









## **Completion Report – Volume- 2**

MACH Performance Monitoring





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







# MACH-II

# Completion Report Volume-II



June 2007

Winrock International Bangladesh Centre for Advanced Studies Center for Natural Resource Studies CARITAS Bangladesh



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## **MACH II Completion Report**

## **Volume 2: Performance Monitoring**

#### Preface

This volume summarizes the activities and achievements of the Management of Aquatic Ecosystems through Community Husbandry (MACH) projects (MACH-I and MACH-II). The first phase project (MACH-I) was initiated in September of 1998 and was completed in 2003. In October of 2003 the second phase or MACH-II started and has been completed with the writing of this completion report in June 2007. The fieldwork of MACH began at two sites (Hail Haor in Sreemangal and the Turog-Bangshi site in Kaliakor) in June of 1999 after an initial inception period. Fieldwork at a third site (Kongsha-Malijhee in Sherpur) began in July of 2000. Hence this report represents the achievements in the field of nearly 8 years in the case of two sites and 7 years in the case of the Sherpur site.

This file is in effect an updating of the MACH Project Performance Monitoring Report (produced earlier as part of the MACH first phase completion report) in line with the USAID SO 6 Performance Monitoring Plan as revised in November of 2001 and subsequently for MACH-II. The performance indicators for MACH were changed half way through the first phase of the project. Some indicators remained the same; some were removed while others were added. Further adjustments were made in late 2003 as a part of the 2<sup>nd</sup> phase adjustments.

The text that follows is shown in nineteen sections representing all 19 indicators and sub-indicators that applied to MACH under the SO system. Each section has a tab number that is referenced in a summary sheet at the beginning. Within each section there is a cover page showing the indicator in that section, a reference sheet for the indicator, and a series of descriptions and tables that provide the reader with the background on how the indicator targets and results have been derived. In addition if appropriate, maps have been provided demonstrating the location and position of the accomplishments.

With this document the reader is able to understand how results have been derived (methods used) and to what extent the project has achieved its target indicators. Background data in some cases has been provided in greater detail so that verification is simplified.

SO 6 Intermediate results and indicators for MACH-II			
SO 6: Improved Management of Open Water and Tropical Forest Resources			
• Indicator 6a: Extent to which best practices from USAID-funded projects are			
used elsewhere			
• Indicator 6b: Increased produ	ction of natural resources in targeted areas		
Indicator 6c: Increased biodiv	ersity in targeted areas.		
Intermediate Results			
R 6.1: Effective Community Based	Indicator 6.1a: Area of floodplain where		
Implemented	sustainable management is implemented.		
IR 6.2: Select Habitats and Ecosystems	Indicator 6 2a: Aquatic habitats converted from		
Improved	seasonal to perennial in targeted areas		
	Indicator 6.2c: Riparian habitat improved in		
	targeted areas		
IR 6.2.1: Innovations and Best Practices	Indicator 6.2.1a: Number of sanctuaries		
Adopted	established		
	Indicator 6.2.1b: Number of wetland/riparian trees		
	successfully established		
IR 6.2.2: Alternative Incomes Realized for	Indicator 6.2.2a: Average annual increase of RUG		
Target Groups	member supplemental income		
	Indicator 6.2.2b: Number of RUG fishers having		
	reduced effort		
IP 6 2: Salaat Paliaias Implemented that	Indicator 6.2.20: Total number of new AIG loans		
Support IRs 1 & 2	community resource management groups granted		
Support INS 1 & 2	in target areas		
	Indicator 6.3b: Number of communities adopting		
	the following key regulations in target areas:		
	• Restrictions on the use of inappropriate fishing		
	methods and gear		
	• Restrictions on the fishing season and		
	harvesting of fish fry		
	• Restrictions on the areas of fishing		
IR 6.4: Public Awareness of Key Issues	Indicator 6.4a: Number of individuals reached by		
Increased	the public awareness activities		
	Indicator 6.4b: Percentage increase in awareness		
	of wetland resource issues from baseline (%		
ID 6 5: Improved Institutional Conseity	Indicator ( 5 or Number of local covernment		
IK 6.5: Improved Institutional Capacity	matcalor 6.5a: Number of local government		
	discussed		
	Indicator 6 5b: Official circulars for UDCC agenda		
	item and permission for RMO members to attend		
	UP meetings as needed		
	Indicator 6.5c: UFC formed with charters/GOB		
	circulars in place linking local government to		
	resource management organizations		
	Indicator 6.5d: Trust Fund established for		
	Institution		



**SO6 Results Framework** 

# **Strategic Objective 6**

**Indicator 6.a:** Extent to which best practices from USAID projects are used elsewhere

June 2007

Management of Aquatic Ecosystems through Community Husbandry (MACH)

Strategic Objective 6: Improved Management of Open Water and Tropical Forest Resources			
Indicator 6a: Extent to which best practices from USAID projects are used elsewhere.			
A. Description	U	nit of measure	e:
<b>Precise Definition of Indicator:</b> Number of occasions where a new or innovative best			
practice, identified or supported by a USAID project, is used by other organizations	Year	Planned	Actual
(e.g. other donors, NGOs/communities or the GOB). Specific examples of best			0
practices are:	Baseline		Ū
1. Co-management of natural resources	2000		
2. Sanctuary development		MACH-I	
Unit of Measure: Number of occasions			
Disaggregate by: N/A	2001		
Disuggi oguto by. 1971			
Justification/Management Utility: This provides a sense of whether local best	2002		
practices and models are replicated more broadly. This is important because replication	2002		
of the best practices nationwide will ensure a better sustainable management of natural			
time, rehabilitation of degraded accession	2003		143 *
time, renabilitation of degraded ecosystem.	2003		145
B. Plan for Data Collection by USAID		MACH-II	
<b>Data Collection Method:</b> Examples throughout the year will be collected and reported			
on an annual basis.	2004	3	3
Method of Acquisition by USAID: Receipt of Semi-Annual Reports from Winrock	2001	5	5
Data Source(s): Project reports from implementers and other donors, information from			
the LCG and the Wetland Network.	2005	3	3
Frequency/ Timing of Data Collection: Information will be recorded as available.		5	5
Estimated Cost of Collection: low			
<b>Responsible Individual(s) at USAID:</b> Team Leader	2006	3	6
C. Data Quality Issues	2000	5	0
C. Data Quality Issues Data of Initial Data Quality Assassment:			
<b>Known Data Limitations (if any):</b> This indicator although set at the SO level may not			
be a direct outcome of USAID's program implementation efforts. When complimented			
with the other indicators, it will provide more depth to SO performance.			
Actions Taken or Planned to Address Data Limitations: None.			
Date of Future Data Quality Assessments:			
Procedures of Future Data Quality Assessments:			
-			
D. Plan for Data Analysis, Reporting, and Review			
<b>Data analysis:</b> Semi-annually, particularly prior to the semi-annual reviews			
Presentation of Data: Table			
<b>Review of Data:</b> Semi-annual for project management purposes and portfolio reviews.			
<b>Reporting Data:</b> R4, internal mission and CBJ			
D. Other Notes			
Notes on the Baselines/Targets: Baseline is zero			
Location of Data Storage: M:\EGFEpub\Environment\PMP\Data			
<b>Comments:</b> This indicator is a special status indicator. It is expected that the public			
outreach efforts will be instrumental in making other actors in the sector. including the			
GOB and other donors, aware of the success of the best practices, facilitating their			
replication. USAID believes that replication of best practices will lead to national level			
impacts but recognizes that it cannot control replication by outside agencies.			
<sup>1</sup> /Number of occasions where a best practice used by:			

- other organizations Donors .
  - -
  - Projects -\_
    - NGOs (See following pages)

## Strategic Objective 6: Indicator 6a: Extent to which best practices from USAID funded projects are used elsewhere.

This indicator was not one of the original project indicators when the project started. This indicator has been added in November 2001 during the revision of the performance indicators by USAID. As the project cannot guarantee that other programs and groups will take up the approach, this indicator was termed a "Special Status" indicator.

It was understood from the beginning that the project could not force others to use approaches found successful in MACH. MACH was demonstrating to others through example and field demonstration. The project has taken other project personnel and NGO personnel working in similar programs to the MACH sites for orientation. MACH has also taken government officials from the Ministries of Fisheries, Planning, Land, Finance (ERD and IMED), and Environment to project sites and generated awareness of the approach and its merits. In addition MACH has had foreign visitors from India, Nepal, Sri Lanka, Vietnam, Cambodia, and Brazil all looking at the co-management approach established by MACH. These institutions have spread the word within their ministries as well as in outside forums which have helped in the dissemination and spread of the approach. Many of MACH's efforts and work in getting people to the field has resulted in paving the way for other projects to get support for community-based approaches in government. Also other existing and new co-management project designs have been influenced by visits to MACH.

Another aspect is that because of MACH's success in the approach, the NGOs working within MACH are exporting the ideas to other programs of a similar nature that they are involved in. Examples of this are CNRS and CARITAS as they are involved in not only MACH but in CBFM, SEMP, UNDP programs and parts of Fourth Fisheries Project. The approaches and successes developed in MACH are taken by these NGOs to the other programs.

The examples of "Best Management Practices" specified in the performance monitoring plan are:

- 1. Co-management of natural resources
- 2. Sanctuary development
- 3. Alternate income generating activities for natural resources dependent populations

The unit of measure is to be the number of occasions where these are used by other organizations (eg. Projects, NGOs, GoB, communities).

The CBFM project 2<sup>nd</sup> phase incorporated elements that were not in the 1<sup>st</sup> phase but that do exist in MACH. Their project review recommended and the project accepted the need for closer project links to local government institutions where they are working. The CBFM project also relied on two of the same National NGOs as MACH, plus others, and the approaches used by them will be the successful elements used in MACH for example. The CBFM review referred to the MACH project approach with local government as one that they favored for adoption.

The Dampara project employed methods from MACH as did some of the Danida programs in Patuakhali and Noakhali. Government officials that have visited and have understood the concept have used MACH as an example. The former Project Coordinating Director of the Fourth Fisheries Project was in the MACH Technical Committee, and is now acting Director Inland Fisheries for DOF, he regularly participates in shared discussion on approaches. The Fourth Fisheries Project (FFP) was nearly countrywide and worked closely and used results from MACH in their sites. The FFP has adopted the sanctuary approaches with more local involvement of communities as MACH has recommended. See the following pages for the locations where best practices used in MACH are being used elsewhere. It is not possible to say that only because of MACH that these best practices have occurred in all of these locations. MACH has certainly interacted with the groups shown and it is likely either directly contributed or supported decisions that were taken.

In addition MACH II worked closely with the Department of Fisheries and the staff of the FFP through workshops and field trips to encourage the incorporation of selected MACH best practices into the overall Department of Fisheries Inland Capture Fisheries Strategy and into the FFP. Through this process of dialog and workshops MACH has encouraged the adoption of best management practices found to be most successful in MACH. The Strategy and resultant program proposed many of the best practices employed in MACH and the strategy laid out the framework for this to be done in all the Upazilas using a co-management approach modeled on that introduced by MACH. This Inland Capture Fisheries Strategy was approved by the MOFL in early 2006. Incorporation of best practices in Fourth Fisheries sites has been formalized through MOAs and implementation agreements during MACH-II. One of the big achievements was the inclusion of the MACH Approach in the Poverty Reduction strategy Paper (PRSP) of the government of Bangladesh. The GoB has stated that the MACH approach should be used in the Inland Capture Fisheries Management.

MACH also worked with DoF to establish best practices for alternative livelihoods for fishers in Chandpur during Jatka fishing ban (based on DoF request) and best practices with areas on the Bongshi river and in areas outside of the projects management area in Sherpur. These have been taken up through the initiative of the local communities and the local governments.

Organization	Practices	No. of occasions & places	
1. Fisheries Resource Dev. Project in open & close Jalmahals under new fisheries policy (DOF, funded by GOB).	<ul> <li>Sanctuary establishment</li> <li>Co-management</li> <li>Community organization</li> <li>Habitat restoration</li> <li>Restriction of harmful gears</li> <li>Seasonal restriction on fishing</li> </ul>	<ul> <li>Places: In 23 districts:</li> <li>Rangpur, Bogra, Naogaon, Rajshahi, Shirajgonj, noabgonj, Kurigram, Gopalgonj, Kishorgonj, Jamalpur, Minshigonj, Mymensingh, Netrokona, Tangail, Chittagong, Habogonj, Laxmipur, Moulvibazar, Sunamgonj, Meherpur, Sylhet, Bhola, Sherpur.</li> <li>13 openwater sanctuaries and 20 closed water sanctuaries are established.</li> </ul>	
2. Patuakhali-Barguna Project- (DOF, funded by DANIDA)	<ul> <li>Sanctuary maintenance</li> <li>Co-management</li> <li>Habitat restoration</li> <li>AIGA for the fishers</li> </ul>	2 districts: Patuakhali, Barguna area	
3. Fourth Fisheries Project (DOF, funded by World Bank, DFID, GEF, GOB)	<ul> <li>Sanctuary establishment</li> <li>Stocking of fish fingerling</li> <li>Habitat restoration</li> <li>Community based management</li> <li>Co-management</li> </ul>	In <b>53</b> places of the following districts : Noakhali, Naogaon, Pabna, Natore, Gaibanda, Kurigram, Thakurgaon, Rongpur, Bogra, Khulna, Narail, Bagerhat, Jessore, Magura, Faridpur, Madaripur, Barishal, Bhola, Patuakhali, Manikgonj, Munshigonj, Narashindi, Mymansingh, Kiashorgonj, Netrokona, Sylhet, Comilla, Laxmipur, Khagrachari.	
3a. NGOs working in Fourth Fisheries Project: BRAC, GMF, Proshika, TMSS, SSS, ESDO, SDO, Padakhep, Nabolok.	Already covered	Already covered (same areas and locations)	
4. CNRS a) in SEMP project (MOEF, funded by UNDP)	<ul> <li>Co-management</li> <li>Sanctuary establishment</li> <li>Time closure</li> <li>Effort control</li> </ul>	In <b>3</b> places of Sunamgonj & Moulvibazar districts.	
b) in CBFM -2 Project (see below)	See below	See below ( <b>6</b> districts: Sunamgonj, Tangail, Narail, Magura, Kishorgonj, Moulvibazar)	
c) in WRMP (Wetland Resource management Project) (NGO project funded by Ford Foundation)	<ul> <li>Habitat restoration</li> <li>Sanctuary maintenance</li> <li>Community based resource management</li> </ul>	<b>3</b> places in Tangail, Sunamgonj, Brahamanbaria.	
d) Coastal Fishermen	<ul> <li>Habitat restoration</li> </ul>	Different places in Cox's Bazar district.	

#### Indicator 6a: Extent to which best practices were adopted until 2003.

Organization	Practices	No. of occasions & places
Empowerment Project (DOF funded by UNDP)	• Fishing effort reduction	(1)
<ul> <li>5. DAMPARA Project (BWDB project funded by CIDA)</li> <li>6. CBFM-2 Project (Department of Fisheries, funded by DFID)</li> </ul>	<ul> <li>Sanctuary establishment</li> <li>Habitat restoration</li> <li>Co-management</li> <li>Sanctuary establishment</li> <li>Community organization</li> <li>Co-management</li> <li>Close-season followed</li> </ul>	Netrokona (1 Upazila about 39 sanctuaries small and larger) In 22 districts, 47 Upazilas, 78 jalmohals plus floodplains totalling over 100 waterbodies in Dinajpur, Rangpur, Gaibanda, Bogra, Naogaon,
	<ul> <li>Habitat restoration</li> <li>Restriction on harmful gears</li> <li>Re-introduction of endangered fish species</li> <li>Water pollution control</li> <li>AIGA</li> <li>Social awareness on aquatic resources</li> </ul>	Sirajgonj, Pabna, Magura, Narail, Jessore, Gopalgonj, Tangail, Mymensingh, Netrokona, Kishorgonj, B.Baria, Comilla, Sunamgonj, Gazipur, Faridpur, Moulvibazar.
6a. WorldFish Center (coordinates CBFM-2)	Already covered	Already covered
6b NGOs working in CBFM-2: Banchte Shekha, BRAC, Caritas, CNRS, Center for Rural & Environmental Development (CRED), Grassroot Health & Rural Organization for Nutrition Initiative (GHARONI), Proshika, Shiksha Shastha Unnayan Karzakram (SHISUK), Society Development Committee (SDC)	Already covered	Already covered
6c. TARA (research under CBFM-2)	<ul><li>Sanctuary establishment</li><li>Fish conservation</li></ul>	<b>3</b> places in Netrokona district: Kongsha, Someswari, Ubdakhali. (3 different types of sanctuaries being tested)
7. DFID (through Fourth Fisheries Project and CBFM-2)	Already covered	Already covered
8. DANIDA (through PBAEP)	Already covered	Already covered
9. World Bank (through Fourth Fisheries Project)	Already covered	Already covered

#### Indicator 6a: Extent to which best practices were adopted in 2004.

Organization P	Practices	No. of occasions & places
During the reporting period LGED sought and acted on MACH's advice. MACH was recomended in the PRSP as the approach to be used in future inland water/wetland management program. Also BMPs have been taken up on the Bangshi river west of our Kaliakoir site as well as in outlying areas to the west of our Sherpur site	<ul> <li>Sanctuary</li> <li>habitat restoration</li> <li>CBO formation</li> </ul>	3 occasions in 3 different locations (i.e. the Upazilas of Sunamgonj sadar, Biswamvarpur and Jamalgonj of Sunamgonj district

#### Indicator 6a: Extent to which best practices were adopted in 2005.

Organization	Practices	No. of occasions & places
1 MACH BMPs being used in 3 FFP	Sanctuary	<b>3</b> FFP sites started, 6 more in planning
sites. Agreements signed with DOF and	habitat restoration	process.
community organizations and activities	CBO strengthening	
(works) are underway.	6 6	
A further 6 sites agreed and started		
during 05-06. Continued to work with		
DoF on the inland fisheries strategy		
which incorporate MACH BMPs. Also		
planning alternate livelihood BMP for		
Jatka fishers in Chandpur.		

Indicator 6a: Extent to which best pra	ctices were adopted in 2006.

During 2006 BMPs of MACH have been extended in an additional 6 sites in NW region of Bangladesh under• Sanctuary habitat restoration • CBO strengthening6 FFP sites where MACH best management practices were adopted. Additionally MACH approaches and	Organization	Practices	No. of occasions & places
other DoF projects. A number of technical and social BMPs are being executed in all 9 sites of FFP.MACH institutional approachesbest practices adopted by the DoF and the MoFL through the ICF strategy, Road map, and action plan and program. The GoB has taken on the MACH into their strategy. (ICFS) which incorporates MACH BMPs and in particular the local govt. setup of MACH into their strategy. The ICFS has been approved by the MoFL. MACH has or will have had a country wide impact once the program being developed by the Department of Fisheries is put in place. MACH stated to provide technical and logistic support to develop a program for donor support of the implementation of the ICFS. MACH supported the DoFs ICF section in spreading the community based co- management approach of MACH. The DoF applying BMP for alternative income generation of Jatka fishers based on MACH approach directly as the approach to be followed in managing the Fisheries directly recommends MACH best practices and approachesHACH institutional approachesOther MachesFisheries at country wide implementation of the Department of Fisheries directly recommends MACH best practices and approachesImplementation all best practices and approaches	Organization During 2006 BMPs of MACH have been extended in an additional 6 sites in NW region of Bangladesh under other DoF projects. A number of technical and social BMPs are being executed in all 9 sites of FFP. MACH worked with DoF on the inland capture fisheries strategy (ICFS) which incorporates MACH BMPs and in particular the local govt. setup of MACH into their strategy. The ICFS has been approved by the MoFL. MACH has or will have had a country wide impact once the program being developed by the Department of Fisheries is put in place. MACH started to provide technical and logistic support to develop a program for donor support of the implementation of the ICFS. MACH supported the DoFs ICF section in spreading the community based co- management approach of MACH. The DoF applying BMP for alternative income generation of Jatka fishers based on MACH experience. The Government of Bangladesh in its Poverty Reduction Strategy Paper (PRSP) for the country has mentioned the MACH approach directly as the approach to be followed in managing the Fisheries of Bangladesh. ICF future program document of the Department of Fisheries directly recommends MACH best practices and approaches.	Practices         • Sanctuary         • habitat restoration         • CBO strengthening         • MACH institutional approaches	No. of occasions & places         6 FFP sites where MACH best         management practices were adopted.         Additionally MACH approaches and         best practices adopted by the DoF and         the MoFL through the ICF strategy,         Road map, and action plan and         program. The GoB has taken on the         MACH approach in their poverty         reduction strategy paper.

# **Strategic Objective 6**

**Indicator 6.b:** Maintaining or increasing production of natural resources (fish) in targeted area Increase in wetland and riparian trees

June 2007

Management of Aquatic Ecosystems through Community Husbandry (MACH)

Strategic Objective 6: Improved Management of Open Water and Tropical Forest Resources			
Indicator 6b: Increased production of natural resources in targeted areas (fish)			
A. Description	Cumulative U	Jnit of measu	re: fish Kg/ha
Precise Definition of Indicator: This indicator measures the increase in production			
of fish and other aquatic resources in target areas. Target areas are the Turag	Year	Planned	Actual
<b>Unit of Measure:</b> Kg/ha of fish. <b>Disaggragate by:</b> Project Site	Baseline		TB = 58 HH = 171
<b>Disaggi egate by.</b> 110 jett Site. <b>Justification/Managament Utility:</b> Fisheries and watland resources play a critical	1999-2000		
roll in Bangladesh's overall food security. Production is a direct indicator of		MACH-I	
improved management of open water resources.	2000-2001	TB=61 HH=174	TB=125 HH=205 KM=base=150
B. Plan for Data Collection by USAID		TD 71	TB=105
<b>Data Collection Method:</b> The grantee collects data every 10 days from the targeted	2001-2002	IB=/I	HH=191
areas throughout the year for the wetland component.		HH=184	KM=149
Method of Acquisition by USAID: Receipt of Semi Annual Reports from Winrock		TB=81	TB=140
<b>Data Source(s):</b> Semi annual and annual reports of the grantee.	2002-2003	HH=194	HH=287
and submits somionnual and annual reports to USAID		KM=160	KM=273
Estimated Cost of Collection: High but already factored into budget and integrated		MACH-I	[
into project management			TB=315
<b>Responsible Individual(s) at USAID:</b> Team Leader	2003-2004	195	HH=162
			KM=315
C. Data Quality Issues	2004 2005		TB=320
Date of Initial Data Quality Assessment: FY2002	2004-2005	200	HH=388
Known Data Limitations (if any): No reliable historical data on the resource as			KM=416
affected by varying hydrological regimes to compare the baseline. Results are not			TB=235
always attributable to USAID's assistance. Production varies in a given year based	2005-2006		HH=256
on the seasons and climatic/hydrologic variations.			KM=307
Actions Taken or Planned to Address Data Limitations:			
Use of control areas was tried but later abandoned due to problems matching with			
project sites and differences in hydrological variations; supervision and training of			
data collectors to ensure comparability.			
Date of Future Data Quality Assessments: Procedures of Future Data Quality Assessments:			
Trocedures of Future Data Quanty Assessments.			
D Plan for Data Analysis Reporting and Review			
<b>Data analysis:</b> Prepared and analyzed by SO Team			
Presentation of Data: Table			
<b>Review of Data:</b> Semi-annual mission portfolio review, and individual review with			
implementers			
Reporting Data: Internal mission report, R-4 report, CBJ			
E. Other Notes			
Notes on the Baselines/Targets:			
Location of Data Storage: P:\MissionShareable\EGFEpub\Environment\PMP			
<b>Comments:</b> fluctuations in catches affected by flood extent and timing			

*Note: This SO has two parts. For wetland and riparian tree the summary table and supporting text can be found immediately after page 41 of the fish section.* 

## Strategic Objective 6: Indicator 6b: Increased production of natural resources in targeted areas (fish)

Under this indicator the following are discussed:

- 1. The overall indicatorpage 2
- 2. The methods used pages 3-5
- 3. Fish catch and effort pages 5-11
- 4. Supporting tables pages 12-24
- 5. Fish consumption pages 25-41

In addition So6b for wetland and riparian tree has a separate section after page 41.

## Overview

There was no previous historical data set of sufficient quality and temporal magnitude to track trends in fish production in the MACH Project sites. It is therefore very difficult to accurately measure open water fish production impacts against a backdrop of non-existent historical trend data. The project having a short lifetime could not develop sufficient background trend data to understand the natural variations and complexities of the existing fishery fully. The catch data taken by the project is regarded as very reliable (in itself) but the variables that determine the catch naturally vary every year. The periodicity of and area of water coverage (extent) for example vary from year to year. These hydrologic and climatological changes cause variation in the catch normally. It is these "normal" fluctuations for which historical trend data is insufficient in Bangladesh. For the specific MACH sites there is also no historical record of area and extent of inundation from year to year. Therefore the results shown by the project data may not all be attributable to USAID's assistance. The project has attempted to use the 6-7 years of data that has been gathered to try to understand the gross trend in production for each of the areas taking into account the hydrology recorded by the project. One significant trend has been noted though through MACH I and MACH II. This has been that the catch/yield at all sites has been trending upwards and the evidence for this has been further strengthened by the fact that fish consumption around the sites has also increased.

One possible solution to understanding the background trend that the project looked at was to use another basin (other than the ones MACH works in) as a control. For this approach to be viable the other basin must be similar in nature to the one to be tested. The project looked for possible controls but was unable to find ones that did not have significantly different conditions. There were so many differences that the controls were unworkable and would have been misleading.

With the high degree of hydrological variability in the floodplain, this indicator should be used to look at gross trends only. The actual catch data has been in the ranges that would be expected and the differences found between sites in the Catch per Unit of Area seem very plausible. In general regional averages for yields per hectare in high quality active floodplains are in the range of 300 to 400 kg/ha. The Turag-Bangshi site being a highly degraded system had a low catch (58 kg/ha during the baseline year) and increased to 105-140 kg/ha in the first three project impact years. Yet yield in the Turag Bangshi site in the last three project years has averaged about 290 kg/ha which is comparable to the other sites even though it has the least dry season water followed by the Kangsha-Malijee site. Hail Haor has the greatest dry season water area of the three sites and had the highest baseline yield. However, the baseline yields of all three sites were well below that expected in reasonably healthy connected floodplains of the region.

The project throughout its life monitored catches intensively every 10 days. The yields have been evaluated and are discussed briefly below. As one can see from the data contained in the attached tables the fisheries of the three areas had declined and production was far reduced from what should have existed in a healthy floodplain. Just maintaining yields over the past five years from the baseline figures would have been an achievement. As can be seen in the following tables, with improved management including dry season sanctuary establishment, habitat restoration, and the adoption of sustainable fishing norms by the RMOs, MACH has seen not only maintenance of the baseline yields

but substantial increases which appear to be maintainable. In TB site yields in 2003-06 were five times the baseline, while in KM site yields in 2002-06 were double the yields of the initial two years, and in Hail Haor yields in 2004-06 were 88% higher than in the baseline. This is data is the product of recording many hundreds of actual fishing events over the past seven years in all types of habitat and with all types of gears. MACH also has anecdotal evidence from the many interviews which have reflected the patterns seen in the data.

## The monitoring methodology for fish catch

The baseline data collection year in Hail Haor was from April 1999 through March 2000, in Turag-Bangshi it was May 1999 through April 2000, and in Kangsha-Malijhee (Sherpur) site it was August 2000 to July 2001. Thereafter impact monitoring continued in all three sites. The following methodology and analysis procedure were followed.

## 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 area is high, as it is over most of the floodplains of Bangladesh. Fishing method and gear techniques vary considerably by different habitat locations. In order to portray a fish catch that represents the project area, the habitats were 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 zones of the area. Baseline conditions are used to measure parameter changes after appropriate interventions and implementation of fisheries management. The aim was to capture changes that were expected to be both local (in a specific habitat) and global (throughout the project site). Accordingly a number of locations and habitats were selected and have been monitored in the same way ever since.

## **Monitoring Site Selection**

The monitoring sites (Table 1) selected during the baseline study (following the wetland inventory and resource mapping exercise conducted by MACH) have continued to be monitored for the impact assessment. The same criterion as in the baseline has been followed. The sites monitored were not selected to focus on locations where impacts from management improvements introduced through MACH might be concentrated, but to represent the whole of the wetland system – for example in Hail Haor some of the areas monitored are in areas that have continued to be controlled by traditional leaseholders and are not directly managed by RMOs, but would be expected to be impacted to the extent that the whole haor is benefited by changes in management in a substantial part of it.

## **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 judgment of the fisheries biologist. Accordingly, attempts have been made to be consistent so that the most reliable 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 locations. 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 by all types of 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 days interval and accordingly data was collected three times a month from the selected locations. Gear of the same type with differing dimensions were standardized for some purposes in the analysis to 100 feet (30.8 m) (see MACH Baseline report on fisheries, vegetation, wildlife and protein consumption).

#### **Monitoring Parameters**

Fish catch assessment monitoring collects data on fishing intensity, species diversity, catch composition, fishers by category and fishing gear through a questionnaire. The data gathered on these parameters acts as a benchmark during the baseline and was then used to measure impacts. The terminology is defined as follows:

#### Fish catch:

- species by number and weight

#### 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

#### **Fishing rights:**

- the fisher's access to the fishing ground

#### **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. Fishing intensity, duration of fishing, total catch, catch by species, and the number of species with their abundance have been analyzed. Catch per Unit of Effort (CPUE) has been analyzed along with above mentioned parameters and has been used to determine the Catch per Unit Area (CPUA) which has been considered as the indicator of fish yield. 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-September), Post-Monsoon (October-December) and Dry (January-March).

**Fishing gear:** The types of fishing gear found in operation during monitoring were recorded with their dimensions. For current *jal* (nylon monofilament gill nets) and *ber jal* (seine nets) gear units of the same type but with differing dimensions were standardized to 100 feet (30.8 m) for use in some of the analysis for Catch per Unit of Effort (CPUE). An alternative standardization was also used - catch per person day - since this can be used to compare across fishing gear types.

Withing	monitoring	mannat	
locations	area (ha)		
Hail Haor Site			
Jethua Beel	67.95	Beel, canal,	
		floodplain	
Gopla River	41.23	River	
Boulashir floodplain	234.38	Floodplain	
Cheruadubi Beel	30.40	Beel	
62-Beel Complex	419.48.	Beel, floodplain	
Rustompur Beel	221.73	Beel, canal,	
Complex		floodplain	
Balla Beel	159.09	Beel, floodplain	
Total	1174.26		
Turag Bangshi Site			
Mokash Beel South	100	Beel	
Mokash Beel North	100	Floodplain	
Kalidaha Beel	50	Beel	
Mokash Khal	0.70	Canal	
Turag River	14	River	
Aowla Khal	1.02	Canal	
Aowla Beel	100	Beel	
Bangshi River	17	River	
Total	382.72		
KM site			
Baila Beel	44.10	Beel, floodplain	
Takimari Beel	34.75	Beel, floodplain	
Kewta Beel	33.07	Beel	
Nijla Beel	63.92	Beel, floodplain	
Bagadubi Khal	4.20	Khal	
Malijhi River	5.00	River	
(Baharalia kur)			
Aowra Bowra Beel*	69.33	Beel	
Bailasha Beel	13.35	Beel, floodplain	
Total	267.72		

 Table 1: Monitoring locations, habitats and areas

 Monitoring
 Habitat

\* Not under an RMO, treated as a control and excluded from main analysis

**Fishing intensity and duration of fishing:** Fishing intensity describes the amount of gear used during the monitored day. This has been calculated from an average of three sampling days per month. Gear numbers of all types were 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 (kg) per unit of gear per hour of operation, or alternatively the average catch in kg per fisher per day of fishing.

#### **Special considerations**

In this report there is some deviation between data already reported in earlier reports and the impacts shown in this report. This report is the final analysis of the data and incorporates:

- 1. A comparative analysis of baseline versus impact years using the common monitoring locations.
- 2. An estimation made based on the area fixed at the baseline period.
- 3. Output tables/data were further reviewed at the site and as well as at the RMO level. Outputs were finalized after considering the feedback from the sites.

#### MIS unit

The MIS unit analyses data and monitors fish production, bio-diversity, fish and other protein consumption and hydrology. The MIS unit provides monthly output tables for management and RMOs.

## Fish catch and effort trends

The indicator reported above is assumed to represent a sustainable restoration of wetland productivity in the form of fish catches standardized per unit area of wetland (using the maximum normal annual extent of connected inundation in a site). Either a continually rising trend or a shift in catch that is then sustained during the project is expected to confirm this. Unfortunately confidence intervals on catch per ha estimates cannot be calculated since the number of sampling spots is limited. Water level and other environmental factors also influence catches, for example impact year 5 in HH and TB included the 2004 monsoon which was a higher than average flood year. However, it is also important to understand the changes in fishing effort and how these interact with catch estimates. The project aimed to reduce fishing pressure, on the other hand when a fishery is restored more people may be attracted to fishing since more fish are available. Provided the CPUE and CPUA have increased it is likely that the fishery is both sustainable and more productive, even if effort has also increased.

The trends in total fishing effort have differed between the three sites, as represented in the monitoring data, probably in response to the availability of fish (Fig. 1). Thus in Hail Haor effort was declining, possibly in response to the livelihood program and fishing norms from the baseline up to 2003-04, with apparently some success in reducing current net use. In 2004-05 effort returned to the baseline level but the catch per unit effort that year was significantly higher than the baseline in this year of high water levels (as it had been in 2002-03)<sup>1</sup>. This means that effort increased in response to the increased population of fish due to high water levels. In 2005-06 effort fell back and was almost identical to 2003-04, hence overall in this site there appears to be some success in limiting fishing effort to sustainable levels.

<sup>&</sup>lt;sup>1</sup> CPUE as shown in the figures and significance tests here differs from the overall CPUE quoted elsewhere which are based on total sample catch divided by total sample effort. Here, in order to test for significant differences, each fishing unit is treated as an equivalent sample unit and is not weighted by its total catch.

Turag Bangshi fishing In effort in the monitored locations increased in each year after the baseline up to 2004-05. This might be thought a cause for concern. but this was a heavily degraded fishery up to the baseline, catch per unit effort has increased significantly in the same period (although the CPUE is much lower and the effort level much higher than in Hail Haor). Moreover, the greatest increase in effort was in 2004-05, again when water levels were high and CPUE reached its peak (Fig 3). In 2005-06 effort fell to just over the 2000-01 level, but a relatively high proportion of effort was through current nets in 2004-05, this is some cause for concern as the RMOs were supposed to encourage fishers to stop using this gear type.

There is no clear trend in Kangsha-Malijee site regarding effort yet. Even though catches (CPUA) have increased – effort increased up to 2002-03, and then fell in each year to 2005-06.Moreover there have not been significant changes in CPUE in aggregate in this site – although CPUE was higher in impact years 2, 3 and 4, it did not differ significantly from the baseline, and in impact year 5 (2005-06) returned to the baseline level. This contrasts with the other sites – in Turag-Bangshi CPUE









remained at a higher level in the last three impact years, and although it fluctuates in Hail Haor in the last two impact years it remained significantly higher than in the baseline.



Fig. 2 Seasonal pattern of fishing effort by gear type in MACH fishing monitoring sample areas

Fishing effort shows a strong seasonality generally peaking in the late monsoon and post monsoon periods (Fig. 2). However, in Hail Haor there is a relatively high level of fishing effort throughout the year, with current nets and long lines used in the monsoon and traps increasingly used in the post-monsoon to winter period. Fishing peaks are more pronounced in Turag-Bangshi site coinciding with the draw down of water from seasonally flooded areas, but secondary peaks of fishing in the dry season or pre-monsoon are likely to coincide with catching of fish moving into the area to breed with the rising water, or of fish trapped in depressions which are pumped out and for example caught by hand.



Fig. 3 Catch Per Unit Effort (kg/person/day) by site 1999-2006

Since on average catch per person day has risen, the increases in catch per hectare that were found from the surveys are believed to reflect a healthier and more productive wetland system, and should

be sustainable. Fluctuations in catch per hectare are associated with environmental variability. In Fig. 4 the difference in actual dates of the "impact years" of monitoring between the sites mean that the highest peaks for all three sites coincide with production associated with high water levels in 2004. Variations are associated with lower water levels, with high growth of aquatic plants such as water hyacinth which make fishing difficult, and in Turag-Bangshi possibly from water pollution, although a longer series of data would be needed there to determine if that is the case.



To understand better the fishing trends in these complex systems requires analysis by gear type. For example, in the Kangsha-Malijee site out of the main gears used the CPUE has increased significantly (t-tests p<0.05 comparing impact years 3-5 (2003-04 to 2005-06) with the first two years (2000-01 and 2001-02) for ber jal (seine nets), jhaki jal (cast nets), thela jal (push nets), hooks and traps, but did not change significantly for current jal and dharma jal (small lift/dip nets). Similarly in Hail Haor the CPUE for gears operated by individual poorer people – push nets and long lines – has been significantly higher in most of the impact years compared with the baseline. In Turag-Bangshi site there is a less clear cut pattern in the CPUE trend for separate gear types than for all fishing as a whole, but CPUE for cast nets has increased significantly. The supporting tables include data on the mean CPUE (kg/person day) for the main gears in each site along with statistical tests for significant differences between years.

However, even this is not the whole story since the gear characteristics for each type can also change over time, and the RMOs through project support have tried to influence fishers to end use of fine mesh nets (the supporting tables detail the characteristics of the gears sampled each year during the surveys). In Hail Haor large lift nets (veshal jal) appear to have become larger and have significantly smaller mesh size in later years compared with the baseline, and time operated per day for several gear types has fallen. In Turag-Bangshi there were few notable changes in gears although seine nets have become larger. In Kangsha-Malijee site seine nets have increased in length (not significant) over the six years and their mesh size increased significantly (from under 2 mm to about 5 mm) although it is still smaller than in Hail Haor. In the case of current jal both length and mesh size increased significantly (mesh size more than doubling from 17 to 40 mm), and for thela jal (push nets) mesh size has increased significantly (from under 2 mm to over 7 mm, see supporting tables).

Table 2 gives a breakdown of changes in CPUA (kg/ha) for each of the monitoring locations, revealing the differences between habitat types and the existence of "hot-spots" for fishing such as khals where fish are concentrated after the monsoon. However, for these smaller areas there is a lack of obvious links between presence of sanctuaries or RMOs and greater increases in productivity and fish catches. The impacts of improved management have been at the wetland scale rather than restricted to particular RMOs or water bodies within each site.

Site/location	Area (ha)	Management status	Baseline	Impact-1	Impact-2	Impact-3	Impact-4	Impact-5	Impact-6
Hail Haor (Sreemongal)		Status	171.1	205.0	190.8	287.3	161.8	388.6	256.0
Jhethua Beel	67.95	RMO, includes	121.6	190.6	160.1	154.9	102.5	230.7	197.1
		0.21 ha							
Conla Divor (Insida	41.22	sanctuary BMOs but no	202.7	165 7	400.0	722.7	522.5	1202.2	719.2
Hail Haor)	41.25	fishing norms	393.7	403.7	490.0	132.1	525.5	1203.2	/10.5
Boulashir	234.38	Paddy fields near	69.8	78.0	62.0	57.3	70.0	164.0	103.6
Floodplain		2 RMO areas							
Chiruadubi Beel	30.40	In between 2 RMOs	278.3	323.0	619.5	482.9	900.8	2174.8	1336.5
62-Beel Complex	419.48.	Outside RMOs, near permanent sanctuary	263.7	315.8	256.9	448.3	156.0	306.0	229.7
Rustompur Beel	221.73	RMO, includes	159.1	154.4	144.9	254.0	116.7	475.3	254.8
Complex		0.06 ha							
Dalla Daal	150.00	sanctuary PMO includes	25.6	96.9	122.6	151.9	165.9	2217	250.6
Dalla Deel	139.09	1 53 ha of	55.0	00.0	123.0	131.0	105.8	551.7	230.0
		sanctuaries							
				1				1	
Turag Bangshi (Kali	akoir)		57.8	124.7	104.8	140.1	315.2	320.7	204.0
Mokash Beel	100.00	Includes 2 ha	42.0	98.3	79.8	103.9	199.9	246.8	171.4
(South)	100.00	sanctuary	22.5	104.7	104.5	140.4	547.2	200.0	220.1
(North)	100.00	KMO no	33.5	104./	104.5	149.4	547.3	288.8	339.1
Kalidaha Beel	50.00	RMO no	62.4	141.0	69.3	169.2	243.9	292.9	
		sanctuary							
Mokash Khal/	0.70	RMO no	790.9	2381.0	1404.9	3696.4	3439.6	10816.0	4636.2
Turag River (River	14.00	Includes 3 64 ha	144 5	217.2	251.5	253.1	386.8	500.5	313.0
section)	14.00	sanctuary	177.5	217.2	231.3	233.1	500.0	500.5	515.0
Aowla Khal (Canal)	1.02	RMO no sanctuary	627.7	1485.3	858.1	1091.7	712.9	1412.4	2071.1
Aowla Beel	100.00	RMO, several	65.8	77.8	105.0	76.1	174.9	180.1	107.3
		nearby							
D 1'D'	17.00	sanctuaries	07.2	276.1	127.0	202.2	451.5	1205.9	205.1
(Biver section)	17.00		97.3	3/6.1	137.0	292.3	451.5	1205.8	385.1
Kongshow Malijhee	(Sherpur)		150.2	149.2	273.4	315.6	416.1	307.1	
Baila Beel	44.10	Includes 1.87 ha	134.3	144.2	333.7	248.4	303.3	224.5	
Takimari Beel	34.75	RMO, near to sanctuary	180.0	147.0	422.4	482.1	565.4	322.3	
Kewta Beel	33.07	Includes 0.89 ha sanctuary	250.8	186.6	369.7	185.9	488.4	188.1	
Nijla Beel	63.92	No sanctuary	104.3	174.8	156.0	308.7	237.9	230.2	
Bagadubi Khal (Canal)	4.20	No sanctuary	1305.5	847.3	2128.4	4785.6	2841.4	1620.3	
Bahar Ali Kur	5.00	RMO and 2.16	271.2	441.9	973.7	914.4	1999.3	766.5	
(Malijhi River)		ha sanctuary							
Aowra Bowra Beel	69.33	No RMO or management (control)	39.6	28.8	38.0	30.2	229.6	286.3	
Bailsha Beel	13.35	Includes 1.95 ha sanctuary	260.9	251.7	386.1	310.7	686.8	725.7	

Lastly Fig. 5 gives an overview of the monthly pattern of estimated fish production, prices and value of catches over the period monitored. It is estimated that in this period 15,000 mt of additional fish were caught in the three sites, with a value of about Tk 1,000 million.





SO 6.b

## **Supporting Tables**

<b>Crue (kg/gear/day) - Han Haor (Sreennongar)</b>										
Gear	Baseline	Impact-1	Impact-2	Impact-3	Impact-4	Impact-5	Impact-6			
Veshal/Khara jal	5.3	7.4	5.5	7.0	7.6	7.9	6.0			
Ber/Kathi Jal	6.9	11.8	7.5	9.5	12.1	21.0	11.0			
Thele/Afa Jal	2.2	2.7	3.3	2.9	2.9	3.3	2.9			
Current Jal	0.2	0.2	0.4	0.2	0.2	0.2	0.1			
Suta Jal	0.2	0.2	0.3	0.3	0.3	0.4	0.2			
Traps	0.1	0.1	0.1	0.2	0.1	0.3	0.3			
Longline	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Others	2.1	1.5	2.3	7.8	6.4	5.9	5.3			
Comparisons of Column Means	(A)	(B)	(C)	(D)	(E)	(F)	(G)			
Veshal/Khara jal						А				
Ber/Kathi Jal						ABDG				
Thele/Afa Jal			А			А				
Current Jal			EG							
Suta Jal						AEG				
Traps						ABCDE	ABE			
Longline										
Others				ABC						

## CPUE by gear type and site

## CPUF (kg/geor/dox) - Hoil Hoor (Sreemongel)

Results are based on two-sided t-tests assuming equal variances with significance level 0.05. For each significant pair, the key of the smaller category appears under the category with larger mean.

Tests are adjusted for all pair-wise comparisons within a row of each innermost sub-table using the Bonferroni correction.

CPUE (kg/gear/day) - Turag Bangsl	ni (Kaliakoir)	)	
Gear	Baseline	Impact-1	ĺ

Gear	Baseline	Impact-1	Impact-2	Impact-3	Impact-4	Impact-5	Impact-6
Veshal/Khara jal	0.8	2.2	0.5	1.2	3.2	14.9	2.3
Ber/Kathi Jal	1.8	3.9	2.4	3.9	5.4	6.4	4.1
Thele/Afa Jal	0.5	0.8	0.7	0.8	1.0	0.8	0.5
Current Jal	0.1	0.1	0.1	0.1	0.2	0.2	0.3
Moi/Dhore/Moshari Jal	1.2	1.9	0.9	1.0	1.0	1.3	1.0
Dharma Jal	1.4	0.8	0.6	0.7	1.1	1.4	1.8
Jhaki Jal	0.5	0.7	0.5	0.7	0.9	1.2	1.2
Traps	0.2	0.3	0.2	0.2	0.5	0.6	0.3
Longline	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Hooks	0.4	0.3	0.3	0.4	0.3	0.5	0.3
Others	1.2	7.6	3.8	2.6	2.5	2.9	2.7
<b>Comparisons of Column Means</b>	(A)	(B)	(C)	(D)	(E)	(F)	(G)
Veshal/Khara jal						ABCDEG	
Ber/Kathi Jal					AC	ABCDG	
Thele/Afa Jal				А	ABCG		
Current Jal					ABC	ABCD	ABCDEF
Moi/Dhore/Moshari Jal		CDE					
Dharma Jal						D	BCDE
Jhaki Jal					С	ABCDE	ABCDE
Traps							
Longline	BCDEFG						
Hooks						G	
Others		ADEFG					

Results are based on two-sided t-tests assuming equal variances with significance level 0.05. For each significant pair, the key of the smaller category appears under the category with larger mean.

Tests are adjusted for all pair-wise comparisons within a row of each innermost sub-table using the Bonferroni correction.

CPUE	(kg/gear/day)	- Kongshow	Maliihee	(Sherpur)
	(		in the second second	(Supper)

Gear	Baseline	Impact-1	Impact-2	Impact-3	Impact-4	Impact-5
Veshal/Khara jal	2.0	2.0	2.4	8.6	8.2	1.9
Ber/Kathi Jal	2.0	2.3	2.8	3.9	4.7	4.3
Thele/Afa Jal	0.7	0.5	0.9	0.9	0.9	0.9
Current Jal	0.0	0.0	0.3	0.0	0.0	0.0
Dharma Jal	1.5	0.6	1.8	8.3	2.1	1.3
Jhaki Jal	1.3	1.2	2.0	2.3	2.6	1.8
Traps	0.1	0.1	0.0	0.0	0.1	0.0
Hooks	0.3	0.2	0.3	0.3	0.3	0.2
Bana/Bara	1.8	0.3	1.7	0.6	0.7	0.7
Haat	0.4	0.4	1.0	0.5	0.6	0.6
Dewatering	13.3	21.4	3.7	10.0	2.8	4.3
Others	2.1	1.1	2.0	5.1	4.5	1.9
<b>Comparisons of Column Means</b>	(A)	(B)	(C)	(D)	(E)	(F)
Veshal/Khara jal						
Ber/Kathi Jal				AB	ABC	AB
Thele/Afa Jal			В	В	В	В
Current Jal						
Dharma Jal				В		
Jhaki Jal			AB	AB	ABCF	AB
Traps	CDF					
Hooks			В			
Bana/Bara						
Haat			ABDF			
Dewatering						
Others				ABCF	BF	

Results are based on two-sided t-tests assuming equal variances with significance level 0.05. For each significant pair, the key of the smaller category appears under the category with larger mean.

Tests are adjusted for all pair-wise comparisons within a row of each innermost sub-table using the Bonferroni correction.

CPUE (kg/person/day) -	Hail Haor	(Sreemongal)
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Gear	Baseline	Impact-1	Impact-2	Impact-3	Impact-4	Impact-5	Impact-6
Veshal/Khara jal	3.5	4.7	3.1	3.6	3.5	3.9	3.1
Ber/Kathi Jal	1.3	2.1	1.7	1.8	2.3	4.2	1.7
Thele/Afa Jal	1.3	1.7	2.1	2.2	2.0	2.2	2.0
Current Jal	2.4	2.1	3.8	3.0	2.0	2.6	1.6
Suta Jal	4.0	2.5	5.7	4.4	2.7	3.2	2.6
Traps	3.3	3.4	3.4	3.7	3.2	7.2	4.9
Longline	1.8	1.7	2.3	2.9	2.8	2.7	3.0
Others	1.2	1.5	2.7	4.3	3.7	2.8	2.9
<b>Comparisons of Column Means</b>	(A)	(B)	(C)	(D)	(E)	(F)	(G)
Veshal/Khara jal		CG					
Ber/Kathi Jal						ABDG	
Thele/Afa Jal			А	А	А	A	А
Current Jal			EG				
Suta Jal							
Traps						ABCDEG	Е
Longline			AB	ABC	AB	AB	ABC
Others				ABFG	AB		А

Results are based on two-sided t-tests assuming equal variances with significance level 0.05. For each significant pair, the key of the smaller category appears under the category with larger mean.

Tests are adjusted for all pair-wise comparisons within a row of each innermost sub-table using the Bonferroni correction.

CPUE (kg	z/person/day) -	Turag Bangshi	(Kaliakoir)
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Gear	Baseline	Impact-1	Impact-2	Impact-3	Impact-4	Impact-5	Impact-6
Veshal/Khara jal	0.6	1.7	0.5	1.0	3.1	12.0	2.1
Ber/Kathi Jal	0.4	0.6	0.4	0.6	0.8	0.9	0.5
Thele/Afa Jal	0.5	0.7	0.7	0.8	1.0	0.8	0.5
Current Jal	0.2	0.1	0.1	0.1	0.3	0.2	0.4
Moi/Dhore/Moshari Jal	0.8	1.8	1.0	1.2	1.2	1.1	1.0
Dharma Jal	2.1	0.8	0.6	0.7	1.1	1.3	1.8
Jhaki Jal	0.4	0.6	0.5	0.6	0.8	1.1	1.2
Traps	1.3	0.8	0.9	0.9	1.8	1.1	0.8
Longline	1.2	1.2	1.1	1.6	1.4	1.3	1.7
Hooks	0.4	0.3	0.4	0.4	0.4	0.5	0.3
Others	0.6	2.2	1.4	1.6	1.7	1.7	1.9
<b>Comparisons of Column Means</b>	(A)	(B)	(C)	(D)	(E)	(F)	(G)
Veshal/Khara jal						ABCDEG	
Ber/Kathi Jal					ACG	ACG	
Thele/Afa Jal				А	ABCG		
Current Jal					BCD	В	ABCDEF
Moi/Dhore/Moshari Jal		ACDEFG					
Dharma Jal	BCD					D	BCD
Jhaki Jal					AC	ABCDE	ABCDE
Traps					BCDFG		
Longline							С
Hooks						G	
Others		А					

Results are based on two-sided t-tests assuming equal variances with significance level 0.05. For each significant pair, the key of the smaller category appears under the category with larger mean.

Tests are adjusted for all pair-wise comparisons within a row of each innermost sub-table using the Bonferroni correction.

#### CPUE (kg/person/day) - Kongshow Malijhee (Sherpur)

Gear	Baseline	Impact-1	Impact-2	Impact-3	Impact-4	Impact-5
Veshal/Khara jal	0.9	1.6	1.8	6.3	5.8	1.9
Ber/Kathi Jal	0.4	0.5	0.6	0.8	1.0	0.8
Thele/Afa Jal	0.7	0.5	0.8	0.9	0.9	0.9
Current Jal	0.2	0.1	0.9	0.1	0.1	0.1
Dharma Jal	1.4	0.5	1.6	8.1	1.8	1.2
Jhaki Jal	1.0	0.9	1.5	1.7	1.6	1.2
Traps	0.9	1.1	1.1	1.0	1.2	1.0
Hooks	0.6	0.6	1.0	0.9	1.0	0.8
Bana/Bara	0.9	1.4	2.7	0.8	6.7	5.4
Haat	0.4	0.4	1.0	0.5	0.6	0.6
Dewatering	5.9	5.6	0.9	1.9	1.1	2.3
Others	0.9	0.5	0.9	1.7	1.9	1.0
<b>Comparisons of Column Means</b>	(A)	(B)	(C)	(D)	(E)	(F)
Veshal/Khara jal				AB	AB	
Ber/Kathi Jal				А	ABC	А
Thele/Afa Jal			В	В	В	В
Current Jal						
Dharma Jal				В		
Jhaki Jal			AB	ABF	ABF	В
Traps		AF	А		ADF	
Hooks			AB	AB	AB	В
Bana/Bara						
Haat			ABDF			
Dewatering						
Others				AB	ABCF	

Results are based on two-sided t-tests assuming equal variances with significance level 0.05. For each significant pair, the key of the smaller category appears under the category with larger mean.

Tests are adjusted for all pair-wise comparisons within a row of each innermost sub-table using the Bonferroni correction.

