae
47	*Saccharum spontaneum*	Kaissha	Gramineae
48	*Sagittaria sagittifolia*	Kochu	Alismataceae
49	*Salvinia natans*	Tetulapana	Araceae
50	*Scirpus supinus*	Chenchure Ghash	Cyperaceae
51	*Trapa natans*	Shingrai	Trapaceae
52	*Vallisneria spirales*	Pattera	Limnaceae

Appendix 32 - List of Observed Terrestrial Plant Species in the Hail Haor

Sl.	Scientific Name	Local Name	Family	Nature/Group
1	*Acalypha welkesiana*	Patabahar	Euphorbiaceae	shrub
2	*Albizia lebbeck*	Sada Shirish	Leguminosae	tree
3	*Albizia lucida*	Kalokoroi	Leguminosae	tree
4	*Albizia procera*	Sadakoroi	Leguminosae	tree
5	*Alstonia scholaris*	Chaitan	Apocynaceae	tree
6	*Anona squamosa*	Ataphal	Annonaceae	tree
7	*Anthocephalus chinensis*	Kadam	Rubiaceae	tree
8	*Artocarpus chaplasha*	Chambol	Moraceae	tree
9	*Artocarpus heterophyllus*	Kanthal	Moraceae	tree
10	*Azadirachta indica*	Nim	Meliaceae	tree
11	*Bambusa longispiculata*	Bakalbansh	Graminae	tree (like)
12	*Bambusa valgaris*	Zai Bansh	Graminea	tree
13	*Bombax ceiba*	Lal Shimul	Bombacaceae	tree
14	*Borassus flabellifer*	Tal	Palmae	tree
15	*Chrodendrum squamatum*	Lal Vat	Verbinaceae	shrub
16	*Cinnamomum obtusifolium*	Tejpata	Lauraceae	tree
17	*Citrus grandis*	Zambura	Rutaceae	small tree
18	*Citrus limmon*	Labu	Rutaceae	small tree
19	*Clinogyne dichotoma*	Patibet/Murta	Maranthaceae	shrub
20	*Cocos nucifera*	Narikal	Palmae	tree (like)
21	*Crotalaria spectabilis*	Zhonzhoni	Leguminosae	shrub
22	*Dalbergia sissoo*	Sishukath	Leguminosae	shrub
23	*Dendrocalamus strictus*	Lathi Bansh	Graminea	tree (like)
24	*Dillenia indica*	Chalta	Dilleniaceae	tree
25	*Dysoxylum binectariferum*	Rongi	Meliaceae	tree
26	*Ehretia acuminata*	Kalauza	Boraginaceae	tree
27	*Glycosmis arborea*	Datmajon	Rutaceae	shrub
28	*H rosasinensis*	Roktozaba	Malcaceae	shrub
29	*Hibiscus vitifolius*	Boncarpus	Malvaceae	shrub
30	*Hyptis suaveolens*	Tokma	Labiatae	shrub
31	*Ipomoea fistulosa*	Dhalkolmi	Convolvulaceae	shrub
32	*Lantana camara*	Lanton Kanta	Verbinaceae	shrub
33	*Litchi chinensis*	Lichu	Sapindaceae	tree
34	*Mangifera indica*	Aam	Anacardiaceae	tree
35	*Melastoma malabathricum*	Nishi/Lichi	Melastomataceae	shrub
36	*Melocanna baccifera*	Mulibansh	Goramineae	tree (like)
37	*Morus indica*	Tut	Moraceae	small tree
38	*Murraya paniculata*	Kamini	Rutaceae	shrub
39	*Phyllanthus veticulatus*	Chitki	Euphorbiaceae	shrub
40	*Psidium guajava*	Peara	Myrtaceae	small tree
41	*Ricinus communis*	Verenda	Euphorbiaceae	shrub
42	*Saccharum sp.*	Aakh	Graminae	shrub (like)
43	*Samanea saman*	Raintree/Rentree	Leguminosae	tree
44	*Solanum melongena*	Begun	Solanaceae	shrub
45	*Spondias pinnata*	Amra	Anacardiaceae	tree

Sl.	Scientific Name	Local Name	Family	Nature/Group
46	*Streblus asper*	Shaora	Urticaceae	small tree
47	*Swietenia mahagoni*	Mahogini	Meliaceae	tree
48	*Syzygium fruticosum*	Khudijum	Myrtaceae	small tree
49	*Tamarindus indica*	Tetul	Leguminosae	tree
50	*Tectona grandis*	Tick	Verbinaceae	tree
51	*Thea sinensis*	Tea	Theaceae	shrub
52	*Thevetia peruviana*	Haldakarobi	Apocynaceae	small tree
53	*Trema orientalis*	Ziga	Ulmaceae	tree
54	*Xanthium indicum*	Zorgunda	Compositae	shrub
55	*Zizyphus mauritiana*	Kul/Boroi	Rhamnaceae	small tree