## **CPUA** by sampling location and season

## Sreemongol (Hail Haor)

## Baseline (April 1999 – March 2000)

		CPUA(Kg/ha)						
Location	Area(ha)	Pre-	Monsoon	Post-	Dry-Season	All-Season		
		Monsoon		Monsoon				
Jethua Beel	67.95	13.37	62.80	26.41	19.00	121.58		
Gopla River	41.23	59.53	97.52	146.50	90.12	393.67		
Boulashir Flood Plain	234.38	11.20	24.01	24.37	10.24	69.82		
Chiruadubi Beel	30.40	0.00	18.80	131.45	128.06	278.31		
62-Beel Complex	419.48	3.35	115.43	128.28	16.68	263.75		
Rustompur Beel Complex	221.73	0.00	58.18	100.90	0.00	159.09		
Balla Beel	159.09	2.59	17.56	14.87	0.58	35.60		
All Location	1174.26					171.08		

#### Impact Year – 1 (April 2000 – March 2001)

		CPUA(Kg/ha)					
Location	Area(ha)	Pre-	Monsoon	Post-	Dry-Season	All-Season	
		Monsoon		Monsoon			
Jethua Beel	67.95	16.45	31.64	12.15	130.31	190.55	
Gopla River	41.23	53.47	0.00	72.75	339.51	465.73	
Boulashir Flood Plain	234.38	12.27	25.11	19.57	21.06	78.01	
Chiruadubi Beel	30.40	54.93	18.02	87.64	162.37	322.97	
62-Beel Complex	419.48	12.19	136.05	71.25	96.31	315.80	
Rustompur Beel Complex	221.73	7.53	51.77	62.28	32.85	154.43	
Balla Beel	159.09	3.86	0.00	20.58	62.40	86.84	
All Location	1174.26					205.05	

#### Impact Year – 2 (April 2001 – March2002)

		CPUA(Kg/ha)						
Location	Area(ha)	Pre-	Monsoon	Post-	Dry-Season	All-Season		
		Monsoon		Monsoon				
Jethua Beel	67.95	1.13	18.78	46.24	93.95	160.08		
Gopla River	41.23	85.22	2.49	99.52	302.76	490.00		
Boulashir Flood Plain	234.38	29.36	11.26	12.14	9.27	62.03		
Chiruadubi Beel	30.40	106.35	96.89	97.59	318.67	619.49		
62-Beel Complex	419.48	13.28	40.57	72.63	130.40	256.89		
Rustompur Beel Complex	221.73	38.93	37.65	43.39	24.89	144.86		
Balla Beel	159.09	33.63	16.39	19.99	53.56	123.57		
All Location	1174.26					190.75		

#### Impact Year – 3 (April 2002 – March 2003)

		CPUA(Kg/ha)						
Location	Area(ha)	Pre-	Monsoon	Post-	Dry-Season	All-Season		
		Monsoon		Monsoon				
Jethua Beel	67.95	12.14	17.53	33.11	92.12	154.91		
Gopla River	41.23	0.00	0.00	169.20	563.52	732.72		
Boulashir Flood Plain	234.38	9.84	11.86	15.07	20.51	57.28		
Chiruadubi Beel	30.40	53.47	116.83	54.48	258.16	482.94		
62-Beel Complex	419.48	13.51	101.75	163.65	169.37	448.29		
Rustompur Beel Complex	221.73	19.12	45.63	109.31	79.91	253.96		
Balla Beel	159.09	24.17	27.52	51.90	48.17	151.76		
All Location	1174.26					287.28		

		CPUA(Kg/ha)					
Location	Area(ha)	Pre-	Monsoon	Post-	Dry-Season	All-Season	
		Monsoon		Monsoon			
Jethua Beel	67.95	5.42	19.96	22.11	54.98	102.47	
Gopla River	41.23	43.73	10.54	156.30	312.96	523.53	
Boulashir Flood Plain	234.38	14.88	15.96	4.43	34.71	69.99	
Chiruadubi Beel	30.40	118.29	103.34	184.82	494.32	900.77	
62-Beel Complex	419.48	15.62	12.26	57.83	70.26	155.98	
Rustompur Beel Complex	221.73	16.91	39.12	18.91	41.76	116.69	
Balla Beel	159.09	29.89	38.25	59.69	38.00	165.83	
All Location	1174.26					161.82	

## Impact Year – 4 (April 2003 – March 2004)

## Impact Year – 5 (April 2004 – March 2005)

		CPUA(Kg/ha)						
Location	Area(ha)	Pre-	Monsoon	Post-	Dry-Season	All-Season		
		Monsoon		Monsoon				
Jethua Beel	67.95	17.44	26.61	46.81	139.82	230.67		
Gopla River	41.23	103.47	84.66	133.14	881.90	1203.18		
Boulashir Flood Plain	234.38	32.38	39.79	25.92	65.89	163.97		
Chiruadubi Beel	30.40	197.26	174.70	343.77	1459.10	2174.84		
62-Beel Complex	419.48	43.03	89.25	74.85	98.87	306.01		
Rustompur Beel Complex	221.73	81.93	132.94	172.39	88.05	475.31		
Balla Beel	159.09	57.95	101.33	92.85	79.56	331.69		
All Location	1174.26					388.63		

## Impact Year – 6 (April 2005 – March 2006)

		CPUA(Kg/ha)						
Location	Area(ha)	Pre-	Monsoon	Post-	Dry-Season	All-Season		
		Monsoon		Monsoon				
Jethua Beel	67.95	8.13	25.55	16.52	146.90	197.09		
Gopla River	41.23	128.21	69.33	147.67	373.12	718.34		
Boulashir Flood Plain	234.38	21.90	20.71	27.52	33.50	103.63		
Chiruadubi Beel	30.40	94.94	122.84	451.14	667.60	1336.53		
62-Beel Complex	419.48	27.60	62.95	54.93	84.18	229.66		
Rustompur Beel Complex	221.73	15.70	36.08	114.42	88.55	254.75		
Balla Beel	159.09	21.98	31.77	147.58	49.27	250.60		
All Location	1174.26					256.01		

## CPUA by sampling location and season

## Kaliakoir(Turag-Bangshi)

#### Baseline (May 1999 – April 2000)

		CPUA(Kg/ha)						
Location	Area(ha)	Pre-	Monsoon	Post-	Dry-Season	All-Season		
		Monsoon		Monsoon				
Mokash Beel (South)	100.00	1.87	4.41	28.30	7.45	42.03		
Mokash Beel (North)	100.00	1.97	4.30	15.51	11.70	33.48		
Kalidaha Beel	50.00	8.55	10.06	30.31	13.48	62.40		
Mokash Khal	0.70	26.73	67.60	574.19	122.35	790.88		
Turag River	14.00	29.01	3.01	76.73	35.71	144.47		
Aowla Khal	1.02	0.00	92.93	534.75	0.00	627.68		
Aowla Beel	100.00	14.42	17.38	26.11	7.87	65.78		
Bongshi River	17.00	6.97	6.25	35.55	48.57	97.34		
All Location	382.72					57.80		

## Impact Year – 1 (May 2000 – April 2001)

	CPUA(Kg/ha)						
Location	Area(ha)	Pre-	Monsoon	Post-	Dry-Season	All-Season	
		Monsoon		Monsoon			
Mokash Beel (South)	100.00	8.42	8.39	66.18	15.25	98.25	
Mokash Beel (North)	100.00	7.26	12.88	70.09	14.46	104.68	
Kalidaha Beel	50.00	19.14	12.38	80.29	29.16	140.97	
Mokash Khal	0.70	133.25	212.30	1878.87	156.58	2380.99	
Turag River	14.00	12.88	5.50	153.14	45.72	217.23	
Aowla Khal	1.02	42.55	79.46	1363.29	0.00	1485.30	
Aowla Beel	100.00	16.85	8.38	42.10	10.51	77.84	
Bongshi River	17.00	44.15	22.58	272.21	37.18	376.12	
All Location	382.72					124.75	

#### Impact Year – 2 (May 2001 – April 2002)

		CPUA(Kg/ha)						
Location	Area(ha)	Pre-	Monsoon	Post-	Dry-Season	All-Season		
		Monsoon		Monsoon				
Mokash Beel (South)	100.00	4.81	34.05	35.29	5.64	79.80		
Mokash Beel (North)	100.00	9.15	46.62	42.34	6.35	104.46		
Kalidaha Beel	50.00	11.74	6.86	28.52	22.23	69.34		
Mokash Khal	0.70	222.43	320.53	588.81	273.18	1404.94		
Turag River	14.00	33.55	11.55	149.82	56.63	251.54		
Aowla Khal	1.02	129.81	123.37	601.75	3.14	858.07		
Aowla Beel	100.00	6.17	42.30	46.73	9.75	104.96		
Bongshi River	17.00	42.38	17.86	48.37	28.43	137.04		
All Location	382.72					104.78		

#### Impact Year – 3 (May 2002 – April 2003)

		CPUA(Kg/ha)						
Location	Area(ha)	Pre-	Monsoon	Post-	Dry-Season	All-Season		
		Monsoon		Monsoon				
Mokash Beel (South)	100.00	4.82	12.81	81.68	4.55	103.86		
Mokash Beel (North)	100.00	9.45	24.71	99.74	15.52	149.42		
Kalidaha Beel	50.00	44.03	48.12	40.37	36.65	169.17		
Mokash Khal	0.70	386.83	777.57	2237.56	294.46	3696.42		
Turag River	14.00	34.35	17.79	111.52	89.42	253.07		
Aowla Khal	1.02	74.92	281.31	644.42	91.09	1091.74		
Aowla Beel	100.00	7.17	29.74	27.53	11.68	76.12		
Bongshi River	17.00	29.71	54.84	142.39	65.34	292.27		
All Location	382.72					140.08		

## Impact Year - 4 (May 2003 - April 2004)

		CPUA(Kg/ha)						
Location	Area(ha)	Pre-	Monsoon	Post-	Dry-Season	All-Season		
		Monsoon		Monsoon				
Mokash Beel (South)	100.00	13.68	44.24	134.36	7.58	199.86		
Mokash Beel (North)	100.00	12.35	302.98	204.93	27.00	547.26		
Kalidaha Beel	50.00	40.94	44.16	115.75	43.05	243.90		
Mokash Khal	0.70	741.16	557.25	1639.03	502.17	3439.61		
Turag River	14.00	42.80	23.64	162.15	158.26	386.84		
Aowla Khal	1.02	59.08	86.13	567.70	0.00	712.91		
Aowla Beel	100.00	8.84	73.13	72.20	20.78	174.94		
Bongshi River	17.00	67.85	61.10	205.61	116.98	451.55		
All Location	382.72					315.19		

#### Impact Year - 5 (May 2004 - April 2005)

		CPUA(Kg/ha)						
Location	Area(ha)	Pre-	Monsoon	Post-	Dry-Season	All-Season		
		Monsoon		Monsoon				
Mokash Beel (South)	100.00	11.25	93.64	137.27	4.65	246.80		
Mokash Beel (North)	100.00	8.45	112.47	157.19	10.64	288.75		
Kalidaha Beel	50.00	29.08	107.37	141.51	14.96	292.91		
Mokash Khal	0.70	547.69	1813.35	7875.07	579.93	10816.05		
Turag River	14.00	70.45	81.69	231.40	116.98	500.51		
Aowla Khal	1.02	77.10	581.19	754.09	0.00	1412.38		
Aowla Beel	100.00	13.58	77.12	72.64	16.78	180.13		
Bongshi River	17.00	65.38	688.13	234.11	218.18	1205.81		
All Location	382.72					320.68		

#### Impact Year - 6 (May 2005 - April 2006)

		CPUA(Kg/ha)							
Location	Area(ha)	Pre-	Monsoon	Post-	Dry-Season	All-Season			
		Monsoon		Monsoon					
Mokash Beel (South)	100.00	11.98	70.79	80.37	8.30	171.44			
Mokash Beel (North)	100.00	116.57	91.69	116.04	14.84	339.14			
Mokash Khal	0.70	1065.95	896.54	2101.55	572.14	4636.19			
Turag River	14.00	61.73	56.41	113.65	81.17	312.96			
Aowla Khal	1.02	81.43	470.40	1519.30	0.00	2071.14			
Aowla Beel	100.00	11.35	36.20	44.26	15.50	107.31			
Bongshi River	17.00	74.51	77.57	149.92	83.09	385.09			
All Location	332.72					234.66			

## **CPUA** by sampling location and season

## Sherpur(Kongshow Malijhee)

#### Baseline (August 2000 – July 2001)

	ha)					
Location	Area(ha)	Pre-	Monsoon	Post-	Dry-Season	All-Season
		Monsoon		Monsoon		
Baila Beel	44.10	27.94	39.94	48.77	17.62	134.27
Takimari Beel	34.75	17.49	38.62	76.20	47.67	179.98
Kewta Beel	33.07	12.86	68.26	110.46	59.18	250.77
Nijla Beel	63.92	12.51	35.27	48.17	8.38	104.33
Bagadubi Khal	4.20	75.00	790.73	377.66	62.15	1305.54
Bahar Ali Kur(Malijhee River)	5.00	20.68	19.92	14.21	216.36	271.17
Aowra Bowra Beel	69.33	30.84	8.71	0.00	0.00	39.55
Bailsha Beel	13.35	55.70	21.67	71.02	112.49	260.88
All Location	267.72					150.16

#### Impact Year – 1 (August 2001 – July 2002)

		CPUA(Kg/ha)						
Location	Area(ha)	Pre-	Monsoon	Post-	Dry-Season	All-Season		
		Monsoon		Monsoon				
Baila Beel	44.10	20.89	43.19	43.25	28.90	144.23		
Takimari Beel	34.75	17.72	46.96	38.78	43.49	146.96		
Kewta Beel	33.07	42.10	71.69	29.76	43.05	189.60		
Nijla Beel	63.92	47.57	34.10	46.41	46.70	174.78		
Bagadubi Khal	4.20	105.32	325.30	277.50	139.15	847.28		
Bahar Ali Kur(Malijhee River)	5.00	65.28	106.21	221.69	48.75	441.92		
Aowra Bowra Beel	69.33	18.56	10.21	0.00	0.00	28.76		
Bailsha Beel	13.35	76.44	52.69	72.48	50.04	251.66		
All Location	267.72					149.16		

## Impact Year – 2 (August 2002 – July 2003)

CPUA(Kg/ha)							
Location	Area(ha)	Pre-	Monsoon	Post-	Dry-Season	All-Season	
		Monsoon		Monsoon			
Baila Beel	44.10	104.27	84.56	68.44	76.04	333.71	
Takimari Beel	34.75	99.31	127.87	72.22	122.92	422.37	
Kewta Beel	33.07	79.68	91.47	80.47	118.05	369.66	
Nijla Beel	63.92	22.49	49.37	50.74	33.36	155.95	
Bagadubi Khal	4.20	304.42	1270.89	279.97	273.17	2128.45	
Bahar Ali Kur(Malijhee River)	5.00	127.26	374.16	169.30	303.02	973.73	
Aowra Bowra Beel	69.33	24.86	13.15	0.00	0.00	38.01	
Bailsha Beel	13.35	134.31	81.55	75.05	95.22	386.13	
All Location	267.72					273.37	

#### Impact Year – 3 (August 2003 – July 2004)

			CPUA(Kg/ha)						
Location	Area(ha)	Pre-	Monsoon	Post-	Dry-Season	All-Season			
		Monsoon		Monsoon					
Baila Beel	44.10	32.41	90.72	79.64	45.61	248.38			
Takimari Beel	34.75	44.98	227.91	136.41	72.81	482.10			
Kewta Beel	33.07	45.29	54.01	48.09	38.48	185.87			
Nijla Beel	63.92	13.43	108.31	125.83	61.10	308.67			
Bagadubi Khal	4.20	192.97	3858.31	623.07	111.28	4785.63			
Bahar Ali Kur(Malijhee River)	5.00	35.24	647.70	129.61	101.84	914.39			
Aowra Bowra Beel	69.33	20.25	9.95	0.00	0.00	30.21			
Bailsha Beel	13.35	56.98	6.20	143.73	103.77	310.68			
All Location	267.72					315.62			

## Impact Year - 4 (August 2004 - July 2005)

				CPUA(Kg/	ha)					
Location	Area(ha)	Pre-	Monsoon	Post-	Dry-Season	All-Season				
		Monsoon		Monsoon						
Baila Beel	44.10	43.91	99.34	117.48	42.54	303.28				
Takimari Beel	34.75	17.61	243.18	218.69	85.88	565.36				
Kewta Beel	33.07	47.16	96.81	229.98	114.48	488.42				
Nijla Beel	63.92	16.65	69.37	101.06	50.86	237.94				
Bagadubi Khal	4.20	70.53	1419.66	1119.93	231.23	2841.36				
Bahar Ali Kur(Malijhee River)	5.00	104.09	428.29	1352.30	114.64	1999.32				
Aowra Bowra Beel	69.33	159.19	70.44	0.00	0.00	229.63				
Bailsha Beel	13.35	82.07	351.23	207.67	45.78	686.75				
All Location	267.72					416.107				

## Impact Year – 5 (August 2005 – July 2006)

				CPUA(Kg/	ha)					
Location	Area(ha)	Pre-	Monsoon	Post-	Dry-Season	All-Season				
		Monsoon		Monsoon						
Baila Beel	44.10	42.54	98.03	46.64	37.34	224.55				
Takimari Beel	34.75	55.09	160.50	79.09	27.61	322.29				
Kewta Beel	33.07	10.45	70.19	81.74	25.72	188.09				
Nijla Beel	63.92	8.24	78.98	112.33	30.69	230.24				
Bagadubi Khal	4.20	78.47	909.45	531.65	100.75	1620.33				
Bahar Ali Kur(Malijhee River)	5.00	53.82	412.66	241.90	58.14	766.52				
Aowra Bowra Beel	69.33	128.21	158.08	0.00	0.00	286.29				
Bailsha Beel	13.35	105.77	234.40	293.04	92.45	725.66				
All Location	267.72					307.09				

## Fish catch per Unit of Area in three (MACH sites) in Kilograms per hectare per year

Site		Cumulative increase						
	Baseline	Imp-1	Imp-2	Imp-3	Imp-4	Imp-5	Imp-6	over Baseline (kg/ha)
Turog-Bangshi	58	125	105	140	315	321	235	893
Hail Haor	171	205	191	287	162	389	256	464
Kangsha Malijhee	150	149	273	316	416	307	-	711

## Estimated value of incremental catch from MACH sites during monitoring period

Site	Cumulative fish yield increase over baseline kg/ha	Area of wetland where yield change was assessed (ha of wetland)	Estimated increase in total yield from the wetland post baseline (kg)	Estimated increase in value of fish Tk mill (Tk 64.88 per kg, 2006 price)	
Turag Bangshi	893	4,374	3,905,982	253.4	
Hail Haor	464	12,490	5,795,360	376.0	
Kangsha-Malijhee	711	8,210	5,837,310	378.7	
Total		25,074	15,538,652	1,008.1	

## Gear Characteristics in Hail Haor

Gear type		Baseline	Impact-1	Impact-2	Impact-3	Impact-4	Impact-5	Impact-6
Veshal/Khara	No.	100	67	62	73	54	57	76
jal	Length (m)	8.66	9.15	10.52	12.59	11.86	11.11	13.94
	Width (m)	8.47	10.07	10.91	10.63	10.75	11.03	11.02
	Mesh size (mm)	14.37	13.46	10.32	8.05	7.72	7.30	8.28
	No. of fisher	1.63	1.94	4.57	2.59	1.94		2.04
	Total fishing time (hrs/day)	16.20	16.28	13.27	14.29	12.49	11.76	13.00
Ber/Kathi Jal	No.	69	110	17	77	28	84	38
	Length (m)	51.31	68.87	63.20	72.94	92.66	75.85	61.18
	Width (m)	5.53	6.54	6.37	6.61	6.71	6.20	6.18
	Mesh size (mm)	9.30	9.69	9.00	8.78	8.64	6.42	7.87
	No. of fisher	5.35	10.36	12.16	11.42	5.30	-	6.58
	Total fishing time (hrs/day)	9.61	5.16	6.16	9.31	6.68	5.74	7.45
Thele/Afa Jal	No.	244	104	144	114	153	108	160
	Length (m)	1.69	5.65	5.06	4.48	2.12	2.06	3.23
	Width (m)	1.30	1.59	3.97	1.79	2.54	1.61	1.65
	Mesh size (mm)	7.02	8.42	7.58	8.31	6.85	5.85	6.20
	No. of fisher	1.66	2.27	3.04	2.00	1.81		1.52
	Total fishing time (hrs/day)	6.60	5.36	5.78	5.77	4.97	4.07	4.89
Current Jal	No.	376	293	315	471	511	651	503
	Length (m)	33.14	39.62	39.87	38.47	50.51	47.60	43.11
	Width (m)	1.13	1.36	1.60	1.40	1.41	1.75	1.75
	Mesh size (mm)	32.71	33.69	33.69	29.87	33.83	49.83	46.65
	No. of fisher	1.30	2.14	3.08	2.06	1.32		1.17
	Total fishing time (hrs/day)	10.79	11.54	10.84	11.33	10.82	11.44	12.46
Suta Jal	No.	94	17	65	85	102	69	124
	Length (m)	42.27	42.36	31.61	35.42	37.77	38.23	38.66
	Width (m)	1.36	1.59	1.21	3.35	1.10	1.64	1.42
	Mesh size (mm)	41.18	46.18	28.17	52.38	30.74	63.38	47.41
	No. of fisher	1.98	2.69	4.23	2.13	1.26		1.53
	Total fishing time (hrs/day)	13.44	17.95	11.10	14.00	11.80	13.73	14.86

## Gear Characteristics in Turag-Bangshi

Gear type		Baseline	Impact-1	Impact-2	Impact-3	Impact-4	Impact-5	Impact-6
Veshal/Khara jal	No.	10	17	6	19	28	31	36
	Length (m)	13.21	21.11	11.20	14.00	26.08	14.79	14.55
	Width (m)	10.70	10.06	8.50	11.02	11.17	11.56	11.57
	Mesh size (mm)	12.80	33.84	11.00	29.20	15.89	23.11	29.47
	No. of fisher	1.20	1.29	1.00	1.32	1.00		1.14
	Total fishing time (hrs/day)	4.80	5.28	3.00	5.86	4.16	5.36	4.49
Ber/Kathi Jal	No.	51	84	92	81	116	106	89
	Length (m)	126.93	184.73	186.71	194.59	207.24	208.20	213.70
	Width (m)	6.19	7.79	7.68	8.10	7.97	8.07	8.11
	Mesh size (mm)	6.75	5.14	6.57	5.23	5.94	5.54	5.25
	No. of fisher	5.04	6.25	6.52	6.64	8.08		7.84
	Total fishing time (hrs/day)	5.67	4.18	3.70	3.32	4.44	4.05	4.03
Thele/Afa Jal	No.	150	234	181	143	200	110	57
	Length (m)	1.83	2.00	2.04	2.13	2.10	2.14	2.57
	Width (m)	1.44	1.60	1.63	1.70	1.63	1.53	1.38
	Mesh size (mm)	4.47	5.50	5.65	5.42	5.07	5.02	5.02
	No. of fisher	1.19	1.17	1.08	1.08	1.22		1.09
	Total fishing time (hrs/day)	2.60	2.18	2.41	2.47	2.31	2.16	1.35
Current Jal	No.	341	614	400	490	487	660	501
	Length (m)	285.59	368.44	437.67	324.16	279.26	258.30	249.62
	Width (m)	1.06	1.13	1.42	1.23	1.15	1.18	1.20
	Mesh size (mm)	34.09	41.47	34.91	43.53	43.83	51.81	41.81
	No. of fisher	1.09	1.05	1.03	1.03	1.01		1.05
	Total fishing time (hrs/day)	5.48	4.55	6.93	6.11	6.47	5.52	4.95
Moi/Dhore/Mosh	No.	108	105	83	79	90	70	53
ari Jal	Length (m)	8.53	7.30	4.60	8.25	4.77	3.87	3.92
	Width (m)	1.82	2.56	1.79	3.30	2.29	1.89	1.95
	Mesh size (mm)	9.97	10.84	10.22	12.87	11.68	10.56	9.38
	No. of fisher	1.83	1.57	1.63	1.65	1.59		1.34
	Total fishing time (hrs/day)	4.55	3.97	4.08	5.14	4.88	3.88	3.38
Dharma Jal	No.	23	49	37	95	98	155	66
	Length (m)	5.46	6.89	6.60	7.11	6.38	6.58	6.76
	Width (m)	5.44	6.99	6.54	7.12	6.38	6.61	6.76
	Mesh size (mm)	15.65	18.63	17.89	21.16	19.07	19.20	18.23
	No. of fisher	1.70	1.00	1.00	1.01	1.00		1.00
	Total fishing time (hrs/day)	5.43	3.54	3.85	3.86	4.02	3.62	3.89
Jhaki Jal	No.	197	370	396	445	452	641	592
	Length (m)	3.72	3.83	4.00	4.02	4.01	3.97	3.98
	Diameter (m)	5.98	6.50	7.26	6.05	5.98	5.81	5.94
	Mesh size (mm)	11.59	12.30	12.57	12.70	12.16	12.62	14.08
	No. of fisher	1.22	1.08	1.03	1.04	1.01		1.03
	Total fishing time (hrs/day)	3.23	2.41	2.08	2.30	2.32	2.18	2.25
Gear types		Baseline	Impact-1	Impact-2	Impact-3	Impact-4	Impact-5	
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Veshal/ Khara	No.	23	25	16	21	23	12	
jal	Length (m)	42.82	8.85	12.09	9.67	10.14	24.38	
	Width (m)	7.02	7.91	8.29	8.32	8.21	7.56	
	Mesh size (mm)	3.35	1.72	3.13	6.19	7.39	6.75	
	No. of fisher	2.09	1.44	1.38	1.00	1.13	1.00	
	Total fishing time (hrs/day)	10.67	9.30	9.34	13.50	11.52	8.54	
Ber/Kathi Jal	No.	94	153	103	50	63	53	
	Length (m)	75.22	94.37	132.94	126.83	101.31	127.13	
	Width (m)	5.57	5.32	5.14	4.87	4.69	4.46	
	Mesh size (mm)	1.75	1.81	3.26	6.27	5.48	5.00	
	No. of fisher	5.34	5.17	5.63	6.00	5.02	5.34	
	Total fishing time (hrs/day)	5.66	4.44	5.84	5.81	4.92	4.88	
Thele/Afa Jal	No.	435	681	837	651	434	373	
	Length (m)	1.62	2.12	1.85	1.85	1.76	1.75	
	Width (m)	1.44	1.59	1.60	1.58	1.43	1.41	
	Mesh size (mm)	1.86	1.93	4.14	6.78	7.03	7.91	
	No. of fisher	1.03	1.02	1.02	1.00	1.01	1.03	
	Total fishing time (hrs/day)	3.90	2.94	3.02	3.31	3.28	2.92	
Current Jal	No.	249	653	632	382	556	522	
	Length (m)	307.90	412.07	484.42	572.51	574.81	590.64	
	Width (m)	0.94	1.13	0.88	0.90	1.45	0.89	
	Mesh size (mm)	17.53	21.88	35.56	42.09	39.99	40.99	
	No. of fisher	1.14	1.21	1.22	1.30	1.09	1.13	
	Total fishing time (hrs/day)	8.95	9.16	10.65	11.85	11.31	10.64	
Dharma Jal	No.	73	189	181	84	177	115	
	Length (m)	8.65	9.29	9.51	7.85	8.39	7.20	
	Width (m)	8.60	9.31	9.24	7.84	8.39	7.23	
	Mesh size (mm)	12.66	4.54	6.35	13.70	20.10	26.33	
	No. of fisher	1.14	1.13	1.25	1.04	1.10	1.17	
	Total fishing time (hrs/day)	9.29	10.14	10.66	12.72	11.71	11.92	

# Gear Characteristics in Kangsha-Malijhee

# Impacts of fish production trends on fish consumption and household livelihoods

# Introduction

It was expected that due to MACH interventions, there would be qualitative and quantitative changes in wetland productivity and biodiversity. These changes were expected to consequently impact on the fish consumption amounts and pattern of households living around the wetlands. To assess if this was the case selected households from selected villages located within the impact area of the project intervention were monitored for their fish consumption on a regular basis in all the three sites throughout the project period.

# Sample Households

Fish consumption data have been collected each year from between 455 and 490 households from 14 villages in the Hail Haor site, from 280 households from 8 villages in Turag-Bangshi site every year, and from 280 households from 7 villages in Kangsha-Malijhee site except in the baseline year when 289 households were covered. From each sample village, 35 sample households were selected in Hail Haor and Turag-Bangshi sites, and 40 households were selected in Sherpur site. The design was intended to cover the social classes present, this was on the basis of landholding size (landless, marginal farmers, small, medium and large farmers) and they were sampled in proportion to their presence in the villages so most of the households are functionally landless or marginal farmers.

Household fish consumption monitoring started at Hail Haor site from September 1999, in Turag-Bangshi from October 1999 and from January 2001 in Kangsha-Malijhee site (Table 1).

Site	Land-holding	Baseline	Impact-1	Impact-2	Impact-3	Impact-4	Impact-5	Impact-6
Hail Haor	Period	(Sep 99	(May 00	(May 01	(May 02	(May 03	(May 04	(May 05
(Sreemongal)		- Apr	- Apr	- Apr 02	- Apr	- Apr	- Apr	- Apr
		00)	01)		03)	04)	05)	06)
	Landless	295	300	295	291	291	291	295
	Marginal	92	94	92	84	84	84	84
	Small	48	49	48	42	42	42	42
	Medium	36	36	36	28	28	28	28
	Large	19	19	19	10	10	10	10
	Total	490	498	490	455	455	455	459
Turag Bangshi	Period	(Oct 99	(May 00	(May 01	(May 02	(May 03	(May 04	(May 05
(Kaliakoir)		- Apr	- Apr	- Apr 02	- Apr	- Apr	- Apr	- Apr
		00)	01)		03)	04)	05)	06)
	Landless	159	160	159	159	159	159	159
	Marginal	68	69	68	68	68	68	68
	Small	22	22	22	22	22	22	22
	Medium	23	23	23	23	23	23	23
	Large	8	8	8	8	8	8	8
	Total	280	282	280	280	280	280	280
Kangsha-Malijhee	Period	(Jan 01	(Jan 02	(Jan 03	(Jan 04	(Jan 05	(Jan 06	
(Sherpur)		- Dec						
		01)	02)	03)	04)	05)	06)	
	Landless	174	169	169	169	169		
	Marginal	65	62	62	62	62		
	Small	20	20	20	20	20		
	Medium	19	18	18	18	18		
	Large	11	11	11	11	11		
	Total	289	280	280	280	280		

Table 1 Sample sizes and year definition for consumption survey

# **Sampling protocol**

Data was collected at three-day intervals from the sample households using fixed recording formats. The fish that each household planned to eat that day were weighed before cooking by species as far as possible. The households were also asked about their own fishing activities in the previous day and this along with the reported catch were recorded based on recall. In Hail Haor any collection of non-fish aquatic resources was also reported based on the respondents recall and was recorded.

Local trained women were recruited and assigned as Resident Monitors (RMs) to collect the data from the sample households. The field staff of CNRS-MACH supervised and assisted the RMs in data collection, they also checked the data forms and resolved problems and inconsistencies. Later at the site level office, RM activities were discussed and data forms are reviewed, coded and edited by the concerned Field Officers. The forms were then sent to MACH head office for computer processing.

# **Monitoring Parameters**

To compare the changes of fish consumption in terms of quantity and species diversity in the baseline period with the impact years, following parameters were considered:

- Per capita fish consumption by months,
- Per capita fish consumption by land classes,
- Sources of fish consumed
- Species composition of fish consumed,
- Ranking of species by quantity consumed, and
- Other aquatic resources used by the households

# Results

# Fishing

The household monitoring confirms for this sample of households similar seasonality in fishing effort and catches to those found in the catch monitoring in specific parts of the wetlands, there is also a close correlation between effort and catches at the household level (Fig. 1). In the Turag Bangshi site typically households catch about one kilogram of fish per day of fishing, increasing slightly over the project period, while their effort in the peak late monsoon months was higher and for longer in 2004 when inundation was more extensive and prolonged. By comparison in Hail Haor effort levels have changed little between years for this panel of households and are slightly higher than in Kaliakoir, but catches are much higher – in the order of 2-4 kg/household/day depending on the season and year. Given that catch per hectare has risen in Turag-Bangshi during the same period to close to the Hail Haor level, the implication is that households who were not in the villages covered by the monitoring program have started to fish in the floodplain system since MACH started and productivity was restored. By comparison effort levels in the Kangsha-Malijhee site are lower, and catches are low regularly being under a kilogram per household per day.

# Fish consumption

Seasonality in fish consumption is closely associated with the availability of fish and with the household's own catches, peaking in the monsoon and post-monsoon period. In all three sites the highest quantity of fish was consumed in the post monsoon months (October to December), that is the period when fish catch and availability are at their highest. The lowest per capita consumption was in April, the driest month of the year. The monthly variation of fish consumption largely depends on the availability of fish and the purchasing capacity of the people.



Fig. 1 Seasonal patterns of fishing effort and catch reported in household monitoring in three sites.



Fig. 2 Monthly pattern of fish consumption (g/person/day) by site

As shown in the figures, overall fish consumption increased significantly in all sites compared with the baseline data. Major findings indicate that small beel and wetland resident fish and prawns constitute the main fish consumed for all households and particularly for poorer households. The vast majority (55-75%) of fish consumed in these sites and throughout the country is purchased in local markets. This is consistent with studies by Helen Keller International which indicate that over 50% of all fish consumed in rural Bangladesh are purchased.

**Hail Haor**: Per capita fish consumption for all social classes increased significantly from 47 g/day in the baseline period to an average of 58 g/day in impact years 3-6. The highest increase, 36%, in fish consumption occurred among marginal farmers followed by 25% and 22% for medium farmers and landless households respectively. Per capita fish consumption of large farmers did not differ significantly: 52 g/day in impact years 3-6 compared to 56 g/day in the baseline year (Fig. 3a). Fish consumption has fluctuated with fish catches, but on average the improved habitats and management practices are expected to sustain higher supplies of fish, and greater access of poor fishers to fishing grounds through the RMOs and the increasing incomes of the poor through alternative income generating activities such as those provided through the FRUGs are expected to continue to raise

household incomes thus maintaining and increasing demand for fish among the poorer households, so these trends are expected to continue.

**Turag Bangshi:** In Turag-Bangshi all landholding categories had similar levels of fish consumption before the project and all now eat more fish, all have experienced statistically significantly increases (except that the sample of large farmers is small). Combining all social classes, per capita fish consumption significantly increased from 29 g/day at baseline to 43 g/day in impact years 3-6, and increase of 49%. Here all landholding classes gained between 43% and 75% more fish consumption and large farmers more than doubled their fish consumption, followed by 76% and 67% for small and medium farmers respectively.

**Kangsha-Malijhee:** Households in Kangsha-Malijhee had the lowest fish consumption levels of the three sites initially averaging only 23 g/person/day, and this remains the case, but by just the fourth impact year average fish consumption had increased by 50% to 36 g/person/day, and most landholding categories have made similar gains. Even after one year of project activities consumption increased significantly compared with 2-3 years in the other sites. Per capita fish consumption of landless households increased by 44% and for medium and large farm households by 73% and 59% respectively. Only small farmers failed to show significant increases in their fish consumption.

Thus the nutritional benefits from improvements in wetland management and restored productivity have been well distributed across poorer and better off households. Considering the numerical dominance of poorer households in all of these areas, this means that the majority of the increased volume of fish consumed has fed poorer households. However, as will be seen the extra fish eaten are not necessarily the fish caught in these wetlands.

#### Fig. 3a Fish consumption (g/person/day) in Hail Haor

### Hail Haor (Sreemongal)



#### Fig. 3b Fish consumption (g/person/day) in Turag-Bangshi





### Fig. 3c Fish consumption (g/person/day) in Kangsha-Malijee



### Kongshow Malijhee (Sherpur)

# Sources of fish

In all three sites a majority of households from all landholding categories bought the majority of the fish they consumed, even though many of these households also catch fish for own consumption. In none of the sites were increases in fish consumption associated with a greater share coming from own catches. In Hail Haor households on average became more dependent on purchased fish – the quantity per household consumed from own catch fell in impact years 5 and 6 to 86% of the baseline level, while the quantity purchased for consumption rose by 29%. In Turag Bangshi in the same period the average quantity caught and consumed per household rose by 81%, against an increase of 68% in the quantity bought for consumption. In Kangsha-Malijee in a shorter period to impact years 3 and 4, the average quantity caught and consumed per household rose by 21% when the amount bought and consumed increased by 86%. When disaggregated the data indicate to some extent that more of the direct consumption benefits from restored fisheries and higher fish catches went to poorer households. In Hail Haor landless and marginal households increased the quantity of fish consumed from own catches, while small to large landowners tended not to change the quantity coming from own catch although their total consumption of fish increased (Fig 4a). This indicates that landowners bought relatively and in absolute terms more fish, providing an income to the mainly landless and marginal households that fish for an income.



Fig. 4a Sources of fish consumed by different classes of household in Hail Haor

In Turag Bangshi although most landowners catch very little of the fish they consume, the trends in terms of sources of fish consumed are similar for all classes of household – even large farmers increased the amount they themselves catch, particularly in the years of highest fish production (Fig 4b). This presumably reflects the increased availability of fish in the floodplain lands that landowners cultivate and where they can fish when water levels recede at the end of the monsoon. The amounts of fish purchased have also increased substantially for all classes of household.



Fig. 4b Sources of fish consumed by different classes of household in Turag-Bangshi

In Kangsha-Malijee in the baseline year own catches of fish were relatively more important as a source of food for poorer households (landless, marginal and small farmers) than in the other sites. Although households on average caught more fish in later years, the increases in consumption are mainly derived from fish purchased in local markets. This suggests that subsistence fishing has changed little, but with increased total fish catches professional and part time fishers have more to sell and all categories of household have been able to buy this increased production.

If the availability of fish in the wetlands has increased, and a majority of households are landless and marginal farmers, why has such a large part of their increased fish consumption been bought? One factor is increasing specialization which the training and credit provided through MACH has also contributed to - some households have dropped out of fishing, while others continue. But another factor is the relative prices of different types of fish and their availability.



# Fig. 4c Sources of fish consumed by different classes of household in Kangsha-Malijee

# Species composition of fish consumption

A wide range of species were recorded in the household consumption monitoring, just as in the catch surveys. The tables of the top 20 species consumed confirm the overall importance of small native species such as puti and taki (note that in Table 2 "gura mach" are mixed small fishes, while gura icha are various small shrimps). However, some larger (and high value) beel resident carnivorous fishes such as snakeheads (shol) which have benefited from conservation and restoration measures have risen in the league table of species consumed in Hail Haor.

A second trend that is not project related is apparent. In Hail Haor some of the growth in fish consumed is for cultured exotic species notably Thai Pangas and Silver Carp, although exotic fish are still a small proportion of total fish consumed here, where there is a large supply of wild caught fish from the haor, exotic cultured species still rose from 2% to 11% of fish consumed, with the quantity increasing by 10 times over 6 years (Fig. 5).



### Fig. 5 Types of fish consumed as a percentage of total consumption





This trend is more dramatic in Turag Bangshi. Despite the dramatic growth in fish catches in the floodplain there, fish consumption is now dominated by cultured species. For example, Thai Pangas was not in the top 20 most frequently eaten species of fish in the baseline year, but rose to be in the top three places in impact years 3-6 (2002-03 onwards). Exotics and major carp, almost all of which are cultured, contributed just over half of the fish consumed in that site by 2004-05. This growth in fish consumption from aquaculture sources is independent of MACH activities. While the growth in aquaculture is one factor behind this trend, another factor is the demand for larger and more highly prized native fishes, with ready access to Dhaka and high prices there for those native species it is likely that a good proportion of increased catches from the wetlands here are traded out of the locality.

Dry fishDryJat PutiJat IKhalishaTakTakiMolKoiGurShingShirGura machGur	y fish Puti ki ola ra Echa ing ra mach alisha	Dry fish Taki Jat Puti Gura Echa Gura mach Mola Shing	Dry fish Taki Jat Puti Gura Echa Khalisha Meni/Bheda	Dry fish Taki Jat Puti Gura Echa Khalisha	Dry fish Jat Puti Taki Gura Echa Gura mach	Dry fish Taki Jat Puti Gura Echa Gura mach
Jat PutiJat IKhalishaTakTakiMolKoiGurShingShirGura machGur	Puti ki ola ra Echa ing ra mach	Taki Jat Puti Gura Echa Gura mach Mola Shing	Taki Jat Puti Gura Echa Khalisha Meni/Bheda	Taki Jat Puti Gura Echa Khalisha	Jat Puti Taki Gura Echa Gura mach	Taki Jat Puti Gura Echa Gura mach
KhalishaTakTakiMolKoiGurShingShiriGura machGur	ki bla	Jat Puti Gura Echa Gura mach Mola Shing	Jat Puti Gura Echa Khalisha Meni/Bheda	Jat Puti Gura Echa Khalisha	Taki Gura Echa Gura mach	Jat Puti Gura Echa Gura mach
TakiMolKoiGurShingShirGura machGur	ola ra Echa ing ra mach alisha	Gura Echa Gura mach Mola Shing	Gura Echa Khalisha Meni/Bheda	Gura Echa Khalisha	Gura Echa Gura mach	Gura Echa Gura mach
KoiGurShingShirGura machGur	ra Echa ing ra mach	Gura mach Mola Shing	Khalisha Meni/Bheda	Khalisha	Gura mach	Gura mach
ShingShirGura machGura	ing ra mach	Mola Shing	Meni/Bheda	M '/D1 1		oura maon
Gura mach Gur	ra mach	Shing		Meni/Bheda	Khalisha	Khalisha
	alisha	Simp	Gura mach	Shing	Meni/Bheda	Meni/Bheda
Gura Echa Kha	alislia	Meni/Bheda	Mola	Shol	Mola	Shol
Mola Mer	eni/Bheda	Khalisha	Shing	Gura mach	Shing	Shing
Meni/Bheda Ten	ngra	Shol	Shol	Koi	Shol	Mola
Chuna Khalisha Sho	ol	Hilsha	Koi	Hilsha	Tengra	Hilsha
Okol/Cheng Hils	lsha	Tengra	Tengra	Mola	Goinna	Koi
Lal Khalisha Koi	i	Chuna Khalisha	Foli	Foli	Koi	Tengra
Shol Gol	l Chanda	Koi	Lal Khalisha	Tengra	Thengua Echa	Thengua Echa
Magur Chu	una Khalisha	Lal Khalisha	Hilsha	Chuna Khalisha	Mrigel	Thai Pangas
Tengra Mag	agur	Gol Chanda	Magur	Magur	Boal	Goinna
Kanchan Puti Kail	ikla	Thai Pangas	Gol Chanda	Mrigel	Hilsha	Mrigel
Hilsha Foli	li	Goinna	Goinna	Silver Carp	Rui	Foli
Gutum The	engua Echa	Magur	Chuna Khalisha	Gol Chanda	Foli	Silver Carp
Rui Goi	inna	Kaikla	Thai Pangas	Goinna	Thai Pangas	Rui

Table 2a	Тот	o 20	species	in terms	of free	uencv o	f consum	ption in	Hail H	Iaor (	Sreemong	al)
I abic La	-	<i>, .</i> ,	species	in terms	or net	ucney o	i consum	puon m	III III I	1401 (	Sicemong	41)

Exotic species in bold

#### Table 2b Top 20 species in terms of frequency of consumption in Turag-Bangshi (Kaliakoir)

Baseline	Impact 1	Impact 2	Impact 3	Impact 4	Impact 5	Impact 6
Gura mach	Jat Puti	Gura mach	Gura mach	Gura mach	Gura mach	Thai Pangas
Jat Puti	Gura mach	Gura Echa	Thai Pangas	Jat Puti	Thai Pangas	Gura mach
Gura Echa	Gura Echa	Jat Puti	Jat Puti	Thai Pangas	Jat Puti	Jat Puti
Rui	Rui	Thai Pangas	Rui	Rui	Rui	Rui
Tengra	Lamba Chanda	Rui	Gura Echa	Gura Echa	Gura Echa	Silver Carp
Taki	Taki	Taki	Silver Carp	Mrigel	Chapila	Gura Echa
Lamba Chanda	Chapila	Silver Carp	Mrigel	Chapila	Silver Carp	Mrigel
Boro Baim	Tengra	Dry fish	Taki	Dry fish	Dry fish	Chapila
Chapila	Mrigel	Hilsha	Dry fish	Silver Carp	Mrigel	Taki
Thai Sharputi	Dry fish	Mrigel	Thai Sharputi	Taki	Comon Carp	Dry fish
Dry fish	Hilsha	Tengra	Chapila	Hilsha	Thai Sharputi	Hilsha
Mrigel	Boro Baim	Thai Sharputi	Tengra	Thai Sharputi	Taki	Comon Carp
Silver Carp	Silver Carp	Chapila	Comon Carp	Comon Carp	Catla	Catla
Comon Carp	Thai Pangas	Comon Carp	Hilsha	Tengra	Tengra	Thai Sharputi
Bele	Comon Carp	Lamba Chanda	Tilapia	Catla	Hilsha	Tengra
Hilsha	Thai Sharputi	Boro Baim	Boro Baim	Boro Baim	Boro Baim	<b>Bighead Carp</b>
Shing	Mola	Catla	Lamba Chanda	Tilapia	Tilapia	Boro Baim
Mola	Bele	Bele	Catla	Lamba Chanda	Lamba Chanda	Tilapia
Catla	Catla	Tilapia	Guchi Baim	Shol	Guchi Baim	Guchi Baim
Air	Shing	Guchi Baim	Shol	Guchi Baim	<b>Bighead Carp</b>	Shar Puti

Exotic species in bold

Baseline	Impact 1	Impact 2	Impact 3	Impact 4
Dry fish	Dry fish	Dry fish	Dry fish	Dry fish
Gura mach	Jat Puti	Gura mach	Gura mach	Jat Puti
Jat Puti	Gura mach	Gura Echa	Gura Echa	Gura Echa
Taki	Taki	Jat Puti	Jat Puti	Taki
Gura Echa	Gura Echa	Taki	Taki	Silver Carp
Hilsha	Silver Carp	Silver Carp	Silver Carp	Tengra
Silver Carp	Hilsha	Mrigel	Mrigel	Mrigel
Tara Baim	Mrigel	Hilsha	Hilsha	Tara Baim
Tengra	Tengra	Tengra	Thai Sarputi	Bele
Mrigel	Common Carp	Common Carp	Tengra	Gura mach
Rui	Gutum	Dankina	Common Carp	Dankina
Gutum	Dankina	Gutum	Dankina	Hilsha
Dankina	Rui	Koi	Tara Baim	Guchi Baim
Koi	Tara Baim	Rui	Bele	Gol Chanda
Thai Pangas	Chuna Khalisha	Chuna Khalisha	Gutum	Ranga Chanda
Chuna Khalisha	Shar Puti	Tara Baim	Rui	Gutum
Bele	Thai Sarputi	Thai Sarputi	Ranga Chanda	Mola
Thai Sarputi	Koi	Boro Baim	Koi	Thai Sarputi
Gol Chanda	Gol Chanda	Khalisha	Thai Pangas	Common Carp
Common Carp	Boro Baim	Catla	Catla	Meni/Bheda

Table 2c Top 20 species in terms of frequency of consumption in Kangsha-Malijee (Sherpur)

Exotic species in bold

There is no clear trend in changing composition of fish consumed in Kangsha-Malijee – already some cultured exotic species were in the diet in the baseline year, and have retained their position. The increases in production are mostly small species and as the area is relatively remote it would appear that growth in consumption has been even, with little change in the proportions of species and types of fish consumed.

# Use of other aquatic resources

Although fish are the single most important aquatic resource exploited from the wetlands in these three sites, a range of other resources are also used. Therefore the household monitoring program included recording involvement in and use of a wide range of other aquatic resources –plants and animals.

Around two-thirds of households living around Hail Haor collect non-fish aquatic resources of at least one type each year (Table 3). The main resources used are plants – grasses and straw for fodder and Dhol kolmi (*Ipomea*) which has various local names and is used as fuel; while around 14% of households collect snails for poultry and fish feed, and several plant species for human consumption. Households on average (across all monitored households) spend 30 or more days a year collecting non-fish aquatic resources from the haor. Here poorer and better off households appear to be just as much involved. There is no clear trend in use, indicating that in general there have been no changes in either access to these resources or their productivity.

In the Turag Bangshi site about 80% of households have collected some non-fish aquatic resources in each year after the baseline (there the baseline year data may not have been representative of use of some species since it is unlikely that some of the plants suddenly became much more abundant in 2000-2001 (impact year 1). This greater involvement in using aquatic resources may reflect households living closer to parts of the wetland, and it is also associated with a wider range of resources being commonly used: over a quarter of all households collect grass, frogs (as fishing bait), shaluk and fokol (edible water plants). Moreover poorer households tend to spend more days per year collecting these resources, indicating that they are relatively more important for their livelihoods. However, the growing incidence of bird hunting there, involving up to a quarter of all households, is a

concern as the project has been advocating a complete end to hunting birds, with some success in Hail Haor, but apparently the reverse trend is occurring in Turag-Bangshi.

Natural resource	Baseline	Impact-1	Impact-2	Impact-3	Impact-4	Impact-5	Impact-6	Average
Hail Haor (Sreemongal)								
Any item	66.1	76.2	62.4	65.7	60.9	71.0	69.7	67.4
Grass	41.8	40.7	26.7	28.1	21.3	29.7	28.4	31.0
Straw	0	29.3	29.2	36.0	29.9	35.4	33.8	27.7
Dholkolum/Daokolum	19.8	32.0	24.1	29.0	31.0	24.2	24.0	26.3
Snail/Oyster	14.7	20.2	13.1	18.5	10.3	12.5	8.4	13.9
Kolmi/Barisa Leaf	6.3	12.4	10.6	11.9	9.0	9.5	12.5	10.3
Earthworm	3.5	15.1	11.8	9.7	9.2	6.6	8.4	9.2
Fokol	1.4	6.3	10.2	12.3	11.0	9.5	8.4	8.4
Aram Tubercle	0.8	11.4	6.7	7.0	6.6	7.5	4.8	6.4
Shaluk	2.2	8.1	8.8	9.5	6.2	2.0	7.3	6.3
Bird	3.3	7.5	4.5	5.9	4.4	2.9	2.0	4.4
Frog	2.0	3.9	2.9	2.0	1.5	3.5	2.9	2.7
Hyacinth	0	6.1	1.0	3.1	1.1	3.3	0.2	2.1
Turtle	4.3	3.7	1.2	2.2	0.9	1.5	0.9	2.1
Turag Bangshi (Kaliakoir)								
Any item	58.9	85.7	87.5	86.8	89.3	81.4	78.6	81.2
Grass	40.0	47.9	50.7	53.2	55.7	53.9	43.6	49.3
Shaluk	1.1	52.5	55.4	63.6	52.5	50.7	45.4	45.9
Frog	17.9	39.6	42.5	33.6	49.3	17.1	27.1	32.4
Fokol	0.4	21.4	32.9	37.9	35.0	26.1	28.9	26.1
Snail/Oyster	15.4	13.6	17.1	20.4	25.7	20.0	17.1	18.5
Bird	1.4	9.6	12.1	21.8	31.8	21.8	11.1	15.7
Panikola	0	16.4	18.9	26.8	22.5	10.4	7.1	14.6
Wild animal	0	5.7	6.1	10.7	10.7	2.1	1.4	5.3
Dholkolum/Daokolum	2.1	5.7	8.2	2.5	10.4	2.1	0.0	4.4
Kangsha-Malijhee (Sherpu	ır)							
Any item	35.4	11.1	11.8	29.6	36.9			24.9
Grass	24.3	7.9	10.0	24.3	30.6			19.4
Snail/Oyster	16.8	1.1	5.0	8.6	9			8.0
Bird	2.5	2.9	0.4	1.1	3.1			2.0

 Table 3 Percentage of households involved in collection of natural resources from the project wetlands

Only resource types collected by 2% or more of households are included in the table

Surprisingly, since on average household incomes are lower there, the incidence of collecting non-fish aquatic resources is was reported to be much lower involving only a quarter of households in Kongsha-Malijhee site, and better off households are more involved. Also very few types of aquatic resources were reported to be used there. These unexpected patterns deserve further investigation at this site.

Lastly for Hail Haor the use of non-fish aquatic resources was monitored and analyzed in more detail for the baseline year and impact years 1-3, this reveals very major levels of exploitation. For example, each monitored household on average collected about 20 kg of snails and 70 bundles of grass in a year (Table 4). With perhaps 30,000 households in total using the haor this would imply 600 t of snails and 2.1 million bundles of grass collected each year. Most of the non-fish natural resources were used for family maintenance and consumption, but some were sold notably some aquatic fruits – fokol and shinga – and turtles. Although very few turtles were reported caught the ready market for these is a concern as most of the species recorded in Hail Haor are nationally threatened and have suffered a serious population decline. Demand for some of these resources appears to be high – the prices of several products that are regularly sold in local markets have either remained the same or increased during the project period (Table 5).

Resource	Ba	seline	Imr	pact-1	Im	pact-2	Im	pact-3
	Effort	Amount	1	Amount		Amount	1	Amount
	(d/hh/y)	(/hh/y)	Effort	(/hh/y)	Effort	(/hh/y)	Effort	(/hh/y)
Grass (bundle)	23.9	154.3	14.0	73.8	17.2	70.1	11.8	40.8
To Sell		13		10		7		4
Fodder		87		90		93		96
Snail/Ovster (kg)	5.4	23.3	5.1	20.7	5.7	15.0	7.3	23.8
To Sell		3		1		0		0
Poultry feed		23		14		16		7
For Fishing		74		85		84		89
Fish feed		0		0		0		4
Earthworm (Nos.)	2.2	1033.4	3.3	1783.5	4.4	1818.4	2.8	1572.4
To Sell		7		13		1		0
For Fishing		93		87		99		98
Fish feed		0		0		0		2
Dhol kolum/Kolum (bundle)	4.9	38.9	8.7	30.3	9.4	25.5	7.7	19.7
To Sell		13		7		3		4
Use for Roof/Fence		0		0		0		0
Use as Fuel		87		93		97		96
Frog (Nos.)	0.7	102.1	04	433	04	48.9	0.2	39.8
To Sell	0.7	0	0.4	2	0.4	0	0.2	0
For Fishing		100		98		100		100
Turtle (g)	04	706.4	03	621.4	03	460.4	0.7	1744 9
To Fat	0.4	29	0.5	8	0.5		0.7	0
To Sell		71		92		100		100
Bird (Nos.)	0.6	11	12	55	0.6	2.0	0.8	3.0
To Fat	0.0	53	1.2	100	0.0	100	0.0	100
To Sell		2		0		0		100
To Rear		45		0		0		0
Shaluk (hundle)	0.4	1031.0	0.6	2183.5	0.6	1280.8	0.7	2111 7
To Fat	<b></b>	24	0.0	59	0.0	1209.0	0.7	96
To Sell		77		41		0		
Kolmi/Barisa Laaf (hundla)	0.0	55	0.7	18	12	27	0.6	17
To Fat	0.9	3.3	0.7	1.0	1.2	78	0.0	87
To Sell		62		11		22		13
Fodder		2		13		0		15
Fokol (g)	0.2	26	0.7	23.3	10	75.5	3.2	170.3
To Fat	0.2	2.0	0.7	1	1.7	13.5	5.2	170.5
To Sell		93		99		100		100
Panikola (g)	0.1	137.6	0.1	63.7	0.1	107 2	0.0	57.2
To Fat	0.1	100	0.1	100	0.1	107.2	0.0	100
Aram Tubercle (Nos.)	0.7	18	0.8	2.0	11	100	14	100
To Fat	0.7	64	0.0	54	1,1	24	1.7	75
To Sell		36		46		76		25
Shingrai (kg)	0.1	0.2	0.0	20	07	15	07	1/
To Fat	0.1	15	0.9	2.0	0.7	1.5	0.7	2
To Sell		85		09		00		07
Straw (hundle)	Ω 1	0.2	Q /	90 27 4	76	99 <b>)1 7</b>	6.6	9/ 15 2
To Sell	0.1	0.3	0.4	1	/.0	<u> </u>	0.0	15.5
Fodder		<u> </u>		20		27		27
Roof/Fence		01		1		5		57
Fuel		10		60		68		62
1 401	1	1.7	1	09		1 00	1	02

Table 4	Effort (days/household/year) and amount collected	(unit/household/year) by	use of natural resources in Hail
Haor.			

Figures are averaged across all households covered by regular monitoring for fish consumption

Table 5 Prices of non-fish aquat	ic resource	s repo	rted by	househ	olds col	llecting	g and	selling	them in	Hail Ha	or
	D 1'	т	. 1	т		т	2				

Price (Tk/unit)	Baseline	Impact-1	Impact-2	Impact-3
Grass (bundle)	5.87	5.67	5.37	12.81
Snail/Oyster (kg)	13.87	18.06		
Earthworm (per hundred)	1.00	2.00	1.00	
Dhol kolmi (bundle)	3.51	6.45	11.16	10.87
Frog (Nos.)		0.30		
Turtle (kg)	90.49	78.15	77.57	90.79
Bird (Nos.)	83.33			
Shaluk (bundle)	0.03	0.02		0.01
Kolmi/Barisa Leaf (bundle)	4.61	2.91	3.96	2.54
Shapla (bundle)	5.00			
Fokol (kg)	4.95	4.80	5.77	5.30
Aram Tubercle (Nos.)	2.89	2.50	5.08	3.60
Shingrai (kg)	36.29	32.34	32.75	39.14
Straw (bundle)		5.00	20.00	

Bold = resources that were sold by at least some households in each year

Strategic Objective 6: Improved Management of Open Water and Tropical Forest F	Resources		
Indicator 6b: Increased production of natural resources in targeted areas (wetland a	nd riparian tre	es)	
A. Description	Cumulative	Unit of measu	ire: (no.
Precise Definition of Indicator: This indicator measures the no. of trees that have	trees planted	)	
been planted and that will be brought under community based management within			
an integrated wetland/upland management system. Improved means stream bank	Year	Planned	Actual
stabilization, use of soil conserving agricultural production practices, and similar		MACH-I	
measures.	Baseline		
Unit of Measure: No. of trees	2000	-	46,791
Disaggregate by: N/A			
<b>Justification/Management Utility:</b> Indication to measure the increase in aquatic			
nabilities and blochversity. Riparian, wetland and roadside nabilities are important	2001	-	104,968
contributors to the SO level indicators affecting wettand and biodiversity.			
B. Plan for Data Collection			
<b>Data Collection Method</b> . Winrock and its implementation partners will measure	2002	-	196,016
and report on actual amount of riparian area under improved practices			
Method of Collection by USAID:	2002		
<b>Data Source(s):</b> Winrock and its partners	2003	-	333,037
Frequency/ Timing of Data Collection: Semi-annual			
Estimated Cost of Collection: Nominal.		MACH-II	
<b>Responsible Individual(s) at USAID:</b> Team Leader			
	2004	100.000	204 876
D. Data Quality Issues	2004	100,000	204,070
Date of Initial Data Quality Assessment:			
Known Data Limitations (if any):	2005	200.000	272 328
Actions Taken or Planned to Address Data Limitations:	2005	200,000	272,320
Date of Future Data Quality Assessments:			
Procedures of Future Data Quality Assessments:	2006		211.044
	2000	-	511,044
C. Plan for Data Analysis, Reporting, and Review			
Data analysis: Review trends of progress comparing targets to actual			
performance.			
Presentation of Data: In Table			
Review of Data: Semi-annual mission portfolio review,			
R4 review and individual review with recipient.			
<b>Reporting Data:</b> Internal mission report, R4 report and CBJ report.			
F. Other Notes:			
Notes on the Baselines/Targets: There were no riparian improvements in these			
areas before MACH. The rinarian and wetland swamp tree areas were heavily			
degraded with little or no tree growth. Figures are inclusive of both wetland and			
swamp trees and riparian plantings.			
Location of Data Storage: P:\MissionShareable\EGFEpub\Environment\PMP\			
Comments:			
2004: A total of 72,956 wetland trees and 131,920 riparian, roadside, institution/			
homestead and patch forest trees.			
2005 Due to late heavy rains in 2005, planned swamp plantation scheme sites			
remained submerged so planting could not be done. However, the total planted			
during MACH II is above the project target.			
<b>2006:</b> The deferred plantings were made and achievement over 3 years was above			
target.			

# Strategic Objective 6: Indicator 6.b: Increased production of natural resources in targeted areas (Wetland and riparian trees)

Originally MACH was not obligated to plant trees but because of the importance of the watersheds and in particular riparian areas, MACH put resources forward for selected stream (*chara*) banks, areas of wetlands, and adjacent public lands. The planned levels are all in addition to what was originally set out for the project in the way of outputs. This indicator was not an original project indicator.

As the streams selected had no riparian canopy (trees), the baseline condition was considered to be zero. All trees are readily identifiable as all have been planted and none were there previously. The numbers are ascertained by counting directly. The kilometers of stream planted are measured from maps built from accurate geo-referenced satellite images.

The planned levels of performance were dependent on the Investment support (416b) fund availability. MACH has used upwards of 30 different species in the riparian areas to ensure varied habitat for birds and other animals. There are benefits to both the communities managing the trees in terms of the future value of the trees which is considerable and to the stream itself through improving bank stability and reduced erosion. The trees provide structure to the stream banks and income to the communities which was previously not there.

The scope for riparian corridor reforestation was and remains large at the Hail Haor and Kangsha-Malijee sites. The long term benefits will be improved stream bank stability and thereby reduced erosion, providing potential movement and shelter corridors for birds and other animals (forest to the wetland), and the eventual enhanced income to the communities with future selective harvest.

An additional component was planting native swamp tree species – largely Hijal and Koroch – which have been felled from what were once large areas of freshwater swamp forest. This was particularly important in Hail Haor and Turag-Bangshi sites. Problems of survival of these saplings and sources of saplings that did not further reduce wild stocks were issues that required experimentation and development of nursery practices during the project such that larger saplings could be planted out.

Out of about 644,081 trees planted by MACH of 56 species, just over 394,109 are swamp and riparian plantations within the wetlands. The swamp forest trees will generate benefits mainly through ecological functions including acting as fish nursery grounds during the monsoon. Although eventually some lopping of branches may be allowed there is no agreement for them being felled. For riparian and other plantations, the benefit sharing agreements made for each plantation and its participants assume the trees will be felled and replanted on a 15-year cycle. Of these just under 237,000 were surviving when a census was conducted in late 2006. The survival rate was about 45%

for riparian planting, but was lowest for swamp plantations where in the early stages of the project small saplings were used which were found to have low survival. By 2021 the standing value of these trees should be about US\$ 4.0 million at current

Number of tre	es surviving	In October 2	.000		
				Public	
Site	Riparian	Swamp	Roadside	building	Total
HH	11,183	15,724	7,551	13,653	48,111
TB	21,977	19,541	15,785	15,911	73,214
KM	74,747	5,819	33,758	1,298	115,622
Total	107,907	41,084	57,094	30,862	236,947
% surviving	44.9	26.7	39.9	28.9	36.8

Number of trees surviving in October 2006

prices. Assuming that the existing trees survive to harvesting (most losses are in the initial years after planting), the return from the first felling cycle of the other trees should be about Tk 226 million or US\$ 3.3 million by 2021 (net of replanting costs), giving a present value of returns in 2006 (net of replanting costs) for the first cycle of all non-swamp forest trees subsidized by the project of about Tk 106 million or about US\$ 1.5 million. This of course does not take into account the potential environmental benefits from carbon credits generated by these additional trees.

					her on die noof				(m			(~				
			Riparian					Swamp					Institutio	u		Grand
Site	2000	2001	2002	2003	Sub-Total	2000	2001	2002	2003	Sub-Total	2000	2001	2002	2003	Sub-total	Total
HH	13,722	4,107	15,242	15,567	48,638	18,882	5,700	0	1,725	26,307	200	2,100	1,250	8,301	11,851	86,796
TB	0	3,100	10,100	9,892	23,092	0	400	1,225	203	1,828	3,286	6,422	6,658	7,156	23,522	48,442
KM	0	7,873	19,422	69,429	96,724	0	5525	4,299	2,850	12,674	0	944	7,000	15,228	23,172	132,570
Total	13,722	15,080	44,764	94,888	168,454	18,882	11,625	5,524	4,778	40,809	3,486	9,466	14,908	30,685	58,545	267,808

Summary of Reforestation under MACH Project up to August 2003 (tree numbers planted) linked with RMOs supported by CNRS

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Summar	y of Plantati	ions establist	ned under M.	ACH Proje	sct up to Augus.	1) 5002 1	ree numbe	ers planted) i	inked with	n kugs supl	ported by C
			<b>Road Site</b>					Institutio	u		Grand
Site	2000	2001	2002	2003	Sub-Total	2000	2001	2002	2003	Sub-Total	Total
НН	6,020	6,620	4,000	1,950	18,590	480	1830	3830	1,995	8,135	26,725
R	4 200	4 725	2 287	0	11 212	c	1 332	2.475	0	3 807	15 019
											20,00
<b>N</b> M		0000,0	8,200	c7c,1	02,01	-	2,000	000,0	1700	8,200	C 94, C 7
Total	10.220	16.845	14.547	3,475	45.087	480	5.162	11.305	3,195	20,142	65.229

Increase in trees

SO 6.2c (part of 6.b)

Site	<b>Re-forestation by type</b>	Extent o	of area	Sapling
		Km	Ha	planted
HH	Riparian	3.30	-	3,415
	Swamp/wetland	3.19	12.05	34,598
	Roadside	5.00	-	5,778
	Sub-total	11.49	12.05	43,791
T-B	Riparian	1.75	9.93	24,700
	Swamp/wetland	1.20	5.94	16,229
	Roadside	2.00	-	2,925
	Institution/Homestead	-	0.11	275
	Sub-total	4.95	15.98	44,129
K-M	Riparian	5.00	-	4,819
	Swamp/wetland	12.50	-	22,129
	Roadside	83.30	-	75,418
	Patch Forest	-	5.65	13,390
	Institution/Homestead	-	400	1,200
			Homesteads	
	Sub-total	100.80	5.65	116,956
	Grand Total	117.24	33.68	204,876

Summary of Reforestation under MACH Project for the reporting year (November 2003 – October 2004)

# Summary of Reforestation under MACH Project for the reporting year (November 2004 – October 2005)

Site	Plantation type	Extent o	f Area	Number of
		Km	Ha	saplings planted
	New	Plantation		
HH	Riparian/roadside	6	-	5,692
	Swamp	-	4.48	11,200
	Institution	-	3.59	8,982
	Sub-total	6	8.07	25,874
T-B site	Riparian/roadside	5	5.00	16,463
	Sub-total	5	5.00	16,463
K-M site	Riparian/roadside	4.45	8.00	23,715
	Institution	-	0.56	1,400
	Sub-total	4.45	8.56	25,115
Total		15.45	21.63	67,452

### Summary of Reforestation under MACH Project for the reporting year (November 2005-October 2006)

	Plantation type	Extent of	f Area	Number of
Site		Km	Ha	saplings planted
	New Pl	antation		
	Swamp	2.00	-	3,000
	Sub-total	2.00	-	3,000
T-B site	Riparian/roadside	-	0.42	1,260
	Swamp	18	-	25,996
	Institution	-	-	2,860
	Sub-total	18	0.42	30,116
K-M site	Riparian/roadside	3	-	5,600
	Sub-total	3	-	5,600
Total		23	0.42	38,716

# Trees planted under MACH I and II and estimated harvest value

Year	Site		Type of p	olantation	
		Riparian/ Roadside	Swamp	Institution	Total
1999-2000	Hail Haor	19742	18882	680	39304
	Turag-Bangshi	4200	0	3286	7486
	Kangsha-Malijee	0	0	0	0
2000-2001	Hail Haor	10727	5700	3930	20357
	Turag-Bangshi	7825	400	7754	15979
	Kangsha-Malijee	13373	5525	2944	21842
2001-2002	Hail Haor	19242	0	5080	24322
	Turag-Bangshi	12387	1225	9133	22745
	Kangsha-Malijee	27682	4299	12000	43981
2002-2003	Hail Haor	17517	1725	10296	29538
2002 2003	Turag-Bangshi	9892	203	7156	17251
	Kangsha-Malijee	70954	2850	16428	90232
	Kangsna-wanjee				
2003-2004	Hail Haor	9193	34598	0	43791
	Turag-Bangshi	27625	16229	275	44129
	Kangsha-Malijee	80237	22129	14590	116956
2004-2005	Hail Haor	5692	11200	8982	25874
	Turag-Bangshi	16463	0	0	16463
	Kangsha-Malijee	23715	0	1400	25115
2005-2006	Hail Haor	0	3000		3000
	Turag-Bangshi	1260	25996	2860	30116
	Kangsha-Malijee	5600	0		5600
	Outreach	31000			31000
Crand Total		383326	153961	106794	644081
Survival at vr 15 (43%	of Riparian 27% of		100701	100771	011001
Swamp and 29% of Ins	titution)	164,830	41,569	30,970	237,370
Volume forecast	/		<u> </u>	- ,	
	6cft/tree-Riparian				
a). Timber (cft.)	4cft/tree Swamp	988,981	166,278	185,822	1,341,081
b).Fuelwood (cft)	20 pc of timber	197,796	33,256	37,164	268,216
Value (standing)					
	Tk.200 / cft Rip.				
a). Timber	Tk.100/cft Swamp	197,796,216	16,627,788	37,164,312	251,588,316
b). Fuelwood	at Tk. 20/cft	3,955,924	665,112	743,286	5,364,322
Total value	Tk	201,752,140	17,292,900	37,907,598	256,952,638
	US\$ mill	2.88	0.25	0.54	3.67
value per tree at final ha	arvest (2007 prices)	1224	1,224	416	1,224

Benefit distribution varies according to land ownership:

i) roadside: 40% CBO, 40% adjoining landowner, 20% UP

ii) riparian: 25% CBO, 70% adjoining landowner, 5% UP

iii) private land: 30% CBO, 70% landowner

# Tree harvesting projection

Year	Riparian/Roadside	Swamp	Institution	Total
		No trees pla	nted	
1999-2000	23942	18882	3966	46790
2000-2001	31925	11625	14628	58178
2001-2002	59311	5524	26213	91048
2002-2003	98363	4778	33880	137021
2003-2004	117055	72956	14865	204876
2004-2005	45870	11200	10382	67452
2005-2006	6860	28996	2860	38716
Total	383326	153961	106794	644081
		No trees to ha	arvest	
2006	0		0	0
2007	0		0	0
2008	0		0	0
2009	0		0	0
2010	0		0	0
2011	0		0	0
2012	0		0	0
2013	0		0	0
2014	0		0	0
2015	10,295		1,150	11,445
2016	13,728		4,242	17,970
2017	25,504		7,602	33,106
2018	42,296		9,825	52,121
2019	50,334		4,311	54,645
2020	19,724		3,011	22,735
2021	2,950		829	3,779
Total	164,830		30,970	195,800

# **Financial Forecast of Returns from Trees planted under MACH I and II** cost of replanting Tk 60 per tree. Net return to shareholders per tree: Tk 1164

	Value from	riparian/roads	side		Value from i	nstitution		Total
Year	32.5	55	12.5	Total	30	70	Total	
	CBO	landowner	UP		СВО	landowner		
2006	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0	0
2009	0	0	0	0	0	0	0	0
2010	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0	0
2014	0	0	0	0	0	0	0	0
2015	3,894,621	6,590,897	1,497,931	11,983,450	387,827	904,930	1,292,757	13,276,207
2016	5,193,208	8,788,506	1,997,388	15,979,101	1,430,443	3,337,700	4,768,143	20,747,244
2017	9,648,061	16,327,488	3,710,793	29,686,342	2,563,317	5,981,073	8,544,389	38,230,731
2018	16,000,611	27,077,957	6,154,081	49,232,649	3,313,057	7,730,467	11,043,525	60,276,174
2019	19,041,220	32,223,603	7,323,546	58,588,369	1,453,619	3,391,777	4,845,395	63,433,764
2020	7,461,627	12,627,369	2,869,857	22,958,852	1,015,235	2,368,882	3,384,117	26,342,969
2021	1,115,909	1,888,462	429,196	3,433,567	279,674	652,572	932,246	4,365,813
Total	62,355,257	105,524,281	23,982,791	191,862,330	10,443,172	24,367,401	34,810,572	226,672,902
(1USD=70 BD7	Γ)							
US\$	890,789	1,507,490	342,611	2,740,890	149,188	348,106	497,294	3,238,184
Total both							NPV US\$	
types	1,039,978	1,855,595	342,611	3,238,184			(6%)	1,519,564
							NPV Tk	
%	32.1	57.3	10.6				(6%)	106,369,480

# **Strategic Objective 6**

# **Indicator 6.c:** Maintaining or increasing biodiversity June 2007

Management of Aquatic Ecosystems through Community Husbandry (MACH)

Strategic Objective 6: Improved Management of Open Water and Tropical Forest Re	sources		
Indicator 6c: Maintaining or increasing biodiversity			
A. Description	Unit of mea	asure: Numbe	r of species
Precise Definition of Indicator: Biodiversity means the assemblage of all the			
biological organisms in a given ecosystem. This indicator will measure the increase	Year	Planned	Actual
in aquatic species in the three targeted areas.			Fish
Unit of Measure: Number of species.			species
Disaggregate by: N/A	Baseline		HH - 71
Justification/Management Utility: Biodiversity preservation and enhancement is a			TB-82
direct indicator of habitat quality. Habitat quality can be improved through better			KM – 64
management of the resources. Biodiversity increase depends on the restoration of			
degraded habitats, success in establishing sanctuaries, protected areas and buffer	2001	-	-
zones and compliance with the natural resources laws by the resources user			
communities. Changes are expected as habitat complexity increases. This indicator			
will be reported at the end of the strategy period.	2002	-	-
P. Dian for Data Collection			
<b>Data Collection Mathod:</b> Baseline and end of project data collected by the	2002	25 species	Fish-28*
implementers	2003	increase	Plant-47
Method of Acquisition by USAID: Receipt of Semi-Annual and annual Reports			
from Winrock	2004		
Data Source(s):Project implementers	2004		
<b>Frequency/ Timing of Data Collection:</b> Baseline and end of project.			
	2005		Fish
Estimated Cost of Collection: Medium. Already factored into budget.			species
Responsible Individual(s) at USAID: Team Leader			HH - 78
C. Data Quality Issues	2006		TB-84
C. Data Quanty Issues Date of Initial Data Quality Assessment:	2006		KM – 76
Known Data Limitations (if any):			
Actions Taken or Planned to Address Data Limitations:	2007		
Date of Future Data Quality Assessments:	2007		
Procedure of Future Data Quality Assessments:			
D. Plan for Data Analysis, Reporting, and Review			Last
Data analysis: Analysed by SO Team			impact
Presentation of Data: Table	Fish	Baseline	year
Review of Data: Semi-annual mission portfolio review, individual review with	diversity	HH 2.76	НН 3.29
implementers.	indices:	TB 3.22	TB 3.24
Reporting Data: Internal mission report, R4 and CBJ reports, project completion		KM 2.64	KM 2.97
report.			
E. Other Notes:	Water	2004:	2007:
Notes on the Baselines/Targets: Implementers have established baseline data	birds in		
through catch and household surveys.	Baikka	16 species	35 species
Commontate	Beel	2001.1	7 200
Changes in species diversity are expected through life of presient but will be	midwinter	300 birds	/,200
evaluated at the and of the project. Setting yearly targets and measuring performance	count		oirds
would not be productive as the project is re-creating the babitat. The extent of			
reestablishment of species will only be indicated at project completion			
restantistation of species will only be indicated at project completion.			

\*Represents fish species that have either reestablished themselves through project stocking or improved habitat. Each site was counted separetely.

# Strategic Objective 6: Indicator 6c: Increase bio-diversity in targeted areas

# Overview

Bio-diversity within a system is dependent upon the quality of the habitat. When MACH started the wetland habitat that existed in the floodplains where it worked was degraded and often not functional. Dysfunction in the ecosystems had a lot to do with the reduced diversity of fish and other animals as well as vegetation. Restoration of habitat can take years to accomplish and the resultant increases in diversity likely from habitat improvements can take even longer. Full restoration to historical conditions is most often not possible because of human needs and requirements. Restoration programs in the US, where natural processes are allowed to perform the restoration, can take between 15-20 years to show meaningful change.

The MACH project baseline year for Hail Haor (HH) was from April of 1999 through March of 2000; for Turag-Bangsi (T-M) from May 1999 through to April 2000, and for Kangsha-Malijhee (K-M) the baseline year was from August 2000 through July 2001. Establishment of sanctuaries, limits on harmful fishing practices, and the introduction of voluntary bans on fishing in the peak spawning season and on hunting did not begin until 2000 and 2001 or later. By June 2007 both Hail Haor and Turag-Bangsi had data for six years of potential impact (from mid 2000 to mid 2006) under which improved management and restoration of parts of the wetland took place and when impacts might be identified, although the extent of management interventions in 2000-01 (impact year 1) was limited<sup>1</sup>. In the third site of Kangsha-Malijhee, data for five years with potential impacts up to July 2006 are available.

With improvement of habitat, biodiversity should improve. The habitat improvements that community groups (guided by MACH) have implemented are permanent year-round wetland sanctuaries, re-excavation of canals and low areas of beels to make them perennial, and re-introduction of native trees with community protection to limit grazing and destruction in riparian and wetland areas.

The time frame set for the project is far too short to be able to see diversity changes that take years to occur. Realizing this, the project has created for example sanctuary areas within the wetlands and reintroduced species of fish and trees that used to exist there but had been lost when MACH started. By providing early protection in the preferred areas of these species, it was hoped that the reestablishment of some would be jump started. The project did this with fish species that can naturally reproduce within the floodplain and do not rely on rivers. This has been particularly successful with native fish species such as Shol, Gozar, Pabda, Meni, Sarputi, Foli, Gonia, and Kalibaush.

For Hail Haor there is also evidence of increases in wintering water bird populations with protection and restoration of the main sanctuary of Baikka Beel (increasing from about 300 birds of 16 species in 2004 to 7,200 birds of 35 species in 2007).

The other area where the project has intervened to create habitat change is in the planting of trees in riparian and wetland areas. The growth of the canopies of these areas will take 10-15 years alone. It is not expected that diversity changes in wildlife such as birds or mammals for example would be seen before 10 years. The experience in the US has been that where habitat is improved or created, restoration of a more diverse set of organisms using that habitat does occur in time.

This indicator should really be evaluated 10-15 years after the project. The project has reported here in any case in the following tables and figures what has been evident during the short project lifetime. It is expected that as the sanctuaries continue to hold older and larger broodfish for example a reasonably sustainable improved diversity will develop.

<sup>&</sup>lt;sup>1</sup> Data for impact year 7 2006-07 have been collected but there was insufficient time to processand analyze this by June 2007

# Introduction

Historically, millions of rural people in Bangladesh maintained their livelihood from the open capture fishery. Unfortunately, this rich open capture fishery along with other flora and fauna of the wetlands are now under serious threat due to various natural and anthropogenic causes. Apart from the faulty leasing systems and associated problems, habitat degradation, lack of awareness and understanding of the dynamics of the floodplain production systems and over fishing can be underlined as major problems. In this fragile situation, lack of appropriate management interventions and initiatives have further aggravated the declining trend of the wetland biodiversity and productivity.

# MACH initiatives for conserving and enhancing biodiversity

The major focus of the MACH project was to begin restoration and then maintain enhanced biodiversity and productivity of floodplain habitats. The conservation practices and interventions undertaken by MACH were holistic and took into consideration the entire wetland. This involved all stakeholders at different levels of use, control and management. The major focus was on ecosystem function and revitalization of wetland habitat, taking into consideration land, water, fish, watershed, vegetation, wildlife, agriculture and other resources. The wetland resources conservation and management interventions implemented were all suggested and implemented by the users and other local stakeholders. MACH helped the local people to identify the problems and to take measures to improve, conserve and promote the wise use of wetland resources. The interventions implemented at MACH sites for biodiversity conservation and enhancement have included the following:

# Wetland habitat rehabilitation

Several beels and khals (wetland habitats) which were either degraded (or not functioning) have been rehabilitated in each of the three MACH sites. Most of these habitats were seasonal before the interventions, now all these have become perennial and retain water round the year. Fish and other aquatic biota take refuge in these habitats. Khal rehabilitation and in some cases opening, has facilitated migration of fish between habitats. This of course is essential for completion of the biological cycle (spawning, nursing, feeding and taking refuge).

# Restoration of swamp forests

Suitable wetlands have been planted with wet area tree species (Hijal *Barringtonia acutangula* and Koroch *Pongamia pinnata*) in each of the three sites. When fully established these wetland forests will enhance the quality of habitats by providing additional niches for a range of wildlife to feed and when flooded as a refuge area for fish and other aquatic life. The communities (RMOs) also have rights to earn an income from these trees through selling of branches for making of brush piles and for use as fuel wood when they are sufficiently mature, but the agreements are not to fell these trees.

# Watershed management and riparian vegetation restoration

In order to protect the stream banks and reduce soil erosion, selected stream banks within and adjacent to the project sites have been planted with trees (timber, fruit, and others) and shrubs to develop riparian forest along the river course. In addition to the ecological importance of riparian forest for birds and wildlife, as corridors connecting upland areas with the wetlands, and for stabilizing the banks of the streams and rivers, the local communities are also expected to earn income in the long term from felling (and replanting) the trees.

Besides, the riparian reforestation, contour plantation of pineapples on the hills has been successfully demonstrated in the Hail Haor site. The project started with demonstration plots, which attracted many growers in the area. By the end of 2005 26 farmers had over 92 acres under contour cultivation of pineapple on different hills around the haor. It is expected that more growers will continue to adopt this technique when they go for new plantings as it is profitable for them as well as conserving soil.

# Restocking/reinforcement of locally threatened and rare species of fish and trees

Based on the historical knowledge of local fishers and the findings of baseline surveys, lists of locally threatened species of fish and trees for each site were developed. In order to increase the diversity of fauna and flora in the project sites, several locally threatened or lost species of fish have been restocked and re-introduced respectively in each of the three sites. The community participated in the selection of the species. Both adults and fingerlings were released. Similarly, tree species that are threatened or rare or have disappeared from native habitat in these sites have been planted to increase the diversity of flora in each of the sites by restoring parts of the areas towards their former condition.

# Establishment of wetland sanctuaries

A number of wetland sanctuaries (conservation areas) have been established in each of the three MACH sites. As a general rule, wherever there has been re-excavation of wetland habitats sanctuaries have been established in a good part of that area. These sanctuaries provide refuge for fish in the dry season and protect a mix of diverse species in reasonable quantities allowing them to attain maturity for repopulating the floodplain in the next monsoon. The communities have adopted norms for management of the sanctuaries, including rules laid down in their management plans. The key rule practiced is that there should be no fishing or activities of any sort in the sanctuary areas throughout the year. In addition to sanctuaries within water bodies where the communities hold fishing rights and fish in the rest of the area, MACH and the communities have set up larger permanent sanctuaries that are nationally recognized by the government and set aside from leasing or other use for the long term, there is at least one of these in each of the three sites. The larger perennial permanent sanctuaries are very important for long term replenishment of aquatic fauna and in particular fish stocks in the larger floodplain ecosystem. The largest of these - Baikka Beel - covers approximately 100 ha of permanent wetland in Hail Haor and has already been effective in providing breeding grounds for a number of beel resident fish species, larger fish are being caught in the neighboring areas, and migrant waterbirds, particularly ducks, have returned to the area in good numbers because they have a safe refuge and the RMO has successfully prevented hunting and other disturbance.

# Protection of natural growth of plants in wetlands and watersheds

Measures have been taken to protect the natural growth of vegetation on the stream banks in charas in Hail Haor site. Within the planted swamp tree areas other grasses and bushes are growing which also enrich the habitat and thus in turn would increase the biodiversity of the areas.

# Flexible restrictions on using harmful fishing gears and destructive fishing practices

The communities have established time closures on fishing in many areas. The communities have successfully banned use of harmful gears like *khata jal*, *current jal*, *polo* fishing (to protect aquatic vegetation and fish spawn) within the RMO managed water bodies in each of the sites. The fishing bans during critical spawning and fish recruitment periods have resulted in large blooms of small but valuable fish species as well as new vegetative habitat. Fishing by complete dewatering has been stopped in RMO managed wetlands and efforts have been taken to discourage other leaseholders in the area not to dewater the other beels completely for fishing.

# Discouraging hunting of birds and catching of fish fry and brood fish

The communities are organized and motivated to stop hunting of birds and catching of fish fry in RMO managed wetlands. Awareness and motivational campaigns targetted various users and stakeholders, bird hunters and fry/brood fish catchers. For example, in Baikka Beel the RMO successfully resisted attempts by local influentials to shoot birds in the sanctuary once wintering wildfowl returned, and has been able to fine the few people who poached fish there.

# Supporting Evidence of Biodiversity Restoration

This section provides evidence of the changes in biodiversity recorded in the three wetlands, it is followed by more detailed supporting tables. Table 1 summarizes the numbers of fish species recorded each year, while Fig. 1 summarizes the species composition of catch in terms of categories of fish.

### Fig. 1 Catch composition by types of fish







Fish biodiversity was assessed as a simple count of species recorded from the sampling program, which was a constant effort between years in each site. There has been a modest increase in the number of species recorded per year between the baseline years and subsequent years in Hail Haor and Kangsha-Malijhee sites – up to 10 more species in Hail Haor and up to 20 more species in Kangsha-Malijee. But there has been no notable change in numbers in Turag-Bangshi (Table 1).

Table 1 Number of fish species recorded in	
sample catches in monitoring areas	

Year	Hail Haor	Turag Bangshi	Kangsha Malijhee
Baseline	71	82	64
Impact-1	71	81	67
Impact-2	69	86	71
Impact-3	76	91	73
Impact-4	67	85	84
Impact-5	81	85	68
Impact-6	75	83	

Biodiversity does not relate only to the number of species

recorded, but also the proportions of species present and how numerous each is. As can be seen from Fig. 1, in all three sites in the baseline year miscellaneous small fish of a number of species comprised a high proportion of the catch. In the less degraded fisheries (Hail Haor and Kangsha-Malijhee) the recovery has mainly been of other fish such as snakeheads, eels and small catfish able to over winter in the sanctuaries.

As the figure shows, in the 2004 floods more major carp and exotic fish were caught due to escapes from over flooded ponds, which is unrelated with restoration of these fisheries, although there is some general increase in major carps and some of these have been released by the RMOs. The pattern of changing fish catch composition differs between the three sites – in Hail Haor most of the gains have been from higher catches of small catfish and snakeheads which benefit from sanctuaries and excavation. In Turag-Bangshi the baseline catches were very low indicating a highly degraded fishery and small fishes have increased rapidly with improved management and comprise over 50% of the total catch in each impact year. In Turag-Bangshi other species groups such as small catfish, snakeheads, large catfish and prawns have also recovered. By comparison in Kangsha-Malijhee site catches of small fishes as a guild of fish have hardly changed and most groups of fish have increased in proportion to the increased catches.

The dominant species by weight caught in all three sites included jat puti which is typical of floodplains and open waters in Bangladesh. Small shrimps were the highest percentage of catch (10-19%) in baseline and subsequent years in Turag-Bangshi and Kangsha-Malijhee sites. This is a concern, as de Graff et al. (2001) have argued, that a high proportion of shrimps in floodplain catches indicates a fishery that has been severely damaged as it lacks appropriate conditions for breeding and recruitment of larger and beel resident fishes.

A total of 15 native species of fish were re-stocked in the three wetlands during 2001-2005 with the aim of re-establishing or replenishing populations. In Turag-Bangshi the main species stocked was Rui, which may be able to re-establish here since these wetlands include connections to the main river system this species needs to breed in, and two other native carps – Kalibaush and Gonia. There has been a modest increase in Rui catches since 2002-03 (impact year 3) but not in the other carps. In Kangsha-Malijee the main species stocked were Gonia, Rui, Kalibaush and Shol. This appears to have had little impact, catches of Rui did increase but then fell back to their earlier level and catches of the other species have remained low. In Hail Haor there was a major emphasis on stocking Gonia with over half a million fingerlings released, also substantial numbers of Kalibaush, Rui and Deshi Sarpunti were stocked. Catches of Gonia have increased, including into impact year 6 but it is early to say if a self sustaining population has ben re-established, catches of Rui and Kalibaush have also increased, but very few Deshi Sarpunti have been caught.

Considering the quantities of fish caught by species, the diversity of native fish species caught has increased from the baseline. The indices calculated and reported in Table 2 are based on the weight of fish reported for each species in the catch from monitoring areas in each year and are a measure of the

diversity – the higher the number of species and the more even the amount of fish spread across species, the higher the index. It appears that overall diversity of fish in Hail Haor has increased since MACH started, but despite the greatest gains in productivity being in Turag-Bangshi site there has been no change in the diversity of catch there, while increases in diversity of catch in Kansha-Malijee site have been very small.

Year	Hail H	Iaor	Turag-Ba	angshi	Kangsha-Malijee			
	native fin fish	all fish	native fin fish	all fish	native fin fish	all fish		
Baseline	2.759	2.801	3.221	3.242	2.643	2.696		
Impact 1	2.884	2.969	3.279	3.350	2.786	2.967		
Impact 2	3.303	3.419	3.275	3.310	2.826	2.919		
Impact 3	3.290	3.405	3.346	3.427	2.953	2.965		
Impact 4	3.242	3.357	3.097	3.184	2.968	3.082		
Impact 5	3.430	3.599	3.146	3.351	2.974	2.987		
Impact 6	3.294	3.428	3.239	3.415	-	-		

Although surveys of plants, birds and other wildlife were conducted at the start of MACH in Hail Haor and Turag-Bangshi sites, few changes in plant diversity were expected as a result of MACH interventions, apart from tree planting which for example has seen the restoration of patches of swamp forest in the sites. Of the sites, Hail Haor has historically been regarded as an important site for wetland biodiversity in Bangladesh, with relatively more information available on, for example, birds recorded there. However, wintering waterfowl numbers had disappeared from tens of thousands reported in the late 1960s to a handful at the start of MACH. With the creation of a permanent wetland sanctuary covering about 100 ha in Baikka Beel in late 2003, the RMO has banned fishing, hunting, and collection of aquatic plants, except for limited grazing in part of the area. Between 2004 and April 2007, 113 species of birds were recorded within the 100 ha sanctuary. Both numbers and diversity have increased, reaching 7,200 birds of 35 water bird species in January 2007 (Fig. 2). These include large flocks of Fulvous and Lesser Whistling-duck; Northern Pintail, Common Teal, Garganey and Purple Swamphen. Rare globally threatened species have also returned to the area: several Pallas's Fish Eagle and Greater Spotted Eagle (both vulnerable) now spend the winter here, as

do the near-threatened Black-headed Ibis and Ferruginous Pochard. Overall 147 species of bird had been recorded in Hail Haor up to February 2000, but by April 2007 an additional 22 species had been added, the includes five total threatened and seven near-threatened species.



# Supporting tables

Fish Species Diversity of H	all Haor by year (based on sample of fishers'	s' catches in monitored areas)						
Species (BengaliName)	Species (Scientific Name)	Base line	Imp act-1	Imp act-2	Imp act-3	Imp act-4	Imp act-5	Imp act-6
Jat Puti	Puntius sophore							
Kanchan Puti	Puntius conchonius				$\checkmark$	$\checkmark$		
Tit Puti	Puntius ticto	$\checkmark$			$\checkmark$	$\checkmark$		
Jhili Puti	Puntius gelius							
Futani Puti	Puntius phutunio					X	X	X
Teri Puti	Puntius terio	V	X	X	V		X	
Mola Puti	Puntius guganio	X	X	V	V	X		V
Shar Puti	Puntius sarana	X	X			X		
Chola Puti	Puntius chola			X	V			V
Thai Shor Puti	Puntius gonionotus	V			V	V		V
Bagha Puti	Puntius stigma	x	x	x	, V	x	x	, v
Mola	Amblypharyngodon mola	1	1	1	v V	1	1	V
Dhela	Amblypharyngodon microlenis	x	x	x	x	N	x	x
Chala	Orvagstar pholo	1		1	N	1	1	A N
Chen Chela	Chola laubuca	N N	N N	N	N N	N N	2	N N
Ranga Chanda	Chenda nanga	N	N	N	N	N	N	N
Lamba Chanda	Chanda ranga	N	N	N	N	N	N	N
		N	N	N	N	N	N	N
Gol Chanda	Chanda baculis	N	N	N	N	N	N	N
	Gudusia chapra	N	N	N	N	N	N	N
Knalisna		N	N	N	N	N	N	N
Lal Khalisha	Colisa lalius	N	N	N	N	N	N	N
Chuna Khalisha	Colisa laboisa	N	N	N	N	N	N	N
Dankina	Rasbora daniconius	N	N	N	N	N	N	N
Meni/Bheda	Nandus nandus	N	N	N	N	N	N	N
Koi	Anabas testudineus	N	N	N	N	N	N	N
Kali/Napti Koi	Badis badis	V	V	V	V	V	V	V
Bele	Glossogobius giurius							V
Rani	Botia dario					√	√	
Kachki	Corica soborna		X	X	X	X		X
Kaikla	Xenentodon cancila		$\checkmark$	$\checkmark$				
Poa	Pama pama	Х		Х			Х	Х
Gutum	Lepiodocephalus guntea							
Khalla/Kharshulla	Mugil corsula	X	X		Х	X	Х	X
Tin Chokha	Aplocheilus panchax	$\checkmark$			$\checkmark$	$\checkmark$		$\checkmark$
Boro Baim	Mastacembelus armatus	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$		
Guchi Baim	Mastacembelus pancalus	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$		
Tara Baim	Macrognathus aculeatus							
Kuicha	Cuchia cuchia							
Taki	Channa punctatus							
Shol	Channa striata							
Gojar	Channa marulius	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$		
Cheng	Channa gachua							
Nailotika	Oreochromis niloticus	X	X	Х	Х	Х		
Vangra	Labeo boga		X		X	X	X	X
Goinna	Laheo gonius	V		V		V		
Tatkini	Crossocheilus latius	X		X	X	X		X
Raek	Cirrhinus reha	X	x	X	11	X	√	X
Air	Mystus aor	N V	N N	X	V	N V	N	N V
Guzi air/Guzkata	Mystus seenohala	x	v	X	x	1	x	x v
Batasi	Clunisoma (Pseudentronious) athorrinoidas			x X		v	1	
Bairi Tengra	Mustus tangara	$\frac{\Lambda}{}$		N N	1		2	
Golea	Mystus heakari	N	N N	N N	N 1	1	1	N
Tengra	Mustus vittatus	N	N	N	1		1	N
ICHIGIA	IVIVSIUS VIIIUIUS	I V	I N	I V	I V	I V	I V	N 1

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Species (BengaliName)	Species (Scientific Name)	Base line	Imp act-1	Imp act-2	Imp act-3	Imp act-4	Imp act-5	Imp act-6
Kabasi Tengra	Mystus cavasius	X	Х	X				
Bacha	Eutropiichthys vacha	1						X
Baspata/Kazuli	Danio devario	X	X	Х		X	X	X
Boal	Wallago attu	1				$\checkmark$		$\checkmark$
Rita	Rita rita	X	X	Х	X	X		X
Thai Pangas	Pangasius sutchi	X	X	Х		X		X
Kani Pabda	Ompok bimaculatus	1						
Pabda/Madhu Pabda/	Ompok pabda	1						
Kowakata/Ghorakata	1 1							
Chaka/Gangina/Kowakata	Chaka chaka	1				$\checkmark$		$\checkmark$
Shing	Heteropneustes fossilis	1				$\checkmark$	$\checkmark$	
Magur	Clarius batrachus	1						
African Magur	Clarias gariepinus	X		Х	Х	Х	Х	X
Chital	Notopterus chitala	X	Х	Х			Х	
Foli	Notopterus notopoterus	1				$\checkmark$		
Hilsha (Jatka)	Tenualosa ilisha	X	Х	Х	Х	Х		X
Telapia	Oreochromis (Telapia) mossambicus	1				X		
Rui	Labeo rohita	1				$\checkmark$		$\checkmark$
Catla	Catla catla	1	X			$\checkmark$		
Mrigel	Cirrhinus mrigala	1						
Kalibaush	Labeo calbasu	1						
Silver Carp	Hypophthalmichthys molitrix	X		X				
Grass Carp	Ctenopharvngodon idellus	1	V					
Miror Carp	Cyprinus carpio	X	V	X	X	X		
Comon Carp/Karfu	Cyprinus carpio	1	V					
Bighead Carp	Aristechthys nobilis	X	X	X		X		
Gura Echa	Macrobrachium lamrrei	1						
Golda Echa	Macrobrachium rosenbergii	X	X	X	X	X		
Narkeli Chela	Oxygaster bacalia	1				X		X
Naftani/Berkul	Osphronemus(Ctenops) nobilis	1						
Ghaura	Clupisoma garua	V	X	X	X	X	X	X
Tepa/Futkora	Tetraodon cutcutia	V	V		V			
Buth Koi/Bali Chata/Balitora	Nemacheilus batia	X	V		X	X		X
Satka Chingri	Macrobrachium malcolmsonii	X	X				X	
Dimua/Kathalia Echa	Macrobrachium villosimanus	1		X	V	V		V
Thengua Echa	Macrobrachium birmanicus	V	V	V	V	V	V	V
Elong	Rasbora elanga	1	X	X	X	X		X
Gora Gutum/Ganga Shagor	Somelentes gongota	- V		1	X			
Boiragi Echa	Prawn Sn		X	X	X	X	X	X
Reckha Kholisha	Colisa sota	V V	V	1				
Sheild Kholisha	Colisa labiosus	- V	V	v V	X	X	X	X
Kecho Bime	Ophichthys boro	- V	X	X	X	X	X	X
Potka	Tetraodon patoca	- V		V		X	X	
Senia (Eusufi)	Gagata cenia	X	, √	, V	X	X	X	X
Moa	Rohtee cotio	X	√	√		X	1	x
Afila	Gudusia variegata	X	x	X	X	X	, √	
Ful Chela	Salmostoma phulo	X	X	X	X	X	X	, V
Navan bali		X	X	X	X	X	X	, V
Total		71	71	69	76	67	81	75

#### Species Diversity Comparison of Turag Bongshi by different Intervention

Species (BengaliName)	Species (Scientific Name)	Base	Imp	Imp	Imp	Imp	Imp	Imp
A frican Magur	Clarias garianinus	Time V	act-1	act-2 X	act-3	X	X	X
Air	Mustus gar		1	X V	1			A N
Racha	Futroniichthys vacha	1	2	1	N N	1	1	2
Bagha Air	Bagarius bagarius	1	2	1	2	1	1	N
Dagha All	Dugarius ougarius	N	N	1	N	N N	N	N N
Dagila Futi	Funitus stigmu	v	v	N	N	N	N N	N
Bajri Tengra	Mysius lengara		<u> </u>	N	N	N	N	N
	Danio devario	N	N	N	N	N	V	N
Datasi	Chapter a him a invite	N	N	N	N	N	A	N
Bele Dishard Com	Giossogodius giurius	V V		V	N	V V	N	V V
Bignead Carp	Aristechinys hobilis	A	<u> </u>	<u> </u>	N	A	N	A
Boal	Wallago attu	N	N	N	N	N	N	N
Boro Baim	Mastacembelus armatus	N	N	N	N	N	N	N V
Buth Koi/Bali Chata/Balitora	Nemacheilus batia	N	N	N	N	N	N	X
Catla	Catla catla	N	N	N	N	N	N	N
Chaka/Gangina/Kowakata	Chaka chaka	N	N	N	N	N	X	N
Chapila	Gudusia chapra	N	N	N	N	N	N	N
Chela	Oxygaster pholo	V	N	N	N	V	V	N
Cheng	Channa gachua	$\checkmark$			√			V
Chenua	Sisor rhabdophorus	X	X	X	√		X	X
Chep Chela	Chela laubuca	$\checkmark$	X	Х	X	$\checkmark$	$\checkmark$	
Chital	Notopterus chitala	X	Х	Х	$\checkmark$	X	$\checkmark$	
Chola Puti	Puntius chola							
Chuna Khalisha	Colisa laboisa	$\checkmark$						
Comon Carp/Karfu	Cyprinus carpio	$\checkmark$				$\checkmark$	$\checkmark$	
Dankina	Rasbora daniconius	$\checkmark$				$\checkmark$	$\checkmark$	
Dhela	Amblypharyngodon microlepis							
Dimua/Kathalia Echa	Macrobrachium villosimanus							
Fesha	Raconda russeliana		Х	Х		X	X	Х
Foli	Notopterus notopoterus	$\checkmark$				$\checkmark$		
Futani Puti	Puntius phutunio		Х	Х	Х	X	X	Х
Gang Tengra	Gagata viridescens	X	Х		Х	X	X	Х
GangChela/Ghora Chel	Oxygaster gora		Х					
Ghaura	Clupisoma garua							
Goinna	Labeo gonius	X	X	X				
Gojar	Channa marulius	X				X		V
Gol Chanda	Chanda baculis		V	V	V			V
Golda Echa	Macrobrachium rosenbergii	V	V	V	V	V		V
Golsa	Mystus hleekeri	V		V	V	V V		V
Gora Gutum/Ganga Shagor	Somelentes gongota	, V	√	, V	, V	, V	v V	, V
Grass Carp	Ctenopharvngodon idellus	x	√	, , ,	, V	, v	, V	, V
Guchi Baim	Mastacembelus pancalus	1	√	, ,	, v	, v	v v	, √
Guori Bila	Brachygohius nunus	V	N	1	N	V	V	x
Gura Echa	Macrobrachium lamrrei	N N	N	1	N	1	1	$\frac{\Lambda}{}$
Guta Echa	I enjodocenhalus guntea	1	1	1	1	N N	N N	2
Guzi air/Guzkata	Lepiodocephalas gumed	N N	v	1	N N	N N	N N	N
Hilsha (Jatka)	Tomuloga ilisha	N		1	N	N	N	N
Inisila (JatKa)	Punting conhone	N	N	1	N	N	N	N
Jai Puli	Puntus sophore	N	N	N	N	N	N	N
Jiili Fuu Kabagi Tangga	r unitus genus		v v	N	N		N N	N V
Kabasi Tengra	Mystus cavasius	X	X	N	N	X	N	X
Kachki	Corica soborna	N	N	N	N	<b>∖</b>	N I	N
Kaikla	Xenentodon cancila	N,	N,	N	N	N,	N,	N
Kalı/Naptı Koi	Badıs badis	N,	N	N	N .	<u></u>	N,	N
Kalibaush	Labeo calbasu	ν,	N	N	N	\	ν,	٦
Kanchan Puti	Puntius conchonius	1	N	N	√	↓ V	ν	X
Kani Pabda	Ompok bimaculatus	√	√	N	√	√	X	X
Khalisha	Colisa fasciatus	√		$\checkmark$	$$	√	√	$\checkmark$
Species (BengaliName)	Species (Scientific Name)	Base line	Imp act-1	Imp act-2	Imp act-3	Imp act-4	Imp act-5	Imp act-6
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Khalla/Kharshulla	Mugil corsula							
Koi	Anabas testudineus							
Kuicha	Cuchia cuchia			Х				
Lal Khalisha	Colisa lalius							
Lamba Chanda	Chanda nama							
Magur	Clarius batrachus							
Mamoli Chapila	Gonialosa manminna	X					X	X
Meni/Bheda	Nandus nandus	X						
Miror Carp	Cyprinus carpio	X						
Mola	Amblypharyngodon mola							
Mola Puti	Puntius guganio	X	X			X	X	X
Mrigel	Cirrhinus mrigala							
Naftani/Berkul	Osphronemus(Ctenops) nobilis		X	Х	X	X	X	X
Narkeli Chela	Oxygaster bacalia		X	Х	X	X	X	X
Nayan bali	Aspidoparia jaya				$\checkmark$		$\checkmark$	
Pabda/Madhu Pabda/	Ompok pabda				$\checkmark$		$\checkmark$	
Kowakata/Ghorakata								
Peali	Aspidoparia morar		$\checkmark$		$\checkmark$	√	$\checkmark$	
Peashi	Conta conta	$\checkmark$	$\checkmark$		$\checkmark$		$\checkmark$	$\checkmark$
Poa	Pama pama	$\checkmark$	$\checkmark$		$\checkmark$	√	$\checkmark$	
Potka	Tetraodon patoca	$\checkmark$			X	√	$\checkmark$	
Putul	Botia lohachata	$\checkmark$	X	Х	Х	X	X	X
Ranga Chanda	Chanda ranga	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Rani	Botia dario	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Rita	Rita rita	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Rui	Labeo rohita	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Satka Chingri	Macrobrachium malcolmsonii	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Senia (Eusufi)	Gagata cenia	X	X		$\checkmark$		$\checkmark$	$\checkmark$
Shar Puti	Puntius sarana	X	X	Х	$\checkmark$		X	$\checkmark$
Shing	Heteropneustes fossilis	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Shol	Channa striata	$\checkmark$			$\checkmark$	√	$\checkmark$	
Silong	Silonia silondia	$\checkmark$	$\checkmark$		$\checkmark$	X	X	$\checkmark$
Silver Carp	Hypophthalmichthys molitrix	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Taki	Channa punctatus	$\checkmark$	$\checkmark$		$\checkmark$	√	$\checkmark$	
Tara Baim	Macrognathus aculeatus							
Tatkini	Crossocheilus latius		$\checkmark$	$\checkmark$	$\checkmark$	√	$\checkmark$	
Telapia	Oreochromis (Telapia) mossambicus	$\checkmark$			$\checkmark$	√	$\checkmark$	
Tengra	Mystus vittatus		$\checkmark$				$\checkmark$	
Tengra (Batasio)	Batasio batasio	X	$\checkmark$	Х	$\checkmark$	X	X	X
Tepa/Futkora	Tetraodon cutcutia	$\checkmark$	$\checkmark$		$\checkmark$	√	$\checkmark$	
Teri Puti	Puntius terio	X	X	Х	Х			
Thai Pangas	Pangasius sutchi	X	X		Х	X	$\checkmark$	X
Thai Shor Puti	Puntius gonionotus	$\checkmark$	$\checkmark$				$\checkmark$	$\checkmark$
Tin Chokha	Aplocheilus panchax	$\checkmark$	$\checkmark$				$\checkmark$	$\checkmark$
Tit Puti	Puntius ticto	$\checkmark$					$\checkmark$	
Vangra	Labeo boga				Х	X	$\checkmark$	
Total		82	81	86	91	85	85	83

Species (BengaliName)	Species (Scientific Name)	Base	Imp	Imp	Imp	Imp	Imp
		line	act-1	act-2	act-3	act-4	act-5
Jat Puti	Puntius sophore	√		√	$\checkmark$	$\checkmark$	
Kanchan Puti	Puntius conchonius	√	$\checkmark$	√		$\checkmark$	$\checkmark$
Tit Puti	Puntius ticto		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	
Jhili Puti	Puntius gelius		Х	X	$\checkmark$	$\checkmark$	Х
Futani Puti	Puntius phutunio	X	Х		X	X	Х
Teri Puti	Puntius terio	X	Х	X		$\checkmark$	Х
Mola Puti	Puntius guganio		Х	X	X	X	X
Shar Puti	Puntius sarana						
Chital	Puntius chola	X	X	X	X		
Thai Shor Puti	Puntius gonionotus						
Bagha Puti	Puntius stigma	X					
Mola	Amblypharyngodon mola		V	√ √	V	√.	V
Dhela	Amblypharyngodon microlenis	, v	, V	, v	x	v v	, V
Chela	Orvgaster pholo	, v	, V	, v	11	v v	, ,
Chen Chela	Chela laubuca	l v	V	J J	V	V	v v
Ranga Chanda	Chanda ranga	N N	N N	l v	N N	N N	N
Lamba Chanda	Chanda nama	N N	N N	N N	N	N	1
Col Chanda	Chanda hama Chanda hamilia	N N	N		N N	N	2
Chanila	Cualita dacuits	N	N	N	V V	N	N
	Guausia chapra	N	N	N	A	N	N
Knalisna	Colisa fasciatus	N N	N	N N	N	N	N
Lal Khalisha	Colisa lalius	N	N	N	N	N	N
Chola Puti	Colisa laboisa	N	X	N N	X	X	X
Comon Carp/Karfu	Rasbora daniconius	N	N	N	N	N	N
Meni/Bheda	Nandus nandus	X	X	√	V	V	V
Koi	Anabas testudineus			√			
Kali/Napti Koi	Badis badis	√	$\checkmark$	√		$\checkmark$	
Bele	Glossogobius giurius	√	$\checkmark$	√		$\checkmark$	
Rani	Botia dario						Х
Kaikla	Xenentodon cancila		$\checkmark$	√		$\checkmark$	
Poa	Pama pama	X	$\checkmark$		X	X	
Gutum	Lepiodocephalus guntea						
Khalla/Kharshulla	Mugil corsula	X	Х	X			Х
Tin Chokha	Aplocheilus panchax		Х				X
Boro Baim	Mastacembelus armatus					$\checkmark$	
Guchi Baim	Mastacembelus pancalus		$\checkmark$			$\checkmark$	
Tara Baim	Macrognathus aculeatus						
Kuicha	Cuchia cuchia						
Taki	Channa punctatus	V	V				V
Shol	Channa striata	X	, V	, V	, V	, V	, V
Goiar	Channa marulius	X	, V	, V	X	X	, V
Cheng	Channa gachua	1	, V	, v	1	1	1
Bata	Laboo hata	1	N	N N	1	N	2
Nailotika	Creachromic niloticus	v	v	v	N	N	1
Vanara					N N	N	N
Valigia		v	<u> </u>	N N	N N	N	N
	Labeo gontus	Λ	N	N	N	N	N
		V	N	N	V V	V V	V
Kaek	Cirrninus reba	X	N	N	X	X	X
INANGII	Labeo nanaina	<u>ν</u>	٧	۱ ۲	N N	N,	N
Air	Mystus aor	<u>۷</u>	X			N I	X
Guzi air/Guzkata	Mystus seenghala		X	N N	N	N,	N
Bagha Air	Bagarius bagarius	<u></u>	X		X	√	N
Batasi	Clupisoma (Pseudentropious) atherrinoides	V		↓ V		√	√.
Bajri Tengra	Mystus tengara	X	X	↓ V			N
Golsa	Mystus bleekeri						
Tengra	Mystus vittatus		$\checkmark$		$\checkmark$	$\checkmark$	
Kabasi Tengra	Mystus cavasius	X		X	X	X	X

#### Species Diversity Comparison of Kongshow Malijhee by different Intervention

Species (BengaliName)	Species (Scientific Name)	Base line	Imp act-1	Imp act-2	Imp act-3	Imp act-4	Imp act-5
Bacha	Eutropiichthys vacha	X	Х	X			
Baspata/Kazuli	Danio devario	X	Х	X			Х
Boal	Wallago attu	1					
Thai Pangas	Pangasius sutchi	X		$\checkmark$			Х
Silong	Silonia silondia	X	Х	$\checkmark$	X	Х	Х
Gang Magur	Plotosus canius	X	Х	X			X
Kani Pabda	Ompok bimaculatus	1	X	X			
Pabda/Madhu Pabda/	Ompok pabda	1		$\checkmark$			
Kowakata/Ghorakata							
Chaka/Gangina/Kowakata	Chaka chaka	X	X	X			X
Shing	Heteropneustes fossilis						
Magur	Clarius batrachus						
African Magur	Clarias gariepinus	X	$\checkmark$	X	X		X
Foli	Notopterus notopoterus		$\checkmark$	√			$\checkmark$
Hilsha (Jatka)	Tenualosa ilisha	X	$\checkmark$	$\checkmark$	$\checkmark$		Х
Telapia	Oreochromis (Telapia) mossambicus	X	$\checkmark$	$\checkmark$	$\checkmark$		Х
Rui	Labeo rohita	1	$\checkmark$	$\checkmark$	$\checkmark$		
Catla	Catla catla	V	$\checkmark$				
Mrigel	Cirrhinus mrigala	1					
Kalibaush	Labeo calbasu	1					
Silver Carp	Hypophthalmichthys molitrix	√					
Grass Carp	Ctenopharyngodon idellus	√					
Miror Carp	Cyprinus carpio	1					Х
Chuna Khalisha	Cyprinus carpio	1					
Bighead Carp	Aristechthys nobilis	X	Х		X	Х	
Gura Echa	Macrobrachium lamrrei	1					
Golda Echa	Macrobrachium rosenbergii	1		X			
Naftani/Berkul	Osphronemus(Ctenops) nobilis	X		X			Х
Ghaura	Clupisoma garua	1		X	X		
Tepa/Futkora	Tetraodon cutcutia	1					
Dimua/Kathalia Echa	Macrobrachium villosimanus	X	Х	X		Х	Х
Gora Gutum/Ganga Shagor	Someleptes gongota	1					
Gugri Bila	Brachygobius nunus	X	Х		X		Х
Potka	Tetraodon patoca	1	Х	X	X	X	Х
Senia (Eusufi)	Gagata cenia	X		X	X	Х	Х
GangChela/Ghora Chel	Oxygaster gora	1	Х				
Batai	Pseudentropious atherrinoides	1		X	X		X
Dankina	Rasbora daniconius	1		$\checkmark$			
Elong		X	X	X	X		X
Narkeli Chela	Oxygaster bacalia	X	Х	X	X	X	$\checkmark$
Rita	Rita rita	X	Х	X	X		X
Tengra (Batasio)	Batasio batasio	X	Х	X	X		X
Total		64	67	71	73	84	68

Annual catch composition - Hail Haor, Sreemongal (sample catch and percentage by weigh
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Species	Baselin	e	Impact	·1	Impact-	-2	Impact	-3	Impact	-4	Impact-	-5	Impcat-	-6
	kg	%	kg	%	kg	%	kg	%	kg	%	kg	%	kg	%
Total	200,893	100	240,780	100	223,992	100	337,345	100	190,022	100	456,353	100	300,622	100
Small Fish	133,788.9	66.6	166,704.3	69.2	118,133.1	52.7	168,227.6	49.9	93,614.9	49.3	187,654.9	41.1	111,456.3	37.1
Jat Puti	28,670.8	14.3	39,849.7	16.6	26,404.3	11.8	39,824.9	11.8	15,212.2	8.0	43,520.9	9.5	24,098.0	8.0
Kanchan Puti	354.5	0.2	4,012.0	1.7	5,437.9	2.4	7,274.7	2.2	4,466.2	2.4	7,159.7	1.6	3,133.8	1.0
Tit Puti	1,189.1	0.6	2,077.5	0.9	3,141.1	1.4	3,237.1	1.0	3,849.2	2.0	5,760.6	1.3	2,461.3	0.8
Jhili Puti	683.0	0.3	1,619.5	0.7	595.2	0.3	420.9	0.1	1,566.7	0.8	3,616.0	0.8	1,367.3	0.5
Futani Puti	241.3	0.1	434.5	0.2	56.2	0.0	56.2	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Teri Puti	63.1	0.0	0.00	0.0	0.00	0.0	0.5	0.0	3.3	0.0	0.00	0.0	1.1	0.0
Mola Puti	0.00	0.0	0.00	0.0	70.7	0.0	0.2	0.0	0.00	0.0	30.5	0.0	1.9	0.0
Shar Puti	0.00	0.0	0.00	0.0	1,507.1	0.7	689.9	0.2	0.00	0.0	89.6	0.0	31.1	0.0
Chola Puti	11.2	0.0	7.0	0.0	0.00	0.0	85.3	0.0	1.9	0.0	391.8	0.1	1,487.1	0.5
Bagha Puti	0.00	0.0	0.00	0.0	0.00	0.0	2.1	0.0	0.00	0.0	0.00	0.0	21.9	0.0
Mola	15,564.5	7.7	56,457.1	23.4	7,221.3	3.2	8,507.0	2.5	1,321.5	0.7	8,092.8	1.8	2,722.7	0.9
Dhela	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	2.1	0.0	0.00	0.0	0.00	0.0
Chela	808.4	0.4	2,007.2	0.8	566.8	0.3	1,246.9	0.4	216.7	0.1	4,459.3	1.0	453.0	0.2
Chep Chela	36.2	0.0	140.8	0.1	0.6	0.0	22.3	0.0	15.0	0.0	72.0	0.0	0.2	0.0
Ranga Chanda	983.6	0.5	5,345.3	2.2	1,009.1	0.5	1,593.5	0.5	819.2	0.4	1,815.2	0.4	912.6	0.3
Lamba Chanda	290.2	0.1	1,027.6	0.4	1,031.6	0.5	1,913.8	0.6	1,575.2	0.8	4,907.0	1.1	2,611.4	0.9
Gol Chanda	966.8	0.5	2,334.8	1.0	3,475.4	1.6	6,054.6	1.8	4,445.8	2.3	8,632.3	1.9	4,123.1	1.4
Chapila	0.7	0.0	27.9	0.0	36.2	0.0	168.2	0.0	5.3	0.0	792.3	0.2	1.0	0.0
Khalisha	27,406.0	13.6	8,528.6	3.5	13,456.0	6.0	23,205.1	6.9	18,534.7	9.8	17,921.9	3.9	13,490.1	4.5
Lal Khalisha	2,872.8	1.4	1,782.8	0.7	1,123.1	0.5	2,601.5	0.8	1,199.3	0.6	2,336.9	0.5	571.2	0.2
Chuna Khalisha	3,696.4	1.8	3,521.1	1.5	4,071.8	1.8	3,888.2	1.2	2,582.7	1.4	3,633.3	0.8	2,557.8	0.9
Dankina	1,849.0	0.9	3,759.9	1.6	3,182.3	1.4	5,747.8	1.7	2,600.7	1.4	6,417.6	1.4	1,833.8	0.6
Meni/Bheda	25,677.1	12.8	16,084.8	6.7	19,274.7	8.6	25,254.1	7.5	16,469.7	8.7	24,025.7	5.3	19,583.3	6.5
Коі	17,285.4	8.6	1,559.7	0.6	4,439.6	2.0	6,329.8	1.9	4,508.0	2.4	3,424.8	0.8	5,314.5	1.8
Kali/Napti Koi	308.0	0.2	802.6	0.3	1,543.6	0.7	1,906.5	0.6	1,393.9	0.7	1,446.1	0.3	1,325.0	0.4
Bele	203.7	0.1	2,808.5	1.2	5,402.4	2.4	4,543.9	1.3	2,348.8	1.2	11,806.7	2.6	8,421.8	2.8
Rani	0.5	0.0	18.3	0.0	27.9	0.0	274.7	0.1	17.8	0.0	430.4	0.1	0.1	0.0
Kachki	9.8	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	6.2	0.0	0.00	0.0
Kaikla	2,864.0	1.4	7,518.1	3.1	6,500.8	2.9	14,659.9	4.3	6,667.3	3.5	14,174.0	3.1	6,376.9	2.1
Poa	0.00	0.0	23.6	0.0	0.00	0.0	15.0	0.0	3.6	0.0	0.00	0.0	0.00	0.0
Gutum	841.3	0.4	1,547.8	0.6	3,683.1	1.6	3,411.2	1.0	1,500.9	0.8	3,822.0	0.8	3,463.3	1.2
Khalla/ Kharshulla	0.00	0.0	0.00	0.0	32.9	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Tin Chokha	5.0	0.0	39.6	0.0	129.8	0.1	111.5	0.0	60.8	0.0	270.2	0.1	27.4	0.0
Narkeli Chela	0.0	0.0	0.6	0.0	54.0	0.0	1.0	0.0	0.00	0.0	5.3	0.0	0.00	0.0
Naftani/ Berkul	1.8	0.0	215.4	0.1	618.3	0.3	1,290.0	0.4	492.8	0.3	1,517.8	0.3	558.0	0.2
Tepa/Futkora	538.5	0.3	2,459.0	1.0	2,632.5	1.2	3,685.1	1.1	1,652.2	0.9	6,849.7	1.5	4,427.5	1.5
Buth Koi/Bali Chata/ Balitora	0.00	0.0	0.6	0.0	16.4	0.0	0.00	0.0	0.00	0.0	32.1	0.0	0.00	0.0
Elong	49.4	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.1	0.0	0.00	0.0
Gora Gutum/ Ganga Shagor	31.0	0.0	138.3	0.1	0.1	0.0	0.00	0.0	0.6	0.0	6.5	0.0	17.1	0.0
Ful Chela	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	3.2	0.0
Reckha Kholisha	204.8	0.1	296.2	0.1	184.8	0.1	8.8	0.0	80.7	0.0	157.8	0.0	44.2	0.0
Sheild Kholisha	40.5	0.0	8.0	0.0	20.2	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Potka	40.2	0.0	219.3	0.1	1,141.9	0.5	194.9	0.1	0.00	0.0	0.00	0.0	11.3	0.0
Moa	0.00	0.0	30.8	0.0	43.6	0.0	0.3	0.0	0.00	0.0	27.3	0.0	0.00	0.0
Afila	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	2.3	0.0	2.1	0.0
Major Carp	652.8	0.3	3,730.5	1.5	4,443.3	2.0	11,624.5	3.4	6,277.2	3.3	71,313.6	15.6	29,050.0	9.7
Rui	308.5	0.2	3,269.7	1.4	3,577.8	1.6	7,482.6	2.2	4,200.3	2.2	25,943.1	5.7	23,681.6	7.9
Catla	2.4	0.0	0.00	0.0	292.8	0.1	1,891.3	0.6	888.5	0.5	35,606.2	7.8	2,668.5	0.9

Species	Baselin	e	Impact-	-1	Impact-	-2	Impact	-3	Impact	:-4	Impact-	-5	Impcat-	-6
	kg	%	kg	%	kg	%	kg	%	kg	%	kg	%	kg	%
Mrigel	107.8	0.1	320.4	0.1	294.1	0.1	1,275.4	0.4	754.0	0.4	5,866.4	1.3	1,167.6	0.4
Kalibaush	234.0	0.1	140.5	0.1	278.7	0.1	975.2	0.3	434.3	0.2	3,898.0	0.9	1,532.3	0.5
Minor Carp	165.4	0.1	508.7	0.2	2,666.3	1.2	5,473.7	1.6	1,066.5	0.6	5,762.3	1.3	7,527.8	2.5
Vangra	20.6	0.0	0.00	0.0	110.7	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Goinna	144.8	0.1	486.8	0.2	2,555.7	1.1	5,470.9	1.6	1,066.5	0.6	5,421.5	1.2	7,527.8	2.5
Tatkini	0.00	0.0	21.9	0.0	0.00	0.0	0.00	0.0	0.00	0.0	1.7	0.0	0.00	0.0
Raek	0.00	0.0	0.00	0.0	0.00	0.0	2.8	0.0	0.00	0.0	339.1	0.1	0.00	0.0
Small Cat Fish	13,317.0	6.6	20,864.7	8.7	26,346.7	11.8	46,066.7	13.7	21,651.3	11.4	45,483.1	10.0	28,074.2	9.3
Batasi	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	5.2	0.0	0.00	0.0
Bajri Tengra	46.5	0.0	1,111.5	0.5	1,128.9	0.5	1,684.2	0.5	1,799.9	0.9	6,924.4	1.5	2,980.6	1.0
Golsa	271.5	0.1	1,510.0	0.6	3,945.0	1.8	1,335.2	0.4	338.1	0.2	1,546.3	0.3	192.5	0.1
Tengra	6,708.6	3.3	10,318.3	4.3	6,119.5	2.7	22,102.9	6.6	6,609.2	3.5	13,641.0	3.0	8,374.2	2.8
Kabasi Tengra	0.00	0.0	0.00	0.0	0.00	0.0	918.4	0.3	846.5	0.4	3,604.6	0.8	1,040.0	0.3
Bacha	0.4	0.0	1.1	0.0	27.0	0.0	12.2	0.0	6.3	0.0	442.0	0.1	0.00	0.0
Baspata/ Kazuli	0.00	0.0	0.00	0.0	0.00	0.0	2.0	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Kani Pabda	203.9	0.1	761.0	0.3	2,847.5	1.3	3,901.2	1.2	2,101.4	1.1	9,174.4	2.0	3,256.6	1.1
Pabda/Madhu Pabda/	18.4	0.0	228.1	0.1	107.4	0.0	915.4	0.3	315.7	0.2	970.7	0.2	582.3	0.2
Chaka/ Gangina/ Kowakata	52.9	0.0	0.6	0.0	4.9	0.0	140.6	0.0	13.3	0.0	14.6	0.0	39.7	0.0
Shing	4,819.3	2.4	3,608.2	1.5	6,388.2	2.9	6,381.7	1.9	4,622.9	2.4	4,630.5	1.0	6,109.4	2.0
Magur	1,195.4	0.6	3,315.9	1.4	5,704.4	2.5	8,673.0	2.6	4,997.9	2.6	4,529.4	1.0	5,498.9	1.8
Ghaura	0.1	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Senia (Eusufi)	0.00	0.0	10.1	0.0	74.0	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Large Cat Fish	17,457.3	8.7	3,193.6	1.3	5,420.0	2.4	5,280.1	1.6	1,174.6	0.6	28,331.2	6.2	7,685.8	2.6
Air	243.0	0.1	8.1	0.0	0.00	0.0	289.2	0.1	57.2	0.0	446.7	0.1	229.8	0.1
Guzi air/ Guzkata	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	13.4	0.0	0.00	0.0	0.00	0.0
Boal	17,214.3	8.6	3,185.5	1.3	5,420.0	2.4	4,975.7	1.5	1,104.0	0.6	27,525.5	6.0	7,456.0	2.5
Rita	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	29.0	0.0	0.00	0.0
Pangas	0.00	0.0	0.00	0.0	0.00	0.0	15.2	0.0	0.00	0.0	329.9	0.1	0.00	0.0
Eels	6,192.1	3.1	9,335.4	3.9	9,388.2	4.2	16,252.4	4.8	8,113.8	4.3	22,187.9	4.9	21,543.7	7.2
Boro Baim	254.8	0.1	1,368.2	0.6	1,367.0	0.6	2,164.6	0.6	1,491.7	0.8	5,455.5	1.2	4,269.0	1.4
Guchi Baim	3,080.7	1.5	5,959.2	2.5	6,996.0	3.1	10,663.4	3.2	5,002.0	2.6	9,820.1	2.2	13,747.5	4.6
Tara Baim	2,613.4	1.3	1,648.7	0.7	675.8	0.3	3,278.6	1.0	1,570.0	0.8	6,502.9	1.4	2,668.5	0.9
Kuicha	243.0	0.1	359.4	0.1	349.3	0.2	145.9	0.0	50.1	0.0	409.4	0.1	858.6	0.3
Kecho Bime	0.2	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Snakeheads	24,593.9	12.2	19,594.6	8.1	35,123.2	15.7	48,134.3	14.3	41,302.2	21.7	40,984.1	9.0	63,571.0	21.1
Taki	16,419.2	8.2	11,990.3	5.0	19,788.5	8.8	23,930.1	7.1	12,412.2	6.5	14,755.5	3.2	18,728.9	6.2
Shol	6,173.4	3.1	4,329.8	1.8	9,274.4	4.1	14,868.1	4.4	14,682.8	7.7	12,996.1	2.8	20,819.8	6.9
Gojar	1,335.4	0.7	3,238.9	1.3	5,428.4	2.4	8,439.8	2.5	13,434.7	7.1	13,107.3	2.9	23,795.1	7.9
Cheng	665.9	0.3	35.6	0.0	631.9	0.3	896.3	0.3	//2.6	0.4	125.1	0.0	227.1	0.1
Prawns Cura Echo	2,658.9	1.3	8,037.5	3.3	10,255.8	4.6	8,218.5	2.4	6,322.0	3.3	4 714 2	2.5	14,662.3	4.9
Gulda Echa	2,418.8	1.2	2,384.3	1.1	4,549.1	2.0	3,498.9	1.0	2,334.0	1.2	4,/14.2	1.0	0,884.0	2.3
Satka Chingri	0.00	0.0	0.00	0.0	7500	0.0	222 /	0.0	105.0	0.0	0.0	0.0	5.2	0.0
Dimua/	0.00	0.0	0.00	0.0	730.9	0.5	255.4	0.1	195.0	0.1	0.00	0.0	5.5	0.0
Kathalia Echa	1.5	0.0	2.9	0.0	0.00	0.0	3.3	0.0	69.5	0.0	2.7	0.0	4.8	0.0
I hengua Echa	236.9	0.1	5,450.0	2.3	4,947.8	2.2	4,482.8	1.3	3,722.9	2.0	6,884.6	1.5	7,767.2	2.6
Boiragi Echa	1.8	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Thei Shor Dut	110.0	0.1	164.2	0.3	3,315.3	1.5	1,331.3	2.2	3,305.6	1.7	33,109.1	/.3	1,008.5	2.4
Nailotika	/4.4	0.0	104.2	0.1	0.00	0.0	1,832.3	0.5	329.0	0.2	3,037.9	0.8	043.0 20 5	0.3
A frican Magur	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	133.0	0.0	58.5	0.0
Telania	10.00	0.0	5.0	0.0	112.5	0.0	72 8	0.0	0.00	0.0	371 /	0.0	270.8	0.0
Silver Carp	0.00	0.0	15 7	0.0	0.00	0.1	981.5	0.0	97.5	0.0	6 854 0	1.5	210.8	0.1
	0.00	0.0	10.7	0.0	0.00	0.0	201.2	0.5	,,,,	0.1	5,051.7	1.5	2.1.1.2	U.1