Appendix 33 - List of Observed Terrestrial Plant Species in Turag-Bangshi

Sl.	Scientific Name	Local Name	Family	Natural Group
1	*Abroma augusta*	Ulatkambal	Sterculiaceae	small tree
2	*Acacia mangium*	Bulgium	Leguminosae	tree
3	*Acacia moniliformis*	Acacia	Leguminosae	tree
4	*Acrocarpus fraxinifolius*	Malcha	Leguminosae	tree
5	*Aegle marmelos*	Bel	Rutaceae	tree
6	*Albizia lucida*	Kalokoroi	Leguminosae	tree
7	*Albizia sp.*	Koroi	Leguminosae	tree
8	*Anona squamosa*	Ataphal	Annonaceae	tree
9	*Antidesma ghasembilla*	Khadijun	Euphorbiaceae	tree
10	*Artocarpus chaplasha*	Chambol	Moraceae	tree
11	*Artocarpus heterophyllus*	Kanthal	Moraceae	tree
12	*Artocarpus lacucha*	Dahua	Moraceae	tree
13	*Azadirachta indica*	Nim	Meliaceae	tree
14	*Balanostreblus illicifolius*	Shawra	Urticaceae	small tree
15	*Bambusa longispiculata*	Bakalbansh	Graminae	tree (like)
16	*Bambusa tulda*	Bambansh	Graminae	tree (like)
17	*Barringtonia acutangula*	Hijal	Lecythidaceae	tree
18	*Bombax ceiba*	Lal Shimul	Bombacaceae	tree
19	*Borassus flabellifer*	Tal	Palmae	tree
20	*Butea superba*	Lalpalash	Leguminosae	tree
21	*Cajanus cajan*	Aurhor	Leguminosae	shrub
22	*Carica papaya*	Pepe	Caricaeae	shrub
23	*Cassia fistula*	Sonalu	Leguminosae	tree
24	*Citrus aurantifolia*	Patileba	Rutaceae	shrub
25	*Citrus grandis*	Zambura	Rutaceae	small tree
26	*Clerodendrum squamatun*	Vati (lal)	Verbinaceae	shrub
27	*Clinogyne dichotoma*	Patibet/Murta	Maranthaceae	shrub
28	*Cocos nucifera*	Narikal	Palmae	tree (like)
29	*Daemonorops jenkinsianus*	Gollabet	Palmae	shrub
30	*Delonix regia*	Krishnachura	Leguminosae	tree
31	*Dendrocalamus giganteus*	Boruabansh	Graminae	tree (like)
32	*Dendrocalamus longispathus*	Orabansh	Graminae	tree (like)
33	*Dendrocalamus strictus*	Lathi Bansh	Graminea	tree (like)
34	*Dendrocalamus strictus*	Nolibansh	Graminae	tree (like)
35	*Dipterocarpus costatus*	Gorjon	Dipterocarpaceae	tree
36	*Elaeocarpus robustus*	Jolpai	Elaeocarpaceae	tree
37	*Eucalyptus citriodora*	Eucalyptus	Myrtaceae	tree
38	*Feronia limonia*	Kodbel	Rutaceae	small tree
39	*Ficus benghalensis*	Bat	Moraceae	large tree
40	*Ficus hispida*	Junglidumur	Moraceae	tree
41	*Ficus lacor*	Pakur	Moraceae	large tree
42	*Glycosmis arborea*	Datmajon	Rutaceae	shrub
43	*Gmelina arborea*	Gams	Verbinaceae	tree
44	*Ipomoea fistulosa*	Dhalkolmi	Convolvulaceae	shrub
45	*Litchi chinensis*	Lichu	Sapindaceae	tree

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SL	Scientific Name	Local Name	Family	Nature/Group
46	*Mangifera indica*	Aam	Anacardiaceae	tree
47	*Melia sempervirens*	Boishanim	Meliaceae	tree
48	*Moringa oleifera*	Sajna	Moringaceae	small tree
49	*Phoenix sylvestris*	Khujur	Moraceae	tree (like)
50	*Psidium guajava*	Peara	Myrtaceae	small tree
51	*Randia sp.*	Bishlang	Rubiaceae	shrub
52	*Samanea saman*	Raintree/Rentree	Leguminosae	tree
53	*Shorea robusta*	Gojari	Dipterocarpaceae	tree
54	*Swietenia mahagoni*	Mahogini	Meliaceae	tree
55	*Syzygium cuminii*	Jam/Borojum	Myrtaceae	tree
56	*Syzygium fruticosum*	Khudijum	Myrtaceae	small tree
57	*Tamarindus indica*	Tetul	Leguminosae	tree
58	*Tectona grandis*	Tick	Verbinaceae	tree
59	*Thevetia peruviana*	Haldakarobi	Apocynaceae	small tree
60	*Vitex trifolia*	Mishinda	Verbinaceae	small tree
61	*Zanthoxyllum rhetsa*	Bajna	Rutaceae	tree
62	*Zizyphus mauritiana*	Kul/Boroi	Rhamnaceae	small tree
63	*Zizyphus rugosa*	Junglibori	Rhamnaceae	small tree