Species	Baselin	e	Impact-	npact-1 Impact-2 Impact-3		Impact-4		Impact-5		Impcat-6				
	kg	%	kg	%	kg	%	kg	%	kg	%	kg	%	kg	%
Grass Carp	9.8	0.0	76.0	0.0	1,268.4	0.6	1,130.5	0.3	1,142.8	0.6	8,228.2	1.8	1,060.6	0.4
Miror Carp	0.00	0.0	18.0	0.0	0.00	0.0	0.00	0.0	0.00	0.0	19.0	0.0	740.9	0.2
Comon Carp/Karfu	12.7	0.0	394.4	0.2	1,881.9	0.8	3,279.5	1.0	1,735.6	0.9	12,131.4	2.7	3,799.8	1.3
Bighead Carp	0.00	0.0	0.00	0.0	0.00	0.0	14.4	0.0	0.00	0.0	1,639.8	0.4	103.2	0.0
Thai Pangas	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	113.5	0.0	0.00	0.0
Knife Fish	1,950.3	1.0	8,129.1	3.4	8,899.7	4.0	20,735.9	6.1	7,194.5	3.8	9,847.6	2.2	9,979.2	3.3
Chital	0.00	0.0	0.00	0.0	0.00	0.0	235.5	0.1	17.0	0.0	0.00	0.0	352.6	0.1
Foli	1,950.3	1.0	8,129.1	3.4	8,899.7	4.0	20,500.4	6.1	7,177.4	3.8	9,847.6	2.2	9,626.6	3.2
Hilsha	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	17.5	0.0	0.00	0.0
Hilsha (Jatka)	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	17.5	0.0	0.00	0.0
Other	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	3.0	0.0
Nayan bali	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	3.0	0.0

Annual Catch composition	- Turag Bangshi, Kaliako	ir (sample catch and	percentage by v	veight)
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Species	Baseli	ne	Impact	-1	Impact	-2	Impact	-3	Impact	:-4	Impact	:-5	Impca	t-6
	kg	%	kg	%	kg	%	kg	%	kg	%	kg	%	kg	%
Total	22,120	100	47,743	100	40,100	100	53,611	100	120,629	100	122,731	100	78,076	100
Small Fish	7,704.5	34.8	24,656.9	51.6	21,067.4	52.5	28,895.8	53.9	79,152.7	65.6	63,034.1	51.4	38,117.7	48.8
Jat Puti	1,892.2	8.6	5,949.4	12.5	4,261.0	10.6	5,441.4	10.1	15,985.1	13.3	11,181.3	9.1	8,106.8	10.4
Kanchan Puti	26.2	0.1	14.0	0.0	39.6	0.1	68.6	0.1	3.0	0.0	2.7	0.0	0.00	0.0
Tit Puti	537.9	2.4	2,865.1	6.0	3,015.9	7.5	3,227.6	6.0	6,904.6	5.7	3,644.5	3.0	3,372.9	4.3
Jhili Puti	7.5	0.0	19.2	0.0	16.3	0.0	41.1	0.1	15.8	0.0	177.1	0.1	30.6	0.0
Futani Puti	0.9	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Teri Puti	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.0	0.0	1.6	0.0	0.6	0.0
Mola Puti	0.00	0.0	0.00	0.0	0.4	0.0	0.9	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Shar Puti	0.00	0.0	0.00	0.0	0.00	0.0	13.3	0.0	5.4	0.0	0.00	0.0	0.4	0.0
Chola Puti	482.2	2.2	1,065.1	2.2	360.3	0.9	1,538.4	2.9	395.2	0.3	1,323.5	1.1	577.5	0.7
Bagha Puti	1.2	0.0	1,322.8	2.8	392.9	1.0	1,137.3	2.1	853.1	0.7	1,193.4	1.0	774.4	1.0
Mola	56.6	0.3	436.8	0.9	402.8	1.0	543.5	1.0	1,306.7	1.1	1,091.9	0.9	816.0	1.0
Dhela	22.0	0.1	257.2	0.5	267.4	0.7	274.6	0.5	658.7	0.5	498.2	0.4	106.1	0.1
Chela	311.0	1.4	604.5	1.3	775.7	1.9	774.4	1.4	2,900.4	2.4	1,782.9	1.5	1,039.0	1.3
Chep Chela	4.1	0.0	0.00	0.0	0.00	0.0	0.00	0.0	8.0	0.0	50.7	0.0	16.7	0.0
Ranga Chanda	153.0	0.7	343.1	0.7	861.9	2.1	804.9	1.5	1,877.8	1.6	1,033.9	0.8	306.6	0.4
Lamba Chanda	712.4	3.2	671.8	1.4	784.4	2.0	1,208.0	2.3	2,516.5	2.1	1,792.1	1.5	1,120.6	1.4
Gol Chanda	162.8	0.7	859.1	1.8	985.5	2.5	1,389.5	2.6	4,711.6	3.9	2,505.0	2.0	1,188.2	1.5
Chapila	1,421.2	6.4	3,502.0	7.3	3,246.4	8.1	4,472.5	8.3	19,595.5	16.2	23,156.8	18.9	11,622.7	14.9
Khalisha	30.2	0.1	282.9	0.6	311.2	0.8	507.5	0.9	1.631.5	1.4	1.206.7	1.0	995.3	1.3
Lal Khalisha	40.2	0.2	202.0	0.4	373.3	0.9	566.6	1.1	1,402.8	1.2	1,016.4	0.8	1,023.2	1.3
Chuna Khalisha	106.3	0.5	406.1	0.9	369.9	0.9	757.1	1.4	2.441.1	2.0	1.414.6	1.2	740.1	0.9
Dankina	14.3	0.1	117.7	0.2	154.5	0.4	86.3	0.2	189.1	0.2	261.0	0.2	228.0	0.3
Meni/Bheda	0.00	0.0	15.3	0.0	65.9	0.2	261.6	0.5	816.6	0.7	658.8	0.5	585.8	0.8
Koi	111.1	0.5	176.5	0.4	179.8	0.4	328.5	0.6	484.1	0.4	278.5	0.2	191.4	0.2
Kali/Napti Koj	11.2	0.1	69.6	0.1	63.3	0.2	110.9	0.2	89.7	0.1	191.2	0.2	45.0	0.1
Bele	846.2	3.8	2.506.2	5.2	2.273.4	5.7	2.785.2	5.2	8.567.5	7.1	4.669.6	3.8	3.344.4	4.3
Rani	21.3	0.1	41.3	0.1	0.9	0.0	3.7	0.0	18.7	0.0	25.4	0.0	24.7	0.0
Kachki	21.9	0.1	69.5	0.1	390.4	1.0	493.9	0.0	740.9	0.6	357.3	0.3	141.5	0.0
Kaikla	292.7	1.3	1.082.4	2.3	397.8	1.0	953.3	1.8	2.262.3	1.9	1.380.1	1.1	444.8	0.6
Роа	3.3	0.0	76.6	0.2	42.8	0.1	11.0	0.0	53.5	0.0	73.1	0.1	34.4	0.0
Gutum	195.5	0.9	689.0	14	352.3	0.9	682.4	13	983.1	0.8	934.2	0.8	488.2	0.6
Khalla/Kharshulla	33.7	0.2	8.1	0.0	2.6	0.0	10.7	0.0	13.5	0.0	42.8	0.0	42.5	0.0
Peali	10.2	0.0	14.9	0.0	0.3	0.0	0.6	0.0	3.5	0.0	1.3	0.0	3.9	0.0
Tin Chokha	4 9	0.0	11.8	0.0	32.2	0.1	7.6	0.0	9.6	0.0	41.2	0.0	2.7	0.0
Fesha	4.0	0.0	0.00	0.0	0.00	0.0	0.5	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Narkeli Chela	1.4	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Naftani/Berkul	0.0	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Tepa/Futkora	20.0	0.0	192.3	0.0	287.6	0.7	292.3	0.5	1 235 8	1.0	771.4	0.6	565.5	0.7
Buth Koi/Bali	20.0	0.1			207.0	0.1		0.5	1,200.0	1.0	,,1.1	0.0		
Chata/Balitora	9.5	0.0	53.2	0.1	8.4	0.0	1.8	0.0	23.7	0.0	2.8	0.0	0.00	0.0
Putul	0.0	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Gora Gutum/Ganga	7 7	0.0	25.2	0.1	101.4	0.2	72.0	0.1	00.0	0.1	150.0	0.1	120.4	0.2
Shagor	1.1	0.0	55.5	0.1	101.4	0.5	72.0	0.1	09.0	0.1	139.9	0.1	129.4	0.2
Gugri Bila	5.2	0.0	76.3	0.2	207.1	0.5	21.9	0.0	167.7	0.1	0.0	0.0	0.00	0.0
Potka	118.3	0.5	589.5	1.2	17.1	0.0	0.00	0.0	70.3	0.1	41.8	0.0	0.9	0.0
GangChela/Ghora	4.0	0.0	0.00	0.0	1.0	0.0	3.5	0.0	124	0.0	70.5	0.1	6.8	0.0
Chel Mamoli Chapila	0.00	0.0	30.0	0.0	23.6	0.0	0.8	0.0	108.1	0.0	0.00	0.1	0.0	0.0
Major Carn	1 246 4	5.0	2 021 9	61	1 117 2	) Q	<u> </u>	70	6 065 1	5.1	18 665 0	15.0	11 211 5	14.4
Rui	1,240.4	0.7	1 1 1 1 2	3.0	205 7	<b>2.0</b>	2 2 2 2 2 4	1.7	3 058 5	2.2	6 3 7 7 8	5 2	3 652 2	14.4
Catla	130.0	2.7	1,442.3	0.2	293./	0.7	2,202.4	4.5	127.0	0.1	2 016 6	2.4	2 078 0	+./
Mrigel	401.3	2.2	1 1 57 6	0.3 2 4	622.2	1.6	1 542 7	201	2 261 9	20.1	2,710.0 8 182 7	2.4 67	2,070.9	<u> </u>
Kalibaush	120 2	2.1	1,137.0	2.4	192.2	1.0	1,342.7	2.9	2,301.8	2.0	0,103./	0./	3,933.4	2.1
Minor Corn	130.3	0.0	1/2.3	12	162.3	0.5	357.0 DE C	0.0	307.9 121 P	0.4	1,241.9 674.0	1.0	1,525.9	2.0
Vangra	199.8	0.9	10.0	1.3	2 /	0.4	25.0	0.0	431.9	0.4	10/4.9	0.5	24.2	1.4
, angra	0.5	0.0	10.9	0.0	∠.4	0.0	0.00	0.0	0.00	0.0	10.0	0.0	34.3	0.0

Species	Baseli	ne	Impact	-1	Impact	-2	Impact	-3	Impact	-4	Impact	-5	Impca	t-6
	kg	%	kg	%	kg	%	kg	%	kg	%	kg	%	kg	%
Goinna	0.00	0.0	0.00	0.0	0.00	0.0	5.2	0.0	380.6	0.3	362.3	0.3	873.1	1.1
Tatkini	199.5	0.9	626.5	1.3	160.7	0.4	20.3	0.0	51.3	0.0	294.0	0.2	183.3	0.2
Small Cat Fish	2,872.7	13.0	4,248.6	8.9	2,087.4	5.2	3,693.5	6.9	5,968.8	4.9	6,625.8	5.4	4,958.4	6.4
Batasi	1.1	0.0	6.1	0.0	4.7	0.0	0.9	0.0	0.0	0.0	0.00	0.0	4.7	0.0
Bajri Tengra	0.00	0.0	0.00	0.0	38.4	0.1	11.6	0.0	98.8	0.1	143.2	0.1	90.9	0.1
Golsa	215.7	1.0	435.5	0.9	71.5	0.2	277.0	0.5	444.2	0.4	1,104.8	0.9	1,078.0	1.4
Tengra	1,928.8	8.7	2,866.1	6.0	1,474.7	3.7	1,914.3	3.6	3,054.2	2.5	2,934.3	2.4	2,189.3	2.8
Kabasi Tengra	0.00	0.0	0.00	0.0	53.8	0.1	23.1	0.0	0.00	0.0	2.2	0.0	0.00	0.0
Bacha	4.3	0.0	2.3	0.0	40.9	0.1	83.1	0.2	84.6	0.1	202.5	0.2	31.1	0.0
Baspata/Kazuli	48.4	0.2	111.4	0.2	40.2	0.1	245.6	0.5	433.2	0.4	559.6	0.5	184.6	0.2
Silong	10.0	0.0	30.9	0.1	3.1	0.0	33.9	0.1	0.00	0.0	0.00	0.0	23.5	0.0
Kani Pabda	0.4	0.0	33.9	0.1	0.1	0.0	0.4	0.0	1.9	0.0	0.00	0.0	0.00	0.0
Pabda/Madhu	55.6	0.3	167.1	0.3	11.3	0.0	44.7	0.1	500.2	0.4	30.3	0.0	154.6	0.2
Pabda/	55.0	0.5	107.1	0.5	11.5	0.0	++./	0.1	500.2	0.4	50.5	0.0	154.0	0.2
Chaka/Gangina/Ko wakata	17.0	0.1	11.1	0.0	10.1	0.0	5.6	0.0	4.2	0.0	0.00	0.0	8.4	0.0
Shing	408.5	1.8	223.4	0.5	72.6	0.2	165.5	0.3	319.6	0.3	467.3	0.4	350.2	0.4
Magur	44.6	0.2	52.4	0.1	21.6	0.1	260.6	0.5	366.6	0.3	249.9	0.2	405.7	0.5
Ghaura	138.4	0.6	307.7	0.6	192.9	0.5	388.8	0.7	532.1	0.4	683.5	0.6	335.9	0.4
Gang Tengra	0.00	0.0	0.00	0.0	0.2	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Tengra (Batasio)	0.00	0.0	0.9	0.0	0.00	0.0	1.6	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Senia (Eusufi)	0.00	0.0	0.00	0.0	51.4	0.1	237.0	0.4	128.9	0.1	248.0	0.2	101.4	0.1
Large Cat Fish	1,120.7	5.1	1,621.1	3.4	1,889.0	4.7	1,885.4	3.5	2,748.2	2.3	4,922.0	4.0	3,331.4	4.3
Air	501.9	2.3	978.9	2.1	345.5	0.9	15.8	0.0	11.5	0.0	98.8	0.1	155.2	0.2
Guzi air/Guzkata	9.1	0.0	0.00	0.0	1,004.9	2.5	1,296.2	2.4	1,848.5	1.5	2,322.8	1.9	1,682.8	2.2
Bagha Air	35.7	0.2	77.1	0.2	78.3	0.2	206.0	0.4	405.2	0.3	504.4	0.4	649.0	0.8
Boal	323.6	1.5	280.4	0.6	214.4	0.5	153.3	0.3	203.2	0.2	1,686.7	1.4	647.9	0.8
Rita	250.4	1.1	284.7	0.6	232.4	0.6	214.0	0.4	279.8	0.2	230.3	0.2	196.5	0.3
Pangas	0.00	0.0	0.00	0.0	13.4	0.0	0.00	0.0	0.00	0.0	79.1	0.1	0.00	0.0
Eels	3,284.1	14.8	3,437.7	7.2	4,533.8	11.3	2,952.5	5.5	6,744.5	5.6	4,381.9	3.6	4,651.4	6.0
Boro Baim	1,515.3	6.9	1,349.4	2.8	2,111.8	5.3	710.4	1.3	1,015.3	0.8	747.9	0.6	1,014.6	1.3
Guchi Baim	1,000.1	4.5	1,931.3	4.0	1,944.2	4.8	2,039.0	3.8	5,345.0	4.4	3,193.7	2.6	3,290.8	4.2
Tara Baim	767.4	3.5	156.5	0.3	477.8	1.2	203.0	0.4	330.2	0.3	429.6	0.4	282.2	0.4
Kuicha	1.2	0.0	0.5	0.0	0.00	0.0	0.2	0.0	54.1	0.0	10.6	0.0	63.8	0.1
Snakeheads	2,042.6	9.2	4,347.2	9.1	3,466.6	8.6	4,389.4	8.2	5,100.4	4.2	5,198.4	4.2	5,494.5	7.0
Taki	1,650.6	7.5	3,402.7	7.1	2,725.5	6.8	3,283.2	6.1	3,691.3	3.1	3,543.9	2.9	4,155.0	5.3
Shol	342.4	1.5	904.9	1.9	710.7	1.8	1,085.4	2.0	1,345.0	1.1	1,643.3	1.3	1,319.8	1.7
Gojar	0.00	0.0	9.5	0.0	3.4	0.0	10.0	0.0	0.00	0.0	4.5	0.0	1.6	0.0
Cheng	49.5	0.2	30.2	0.1	27.0	0.1	10.9	0.0	64.1	0.1	6.7	0.0	18.1	0.0
Prawns	3,368.0	15.2	5,190.4	10.9	5,001.7	12.5	5,951.8	11.1	10,102.9	8.4	4,803.9	3.9	2,607.5	3.3
Gura Echa	3,007.6	13.6	4,156.4	8.7	4,491.0	11.2	5,110.3	9.5	9,265.0	7.7	3,745.8	3.1	1,860.2	2.4
Golda Echa	12.2	0.1	17.0	0.0	66.8	0.2	54.3	0.1	22.0	0.0	72.6	0.1	176.3	0.2
Satka Chingri	344.1	1.6	1,013.1	2.1	437.6	1.1	787.0	1.5	807.9	0.7	955.8	0.8	546.2	0.7
Dimua/Kathalia Echa	4.2	0.0	3.9	0.0	6.2	0.0	0.2	0.0	8.0	0.0	29.7	0.0	24.8	0.0
Exotic Species	200.5	0.9	286.4	0.6	198.0	0.5	909.6	1.7	1,129.8	0.9	13,073.5	10.7	5,509.3	7.1
Thai Shor Puti	83.0	0.4	78.2	0.2	29.3	0.1	101.1	0.2	64.2	0.1	2,106.7	1.7	663.2	0.8
African Magur	0.00	0.0	29.5	0.1	0.00	0.0	41.0	0.1	0.00	0.0	0.00	0.0	0.00	0.0
Telapia	0.1	0.0	7.7	0.0	91.5	0.2	91.4	0.2	112.0	0.1	125.8	0.1	5.1	0.0
Silver Carp	30.9	0.1	41.4	0.1	18.9	0.0	415.3	0.8	778.3	0.6	5,715.3	4.7	702.4	0.9
Grass Carp	0.00	0.0	10.2	0.0	0.4	0.0	62.6	0.1	77.0	0.1	951.9	0.8	1,158.5	1.5
Miror Carp	0.00	0.0	51.4	0.1	22.6	0.1	30.8	0.1	27.5	0.0	31.8	0.0	37.6	0.0
Comon Carp/Karfu	86.5	0.4	67.9	0.1	35.3	0.1	166.7	0.3	70.8	0.1	4,042.8	3.3	2,942.5	3.8
Bighead Carp	0.00	0.0	0.00	0.0	0.00	0.0	0.5	0.0	0.00	0.0	99.3	0.1	0.00	0.0
Knife Fish	35.8	0.2	379.2	0.8	285.9	0.7	645.3	1.2	676.7	0.6	486.4	0.4	449.0	0.6
Chital	0.00	0.0	0.00	0.0	0.00	0.0	28.7	0.1	0.00	0.0	84.5	0.1	27.2	0.0
Foli	35.8	0.2	379.2	0.8	285.9	0.7	616.6	1.2	676.7	0.6	401.9	0.3	421.7	0.5

Species	Baseli	ne	Impact	-1	Impact	-2	Impact	-3	Impact	-4	Impact	-5	Impca	.t-6
	kg	%	kg	%	kg	%	kg	%	kg	%	kg	%	kg	%
Hilsha	35.5	0.2	4.0	0.0	285.3	0.7	8.9	0.0	1,466.7	1.2	678.9	0.6	523.2	0.7
Hilsha (Jatka)	35.5	0.2	4.0	0.0	285.3	0.7	8.9	0.0	1,466.7	1.2	678.9	0.6	523.2	0.7
Other	9.4	0.0	2.5	0.0	4.4	0.0	36.6	0.1	141.1	0.1	186.1	0.2	131.0	0.2
Nayan bali	7.2	0.0	2.4	0.0	2.0	0.0	15.7	0.0	20.7	0.0	77.2	0.1	78.9	0.1
Peashi	2.2	0.0	0.2	0.0	2.3	0.0	20.5	0.0	120.1	0.1	108.8	0.1	52.0	0.1
Chenua	0.00	0.0	0.00	0.0	0.00	0.0	0.4	0.0	0.3	0.0	0.00	0.0	0.00	0.0

Annual Catch composition - Kongshow Malijhee (Sherpur
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Species	Baseli	ne	Impact	t-1	Impact	:-2	Impact	t-3	Impact	t-4	Impact	t-5
	kg	%										
Total	40.201	100	39.932	100	73.186	100	84,497	100	111.400	100	82.213	100
Small Fish	14,107.1	35.1	15,368.8	38.5	19,755.4	27.0	21,592.4	25.6	31,432.2	28.2	26,599.5	32.4
Jat Puti	6,460.7	16.1	5,451.9	13.7	8,641.3	11.8	7,107.1	8.4	13,327.3	12.0	9,417.0	11.5
Kanchan Puti	16.7	0.0	16.6	0.0	4.2	0.0	9.4	0.0	0.3	0.0	29.4	0.0
Tit Puti	1,389.7	3.5	1,835.0	4.6	959.3	1.3	2,019.8	2.4	1,393.6	1.3	1,547.6	1.9
Jhili Puti	0.6	0.0	0.00	0.0	0.00	0.0	0.3	0.0	6.9	0.0	0.00	0.0
Futani Puti	0.00	0.0	0.00	0.0	1.4	0.0	0.00	0.0	0.00	0.0	0.00	0.00
Teri Puti	0.00	0.0	0.00	0.0	0.00	0.0	0.5	0.0	28.8	0.0	0.00	0.00
Mola Puti	0.1	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Shar Puti	17.4	0.0	150.8	0.4	309.0	0.4	126.9	0.2	139.4	0.1	59.1	0.1
Chola Puti	3.8	0.0	0.00	0.0	1.3	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Bagha Puti	0.00	0.0	2.9	0.0	658.7	0.9	437.8	0.5	1,205.3	1.1	1,062.2	1.3
Mola	40.2	0.1	285.8	0.7	48.3	0.1	11.2	0.0	42.2	0.0	36.5	0.0
Dhela	6.0	0.0	42.2	0.1	0.1	0.0	0.00	0.0	25.0	0.0	0.1	0.0
Chela	415.1	1.0	385.6	1.0	264.4	0.4	922.6	1.1	1,267.0	1.1	1,208.2	1.5
Chep Chela	55.7	0.1	83.3	0.2	65.7	0.1	461.5	0.5	381.8	0.3	97.7	0.1
Ranga Chanda	94.5	0.2	51.0	0.1	47.7	0.1	137.7	0.2	109.1	0.1	510.2	0.6
Lamba Chanda	253.7	0.6	374.5	0.9	243.5	0.3	237.6	0.3	775.0	0.7	1,341.7	1.6
Gol Chanda	671.3	1.7	689.6	1.7	856.1	1.2	1,166.9	1.4	1,298.1	1.2	1,248.0	1.5
Chapila	0.5	0.0	5.5	0.0	6.6	0.0	0.00	0.0	1.9	0.0	25.8	0.0
Khalisha	119.2	0.3	29.2	0.1	220.8	0.3	446.1	0.5	593.4	0.5	447.5	0.5
Lal Khalisha	47.2	0.1	31.2	0.1	16.4	0.0	115.1	0.1	202.9	0.2	253.5	0.3
Chuna Khalisha	489.2	1.2	434.5	1.1	629.6	0.9	512.8	0.6	148.3	0.1	197.3	0.2
Dankina	66.7	0.2	79.3	0.2	132.4	0.2	194.2	0.2	163.0	0.1	172.8	0.2
Meni/Bheda	0.00	0.0	0.00	0.0	274.3	0.4	434.4	0.5	1,237.2	1.1	930.0	1.1
Koi	148.9	0.4	173.3	0.4	260.5	0.4	189.7	0.2	342.0	0.3	178.1	0.2
Kali/Napti Koi	124.0	0.3	113.9	0.3	534.3	0.7	553.6	0.7	363.1	0.3	139.4	0.2
Bele	1,937.5	4.8	3,370.9	8.4	3,813.1	5.2	4,487.7	5.3	4,754.5	4.3	4,488.9	5.5
Rani	2.6	0.0	1.8	0.0	3.5	0.0	55.6	0.1	39.2	0.0	0.00	0.00
Kaikla	314.9	0.8	378.5	0.9	302.9	0.4	427.0	0.5	1,684.1	1.5	1,515.2	1.8
Poa	0.00	0.0	14.9	0.0	4.1	0.0	0.00	0.0	0.00	0.0	0.5	0.0
Gutum	1,269.4	3.2	1,319.4	3.3	1,350.5	1.8	1,358.3	1.6	1,833.7	1.6	1,672.3	2.0
Khalla/Kharshulla	0.00	0.0	0.00	0.0	0.00	0.0	0.2	0.0	0.3	0.0	0.00	0.0
Tin Chokha	13.4	0.0	0.00	0.0	10.2	0.0	0.8	0.0	0.4	0.0	0.00	0.0
Nandil	30.7	0.1	0.3	0.0	7.2	0.0	1.4	0.0	4.7	0.0	2.9	0.0
Narkeli Chela	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.3	0.0
Naftani/Berkul	0.00	0.0	17.3	0.0	0.00	0.0	0.0	0.0	7.4	0.0	0.00	0.0
Tepa/Futkora	39.2	0.1	1.2	0.0	66.3	0.1	93.4	0.1	23.8	0.0	6.9	0.0
Elong	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	15.3	0.0	0.00	0.00
Gora Gutum/Ganga Shagor	57.4	0.1	28.6	0.1	14.2	0.0	66.7	0.1	15.8	0.0	10.1	0.0
Gugri Bila	0.00	0.0	0.00	0.0	6.0	0.0	0.00	0.0	1.4	0.0	0.00	0.00
Potka	20.1	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.00
GangChela/Ghora Chel	0.8	0.0	0.00	0.0	1.7	0.0	16.0	0.0	0.1	0.0	0.1	0.0
Mamoli Chapila	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.00
Major Carp	886.2	2.2	1,765.8	4.4	6,293.1	8.6	11,378.7	13.5	17,746.0	15.9	5,985.8	7.3
Rui	555.3	1.4	142.8	0.4	775.3	1.1	3,903.4	4.6	2,873.6	2.6	610.5	0.7
Catla	20.6	0.1	95.7	0.2	524.9	0.7	186.1	0.2	1,656.3	1.5	813.9	1.0
Mrigel	119.0	0.3	1,203.0	3.0	4,425.8	6.0	6,648.7	7.9	11,612.5	10.4	3,955.8	4.8
Kalibaush	191.3	0.5	324.3	0.8	567.1	0.8	640.5	0.8	1,603.6	1.4	605.5	0.7
Minor Carp	188.9	0.5	222.4	0.6	446.2	0.6	2,378.5	2.8	2,152.6	1.9	543.2	0.7
Bata	62.1	0.2	71.9	0.2	379.5	0.5	2,358.6	2.8	1,545.3	1.4	93.7	0.1
Vangra	3.8	0.0	0.00	0.0	3.6	0.0	5.6	0.0	159.6	0.1	143.4	0.2
Goinna	0.00	0.0	5.6	0.0	32.2	0.0	12.0	0.0	327.9	0.3	305.0	0.4
Tatkini	123.0	0.3	129.5	0.3	30.7	0.0	2.3	0.0	119.7	0.1	0.9	0.0
Raek	0.00	0.0	15.5	0.0	0.2	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Small Cat Fish	4,867.6	12.1	2,840.7	7.1	6,174.8	8.4	4,619.6	5.5	7,557.0	6.8	5,946.5	7.2

Species	Baseli	ne	Impact	t-1	Impact	:-2	Impact	t-3	Impact	t-4	Impact	t-5
	kg	%	kg	%	kg	%	kg	%	kg	%	kg	%
Batasi	23.0	0.1	38.4	0.1	32.2	0.0	36.3	0.0	45.9	0.0	12.0	0.0
Bajri Tengra	0.00	0.0	0.00	0.0	4.9	0.0	91.3	0.1	310.7	0.3	168.8	0.2
Golsa	59.9	0.1	13.3	0.0	43.0	0.1	48.3	0.1	138.8	0.1	8.8	0.0
Tengra	4,427.5	11.0	2,459.7	6.2	5,426.0	7.4	3,895.9	4.6	5,826.5	5.2	4,776.4	5.8
Kabasi Tengra	0.00	0.0	6.1	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Bacha	0.00	0.0	0.00	0.0	0.00	0.0	62.0	0.1	54.7	0.0	3.9	0.0
Baspata/Kazuli	0.00	0.0	0.00	0.0	0.00	0.0	1.7	0.0	0.0	0.0	0.00	0.0
Silong	0.00	0.0	0.00	0.0	7.5	0.0	0.00	0.0	0.00	0.0	0.00	0.00
Gang Magur	0.00	0.0	0.00	0.0	0.00	0.0	0.6	0.0	0.8	0.0	0.00	0.0
Kani Pabda	5.4	0.0	0.00	0.0	0.00	0.0	9.6	0.0	177.8	0.2	35.2	0.0
Pabda/Madhu Pabda/	26.8	0.1	16.4	0.0	284.7	0.4	58.0	0.1	85.0	0.1	43.0	0.1
Kowakata/Ghorakata	20.0	0.1	10.4	0.0	204.7	0.4	58.0	0.1	05.7	0.1	+3.0	0.1
Chaka/Gangina/Kowakata	0.00	0.0	0.00	0.0	0.00	0.0	0.3	0.0	1.9	0.0	0.00	0.00
Shing	282.9	0.7	240.8	0.6	299.0	0.4	351.7	0.4	757.7	0.7	866.6	1.1
Magur	40.0	0.1	58.3	0.1	77.5	0.1	63.9	0.1	135.0	0.1	28.3	0.0
Ghaura	2.2	0.0	5.0	0.0	0.00	0.0	0.00	0.0	1.7	0.0	3.7	0.0
Gang Tengra	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.00
Tengra (Batasio)	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	19.7	0.0	0.00	0.00
Senia (Eusufi)	0.00	0.0	2.8	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0
Large Cat Fish	4,664.5	11.6	3,174.0	7.9	4,101.1	5.6	2,466.6	2.9	5,925.6	5.3	3,212.6	3.9
Air	10.0	0.0	0.00	0.0	0.00	0.0	0.00	0.0	18.5	0.0	0.00	0.00
Guzi air/Guzkata	0.00	0.0	0.00	0.0	48.2	0.1	18.4	0.0	112.9	0.1	55.6	0.1
Bagha Air	2.3	0.0	0.00	0.0	0.00	0.0	0.00	0.0	12.4	0.0	0.2	0.0
Boal	4,652.3	11.6	3,163.5	7.9	4,033.0	5.5	2,424.8	2.9	5,771.8	5.2	3,156.7	3.8
Rita	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	7.5	0.0	0.00	0.0
Pangas	0.00	0.0	10.6	0.0	20.0	0.0	23.4	0.0	2.4	0.0	0.00	0.00
Eels	4,098.4	10.2	3,736.5	9.4	8,357.3	11.4	7,773.2	9.2	8,105.5	7.3	8,227.1	10.0
Boro Baim	685.8	1.7	531.6	1.3	1,493.9	2.0	818.9	1.0	929.8	0.8	912.0	1.1
Guchi Baim	2,159.7	5.4	1,314.4	3.3	4,387.9	6.0	3,884.2	4.6	4,802.4	4.3	4,431.4	5.4
Tara Baim	1,229.1	3.1	1,876.2	4.7	2,467.5	3.4	3,059.5	3.6	2,368.8	2.1	2,876.0	3.5
Kuicha	23.8	0.1	14.3	0.0	8.1	0.0	10.6	0.0	4.5	0.0	7.8	0.0
Snakeheads	2,380.6	5.9	2,971.4	7.4	5,843.2	8.0	5,007.7	5.9	7,163.1	6.4	6,291.7	7.7
Taki	2,372.0	5.9	2,948.8	7.4	5,761.3	7.9	4,933.4	5.8	6,668.0	6.0	5,893.8	7.2
Shol	0.00	0.0	12.8	0.0	62.7	0.1	46.1	0.1	277.7	0.2	312.3	0.4
Gojar	0.00	0.0	3.8	0.0	1.9	0.0	0.00	0.0	0.00	0.0	8.4	0.0
Cheng	8.7	0.0	6.0	0.0	17.3	0.0	28.1	0.0	217.5	0.2	77.2	0.1
Prawns	7,716.8	19.2	5,637.7	14.1	13,325.2	18.2	17,999.4	21.3	17,127.1	15.4	16,406.9	20.0
Gura Echa	7,716.7	19.2	5,636.9	14.1	13,325.2	18.2	17,990.4	21.3	17,120.8	15.4	16,404.1	20.0
Golda Echa	0.2	0.0	0.9	0.0	0.00	0.0	8.2	0.0	6.4	0.0	2.8	0.0
Dimua/Kathalia Echa	0.00	0.0	0.00	0.0	0.00	0.0	0.8	0.0	0.00	0.0	0.00	0.0
Exotic Species	1,273.6	3.2	4,182.6	10.5	8,750.6	12.0	11,176.4	13.2	14,003.4	12.6	8,898.7	10.8
Thai Shor Puti	147.9	0.4	1,010.9	2.5	2,249.7	3.1	3,227.2	3.8	5,210.7	4.7	3,111.6	3.8
Nailotika	0.00	0.0	0.00	0.0	0.00	0.0	14.8	0.0	66.8	0.1	0.4	0.0
African Magur	0.00	0.0	26.1	0.1	0.00	0.0	0.00	0.0	50.3	0.0	0.00	0.00
Telapia	0.00	0.0	30.5	0.1	5.7	0.0	1.7	0.0	0.3	0.0	0.00	0.00
Silver Carp	5.6	0.0	674.1	1.7	372.9	0.5	2,597.6	3.1	2,225.0	2.0	514.4	0.6
Grass Carp	8.1	0.0	416.6	1.0	923.8	1.3	251.0	0.3	851.7	0.8	433.2	0.5
Miror Carp	90.9	0.2	50.3	0.1	86.4	0.1	69.1	0.1	39.8	0.0	0.00	0.00
Comon Carp/Karfu	1,021.1	2.5	1,974.2	4.9	5,106.9	7.0	5,014.9	5.9	5,558.8	5.0	4,814.3	5.9
Bighead Carp	0.00	0.0	0.00	0.0	5.2	0.0	0.00	0.0	0.00	0.0	24.8	0.0
Knife Fish	16.0	0.0	8.3	0.0	135.4	0.2	94.1	0.1	126.6	0.1	101.1	0.1
Chital	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.4	0.0	16.0	0.0
Foli	16.0	0.0	8.3	0.0	135.4	0.2	94.1	0.1	126.2	0.1	85.1	0.1
Hilsha	0.00	0.0	22.6	0.1	3.2	0.0	10.0	0.0	43.7	0.0	0.00	0.0
Hilsha (Jatka)	0.00	0.0	22.6	0.1	3.2	0.0	10.0	0.0	43.7	0.0	0.00	0.0
Other	1.4	0.0	1.1	0.0	0.00	0.0	0.00	0.0	17.5	0.0	0.00	0.0
Batai	1.4	0.0	1.1	0.0	0.00	0.0	0.00	0.0	17.5	0.0	0.00	0.0

#### Fingerling stocking 2001-2005

Species	2001	2002	2003	2004	2005	Total
Turag-Bangshi				•		
Kalibaush (Labeo calbasu)	10	144		13,622	4,717	18,493
Rui (Labeo rohita)		26,434	109,510			135,944
Gonia (Labeo gonius)		5,051	24,332		19,754	49,137
Deshi Sarputi (Puntius sarana)	80				2,000	2,080
Meni (Nandus nandus)	14					14
Foli (Notopterus notopoterus)	20					20
Chital (Notopterus chitala)					2,000	2,000
Shing (Heteropneustes fossilis)					2,000	2,000
Pabda (Ompok pabda)	12				4,000	4,012
Carps sub-total	10	31,629	133,842	13,622	24,471	203,574
Total	136	31,629	133,842	13,622	34,471	213,700
Kangsha-Malijee						
Kalibaush (Labeo calbasu)	16,940	175		5,298		22,413
Rui (Labeo rohita)		320	27,939	20,344		48,603
Gonia (Labeo gonius)	12,780	11,028	7,439	69,119	12,200	112,566
Bata (Labeo bata)			6,534			6,534
Deshi Sarpunti (Puntius sarana)		2,090			1,000	3,090
Meni (Nandus nandus)		372				372
Shol (Channa striata)	11,180		70			11,250
Gojar (Channa marulius)	1,390					1,390
Chapila (Gudusia chapra)			150			150
Chital (Notopterus chitala)					2,000	2,000
Shing (Heteropneustes fossilis)					4,000	4,000
Pabda (Ompok pabda)		137			2,000	2,137
Gulsha (Mystus cavasius)		30				30
Carps sub-total	29,720	11,523	41,912	94,761	12,200	190,116
Total	42,290	14,152	42,132	94,761	21,200	214,535
Hail Haor						
Kalibaush (Labeo calbasu)	2,108	15,213		5,632	12,697	35,650
Rui (Labeo rohita)			117,253	52,468		169,721
Gonia (Labeo gonius)	13,200	14,350	59,092	305,793	154,455	546,890
Deshi Sarpunti (Puntius sarana)	4,136	3,600			3,000	10,736
Chital (Notopterus chitala)					6,004	6,004
Ayer (Mystus aor)	384	2,934	500			3,818
Gulsha (Mystus cavasius)					650	650
Carps sub-total	15,308	29,563	176,345	363,893	167,152	752,261
Total	19,828	36,097	176,845	363,893	176,806	773,469

Note: in Turag-Bangshi in 2001 adult (brood fish) not fingerlings were stocked

Sl. No	Bangla name	Scientific name
*1	Mahogony	Swietania macrophylla
2	Sissoo	Dalbargia sissoo
3	Arjun	Terminalia arjuna
4	Jaam	Sysygium jambulana
*5	Akashmoni	Acacia auriculiformis
*6	Mangium	Acacia mangium
7	Jack Fruit	Artocarnus heterophylla
8	Bakain	Melia azadarach
*9	Teak/Segun	Tectona grandis
10	Aam/Mango	Mangifera indica
11	Kala Koroi/Bhut Koroi	Albizia lebbeck
12	Shil koroj	Albizia procera
*13	Rai Koroi	Albizia rhichardiana
14	Jarul	Lagerstromia flosregene
15	Rain Tree	Samanea saman
16	Kodom	Anthocephalus kadamba
17	Chikrassi	Chickrassia tabularis
18	Chapalish	Artocarpus chaplasha
10	Telsur	Hopea odorata
20	Iolnai	Elaeocarpus robusta
20	Baash/Bamboo	Bambusa vuloaris
22	Kat Badam	Terminalia katanna
23	Borta	Artocarnus lakoocha
23	Semul	Salmalia malabaricum
25	Sheora	Strehlus asper
26	Hijal	Barringtonia acutangula
20	Koroch	Pongamia ninnata
28	Pitali	Trewia mudiflora
29	Borun	Crataeva nurvula
30	Khude Jaam	Svzvgium fruticosa
31	Boroi	Ziziphus mauritiana
32	Babla	Acacia nilotica
*33	Ipil-Ipil	Leucaena lucocephella
34	Chalta	Dillenea indica
35	Neem	Azadirachta indica
*36	Lombu	Pajenellia longifolia
37	Aamloki	Phyllanthus emblica
38	Horitoki	Terminalia chevula
39	Boera	Terminalia ballirica
40	Bot	Ficus bangalensis
41	Aswatha/Pakur	Ficus religiosa
42	Chhatian	Alstonia scholaris
43	Debdaru	Polialthia longifolia
44	Mohua	Bassia latifolia
45	(Jongli) Aamra	Spondias pinnata
46	Bokul	Mimassops elengi
47	Dumoor	Ficus semicordata
48	Garjan	Dipterocarpus turbinatus
49	Pitraj	Amoora wallichi
50	Pobon Jhau	Casuarina equisetifolia
*51	Lohakatt	Xylia dolabriformis
52	Polash	Butea monosparma
53	Krishna Chhura	Delonix regia
54	Agor	Aquillaria agallocha
55	Kainjal	Bischopia javanica
56	Chalta	Dellenia indica

#### Species of plants (trees) planted in MACH project areas

\* Out of 56 species planted, 48 are native and 8 (with star mark) are domesticated exotic

Monitoring			N7 1		, ,		
locations			Number oj	f Fish Specie	es observed		
	Baseline	Impact-1	Impact-2	Impact-3	Impact-4	Impact-5	Impact-6
Jethua Beel	38	48	47	47	47	42	44
Gopla River	54	44	49	55	52	57	59
Boulashir FP	50	51	51	50	50	61	53
Chiruadubi Beel	46	44	52	50	50	54	54
62- Beel	59	59	61	63	51	68	58
Rustampur Beel	50	51	50	62	49	64	59
Balla Beel	39	55	50	55	61	63	54
Overall	71	71	69	76	67	80	75

#### Fish Species diversity in Hail Haor by Monitoring Locations and by Year

#### Fish Species diversity in Turag-Bongshi by Monitoring Locations and by Year

Monitoring Locations							
			Number oj	f Fish Species	observed		
	Baseline	Impact-1	Impact-2	Impact-3	Impact-4	Impact-5	Impac
Mokash Beel (South)	55	58	51	57	56	60	58
Mokash Beel (North)	58	56	62	52	62	68	65
Kaliadaha Beel	59	54	49	54	58	61	-
Mokash Khal/Solhati Khal	39	46	51	50	55	62	61
Turag River Section	54	55	58	71	60	77	72
Aowla Khal (Canal)	50	46	46	49	45	57	64
Aowla Beel	59	58	59	66	65	72	70
Bangshi River Section	67	70	67	75	71	73	72
Overall	82	81	86	91	85	85	

#### Fish Species diversity in Kongshaw-Malijhee by Monitoring Locations and by Year

Monitoring Locations						
		Nu	mber of Fish	Species obser	rved	
	Baseline	Impact-1	Impact-2	Impact-3	Impact-4	Impac
Baila Beel	46	43	41	50	48	52
Takimari Beel	44	41	39	46	56	59
Kewta Beel	39	45	42	44	41	38
Nijla Beel	37	48	42	41	44	43
Bagadubi Khal (Canal)	46	46	47	47	57	55
Bahar Ali Kur (Malijhee River)	32	40	37	49	64	60
Aowra Bowra Beel	21	31	25	25	44	40
Bailsha Beel	36	41	35	35	53	48
Overall	64	67	71	73	84	

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Site		Fish		Plant
	No.	Local Name (Scientific Name)	No.	Local Name (Scientific Name)
Hail Haor	8	*Shar Puti (Puntius sarana), Satka Chingri (Macrobrachium malcolmsonil), *Goinna (Labeo gonius), Ayer (Mystus aor), *Rui (Labeo rohita), *Kalibaush (Labeo calbasu), *Pabda/Madhu Pabda (Ompok pabda), Moa (Rohtee cotio),	18	Sissoo (Dalbargia sissoo), Arjun (Terminalia arjuna), Bakain (Melia azadarach, Chikrashi (Chickrassia tabularis), Telsur (Hopea odorata), Katt Badam (Terminalia katappa), Dewa/Borta (Artocarpus lakoocha), Hijol (Barringtonia aquatangula), Koroch (Pongamia glabra), Borun (Crataeva nurvula), Khude Jaam (Syzygium fruticosa), Babla (Acacia nilotica), Chalta (Dillenea india), Donothina) (Locali), Chanta
				(Spondias pinnata), <b>Garjan</b> (Dipterocarpus turbinatus).
Turag Bongshi	10	Mola Puti (Puntius guganio), *Goinna (Labeo gonius), Ayer (Mystus aor), Guzi air/Guzkata (Mystus seenghala), *Pabda/Madhu Pabda (Ompok pabda), *Foli (Notopterus notopoterus), *Rui (Labeo rohita), *Kalibaush (Labeo calbasu), *Meni/Bheda (Nandus nandus), Goiar (Channa marulius),	r-	Sissoo (Dalbargia sissoo), Arjun (Terminalia arjuna), Bakain (Melia azadarach), Chikrashi (Chickrassia tabularis), Katt Badam (Terminalia katappa), Hijol (Barringtonia aquatangula), Haritaki (Terminalia chevula).
Kongshow Malijhee	10	<ul> <li>*Meni/Bheda (Nandus nandus), Bajri Tengra (Mystus tengara),</li> <li>*Shar Puti (Puntius sarana),</li> <li>*Chapila (Gudusia chapra), *Shol (Channa striata), *Gojar (Channa marulius), *Goinna (Labeo gonius), *Pabda/Madhu Pabda (Ompok pabda), *Rui (Labeo rohita), *Kalibaush (Labeo calbasu),</li> </ul>	22	<ul> <li>Sissoo (Dalbargia sissoo), Arjun (Terminalia arjuna), Bakain (Melia azadarach), Chikrashi (Chickrassia tabularis), Katt Badam (Terminalia katappa), Dewa/Borta (Artocarpus lakoocha), Hijol (Barringtonia aquatangula), Koroch (Pongamia glabra), Babla (Acacia milotica), Chalta (Dillenea indica), Aamloki (Phyllanthus emblica), Haritaki (Terminalia chevula), Bahera (Terminalia ballirica), Debdaru (Polialthia longifolia), Mahua (Bassia latifolia), Aamra (Spondias pinnata), Bokool (Mimassops elengi), Garjan (Dipterocarpus turbinatus), Telsur (Hopea odorata), Pitraj (Amoora wallichi), (Pobon) Jhau (Casuarina equisetifolia), Agor (Aquillaria agallocha).</li> </ul>
Total	28		47	

Note: \* Introduced, re-introduced fish species

													Ĩ
No.	Species name	Scientific name	Season-	Status in	Global				Baikka Bee	<b>Sanctuary</b>			
			ality	Hail	threat	Status in	13-Dec-	28-Jan-	24 Jan &	1&3 Feb	13-Jan-	2006-07	date of
				Haor	status	sanctuary	02	04	10 Feb 2005	2006	07	winter max	max
							EH, WC	EH, WC	PT, EH	PT	PT	PT	
	<b>DUCKS, GEESE, SWANS</b>	ANATIDAE											
-	Fulvous Whistling-duck	Dendrocygna bicolor	M	c		c				1500	1000	4000	24-Nov
10	Lesser Whistling-duck	Dendrocygna javanica	M	c		c	460		18	2500	3500	3500	13-Jan
Э	Greylag Goose	Anser anser	M	1		1					2	2	13-Jan
4	Bar-headed Goose	Anser indicus	M	r		1						5	02-Mar
S	Ruddy Shelduck	Tadorna ferruginea	M	r		1			2				
6	Cotton Pygmy-goose	Nettapus coromandelianus	ч	nc		nc	4	8		50	50	60	21-Dec
7	Gadwall	Anas strepera	M	nc		nc				50	50	300	22-Feb
~	Eurasian Wigeon	Anas penelope	M	r		'n					3	5	07-Feb
6	Spot-billed Duck	Anas poecilorhyncha	M	nc									
10	Northern Shoveler	Anas clypeata	M	nc		nc			1	4	5	33	02-Mar
=	Northern Pintail	Anas acuta	M	c		c			100	700	500	1000	07-Feb
12	Garganey	Anas querquedula	M	с		c			30	200	100	500	21-Dec
13	Common Teal	Anas crecca	M	c		с			100	300	009	009	13-Jan
14	Common Pochard	Aythya ferina	M	nc		1						1	07-Feb
15	Ferruginous Pochard	Aythya nyroca	M	nc	NT	nc				87	53	53	13-Jan
16	Baer's Pochard	Aythya baeri	M	1	Λ								
17	Tufted Duck	Aythya fuligula	M	r		1						1	21-Dec
	WOODPECKERS	PICIDAE											
18	Eurasian Wryneck	Jynx torquilla	M	r		2						1	21-Dec
	HOOPOE	UPUPIDAE											
19	Common Hoopoe	Upupa epops	R	nc		r					1	2	02-Mar
	ROLLERS	CORACIIDAE											
20	Indian Roller	Coracias benghalensis	R	uc									
	KINGFISHERS	ALCEDINIDAE											
21	Blyth's Kingfisher	Alcedo hercules	Λ	1	NT								
22	Common Kingfisher	Alcedo atthis	R	c		c			common	common	common	common	
23	White-throated Kingfisher	Halcyon smyrnensis	R	c		с				1	1	1	
24	Pied Kingfisher	Ceryle rudis	R	nc		nc					2	2	
	<b>BEE-EATERS</b>	MEROPIDAE											
25	Green Bee-eater	Merops orientalis	R	r									
26	Blue-tailed Bee-eater	Merops philippinus	s	nc		nc							

Birds recorded from Baika Beel Wetland Sanctuary, Hail Haor in 2002-07 compared with earlier records from the haor.

N0.	Species name	Scientific name	Season-	Status in	Global				<b>Baikka Bee</b>	<b>Sanctuary</b>			
			ality	Hail	threat	Status in	13-Dec-	28-Jan-	24 Jan &	1&3 Feb	13-Jan-	2006-07	date of
				11401	<b>SLALUS</b>	sanctuary	70	64	10 F eD 2005	0007	/0	winter max	тах
	CUCKOOS	<b>CUCULIDAE</b>											
27	Pied Cuckoo	Clamator jacobinus	S	r		2							
28	Indian Cuckoo	Cuculus micropterus	S	nc									
29	Lesser Cuckoo	Cuculus poliocephalus	Λ	1									
30	Plaintive Cuckoo	Cacomantis merulinus	R	c		c			1	1	few	few	
31	Lesser Coucal	Centropus bengalensis	R	3		3						1	
	PARROTS	PSITTACIDAE											
32	Rose-ringed Parakeet	Psittacula krameri	R	c		1							
	SWIFTS	APODIDAE											
33	Asian Palm Swift	Cypsiurus balasiensis	R	nc		2					few	few	
	TYPICAL OWLS	STRIGIDAE											
34	Spotted Owlet	Athene brama	R	nc		r					2	2	
	<b>PIGEONS, DOVES</b>	COLUMBIDAE											
35	Oriental Turtle Dove	Streptopelia orientalis	R	nc									
36	Spotted Dove	Streptopelia chinensis	R	с		с			few	few	few	few	
37	Red Collared Dove	Streptopelia tranquebarica	R	c									
38	Eurasian Collared Dove	Streptopelia decaocto	R	с		r						few	
	RAILS, COOTS	RALLIDAE											
39	Slaty-breasted Rail	Gallirallus striatus	R	1		1							
40	<b>Ruddy-breasted Crake</b>	Porzana fusca	R	r		r	1		2			1	24-Nov
41	Watercock	Gallicrex cinerea	S	r		1						1	22-Feb
42	<b>Purple Swamphen</b>	Porphyrio porphyrio	W	с		с	29	8	21	300	174	300	22-Feb
43	<b>Common Moorhen</b>	Gallinula chloropus	W	с		с	48	4	13	100	213	213	13-Jan
44	Common Coot	Fulica atra	W	nc		nc				48	12	12	13-Jan
	SNIPES, SANDPIPERS	SCOLOPACIDAE											
45	Pintail Snipe	Gallinago stenura	W	с		r				1		1	21-Dec
46	Swinhoe's Snipe	Gallinago megala	v	1									
47	<b>Common Snipe</b>	Gallinago gallinago	W	с		nc	12	1		1	20	20	13-Jan
48	Jack Snipe	Lymnocryptes minimus	W	r									
49	<b>Black-tailed Godwit</b>	Limosa limosa	W	nc	NT	nc			75				
50	<b>Bar-tailed Godwit</b>	Limosa lapponica	M	1									
51	<b>Spotted Redshank</b>	Tringa erythropus	M	nc		nc			47	1	130	130	13-Jan
52	<b>Common Redshank</b>	Tringa tetanus	W	'n									
53	<b>Marsh Sandpiper</b>	Tringa stagnatilis	M	uc		nc			14		27	27	13-Jan
54	<b>Common Greenshank</b>	Tringa nebularia	W	nc		nc	14		3				

N0.	Species name	Scientific name	Season-	Status in	Global				<b>Baikka Bee</b> l	Sanctuary			
			ality	Hail Haor	threat	Status in	13-Dec-	28-Jan-	24 Jan &	1&3 Feb	13-Jan- 07	2006-07	date of
				IIAUI	SLALUS	sanctuary	70	4	10 F eD 2005	0007	/0	winter max	шах
55	Green Sandpiper	Tringa ochropus	W	nc		r	2	1					
56	Wood Sandpiper	Tringa glareola	W	с		nc			5	9	9	6	21-Dec
57	Common Sandpiper	Actitis hypoleucos	W	r		r		2	1				
58	Little Stint	Calidris minuta	M	r		r	5		10				
59	Temminck's Stint	Calidris temminckii	M	ပ		nc					2	2	13-Jan
60	Curlew Sandpiper	Calidris ferruginea	M	r									
61	Ruff	Philomachus pugnax	M	c		с	73	115	350	400	57	200	21-Dec
	PAINTED SNIPE	ROSTRATULIDAE											
62	<b>Greater Painted-snipe</b>	Rostratula benghalensis	R	r									
	JACANAS	JACANIDAE											
63	Pheasant-tailed Jacana	Hydrophasianus chirurgus	R	c		с	7		20	111	4	30	02-Mar
64	Bronze-winged Jacana	Metopidius indicus	R	c		с				30	6	6	13-Jan
	STILTS, AVOCETS	RECURVIROSTRIDAE											
65	Black-winged Stilt	Himantopus himantopus	M	с		с	37		42	2	06	06	13-Jan
	PLOVERS	CHARADRIIDAE											
66	<b>Pacific Golden Plover</b>	Pluvialis fulva	W	c		с		30		20		500	24-Nov
67	Grey Plover	Pluvialis squatarola	W	1									
68	Long-billed Plover	Charadrius placidus	Λ	1									
69	Little Ringed Plover	Charadrius dubius	W	c		с			13	3	4	9	21-Dec
70	Kentish Plover	Charadrius alexandrinus	W	r									
71	Lesser Sand Plover	Charadrius mongolus	W	r		1	30						
72	Grey-headed Lapwing	Vanellus cinereus	W	c		с		70	116	108	34	40	07-Feb
73	Red-wattled Lapwing	Vanellus indicus	R	r									
	<b>PRATINCOLES</b>	GLAREOLIDAE											
74	<b>Oriental Pratincole</b>	Glareola maldivarum	R	nc									
75	Small Pratincole	Glareola lactea	R	1									
	CULLS	LARIDAE											
76	Brown-headed Gull	Larus brunnicephalus	M	1									
	TERNS	STERNIDAE											
77	Common Tern	Sterna hirundo	Λ	1									
78	Whiskered Tern	Chlidonias hybridus		с		nc			15				
	OSPREY	PANDIONIDAE											
79	Osprey	Pandion haliaetus	W	2									
	HAWKS, EAGLES	ACCIPITRIDAE											
80	Black-shouldered Kite	Elanus caeruleus	R	r		1						1	22-Feb

No.	Species name	Scientific name	Season-	Status in	Global				<b>Baikka Beel</b>	Sanctuary			
			ality	Hail Haor	threat status	Status in sanctuary	13-Dec- 02	28-Jan- 04	24 Jan & 10 Feb 2005	1&3 Feb 2006	13-Jan- 07	2006-07 winter	date of max
81	Black (Pariah) Kite	Milvus mierans	Я	J		c			1	few	.0	27	22-Feb
82	Brahminy Kite	Haliastur Indus	R	ు		v			3	9	6	6	13-Jan
83	Pallas's Fish Eagle	Haliaeetus leucoryphus	R	nc	٨	nc			1 imm	3 (1 ad)	3 (1 ad)	6 (2 ad)	22-Feb
84	Grey-headed Fish Eagle	Ichthyophaga ichthyaetus	R	2	NT								
85	White-rumped Vulture	Gyps bengalensis	R	nc	С								
86	Eurasian Griffon	Gyps fulvus	Λ	1									
87	Himalayan Griffon	Gyps himalayensis	Λ	1									
88	Crested Serpent Eagle	Spilornis cheela	R	r									
89	Western Marsh Harrier	Circus aeruginosus	M	c		c			4			2	3 dates
90	Eastern Marsh Harrier	Circus spilonotus	M	c		c				1	3	3	13-Jan
91	Hen (Northern) Harrier	Circus cyaneus	M	3									
92	Pied Harrier	Circus melanoleucos	M	c		nc						2	07-Feb
93	Shikra	Accipiter badius	R	1									
94	Eurasian Sparrowhawk	Accipiter nisus	M	r									
95	Indian Spotted Eagle	Aquila hastata	M	1	٧	1						2	07-Feb
96	Greater Spotted Eagle	Aquila clanga	W	uc	V	nc			1	2	1	4	21-Dec
97	Steppe Eagle	Aquila nipalensis	M	r		r						2	22-Feb
98	Imperial Eagle	Aquila heliaca	Λ	2	Λ	2					1	1	13-Jan
	FALCONS	FALCONIDAE											
96	Common Kestrel	Falco tinnunculus	W	r									
100	Eurasian Hobby	Falco subbuteo	W	2									
	GREBES	PODICEPEDIDAE											
101	Little Grebe	Tachybaptus ruficollis	M	nc		nc		4		4		2	02-Mar
	DARTERS	ANHINGIDAE											
102	<b>Oriental Darter</b>	Anhinga melanogaster	W	r	NT	r					2	2	13-Jan
	CORMORANTS	PALACROCORACIDAE											
103	Little Cormorant	Phalacrocorax niger	R	c		с	3	7	11	50	34	72	22-Feb
104	Great Cormorant	Phalacrocorax carbo	M	1		1							
	HERONS	ARDEIDAE											
105	Little Egret	Egretta garzetta	R	c		c	17	11	20	10	1	80	22-Feb
106	Grey Heron	Ardea cinerea	W	c		с		11	13	25	12	33	07-Feb
107	Purple Heron	Ardea purpurea	R	uc		nc	2		1	1	2	5	24-Nov
108	Great Egret	Casmerodius albus	R	с		с		1	26	70	72	100	21-Dec
109	Intermediate Egret	Mesophoyx intermedia	R	с		с	136		12	180	36	36	13-Jan
110	Cattle Egret	Bubulcus ibis	R	с		с	27		30	79	175	700	24-Nov

No.	Species name	Scientific name	Season-	Status in	Global			H	saikka Beel	Sanctuary			
			ality	Hail	threat	Status in	13-Dec-	28-Jan-	24 Jan &	1&3 Feb	13-Jan-	2006-07	date of
				Haor	status	sanctuary	02	04	10 Feb 2005	2006	07	winter max	max
111	Indian Pond Heron	Ardeola grayii	R	c		c		22	8	9	75	75	13-Jan
112	Chinese Pond Heron	Ardeola bacchus	Λ	1									
113	<b>Black-crowned Night Heron</b>	Nycticorax nycticorax	R	2		1							
114	Yellow Bittern	Ixobrychus sinensis	R	r		r			3		1	1	13-Jan
115	<b>Cinnamon Bittern</b>	Ixobrychus cinnamomeus	R	r		1						1	18-Apr
116	<b>Black Bittern</b>	Dupetor flavicollis	R	1									
	IBISES	<b>THRESKIORNITHIDAE</b>											
117	<b>Black-headed Ibis</b>	Threskiornis melanocephalus	R	nc	NT	nc			3	2	7	7	13-Jan
	STORKS	CICONIIDAE											
118	Asian Openbill	Anastomus oscitans	R	с		nc			49			7	21-Dec
	SHRIKES	LANIIDAE											
119	Brown Shrike	Lanius cristatus	W	c		nc					1		
120	Long-tailed Shrike	Lanius schach	R	c		nc			few	few	few	few	
	CROWS	CORVIDAE											
121	Rufous Treepie	Dendrocitta vagabunda	R	с									
122	Large-billed (Jungle) Crow	Corvus macrorhynchos	R	c		nc			common			few	
	DRONGOS	DICRURIDAE											
123	Black Drongo	Dicrurus macrocercus	R	с		с			common	common	common	common	
	THRUSHES, CHATS	MUSCICAPIDAE											
124	Taiga Flycatcher	Ficedula albicilla	M	1									
125	Siberian Rubythroat	Luscinia calliope	W	r									
126	Bluethroat	Luscinia svecica	W	nc		r						1	
127	Oriental Magpie Robin	Copsychus saularis	R	nc		r							
128	Common Stonechat	Saxicola torquata	W	c		nc			few		few	few	
	STARLINGS, MYNAS	STURNIDAE											
129	Chestnut-tailed Starling	Sturnus malabaricus	W	1		1						4	
130	Asian Pied Starling	Sturnus contra	R	с		с			common	common	common	common	
131	Common Myna	Acridotheres tristis	R	с		с			common			few	
132	Jungle Myna	Acridotheres fuscus	R	nc		nc				2	few	few	
	SWALLOWS, MARTINS	HIRUNDINIDAE											
133	Sand Martin	Riparia ripari	W	с		nc					few	sev	
134	Plain Martin	Riparia paludicola	R	nc									
135	Barn Swallow	Hirundo rustica	M	c		c			common	several	common	common	
136	Red-rumped Swallow	Hirundo daurica	W	nc		1							
137	Asian House Martin	Delichon dasypus	M	1									

	Species name	Scientific name	Season-	Status in	Global				3aikka Beel	<b>Sanctuary</b>			
			ality	Hail	threat	Status in	13-Dec-	28-Jan-	24 Jan &	1&3 Feb	13-Jan-	2006-07	date of
				Haor	status	sanctuary	02	04	10 Feb 2005	2006	07	winter max	max
⊢	BULBULS	PYCNONOTIDAE											
8 1	Red-vented Bulbul	Pycnonotus cafer	R	nc		nc				1	common	common	
Ĕ	CISTICOLAS, PRINIAS	CISTICOLIDAE											
6	Zitting Cisticola	Cisticola juncidis	R	c									
F	WARBLERS, BABBLERS	SYLVIIDAE											
10:	Black-browed Reed Warbler	Acrocephalus bistrigiceps	M	1									
IIII	Paddyfield Warbler	Acrocephalus agricola	M	c		c				1	common	common	
12	Blyth's Reed Warbler	Acrocephalus dumetorum	M	nc		nc						few	
t3	Clamorous Reed Warbler	Acrocephalus stentoreus	R	с		nc			few		1	few	
4	Thick-billed Warbler	Acrocephalus aedon	M	r									
<u>†5</u> ]	Dusky Warbler	Phylloscopus fuscatus	M	c		c					common	common	
9 9	Striated Grassbird	Megalurus palustris	R	nc		nc					common	4	
5	Striated Babbler	Turdoides earlei	R	с		c			common	common	4	common	
	LARKS	ALAUDIDAE											
t8 I	Bengal Bushlark	Mirafra assamica	R	c		r						1	
6	Oriental Skylark	Alauda gulgula	R	c									
•1	SUNBIRDS	NECTARINIIDAE											
50 1	Purple-rumped Sunbird	Nectarina zeylonica	R	r									
51 1	Purple Sunbird	Nectarinia asiatica	R	1									
•1	SPARROWS, WAGTAILS	PASSERIDAE											
52 1	House Sparrow	Passer domesticus	R	c		nc						few	
53 1	White Wagtail	Motacilla alba	W	c		nc			common	1		few	
4	White-browed Wagtail	Motacilla maderaspatensis	R	1									
55 (	Citrine Wagtail	Motacilla citreola	W	c		c				few	common	common	
56	Yellow Wagtail	Motacilla flava	W	c		с					common	common	
57 1	Richard's Pipit	Anthus richardi	W	c		r						1	
58 1	Paddy field Pipit	Anthus rufulus	R	c		nc					few	few	
. 6	Tawny Pipit	Anthus campestris	W	1									
0 1	Rosy Pipit	Anthus roseatus	W	c		nc			several		several	several	
51 1	Black-breasted Weaver	Ploceus benghalensis	R	uc									
52 5	Streaked Weaver	Ploceus manyar	R	r									
63 1	Baya Weaver	Ploceus philippinus	R	с		с			common	common	common	common	
2	Indian Silverbill	Lonchura malabarica	R	uc									
55	Scaly-breasted Munia	Lonchura punctulata	R	c									
56 1	Black-headed Munia	Lonchura malacca	R	с									

SO6.c

No.	Species name	Scientific name	Season-	Status in	Global			I	<b>3aikka Beel</b>	Sanctuary			
			ality	Hail	threat	Status in	13-Dec-	28-Jan-	24 Jan &	1&3 Feb	13-Jan-	2006-07	date of
				Haor	status	sanctuary	02	9	10 Feb	2006	07	winter	max
									2005			max	
	FINCHES, BUNTINGS	FRINGILLIDAE											
167	Chestnut-eared Bunting	Emberiza fucata	M	r									
168	Little Bunting	Emberiza pusilla	W	1									
169	Yellow-breasted Bunting	Emberiza aureola	W	nc	NT	nc						30	18-Apr
	Unidentified egrets										200		
	Total waterbird number						206	296	I, I74	6,949	7,262	12,708	
	Total waterbird species						18	I6	32	33	35	45	
	Total ducks						464	8	251	5,391	5,863	10,060	

Bold = waterbirds

1992 and 1993 data from NERP (1993) Wetland Resources Specialist Study. FAP 6. BWDB and FPCO. Exact area of the haor surveyed is not shown recorded but is likely to have been larger than Baikka Sanctuary, survey location within the haor not known, only waterbirds and raptors recorded 2002 and 2003 data from Baikka Beel, only waterbirds recorded

Where a columns has more than one date, the numbers are the maximum of daily counts

Records from other parts of the haor included from: R Halder; DL Johnson; D Millin; DA Scott; PM Thompson; JD Woolner Observers: AK - Anisuzaman Khan; SR - SMA Rashid; EH - Enam Ul Haque; WC - WJ Collis; PT - Paul M Thompson List shows all species known to have been recorded from Hail Haor up to June 2007

### Season:

Resident ĸ

- Winter visitor ≥
- Summer/monsoon visitor s >
  - Vagrant

### Status:

- number of sightings of rare species since 1977 (where known) 1-5
- rare = 5+ sightings since 1977 but unlikely to be seen during 1 visit
- uncommon, a fair chance of being seen on a single visit (in the right season) nc
  - common, expect to see these on a single visit (in the right season). J

# Threat status:

- Critical ΰ
- Vulnerable
- Near Threatened - LN

BirdLife International (2001) Threatened birds of Asia: the BirdLife International Red Data Book. Cambridge, UK: BirdLife International.

### **Strategic Objective 6**

## **Indicator 6.1.a:** Area of Floodplain where Sustainable Management is implemented

June 2007

Management of Aquatic Ecosystems through Community Husbandry (MACH)

Strategic Objective 6: Improved Management of Open Water and Tropical Forest Reso	urces		
Intermediate Result 6.1: Fully developed and effective community-based resource mar	nagement 1	nechanisms impl	emented
<b>Indicator 6.1a:</b> Area of floodplain where sustainable management is implemented			
A. Description	Cumulat	ive Unit of meas	ure: Ha.
Precise Definition of Indicator: Sustainable management is defined by meeting the			
following criteria:	<b>N</b> 7		Actua
1. Participatory mechanisms for decision making are used (e.g. community	Year	Planned	1
management committee, local government management committee). These			
committees must include representatives both from the local government and the	Baseli		0
community.	ne		
2. Planning of activities is coordinated to identify priorities, needs, and resources for		MACH-I	
implementation			
3. Procedures for environmentally sound resource use established.	2000	1,200	2,200
Includes both open water and riparian areas.			6.0.0
Unit of Measure: Hectare	2001	5,200	6,300
Disaggregate by: N/A			
Justification/Management Utility: This is a quantitative indicator that allows the SO	2002	11,200	11,202
Team to determine progress. Increase in area indicates the expansion of sustainable			
management practices on one hand and improvement of habitat on the other.	2003	15,000	18,866
Sustainable management practices will be instrumental in improving degraded habitats		,	,
and ecosystems to ensure increased production of natural resources and enhance		MACH-II	
biodiversity.			
B. Plan for Data Collection	2004	800	820
Data Collection Method: Surveys, satellite imagery, LGED maps.			0_0
Method of Acquisition by USAID: Receipt of Semi-Annual Reports form Winrock			
Data Source(s): Winrock International and partners	2005	1500	2055
Frequency/ Timing of Data Collection: Annual.	2005	1500	2055
Estimated Cost of Collection: Medium		The	
Responsible Individual(s) at USAID: Team Leader		management	
C. Data Quality Issues		activities	
Date of Initial Data Quality Assessment: Not undertaken to date. This is a new		were	
indicator.	2006	consolidated	
Known Data Limitations (if any):	2000	in the 20 921	
Actions Taken or Planned to Address Data Limitations:		hectares of	
Date of Future Data Quality Assessments:		developed	
Procedures of Future Data Quality Assessments:		areas.	
D Plan for Data Analysis Banarting and Daviaw			
<b>Data analysis:</b> Review, by SO 6 Team, trends of progress comparing target to actual			
performance			
Presentation of Data: Table mans and photos			
<b>Review of Data:</b> Semi-annual mission portfolio review R4 review and individual			
review with recipient			
<b>Reporting Data:</b> Internal mission report R4 report and CBI report			
E. Other Notes			
<b>Notes on the Baselines/Targets:</b> Established by the grantee from land survey records			
satellite images and LGED maps. No sustainable Management practices in place			
before MACH.			
Location of Data Storage: P:\MissionShareable\EGFEpub\Environment\PMP			
<b>Comments: 2004</b> : new areas taken under management mostly in the Turog Bangshi			
(TB) site where a total new area of 780 ha. was taken under sustainable management.			
A further 40 hectares was established in Hail Haor (HH).			
2005: improved management was established in the villages and wetland area around			
Goaliar khal wetland (560 ha.) in Turag-Bonshi and in 675 ha. of floodplain in the			
Ramedia beel management area in Hail Haor.			
<b>2006:</b> During January 2006 to April 2007 the improved management norms were			
consolidated to make the management practices sustainable in the area which was			
brought under. So, further new area had not been expanded.			

#### **Strategic Objective 6:** Indicator 6.1.a: **Area of Floodplain where Sustainable Management is implemented**

#### The area under improved management is that area where:

#### A. Participatory mechanisms in place:

- 1. Community based Resource Management Organizations (RMO) formed and functional
- 2. Union Parishad chairmen and members are involved and meet regularly on area resource management issues and serve as advisers to the RMOs when requested
- 3. Upazila Fisheries Committee (previously LGC) formed and active in area resource management, co-management practiced
- 4. Endowment established to provide financial resources to the organizations through the UFC.

B. **Resource Management Plan** in place identifying priority needs and resources, with environmentally sound resource use procedures established. Each RMO has a management plan, which it reviews and updates each year.

#### C. Best management practices were adopted (procedures for sound resource use established):

- 1. Sanctuaries established
- 2. Time or area fishing closure periods established and effectively implemented
- 3. Refrain from destructive harvest practices (de-watering, use of destructive gears, spawn collection reduced)
- 4. Re-introduction of previously existing species into sanctuary habitat
- 5. Restoration of wetland areas from annual to perennial
- 6. Introduction of fish aggregating and fish harvesting prevention devices in sanctuaries

MACH has already had success in implementing land management policy changes for the Hail Haor basin by getting changes made to the leases for government land where pineapple is planted on the hillsides. The project has been a factor in getting longer-term leases for RMO's, and changes to the yearly 25% on the initial rate then afterward 10% annual increase over previous year's lease rate. The project has also worked toward having certain restrictions placed on the lease such as mandatory sanctuary creation, alternating harvest, and no de-watering. MACH has successfully changed a government policy by getting agreement that 8 critical areas in the MACH floodplains be set aside, the GoB give up the revenue and that these areas be managed by the communities as sanctuaries and conservation areas for all time in the future. This has been accomplished and will favorably impact the entire 25,000 hectares of wet season wetlands of the MACH project. The setting up of these 8 permanent sanctuaries will ensure that the integrity of the fishery and wetlands can be sustained.

**Methodology for Area Delineation.** The project has worked at 4 levels in improving the management of resource areas. The organization at the resource level (1<sup>st</sup> level) is the Resource Management Organization (RMO) and this is a community-based organization managing a part or an entire wetland area. The Union Parishad Chairman can be an advisor to this organization and plans are shared and coordinated in two directions with the Union Parishad (2<sup>nd</sup> level) and the next level at the Upazila (3<sup>rd</sup> level). Here MACH has formed Local Government Committees (to continue long-term as Upazila Fisheries Committees) for providing GoB support and strength to the resource management decisions made by the RMOs. The fourth level is the MACH Steering Committee at the National Level.

The Area under improved management has been determined as that area which has come under the best management practices of a Resource Management Organization and the institutional support of Local Government both at the Union and the Upazila level where best management practices

described above and being implemented. On the following pages the delineated improved management is shown in both tabular and map form. The various resource management organization data sheets are also provided for reference.

PMO				Year			Total
RIVIO	LU	2001	2002	2003	2004	2005	Totai
	Land	440.65		120.98			561.63
	Settlement	51.98	17.56	12.55			82.09
Agari Beel RMO	Waterbody	8.94		50.09			59.03
	Road Side Plantation	1.84	7.22				9.06
	Total	503.42	24.78	183.62			711.81
	Land	107.71	18.01	50.16			175.89
	Settlement	150.24					150.24
Balla Beel RMO	Waterbody	107.64	9.61	60.52			177.77
	Road Side Plantation		0.82				0.82
	Chhora Plantation	1.23	0.65	1.82			3.70
	Total	366.83	29.08	112.51			508.42
	Land			618.25			618.25
	Settlement		35.59				35.59
	Waterbody		0.38	1292.39			1292.77
Boro Gangina RMO	Road Side Plantation		6.40	2.35			8.75
	Kanda			43.52			43.52
	Khal		15.31	5.95			21.25
	Total	0.00	57.68	1962.46			2020.13
	Land	510.17					510.17
	Settlement	55.71	1.28				56.99
	Waterbody	181.68					181.68
Dumuria Beel RMO	Road Side Plantation	2.23	3.40				5.64
	Chhora Plantation			2.44			2.44
	Kanda	13.75					13.75
	Total	763.55	4.69	2.44			770.68
	Land	247.97		428.28			676.25
	Settlement	65.18		15.23			80.41
Jethua Beel RMO	Waterbody	2.51		575.71			578.22
	Road Side Plantation	1.57	2.09	6.98			10.64
	Chhora Plantation		• • • •	2.62			
	Total	317.24	2.09	1028.82			1345.53
	Land	241.70	25.52	619.23			860.94
	Settlement	77.99	35.73	7.01			113.71
Kazura Beel RMO	Waterbody	9.25		/.81			17.06
	Road Side Plantation	1.96	25.52	(25.05			1.96
		330.90	35.73	627.05			993.67
		87.89	191.16	391.90			670.95
	Settlement	129.77	100.44	192 (2			129.77
Sananda Beel RMO	Waterbody	4.14	100.44	182.62			287.20
	Road Side Plantation	1.93	3.26	2.01			5.19
	Chnora Plantation	222.74	204.96	2.01			2.01
	Iotal	223.74	294.80	5/0.53		((2.00	1095.12
	Land				22.00	663.00	
Ramaia Beel	Watanhady				7.00	12.00	33.00
	Tatal				/.00	12.00	715.00
	Iotal	48.05			40.00	0/5.00	/15.00
	Lallu Sattlamant	48.93					48.95
Alia Chhora RMO	Chhara Diantation	57.55		12.24			37.53
	Total	96.40	0.00	13.24			13.24
	Lond	166.25	0.00	13.24			99.12 166.25
Baula Chhora DMO	Lallu Sattlamant	100.33					100.35
Baula Chilora KwiO	Total	30.00	0.00	0.00			30.00
	10121	190.35	0.00	0.00			190.35
L					L		

#### Area under Improved Management (ha) Hail Haor Site

BMO				Year			Total
RIVIO	LU	2001	2002	2003	2004	2005	Totai
	Land	86.37					86.37
Jag Chhora RMO	Chhora Plantation		1.38				1.38
	Total	86.37	1.38	0.00			87.75
Joita Chhara DMO	Land	184.19					184.19
Joita Chilora Kivio	Total	184.19	0.00	0.00			184.19
	Settlement	85.35	182.69				268.04
Out side of DMO but	Road Side Plantation		14.31	2.96			17.27
Dut side of KNO but	Chhora Plantation			3.68			
managed by KUG/MACH	Pineapple Demo	0.49	1.92	10.39			12.80
	Total	85.84	198.92	17.03			298.11
Grand Total		3144.90	649.20	4523.68	40.00	675.00	9026.48

#### Area under Improved Management (ha) Kongshaw-Malijhee Site

NAME		¥	Year			Total
INAIVIE	2001	2002	2003	2004	2005	Totai
Beel						
Aourabaura Village Committee	65	205	15			285
Bailsha Beel RMO	300		330			630
Dholi-Baila Beel RMO	430	15	125			570
Kewta Beel RMO	170	270	780			1220
Takimari-Dharabasia Beel RMO	690		950			1640
River / Jhora						
Bogdubi-Paglarmukh River Section			10			10
Kalghosha Chhora Committee		330				330
Nakshi Jhora Committee		60				60
Someswari River Committee			10			10
Gaimara Kur Committee			1520			1520
Grand Total	1655	880	3740	0	0	6275

*N.B.* Under outreach program 6750 hectare "Jheenigati plantation zone" is managed by plantation committees

#### Area under Improved Management (ha) Turag-Bangshi Site

Nemo		Yea	ır			Total
Ivanie	2001	2002	2003	2004	2005	Totai
Alua Beel RMO	600	950	900			2450
Mokosh Beel RMO	725	950				1675
River / Khal						0
Turag River RMO	155					155
Goallar River RMO				780	560	1340
Total	1480	1900	900	780	560	5620

Source of Data Monthly Reports of Resource Management Organization of MACH sites

RMOs	Sub- committee formed	Managed by RMOs	Species re- introduced	Brush done ( Tetra- piling	piling Br) & pod (Tp)	Stop fishing in sanctuaries
				Br	Тр	
H-H site						
1. Sananda						
2. Balla						
3. Jethua	$\checkmark$					
4. Kajura						
5. Agari						
6. Borogangina					$\checkmark$	
7. Dumuria					X	
8. Ramedia					$\checkmark$	
T-B site						
9. Mokosh						
10. Aula					$\checkmark$	
11. Turag River					х	
12. Goaliar					х	
K-M site						
13. Kewta						
14. Takimari-						$\checkmark$
Dharabasia						
15. Dhali-Baila						
16. Bailsha			$$			$$



#### MACH Project MACH-CNRS Wetland Resource Management Organizations (RMOs) in Three Sites Report as on April, 2007

Site	RMO	Daha/Kum group	Stream committees
Hail Haor	Sanada RMO	-	Alia Chhara Committee
	Jethua RMO	-	Boula Chhara Committee
	Balla RMO	-	Jaag Chhara Committee
	Dumuria RMO	-	Joita Chhara Committee
	Agari RMO	-	Ful Chhara Committee
	Kajura RMO	-	
	Borogangina RMO	-	
	Ramedia RMO	-	
Total	8 nos.	-	5 nos.
Turag-Bangshi	Mokosh RMO	Naler Daha Committee	-
		Nawkhola Dholi Daha	
		Committee	
		Tamail Daha Committee	
		Moisher Daha Committee	
		Gorer Daha Committee	
	Turag River RMO	Golachipa Kum Committee	-
		Lalkhar Kum Committee	
		Gabtoli Sayedpur Kum	
		Committee	
	Alua RMO	Burir Daha Committee	-
		Doika Daha Committee	-
		Bhangi Danga Daha Committee	-
		Bamoner Ghuni Committee	-
		Boro Daha Committee	-
		Folimara Daha Committee	-
		Gurerhari Daha Committee	-
		Krishnar Hari Daha Committee	-
	Goalia River RMO	Section 1	-
		Section 2	-
		Section 3	-
		Section 4	-
Total	4 nos.	20 nos.	-
Kangsha-	Kewta RMO		Kalaghosa-1 Jhara Committee
Malijhee	Takimari-Dharabashia	Bahar Ali Kur Committee	Kalaghosa-2 Jhara Committee
	RMO	(Malijhee River)	
		Gaimara Kur Committee	
	Dholi-Baila RMO	-	Nakshi-Mala Jhara Committee
	Bailsha RMO	-	-
Total	4 Nos.	2 Nos.	3 Nos.
G. Total	16 Nos.	22 Nos.	8 Nos.

Note: in Turag-Bangshi site the RMOs were built up from a series of smaller "daha" committees which cover different parts of the total RMO area, each daha committee is represented in the RMO, the general body of the RMO comprises all members of the constituent daha committees. In Kangsha-Malijhee some RMOs have within them kur committees to manage particular scour holes in rivers within their area, but it is not necessary that all RMO members belong to a smaller area committee. In Hail Haor there is no area subdivision of the RMO membership and areas. Stream (chhara/jhara) committees are different and separate, they do not have a direct link with specific RMOs, and

Stream (chhara/jhara) committees are different and separate, they do not have a direct link with specific RMOs, and comprise of stakeholder groups who aim to maintain and protect riparian plantations and stream functions in areas that drain into the wetlands.

### **Strategic Objective 6**

## Indicator 6.2a: Aquatic habitats converted from seasonal to perennial in targeted areas.

June 2007

Management of Aquatic Ecosystems through Community Husbandry (MACH)

Strategic Objective 6: Improved Management of Open Water and Tropical Forest Resc	urces		
Intermediate Result 6.2: Selected Habitats and Ecosystems Improved and Restoration	Rehabilitat	ion Activiti	es
Intensified			
Indicator 6.2a: Aquatic habitats converted from seasonal to perennial in targeted areas	1		
A. Description	Cumulativ	e Unit of m	easure: Ha.
Precise Definition of Indicator: Perennial aquatic habitat retains sufficient water			
during the dry season to maintain fish stocks. Seasonal aquatic habitat dries up.	Year	Planned	Actual <sup>1</sup> /
Unit of Measure: Hectare			
Disaggregate by: N/A	Baseline	0	0
Justification/Management Utility: Area of perennial water-bodies and associated	2000		
habitat improvement efforts that re-convert water bodies from seasonal to perennial		MACH-I	
status in targeted areas. This is a quantitative indicator that allows the SO Team to determine the success of the ecosystem improvement effort. Physical intervention will improve the connections between rivers and heads (normalised water bodies) and	2001	15	25
selected beels will be deepened, which will increase the area of perennial water bodies.	2002	40	142
<b>B.</b> Plan for Data Collection Data Collection Method: Annual by Winrock International and partners Method of Acquisition by USAID: Receipt of Semi-Annual and annual Reports from Winnsels	2003	50	269
Winfock Data Source(s): Land many sotallite images GPS ground surveys		MACH-II	
Frequency/Timing of Data Collection: Annual			
Estimated Cost of Collection: Medium	2004	200	367
<b>Responsible Individual(s) at USAID:</b> Team Leader			
C. Data Quality Issues Date of Initial Data Quality Assessment: None	2005	500	448
Known Data Limitations (if any): Dry season water area varies from one year to another due to variations in local rains and irrigation withdrawals Actions Taken or Planned to Address Data Limitations:	2006	-	512
Date of Future Data Quality Assessments: Procedures of Future Data Quality Assessments:	2007	-	550
D. Plan for Data Analysis, Reporting, and Review			
<ul> <li>Data analysis: Review trends of progress comparing targets for actual performance.</li> <li>Presentation of Data: In Table</li> <li>Review of Data: Semi-annual mission portfolio review, R-4 review, and individual review with recipient.</li> <li>Reporting Data: AR/SAR and CBJ report</li> </ul>			
E. Other Notes Notes on the Baselines/ Targets: Baseline is zero.			
Location of Data Storage: P:\MissionShareable\EGFEpub\Environment\PMP			
<b>2004</b> : The area shown represents the beel and khal basin area that exists in wet season			
which is converted from seasonal to perennial.			
<b>2005</b> : During this period due to early rainfall very little excavation work was accomplished as the dry season was short.			

#### **Strategic Objective 6:**

Indicator 6.2.a: Aquatic habitat converted from seasonal to perennial in targeted areas

The targets for this indicator were based on the approval and availability of the Investm ent support fund (416b)'in the y ear 2000. This fund did not become available to MACH until April of 2003. This indicator was not an original project indicator.

In the attached tables there can be seen three types of figures. The area of beel or length of khal where there was actual soil removal or deepening (area/length excavated), secondly the area of the beel or lake"resourc e as identified in the government records as that part which is leased (Area of water body), and thirdly the probable immediate basin impact area or the area of aquatic habitat impacted by the change of the water body from seasonal to perennial (Influence area). The baseline is the area that is not perennial with the impacted area becoming perennial through depth alteration.

The areas shown are those water bodies that prior to the project intervention dried during the dry season or retained insufficient water to support a fish population. The impact of the drying of the pools of water bodies is that residual fish stocks diminish and fewer individuals are available for reproduction to replenish the stocks on the floodplain in the wet season. Diversity also diminishes due to the lack över the dry season'habitat area. By restoring these dry season fish reserves, adult brood stock can be retained to quickly repopulate the floodplain during the wet season and the impact is over a larger beel and floodplain area. These activities impact the entire wet season wetland area. The aquatic habitat converted from seasonal to perennial is that area that expands in the wet season and contracts in the dry season and is considered a beel or a fishery.

The increase in perennial wetland area will likely have some of the most pronounced and prolonged impacts on the function of the wetland and thereby the fish production and diversity. It also does not require large areas to be protected during the dry season to have an impact. Small areas that are well protected provide for larger individual parent fish from one year to the next and a higher assured level of reproduction to repopulate larger water floodplains.

#### Meters of channel rehabilitated

**This indicator was not one of the original project indicators**. Targets for this were set based on the availability of the local currency fund in 2000. This fund was not made available to the project until April of 2003, because of delays in processing the investment fund program through the GoB channels.

The project is also not implementing as many of the channel or canal rehabilitation schemes (reexcavation) as was originally envisioned for another reason as well. The potential benefits of improved canal or channel connectivity for fish movement are often far outweighed by the potential disturbances and loss of wetland function that might occur from the improved drainage of the wetland. If the drainage is improved from a beel to a river for example the beel might actually drain faster than before further shrinking the inundation extent and the dry season storage of water. The project has restored only those channels or canals that will not alter the wetland area that currently exists and rejects any excavation or restoration that would reduce the size of the wetland area. Only those channels that will allow for improved migration of fish between beels have been rehabilitated. Rehabilitation has also been done where making certain portions deeper to serve as refuges for dry season fish stocks have been advantageous to production.

Even though in limited cases the rehabilitation may be successful, the project recommends that this indicator not be used as a determinant of project success. The attached tables show the meters of canal rehabilitated in the three sites and this is accomplished through actual field measurement. It should be noted that all canal or beel link channel excavation schemes are decided on by the community and developed by themselves for the most part with local labor.

Canal re-excavation	ı schemes in	2002 and 2003
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	Name of scheme	Through June	FY 20	002-03 August	Total	Influence area
		30, 2002			length (m)	of the schemes
		Length of re-	Re-	Length of		(ha)
		excavated	excavated	re-excavated		
		canal (m)	area (ha)	canal (m)		
HH						
Site:						
1	Jathua canal	1,800			1,800	278
2	Borogangina-I	1,000			1,000	101
3	Borogangina-II	676			676	
4	Kajura canal	100			100	178
5	Borogangina-III		4.1	845	845	
6	Bargangina		12.1	1,907	1,907	
7	Choradoba to Kankata		2.3	468	468	
	Sub-total area (m)	3,576	18.5	3,220	6,796	557
KM Site:						
1	Kur in Katakhali khal-I	500			500	54
2	Kur in Katakhali khal-II	493			493	36
					120	101
3	Someswari	426			426	101
4	Katakhali -V (FC)		2.4	1,235	1,235	
5	Katakhali -VI (LC)		1.2	378	378	
6	Tenachura Khal		1.6	965	965	
	Sub-total area (m)	1,419	5.2	2,578	3,997	191
TB Site	•	, , , , , , , , , , , , , , , , , , ,				
1	Mokesh to Turag canal	500	0	0	500	390
	Sub-total area (m)	500	0	0	500	390
	Total	5,495	23.7	5,798	11,293	1,138

dated statement	Area ce area of	water body of the scheme	Ha Ha	-	6.00 320	3.60 92	0.32 200	29.50 396	29.04 293	2.36 2.78	0.00 396	0.00 92	1.42 362	33.10 0		29.50 0	2.39 0	137.23 2429	0		36	36	36 1.23 30	36 1.23 13.77 87	36         36           1.23         30           13.77         87           2.46         0	36         36           1.23         30           13.77         87           2.46         0           1.62         2
Conse	Area re-	excava ted	На		1.25	0.71	0.20	0.61	0.10	2.01	1.88	0.52	0.47	1.82		1.57	0.41	11.55					0.08	0.08	0.08 0.79 2.83	0.08 0.79 2.83 0.20
03	Influ ence area	of the sche me	На															0.00								
rough 20	Area of	water body	На													29.50	2.39	31.89							1.21	1.21
Th	Area of	exca vated beel	На													1.57	0.41	1.98							1.21	1.21
2	Influe nce area	of the schem e	Ha								396	92	362					850							0	0 0
ough 200	Area of	water body	Ha	1									1.42	33.10				34.52							1.25	1.62
Th	Area of	excavat ed beel	На	1							1.88	0.52	0.47	1.82				4.69							1.62	1.62
	Influenc e area	of the scheme	Ha			92	200	396	293	278								1259		36	2	6	30	30 30 87	30 87	30 87
hrough 2001	Area of	water body	Ha	-		3.60	0.32	29.50	29.04	2.36								64.82					1.23	1.23	1.23	1.23
L	Area	re- excavated	Ha	-		0.71	0.20	0.61	0.10	2.01								3.63					0.08	0.08	0.79	0.08
00	Influence area	of the scheme	На		320.00													320								
Through 20	Area of	water body	На		6.00													6.00			-					
L	Area of	excavat ed beel	На		1.25													1.25								
			Name of scheme	te:	Chiradoba beel	Sananda beel-I	Kajura beel	Agari beel-I	Balla beel	Jathua beel	Agari beel-II	Sananda beel-II	Charadoba beel	Borogangina	Kajura beel/canal	Lalitagangina	Uchari	otal area (Ha)	ite:	Katakhali-I		Khatakhali-II	Khatakhali-II Darabasia beel	Khatakhali-II Darabasia beel Kewta beel	Khatakhali-II Darabasia beel Kewta beel Bailsha beel	Khatakhali-II Darabasia beel Kewta beel Bailsha beel Dainnar
				HH Si	01	02	03	04	05	90	07	08	60	10	11	12	13	Sub-to	KM Si	01			02	03	03 04	05 05 02

Aquatic habitat converted from seasonal to perennial in targeted areas

conversion to perennial water

4

SO 6.2a

Aquatic habitat converted from seasonal to perennial in targeted areas

tement	Influen ce area	of the scheme	Ha	155	0	780	C	0	0	0	0	0	0	780	3364
olidated sta	Area of water body		Ha	19.94		8.10	50.20	27.53	10.12	12.15	0.40	2.63	1.21	112.35	269.52
Consc	Area re-	excava ted	Ha	4.63		0.19	2 0.2	0.81	0.28	2.02	0.10	2.63	1.21	9.28	25.46
03	Influ ence area	of the sche me	Ha	0.00											0.00
rough 2(	Area of	water body	Ha	1.21								2.63	1.21	3.85	36.95
μ	Area of	exca vated beel	Ha	1.21								2.63	1.21	3.85	7.04
12	Influe nce area	of the schem e	Ha	2		390								390	1242
rough 200	Area of	water body	На	3.73		4.05	50.20	27.53	10.12	12.15	0.40			104.45	142.70
Th	Area of	excavat ed beel	Ha	2.54			, CO C	0.81	0.28	2.02	0.10			5.24	12.47
	Influenc e area	of the scheme	Ha	153		390								390	1802
hrough 2001	Area of	water body	Ha	15.00		4.05								4.05	83.87
L	Area	re- excavated	Ha	0.87		0.19								0.19	4.69
00	Influence area	of the scheme	Ha												320
Through 20	Area of	water body	На												6.00
L	Area of excavat ed beel														1.25
			Name of scheme	ital area (Ha)	e:	Naler Doha	Nowkhola Doli heed	Folimara-1	Daika	Dholi bariguni & Bamuner guni	Bastoli	Dholi bariguni	Folimara -2	otal area (Ha)	Total
				Sub-to	TB Sit	01	6	03	04	05	90	07	08	Sub-to	

പ
#### November 2003-October 2004 Total area of water-Area of Name of scheme excavated waterbodies, ha, Remarks bodies (ha) (in wet season) Ha Ha HH Site: Ramai beel wit link canal 01 2.00 2.53 Partially excavated 02 Lalitagangina II 1.20 29.50 03 Bargangina II 1.91 3.82 04 Bargangina III 1.26 2.52 Lalita gangina to Agari link canal 0.20 05 0.10 0.58 06 Sananda 3.60 07 Balla beel 2.00 | Partially excavated 1.82 08 Digholee Beel 3.34 3.50 Partially excavated 09 Khoia Beel 2.27 2.50 Partially excavated 10 Medi Beel with link canal 1.86 2.00 Partially excavated Sub-total area (Ha) 16.34 52.17 **KM Site:** 1 Dholi beel 2.50 3.15 2 Balisha beel 10.27 1.50 Batia beel 1.00 1.20 3 Bogadubi khal 2.00 3.48 4 0.95 5 Tenachura khal 0.48 Tenachura khal at Kanduli village 1.50 0.76 6 7 Katakhali khal 1.00 1.44 8 Kewta Beel 2.25 2.50 partially excavated 9 Kaitary Beel 1.25 1.00 partially excavated 10 Chaira Beel 2.25 2.50 partially excavated Sub-total area (Ha) 9.98 21.25 **TB Site:** Nowkhola and Doli beel 4.00 50.20 1 2 Folimara-doha 3.50 27.53 3 Dholi bariguni & Bamuner guni II 2.59 12.15 4 Dholi bariguni & Bamuner guni III 2.00 2.50 partially excavated Goliar khal-1 6.00 50.00 5 6 Goliar khal-2 6.00 50.00 7 Goliar khal-3 6.00 50.00 Goliar khal-4 6.00 50.00 8 Vangidangar Ghuna 1.25 1.50 9 293.88 Sub-total area (Ha) 37.34 63.66 367.30 Total

#### Management of Aquatic Ecosystem through Community Husbandry (MACH) Aquatic habitat converted from seasonal to perennial in targeted areas

#### Management of Aquatic Ecosystem through Community Husbandry (MACH) Aquatic habitat converted from seasonal to perennial in targeted areas

		November 2004-October 2005					
	Name of scheme	Area of	Total area of water-	Domorika			
	Name of scheme	bodies (ha)	(in wet season)	Kemarks			
		На	На				
HH Site	•						
01	Sananda Beel	0.02	2.00	work done			
Sub-tot	al area (Ha)	0.02	2.00				
KM Sit	e:						
1	Katakhali khal near Paglar Mukh	0.87	4.00	Almost completed			
2	Tenachora Khal under Dholi-Baila complex	1.83	5.00	partially completed due to rain			
3	Tenachora Khal under Bailsha complex	2.25	6.00	partially completed due to rain			
4	Dholi Beel	2.23	30.00	completed			
Sub-tot	al area (Ha)	7.18	45.00				
TB Site							
1	Guarhari	0.42	5.00	partially excavated due to rain			
2	Kishnerhari	0.87	6.00	partially excavated due to rain			
3	Bamuner guni III	0.50	3.00	partially excavated due to rain			
4	Goliar khal-5	3.00	20.00				
Sub-tota	l area (Ha)	4.79	34.00				
	Total	11.99	81.00				

Sl No.	Name of scheme	Туре	Area of excavated waterbodies (ha)	Total area of waterbodies in wet season (ha)
1	2	3	4	5
A. S	reemangal Site:	T		
01	Jaduria # 01	Beel	-	-
02	Jaduria # 04	Beel	0.10	8.00
03	Jaduria # 05	Beel	0.67	3.00
04	Jaduria # 06	Beel	0.10	8.00
05	Magura beel	Beel	-	-
06	Dolidoba beel	Beel	0.88	5.00
07	Balla beel	Beel	0.42	7.00
08	Medi beel	Beel	0.93	6.00
09	Koir beel	Beel	1.86	8.00
10	Jurmehedi beel	Beel	0.88	6.00
	Lalerdoba beel	Beel	-	-
12	Vimsi pond	Pond	0.15	0.50
13	Tikria pond	Pond	0.09	0.50
	Sub-total -A		6.08	52.00
B. SI	herpur Site:	1		
14	Gajarmari Khal in Dholi beel	Khal	-	-
15	Tenachora Khal under Dholi - Baila Complex	Khal	1.56	4.00
16	Tenachora Khal under Bailsha Complex	Khal	1.56	5.00
17	Katakhali Khal near Shashan Ghat	Khal	0.28	1.00
18	Bogadubi Khal to Dholi Beel	Khal	-	-
19	Katakhali Khal near Bel tree	Khal	-	-
	Sub - Total		3.40	10.00
20	Bailsha Beel	Beel	-	
	Sub - Total		-	-
	Total -B		3.40	10.00
C. K	aliakoir Site:			
21	Boro doho	Beel	0.46	2.00
	Sub-total -C		<u> </u>	2 00
	$T_{atal} (A + B + C)$		0.40	2.00
	10tal (A+D+C)		9.94	04.00

#### Aquatic habitat converted from seasonal to perennial in targeted areas November 2005-October 2006

Sl No.	Name of scheme	Туре	Planned area of scheme (ha)	Area of excavated waterbodies (ha)	Total area of waterbodies in wet season (ha)	
1	2	3	4	5	6	
A. Sı	reemangal Site:					
	Beel:					
01	Jaduria # 04	Beel	2.00	2.00	10.00	
02	Jaduria # 06	Beel	2.00	1.00	5.00	
03	Dolidoba beel	Beel	0.50	0.50	2.00	
04	Balla beel	Beel	1.00	0.25	1.00	
05	Medi beel	Beel	2.00	0.75	2.00	
			7.50	4.50	20.00	
	Khal:					
06	Baragangina Khal	Khal	1.00	0.50	3.50	
			1.00	0.50	3.50	
	Sub-total -A		8.50	5.00	23.50	
B. Sł	herpur Site:					
07	Tenachora Khal from the house of Mostafa to Liakot	Khal	6.00	1.50	10.00	
	Sub - Total		6.00	1.50	10.00	
C. K	aliakoir Site:					
08	Boro doho	Beel	1.00	0.50	4.50	
	Sub-total -C		1.00	0.50	4.50	
	Total (A+B+C)		15.50	7.00	38.00	

#### Aquatic habitat converted from seasonal to perennial in targeted areas November 2006-April 2007

# **Strategic Objective 6**

# **Indicator 6.2b:** Riparian habitat improved in targeted areas

June 2007

Management of Aquatic Ecosystems through Community Husbandry (MACH)

Strategic Objective 6: Improved Management of Open Water and Tropical Forest Resources						
Intermediate Result 6.2: Selected Habitats and Ecosystems Improved and Restoration Intensified	n / Rehabilita	ation Activitie	es			
Indicator 6.2b: Riparian habitat improved in targeted areas						
A. Description	Cumulativ	e Unit of mea	sure: (km)			
<b>Precise Definition of Indicator:</b> This indicator measures the area of riparian habitat that will be brought under community based management within an integrated	Year	Planned	Actual			
wetland/upland management system. Improved means stream bank stabilization, use		MACH-I				
of soil conserving agricultural production practices, and similar measures. <b>Unit of Measure:</b> Kilometers of stream length	2001	20	26.5			
<b>Disaggregate by:</b> N/A <b>Justification/Management Utility:</b> Indication to measure the increase in aquatic habitats and biodiversity. Riparian habitats are important contributors to the SO level	2002	30	80			
B. Plan for Data Collection	2003	40	166.91*			
Data Collection Method: Winrock and its implementation partners will measure						
and report on actual amount of riparian area under improved practices.		MACH-II				
Method of Collection by USAID: Data Source(s): Winrock and its partners.	2004	50	117.24 km + 33.68 ha <sup>1</sup>			
Estimated Cost of Collection: Nominal. Responsible Individual(s) at USAID: Team Leader	2005	80	132.69 km +			
			55.31 ha			
D. Data Quality Issues Date of Initial Data Quality Assessment: Known Data Limitations (if any):	2006	-	155.69 km + 55.73 ha			
Actions Taken of Planned to Address Data Limitations: Date of Future Data Quality Assessments: Procedures of Future Data Quality Assessments:						
<ul> <li>C. Plan for Data Analysis, Reporting, and Review</li> <li>Data analysis: Review trends of progress comparing targets to actual performance.</li> <li>Presentation of Data: In Table</li> <li>Review of Data: Semi-annual mission portfolio review,</li> <li>R4 review and individual review with recipient.</li> <li>Reporting Data: Internal mission report, R4 report and CBJ report.</li> </ul>						
<ul> <li>E. Other Notes:</li> <li>Notes on the Baselines/Targets: There were no riparian improvements in the areas planted before MACH. Targets and actual are cumulative.</li> <li>Location of Data Storage: P:\MissionShareable\EGFEpub\Environment\PMP\</li> <li>Comments: * In MACH-I in addition to 166.91 km riparian plantation a total of 8.42 ha swamp/patch plantation was done. Total no of sapling planted was 267,808 including institutional premises. A total of 65,229 saplings were planted along the rural road side organized by the resource users. So during 1999-2003 a total of 333,037 saplings were planted.</li> <li>In 2004 riparian, swamp and roadside plantation for all three sites.</li> <li>In 2005 overall target has been exceeded. Planting in 2005-2006 was reduced to only those schemes with the highest impact. Some of the areas have been planted in large blocks and these have been shown in hectares. One hectare of planting is equivalent to 2.5 km of riparian/strip planting and these are to be added to the km figure shown.</li> </ul>						

<sup>&</sup>lt;sup>1</sup> One hectare of trees is approximately equal to 2.5 km of stream or river length.

#### **Strategic Objective 6:** Indicator 6.2.c: **Riparian habitat improved in targeted areas**

This was an area that MACH was not obligated to perform in but because of the importance of the watershed and in particular the riparian area, MACH put resources forward on selected demonstration chharas (streams). The planned levels are all in addition to what was originally set out for the project in the way of outputs. This indicator was not an original project indicator.

As the streams selected had no riparian canopy (trees) and none of the bank holding tree roots, the baseline condition was considered to be zero. All trees are readily identifiable as all have been planted as none were there previously. The numbers are ascertained by counting directly. The kilometers of stream planted are measured from maps built from accurate geo-referenced satellite images.

The planned levels-of-performance have been dependent on the Investment support (416b) fund continuing to be available. There were delays in getting the release of the fund and progress suffered. All funds for this activity came from local currency funds and requests went from the project to the MoFL to Ministry of Finance and finally to the Accountant General for release. During the MACH-II 1<sup>st</sup> year because of a delay in receiving the last quarter fund the tree planting had to be halted. Essentially two months of prime planting time were lost and this had an impact on both the quantity and quality of planting. Because the last quarter fund was not arranged in a timely manner programs had to be shut down to wait for the fund from the GoB. However, by 2005-06 it was possible to catch up on tree planting which has exceeded the original targets.

MACH used upwards of 45 different species in the riparian and low wetland areas to ensure varied habitat for birds and other animals. There are benefits to both the communities managing in terms of the future value of the trees, which is considerable, and to the stream itself through improving bank stability and reduced erosion. The trees provide structure to the stream banks and income to the communities that was previously not there.

The scope for riparian corridor reforestation is quite large at the HH and KM sites. The long-term benefits would be in improving stream bank stability and thereby reducing erosion, providing potential movement and shelter corridors for birds and other animals (forest to the wetland), and a potential enhanced income to the communities with future selective harvest. Verification is done by direct measurement of the stream distance that has been planted. These are included on site activity maps as well.

#### Summary of Chhara/ Small Hill Stream Pilot Program

#### Introduction

The original design of MACH did not include working in the uplands. During the participatory planning at the community level with the stakeholders, it was determined to sustain the long-term future of Hail Haor as a wetland resource system, it would be necessary to manage the chharas flowing from the hills into the haor. Considering the communities' suggestions, MACH initiated on a pilot basis improved management in four chharas. The chharas selected were Jaita, Boula, Alia and Jag. Out of four chharas Jaita is receiving more resources.

Hail Haor watershed is located in the northeast hills of Bangladesh. Hail Haor watershed area is estimated to be 60,000 ha, approximately 85% in Bangladesh and 15% in India. Due to the undulating landscape and optimum climatic conditions this area was once forested and this habitat supported a very diverse and abundant flora and fauna, much of this has been reduced. West Bhanugach Reserve Forest, which is about 3,440 ha, is situated on the east side of Hail Haor. This is one of the important patches of tropical forest remaining in Bangladesh and still supports a wide range of flora and fauna. Hail Haor watershed is now a zone under intensive multi crop cultivation. The upper catchment, previously dense forest, is now covered with tea, pineapple and lemon gardens. Adjoining the middle reach of most chharas tea and lemons are grown, and the lower flood plain and a good part of the haor basin is under rice cultivation.

The communities around the haor have said that as many as 352 streams used to flow from the upper catchment into the Haor. Presently a total of 59 flowing chharas have been found by inventory that feed Hail Haor. Loss of riparian vegetation has resulted in the degradation of the stream banks and loss of their function as a wildlife corridor. The existing habitats have become segregated patches limiting wildlife shelter, and bank stability.

#### Chhara (Hill Stream)

All the Chharas that feed Hail Haor originate from the hills of Sreemangal, Bahubal, and Kamalgonj Upazilas namely Balisera, Satgaon and Faizabad hills. Water flowing through chharas varies in quantity and quality, as their upper catchments are different. It is evident that because of watershed degradation the hill streams have unstable banks, carry increased sediment and are "flashy" during the wet season, while many of the chharas dry up during the dry season.

Among the 59 Chharas only a few (Bilas, Alia, Jaita, Shaon and Jaag Chhara) supply most of the water to the haor, particularly during the dry season.

#### **Problems Identified**

The vegetative cover including the forest, and the aquatic habitats have degraded largely due to human interactions. Problems related to the watershed of Hail Haor were identified in problem census workshops. The problems and solutions were analyzed. It was found that increasing use of irrigation water during the dry season, excessive siltation, chhara bank erosion, use of agro-chemicals, and land use for pineapple and lemon cultivation in the upper catchment were the major interventions affecting the Hail Haor watershed.

#### **Regeneration of Riparian Vegetation**

Riparian trees along unprotected streams is nonexistent or highly degraded due to exploitation or harvesting for firewood, timber, forage and grazing. The 59 chharas have a combined total length of about 360 km of which 95% is degraded. To reestablish riparian vegetation along streams of the watershed area, selected chharas are being managed and planted with trees, shrubs and grasses.

Considering the need to improve resource management in the haor watershed, MACH with its existing resources worked to improve the riparian conditions of four Hail Haor feeder streams:

1. Jaita Chhara	6.98 km
2. Boula Chhara	7.13 km
3. Alia Chhara	8.79 km
4. Jug Chhara	6.63 km

Based on this experience, the program was extended to the equivalent streams (known there as jhara) in Konsha-Malijhee site, where a jhara management program started in 2002, initially focusing on four streams:

- 1. Kalagosha Jhara –1 5 km
- 2. Kalagosha Jhara –2 4.2 km
- 3. Nakshi Jhara3.5 km
- 4. Bagadobi Jhara 1 km (12.3 ha)

The major activities for chhara management piloting were:

Major Activities	Hail Haor			Kongsha-Malijhee				
	Jaita	Boula	Alia	Jug	Kalagosha	Kalagosha	Nakshi	Bagadobi
	Chhara	Chhara	Chhara	Chhara	Jhara -1	Jhara –2	Jhara	Khal
Awareness program	Х	х	Х	Х	х	X	Х	Х
Formation of RMOs	Х	х	Х	Х	х	X	Х	Х
Riparian habitat	х	х	x	X	x	x	x	х
improve (regeneration								
of riparian vegetation)								
Riparian trees	х	х	x	X	x	x	x	X
afforestation								
Trees and vetiver	х				x	x	x	х
nursery								
Demo programs	х			X				
(pineapple and Lemon)								
Water flow and	х	х	x	x	x	x	x	х
Sedimentation								
monitoring								

Jhara/Chhara resource management organizations (committees) have been formed with representatives from the villages along the streams. By the end of 2005 there were 23 such committees in Kansha-Malijhee site and five such committees in Hail Haor site (see table). These are separate committees based on local landowners and poor people, where the benefits from final felling of the trees (after provision for replanting) are to be shared between the committee members, the adjacent/participating landowners, and the local government). The members were agreed on with the villagers (in some sites through participatory planning). Jhara/chhara management activities have also been implemented by the concerned main 16 RMOs in all three sites in areas within their immediate activities, with the guidance of MACH staff. Selection of riparian tree species was done by the committees/RMOs. Technical support in connection with riparian tree plantations has been provided from the MACH Project.

#### Summary of Jara/plantation committees

Sl.	Name of the committees	No. of	Location	No. of	Estimated %
No		members		trees	of survival of
				planted	trees
1	Under Jhenaigathi Upazila				
1	Dhansail-Kalagosha Plantation Committee	23	Dhansail Union	26461	65
2	Nokshi-Malajhara Plantation Committee	23	Kangsha Union	9405	68
3	ShahatiJhara Plantation Committee	17	Jhenaigathi Union	6000	55
4	Bogadubi Plantation Committee	16	Jhenaigathi union	18300	60
5	Hatibandha Plantation Committee	17	Hatibandha union	2950	62
6	Dakabor Plantation Committee	15	Jhenaigathi union	3205	65
7	Bongaon Plantation Committee	23	Gouripur union	11270	73
8	Jhigathola Plantation Committee	25	Gouripur union	9967	59
9	Baromari Plantation Committee	19	Nolkura union	3874	85
10	Bonkaligram Plantation Committee	15	Jhenaigathi union	3003	65
11	Protabnagar Plantation Committee	13	Jhenaigathi union	4828	55
12	Dighirpar plantation Committee	18	Jhenaigathi union	2500	73
13	Ghagrakamarpara Plantation Committee	17	Hatibandha union	3839	75
14	Dighirpar Plantation Committee	23	Jhenaigathi union	3537	65
15	Maroshi Charland Plantation Committee	42	Jhenaigathi union	20000	95
16	Deflai-nunkhola plantation committee	30	Nolkura union	4000	55
17	Bakakura-Panbor plantation Committee	126	Kangsha union	24266	60
18	Gandhigaon Plantation Committee	30	Kangsha union	5000	72
19	Jhenaigathi-Kalagosha plantation Comittee	21	Nolkura union	14385	75
20	Uttardeflai Plantation Committee	29	Nolkura Union	1765	50
1	Under Sherpur Sadar Upazila				
21	Chuarkhal Plantation Committee	23	Koloshpar Union	3000	75
22	Pakuria Fokirpara Plantation Committee	19	Pakuria Union	2175	74
23	Surjodi Daskhinpara Plantation Committee	13	Kamaria Union	662	45
Tota	l Kangsha-Malijhee	597		184392	66
	Under Sreemangal Upazila (Hail Haor)				
	Joita Chara	31	Bhunobir Union	9,045	1,009 (11%)
	Boula Chara	26	Mirzapur Union	4,004	1,447 (36%)
	Jag Chara	32	Sreemongal Union	3,270	701 (21%)
	Alia Chara	31	Bhuobir Union	5,635	1,545 (27%)
	Ful Chara	12	Sreemongal Union	3,250	2,467 (76%)
Tota	l Hail Haor	132		25204	28

Site	Re-forestation by type	Extent o	f area	Sapling
		Km	На	planted
HH	Riparian	3.30	-	3415
	Swamp/wetland	3.19	12.05	34598
	Roadside	5.00	-	5778
	Sub-total	11.49	12.05	43791
T-B	Riparian	1.75	9.93	24700
	Swamp/wetland	1.20	5.94	16229
	Roadside	2.00	-	2925
	Institution/Homestead	-	0.11	275
	Sub-total	4.95	15.98	44129
K-M	Riparian	5.00	-	4819
	Swamp/wetland	12.50	-	22129
	Roadside	83.30	-	75418
	Patch Forest	-	5.65	13390
	Institution/Homestead	-	400	1200
			Homesteads	
	Sub-total	100.80	5.65	116956
	Grand Total	117.24	33.68	204876

Site wise Plantation for the period of November 2003 – October 2004

Site	wise	Plantation	for the	• neriod	of November	2004 -	October	2005
Site	1130	1 lantation	IUI UII	periou		2004	OCIUDUI	2005

Site	e Plantation type Exte		Area	Number of saplings					
		Km	Ha	planted					
	New Plantation								
HH	Riparian/roadside	6	-	5692					
	Swamp	-	4.48	11200					
	Institution		3.59	8982					
	Sub-total	6	8.07	25874					
T-B site	Riparian/roadside	5	5.00	16463					
	Sub-total	5	5.00	16463					
K-M site	Riparian/roadside	4.45	8.00	23715					
	Institution	-	0.56	1400					
	Sub-total	4.45	8.56	25115					
Total		15.45	21.63	67452					

#### Site wise Plantation for the period of November 2005 – October 2006

Site	Plantation type	Extent o	f Area	Number of saplings						
		Km	Ha	planted						
	New Plantation									
HH	Swamp	2	-	3000						
	Sub-total	2	-	3000						
T-B site	Swamp	18	-	25996						
	Riparian/roadside	-	0.42	1260						
	Sub-total	18	0.42	30116						
K-M site	Riparian/roadside	3	-	5600						
	Sub-total	3	-	5600						
Total		23	0.42	38716						

Site	Year of Plantn	Type of Plantatn	Name of Plantation Scheme	Exter	nt of Plan	tation	Remarks
	1 1001011,					Saplings	
				Km	На	planted	
Hail Haor	1999-	Riparian Plantatn	i) Boula Chhar	7		4004	
	2000	T lantatil.	ii) Joita Chhara	7		6.018	
			iii) Aliya Chaara	5		1 400	
			iv) Jaag Chhara	4		2 300	
			Sub-Total	23		13.722	
		Swamp				10,722	
		Plantation	a. Kagaura Kandi		1.5	10,000	
			b. Ichhamoti Chhara	0.7		370	
			c. Kazura Beel Bank	0.175		412	
			d. Agari Beel Bank	0.35		700	
			e. Jethua Beel Bank	0.73		2500	
			f. Gondorbopur			900	
			g. Lamua Road	4		4,000	
			Sub-Total	5.955	1,5	18,882	
		Institution Plantatn.	1 Institution			200	
		Total for the	e year 1999-2000	28.955		32,804	
	2000 -	Riparian					Additional
	2001	Plantatn.	i). Joita Chhara			3,027	planting in
			ii). Aliya Chhara			110	plantn. Area
			iii). Jaag Chhara	0.5		970	1
			Sub-Total			4,107	
		Swamp	V V <sup>1</sup>		2.2	5 700	
		Institution	a. Kagaura Kandi		2.3	5,700	
		Plantatn.	16 Institutions			2,100	
		Total for the	e year 2000-2001	0.5		11,907	
							3-5 rows
							expanded
	2001 -	Riparian					1999-2000
	2002	Plantatn.	i). Joita Chhara			4,546	plantn. area
			ii). Aliya Chhara	3		10,696	
			Sub-Total	3		15,242	
		Institution Plantate	4 Institutions			1 250	
		Total for the	- 4 mstrutions	3		1,230	61 203
	2002-	Riparian				10,472	01,205
	2003	Plantatn.	i). Jolom Chhara	1	0	626	
			ii). Mora Chhara	0.8		500	
			iii). Ichhamoti Chhara	0.6		645	
			iv). Burchungi Chhara	1		448	
			v). Makria Chhara	2.5		1,255	
			vi). Alia CHHar (Middle)	3		2,220	
			vii). Alia Chhara lower	1		650	
			v111). Ful Chhara (Upper &	1		2 250	
			iv) Shaon Chhara)	25		1 200	
			x) Boruna to Hazipur road	2.5		3 135	
<u> </u>			xi). Shial Chhara emkktt.	0.5		1.233	

#### Site wise, Year wise Plantations Raised from 1999 – 2003 Partner Organization: CNRS

Site	Year of	Type of	Name of Diantation Scheme	Exter	at of Diam	tation	Domonica
Sile	Plantin,	Plantain.	Name of Plantation Scheme		it of Plan	200	Kemarks
				0.75		1 205	
			xii). Kajura Canal	0.75		1,205	
			Sub-total	18.65	U	15,567	
		Swamp	Kagaura Kandi	0.5		1,725	
		Plantatn.	43 institutions			8.301	
		Total for the	e vear 2002-2003	19.15		25,593	
	Crand To	tal for UU Sit	to (1999-2003)	51 605		86 706	
				51.005		00,790	
Turag- Bongshi	1999 -	Institution	16 Institutions			3 286	
Doligsili	2000	Total for the	10 Institutions			3 286	
	2000-	Rinarian				3,200	
	2001	Plantatn.	Turag River Bank	4		3,100	
		Swamp	-				
		Plantatn.			0.16	400	
		Institution	35 Institutions			6 122	
		Tantall.	35 Institutions	4	0.16	0,422	
	2001 -	Riparian	e year 2000-2001	4	0.10	9,922	
	2001	Plantatn.	Turag River Bank	10		10,100	
		Swamp	Mokosh & Alua beel periphery				
		Plantatn.	planting	1	0.13	1,225	
		Plantatn	18 Institutions			4 213	
		Homestead				1,215	
		plantatn.	489 Homesteads			2,445	
		Total for the	e year 2001-2002	11	0.13	17,983	
	2002-	Riparian					
	2003	Plantatn.	i). Billbaria to Rashidpur	2		1,702	
			Road	0.75		400	
			iii). Boroibari bridge to Ideal college Rd	1		640	
			iv).Turag river bank (Kutubdia to				
			Gabtali)	4		4,948	
			v).Kaliakoir Sr. Madrasga to Rajabazaar	1		987	
			vi) Dhalibari to Medi Road	0.5		240	
			vij) Alua Beel surranding	0.5	0.3	665	
			viii) Der Chala Beel surranding		0.3	310	
			Sub Total	0.25	0.2	0 007	
		Swamp		9.25	0.5	9,092	
		Plantatn.	Folimaradoah surrounding		0,2	203	
		Institution Plantatn.	24# Institutions			7,156	
		Total for the	e year 2002-2003	9.25	0.7	17,251	
	Grand To	otal for T-B Si	te (1999-2003)	24.25		48,442	
Kongsho- Malijhee	2000- 2001	Riparian Plantatn.	i). Paglarmukh to Tinani -Stream bank	3		3,839	
			ii). Hasligaon to Dargar khal	2		1,426	
			iii). Katakhali bridge to Takimari	1.2		1 100	Includes 700
			iv). Biswa road Porar Dokan -	1.2		1 251	riijai sapilligs
			v). Patch forest, Ghagra-	1.23		1,231	
			Kamarpara		0.1	257	
			Sub-Total	7.45	0.1	7,873	

Site	Year of Plantn,	Type of Plantatn.	Name of Plantation Scheme	Extent of Plantation			Remarks
		Swamp Plantatn	Paglar Mukh to Dorgar Khal	6.5		5 525	
		Institution		0.5		0.14	
		Plantain.		12.05	0.1	944	
	2001	Total for 200	JU-2001	13.95	0.1	14,342	
	2001 - 2002	Plantatn.	i). Batia Gaon to Dorgar Khal	3		2.335	
			ii). Bania Para toMalijhee rive	2		1 510	
			iii). Kala Ghosha Jhara Bank	0.5		11.290	
			iv). Bagher Vita Ashrayan	8.5		11,380	Includes 352
			approach Rd.	1.5		2,892	Hijal saplings
			v). Nokshi-Mala Jhara (Jamtali			4 9 9 7	
			Bazaar	1.2		1,305	
			Latif's House)				
			Sub-Total	16.2		19,422	1
		Swamp plantation	a. Kata Khali bride to Takimari Beel	0.8		1,067	added to down slope of 2001 plantation
			b. Baliachandi to Dariar Par	2		3,232	
		Institution Plantatn	73 Institutions			7.000	
		Total for 200	01-2002	19	0	30.721	
	2002-	Riparian	1. Jhinaigati BRAC to Dakabar	17		00,721	
	2003	Plantatn.	road	1		1,000	
			2. Dhanshail to Banda bhatpara	2		2,835	
			3. Batibanda uttarpara to Dakhinpara	3		2,950	
			4. Digharpar madrasha to J. gati bridge	1		3 250	
			5. Konagaon bridge to			1,100	
			Baliachandi rd.	1.1		1,100	
			forest		0.4	2,205	
			<ol> <li>UNO office backside Rd. Jhenaigati</li> </ol>	3		6,000	
			8.Tetultala bazaar to Surjadi Hospital	1.3		1,150	
			9. Surjadi eidgaon -Tinanipara				
			pucca rd.	0.9		750	
			10. Protabia to Bot Tala Road	1.5		1,300	
			11. Shutir Par Bazar to Chakan Dharia Road up to Balurghat Bridge	1.0		662	
			12. Chakpara Koroikanda bridge to border of Nalitabari	1.0		1000	
			13. Haora niz Fakir bari to	1.0		1000	
			Moinary beel 14. Julgaon Sarker Bari to Kata	0.5		410	
			Khali Khal Road	1.0		1000	
			15. Julgaon Koya Road (from Hazi Nowab Ali's House to Hasligaon	0.5		506	
			16. Bania Para to Ruha Beel Road	1.0		1000	
			17. Katakhali khal	2.0		2100	

Site	Year of Plantn,	Type of Plantatn.	Name of Plantation Scheme	Extent of Plantation			Remarks
			18. Dhansail Modhypara to				
			Chakpara Road (from Abdul				
			Jabbar's house to Harun's house				
			via Latit's nouse)	1.3		1129	
			19. Tota Member's house to Dudnoi Bazar Road via Panbor	5.0		4800	
			20. Tal Tala to Abul Hossen				
			Master's house, Dhanshail	1.0		935	
			21. Bagher Vita Bazar to Gajarmari Ghat Road, Dhanshail	2.5		2,970	
			22. Dhanshail Maittya Mosque to Bhaluka School Road	2.0		1690	
			23. Shahati Bridge to Bhaluka	2.0		1070	
			School Dhanshail	2.0		1900	
			24. Nun Khola to Jaam tali Bazar Road	3.0		3000	
			25. Jhenaigati Girl's School to	1.0		2500	
			26. Bakkar Mistry's House to	4.0		3500	
			Bangal Bura's House road	1.5		610	
			27. Bakakura Bazar to Panbor Bazar Via Dhanshail Chalkpara				
			Mad.	3.5		3800	
			28. Bakakura Bazar to Tri-				
			muhani via Bakakura Christian			1000	
			Mission	1.5		1300	
			Dariarpar Road (Upto				
			Chairman's House Bridge )	2.0		1902	
			30. Noon Khola to Deplai School				
			Road	3.0		2000	
			31. Abdul Jabbar's Land at				
			Chalkpara, Dhanshail		0.60	1100	
			32. Achia Bewa's Private Land at Dhanshail		0.28	300	
			33. Abul Hossain Commander's		0.28	500	
			Private land at Dhanshail		0.30	700	
			34. Jhuhurul Mohlana House to				
			Bakkar Mohlana House	1.0		1000	
			35. Abdul Zabbar's (BDR)	1.0		1000	
			Private Land Chalkpara,				
			Dhanshail		1.25	1075	
			36. Abdul Ali's Private Land Bakakura, Dhanshail		1.00	1300	
			37. Gazni Obokash kendra		1.00	1300	
			plantatn.		2	5,200	
		0	Sub Total=	55.05	5.83	69,429	
		Swamp plantation	I). Dorikalinagar to Kanduli	3		2,850	
		Institution Plantatn	103 # Institutions			15.228	
		Total for 20	02-2003	58.1	<u> </u>	87.507	
	Grand To	tal for K-M S	lite (!999 - 2003)	91.05		132.570	
Grand Tot	al (UptoAu	g,03)	(	166.91		267,808	

#### Site wise, Year wise Plantations Raised from 1999 – 2003 Partner Organization : Caritas

Site	Year of Plantate	Type of Plantatn	Name of Plantation	Extent of		# Saplings	Remarks
	1 Iantatii,	1 Idillatii.	Scheme	km	На	planed	
Hail			i). Pachoun - Kheaghat	KIII	IIu		
Haor	1999-2000	Road Side	doad	1		900	
			ii). Rustampur- Hail Haor road	1		400	
			iii). Bilash Chhara Par	0.5		925	
			iv). Boruna - Hazipur	010		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
			road	1		925	
			v). Baruna - Nayansri road	1		870	
			vi). Kaliargaor - Hail				
			Haor road	1		1,000	
			vii). Baroiuri Hail	1		1.000	
			Haor road	1		1,000	
		Institution	Sub-Total	6.5		6020	
		Plantatn.				480	
		Total for the ye	ar 1999-2000	6.5		6,500	
			i) . Boulashir - Hail				
	2000-2001	Road Side	Haor road	1		1,000	
			ii). Vimshi - Hail Haor	1		050	
				1		950	
			iii). Fatki - Likria road	1.5		1,000	
			Haor road	1		1.000	
			v). Rahim Nagar-			1,000	
			Nayansree road	1		900	
			vi). Gram				
			Sreemongol- Hail	1		870	
			vii) Atghor-Manik	1		870	
			Haor Road	1		900	
			Sub-Total	7.5		6,620	
		Institution				· · · · ·	
		Plantatn.				330	
		Homestead				1 500	
		plantn.	2000 2001			1,500	
		Total for the yes	ar 2000-2001	7.5		8,450	
	2001-2002	Roadside	Haor road	1		1.000	
			ii). Gram Sreemongol-			,	
			Hail Haor road	1		1,000	
			iii). Atghor-Manik Haor Road	1		1,000	
	1		iv). ZamShi - Horina			,	
			Kandi road	1		1,000	
			Sub-Total	4		4,000	
		Institution				20	
		Homestead				30	
		plantn.				3,800	
		Total for the year	ar 2001-2002			7,830	
			Bilasherpar to				
	2002-2003	Roadside	Motiganj road	2		1,950	
			Institution Plantation			1,995	
		Total for the year	ar 2002-2003	2		3,945	
	Grand Total	for H H Site (1999	-2003)			26,725	

				Extent of			
				Plantatn.			
Turag- Bongshi	1999-2000	Road Side	i). Matikata - Mazu Khan road	2		2,500	
			ii). Sina Bao -Mokosh	1		700	
			iii) Devel Teli Deed	0.5		700	
			iv) Main road to	0,5		200	
			Vulua Ashravan				
			project	0.5		800	
			Sub-Total	4		4,200	
		Total for the yea	ar 1999-2000	4		4,200	
			i). Minarbaa - Betara			,	
	2000-2001	Road Side	road			600	
			ii). Sutrapur Chourasta- Majhi Para road	1		945	
			iii). Nama Shulai - Azgana	1		620	
			iv). Boroi Bari Bazaar	1		020	
			- Dakurail road	1		960	
			v). Madan Khali -				
			Boali road	2		1,600	
			Sub-Total	6		4,725	
		Homestead	222 Homostooda			1 222	
		Tatal far the rea	355 Homesteaus	(		1,332	
		Total for the yea	i) Ratannur - Mazu	0		0,057	
	2001-2002	Road Side	Khan road	1		915	
			ii). Kanchanpur- Kota Moni road	1		792	
			iii). Shola Hati - Dhonia Para	1		580	
			Sub-Total	3		2.287	
		Homestead		-			
		plantn.	456 Homesteads			2,475	
		Total for the yea	ar 2001-2002	3		4,762	
	2002-2003	0	0	0	0	0	
	Grand total fo	or T-B Site (1999-2	2003)			15.019	
Kongsho						- )	
- Malijhee	2000-2001	Road Side	i). Pakuria Beel bank- Bakar Kunda road	2		2,000	
			ii). Matia Para- Balu				
			Char road	1		1,000	
			Kona gaon road	1		1,000	
			iv). Kona gaon				
			primary Scool - Suri	1		1 000	
			v) Dori Kakinagor -	1		1,000	
			west Beel Bank	0.5		500	
			Sub-Total	5.5		<u>5,500</u>	
		Homestead					
		plantn.	400 Homesteads			2,000	
		Total for the yea	ar 2000-2001	5.5		7,500	
	2001-2002	Road Side	I).Hawra Neez to Jarar Bari	1.5		1,500	
			II). Ram Khila - Bada Tegharia road	2		2 060	
			iii). Dori Kali Nagar to			2,000	
			Utta Beel Bank	0.6		600	
			iv) Kanduki Cou rastra	1.8		1,800	

				Extent of Plantatn.		
			to sonnashy tola			
			v). Sari Kalinagor to Balu Chor	1.3	1,300	
			vi). Salda - Baliya - Chondi	1	1,000	
			Sub-Total	8.2	8,260	
		Homestead plantn.	1,000 Homesteads		5,000	
		Institution Plantatn.	90 Institutions			
		Total for the year	ar 2001-2002	8,2	13,260	
	2002-2003	Roadside	i). Salda pry. School to east Tematha Rd.	0.8	825	
			ii). Sarikalinagar to Gajarmari Rd.	0.7	700	
			Sub-Total	1.5	1,525	
			Homestead Plantation		1,200	
		Total for the year	ar 2002-2003	1.5	2,725	
	Grand Total	for K-M Site (1999		23,485		
Grand To	tal for Caritas	RUG fostered pla		65,229		

# **Strategic Objective 6**

# **Indicator 6.2.1a:** Number of sanctuaries established June 2007

Management of Aquatic Ecosystems through Community Husbandry (MACH)

Strategic Objective 6: Improved Management of Open Water and Tropical Forest Resources							
Intermediate Result 6.2.1: Innovations and Best Practices Adopted							
Indicator 6.2.1a: Number of sanctuaries established							
A. Description	Cumulativ	e Unit of m	easure: #				
Precise Definition of Indicator: This indicator records the number of fish sanctuaries established by the							
community groups through USAID assistance. "Established" means clearly demarcated and in existence	Year	Planned	Actual				
for at least one year.							
Unit of Measure: Number	Baseline	0	0				
Desegregate by: N/A Instification (Management Utility, Constructly establishment allows equation species to survive from and		-	-				
<b>Justification/Management Utility:</b> Sanctuary establishment allows aquatic species to survive from one		МАСНІ					
Community establishment protects these sanctuaries from depletion during the dry season. Sanctuary		WIACII-I					
establishment is one of the "best practices" being promoted and reported on under indicator 6a.	2000	1.5	16				
B. Plan for Data Collection	2000	15	16				
<b>Data Collection Method:</b> Winrock and partners will conduct an actual count to verify information from							
community Resource Management Committees.							
Method of Collection by USAID: Semi-Annual and Annual Reports from Winrock	2001	30	54				
Data Source(s): Winrock and its partners							
Frequency/ Timing of Data Collection: Semi-Annual							
Estimated Cost of Collection: Nominal. Already built into Winrock work program.	2002	40 (70)	64				
Responsible Individual(s) at USAID: Team Leader		~ /					
C. Data Quality Issues							
Date of Initial Data Quality Assessment: none to date	2003	50 (75)	66				
Known Data Limitations (if any): see below	2005	50(75)	00				
Actions Taken or Planned to Address Data Limitations: revisions in text							
Date of Future Data Quality Assessment:		MACH-I	l				
Procedure of Future Data Quality Assessment:	2004						
D. Plan for Data Analysis, Reporting, and Review	2004	5	6				
<b>Data analysis:</b> SO team will analyze data.		0	0				
Presentation of Data: Table							
Review of Data: Semi-annual mission portfolio review, and regular performance monitoring.	2005	0	1.4				
<b>E</b> Other Neter	2005	9	14				
L. Olici Noles. Notes on the Reselines/Targets: No sanctuaries existed in the targeted areas before intervention of							
MACH project							
Location of Data Storage: P:\MissionShareable\EGEEnub\Environment\PMP	2006	9	15				
Comments:							
2004: Four new sanctuaries were established in the Turag Bangshi site and two in the Kangsha-Maliihee							
site. Most of the required sanctuaries were established in phase I. Only those waterbodies with new leases	2007	9	16				
handed over at the end of phase I and beginning of phase II have the potential and need for new sanctuary	2007	,	10				
establishment							
2005: A major sanctuary was established in by merging Chapra Magural with Jaduria in Hail Haor							
covering 122 acres plus adjacent lands which will form a fish and wildlife sanctuary serving the whole							
Haor. On the Bongshi river 4 Kum sanctuaries or Kuripara, Palashtoli, HatuBhang, and Beltoil were							
established. An additional 2 sanctuaries in Aloa RMO (Abdair Beel and Jugarhari Daha) were							
established. The last is in Dholi beel of Sherpur site.							
<b>2006:</b> Medi beel under the Ramedia RMO of Hail Haor site has been set a side as a sanctuary. A part of							
the beel was excavated in 2006 and conserved as a sanctuary in 2006. The remaining portion has been							
excavated to make it deeper and capable of storing more water. The entire beel is now under one							
sanctuary.							
2007: One new sanctuary was established in 2007 in Dholidoba which was found effective for the whole							
waterbody of Dumuria beel complex							
Outreach: In 9 locations a total of 20 sanctuaries were either newly established or renovated and							
ennanced by the MACH outreach program. These 20 have not been reported above but are in addition to the 16 established in the MACH sites from 2004							
une to established in the MACH sites from 2004. Qualification to data about all of these from 2004.							
Quantication to data sheet: an of mese figures (as cumulated during the two projects) do not take into							
account augustinents over time some sanctuanes were rater abandoned, also only areas that had							
these are adjoining making one larger effective sanctuary (see text). Figures in parenthesis for planned							
during MACH-I were figures that Winrock and nartners revised unwards of what was required under the							
project.							

#### Strategic Objective 6: Indicator 6.2.1a: Number of sanctuaries established

#### Sanctuary Establishment

**Introduction:** One of the objectives of the MACH project was to conserve and enhance biodiversity. Increased biodiversity through establishing sanctuaries had been emphasized and reflected in project documents. To this end, the MACH project in all its three sites had taken steps toward conservation of fish and other wetland flora and fauna through establishing sanctuaries. MACH supported communities established sanctuaries in the deep scour holes of rivers, in parts of beels where 10-year lease arrangements have been arranged by the project through the MoL, and most recently MACH and its community-based programs were granted rights to establish permanent sanctuaries over an entire beel forever against a nominal lease value. One of these is more than 122 acres and the entire area has been set aside as a sanctuary.

**Sanctuary Rational**: The floodplain fishery in Bangladesh has in the past been very rich and diverse. To maintain a sustainable floodplain fisheries production, it is necessary to maintain the fish community, the habitat diversity and practices of sustainable fishing or harvesting. Sanctuaries are important today because of the extreme loss of habitat for fish in the dry season. The sanctuaries form a very important link for replenishing the stocks of fish in floodplain ecosystems and providing shelter throughout the year. Permanent (year round) locally established sanctuaries are set aside by the RMOs as part of their management plans and provide dry season shelter for increasing quantities of parent stock necessary for replenishing a defined floodplain ecosystem through reproduction each year.

**Selection of sites:** The sanctuaries established were of a reasonable size to provide adequate space and shelter for parent fish stocks to be able to repopulate the habitat managed by the RMOs. Prior to selecting the locations, detailed information has been gathered on the biological condition, social interaction (fishing intensity and users status), existing management system and physical condition of the proposed area. Consideration has also been paid to the location of the sanctuary site. The collected data has been analyzed, reviewed and the technical feasibility has been established to ensure the restoration and improvement activities are successful.

**Management:** The number, location and size of the sanctuaries established can be seen on the tables that follow. All these sanctuaries have been established based on RMOs decisions and long term plans. Brush piling with tree branches and bamboo has been made in all sanctuaries to improve habitat quality as well as to protect fish. Signboards, slogans and red flags have been erected at sites to draw the attention of the wetland users. MACH has also been supporting the RMOs in using for the first time permanent structure (concrete hexapods) to create shelter for fish and aquatic invertebrates as well as provide permanent protection from inadvertent or planned netting.

In the Turog Bangshi site the sanctuaries are Daha (deep pools in the beels/lake) and Kum (or river scour hole) in the Turag river. In Hail Haor sanctuaries are in beels (lakes), and khals (canals). In the Kongshow Malijhee site the sanctuaries are in deeper spots in beels and rivers. The RMOs at all sites form sanctuary management sub-committees within their organizations for management.

Management plans are developed by the community organizations (by the RMOs). These management plans lay out the regulations to be put in place in the wetlands including the water bodies and sanctuaries to be established. The regulations can include full closure of all fishing 12 months per year, time closure (dry season) or particular times of the year, ban on the use of destructive gears like the khata jal, current jal (to protect the aquatic vegetation and spawn of the fish), stop or reduce fry/brood fishing, stop dewatering in the water body and the sanctuaries. Fishing has in most cases been totally banned in the specified sanctuary areas within the beels. The concerned RMOs are responsible for guarding of the sanctuaries year round and they also inform the community and local government about the establishment and condition of the sanctuaries.

**Revisions to area and number of sanctuaries.** The SO summary sheet for this indicator shows that 82 sanctuaries had been established by the beginning of 2007. However, a re-inventory conducted in mid 2007 confirmed that while this number of sanctuary spots with habitat improvements had been made by the project, several actually adjoined one another when the total no-fishing zone declared by the RMO was considered rather than just the area, also a few were no longer being observed. As a result there are now 63 existing distinct sanctuaries within the three sites, and not the 82 shown in previous reports. The 16 shown for MACH-II (set up during the MACH II period) though are all in existence. The changes came to the MACH-I sanctuaries. However, the actual area set aside with no fishing or exploitation by the RMOs is more than double that shown in previous reports (since only areas excavated or with fish protection devices were counted before) amounting to about 194ha (479 acre) of wetland sanctuaries compared with about 78ha (191 acre) shown in earlier reporting.

Year and		Hail Haor			Turag-Bangs	hi	Kangsha-Malijhee			
waterbody	No	Improved	No fishing	No	Improved	No fishing	No	Improved	No fishing	
type		habitat* (acre)	area (acre)		habitat* (acre)	area (acre)		habitat* (acre)	area (acre)	
Beel										
2001	6	9.49	11.44	9	5.24	26.20	12	5.92	11.63	
2002	0	0	0	5	10.94	54.70	0	0.00	0.00	
2003	1	21.88	21.88	0	0.00	0.00	0	0.00	0.00	
2004	0**	100.50	211.72	6	5.00	25.00	1	1.50	4.30	
2005	0	0.00	0.00	2	3.00	15.00	1	3.00	7.07	
2006	1	4.88	4.88	-		-	-	-	-	
2007	1	1.48	1.48							
River/khal										
2001	0	0.00	0.00	3	5.80	29.00	2	1.66	2.22	
2002	1	1.19	10.32	0	0.00	0.00	3	2.20	2.88	
2003	1	0.46	0.96	0	0.00	0.00	3	2.12	6.89	
2004	0	0.00	0.00	0	0.00	0.00	1	0.50	0.78	
2005	0	0.00	0.00	4	6.20	31.00				
Total	11	139.88	262.68	29	36.18	180.90	23	16.90	35.77	

Watland		· ··· · · · · · · · · ·	MACH		h	
wettand	sanctuaries	existing i	п масн	sites in 2007	by year of	creation.

\* Re-excavated area and/or area with fish protection devices such as hexapods within sanctuary (the area reported in MACH annual reports).

\*\* Part of the same national sanctuary as the beel area reported in 2003 in this site, note that 111.22 acres is khas land which is part of the no-fishing zone but not formally declared as sanctuary by the government.

#### Abandoned sanctuaries:

In Hail Haor there have been several cases where more than one spot with improved habitat is in a contiguous sanctuary (no fishing zone) so the number of sanctuaries reported here is reduced from previous reports (see table- below - **Summary Table of Sanctuary numbers and area**). Four sanctuaries (total area 6.48 acres) were only observed for one year 2001-02. Other 2 contiguous sanctuaries (0.15 acre) were maintained as single sanctuary through 2006. Another of 0.52 acres was planned and included in project reports for 2001 but was never actually established.

Turag-Bangshi - two of unknown characteristics, one replaced in 2001 the other in 2004.

Kangsha-Malijhee - one 0.21 acre fish protection device of 2001 was converted shortly after to a katha for fishing by the RMO with LGC approval.

On the following tables and maps the number and locations of the sanctuaries has been shown. The locations have been mapped through field GPS reconnaissance.

**Introductions of locally threatened fish species**. Re-stocking of locally threatened fish species is a means to restore bio-diversity by selecting naturally occurring species that have declined in the project sites. Accordingly broods of Meni (*Nandus nandus*,), Pabda (*Ompak pabda*), Sarputi (*Puntius Sanana*) Foli (*Notopterus notopterus*), Kalibaus (*Labeo calbasu*) were introduced into the sanctuaries where the male/female ratio was maintained at 2:1.

Introductions of fry and fingerling of locally threatened fish species has been done in all three MACH sites as well. In the Kongsha-Malijhee area Shoil, Gojar, Ghoinna, Kalibaus, Pabda and Sorputi have been introduced. Similarly, in the Hail Haor Ghoinna, Kalibaus, Air, Chital and Sorputi were restocked. Most of the re-introduced species have re-established themselves in the habitats where they were about to become or had become extinct. The threatened species introduction program in the respective water bodies have been undertaken by the RMOs through their trial Endowment Fund since 2006.

#### Declaration of permanent sanctuary by the Government based on the MACH project

Eight (8) water bodies important within the three project ecosystems and nationally for their aquatic life, particularly fish, were declared by the GoB as sanctuaries for all time to come. The GoB has given up revenue earning from these water bodies in lieu of protection through community based comanagement for the improvement of the entire eco-system including the fishery. On behalf of the RMOs MACH took the proposal to MoL through the UP, LGC, DC, DoF and MoFL with their endorsement. Eventually the MoL has declared these water bodies officially as permanent sanctuaries. This is a mile-stone in the history of conservation of wetland resources in Bangladesh. These sanctuaries are being managed by the relevant RMOs.

There are three types of centrally declared (national) sanctuaries, those are Complete beel (water body) as sanctuary, part of a beel (water body), and Kur/Kum (deepest part of river) of river as sanctuaries. These sanctuaries have been declared by memo no. ML/Sha-7/Misc.-40/2002 dated 01/07/2003 in the MoFL/MoL. Of these the sanctuary in Hail Haor ("Baikka Beel") has already restored not only the fishery but also important wintering water bird populations. Further details on this sanctuary and a copy of the sanctuary establishment letter are included in volume 3.

Name of Waterbody Location		Area (acre)	Remarks		
Hail Haor					
Jaduria Beel	Plot No. 9	100.50	Existing. Both form parts of the		
	Habibpur		single contiguous "Baikka Beel"		
	Srimangal, Moulvibazar		wetland sanctuary along with		
Chapra-Magura	Plot No. 477, 478 & 492	21.88	adjoining public lands.		
	Habibpur				
	Srimangal, Moulvibazar				
Kangsha-Malijhee					
Malijhee River (Part)	Plot No. 2556-59, 2565, 2577-79	Kur plus* 200m up	Existing		
	Malijheekanda	stream & 200m down	_		
	Jhenaigathi, Sherpur	stream			
Turag-Bangshi					
Mokosh Beel (Nawkhola	Plot No. 3807	2.24	Existing		
Dhalidoho)	Saturia		C C		
	Kaliakoir,Gazipur				
Alua Beel (Baradaha)	Plot No. 143	4.44	Existing		
	Bara Gobindapur				
	Kaliakoir,Gazipur				
a) Galachipa Kum	Plot No. 2233	Kum plus* 200m up	Existing. All three are deeper		
· ·	Boali	stream & 200m down	spots in the Turag River and the		
	Kaliakoir,Gazipur	stream	project is working to get		
b) Lalkhar Kum	Plot No. 670	Kum plus* 200m up	recognition for community		
	Boroibari	stream & 200m down	management through the RMO		
	Kaliakoir,Gazipur	stream	of this whole length of river for		
c) Gabtoli-Sayedpur	Plot No. 1	Kum plus* 200m up	better coordination with the		
Kum	Shakhipur	stream & 200m down	sanctuary spots		
	Plot No. 120	stream			
	Gabtoli				
	Kaliakoir,Gazipur				
Total	8	129.06			

#### List of permanent/central sanctuaries under MACH declared by MOL:

\* Area is not included in total but would be an additional 16-20 acres

#### Renovation and re-enforcement of sanctuaries under outreach program

During 2005-06 and 2006-07 the MACH project extended its support in nine locations in the northwest and north-central regions of the country where CBOs established some sanctuaries through project supports and DoF guidance. With the MACH assistance some of the previous DoF fourth fisheries project sanctuaries (11) were renovated and the CBOs were made aware of their responsibilities in maintaining the sanctuaries. MACH further established 9 new sanctuaries as well with the existing CBOs. In nine locations a total of 20 sanctuaries (11 old, 9 new) were improved and renovated with brushwood piling, hexapod placement, excavation etc. Those are shown in the table below. These 20 are in addition to the 63 established in the 3 main project sites bringing the total sanctuaries either established or supported to 83.

Name of the water-body and name of sanctuary	Established since inception to June 2007		Actual no- fishing	Year established	Mana- ged by	No. of existing sanc-	Remarks	
····· ······ ······ ··················	No.	Area (acre)	area (acre)**		8	tuaries		
Sananda Beel		(acre)						
Sananda Sanctuary-1	1	0.14		2000	~ .		This whole area (3 sanctuaries)	
Sananda Sanctuary-2	1	0.14	1.03	2001	Sananda	1	is collectively treated as one	
Sananda Sanctuary-3	1	0.14		2001	KMU		large sanctuary.	
Sub-total	3	0.42	1.03			1		
Balla Beel								
Balla Sanctuary-1	1	1.61		2001			Basically there were 2	
Balla Sanctuary-3*	1	1.61	2.62	2001	Balla	1	sanctuaries but big one (1, 3*,	
Balla Sanctuary-4*	1	0.69	1.15	2001	RMO		4*) was reported as 3.	
Balla Sanctuary-2		1.15	1.15	2001		1		
Sub-total	4	5.06	3.77			2		
Jethua Beel	1	0.52	0.52	2001	Lathua	1	Banantad 2 but magantly 1 is	
Jethua Sanctuary-1	1	0.52	0.52	2001	PMO	1	maintained as sanctuary	
Sub total	2	1.04	0.52	2001	KWO	1	maintained as sanctuary	
Kajura Reel		1.04	0.32		Kajura	1		
Kajura Sanctuary-1	1	0.33	0.33	2001	RMO	1		
Sub-total	1	0.33	0.33	2001		1		
Agari Beel	-						Total re-excavated area There	
Agari Sanctuary-1	1	0.8		2001			is not enough space for fishing	
Agari Sanctuary-2	1	0.69		2001		1	in between the initial	
Agari Sanctuary-3	1	0.34	5.79	2002	Aagari	1	sanctuaries so the whole area	
Agari Sanctuary-4	1	0.41		2002	KMU		has been set aside as no fishing	
Agari Sanctuary-5	1	0.4		2002	]		by RMO	
Sub-total	5	2.64	5.79			1		
Borogangina Canal							There is space for fishing in	
Borogangina Sanctuary-1	1	0.59		2002			between the sanctuaries but	
Borogangina Sanctuary-2	1	0.3	10.32	2002		1	RMO declared the total re-	
Borogangina Sanctuary-3	1	0.3	0.06	2002		1	excavated area as sanctuary.	
Borogangina Sanctuary-4	1	0.46	0.96	2003	Bora-	1	Barkandi	
Balkka beel sanctuary	1	21.00	21.00	2002	gangina		The normanian construction Khos	
Laduria (PS)	1	21.00	21.00	2003	RMO		area is not handed over but	
Jadulla (FS)	1	100.5	100.30	2004		1	located in between handed over	
khas land in PS***			111.22	2004		1	sanctuary areas and also	
							protected	
Sub-total	6	124.03	244.88			3		
Dumuria Beel Complex							No longer exists. Shallow and	
Chharadoba Sanctuary-1	1	0.08		2002			has been replaces by Dolidoba	
Chharadoba Sanctuary-2	1	0.07	0	2002		0	beel after re-excavation in 2007.	
Dholidoba beel sanctuary	1	1.48	1.48	2007		1	Established in 2007.	
Patharia beel Sanctuary- 1*	1	0.92	0	2001	Dum- aria	0	No longer protected	
Cheruabadaly Sanctuary- 1*	1	1.47	0	2001	RMO	0	No longer protected	
Cheruabadaly Sanctuary- 2*	1	2.11	0	2001		0	No longer protected	
Gopla river Sanctuary-1*	1	1.98	0	2001	1	0	No longer protected	
Sub-total	7	6.63	1.48			1		
Medi beel	-							
Medi beel sanctuary-1	1	4.88	4.88	2006, 2007	Ramedi a RMO	1	Whole beel is treated as sanctuary.	
Total	29	149.15	262.68			11		

W. d 1 G		O'A MACH	(T 3007)
wettand Sanctuaries	ат пан паог	Sile, MACH	(June 2007)

\* Not functioning, those were maintained for three years \*\* Sanctuary area + surrounding no fishing area

\*\*\* this large area joins onto and is in between two parts of the PS and currently is protected as part of the Permanent Sanctuary

No.         Area (acre)         (Nrt Y)         matchinks           Nalet Daha Sanctaury         1         0.5         2.50         2001         Mokosh RMO         1           Nalet Daha Sanctaury         1         0.5         2.50         2001         do         1           Burit Daha Sanctaury         1         0.5         2.50         2001         do         1           Mastere Chani Sanctaury         1         0.4         2.00         2001         do         1           Naketer Ghani Sanctaury         1         0.4         2.00         2001         do         1           Naketor Ghani Sanctaury         1         0.4         2.00         2001         do         1           Naketor Sanctaury (central sanctaury)         1         1.24         6.20         2001         do         1           Tamail Dala Sanctaury         1         0.2         1.00         2001         do         1           Sub-total Sanctaury         1         1.5         7.50         2001         Turag River         1           Coluchipa Kur         9         5.24         26.20         Turag River         1         1         1         1         1         1	Name of the water-body and Name of Sanctuary	Established since inception to June 2007		Actual no fishing area	Year Established	Managed by RMO	No. of existing	Remarks
Motos Beel         Image Data Sancturary         1         0.5         2.50         2001         Mokosh RMO         1           Moisher Daha Sancturary         1         0.5         2.50         2001         do         1           Moisher Daha Sancturary         1         0.5         2.50         2001         do         1           Moulovir Ghuni Sancturary         1         0.4         2.00         2001         do         1           Master Chan Sancturary         1         0.4         2.00         2001         do         1           Nawkhola Sancturary (central sancturary)         1         1         5.00         2001         do         1           Sancturary         1         0.2         1.00         2001         do         1           Tamail Daha Sancturary         1         0.2         1.00         2001         do         1           Tamail Daha Sancturary         1         1.5         7.50         2001         Turag River         1         1           Colachipa Kum Sancturary         1         1.8         9.00         2001         do         1         1           Colachipa Kum Sancturary         1         1.8         9.00         2002<		No.	Area (acre)	(acre)			sanctuaries	
Nater Daha Sanctuary         1 $0.5$ $2.50$ $2001$ Mokosh RMO $1$ Burir Daha Sanctuary         1 $0.5$ $2.50$ $2001$ do $1$ Mudivir Ghuni Sanctuary         1 $0.4$ $2.00$ $2001$ do $1$ Master Ghuni Sanctuary         1 $0.4$ $2.00$ $2001$ do $1$ Nawkhola Sanctuary (central sanctuary)         1 $1.24$ $6.20$ $2001$ do $1$ Subtata         Subtatary         1 $0.2$ $1.00$ $2001$ do $1$ Subtata         9 $5.24$ $26.20$ $2001$ do $1$ Tamail Daha Sanctuary         1 $0.2$ $1.00$ $2001$ do $1$ Subtata         9 $5.24$ $26.20$ $2001$ $Turag River$ $1$ Colachipa Kum Sanctuary         1 $1.5$ $7.50$ $2001$ $do$ $1$ Lalkar Kum Sanctuary         1 $1.5$ $7.50$ <	Mokosh Beel							
Moisher Daha Sanctuary         1         0.5         2.50         2001         do         1           Moulovir Ghuni Sanctuary         1         0.4         2.00         2001         do         1           Masterer Ghuni Sanctuary         1         0.4         2.00         2001         do         1           Navkhola Sanctuary         1         0.5         2.50         2001         do         1           Navkhola Sanctuary (central sanctuary)         1         0.5         2.50         2001         do         1           Mois Sanctuary (central sanctuary)         1         1.24         6.20         2001         do         1           Image River         1         0.2         1.00         2001         do         1         1           Golachipa Kum Sanctuary         1         0.2         1.00         2001         do         1	Naler Daha Sanctuary	1	0.5	2.50	2001	Mokosh RMO	1	
Burir Daha Sanctuary         1         0.5         2.50         2001         do         1           Modevir Ghuni Sanctuary         1         0.4         2.00         2001         do         1           Nepaler Ghuni Sanctuary         1         0.5         2.50         2001         do         1           Nawkhola Sanctuary (central sanctuary)         1         1         5.00         2001         do         1           Sanctuary)         1         1.24         6.20         2001         do         1           Sanctuary         1         0.2         1.00         2001         do         1           Tamail Daha Sanctuary         1         0.2         1.00         2001         do         1           Golachipa Kum Sanctuary         1         1.5         7.50         2001         Turag River         1         1.8         9.00         2001         do         1           Central sanctuary         1         2.5         12.50         2001         do         1         3           Sanctuary (central sanctuary)         1         2.2         11.00         2002         Alue         1         3           Gaboli Sayedpur Kum         5.8         <	Moisher Daha Sanctuary	1	0.5	2.50	2001	do	1	
Moulovir Ghuni Sanctuary         1         0.4         2.00         2001         do         1           Masterer Ghuni Sanctuary         1         0.5         2.50         2001         do         1           Nawkhola Sanctuary (central sanctuary)         1         1         5.00         2001         do         1           Dholi Daha Sanctuary (central sanctuary)         1         1.24         6.20         2001         do         1           Tamail Daha Sanctuary (central sanctuary)         1         0.2         1.00         2001         do         1           Golachipa Kum Sanctuary         1         0.2         1.00         2001         do         1           Central sanctuary)         1         1.5         7.50         2001         Turag River         1           Golachipa Kum Sanctuary         1         1.5         7.50         2001         do         1           Likhar Kum Sanctuary         1         2.5         12.50         2001         do         1           Golachipa Kum Sanctuary         1         2.5         12.50         2001         do         1           Sanctuary (central sanctuary)         1         2.5         12.50         2002         do <td>Burir Daha Sanctuary</td> <td>1</td> <td>0.5</td> <td>2.50</td> <td>2001</td> <td>do</td> <td>1</td> <td></td>	Burir Daha Sanctuary	1	0.5	2.50	2001	do	1	
Masterer Ghuni Sanctuary         1         0.4         2.00         2001         do         1           Navkhola Sanctuary (central sanctuary)         1         0.5         2.50         2001         do         1           Dholi Daha Sanctuary (central sanctuary)         1         1.24         6.20         2001         do         1           Sub-total sanctuary         1         0.2         1.00         2001         do         1           Tamail Daha Sanctuary         1         0.2         1.00         2001         do         1           Sub-total         9         5.24         26.20         9         9           Central sanctuary         1         1.5         7.50         2001         Tarag River         1           Central sanctuary         1         1.8         9.00         2001         do         1           Calachira Kum Sanctuary         1         2.5         12.50         2001         do         1           Sanctuary (central sanctuary)         1         2.2         11.00         2002         do         1           Sanctuary (central sanctuary)         1         2.2         11.00         2002         do         1           Banc	Moulovir Ghuni Sanctuary	1	0.4	2.00	2001	do	1	
Nepaler Ghuni Sanctuary         1         0.5         2.50         2001         do         1           Nawkhola Sanctuary (central sanctuary)         1         1         5.00         2001         do         1           Dholi Daha Sanctuary (central sanctuary)         1         1.24         6.20         2001         do         1           Tamail Daha Sanctuary (central sanctuary)         1         0.2         1.00         2001         do         1           Golachipa Kum Sanctuary (central sanctuary)         1         1.5         7.50         2001         Turag River         1           Golachipa Kum Sanctuary         1         1.5         7.50         2001         do         1           Lakhar Kum Sanctuary         1         1.5         7.50         2001         do         1           Sanctuary (central sanctuary)         1         2.5         12.50         2001         do         1           Sanctuary (central sanctuary         1         1.8         9.00         2002         do         1           Bamouer Ghuni Sanctuary         1         1.5         7.50         2002         do         1           Doika Daha Sanctuary         1         1.5         7.50         2002 </td <td>Masterer Ghuni Sanctuary</td> <td>1</td> <td>0.4</td> <td>2.00</td> <td>2001</td> <td>do</td> <td>1</td> <td></td>	Masterer Ghuni Sanctuary	1	0.4	2.00	2001	do	1	
Nawkoła Sanctuary (central anctuary)         1         1         5.00         2001         do         1           Sanctuary)         1         1.24         6.20         2001         do         1           Sanctuary)         1         0.2         1.00         2001         do         1           Sanctuary         1         0.2         1.00         2001         do         1           Sub-total         9         5.24         26.20         9         9           Turag River         2001         Turag River         1	Nepaler Ghuni Sanctuary	1	0.5	2.50	2001	do	1	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Nawkhola Sanctuary (central	1	1	5.00	2001	1	1	
Dholi Daha Sanctuary (central sanctuary)         1         1.24         6.20         2001         do         1           Sanctuary)         1         0.2         1.00         2001         do         1           Turag River         0         5.24         26.20         9         9           Central Sanctuary (central sanctuary)         1         1.5         7.50         2001         Turag River (central sanctuary)         1         1.8         9.00         2001         do         1           Central sanctuary (central sanctuary)         1         1.8         9.00         2001         do         1           Gabtolis Sayedpur Kum         3         5.8         29.00          3	sanctuary)	1	1	5.00	2001	do	1	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Dholi Daha Sanctuary (central	1	1.04	( 20	2001	1	1	
Tamail Daha Sanctuary (replaced Kalia Daha)         1 $0.2$ $1.00$ $2001$ $do$ $1$ Sub-total         9 $5.24$ $26.20$ $2001$ $3$ Turag River (central sanctuary)         1 $1.5$ $7.50$ $2001$ Turag River RMO $1$ Lakknar Kum Sanctuary (central sanctuary)         1 $1.8$ $9.00$ $2001$ $do$ $1$ Gaboti Sayedpur Kum Sanctuary (central sanctuary)         1 $2.5$ $12.50$ $2001$ $do$ $1$ Bamoner Ghuni Sanctuary         1 $2.2$ $11.00$ $2002$ $Alua RMO$ $1$ Brangi Danga Daha Sanctuary         1 $1.8$ $9.00$ $2002$ $do$ $1$ Brangi Danga Sanctuary         1 $1.8$ $9.00$ $2002$ $do$ $1$ Brandia Sanctuary         1 $1.5$ $7.50$ $2002$ $do$ $1$ Gababa Sanctuary         1 $1.5$ $7.50$ $2002$ $do$ $1$ Goliar Sanctuary         1	sanctuary)	1	1.24	6.20	2001	do	1	
(replaced Kalia Daha)         1         0.2         1.00         2001         do         1           Sub-total         9         5.24         26.20         9           Golachipa Kum Sanctuary (central sanctuary)         1         1.5         7.50         2001         Turag River RMO         1           Lalkhar Kum Sanctuary (central sanctuary)         1         1.8         9.00         2001         do         1           Gabtoli Sayedpur Kum Sanctuary (central sanctuary)         1         2.5         12.50         2001         do         1           Banneer Ghuni Sanctuary         1         2.5         12.50         2002         do         1           Banneer Ghuni Sanctuary         1         2.2         11.00         2002         do         1           Bond Dang Daha Sanctuary         1         1.8         9.00         2002         do         1           Borio Daha Sanctuary         1         1.5         7.50         2002         do         1           Guiarsanctuary (central sanctuary)         1         1.4         5.00         2002         do         1           Gola resonctuary (central sanctuary)         1         1         5.00         do         1 <tr< td=""><td>Tamail Daha Sanctuary</td><td>1</td><td>0.0</td><td>1.00</td><td>2001</td><td>1</td><td>1</td><td></td></tr<>	Tamail Daha Sanctuary	1	0.0	1.00	2001	1	1	
Sub-total         9         5.24         26.20         9           Turag River (central sanctuary)         1         1.5         7.50         2001         Turag River RMO         1           Lalkhar Kum Sanctuary)         1         1.8         9.00         2001         do         1           Lalkhar Kum Sanctuary)         1         1.8         9.00         2001         do         1           Gabtoli Sayedpur Kum Sanctuary (central sanctuary)         1         2.5         12.50         2001         do         1           Bamoner Ghuni Sanctuary         1         2.5         12.50         2002         Alua RMO         1           Bamoner Ghuni Sanctuary         1         2.2         11.00         2002         do         1           Doika Daha Sanctuary         1         1.8         9.00         2002         do         1           Doika Daha Sanctuary         1         1.5         7.50         2002         do         1           Boro Daha Sanctuary (central sanctuary)         1         1         5.00         2004         do         1           Krishnerhari Daha Sanctuary         1         1         5.00         2004         Go         1 <t< td=""><td>(replaced Kalia Daha)</td><td>1</td><td>0.2</td><td>1.00</td><td>2001</td><td>do</td><td>1</td><td></td></t<>	(replaced Kalia Daha)	1	0.2	1.00	2001	do	1	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Sub-total	9	5.24	26.20			9	
	Turag River	-			2001			
(central sanctuary)         1         1.5         7.50         2001         RMO         1           Lalkhar Kum Sanctuary         1         1.8         9.00         2001         do         1           Gabtoli Sayedpur Kum         1         2.5         12.50         2001         do         1           Gabtoli Sayedpur Kum         1         2.5         12.50         2001         do         1           Samctuary (central sanctuary)         1         2.5         12.60         2001         do         1           Barnoner Ghuni Sanctuary         1         2.2         11.00         2002         do         1           Doika Daha Sanctuary         1         1.8         9.00         2002         do         1           Borro Daha Sanctuary (central sanctuary)         1         1.5         7.50         2002         do         1           Krishnerhari Daha Sanctuary         1         1         5.00         2004         do         1           Gutar Khal         7         12.94         64.70         7         7         7           Goliar Sanctuary 1         1         0.75         3.75         2004         Goliar RMO         1           Goli	Golachipa Kum Sanctuary					Turag River	1	
Child Michael (central sanctuary)         1         1.8         9.00         2001         do         1           Cabtoli Sayedpur Kum Sanctuary (central sanctuary)         1         2.5         12.50         2001         do         1           Sub-total         3         5.8         29.00         do         1           Banoner Ghuni Sanctuary         1         2.2         11.00         2002         Alua RMO         1           Bhangi Danga Daha Sanctuary         1         1.8         9.00         2002         do         1           Doika Daha Sanctuary         1         1.5         7.50         2002         do         1           Polimara Daha Sanctuary (central sanctuary)         1         1.5         7.50         2002         do         1           Boro Daha Sanctuary (central sanctuary)         1         1         5.00         2004         do         1           Guiar Shantuary (central sanctuary (central sanctuary)         1         1         5.00         2004         do         1           Goilar Shat         7         12.94         64.70         7         7         60iar RMO         1         60iar RMO         1           Goliar Sanctuary 2         1         0.75	(central sanctuary)	1	1.5	7.50	2001	RMO	-	
Image: Control Sanctuary         1         1.8         9.00         2001         do         1           Gabtoli Sayedpur Kum         3         2.5         12.50         2001         do         1           Sanctuary (central sanctuary)         1         2.5         12.50         2001         do         1           Sub-total         3         5.8         29.00         3         3         3           Alua Beel	Lalkhar Kum Sanctuary					10.10	1	
Construction         Construction<	(central sanctuary)	1	1.8	9.00	2001	do	-	
Construction boy open and the second open a	Gabtoli Savednur Kum						1	
Sultation (central stratter)         3         5.8         29.00         3           Alua Beel         -         -         -         -         -           Bamoner Ghuni Sanctuary         1         2.2         11.00         2002         Alua RMO         1           Bhangi Danga Daha Sanctuary         1         1.8         9.00         2002         do         1           Doika Daha Sanctuary         1         1.5         7.50         2002         do         1           Boro Daha Sanctuary (central sanctuary)         1         1.5         7.50         2002         do         1           Boro Daha Sanctuary (central sanctuary)         1         4.44         22.20         2002         do         1           Guiar Sanctuary (central sanctuary         1         1         5.00         2004         do         1           Guiar Sanctuary 1         1         1         5.00         2004         do         1           Goliar Sanctuary 1         1         0.75         3.75         2004         Goliar RMO         1           Goliar Sanctuary 2         1         0.75         3.75         2004         Goliar RMO         1           Goliar Sanctuary 4	Sanctuary (central sanctuary)	1	2.5	12.50	2001	do	-	
Alua Beel         S.0 $2.00$ Alua Roman $3$ Bamoner Ghuni Sanctuary         1         2.2         11.00         2002         Alua RMO         1           Bhangi Danga Daha Sanctuary         1         1.8         9.00         2002         do         1           Doika Daha Sanctuary         1         1.5         7.50         2002         do         1           Folimara Daha Sanctuary         1         1.5         7.50         2002         do         1           Boro Daha Sanctuary (central sanctuary)         1         4.44         22.20         2002         do         1           Krishnerhari Daha Sanctuary (replaced Dilarhari)         1         1         5.00         2004         do         1           Guerchari Daha Sanctuary         1         1         5.00         2004         do         1           Guers Khal         7         12.94         64.70         7         7         7           Goliar Sanctuary 1         1         0.75         3.75         2004         Goliar RMO         1           Goliar Sanctuary 2         1         0.75         3.75         2004         Goliar RMO         1           Goliar San	Sub-total	3	5.8	29.00			3	
Alta Deci         Image		5	5.0	29.00			5	
Daminal Online Online Matching       1       2.2       11.00       2002       And RMO       1         Bhangi Danga Daha Sanctuary       1       1.8       9.00       2002       do       1         Doika Daha Sanctuary       1       1.5       7.50       2002       do       1         Boro Daha Sanctuary (central sanctuary)       1       1.5       7.50       2002       do       1         Krishnerhari Daha Sanctuary (replaced Dilarhari)       1       4.44       22.20       2002       do       1         Gurerhari Daha Sanctuary       1       1       5.00       2004       do       1         Goliar Khal       7       12.94       64.70       7       7       7         Goliar Sanctuary 1       1       0.75       3.75       2004       Goliar RMO       1         Goliar Sanctuary 3       1       0.75       3.75       2004       Goliar RMO       1         Goliar Sanctuary 4       1       0.75       3.75       2004       Goliar RMO       1         Goliar Sanctuary 4       1       0.75       3.75       2004       Goliar RMO       1         Goliar Sanctuary 4       1       0.75       3.75       2004<	Bamoner Ghuni Sanctuary	1	2.2	11.00	2002	Alua RMO	1	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Bhangi Danga Daha Sanctuary	1	1.8	9.00	2002	do	1	
	Doika Daha Sanctuary	1	1.0	5.00	2002	do	1	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Folimara Daha Sanctuary	1	15	7.50	2002	do	1	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Pomo Daha Sanctuary (control	1	1.5	7.50	2002	uo	1	
Sanctuary         I	Boro Dana Sanctuary (central	1	4.44	22.20	2002	do	1	
Rhismernari Daha Sanctuary (replaced Dilarhari)11 $5.00$ $2004$ do1Gurerhari Daha Sanctuary11 $5.00$ do1Gurerhari Daha Sanctuary7 $12.94$ $64.70$ do7Goliar Khal2004200477Goliar Sanctuary 11 $0.75$ $3.75$ 2004Goliar RMO1Goliar Sanctuary 21 $0.75$ $3.75$ 2004Goliar RMO1Goliar Sanctuary 31 $0.75$ $3.75$ 2004Goliar RMO1Goliar Sanctuary 41 $0.75$ $3.75$ 2004Goliar RMO1Sub-total4315.00 $4$ 4Total2326.98134.90 $2005$ $4_2$ $4$ Muripara Kum1 $1.4$ $7.00$ $2005$ $do$ 1Palashtoli Kum1 $1.5$ $7.50$ $2005$ $do$ 1HatuBhanga Kum1 $1.5$ $7.50$ $2005$ $do$ 1Abdair Beel Sanctuary1 $1.5$ $7.50$ $2005$ $do$ 1Jugarhari (Mollarhari) Daha1 </td <td>Sanctuary)</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>1</td> <td></td>	Sanctuary)						1	
InterpretationImage: constraint of the system	(replaced Dilerbari)	1	1	5.00	2004	do	1	
Gurernan Data Sanctuary         1         1         3.00         do         1           Sub-total         7         12.94         64.70         7           Goliar Khal         2004         7           Goliar Sanctuary 1         1         0.75         3.75         2004         Goliar RMO         1           Goliar Sanctuary 2         1         0.75         3.75         2004         Goliar RMO         1           Goliar Sanctuary 3         1         0.75         3.75         2004         Goliar RMO         1           Goliar Sanctuary 4         1         0.75         3.75         2004         Goliar RMO         1           Goliar Sanctuary 4         1         0.75         3.75         2004         Goliar RMO         1           Goliar Sanctuary 4         1         0.75         3.75         2004         Goliar RMO         1           Guis Sanctuary 4         1         0.75         3.75         2004         Goliar RMO         1           Guis Sanctuary 4         1         0.75         3.75         2004         Goliar RMO         1           Multiple         23         26.98         134.90         20         Azgana UP,         1	(replaced Dhaman)	1	1	5.00			1	
Sub-total         7         12.94         64.70         2004         7           Goliar Khal         1         0.75 $3.75$ 2004         Goliar RMO         1           Goliar Sanctuary 1         1         0.75 $3.75$ 2004         Goliar RMO         1           Goliar Sanctuary 2         1         0.75 $3.75$ 2004         Goliar RMO         1           Goliar Sanctuary 3         1         0.75 $3.75$ 2004         Goliar RMO         1           Goliar Sanctuary 4         1         0.75 $3.75$ 2004         Goliar RMO         1           Goliar Sanctuary 4         1         0.75 $3.75$ 2004         Goliar RMO         1           Goliar Sanctuary 4         1         0.75 $3.75$ 2004         Goliar RMO         1           Guiar Sanctuary 4         1         0.75 $3.75$ 2004         Goliar RMO         1           Sub-total         4         3         15.00          4         23           Outside Project         -         -         -         -         1           Kuripara Kum         1         1.5 <td>Gurernari Dana Sanctuary</td> <td>1</td> <td>12.04</td> <td>5.00</td> <td></td> <td>do</td> <td>1</td> <td></td>	Gurernari Dana Sanctuary	1	12.04	5.00		do	1	
Goliar KhalII2004Control (Control (Contr	Sub-total	1	12.94	64.70	2004		7	
Golar Sanctuary 11 $0.75$ $3.75$ $2004$ Golar RMO1Golar Sanctuary 21 $0.75$ $3.75$ $2004$ Golar RMO1Golar Sanctuary 31 $0.75$ $3.75$ $2004$ Golar RMO1Golar Sanctuary 41 $0.75$ $3.75$ $2004$ Golar RMO1Outside Project43 $15.00$ $2005$ Azgana UP, Azgana UP, Turag RMO1Nuripara Kum1 $1.5$ $7.50$ $2005$ do1Palashtoli Kum1 $1.5$ $7.50$ $2005$ do1Abdair Beel Sanctuary1 $1.5$ $7.50$ $2005$ $do$ 1Jugarhari (Mollarhari) Daha1 $1.5$ $7.50$ $2005$ $do$ 1Golar Sub-total6 $9.2$ $46.00$ $0.55$ $0.55$ $0.55$	Goliar Khal	1	0.75	2.55	2004			
Gohar Sanctuary 21 $0.75$ $3.75$ $2004$ Gohar RMO1Goliar Sanctuary 31 $0.75$ $3.75$ $2004$ Goliar RMO1Goliar Sanctuary 41 $0.75$ $3.75$ $2004$ Goliar RMO1Sub-total4315.004Total2326.98134.9023Outside Project23Nuripara Kum1 $1.4$ $7.00$ $2005$ SUFO Mirzapur, Turag RMOPalashtoli Kum1 $1.5$ $7.50$ $2005$ do1HatuBhanga Kum1 $1.5$ $7.50$ $2005$ do1Abdair Beel Sanctuary1 $1.5$ $7.50$ $2005$ do1Jugarhari (Mollarhari) Daha1 $1.5$ $7.50$ $2005$ do1Sub-total6 $9.2$ $46.00$ $4.00$ $6.01$ $6.02$	Goliar Sanctuary I	1	0.75	3.75	2004	Goliar RMO	1	
Goliar Sanctuary 31 $0.75$ $3.75$ $2004$ Goliar RMO1Goliar Sanctuary 41 $0.75$ $3.75$ $2004$ Goliar RMO1Sub-total4315.004Total2326.98134.9023Outside Project $ -$ 2005Kuripara Kum1 $1.4$ $7.00$ $2005$ SUFO Mirzapur, Turag RMOPalashtoli Kum1 $1.5$ $7.50$ $2005$ do $1$ HatuBhanga Kum1 $1.5$ $7.50$ $2005$ do $1$ Abdair Beel Sanctuary1 $1.5$ $7.50$ $2005$ $Azgana UP, Turag RMO$ $1$ Jugarhari (Mollarhari) Daha1 $1.5$ $7.50$ $2005$ $do$ $1$ Sub-total $6$ $9.2$ $46.00$ $Mo$ $Mo$ $1$	Goliar Sanctuary 2	1	0.75	3.75	2004	Goliar RMO	1	
Goliar Sanctuary 41 $0.75$ $3.75$ $2004$ Goliar RMO1Sub-total4315.004Total2326.98134.9023Outside Project $$	Goliar Sanctuary 3	1	0.75	3.75	2004	Goliar RMO	1	
Sub-total4315.004Total2326.98134.9023Outside Project $I$ $I$ $I$ $I$ $I$ Kuripara Kum1 $I$ $I.4$ $7.00$ $2005$ $SUFO$ Mirzapur, Turag RMO $I$ Palashtoli Kum1 $I.5$ $7.50$ $2005$ $do$ $I$ HatuBhanga Kum1 $I.5$ $7.50$ $2005$ $do$ $I$ Beltoli Kum1 $1.5$ $7.50$ $2005$ $do$ $I$ Jugarhari (Mollarhari) Daha1 $1.5$ $7.50$ $2005$ $do$ $I$ Sub-total $6$ $9.2$ $46.00$ $I$ $I$ $I$	Goliar Sanctuary 4	1	0.75	3.75	2004	Goliar RMO	1	
Total2326.98134.9023Outside Project $I$ $I$ $I$ $I$ $I$ Kuripara Kum11.4 $7.00$ $2005$ $SUFO$ Mirzapur, Turag RMO1Palashtoli Kum11.5 $7.50$ $2005$ $do$ 1HatuBhanga Kum11.5 $7.50$ $2005$ $do$ 1Beltoli Kum11.5 $7.50$ $2005$ $do$ 1Jugarhari (Mollarhari) Daha11.5 $7.50$ $2005$ $do$ 1Sub-total6 $9.2$ $46.00$ $do$ 1	Sub-total	4	3	15.00			4	
Outside ProjectIIIIIAzgana UP, SUFO Mirzapur, Turag RMOIKuripara Kum11.47.002005SUFO Mirzapur, Turag RMOIPalashtoli Kum11.57.502005doIHatuBhanga Kum11.89.002005doIBeltoli Kum11.57.502005doIAbdair Beel Sanctuary11.57.502005doIJugarhari (Mollarhari) Daha11.57.502005doI <b>69.246.006666</b>	Total	23	26.98	134.90			23	
Kuripara Kum11.47.00 $2005$ Azgana UP, SUFO Mirzapur, Turag RMO1Palashtoli Kum11.57.50 $2005$ do1HatuBhanga Kum11.89.00 $2005$ do1Beltoli Kum11.57.50 $2005$ do1Abdair Beel Sanctuary11.57.50 $2005$ Azgana UP, Alua RMO1Jugarhari (Mollarhari) Daha11.57.50 $2005$ do1 <b>69.246.00666</b>	Outside Project							
Kuripara Kum11.47.002005SUFO Mirzapur, Turag RMOPalashtoli Kum11.57.502005do1HatuBhanga Kum11.89.002005do1Beltoli Kum11.57.502005do1Abdair Beel Sanctuary11.57.502005Azgana UP, Alua RMO1Jugarhari (Mollarhari) Daha11.57.502005do1 <b>Sub-total69.246.0066</b>						Azgana UP,	1	
Palashtoli Kum11.5 $7.50$ $2005$ do1HatuBhanga Kum11.8 $9.00$ $2005$ do1Beltoli Kum11.5 $7.50$ $2005$ do1Abdair Beel Sanctuary11.5 $7.50$ $2005$ $Azgana UP, Alua RMO$ 1Jugarhari (Mollarhari) Daha11.5 $7.50$ $2005$ do1 <b>Sub-total69.246.0066</b>	Kuripara Kum	1	1.4	7.00	2005	SUFO Mirzapur,		
$\begin{array}{c c c c c c c c c c c c c c c c c c c $						Turag RMO		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Palashtoli Kum	1	1.5	7.50	2005	do	1	
Beltoli Kum         1         1.5         7.50         2005         do         1           Abdair Beel Sanctuary         1         1.5         7.50         2005         Azgana UP, Alua RMO         1           Jugarhari (Mollarhari) Daha         1         1.5         7.50         2005         do         1           Sub-total         6         9.2         46.00          6         6	HatuBhanga Kum	1	1.8	9.00	2005	do	1	
Abdair Beel Sanctuary         1         1.5         7.50         2005         Azgana UP, Alua RMO         1           Jugarhari (Mollarhari) Daha         1         1.5         7.50         2005         do         1           Sub-total         6         9.2         46.00         6         6         6	Beltoli Kum	1	1.5	7.50	2005	do	1	
Jugarhari (Mollarhari) Daha         1         1.5         7.50         2005         do         1           Sub-total         6         9.2         46.00         6         6	Abdair Beel Sanctuary	1	1.5	7.50	2005	Azgana UP, Alua RMO	1	
Sub-total         6         9.2         46.00         6	Jugarhari (Mollarhari) Daha	1	1.5	7.50	2005	do	1	
	Sub-total	6	9.2	46.00			6	

#### Wetland Sanctuaries at Turag-Bangshi Site, MACH (June 2007)

\*\* Sanctuary area + surrounding no fishing area

Neme of the meter hade and Neme	Est.	hlished sines	A street we fishing	Very	Managadha		Damasla
Name of the water-body and Name	Esta	addished since	Actual no lisning	Y ear Established	Managed by	No. of	Remarks
of Sanctuary	mee	2007	area (acre)	Establisheu	KNO	existing	
	No.	Area (acre)	-			sanctuaries	
Kewta Beel	1.00						
Kewta Sanctuary-1	1	0.46	0.74	2001	Kewta RMO	1	
Kewta Sanctuary-2	1	0.16	0.49	2001	do	1	
Kewta Sanctuary-3	1	0.18	0.51	2001	do	1	
Kewta Sanctuary-4	1	0.12	0.45	2001	do	1	
Sub-total	4	0.92	2.19			4	
Takimari-Dharabashia Beel							
Dharabashia Sanctuary-1	1	0.21	Converted to	2001	T-D RMO	0	
			Katha with LGC				
			approval				
Kathakhali Khal Sanctuary-1	1	0.89	1.17	2001	do	1	
Kathakhali Khal Sanctuary-2	1	0.77	1.05	2001	do	1	
Kathakhali Khal Sanctuary-3	1	0.67	0.95	2002	do	1	
Kathakhali Khal Sanctuary-4	1	0.94	1.22	2002	do	1	
Kathakhali Khal Sanctuary-5 New	1	0.5	0.78	2004	do	1	
Batia Beel	1	1.5	4.3	2004	do	1	
Malijhee River (Dainnar Kur) (central	1	0.8	5.33	2003	do	1	
sanctuary)							
Sub-total	8	6.28	14.8			7	
Dholi- Baila Beel							
Dholi Sanctuary	1	3	7.07	2005	Dholi- Baila	1	
					RMO		
Dholi- Baila Sanctuary-1	1	0.5	0.77	2001	do	1	
Dholi- Baila Sanctuary-2	1	0.5	0.77	2001	do	1	
Dholi- Baila Sanctuary-3	1	0.5	0.77	2001	do	1	
Dholi- Baila Sanctuary-4	1	0.5	0.77	2001	do	1	
Dholi- Baila Sanctuary-5	1	0.5	0.77	2001	do	1	
Dholi- Baila Sanctuary-6	1	0.5	0.77	2001	do	1	
Tanachura/Shomeshwari river San1	1	0.59	0.71	2002	do	1	
Tanachura / Shomeshwari river San2	1	0.39	0.51	2003	do	1	
Tanachura / Shomeshwari river San3	1	0.93	1.05	2003	do	1	
Sub-total	10	7.91	13.96			10	
Bailsha Beel							
Bailsha Sanctuary-1	1	1	2.41	2001	Bailsha RMO	1	
Bailsha Sanctuary-2	1	1	2.41	2001	do	1	
Sub-total	2	2	4.82			2	
Total	24	17.11	35.77			23	

#### Wetland Sanctuaries at Kangsha-Malijhee, MACH (June 2007)

#### Summary Table of Sanctuary numbers and area (June 2007):

Site	Name of Waterbody	Number reported	Area Reported	Number Existing	No fishing	Remarks
			(acre)	sanctuary	area	
MACH-I					(acre)	
	Sananda Beel	3	0.42	1	1.03	Three sanctuaries were adjacent to each other. All threes were merged together and are being treated as one sanctuary.
	Balla Beel	4	5.06	2	3.77	4 sanctuaries were located in 2 locations in a cluster, afterward those were merges in 2 locations forming #2.
	Jethua Beel	2	1.04	1	0.52	Another of 0.52 acres was planned and included in project reports for 2001 but was never actually established.
	Kajura Beel	1	0.33	1	0.33	
	Agari Beel	5	2.64	1	5.79	Total re-excavated area. There is not enough space for fishing in between the initial sanctuaries so the whole area has been set aside as no fishing by RMO
нн	Borogangina Canal	5	23.53	2	11.28	There was space for fishing in between the sanctuaries but RMO found it as a problem for protecting the sanctuaries from intentional fishing. So, they declared 2 major sanctuary concentrated area as 2 sanctuaries
	Chapra Magura Beel	1	21.88	0	0	Eventually this sanctuary was merged with Jaduria as a part of Baikka beel sanctuary.(see table below)
	Dumuria Beel Complex (Charadoba- 2, Patharia-1, Cheruadubi- 2, Gopla river-1)	6	6.63	0	0	Out of 6 reported sanctuaries 4 were used as temporary sanctuary for 2 years since establishment and later on those were dismantled. Remaining 2 were treated as one permanent sanctuary as those were very close to each other but due to shallowness of water and management strategy those were abolished and 1 new sanctuary has been established in 2007 in Dholidoba (see table below) which was found equally effective to the whole waterbody of Dumuria beel.
	SubTotal	26	39.65	8	22.72	•
ТВ	Mokosh Beel	9	5.24	9	26.20	
	I urag Kiver	1 3	5.80	1 3	29.00	

Site	Name of Waterbody	Number reported	Area Reported (acre)	Number Existing sanctuary	No fishing area (acre)	Remarks
тр	Alua Beel	7	12.94	7	64.70	
ID	SubTotal	19	23.98	19	119.90	
	Kewta Beel	4	0.92	4	2.19	
KM	Takimari Darabashia	6	4.28	5	9.72	One converted to Katha as per proposal of RMO with LGC approval
	Dholi Baila	9	4.91	9	6.89	
	Bailsha Beel	2	2.00	2	4.82	
	SubTotal	21	12.11	20	23.62	
	MACH-I	66	75.74	47	166.24	
	Total					

Site	Name of Waterbody	Number reported	Area Reported	No. of existing	No fishing	Remarks
			(acre)	sanctuary	area	
МАСИ П					(acre)	
MACH-II	Induria (Later	1	100.50	1	100 50	Finally Jaduria (100 50) &
	on it has been	1	100.50	1	+ 21.88	Chapra Magura (21.88) has
	named as				+11122 =	been merged & named as
	Baikka beel				233.60	Baikka heel sanctuary There
	Sanctuary)				255.00	is wetland (111.22) in between
	salietuary)					those 2 parts where fishing is
HH						also restricted.
	Medi Beel	1	4.88	1	4.88	
	Dholidoba	1	1.48	1	1.48	Established in 2007 but it's a
						replacement of Chharadoba
						sanctuary.
	SubTotal	3	106.86	3	239.96	
	Goliar khal	4	3.00	4	15.00	
	Turag river	6	9.20	6	46.00	
тр	and Alua					
ID	beel(Outside					
	project)					
	SubTotal	10	12.20	10	61.00	
	Katakhali	2	2.00	2	5.08	
	khal and					
KM	Batia beel					
KM	Dholi	1	3.00	1	7.07	
	Sanctuary					
	SubTotal	3	5.00	3	12.15	
	MACH-II	16	124.06	16	313.11	
	Total					

#### Sanctuaries renovated under Outreach program:

Name of the Items	No.	Area (ha)
a) Sanctuary renovated through brushwood piling, bamboo post, depiction of signboard and pillar	16	15.00
b) Sanctuary renovated through permanent structures, 1,450 hexapod & 330 pipe	2	2.45
c) Sanctuary renovated through earthwork	2	2.23
Sub-total 1	20	19.68

#### List of sanctuary in outreach program

SI	Name of the sanctuary	Waterbody	Upazila	District	FMC	Work
		Balajhan	-			Earthwork,
1	Furunga beel near Balajhan River	River	Mithamoin	Kishoregonj	Balajhan	Brushwood
		Balajhan				Pillar, Signboard,
2	Balajhan River	River	Mithamoin	Kishoregonj	Balajhan	Brushwood
		Jal Ghagotia	Netrokona			
3	Jal Ghagotia Beel	Beel	Sadr	Netrokona	Jal Ghagotia	Hexapod, Pipe
		Bramoputtra			Bramoputtra	Pillar, Signboard,
4	Joshiddar	Nod	Trishal	Mymensingh	Nod	Brushwood
		Bramoputtra			Bramoputtra	Pillar, Signboard,
5	Jheelki	Nod	Trishal	Mymensingh	Nod	Brushwood
		Bramoputtra			Bramoputtra	Pillar, Signboard,
6	Baroigaon	Nod	Trishal	Mymensingh	Nod	Brushwood
		Ichhamoti			Ichhamoti	Pillar, Signboard,
7	Dolawari	River	Santhia	Pabna	River	Brushwood
		Ichhamoti			Ichhamoti	Pillar, Signboard,
8	Bonogram	River	Behra	Pabna	River	Brushwood
9	Borodoha near rest house	Gur Nodi	Singra	Natore	Gur Nodi	Pillar, Signboard
						Pillar, Signboard,
10	Chotodoha	Gur Nodi	Singra	Natore	Gur Nodi	Brushwood
		Tangon				Hexapod, Pipe,
11	Kodomtola	River	Pirgonj	Thakurgaon	Tangon River	Pillar, Signboard,
						earthwork
		Tangon				Pillar, Signboard,
12	Naoghata	River	Pirgonj	Thakurgaon	Tangon River	brushwood
1.0		Tangon	D			Pillar, Signboard,
13	Sagoni	River	Pirgonj	Thakurgaon	Tangon River	Brushwood
		Masankura	D: 11		Masankura	Pillar, Signboard,
14	Existing Masankura Mora Nodi	Mora Nodi	Pirgachha	Rangpur	Mora Nodi	Brushwood
1.5		Masankura	D: 11		Masankura	Pillar, Signboard,
15	New Masankura Mora Nodi*	Mora Nodi	Pirgachha	Rangpur	Mora Nodi	Earthwork
	Railway bridge in Jamuneswari	Jamuneswari			Jamuneswari	Pillar, Signboard,
16	River	River	Bodorgonj	Rangpur	River	Brushwood
17		Jamuneswari			Jamuneswari	Pillar, Signboard,
17	Belerghat in Jamuneswari River	River	Bodorgonj	Kangpur	River	Brushwood
10		Ichhamoti	G 41		Ichhamoti	Pillar, Signboard,
18	Sonatola in Ichhamoti River	River	Santhia	Pabna	River	Brushwood
10		Ichhamoti	G 41		Ichhamoti	Pillar, Signboard,
19	Bokuitola in Ichhamoti Kiver	Kiver	Santhia	Pabna	Kiver	Brushwood
20	Silonda Jolkor part in Boral River	Boral River	Santhia	Pabna	Silonda River	Pillar, Signboard
21	Chotopathailhat in Boral River <sup>1</sup>	Boral River	Santhia	Pabna	Silonda River	Pillar, Signboard

\* As earthwork of this sanctuary was not completed, so community do not treat it as a sanctuary

# **Strategic Objective 6**

# **Indicator 6.2.1b:** Number of wetland/riparian trees successfully established

June 2007

Management of Aquatic Ecosystems through Community Husbandry (MACH)

Strategic Objective 6: Improved Management of Open Water and Tropical Forest Resources							
Intermediate Result 6.2.1: Innovation and Best Practices Adopted							
Indicator 6.2.1b: Number of wetland/riparian trees successfully established							
A. Description	Cumulative	Cumulative Unit of measure: (km)					
Precise Definition of Indicator: This indicator measures the number of trees							
planted in riparian and wetland habitat through community based management	Year	Planned	Actual				
within an integrated wetland/upland management system.		MACH-I					
Unit of Measure: numbers of saplings planted and alive after one year (includes	Baseline						
replacements)	2000	-	46.791				
Disaggregate by: N/A							
Justification/Management Utility: Indication to measure the increase in aquatic							
habitats and biodiversity. Riparian and wetland habitats are important contributors	2001		104 968				
to the SO level indicators affecting wetland and biodiversity.	2001	-	104,908				
B. Plan for Data Collection			100010				
Data Collection Method: winrock and its implementation partners will count	2002	-	196,016				
Mothed of Collection by USAID.							
Method of Conection by USAID: Data Source(s): Winrock and its partners	2003						
Fraguency/Timing of Data Collection: Semi annual	2003	-	333,037				
Estimated Cost of Collection: Nominal							
Responsible Individual(s) at USAID: Team Leader	MACH-II						
Responsible individual(s) at OSMID. Team Leader							
D. Data Quality Issues Date of Initial Data Quality Assessment:		100.000	204.976				
		100,000	204,870				
Known Data Limitations (if any): none							
Actions Taken or Planned to Address Data Limitations:	2005	200.000	272.228				
Date of Future Data Quality Assessments:	2005	200,000	272,328				
Procedures of Future Data Quality Assessments:							
C. Plan for Data Analysis, Reporting, and Review	2006	-	311,044				
Data analysis: Review trends of progress comparing targets to actual							
performance.							
Presentation of Data: In Table							
Review of Data: Semi-annual mission portfolio review,							
R4 review and individual review with recipient.							
Reporting Data: Internal mission report, R4 report and CBJ report.							
E. Other Notes:							
Notes on the Baselines/Targets: There were no trees along the chosen streams							
before MACH. There were no targets for MACH-I as this indicator was developed							
later.							
Location of Data Storage: P:\MissionShareable\EGFEpub\Environment\PMP\							
<b>Comments: 2004</b> : More than 45 species of trees planted. Have been able to							
exceed the planned target in spite of ISM funding constraints in June and July.							
2005: Achievement over 2 years is well above target. Explanation for year 2							
shortfall - due to inundation of sites for swamp forest.							
<b>2006:</b> The shortfall planed tree planting was covered.							

#### **Strategic Objective 6:**

Indicator 6.2.1b: Number of wetland/riparian trees successfully established

This indicator recorded the number of trees planted and complements 6.2b (the area in which those same trees are planted). Supporting evidence under 6.2b includes the numbers of trees planted and so is not repeated here. This section simply summarizes the monitoring program and progress during MACH-II.

The restoration of stream banks and the creation of habitat for aquatic and terrestrial animals is an important element of MACH. MACH supported riparian and wetland forest creation at all three sites. Accomplishing this indicator was totally dependent on the local currency funds remaining available as all tree planting activities fall under the Investment Support to MACH fund.

An additional component of this was planting native swamp tree species – largely Hijal and Koroch – which have been felled from what were once large areas of freshwater swamp forest. This is particularly important in HH and TB sites. Problems of survival of these saplings and sources of saplings that did not further reduce wild stocks were issues that required experimentation and development of nursery practices during the project such that larger saplings could be planted out.

MACH had a detailed monitoring program set up with data sheets filled out on each scheme on a semi-annual basis showing planting survival and replacement. There are two separate independent counts done first by the community groups themselves and secondly by an independent team of individuals to verify and count on a quarterly basis. Direct counts are the means of verification of this indicator. It is expected that 70-80 % will survive the first year and MACH works to replace during the following year at least once. These replacements are not included in the totals shown here, which therefore represent the number of trees that should have been surviving after one year of planting.

	Unit of measure: number									
Year	Planned	Actual	Remarks							
Year 1	100,000	Wetland- 72,956	More than 45 species of trees. Have been							
		Riparian- 32,934	able to exceed the planned target in spite of							
		Roadside- 84,121	ISM funding constraints in June and July.							
		Inst./Home- 1,475								
		Patch forest-13,390								
		Total- 204,876								
Year 2	100,000	Wetland – 11,200	Achievement over 2 years is well above							
		Riparian - 31,900	target. Explanation for year 2 shortfall -							
		Roadside - 13,970	due to inundation of sites for swamp forest							
		Institutional- 10,382	already noted. The shortfall will however							
		Total - 67,452	be covered in November-December 2006							
Year 3	-	Wetland - 28,996	Achievement over 3 years is well above							
		Riparian - 6,860	target							
		Institutional - 2,860								
		Total - 38,716								
Total	200,000									

#### Summary of tree planting under MACH-II (ISMP support)

Out of about 644,081 trees planted by MACH, just over 358,000 were swamp and riparian plantations within the wetlands. The swamp forest trees generate benefits mainly through ecological functions including acting as fish nursery grounds during the monsoon. Although eventually some lopping of branches may be allowed there is no agreement for them being felled. For riparian trees it is assumed

they will be felled and replanted on a 15 year cycle and that 40% of the planted trees will survive to felling. Again not counting any lopping before felling, the present value of return net of replanting costs for the first cycle of these trees subsidized by the project is estimated to be about Tk 152 million or about US2.4 m illion.

# **Strategic Objective 6**

**Indicator 6.2.2a:** Average annual increase in targeted individual RUG member supplemental income

June 2007

Management of Aquatic Ecosystems through Community Husbandry (MACH)

Strategic Objective 6: Improved Management of Open Water and Tropical Forest Resources						
Intermediate Result 6.2.2: Alternative Incomes realized for targeted beneficiaries						
Indicator 6.2.2a: Average annual increase in targeted individual RUG member supplen	nental income	•				
A. Description	Cumulative	Unit of meas	sure: %			
<b>Precise Definition of Indicator:</b> This indicator measures the increase in supplemental income, from the baseline established at the outset of the activity, of the targeted	Year	Planned	Actual			
beneficiaries who are being given alternate income generating technologies and credit by the program. "Targeted beneficiaries" are those dependent on fishing/aquatic resources for their livelihoods, and whose income would be adversely affected in the	Baseline					
near term by the institution of geographic or temporal restrictions on fishing. <b>Unit of Measure:</b> Percentage increase in 1 <sup>st</sup> phase , In 2 <sup>nd</sup> phase Tk. increase on total income	2000	20%	19%			
<b>Disaggregate by:</b> Gender <b>Justification/Management Utility:</b> Increased income of this target group from new income sources will reduce the need for fishing or collection of aquatic species during the "lean" season. This will help protect sanctuaries and other aquatic habitats	2001	30%	31%			
<ul><li>B. Plan for Data Collection</li></ul>	2002	40%	37%			
Data Collection Method: Annual surveys by Winrock partner. Method of Collection by USAID: Reports from Winrock & Partners. Data Source(s): Winrock and its partners.	2003	50%	46%			
Frequency/ Timing of Data Collection: Annual	Old Loanee (Tk)					
<b>Estimated Cost of Collection:</b> Medium, included in activity budgets. <b>Responsible Individual(s) at USAID:</b> Team Leader	2004	2,000	3,500			
C. Data Quality Issues Date of Initial Data Quality Assessment:	2005	2,500	11,100			
<b>Known Data Limitations (if any):</b> Increase in income may not be always attributable to adoption of alternative income-generating technologies. Data will need to be adjusted for inflation.	2006	3,500	10,400			
Actions Taken or Planned to Address Data Limitations: Other probable factors	Nev	v Loanee (Tl	0 0			
adding to income will be factored into the analytical methods.	1.07					
Date of Future Data Quality Assessments: ongoing Procedure of Future Data Quality Assessments:	2004	-	-			
<b>D. Plan for Data Analysis, Reporting, and Review</b> <b>Data analysis:</b> Review trends of increase in income among the select beneficiaries. <b>Presentation of Data:</b> Table	2005	1,800	5,200			
<b>Review of Data:</b> Semi-annual mission portfolio review, R4 review and individual review with recipient. <b>Renorting Data:</b> Internal mission report R4 report and CBI report	2006	2,000	9,700			
reporting Data. Internal mission report, ict report and ODJ report.						
<ul> <li>E. Other Notes: Caritas monitors this item on an annual basis every October</li> <li>Notes on the Baselines/Targets: Winrock and its partners have established baseline data through a household survey. Baseline is Tk 1450 taka/capita/year.</li> <li>Location of Data Storage: P:\MissionShareable\EGFEpub\Environment\PMP</li> <li>Comments: Reviews of the data in 2005-06 indicated a consistent trend but raised some questions over the income gains reported previously. In general a 45-50% gain in reported daily income (over that reported by participants in the year before first loan) was found after 3 or more years of support in IGAs through the RUGs.</li> </ul>						
## Strategic Objective 6:

## Indicator 6.2.2a: Alternative Income of Targeted Resources User Group (RUG) members

Recognizing that the reduction of fishing pressure is a key element to the revival of the floodplain fisheries, MACH has included supplemental income generating activities that focused on fishers and others dependent on wetland resources.

The overall finding of both MACH surveys completed by Caritas and an independent consultant (RMC/ Socio-Consult), were that project credit had a positive impact and exceeded planned targets during phase I. In MACH II a larger sample conducted by Caritas was used to measure the average annual increase in RUG member supplemental income as well as the number of RUG fishers having reduced effort, with the aim of a more reliable estimate of whether MACH has had an impact on helping the poor to improve their livelihoods and what the reduction in fishing is. In addition an independent survey (by CBSG) on training and credit in 2006 provided some additional information on the overall program.

However, estimating income gains is difficult and the figures generated must be treated with caution. The following issues arise in attempting to estimate changes in income:

- Head of household's income is usually the most significant component of the household income and livelihood, but monitoring for alternative income generating activity (AIGA) impacts has considered the RUG borrower only so the relative contribution of AIGAs to household income is only approximately known.
- Past surveys covered a mixture of a panel of repeat borrowers and fresh samples of RUG members- when these are mixed it combines participants who have taken different numbers of loans.
- Recall of income over the past year expressed as a daily income is likely to be unreliable.
- Incomes from all sources and their disaggregation have not been considered the focus has been on the main income source and the IGA.

## Description

Average income amongst MACH RUG households is approximately Tk 35,000 per year. The GOB household poverty line has been set at Tk 45,000 indicating that most MACH RUG members are amongst the poorest people in rural Bangladesh. Surveys, undertaken by MACH and others, show that the poor generally take on a wide variety of income generating activities, as compared to (relatively) more affluent members of the community. Income sources amongst the poor are a moving target as the poor are opportunistic in adopting new occupations. As sources of income change from year to year and even season to season, this has made the identification of what is alternative and what is the main income source difficult to identify and track.

MACH-I in the beginning of the project suggested that the credit program seek to increase alternative incomes by 50% or more. The overall finding of both MACH surveys, discussed below, completed by Caritas and RMC/ Socio-Consult, were that project credit had a positive impact and exceeded planned targets. In MACH II the program tried to use more quantitative targets to track credit activities, similar surveys again indicated a positive impact.

The main basis for determining the supplemental income for MACH RUG group members has been the annual surveys undertaken by Caritas. As detailed below, Caritas surveyed a total of 137 RUG members in 2000 in the Hail Haor and Turag-Bangshi sites. Credit efforts did not begin in the Kangsa-Maljhii site until 2001 and baseline interviews of 97 RUG members did not take place until 2002. The same individuals were surveyed in subsequent years. Total income increase over baseline levels as reported by Caritas were Tk 4,015 in Year 1, Tk 6,471 in Year 2, Tk 6,631 in Year 3 and Tk 8,778 in Year 4. Based on these Caritas surveys in Year 4 income of those surveyed increased by a total of 46% over Caritas baseline estimates. Of those surveyed by Caritas over 24% of those who initially reported fishing as their main source of income no longer fished for income by Year 4. Site wise the proportion of RUG members reported in this survey to have left fishing were 54% in Hail Haor, 27% in Turag-Bangshi and 5% in Kangsa-Malijee. Caritas staff at the sites felt that these numbers, while correct for the individuals surveyed, in all probability are too high. They felt that the about 10% of RUG members had given up fishing. However, as will be seen below the evidence of the 2006 survey is more-or-less consistent with the earlier data. Additionally site staff stated that there had been a reduction in overall fishing intensity among RUG members of 20-30%.

Re-assessment of the MACH-I data distinguished batches of borrowers who were surveyed in each year and then re-surveyed for 2003. In each

year and then re-surveyed for 2003. In each case the first survey reported on daily income in the year of first MACH-Caritas loan and the recall income of the previous year. Year wise incomes of the surveyed members are shown in the table. During MACH-I successive years' batches of borrowers reported being poorer and achieving greater gains in income in their first year. The average percentage gain in income was 43% for the year of first loan (Table 1). Thereafter the income gain per year was only about 3% a year (because the Hail Haor participants experienced a fall in income between 2002 and 2003.

 Table 1 Changes in income for AIGA credit recipients by year of first loan in MACH-I

1 <sup>st</sup> Year	1999	2000	2001	2002	2003	Overall
Tk/day						
2000	58	70			86	
2001		54	77		88	
2002			50	83	73	
change %						
2000		21			24	50
2001			43		15	64
2002				66	-12	46

Base year is the year before the first loan. The same households were surveyed a second time in August 2003.

Sample: 2000 = 35; 2001 = 25; 2002 = 35; only Hail Haor and Turag Bangshi considered, Kangsha-Malijee site only has 2002-2003 data.

The MACH-I mid term report and MACH HQ recommended that an outside firm be contracted to verify Caritas' findings. As a result a survey was conducted in late 2002 to specifically identify average supplemental income as well the impact of MACH credit activities. A large sample of 2,500 randomly selected RUG members out of 4,500 were interviewed; 1,636 who had received loans and 850 who had not received loans. The 850 non-recipients of loans are of the same socio-economic status as MACH borrowers. These non-borrowers served as the source of base-line information. Based on that survey it was estimated that the average 'alternative income' for non-borrowers was Tk 1,412 per household. For those RUG households undertaking AIGAs and receiving MACH loans the average profit was reported to be Tk 2,150. Average profit per loan was estimated at 43%. These results were similar to the outcomes found in other organizations undertaking micro-credit.

In MACH II at the end of the first year in September-October 2004 a large sample of 891 RUG members was surveyed by MACH-Caritas, however the sampling was left to the field staff and no women were covered in two sites. This same panel of RUG members was again surveyed in October 2005 and October 2006 to trace changes in income between years, and additional detail on income by sources was collected. In addition a fresh random sample in 2005 was drawn from all first time borrowers recorded from the start of MACH-II (November 2003) to April 2005 and not covered by any other survey. This last survey gives a fair representation of male and female borrowers.

## **Results of MACH-II surveys**

The Tables 2-6 reveal that the reported daily return from the various AIGAs supported by MACH-Caritas loans averaged about Tk 35 per day for the first time borrowers in 2004-05 and Tk 40 per day for the same people in 2005-06; and was Tk 46 per day for the older participants in 2004-05 but fell slightly to Tk 44 per day for the same people in 2005-06.

Site	Sex	Sample	Base	Average	amount of	loan (Tk)	N	o. taking lo	an	% taking loan		
		size	Tk/day	Nov 03	Nov 04 -	Nov 05	Nov 03-	Nov 04 -	Nov 05 -	03-04	04-05	05-06
			2004	- Oct 04	Nov 05	- Oct 06	Nov 04	Nov 05	Oct 06			
HH	Female	41	31.0	3,951	7,268	8,780	23	41	35	56.1	100.0	85.4
	Male	18	50.3	4,389	5,278	7,056	16	15	15	88.9	83.3	83.3
	Total	59	36.9	4,085	6,661	8,254	39	56	50	66.1	94.9	84.8
KM	Female	14	42.9	3,426	6,806	7,286	9	14	12	64.3	100.0	85.7
	Male	49	47.8	2,510	6,258	5,286	27	48	38	55.1	98.0	77.6
	Total	63	46.7	2,714	6,380	5,730	36	62	50	57.1	98.4	79.4
TB	Female	11	39.1	4,404	9,338	6,000	10	11	6	90.9	100.0	54.6
	Male	20	41.3	2,372	5,318	6,350	10	17	14	50.0	85.0	70.0
	Total	31	40.5	3,093	6,745	6,226	20	28	20	64.5	90.3	64.5
Total	Female	66	34.9	3,915	7,515	8,000	42	66	53	63.6	100.0	80.3
	Male	87	46.8	2,867	5,839	5,897	53	80	67	60.9	92.0	77.0
	Total	153	41.7	3,319	6,562	6,804	95	146	120	62.1	95.4	78.4
D 1		C 411-	- 1	1 6 6	41	• 1	A	1. 0	· 11 ·			

#### Loan information of RUG borrowers who borrowed for the first time between November 2003 and April 2005

Random sample of those who borrowed for first time in this period and were not covered in following sample.

#### Incomes in Nov 2004-Oct 2005 of RUG borrowers who borrowed for first time between Nov 2003 and April 2005

			Incor	ne (Tk/da	y)		% incom	ne from		No	% of
			Main							worse	sample
			profession		Other				IGA	off or	worse
Site	Sex	IGA	not fishing	Fishing	sources	Total	IGA	fishing	return*	same	off
HH	Female	30.5	4.5	0.0	4.8	39.8	77	0	1.57	2	5
	Male	35.0	7.1	31.3	0.0	73.4	48	43	1.91	1	5
	Total	32.0	5.3	9.9	3.3	50.5	63	20	1.66	3	5
KM	Female	38.2	12.1	0.0	3.4	53.8	71	0	2.31	1	7
	Male	38.0	8.0	13.8	2.7	62.6	61	22	2.49	1	2
	Total	38.1	8.8	11.0	2.9	60.8	63	18	2.45	2	3
					-						
TB	Female	34.5	12.1	0.0	3.8	50.3	69	0	1.68	0	0
	Male	33.3	7.5	14.0	3.3	58.0	57	24	1.95	0	0
	Total	33.7	9.2	8.8	3.4	55.1	61	16	1.85	0	0
Total	Female	32.9	7.5	0.0	4.3	44.6	74	0	1.75	3	4
	Male	36.4	7.7	17.4	2.3	63.8	57	30	2.26	2	2
	Total	34.9	7.6	10.2	3.1	55.8	63	16	2.03	5	3

#### Incomes in Nov 2005-Oct 2006 of RUG borrowers who borrowed for first time between Nov 2003 and April 2005

			Inco	me (Tk/da	ay)		% inco	ne from		No	% of
			Main							worse	sample
			profession		Other				IGA	off or	worse
Site	Sex	IGA	not fishing	Fishing	sources	Total	IGA	fishing	return*	same	off
HH	Female	41.9	9.9	0.0	5.5	57.3	73	0	1.66	5	12
	Male	60.0	5.6	5.0	9.7	80.3	75	6	2.73	3	17
	Total	47.4	8.6	1.5	6.8	64.3	74	2	1.98	8	14
KM	Female	24.4	13.7	3.9	15.5	57.5	43	7	2.18	3	21
	Male	34.2	7.3	20.4	13.5	75.4	45	27	2.43	3	6
	Total	32.0	8.7	16.7	14.0	71.4	45	23	2.38	6	10
		-	-								
TB	Female	42.3	0.9	0.0	19.6	62.7	67	0	3.03	1	9
	Male	40.8	7.0	17.3	8.8	73.8	55	23	1.69	0	0
	Total	41.3	4.8	11.1	12.6	69.8	59	16	2.09	1	3
Total	Female	38.3	9.2	0.8	9.9	58.2	66	1	1.91	9	14
	Male	41.0	6.9	16.5	11.6	76.0	54	21	2.33	6	7
	Total	39.8	7.9	9.7	10.9	68.3	58	17	2.15	15	10

Number of people who drop out of RUG membership from previous year: HH- 1 male, KM- 6 male and TB- 1 female

\* Tk earned from IGA per Tk borrowed

Income	in Novem	ber 2004 –	October 2	005for a st	ample of RUG	members	active in 2003										
Site	Sex	Sample	Base	Loan	No. taking		Income (T.	k/day) 2004	4-05		% incon	ne from	Total	%	IGA	No	% of
		size	(Tk/	Amount	loan	IGA	Main	Fishing	Other	Total	IGA	fishing	no. of	Change	return*	worse	sample
			day)		(2004-05)		profession		sources				people	in		off or	worse of
			2004				not fishing						fishing	income		same	
HH	Female	86	33.3	no data	n/a	32.5	16.8	n/a	9.9	59.2	54.9	n/a	0	78	I	14	-
	Male	247	71.8	no data	n/a	41.9	11.7	43.4	8.4	105.5	39.8	41.2	168	47	ı	20	
	Total	333	62.1			39.6	13.0	32.3	8.8	93.8	42.2	34.4	168	51	I	34	-
KM	Male	400	55.1	6,798	389	52.6	5.4	19.7	10.6	88.2	59.6	22.3	301	09	3.0	27	
TB	Male	120	66.8	9,919	113	39.0	20.3	21.7	3.5	84.5	46.1	25.7	91	27	2.5	12	-
Total	Female	86	33.3	no data	n/a	32.5	16.8	n/a	9.9	59.2	54.9	n/a	0	78	I	14	-
	Male	767	62.4	5,097	502	47.1	9.6	27.7	8.8	93.3	50.5	29.7	560	50	2.9	59	
	Total	853	59.5	4,583	502	45.6	10.5	24.9	8.9	89.9	50.8	27.7	560	51	2.9	73	
In Hail F	Iaor total s	sample size	was 371.4	female and	1 34 male drop	ped out of	RUGs during t	he year and	1 are not inc	cluded in 1	the table						

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\* Tk earned from IGA per Tk borrowed

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% of	sample	worse off		4	12	10	4	15	4	8	8	
No worse	off or	same		3	29	32	13	17	3	59	62	
IGA	return*			1.64	2.08	1.96	2.24	1.20	1.64	2.05	2.00	
%	Change	in	income	103	85	64	11	22	103	77	48	
Total	no. of	people	fishing	0	168	168	251	28	0	506	506	
ne from	fishing			0.0	36.9	30.8	21.2	12.2	0.0	26.5	24.4	
% incon	IGA			68.0	46.2	49.8	53.9	35.4	68.0	48.0	49.5	
	Total			66.8	115.2	102.9	77.5	81.7	66.8	90.7	88.3	function their
90-9	Other	sources		6.9	11.3	10.2	12.1	7.3	6.9	11.1	10.6	
/day) 2005	Fishing			0.0	42.5	31.7	16.5	10.0	0.0	24.0	21.6	olo ond 1
Income (Tk	Main	profession not	fishing	14.5	8.1	9.7	7.1	35.4	14.5	12.1	12.4	funct 2 that 6 fam
	IGA			45.4	53.3	51.3	41.8	29.0	45.4	43.5	43.7	al duon out
No.	taking	loan	(2004-05)	73	205	278	354	91	73	650	723	1 10 mole to to
Loan	Amount			10,563	10,335	10,393	7,866	11,207	10,563	9,234	9,369	O foresto and
Base	(Tk/	day)	2004	32.9	72.9	62.7	54.8	67.0	32.9	62.8	59.8	1 170 2012
Sample	size			80	233	313	355	116	80	704	784	i onino olimot
Sex				Female	Male	Total	Male	Male	Female	Male	Total	Toon totol an
Site				HH			KM	TB	Total			L. 111

In Hail Haor total sample size was 371. 10 female and 48 male total drop out, from that 6 female and 14 male are from this year. In Kangsha-Malijee total sample size was 400. 45 male dropped out. In Turag Bangshi total sample size was 120. 4 male dropped out. \* Tk earned from IGA per Tk borrowed

However, these averages are for those people who remained as RUG members: in Hail Haor 10% of the 2004 sample of old RUG members left their RUGs by 2005, and a further 5% left in 2006 (most drop outs were men); while in Kangsha-Malijee 11% of RUG members (all men) left between 2005 and 2006 and in Turag-Bangshi 3% (all men) left between 2005 and 2006. Among new borrowers there was hardly any difference in AIGA income between men and women. Their loan supported AIGA was the dominant source of reported income for new female borrowers (74% in 2005 and 66% in 2006), for men their AIGAs contributed 57% of reported income in 2005 and 54% in 2006. Women in the three sites do not fish for an income. Fishing is also a main occupation of a number of respondents. Overall fishing was a source of income for 54% of the new borrowers and 73% of the old borrowers (2004 survey), yet only 24-27% of respondent income came from fishing for the older borrowers (highest for men in Hail Haor at about 40%), and only 16% of income was from fishing for new borrowers (about 25% for men in Turag Bangshi and Kangsha-Malijee).

Overall for the previous borrowers the income gain between 2003-04 and 2004-05 was reportedly about 51% and amounted to about Tk 30 per day or Tk 11,100 over a year; while for the new borrowers the gain was about 34% and amounted to about Tk 14 per day or Tk 5,200 over a year. But it should be noted that in addition to about 95% of these "new borrowers" receiving a loan in 2004-05, 62% had received a loan the previous year. In 2005-06 92% of the "old borrowers" took a loan but their gain in income over 2003-04 fell slightly to 48%, whereas only 78% of the "new borrowers" took a loan yet their gain in income over 2003-04 rose to 64%.

The data for older participants suggests a second jump in income was achieved in 2004-05, but the reliability of this must be questioned. The 2003 base line income of the 891 participants covered by that survey was reported to be only 59-60 Tk per day, yet the MACH-I surveys showed an income for participants in 2003 in the range of Tk 73-88 per day depending on the year of first borrowing. Moreover general inflation has resulted in price increases of about 40% over the life of MACH, while the incomes of those who dropped out are not known. Lastly the surveys give an indication of the returns to borrowing for AIGAs (Figs. 1 and 2).



Fig. 1 Ratio of income from AIGAs to amount borrowed for 2005-06 for old established borrowers



Fig. 2 Ratio of income from AIGAs to amount borrowed for 2005-06 for newer borrowers

As can be seen in the figures, there is a tendency for declining returns on investment as loan size increases, particularly for longer established borrowers who take larger loans of Tk 20,000 or more, whereas the borrowers who take under Tk 10,000 tend to have higher returns compared with their loan. The results are affected to some extent by some respondents having taken loans late in the reporting year that might not be yielding their full return. However, most of the respondents have by now taken several loans and are expected to have ongoing profitable AIGAs, so there must be a concern over those RUG members who reported little or no return from their AIGAs. While the FRUGs will need to closely monitor the returns from and repayments of any members taking larger loans, as they can expect greater returns from spreading their revolving funds over more smaller to medium sized loans and therefore can also expect more reliable repayments from such loans. Alternatively there is a need to analyze closely and provide appropriate advice to those RUG members attempting small enterprises for which they take larger loans.

## **Supporting Evidence – extracts and summaries from surveys**

## Summary of findings from training and credit impact survey 2006

An independent study was conducted by Capacity Building Service Group which had previously investigated changes in awareness. As of June 2006 MACH project had rendered training on AIGA related issues in 241 batches. About 3,796 people had been trained on AIGA skills, of them 57% were male and rest 43% were female. The study was based on a sample survey of 300 RUG members (split evenly between sites) and 18 focus group discussions with 163 RUG members -who had received at least one AIGA training during the project life cycle. In addition, 10 key informant interviews were conducted with Caritas training staff.

About 38% of the respondents were female and the remaining 62% were male. About 43% of the respondents were either illiterate or could only sign, 24% and 32% had primarily and secondary levels of education respectively. Self-employment was overwhelmingly the main profession of the respondents, particularly women, but 20% of respondents (mostly men) were involved in agriculture on their own land. The third main occupation of the respondents was found to be small business where both men and women were involved.

The survey found that 78% of RUG members had received at least one AIGA training, though some of them received more than one AIGA training (81% of male RUG members had received AIGA training compared with 74% of female RUG members). Vegetable cultivation, poultry/duck rearing, cow rearing and fish culture had been the mostly attended AIG training programs. The ratio of male to female participation in training was generally even, except that mostly men were trained in fish culture, while mostly women were trained in tailoring, and bamboo and cane crafts.

Bamboo and cane, cow rearing and fattening, poultry, and vegetable cultivation training were reported to have made more impact on the participants. Bamboo and cane and cow rearing training were rated as most useful by the participants, while vocational training and plant nursery were rated as least useful by the trainees. Cow rearing was seen as the most useful training in Hail Haor and Turag-Bangshi sites, whereas in Kangsha-Malijee site fish culture training was reported to be the most useful AIG training. Poultry and duck rearing training were found to be quite useful to the participants from Hail Haor and Kangsha-Malijee sites, but not so much useful in Turag-Bangshi. Vegetable cultivation training was seen to be moderately effective but this was the most widely provided training, so there was a need to improve training quality in this field.

Out of 181 female AIGA training recipients, only 20% said that the training was highly effective for them, but 42% of male trainees said their training was highly effective. However, 53% of female respondents had found AIGA trainings were useful to them. It indicates that training usefulness differs significantly from effectiveness for female RUG members, moreover 37% of female participants said that their training was not effective compared with 22% of men.

The vast majority (82 %) of the trained RUG members had taken loans, but 18% did not take any loan from MACH but had training on at least one AIGA. Cow rearing has been the main AIGA over the years, whereas small business, fish culture and poultry are the next most popular AIGAs named when taking loans. In the initial years more money was invested in cow rearing, but in recent years, more loans have been used for poultry followed by cow rearing, business and fish culture.

The study data shows that only 46% of people adopting an AIGA had been supported by relevant training. For example, few borrowers had received training on managing a small business when they took loans for that purpose. Respectively 64% and 51% of people borrowing for fish culture and cow rearing had been trained in those fields. Production oriented AIGAs have been better supported by training, for example poultry, vegetable gardening, tailoring, nursery.

More than one third of the respondents were female. About half of them had relevant training for their respective AIGAs: 88% of women involved in poultry rearing had received training on it, but only 46% of women raising cattle received relevant training. Surprisingly none of the women received training on small business though this was the second most common AIGA for women.

The respondents have received credit for both main AIGAs and other AIGAs. Likewise, RUG members had received training on their main AIGA as well as on supplementary AIGAs. The study revealed that out of 364 AIGs for which the 300 respondents received credit from MACH/FRUGs, 58% were their main AIGAs and the remaining 42% were supplementary AIGAs. However, only 38% all AIGAs supported by credit were supported by relevant training (54% of the main AIGAs were supported by relevant training (54% of the main AIGAs were supported by training (Table A).

Particulars	Training received on the same AIG	Training not received on the same AIG	Total
Credit received for main AIGA	114 (54%)	97 (45%)	211 (100%) (58%)
Credit Received for other AIGA	22 (15%)	131 (85%)	153 (100%) (42%)
Total	136 (38%)	228 (62%)	364 (100%)

 Table A Distribution of RUG members by their main AIG and training and credit received.

The study revealed that besides AIGAs (main and supplementary), a portion of the loans had been used for various other purposes including meeting family expenses. Out of 300 respondents, 165 (55%) of respondents mentioned that they had used part of their loan for non-AIG purposes. In 36% of cases loans were used for some kind of capital expenditure including purchase/mortgaging in of land, tube well, irrigation pump, house renovation, etc. But the major part was used to meet recurring costs such as family expenses and to pay for agricultural expenses including day labourers, buying inputs, etc.

The impact of training on various AIG types differed. For example, poultry, tree nursery and to some extent fish culture AIGAs were reported to have benefited tremendously from the training, but the impact of training on cow fattening, goat rearing and tailoring was said to have been quite low, and there was no impact of training on small business. Income levels from AIGAs were reported to be positively correlated with the enterprises that were supported by training.

The earning ratio against the loan invested was found to be highest in vegetable gardening and selling, whereas per capita earning was highest for vocational trades (Table B). But only a handful of participants were involved in these occupations as their main AIGA. Out of 182 respondents with active main AIGAs, it was found that the average income per AIGA was Tk 5,610 or Tk 20 per day for an average of 280 days of work in their main AIGA per person.

AIGA Type	RUG members with	Average profit	Average loan received	Loan used for main
	this main AIGA	(Tk)	in 2005 (Tk)	AIGA (Tk)
Cow rearing and Fattening	66	5,332	9,333	8,571
Fish Culture/trading	36	3,763	9,545	8,545
Poultry	25	5,356	8,909	8,727
Goat Rearing	4	2,567	6,500	5,750
Small Scale Industry	11	3,556	12,600	10,400
Vegetable Gardening	9	5,315	7,250	6,750
/Business				
Nursery	5	4,546	8,500	8,500
Wheat Cultivation	1	4,060	No loan taken	No loan taken
Technical Trade (Vocation)	2	7,533	No loan taken	No loan taken
Tailoring/Embroidery	6	5,775	9,000	9,000
Small/Petty business	17	1,804	9,303	10,424

 Table B: Type of Main AIG of the RUG members by average profit and loan size

These findings are notable because they imply that the method adopted by Caritas of estimating annual income as 365 times the reported daily income in each activity of its participants will overestimate the increment in income of the RUG members from AIGAs. Moreover, the average daily income from AIGAs was lower (half) that reported by Caritas. Men tended to report more days of work and higher incomes per day from their AIGAs than women (Table C).

Tuble e Hiam Hie by gena	er of respondent an	ia average prome ne		
Gender of RUG member	No. of RUG members	Average profit (Tk) from AIGA	Average no. of days worked in year	Average profit (Tk/day)
Female	74	4 523	250	18
Temate	/+	4,525	230	10
Male	108	6,214	300	21
Total	182	2,789	280	20

Table C Main	AIG by gender	of respondent and	l average nrofit trend
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The study revealed a structural change in the source of income among the RUG member respondents since MACH started. There has been a sharp decline on fishing for family income both during the peak season as well as lean season (Fig. 3). Income from agricultural activities and businesses including fish related activities have emerged as major sources of income. On the other hand RUG members have become less dependent on day laboring for an income.



These changes in occupation have had a positive impact on the economic condition of the respondents and have contributed to their reported improved livelihood security: 96% of the respondents now say they get three square meals a day. About 60% of the sample RUG members now actually have surplus income meaning that they can save after meeting their regular expenses, with only 10% remaining in deficit (Table D).

Table D: Distribution of the RUG members by economic
class (%)

Food security/	Hail	Turag-	Kangsha-	Total
income	Haor	Bangshi	Malijee	
Surplus	51	62	65	60
Break-even	33	34	24	30
Occasional deficit	11	3	10	8
Usually deficit	5	1	1	2
Total	100	100	100	100

The study investigated the occupational pattern and income level of the RUG members prior to the MACH project and their joining the RUG compared with 2006. Almost all the participants reported they had more than one source of income for their livelihood. They have gradually shifted their occupations over the last few years. Before the start of MACH 47% of the sample RUG households did not fish but for the remaining 53% it had been an important income source and they earned around 26% of their income from that sector. There has been little change in involvement in agriculture, but by 2006 only 18% of RUG respondent households were involved in fishing (meaning that 35% reported they gave up fishing for an income) and their income from fishing had come down even

more to just 5%. On the other hand poultry, small businesses, vegetable gardening and fish culture had become more prominent as employment and income sources.

Overall the survey found evidence that the objective of the AIGA program had been met: those who joined RUGs have reduced their dependency and exploitation on fish and other aquatic resources, while training has positively contributed towards diversification of income sources and enhanced income. However, skills have not necessarily been developed in the activities that RUG members have used their loans for, and part of the credit received has been diverted to other purpose including consumption.

## **MACH-I Caritas Survey Findings**

## Year 1 Impacts

In Year 1 (2000), at the Hail Haor and Turag-Bangshi sites, Caritas reported that those implementing AIGAs showed average income increases of. 19% or Tk 4,015 (based on a survey of 137 respondents out of 511 borrowers as of December 2000) (Table A).

## Year 2 Impacts

In the second year (2001) in Hail Haor and the Turag-Bangshi sites average supplemental income increased to Tk 6,471 or 31% (based on 183 respondents out of 1,279 borrowers in December 2001) (Table B).

## Year 3 Impacts

In Year 3 by late September 2002 supplemental income increased on average to Tk 6,631 or 40% (based on 37 individual users opinions out of 74 borrowers covered by the baseline sample of 2000 in Hail Haor and Turag-Bangshi sites. Moreover, in Kangsha-Malijee site alternative income increased by 30% (based on the income status of 97 borrowers). The average supplemental income increase for all three sites was 37% (Table C).

#### Year 4 Impacts

To meet the data requirements of the ending of MACH-I a limited survey was conducted in August 2003. The sample RUG members in the Sreemongal and Kaliakoir sites (interviewed before in 2000 and 2001) had an average alternative income increase of Tk 8,778 for the year, or 52% (based on 91 respondents surveyed). In Kangsha-Malijee site the 2<sup>nd</sup> survey covering the 3<sup>rd</sup> year of implementation of AIGAs found that alternative income increased by 40% (based on 94 individuals surveyed). The overall supplemental income increase for the three sites was 46% (based on 165 interviews (Table D).

Caritas was included in MACH because of its long experience working in wetland communities and with micro-credit. MACH adopted the Caritas model for use in its credit system. Early in the process MACH and Caritas agreed to raise the maximum loan size so that RUG members could receive up to Tk 5,000 for a first loan. Subsequently RUG members have been allowed to borrow Tk 8,000 in their second and Tk 10,000 if they apply for a third loan. A total of 4,058 individual users received 7,008 loans in MACH-I. These were used to generate income from 27 trades (Table E).

Moreover, a small number of special entrepreneurial loans were attempted, based on the performance and potential of selected members. These amounted to Tk 15,000-30,000 with 13 individuals (three women) receiving these loans.

Table-A : Status of income increase of RUG members in December 2000

Sito	No. of Resourc e Area	Union council covered (nos.)	Village covered (nos.)	RUG covered (nos.)	Daily aver grou	individual aka)	Domarks	
Site					Before IGA	After IGA	Increased %	Keinai Ks
Hail Haor	3	5	7	11	55.79	66.42	19.69	
Turag-Bangshi	2	2	9	9	58.29	69.67	19.63	
Actual*				Avg.	57.04 <sup>(1)</sup>	68.05 <sup>(2)</sup>	<b>19.66</b> <sup>(3)</sup>	
Reported*				Avg.	57	68	19.44	Report published

#### Table-B : Status of income increase of RUG members in December 2001

Site	No. of	Union council	Village	RUG	Daily aver grou	age income of p members (t	individual aka)	Domorko
Sile	ce Area	covered (nos.)	(nos.)	(nos.)	Before IGA	After IGA	Increased %	Remarks
Hail Haor	7	7	19	35	47.23	64.23	36.00	
Turag-Bangshi	3	4	17	20	52.02	67.93	31.77	
Actual*				Avg.	<b>49.63</b> <sup>(1)</sup>	66.08 <sup>(2)</sup>	33.89 <sup>(3)</sup>	
Reported**				Avg.	57	74.73	31.11	Report published

\* \*\* The actual data varied from the reported data due to differences between manual calculations and spreadsheet calculations.

Table-C : Status of income increase of RUG members in September 2002

Site	Re- survey	No. of Resource	Union council	Village covered	RUG covered	Daily individ	average i ual group (taka)	ncome of members	Remarks
	sample	Area	(nos.)	(nos.)	(nos.)	Before IGA	After IGA	Increased %	
	Base	4	5	11	11	55.90	78.82	41.00	Re-survey
<b>1111</b> (1)	Base 2001	7	6	16	35	51.07	65.47	28.20	Re-survey
HH	New sample 2002	7	7	19	30	49.22	58.05	17.94	Survey on new sample
	Base 2000	2	5	11	9	58.26	81.32	39.58	Re-survey
TB <sup>(2)</sup>	Base 2001	3	7	15	20	55.63	74.64	34.17	Re-survey
	New sample 2002	3	9	23	19	33.94	40.81	20.24	Survey on new sample
KM <sup>(3)</sup>	New sample 2002	4	7	21	33	50.61	65.86	30.13	Survey on new sample

Table – D : Status of income increase of RUG members in September 2003

Site	No. of	Union council covered (nos.)	Village covered (nos.)	RUG covered (nos.)	Daily aver grou	individual aka)	Domarks	
Site	e Area				Before IGA	After IGA	Increased %	Kemai Ks
Hail Haor	7	7	19	56	51.23	77.88	52.02	Covering all base sample
Turag- Bangshi	3	4	17	35	57.66	87.03	50.94	Do
Kangsha- Malijee	4	7	21	74	48.54	68.12	40.34	Do
Total	14	18	57	165	51.39	75.44	46.55	Weighted average

Type of AIGA	Hail Haor	Kangsha-Malijee	Turag-Bangshi	Total
Fish culture	33	52	8	93
Fish fry business	37	7	11	55
Lease of pond/beel	15	98	5	118
Fish business	445	184	165	794
Fish nursery	21	9	2	32
Dried fish business	85	15	20	120
Cage fish culture	20	25	10	55
Milk cow rearing	275	349	151	775
Goat rearing	24	15	30	69
Duck rearing	65	43	11	119
Buffalo rearing	54	13	10	77
Cow/calf rearing	292	154	15	461
Poultry	66	68	25	159
Rich business	238	194	29	461
Paddy husking	163	210	10	383
Vegetable and eggs	138	7	51	196
Plant nursery	16	20	8	44
Rickshaw driving	82	304	49	435
Grocery shop	121	86	28	235
Boat making	46	28	9	83
Sewing machine	37	46	21	104
"Hockery"	23	32	11	66
Wood, cloth, muri and seasonal				
business	205	68	142	415
Handicrafts	62	23	16	101
Carpentry	27	5	26	58
Small business	180	515	92	787
Fruit business	15	0	16	31
Power tiller/pump	5	0	2	7
Agriculture	227	4	25	256
Others	190	168	61	419
Total	3,207	2,742	1,059	7008

Table E: Number of implemented AIGA by the RUG members in MACH-
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## Data collection and analysis (MACH-I)

Most of RUG members do not record or remember their income, which in some cases they earned six months before. For some AIGAs it is easy to determine income and expenditure as they take place on a cyclical basis (like poultry, cow fattening, plant nursery, etc.). The field staff collected information on income and expenditure from selected RUG members per cycle and the number of completed cycles from each respondent. Finally, income changes were calculated as follows:

(a) Daily average income of RUG members (before being a the member of the samity) = (a)

Present daily average income from AIGA :

- (i) Period of one cycle to obtain profit from the activity (days)
- (ii) Number of cycles completed within last 365 days and fraction of ongoing cycle (if any)
- (iii) Profit per cycle of activity
- (b) = Daily average income from AIGA =  $\frac{\text{Profit per cycle (iii)}}{\text{Period per cycle (days) (i)}}$  X Number of cycle completed (ii)
- (c) = Present daily average income from main profession

(d) = Present total income = (b) + (c)

Percentage increase in income (%) =  $\frac{(d) - (a)}{(a)} \times 100$ 

## **Independent Credit Survey 2002**

Based on the suggestion of the 2001-2002 Mid-Term Review, MACH requested that Caritas undertake a survey of its credit operations through an independent firm. Resource Management Consultants was selected to develop the questionnaire, conduct the survey and prepare a report. Problems developed with the data base and questionnaires and the firm Socio-Consult assisted in 'cleaning' of the questionnaire, reentry of the data and development of required tables.

Specific tasks included acquiring information on: the poverty status of RUG members, income from non-borrowers to provide baseline information, overall income from loans, and quantifying income from loans and profitability of those loans.

Questionnaires were developed and the field aspects of the survey were completed in November 2002. The original questionnaires required significant review and after several false starts it was determined that much of the data required re-entry. This was completed and tables were developed in June 2003.

## **RUG Members**

Table A shows that the vast majority of RUG households have less than 0.5 acres of land. In Table B incomes of RUG households are shown to average approximately Tk 35,000, well below Tk 45,000 used by the Government of Bangladesh and World Bank to identify the poor. MACH Caritas staff had been successful in including the poor in the RUGs.

## **Loan Impacts**

Tables C and D show profit levels by site and type of loan activity. The overall findings are that the average profit, that is income from the AIGA after paying off the loan, was approximately Tk 2,150. In addition given an average loan size of Tk 4,900, profit for all activities for all sites was 43% of the loan. All activities appeared to be profitable for RUG members ranging from 66% to 24% for the activities documented. The most profitable activities appeared to be rickshaws, small business (small shops) and fish trading (reselling fish- generally dried fish).

## **Supplemental Income**

According to the information shown in Table E which tracks incomes of RUG member who have not received loans the average or base line *supplemental income* was estimated to be Tk 1,412. MACH limits supplemental income to non-mainstream activities in this case "collection". Collection was the term used to indicate income derived from subsistence activities – collection of grass or fodder, wild aquatic vegetables, fuel and other common pool resources. As shown MACH credit activities have not affected collection and use of non-fish wetland resources.

Desses Cultivelle Land			Borrower		Non-borrower			
Possess Cuntivable Land		HH	KM	TB	HH	KM	TB	
NoLand	N	459	485	225	164	301	102	
No Land	%	64%	79%	73%	58%	78%	53%	
Up to $0.50$ sore	N	108	98	42	40	70	36	
Op to 0.50 acre	%	15%	16%	14%	14%	18%	19%	
0.51 to $1.50$ acro	N	116	24	34	58	13	39	
0.51 to 1.50 acre	%	16%	4%	11%	21%	3%	20%	
1 51 to 2 50 aara	N	16	3	4	8	1	13	
1.51 to 2.50 acre	%	2%	1%	1%	3%	0%	7%	
Above 2.50 acre	N	18	2	2	13	3	3	
Above 2.50 acre	%	2.50%	0.30%	0.70%	4.60%	0.80%	1.60%	
Dopulation	N	717	612	307	283	388	193	
ropulation	%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	

|--|

Site	Nos.	Average income (Tk) for the year 2002									
		Agricultural	Fish income	Non-agricultural	Business	Collection	Family income				
Hail Haor	1000	8,758	11,595	6,304	11,671	1,586	39,913				
Kongsha- Malijhee	1000	4,275	5,457	10,497	5,965	972	27,164				
Turag- Bangshi	500	10,380	6,323	8,458	13,565	1,689	40,414				
Total	2500	7,289	8,085	8,412	9,767	1,361	34,914				

 Table B: RUG member incomes in 2002

Note: Averages generated from all 2500 sample respondents

#### Table C: Average profit/income from AIGAs supported by loans by site

Loon Uso	I	Hail Haor	Kang	sha-Malijhee	Tui	ag-Bangshi	Overall		
	Nos.	Income (Tk)	Nos.	Income (Tk)	Nos.	Income (Tk)	Nos.	Income (Tk)	
Barber shop	0	0	2	2,233	1	36,000	3	13,489	
Poultry	13	2,178	0	0	6	4,000	19	2,753	
Rickshaw	15	1,802	82	2,651	4	5,250	101	2,627	
Other	55	2,900	26	2,622	30	1,117	111	2,353	
Small business	201	1,998	177	1,906	81	3,700	459	2,263	
Farming	70	1,963	21	1,164	16	4,911	107	2,247	
Fish trade	79	2,497	85	2,058	48	2,044	212	2,218	
Rice trade	81	2,479	47	1,910	5	800	133	2,215	
Sewing machine	3	1,600	1	0	4	3,000	8	2,100	
Vegetable gardening	8	1,910	1	500	1	3,500	10	1,928	
Milk cow	135	1,542	124	1,446	97	2,743	356	1,835	
Nursery	4	3,008	0	0	4	586	8	1,797	
Fish culture	18	1,672	10	1,635	4	1,500	32	1,639	
Cottage industry	2	850	2	2,000	0	0	4	1,425	
Cow rearing	33	1,119	24	1,252	5	386	62	1,111	
Total	717	2,038	602	1,905	306	2,897	1,625	2,151	

#### Table E: Average annual family income for non-borrowers from different sector by program area

	Nos.	Average Annual Income (Tk) in 2002									
Site		Agricultural	Fish income	Non- agricultural	Business	Collection	Family income				
Hail Haor	283	9,744	10,203	7,684	11,097	1,831	40,560				
Kongsha-Malijhee	388	3,675	5,123	12,258	4,888	890	26,833				
Turag-Bangshi	193	12,168	5,471	6,837	11,307	1,845	37,629				
Total	864	7,560	6,865	9,549	8,356	1,412	33,741				

Table D: Averag	e profit t	for each typ	e of AIGA	investm	ent in 2(	02										
		Hail F	Iaor			Kangsha	-Malijee			Turag	-Bangshi			Ove	er all	
Loan Use		Avg.	Avg. Pı	.ofit		Avg.	Avg. Pr	ofit		Avg.	Avg. Pr	ofit	-	Avg.	Avg. Pı	.ofit
	N0S.	Loan (Tk)	Taka	%	Nos.	Loan (Tk)	Taka	%	Nos.	Loan (Tk)	Taka	%	Nos.	Loan (Tk)	Taka	%
Small business	201	5,348	1,998	37	177	3,423	1,906	56	81	6,210	3,700	60	459	4,758	2,263	48
Fish trade	79	6,076	2,497	41	85	3,566	2,058	58	48	6,563	2,044	31	212	5,180	2,218	43
Veg. gardening	8	5,625	1,910	34	-	3,000	500	17		5,000	3,500	70	10	5,300	1,928	36
Milk cow	135	5,941	1,542	26	124	3,675	1,446	39	97	6,196	2,743	44	356	5,221	1,836	35
Cow rearing	33	5,182	1,119	22	24	3,500	1,252	36	5	5,400	386	7	62	4,548	1,111	24
Poultry	13	8,923	2,178	24	0	0	0	0	9	6,833	4,000	59	19	8,263	2,753	33
Fish culture	18	6,056	1,672	28	10	3,800	1,635	43	4	2,750	1,500	55	32	4,938	1,639	33
Sewing machine	3	6,000	1,600	27	-	4,000	0	0	4	6,500	3,000	46	8	6,000	2,100	35
Cottage	2	2,000	850	43	2	4,000	2,000	50	0	0	0	0	4	3,000	1,425	48
Barber shop	0	0	0	0	2	3,667	2,233	61		8,000	36,000	450	3	5,111	13,489	264
Rickshaw	15	5,333	1,802	34	82	3,503	2,651	76	4	8,500	5,250	62	101	3,972	2,628	66
Nursery	4	5,750	3,008	52	0	0	0	0	4	6,000	586	10	8	5,875	1,797	31
Farming	70	4,772	1,963	41	21	3,101	1,164	38	16	6,500	4,911	76	107	4,702	2,247	48
Rice trade	81	5,704	2,479	43	47	3,830	1,910	50	5	5,400	800	15	133	5,030	2,215	44
Other	55	5,618	2,900	52	26	3,692	2,622	71	30	5,532	1,117	20	111	5,144	2,353	46
Total	717	5,618	2,038	36	602	3,550	1,905	54	306	6,180	2,897	47	1,625	4,958	2,150	43

2002
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AIGA in
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SO 6.2.2a

## **Strategic Objective 6**

## Indicator 6.2.2b: Number of RUG fishers having reduced fishing effort

June 2007

Management of Aquatic Ecosystems through Community Husbandry (MACH)

Strategic Objective 6: Improved Management of Open Water and Tropical Forest Resources					
Intermediate Result 6.2.2: Alternative Incomes realized for targeted beneficiaries					
<b>Indicator 6.2.2b:</b> Number of RUG fishers having reduced fishing effort (new)*					
A. Description	Cumulativ	e Unit of me	asure:		
Precise Definition of Indicator: This is a new indicator established under MACH-II. It	Ave. reduced daily fishing				
was changed and now measures the total reduction in fishing hours for RUG members	hours.				
based on the average number of hours per day that a sample of RUG members fished					
compared with a baseline.	Year	Planned	Actual		
Unit of Measure: Ave. reduced daily fishing hours.					
Disaggregate by: Gender	Baseline				
Justification/Management Utility: Even with conservation measures fisheries are					
threatened by unsustainable fishing effort. Yet the livelihood/enterprise development		MACH-I			
component aims to neip fisners who join RUGs to find more profitable uses for their					
time so that they have an incentive to reduce fishing.	2000				
B. Plan for Data Collection					
Data Collection Method: Annual surveys by Winrock partner					
Method of Collection by USAID: Reports from Winrock	2001				
<b>Data Source(s):</b> Winrock and its partners					
Frequency/Timing of Data Collection: Annual					
Estimated Cost of Collection: Medium included in activity budgets	2002				
<b>Responsible Individual(s) at USAID:</b> Team Leader					
	2002				
C. Data Quality Issues	2003				
Date of Initial Data Quality Assessment: None to date					
Known Data Limitations (if any): Changes in effort may also be affected by		MACH-II			
environmental factors. Recall of average daily effort over a year is likely to be	2004	2,400	2,495		
indicative rather than exact. The survey focuses on RUG members but non RUG members also fish.					
		2.500	4,487		
Actions Taken or Planned to Address Data Limitations: at the project end changes		,	,		
in individual effort could be investigated more qualitatively through focus groups, while					
aggregate changes in effort can be estimated from the household monitoring and catch	2006	2,600	4938		
surveys (which are not limited to RUG members).		,			
Date of Future Data Quality Assessments:					
Procedure of Future Data Quality Assessments:					
D Plan for Data Analysis Reporting and Review					
<b>Data analysis:</b> Review trends of reduced fishing effort among the select beneficiaries					
Presentation of Data: Table					
<b>Review of Data:</b> Semi-annual mission portfolio review. R4 review and individual					
review with recipient.					
Reporting Data: Internal mission report, R4 report and CBJ report.					
E. Other Notes: Caritas monitors this item on an annual basis every October					
Notes on the Baselines/Targets: Winrock and its partners have established baseline					
data through a household survey. Baseline is 3.96 hours of fishing per day per RUG					
member in 2003.					
Location of Data Storage: P:\MissionShareable\EGFEpub\Environment\PMP					
Comments:					
<b>2004:</b> Among the targeted fishers (RUG fishers) the average fishing hours per RUG					
Tisners was 3.96 in 2003. By September of 2004 this had reduced to 3.02 or a reduction					
of 0.94 nours of fishing per day. Targets reestablished at 2,400 hours, 2,500 and 2,600					
Dy 2000					
2005: A cumulative total of 94 lisners have left lisning among the 8/0 surveyed. From					
an average of 5.90 nours of fishing per day baseline (Nov 03) to 2.27 nrs/day in Sept					
2003. 2006: A cumulative total of 119 fichers have left fishing among the 870 surveyed. From					
an average of 3.96 hours of fishing ner day baseline (Nov 03) to 2.10 hrs/day in Sent					
2006 i.e reduction was 1.86 hrs/hrs/day					

## **Strategic Objective 6:**

## Indicator 6.2.2b: Number of RUG fishers having reduced fishing effort (modified from original specification as number of RUG fishers having reduced effort)

This is a new indicator established for MACH phase II. This has been instituted to determine the impact of alternative income generation, credit and training on the success of fishers to reduce effort on the fishery. During this reporting period 2004 it was seen that the previous unit of measure did not reflect the change in fishing level as many fishers are part time. It was determined that a better measure would be hours of reduction which has been reflected below.

**Methodology:** MACH is working with 2655 fishers to reduce the fishing pressure at three large wetland sites through implementing different income generating activities and providing training and credit. Attempts by MACH-Caritas have been made to be consistent, so that the best possible estimation can be made with the collected data.

**Data Collection & Analysis**: Data is collected from 33% (870 fishers) of MACH organized fishers. The 33% base sample is selected randomly and data is collected during September of each year to determine the effort reduction. Data is analyzed in the following manner.

a) Daily average fishing hours of fishers at the end of previous year is considered as baseline.

b) Present daily average fishing hours after implementing IGA for at least 12 months is calculated in the following manner.

- i) Average daily fishing hours of sampled fishers
- ii) Average no. of fishing days in 365 days for the sampled fishers
- iii) Average fishing hours in a day for a fisher = Daily fishing hrs X no. of fishing days in a year

365 days

iv) Daily reduction or increase of total fishing hours = (daily base fishing hrs.- average fishing hrs. in a day in impact year) X total no. of fishers = ..... hours.

It is observed from the data of 2006 that average fishing hours per day is reduced and 119 fishers have left their profession whereas 94 left in 2005. There is a trend of fishing pressure reduction with 4,938 hours reduced in 2006.

## **Strategic Objective 6**

# Indicator 6.2.2c: Total number of new AIG loans June 2007

Management of Aquatic Ecosystems through Community Husbandry (MACH)

Strategic Objective 6: Improved Management of Open Water and Tropical Forest Resources							
Intermediate Result 6.2.2: Alternative Incomes realized for targeted beneficiaries							
Indicator 6.2.2c: Total number of AIG loans							
A. Description	Unit of me	asure: No. c	of Loans.				
Precise Definition of Indicator:	Year	Planned	Actual				
Unit of Measure: No. of Loans.							
Disaggregate by: Gender	Baseline		0				
Justification/Management Utility: An intermediary indicator – loans are a key							
step in developing alternative livelihoods for beneficiaries (RUG members).		MACH-I					
B. Plan for Data Collection	2000	Na	511				
Data Collection Method: continual record keeping by Winrock partner.		1.00					
Method of Collection by USAID: Reports from Winrock							
Data Source(s): Winrock and its partners.	2001	Na	1 771				
Frequency/Timing of Data Collection: Annual	2001	itu	1,771				
Estimated Cost of Collection: none, included in activity budgets.							
Responsible Individual(s) at USAID: Team Leader	2002	Na	2 842				
	2002	INA	2,042				
C. Data Quality Issues							
Date of Initial Data Quality Assessment: None to date	2003	No	1 994				
Known Data Limitations (if any): None identified, FRUGs are expected to keep	2003	INA	1,004				
as reliable a records as Caritas and to share their records with the project up to its							
end.		MACH-II					
Actions Taken or Planned to Address Data Limitations: none required beyond	2004	2 500	2,609				
scheduled training for FRUGs.		_,	_,000				
Date of Future Data Quality Assessments:	2005	2 000	2 (70				
Procedure of Future Data Quality Assessments:		3,000	2,670				
D. Blan for Data Analysis Departing and Devisory							
Deta analysis, shoels that number of loans disbursed is on target	2006	_	2 542				
Data analysis: Check that humber of loans disbursed is on target	2000	_	2,342				
<b>Device</b> of Data. Sami appual mission portfolio review D4 review and individual							
review of Data: Semi-annual mission portiono review, K4 review and individual							
Reporting Datas Internal mission report D4 report and CDI report							
<b>Reporting Data:</b> Internal mission report, R4 report and CBJ report.							
F. Other Notes: Caritas monitors this item on an annual basis every October							
Notes on the Baselines/Targets: there is no baseline but anart from 2000 the first							
vert of micro-credit on average 50% of RUG members have taken a new loan in							
each year and this standard is expected to be maintained							
Location of Data Storage: P:\MissionShareable\EGEEnub\Environment\PMP							
Comments:							
<b>2004:</b> A total of 2609 new loans have been disbursed in which 365 members have							
taken first loan during the reporting period. This is based on data through October							
or year 1 of MACH II							
<b>2005:</b> 541 members took 1st loan during the year. Due to flooding in 2004 in two							
of the three sites larger than expected numbers of members were unable to take							
loans A total of 2 670 loans were taken during the year							
<b>2006:</b> 545 members took 1st loan out of total 2 542 loans during the year. Out of a							
total MACH II target of 5,500 AIG loans, 7.821 loans were disbursed.							

## **Strategic Objective 6:**

Indicator 6.2.2c: Total number of AIG loans

Recognizing that the reduction of fishing pressure is a key element to the revival of the floodplain fisheries, MACH has included supplemental income generating activities that focus on fishers and others dependent on wetland resources.

**Plan for achieving the results:** A large number of loans have been disbursed to RUG members for implementing alternative income generation activities during MACH-I. Considering the result of MACH-I, a need based site-wise plan has been developed to continue the effort in MACH-II, so that the resource users could reduce their fishing effort, increase family income and reduce dependence on wetlands. MACH is providing training and demonstrations for different skills to RUG members utilizing loan money. RUG members have been utilizing Tk 5,000 as the 1<sup>st</sup> ceiling, Tk 8,000 as a second and Tk 10,000 as a third ceiling. As the members from MACH I are now becoming skilled and capable to utilize more money, MACH-II is implementing a fourth ceiling up to Tk 15,000 under the "normal" loan program. MACH-II has also expanded large-scale enterprise loans for skilled and potential RUG members where the ceiling is Tk 30,000 and above.

As a result the average loan size has increased from about Tk 4,500 in 2000 to Tk 8,600 in 2005. Old loanees have become more efficient in utilizing the loans and they are being provided with larger and larger loans. During MACH II a total of 7,821 loans were disbursed. From 2006 onwards an increasing proportion of loans have been disbursed by the FRUGs. From May-June 2007 all revolving funds have been transferred to the FRUGs. Which are entirely responsible for disbursing loans following the same principal as under the project.

Means of Verification: Loan data was collected monthly and reporting was done semi-annually and annually.

## **Strategic Objective 6**

## **Indicator 6.3a:** Number of water bodies leased to community resource management groups in targeted areas

June 2007

Management of Aquatic Ecosystems through Community Husbandry (MACH)

Strategic Objective 6: Improved Management of Open Water and Tropical Forest Resources						
Intermediate Result 6.3: Select Policies Implemented that Support IR \s 1 and 2						
Indicator 6.3a: Number of water bodies leased to community resource management groups in targeted areas.						
A. Description	Cumulative Unit of measure:					
Precise Definition of Indicator: Indicator counts the number of water bodies given	Number of	Leases				
out by the Ministry of Land (or other relevant authority) to local communities on 5 –						
10 year leases.	Year	Planned	Actual			
Unit of Measure: Number of local leases approved						
Disaggregate by: N/A	Baseline		0			
Justification/Management Utility: Indication of reform policy developed and						
implemented. This policy change will assist local communities to effectively control of		MACH-I				
community water bodies. This is the first step in sustainable management of resources.						
P. Dian for Data Collection	2000	2	2			
D. Flail 101 Data Collection						
Method of Collection by USAID. Reports from Winrock						
Data Source(s): Winrock and its partners	2001	13	13			
Frequency/ Timing of Data Collection: Semi-annual						
Estimated Cost of Collection: Nominal						
Responsible Individual(s) at USAID: Team Leader	2002	17	18			
<b>r</b>						
C. Data Quality Issues	0.002	20				
Date of Initial Data Quality Assessment:	2003	20	24			
Known Data Limitations (if any): There may be problems in the implementation of						
the policy. This will be monitored.		MACH-II				
Actions Taken or Planned to Address Data Limitations: Regular monitoring.						
Date of Future Data Quality Assessments: None planned.	2004	3	12			
Procedures of Future Data Quality Assessment:		-				
D. Plan for Data Analysis, Reporting, and Review	2005	8	12			
Data analysis: Winrock and partners will collect data on a case by case basis and						
compile and report data annually						
Presentation of Data: Lable	2006	-	-			
Review of Data: Semi-annual portiono review, and regular activity monitoring.						
<b>Reporting Data:</b> Internal mission report, K4 and CBJ reports.						
F. Other Notes						
L. Unici indus: Notes on the Baselines/Targets. Baseline completed in 2000, no leases were allowed						
to community groups before MACH						
Location of Data Storage: P.\MissionShareable\EGEEnub\Environment\PMP						
<b>Comments:</b> Models and best practices are developed at the local level to demonstrate						
to decision-makers. The demonstration effect is transfused to the ton-level policy						
makers through the Local Government Committees and the Steering Committee. This						
indicator represents a fundamental step for implementation of the program.						
<b>2004</b> : A total of 12 additional beels were leased by the RMOs in the Hail Haor site.						
Out of 12 water bodies 9 were handed over to the RMOs, while the remaining 3 are						
small and could not be taken up by RMO as those were disputed by private owners						
2005: No further water body leasing envisioned; target achieved in 1st year of MACH-						
II. Two water bodies remain disputed.						
2006: During the year no new waterbody has been requested for leasing by the						
community organizations. The management activities were consolidated in the water						
bodies already leased to the RMOs.						

## Strategic Objective 6: Indicator 6.3.a: Leases of water bodies to community resource management groups granted in target areas for a reasonable time period

Some of the critical water bodies in the floodplain areas of MACH sites have been leased out for up to 10 years (and onward with evaluation every 5 years for the long term) to Resource Management Organizations by the Ministry of Land in collaboration with the Ministry of Fisheries and Livestock and MACH. In addition MACH has been successful in getting the GoB through the Ministry of Land to grant MACH community groups perpetual rights over 8 significant areas in MACH wetlands. These 8 locations will be permanently secured as sanctuaries for all time. Among the 8 areas there are 2 beels of 122 acre area that have been declared as National sanctuaries foregoing the annual lease value worth in excess of Tk. 80,000. These 2 beels have been leased to the registered Borogangina RMO for Tk. 501 per annum.

MACH also worked through its policy change efforts at the site level and within the Ministry of Land and the MoFL to promote the removal of the previous 25%/10%/10% increases in lease costs that the MoL imposed on the lessees of the water bodies reserved for projects and community organizations. This policy of increasing the lease rate every year has been very detrimental to the resource and has promoted the "take everything" attitude that prevailed in MACH areas at the beginning of the project. The MoL has reduced this as a policy – moving to a 25% increase on transfer of a water body followed by a review after 5 years with no annual increases. In addition the MoL has for the first time dropped the entire lease value of a jalmohol for MACH groups for a permanent sanctuary status.

In addition to 24 water bodies reserved by the MoL for Resource Management Organizations formed in MACH areas or to be sanctuaries for their entire areas; a further 12 beels of 186 acres were allocated to RMOs for improved management in Hail Haor area during the 1<sup>st</sup> year of MACH-II by the MoL. But out of these, three beels (two in HH and one in KM site) could not be taken over by RMOs due to litigation and claims of private ownership. Nevertheless regardless of the ownership these are under improved management of RMOs.

The copies of the government orders for the handover and the signed handover document at the site serve as evidence (See volume 3).

Site	Slno	Name of Water bodies	Area (acre)	Area(ha)	Managed by RMO	Remarks
	1	Balla Beel	70.73	28.62	Balla RMO	
	2	Dighali Beel	35.25	14.27	Balla RMO	
	3	Agari Beel	72.86	29.49	Agari RMO	
	4	Lori	1.58	0.64	Agari RMO	
	5	Kajura Beel	0.40	0.16	Kajura RMO	
	6			6.88	Kajura RMO	Dropped due to
		Arardor	17.00			litigation problem
	7	Jurmehedi	3.89	1.57	Kajura RMO	
	8	Udgai	3.26	1.32	Kajura RMO	
	9	Sananda Beel	8.89	3.60	Sananda RMO	
	10	Jethua Beel	5.82	2.36	Jethua RMO	
	11	Laler doba Beel	618.83	250.43	Jethua RMO	
	12	Baragangina Canal	13.54	5.48	Baragangina RMO	
	13	Barkandi Beel	10.25	4.15	Baragangina RMO	
Hail	14	Chapra Magura Beel	21.88	8.85	Baragangina RMO	
Haor	15	Jaduria Beel	100.50	40.67	Baragangina RMO	
	16			0.40	Baragangina RMO	Dropped due to
		Budaidoba	1.00			litigation problem
	17	Ramai Beel	6.24	2.53	Ramedia RMO	
	18	Medi Beel	11.98	4.85	Ramedia RMO	
	19	Khaiya Beel	9.00	3.64	Ramedia RMO	
	20	Borokuma	11.30	4.57	Ramedia RMO	
	21	Chotokuma	1.35	0.55	Ramedia RMO	
	22	Charurdoba and		0.93		
		Chatladoba	2.31		Dumuria RMO	
	23	Latua-Matra and		2.89		
		Kankata	7.15		Dumuria RMO	
	24	Dumer Beel	125.00	50.59	Dumuria RMO	
	25	Dholidoba	3.00	1.21	Dumuria RMO	
	26	Patradoba	8.73	3.53	Dumuria RMO	
	]	Fotal	1171.74	474.19		
	1	Mokosh Beel	30.98	12.54	Mokosh RMO	
	2	Alua Beel	10.07	4.08	Alua RMO	
	3	Kalidaha Beel	15.22	6.16	Mokosh RMO	There was a little
						Khas land, initially it
Turag-						was managed by
Bongshi						RMO but some
_						private people have
	1	Parts of Turag*	$(400 \text{m} \pm \text{Kum})$		Turng PMO	possession.
	+	Bangshi River	X 3		Turag Kivio	
	]	Fotal	56.27	22.77		
	1	Kewta Beel	99.20	40.14	Kewta RMO	
	2	Dhali Beel	34.00	13.76	Dhali-Baila RMO	
Kangsha	3	Baila Beel	20.00	8.09	Dhali-Baila RMO	
-	4	Bailsha Beel	7.04	2.85	Bailsha RMO	
Malijhee	5	Aura Baura Beel	34.12	13.81		Disputed**
	6	Part of Malijhee*	200m+Kur		Takimari Dharabasia RMO	
		River				
	7	[otal	194.36	78.66		
	Gra	nd Total	1422.37	575.62		

### Indicator 6.3a: Lease of water bodies to Community Resource Management Organizations:

\* Area is not included in total \*\* not actually handed over and not under an RMO's influence

## **Strategic Objective 6**

**Indicator 6.3b:** Number of communities adopting the following key regulations in targeted areas

June 2007

Management of Aquatic Ecosystems through Community Husbandry (MACH)

Strategic Objective 6: Improved Management of Open Water and Tropical Forest Resources						
Intermediate Result 6.3: Select Policies Implemented that Support IRS 1 and 2 Indicator 6 3b: Number of communities adopting two or more of the following	ou rogulatic	ns in target o	range			
Restrictions on the use of inappropriate fishing gear	key legulatie	nis ili target a	icas.			
<ul> <li>Restrictions on the fishing season &amp; harvesting of fish fry and</li> </ul>						
<ul> <li>Restrictions on the area of fishing</li> </ul>						
(3 Description	Cumula	tive Unit of r	neasure:			
<b>Precise Definition of Indicator:</b> This indicator measures the number of target						
communities adopting select natural resources and best management practices	Year	Planned	Actual			
and policies. Communities (defined here as a village) include all the people						
who directly and/or indirectly depend on the natural resources base, whose	Baseline		0			
actions have an impact on the natural resources. To be counted a community	2000					
must adopt at least two practices.		MACH-I				
Unit of Measure: Number of communities (villages)						
Disaggregate by: N/A	2001	50	60			
Justification/Management Utility: Indication of local level adoption of						
sustainable management of natural resources by the communities is a direct						
measure of policies implemented at the community level.	2002	70	86			
D. Diser free Date Callesting						
B. Plan for Data Collection Data Collection Mathada Direct enumeration by Winneds and northern						
Mathad of Collection Method: Direct enumeration by Winrock and partners	2003	76	103			
<b>Data Source</b> (s). Winrock and its portners						
Frequency/Timing of Data Collection: Annual		MACH-II				
Estimated Cost of Collection: Nominal						
Responsible Individual(s) at USAID: Team Leader	2004	8	10			
Responsible individual(s) at OSMID. Team Deader						
C. Data Quality Issues						
Date of Initial Data Quality Assessment:	2005	12	14			
Known Data Limitations (if any): maintenance of restrictions, once imposed,						
will be crucial.						
Actions Taken or Planned to Address Data Limitations: Regular monitoring	2006	-				
Date of Future Data Quality Assessments:						
Procedures of Future Data Quality Assessments:						
D. Plan for Data Analysis, Reporting, and Review						
<b>Data analysis:</b> SO team will review trends of adoption of the key regulations.						
Presentation of Data: Table						
<b>Review of Data:</b> Semi-annual mission portfolio review, and regular						
Implementation monitoring.						
<b>Reporting Data:</b> Internal mission report, K-4 and CBJ reports.						
F. Other Notes						
Notes on the Baselines/Targets: Baseline was established in July/2001						
Location of Data Storage: P.\MissionShareable\EGFEpub\Environment\PMP						
<b>Comments:</b> Community self-enforcement of best management practices is						
crucial to overall, long-term success. The communities must be fully aware of						
the practices most suitable for their areas and willing to enforce the regulations						
they agree to. This has been accomplished and the communities have been						
empowered through their representational organizations (RMOs) and their						
membership in the local government committees or UFCs.						
2004: 10 additional communities adopted key regulations, 4 in Hail Haor, 4 in						
Turog Bangshi area, and 2 in the Kangsha Malghee or Sherpur site						
<b>2005</b> : Four additional communities of the Kaliakor area adopted key regulations						
along the Bongshi river. Kuripara, Pulashtoli, Hatubhanga, Beltoil.						
Note: A total of 117 villages have set up best management practices in the						
MACH areas. In addition MACH II further supported a total of 120						
vinages/communities inrough the outreach program in 9 areas.						

## **Strategic Objective 6:**

**Indicator 6.3b:** Number of communities adopting two or more of the following key regulations in target areas:

- Restrictions on the use of inappropriate fishing gear
- Restrictions on the fishing season & harvesting of fish fry and
- Restrictions on the area of fishing

## Regulations adopted by the Community Organizations

The MACH project worked with communities and local government to improve management over large areas of degraded or non-functional wetlands in Bangladesh. The community organizations were formed with all types of stakeholders including wetland resource users particularly the poor fishers. To ensure sustainable management of the wetland resources the community organizations adopted regulations in the areas under their management. The major regulations adopted by the communities are given below.

MACH has helped form 16 Resource Management Organizations for wetland management in three MACH sites. Most of the RMOs are built up of several village or smaller waterbody management groups. In addition members of committees formed to protect riparian habitat (see SO 6.2b) have also agreed to abide by the fishing rules established by adjacent RMOs.

The communities have adopted time closures for fishing during the critical pre-monsoon season for varying periods of up to three months. The time closure varies among the sites as there is a variation of the inundation period. In Hail Haor the time closure is typically for a period of three months from March to May while in the Turag – Bangshi and Kangsha Malihjee from April to June.

The communities have also instituted regulations on harvesting of fish fry within their management areas. The communities monitor and regulate the destructive harvest of certain species that have schooling young. The communities with local government support limit the use of inappropriate fishing gears particularly the small mesh size of current jal (nylon monofilament net) according to the country-wide ban. The organizations have in addition protected riparian areas.

Communities through resource management organizations have adopted regulations preventing fishing in sanctuary areas, these sanctuary areas include a 200 ft radius extended no-fishing zone around any fish protection devices or deepened spot, and these enlarged areas have been recorded in SO 6.2.1a.

Within the managed water bodies the communities have stopped fishing through de-watering in the dry season. The de-watering was particularly destructive as it claimed all species and generally all fish in an area.

In addition to the establishment of community regulations, MACH has promoted community reintroduction of threatened local species. The species re-introduced were selected by the community organizations. These species were historically present in the areas. The species of fish so far reintroduced are *meni, gazar, deshi sarputi, pabda, kalibaus, foli and gainna.* The community organizations organize and participate in the re-introduction of lost fish species and then regulate and conserve these in the sanctuaries as well as in the areas under their management. The communities also announce widely and release those species during the months following their stocking if caught.

Communities or villages to be counted must adopt at least two best management practices shown above. The numbers in the following tables are arrived at through direct enumeration by the partners of those communities adopting two or more of the best management practices.

## Regulations adopted by the Communities (villages were covered under MACH-I except where a year is noted – 2004 or 2005)

Name of Community Organizations	8 Regulations adopted by the communities			
Hail Haor				
1. Sananda RMO	• Time closure (dry season – March-May) for fishing			
	• Stop use of destructive gears like current ial			
(4 villages: Mirjapur, Jatrapasha,	• Stop fry/brood fishing			
Kashipur and South Pachuan)	Conserve re- introduced species			
	<ul> <li>Ston fishing through de watering in the management grass under Sananda</li> </ul>			
	RMO			
	• Ston fighing in the specified construction within the Sananda heals			
2 Lethur DMO	• Stop fishing in the spectred salicitaties within the Salianda beets			
2. Jetilua KiviO	• Time closure (dry season – March-May) for fishing			
(6 villagos:	• Stop use of destructive gears			
Den guria Denavira Dehagara	Stop fry/brood fishing			
Malaguria, Kanavini, Bobasara,	• Stop fishing through de-watering in the management areas under Jethua RMO			
Bommo North	Conserve re- introduced species			
Boruna Norun )	<ul> <li>Totally stop fishing in the sanctuaries within the Jethua beels</li> </ul>			
3. Balla RMO	<ul> <li>Time closure (dry season – March-May) for fishing</li> </ul>			
	<ul> <li>Stop use of destructive gears like current jal and light fishing</li> </ul>			
(3 villages: Gondhorbopur*,	<ul> <li>Stop fry/brood fishing</li> </ul>			
Vimshi and Bhunabir*)	• Stop fishing through de-watering in the management areas under Balla RMO			
	• Totally stop fishing in the sanctuaries within the Balla beels			
4. Kazura RMO	• Time closure (dry season – March-May) for fishing			
	Ston use of destructive gears			
(2 villages: Anekelibuda and	<ul> <li>Stop fast of desirative gears</li> <li>Stop fast/broad fishing</li> </ul>			
Anekeliboro)	Concerve re-introduced species			
	Conserve re- introduced species			
	• Stop fishing through de-watering in the management areas under Kazura			
	• I otally stop fishing in the sanctuaries within the Kazura beels			
5. Agari RMO	• Time closure (dry season – March-May) for fishing			
	• Stop use of destructive gears like current jal			
(3 villages: Atghor, Hossenpur	Stop fry/brood fishing			
and Manik Haor)	Conserve re- introduced species			
	• Stop fishing through de-watering in the management areas under Agari RMO			
	<ul> <li>Totally stop fishing in the sanctuaries within the Agari beels</li> </ul>			
6. Duamuria RMO	<ul> <li>Time closure (dry season – March-May) for fishing</li> </ul>			
	• Stop use of destructive gears like current jal			
(3 villages: Rustumpur,	Stop fry/brood fishing			
Badealisha* and East Laiyerkul)	Conserve re- introduced species			
	• Stop fishing through de-watering in the management areas under Duamuria			
	RMO			
	<ul> <li>Totally stop fishing in the sanctuaries within the Duamuria beels</li> </ul>			
7 Baragangina RMO	<ul> <li>Time closure (dry season – March-May) for fishing</li> </ul>			
	Ston use of destructive gears like current ial			
(3 villages: Hazinur, South	• Stop use of destructive gears like current jar			
Boruna, and Mid Boruna)	Conserve re-introduced species			
	Conserve re- introduced species     Step ficking through the protoning is (1)			
	• Stop fishing through de-watering in the management areas under Baragangina			
	• I otally stop fishing in the sanctuaries within the Baragangina RMO area (this			
0 Demedia DMO	is based on one large wetland sanctuary serving the whole haor)			
8. Ramedia RMO	• Stop fishing through de-watering in the management areas under Ramedia			
(all 2004) (A stills as a Cl 1	KMU			
(4 Villages: Unorachao,	• Time closure (dry season – March-May) for fishing			
Dashkannia, Mordannall and	• Stop use of destructive gears like current jal			
DOFOIUTI)	Totally stop fishing in the sanctuaries within the Ramedia beels			
9. Alia Chhara Committee	Time closure for fishing			
	Reduction of use of destructive fishing gears			
(2 villages: Alisarkul and	Stop fry/brood fishing			
Badealisha*)	• Totally stop fishing in the sanctuaries areas			
	• Maintenance of vegetation along the edge of chhara/ihara for reducing erosion			
	• Periodical removal of silt from chhara to keep them open toward wetland			
	Regenerate habitat for wildlife			
10. Joita Chhara Committee	• Time closure for fishing			

Name of Community Organizations	Regulations adopted by the communities
	Reduction of use of destructive fishing gears
(2 villages: Shasan and	Stop fry/brood fishing
Bhunabir*)	<ul> <li>Totally stop fishing in the sanctuaries areas</li> </ul>
	Maintenance of vegetation along the edge of chhara/jhara for reducing erosion
	<ul> <li>Periodical removal of silt from chhara to keep them open toward wetland</li> </ul>
	Regenerate habitat for wildlife
11. Boula Chhara Committee	Time closure for fishing
	<ul> <li>Reduction of use of destructive fishing gears</li> </ul>
(2 villages: Boulashir and	Stop fry/brood fishing
Gondnorbopur*)	<ul> <li>Totally stop fishing in the sanctuaries areas</li> </ul>
	Maintenance of vegetation along the edge of chhara/jhara for reducing erosion
	• Periodical removal of silt from chhara to keep them open toward wetland
	Regenerate habitat for wildlife
12. Jaag Chhara Committee	• Time closure for fishing
	Reduction of use of destructive fishing gears
(2 villages: Isnaopur and	Stop fry/brood fishing
Naogaon	• Totally stop fishing in the sanctuaries areas
	• Maintenance of vegetation along the edge of chhara/jhara for reducing erosion
	• Periodical removal of silt from chhara to keep them open toward wetland
12 Eul Chhang C itt	• Regenerate habitat for wildlife
13. Ful Chnara Committee	• I me closure for fishing
(2 villages: Islampur, Amaratnur)	• Reduction of use of destructive fishing gears
(2 vinages: Islampur, Amaratpur)	• Stop fry/brood fishing
	• I otally stop fishing in the sanctuaries areas
	Maintenance of vegetation along the edge of chara/jhara for reducing erosion
	Periodical removal of sill from chara to keep them open toward wetland     Becomercia habitat for wildlife
Sub-Total: 35 Villages	Kegenerate natitat for whithine
Turag Bongshi	
1 Mokesh Beel RMO	• Time closure (dry season – March-May) for fishing
	Ston partially use of destructive gears like current ial
(16 villages: Kouchakuri,	Stop partially use of destructive gears like earrent jui
Amdoir, Sinaboho, Bashtali*,	Conserve re- introduced species
Saturia-solahati, Majukhan,	• Stop fishing through de-watering in the management areas under Mokesh
Nagchala, Taltoli, Kaliadoha*,	RMO
Boroibari*, Haturia Chala,	• Totally stop fishing in the specified 9 small sanctuaries areas within the beel
Rangamati, Baganbor, Buluia,	
Kacharosh, and Bangar Jangal)	
2. Turag River RMO	• Stop use of destructive gears like current jai
(17 villages: Galachina Boali	• Stop Iry/brood lishing
Modankhali, Kundagata	<ul> <li>Conserve re- introduced species</li> <li>Totally star fishing in the 2 near of specified construction areas within the river</li> </ul>
Oliarchala, Gapinpur, Boroibari*,	• Totally stop fishing in the 5 nos. of specified sanctuaries areas within the fiver
Kaliadoha*, Dhighibari,	
Bashtali*, Gabtali, Syedpur,	
Namashulai, Kaliakoir, Sutrapur,	
Ragunathpur and Shailakhali)	
(2005 added 4 villages: Kuripara,	
Polashtol, Hatubhanga	
(Cintarashari), Belton)	Time den seen Amil Luce for fishing
J. Alua NWO	<ul> <li>I line closure (dry season – April-June) for fishing</li> <li>Stop use of destructive generalities current int</li> </ul>
(6 villages: Madiashulai Asharria	<ul> <li>Stop use of destructive gears like current jai</li> <li>Stop fru/broad fishing</li> </ul>
Bari, Azgana, Kanchanbur.	<ul> <li>Sup II y/01000 IISIIIIg</li> <li>Stop fishing through de watering in the management areas under Alue DMO</li> </ul>
Rashidpur and Beelbaria)	<ul> <li>Stop fishing unough uc-watching in the management areas under Alda KMO</li> <li>Totally stop fishing in the specified 5 senaturies areas within the heal</li> </ul>
4 Goalia RMO	• Time closure (dry season $= 15^{\text{th}}$ Baisak to $15^{\text{th}}$ Ashar) for fishing
All 2004	<ul> <li>Time crossine (ary season = 15 Datsak to 15 Astral) for fishing</li> <li>Stop use of destructive gears like current ial and maisbari ial</li> </ul>
(4 villages: Fulbaria. Pagal Nath	<ul> <li>Stop use of destructive gears like current jar alle monshall jar</li> <li>Stop fishing through de-watering in the management areas under Goalia PMO</li> </ul>
Challa, Nabirbohor and Sreepur )	<ul> <li>Totally stop fishing in the specified 4 sanctuaries areas within the RMO area</li> </ul>
Sub-Total: 44 Villages	Towny stop noning in the specified Tourcuartes areas within the RWO area
Kongshow Malijhee	
1. Kewta Beel RMO	• Time closure (dry season – April-June) for fishing

Name of Community Organizations	Regulations adopted by the communities			
	• Stop partially use of destructive gears like current/katha jal			
(7 villages: Pakuria, Tirchha,	Stop fry/brood fishing			
Bakar Kanda, Tilkandi	Conserve re- introduced species			
(Tarakandi), Barogoria, Haora	• Stop fishing through de-watering in the management areas under Kewta beel			
Nij and Surjadi uttor para)	RMO			
	• Totally stop fishing in the sanctuaries areas within the Kewta beel			
2. Kewta RMO (Kur	• Time closure (dry season – April-June) for fishing			
Committee)	• Stop use of destructive gears like current ial			
,	Stop fry/brood fishing			
(6 villages: Nakshi, Balurghate,	Conserve re- introduced species			
Gaglajani, Shalchura, Gugra	• Stop fishing through de-watering in the management areas under Kur			
Kandi and Pepuleshar)	Committee			
	• Totally stop fishing in the sanctuaries areas within the river			
3. Kewta RMO (Nizla Beel	• Time closure (dry season – April-June) for fishing			
Committee)	Stop use of destructive gears like current ial			
	<ul> <li>Stop use of destructive genes into current jur</li> <li>Stop fry/broad fishing</li> </ul>			
(2 villages: Chakpara and	Conserve re- introduced species			
Gajaria)	<ul> <li>Stop fishing through de-watering in the management areas under Nizla Beel</li> </ul>			
	Committee			
	Totally stop fishing in the sanctuaries areas within the Nizla heels			
4. Kewta RMO (Chira Beel	Time closure (dry season – April-June) for fishing			
Committee	• Stop use of destructive gears like current ial			
	Stop use of destructive gears like eartent jui			
(2 villages: Chak Andaria and	Conserve re- introduced species			
Sutir Par)	<ul> <li>Stop fishing through de-watering in the management areas under Chira Beel</li> </ul>			
	Committee			
	• Totally stop fishing in the sanctuaries areas within the Chira beels			
5. Takimari-Dara Bashia	Time closure (dry season – April-June) for fishing			
RMO	Stop use of destructive gears like current/katha ial			
	Stop five of desidence gears file eartena kana jui			
(5 villages: Jolgaon, Changuria,	Conserve re- introduced species			
Baniapara, Malijhekanda and	<ul> <li>Ston fishing through de-watering in the management areas under Takimari-</li> </ul>			
Hasligaon)	Dara Bashia RMO			
(2004 added 2 villages:	• Totally stop fishing in the sanctuaries areas within the Takimari-Dara Bashia			
Rangmatia and Batia)	beel			
6. Dhali-Baila RMO	• Time closure (dry season – April-June) for fishing			
	• Stop use of destructive gears like current/katha jal			
(5 villages: Balia Chandi,	• Stop fry/brood fishing			
Konagaon, Darikalinagar, Paikura	Conserve re- introduced species			
and Sarikalinagar)	• Stop fishing through de-watering in the management areas under Dhali-Baila			
	RMO			
	• Totally stop fishing in the sanctuaries areas within the Dhali-Baila beel			
7. Bailsha RMO	Time closure (dry season – April-June) for fishing			
	Stop use of destructive gears like current jal			
(3 villages: Kanduli,Dariar par	Stop fry/brood fishing			
and Bagervita)	Conserve re- introduced species			
	• Stop fishing through de-watering in the management areas under Bailsha			
	RMO			
	Totally stop fishing in the sanctuaries areas within the Bailsha beel			
8. Kalaghosa-1 Jhara	Time closure for fishing			
Committee	Reduction of use of destructive fishing gears			
	Stop fry/brood fishing			
(2 villages: Kangsha and	<ul> <li>Totally stop fishing in the sanctuaries areas</li> </ul>			
(Janunigaon)	Maintenance of vegetation along the edge of chhara/jhara for reducing erosion			
	Periodical removal of silt from chhara to keep them open toward wetland			
	Regenerate habitat for wildlife			
9. Kalaghosa-2 Jhara	Time closure for fishing			
Committee	Reduction of use of destructive fishing gears			
(1	Stop fry/brood fishing			
(1 villages: Dnansail)	• Totally stop fishing in the sanctuaries areas			
	• Maintenance of vegetation along the edge of chhara/jhara for reducing erosion			
	<ul> <li>Periodical removal of silt from chhara to keep them open toward wetland</li> </ul>			

Name of Community Organizations	Regulations adopted by the communities
	Regenerate habitat for wildlife
10. Nakshi Jhara Committee	• Time closure for fishing
	Reduction of use of destructive fishing gears
(3 villages: Naokuchi, Deplai and	Stop fry/brood fishing
Nunkhola)	• Totally stop fishing in the sanctuaries areas
	• Maintenance of vegetation along the edge of chhara/jhara for reducing erosion
	• Periodical removal of silt from chhara to keep them open toward wetland
	Regenerate habitat for wildlife
Sub-Total: 38 Villages	
Total:117 Villages	

\*Villages associated with more than one resource management areas.

## Number of Communities adopting two or more of the following key regulations in target area:

- Restrictions on the use of inappropriate fishing gears
- Restriction on fishing season and harvesting of fish fry and
- Restriction on the area of fishing

Name of the Villages and address	Name of the Resource	No. of Village	Population
	Hail Haor		
Miriapur Jatrapasha Kashipur and South Pachuan	Sananda RMO	4	6080
inigupui, sutupusiu, reusinpui and south i uchuan	Sunanda Kivio		0000
Ranguria, Ranavim, Bobasara, Mohammadpur,	Jethua RMO	6	5917
Nayanshree, and Boruna North			
*Gondhorbopur, Vimshi and *Bhunabir	Balla RMO	3	6603
Anekelibuda and Anekeliboro	Kajura RMO	2	2997
Atghor, Hossenpur and Manik Haor	Agari RMO	3	3304
Rustumpur, *Badealisha and East Laiyerkul	Duamuria RMO	3	6176
Hazipur, South Boruna, and Mid Boruna	Baragangina RMO	3	5715
Ghorachao, Dashkahnia, Mordanhall and Boroiuri	Ramedia RMO		2208
Ghorachao, Dashkannia, Wordannan and Doronari	Kalikula KWO		2200
Alisarkul and *Badealisha	Alia Chhara Committee	2	3006
Shasan and *Bhunabir	Joita Chhara Committee	2	1077
Boulashir and *Gondhorbopur	Boula Chhara Committee	2	2740
Ishabpur and Naogaon	Jaag Chhara Committee	2	2480
Islampur, Amanatpur	Ful Chhara Committee	2	375
Total		35	48678
	Turag Bongshi	- I	1
Kouchakuri, Amdoir, Sinaboho, *Bashtali, Saturia- solahati, Majukhan, Nagchala, Taltoli, *Kaliadoha, *Boroibari, Haturia Chala, Rangamati, Bagambor, Buluia, Kacharosh, and Bangar Jangal	Mokesh Beel RMO	16	18096
Galachipa, Boali, Modankhali, Kundagata, Oliarchala, Gapinpur, *Boroibari, *Kaliadoha, Dhighibari, *Bashtali, Gabtali, Syedpur, Nama Ashulai, Kaliakoir, Sutrapur, Ragunathpur and Shailakhali	Turag River RMO	17	13135
Kuripara, Polashtoli, Hatubhanga (Chitarashari), Beltoil (2004 additions)		4	12880
Madiashulai, Asharria Bari, Azgana, Kanchanpur, Rashidpur and Beelbaria	Alua RMO	6	13342
Fulbaria, Pagal Nath Challa, Nabirbohor and Sreepur	Goaliar RMO	4	6860

Name of the Villages and address	Name of the Resource	No. of Village	Population			
	Management Area					
Total		44	64313			
Kongsha-Maliihee						
Pakuria, Tirchha, Bakar Kanda, Tilkandi (Tarakandi), Barogoria, Haora Nij and Surjadi uttor para	Kewta Beel RMO	7	14520			
Nakshi, Balurghate, Gaglajani, Shalchura, Gugra Kandi and Pepuleshar	Kur Committee under Kewta RMO	6	15411			
Chakpara and Gajaria	Nizla Beel Committee under Kewta RMO	2	2271			
Chak Andaria and Sutir Par	Chira Beel Committee under Kewta RMO	2	4500			
Jolgaon, Changuria, Baniapara, Malijhekanda, Hasligaon, Rangmatia, and Batia	Takimari-Dara Bashia RMO	7	15808			
Balia Chandi, Konagaon, Darikalinagar, Paikura and Sarikalinagar	Dhali-Baila RMO	5	9878			
Kanduli, Dariar par and Bagervita	Bailsha RMO	3	6499			
Kangsha and Gandhigaon	Kalaghosa-1 JC	2	5566			
Dhansail	Kalaghosa-2 JC	1	5276			
Naokuchi, Deplai and Nunkhola	Nakshi JC	3	5488			
Total		38	85217			
Total (three sites)		117	198,208			

\*Villages associated with more than one resource management areas. Population considered with concerned Beel RMOs total (103) villages stands on counted once only.

In addition to above communities there are ten more CBOs (FMCs) in the outreach areas where MACH extended the practices of adopting key regulations for managing the resources in their surrounding localities. A brief of the information is given below:

Upazila and District	Name of resource	Villages	Appx. Population
	management organizations		
Sathia, Pabna	Silonda Fishery	6	9,000
Sathia, Pabna	Ichamoti	8	12,600
Singra, Natore	Gur Nadi	9	13,000
Badarganj, Rangpur	Jamuneswari	6	10,000
Pirgacha, Rangpur	Masankura	4	8,000
Pirganj, Thakurgaon	Tanguar Nadi	8	9,500
Fulchari, Gaibandha	Konai Brahmaputra	4	8,000
Trishal, Mymensingh	Old Brahmaputra	7	11,000
Netrokona sadar, Netrokona	Jalghgutia Beel	8	10,500
Mitahmoin, Kishorganj	Balajan River	8	8,500
Total	10 FMC	120	100,100

A total of 117 villages have set up best management practices in the MACH areas. In addition MACH II further supported a total of 120 villages/communities through the outreach program in 9 areas.

## **Reference Indicators 6.3b**

Name of the	RMO take resolution	Communities are	Reduce	Stop de-	Stop fishing	Stop fish	Early monsoon
Community	regarding fishing	aware about	destructive	watering in the	in the	fry and	closed season for
Community	regulations	regulations	fishing	target areas	sanctuaries	brood catch	fishing
Hail Haor		regulations	1.0.1.1.8		Sunotunitos		
Sananda	1	2	1	2	2	1	1
Jathua			N	N	N		1
Jethua	N I	N	N	N	N	N	N
Balla	√						
Kazura		$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$
Agari		$\checkmark$		$\checkmark$			$\checkmark$
Dumuria	√	$\checkmark$	$\checkmark$	$\checkmark$			$\checkmark$
Bargangina	√ √	√	$\checkmark$	√			√
Ramedia							
Turag							
Bangshi							
Mokesh	√	$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$
Turag	√	$\checkmark$		$\checkmark$	$\checkmark$		$\checkmark$
Alua	√	$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$
Goaliar							
K-M site							
Kewta	√ √	√	$\checkmark$	√			√
Takimari	√			$\checkmark$			$\checkmark$
Darabashia							
Dhali-Baila	√ √		$\checkmark$	$\checkmark$			$\checkmark$
Bailsha	√ √	$\checkmark$	$\checkmark$	$\checkmark$			$\checkmark$

## Communities adopting Fishing Regulations in Management Areas

## **Strategic Objective 6**

**Indicator 6.4a:** Number of individuals reached by the public awareness activities in the country

June 2007

Management of Aquatic Ecosystems through Community Husbandry (MACH)

Strategic Objective 6: Improved Management of Open Water and Tropical Forest Resources					
Intermediate Result 6.4: Public Awareness of Key Issues Increased through expanded	outreach and	d public edu	cation		
effort					
Indicator 6.4a: Number of individuals reached by public awareness activities in the cou	intry				
A. Description	Cumulativ	e Unit of m	easure:		
Precise Definition of Indicator: This is a process indicator that records the number of	Number of people				
people attending or participating in selected awareness generation activities. Public					
awareness activities include community training activities, attendance at MACH-	Veer	Dlannad	Actual		
sponsored cultural events (e.g., village theatre) with environmental messages and	rear	Flanned	1/		
similar events.					
Unit of Measure: Number of persons	1999	5,000	9,966		
Disaggregate by: N/A					
Justification/Management Utility: This is an output indicator that will be measured		MACH-I			
over the life of the SO. Its limitations are well understood. This will be augmented by					
a future indicator to measure impact or changed behavior.	2000	20000	25 099		
	2000	20000	20,000		
B. Plan for Data Collection					
Data Collection Method: Counting of participants in the meetings by Winrock and	2001	50,000	82 815		
partners.	2001	20,000	02,015		
Data Source(s): Winrock and its partners.					
Method of Collection by USAID: Reports from Winrock	2002	100.000	197 000		
Timing/Frequency of Data Collection: Semi-annual	2002	100,000	177,000		
Estimated Cost of Collection: Nominal.					
Responsible Individual(s) at USAID: Team Leader	2003	125 000	306 448		
	2005	125,000	500,110		
C. Data Quality Issues		МАСИИ			
Date of Initial Data Quality Assessment:	MACH-II				
Known Data Limitations (if any): does not measure real impact					
Actions Taken or Planned to Address Data Limitations: none planned for this	2004	30,000	54,370		
specific indicator					
Date of Future Data Quality Assessments:					
Procedures of Future Data Quality Assessments:	2005	70.000	104 200		
	2005	/0,000	184,389		
D. Plan for Data Analysis, Reporting, and Review					
Data analysis: N/A					
Presentation of Data: 1 able	2006	110.000	220 7(1		
<b>Review of Data:</b> Semi-annual mission portfolio review, R4 review, and individual	2006	110,000	229,761		
review with recipient.					
<b>Reporting Data:</b> Internal mission report, R-4 report and CBJ report.					
E. Other Natari	2007		220 126		
E. Other Notes: Notes on the Boselines/Tensets:	2007	-	238,136		
Notes on the Dasennes/ Largets:					
<b>Commonts</b> This indicator designed as a prove for multiplication of Data Storage: P:\\visitstonShareable\EGFEpub\Environmeni\PMP					
<b>Comments:</b> This indicator, designed as a proxy for public awareness. This indicator has been complemented by a) implementary' information via project estivities, and b)					
A sample surveys that examines the effect of expression of entities on the chirations					
A sample surveys matexammes me affect of awareness activities on the objectives					
wetland resource issues from baseline)					
#### Strategic Objectives 6: Indicator 6.4a: Number of individuals reached by public awareness activities

Public awareness of the decline and or change in status of their natural resources and their environment is an important first step on the road to improving the management through communitybased organization and co-management solutions. The ultimate goal is to build a consensus locally on the issues and problems and then develop the capacity to conserve and maintain wetland resources for the continuous benefit of the poor. MACH has taken many steps at the local level to achieve the increased awareness of the wetland issues. The major activities and awareness program tools of MACH are described below.

1. **Project Introductory Meetings:** Project introductory meetings were done at different levels during the inception of the project. These meetings were conducted at the Upazila, Union, Village and Para level. The objectives were to generate awareness in the communities about their local wetland including its value and function. These meetings also provided the opportunity to open up discussion on the environment and related issues. It provided for discussion of the problems and how they could address them with the support of the project. This introductory meeting is normally a full day program and depending on the location there were anywhere from 30 to 200 people participating.

2. Uthan Baithak (small meetings in village courtyards): These are small, informal but effective meetings conducted to further explain the resource situation in relation to the livelihood of the people in the village. The individuals in the Uthan Baithak are encouraged to discuss environmental problems and ways that a sustainable resource management solution can be put in place. During these meetings the project objectives, approach and their role is further explained. They are also encouraged to participate in the community-based activities. Normally 10 to 30 people participate in the Uthan Baithak.

3. Knowledge Sharing with NGOs and Local Elites: Local NGOs and elites are invited to share and disseminate local issues, project concept and activities. Ten to 15 persons participate in these sorts of meetings.

4. Village Drama: A very effective awareness tool has been the MACH village environmental/wetland drama. These dramas or village theatre have generated very wide awareness about wetlands, the status of the fishery within the wetland and the problems and solutions recommended. With the drama the coverage and effectiveness is very high. MACH has been able to reach many thousands of people through this effective method. It is observed that 300 to more than 1000 people attended at a time. MACH has found the effect to be long lasting. Fishermen still talk about the items portrayed in the drama and it does have an impact on the individual resource user. Because of the strong and powerful message, resource users have a very high degree of probability of improving poor resource use practices.

5. Folk Songs (Baul songs): This is another popular media used in rural Bangladesh. The singer explains problems of the people and the resources and the linkages in a very emotional way. These "Baul" songs come up with ways of overcoming the problems of the wetlands and what will be the result if implemented properly. Normally 200 to 400 people participate in the singing functions.

6. **Day Observance:** Environment and related days are observed through special events/functions in all the 3 project sites. These observances have already sent awareness messages to thousands of school students in MACH project areas. Relevant environmental, natural resource and other relevant information are given through different functions during the "Rally", discussion, learning activity, drawing and quiz competition among students. Also folk songs, drama and other awareness activities are done in relation to the theme of the occasion. Depending on the type of activity, from 100 to more than 1000 people participate.

7. **School Program:** In selected schools MACH staff provided environmental and natural resource related education directly. So far 21 schools and about 1500 students were covered in MACH sites. Through this program the future generation of the country is reached and through them their parents are also reached.

8. **Bill-Boards and Sign-Boards:** Sign boards placed strategically around the resource area carry messages on resources, conservation and its need, how to stop destructive resource use activities. These are installed in public places (Hat, Bazar), roadside, and tea shops for example. These are for the wider public and have been found to be very useful.

9. **Exhibitions:** In different occasions exhibitions are organized at the Upazila and district levels where MACH Site Offices take part and make presentations giving a wider coverage to resource conservation and the methods. These are well-attended activities that last 3 to 7 days.

10. **Through Resource User Groups (RUG):** MACH RUG groups comprise 5,200+ families that fish in the water of the wetlands being managed. These groups of poor fishermen have received weekly awareness briefings on improved fishing practices and the need for management planning for the maintaining of the fishery.

In addition to the above, MACH conducted a continual awareness campaign at the central government level which resulted in some very significant policy changes particularly at the Ministry of Land. MACH has worked extremely hard at educating senior officials in government on the benefits of proper resource management by getting them to make field visits. MACH has conducted awareness building field visits and made critical presentations seeking policy changes particularly with regard to land and water leasing policies. MACH through its awareness programs has achieved permanent sanctuary status for 8 water bodies in the three project sites. This is the first time ever that the Land Ministry has foregone revenue for a conservation measure.

MACH has also worked very hard and has through constant workshops, cross visits, special functions and Local Government Committee meetings been able to change the minds and convince local administrators of the need and value of community-based co-management of natural resources.

Awareness Program by MACH Summary statement Number of Participants of different Activities (1999-2003)

SI.	Activities/Tasks	HH	Sites	TB	Sites	KM	Sites	All Tota	ll (3 Sites)
N0.		Caritas	CNRS	Caritas	CNRS	Caritas	CNRS	Caritas	CNRS
1.	Introductory meeting:								
	Uthan boithak/Para	170(5,595)	118 (5,260)	176(4,009)	91 (3,659)	137(4,633)	272 (3,929)	483(14,237)	481 (12,848)
	Village Meetings/Programs	I	141 (5,275)	14(2,969)	90 (5,548)	38(7,125)	162 (5,602)	52(10,094)	393 (16,425)
	UP, Upazilla and District level meetings	3(1,950)	20 (456)	2(861)	13 (324)	6(4,500)	11 (507)	11(7,311)	44 (1,287)
5.	School level programs	I	5 (1,727)	I	1 (500)	1	2 (200)	1	8 (2,427)
Э	School level Class Session	I	I	I	226 (631)	I	58 (162)	I	284 (793)
4.	Day observance/Art & Quiz competition/Fish week (Fish Fortnight)/Field day	15(8,150)	16 (9,769)	4(2,481)	13 (7,145)	6(4,020)	13 (9,400)	25(14,651)	42 (26,314)
5.	Boul Song, Video Shows and community miking	29(21,921)	93 (24,974)	40(25,388)	40 (1,4017)	40(48,099)	38 (27,747)	109(95,408)	171 (66,738)
6.	Knowledge Sharing community level among GO/NGOs/workshop	I	18 (65)	I	25 (1,590)	I	2 (469)	1	45 (2,124)
7.	Village Level Meetings (Watershed Management)	I	77 (715)	I	I	I	I	1	77 (715)
%	Exhibition in Fair	I	3 (14,445)	I	2 (5,738)	I	2 (14,893)	I	7 (35,076)
	Total	217(37,616)	491 (62,686)	236(35,708)	501(39,152)	227(68,377)	560 (62,909)	680(141,701)	1,552 (164,747)

Note: Number of participants is in parenthesis

4

Appendix-8: Awareness Program by MACH-CNRS

# Awareness Program by MACH-CNRS Summary statement Number of Participants of different Activities (1999-2003)

SI.	Activities/Tasks	H	H Sites	IT	3 Sites	KN	M Sites	All To	tal (3 Sites)
No	-	Jan.'03- Aug.'03	Since inception Upto August'03						
1.	Introductory meeting:								
	Uthan boithak/Para	33 (925)	118 (5,260)	10 (265)	91 (3,659)	75 (1,011)	272 (3,929)	118 (2,201)	481 (12,848)
	Village Meeting	16 (465)	141 (5,275)	6 (660)	90 (5,548)	69 (1,552)	162 (5,602)	94 (2,677)	393 (16,425)
	UP, Upazilla and District level meeting	3 (85)	20 (456)	2 (64)	13 (324)	3 (290)	11 (507)	8 (439)	44 (1,287)
5.	School level program	4 (552)	5 (1,727)	I	1 (500)	ı	2 (200)	4 (552)	8 (2,427)
ж.	School level Class Session		I	10 (253)	226 (631)	26 (155)	58 (162)	36 (408)	284 (793)
4	Day observance/Art & Quiz competition/Fish week (Fish Fortnight)	4 (2,900)	16 (9,769)	3 (2,415)	13 (7,145)	2 (1,700)	13 (9,400)	9 (7,015)	42 (26,314)
5.	Boul Song, Video Shows and community miking	77 (8,993)*	93 (24,974)	25 (8,400)*	40 (1,4017)	21 (3,759)*	38 (27,747)	123 (21,152)	171 (66,738)
6.	Knowledge Sharing community level among GO/NGOs/workshop	1	18 (65)	14 (1,446)	25 (1,590)	2 (469)	2 (469)	16 (1,915)	45 (2,124)
7.	Village Level Meeting (Watershed Management)	9 (65)	77 (715)	I	I	ı	I	9 (65)	77 (715)
<u>%</u>	Exhibition in Fair	1	3 (14,445)	I	2 (5,738)	I	2 (14,893)	I	7 (35,076)
	Total	146 (13,985)	491 (62,686)	73 (13,503)	501(39,152)	198 (8,936)	560 (62,909)	417 (36,424)	1,552 (1,64,747)
	oto: Mumbos of soutionsate in i	in nononthoosis							

ote: Number of participants is in parenthesis \* Only video show

#### Awareness Program by MACH-Caritas Summary Statement

Summary Statement Number of Participants of different Activities (1999-2003)

Sl.	Activities/Tasks	HH Sites	<b>TB</b> Sites	KM Sites	All Total
No.		Caritas	Caritas	Caritas	Caritas
1.	Introductory meeting:				
	• Uthan boithak/Para	170(5,595)	176(4,009)	137(4,633)	483(14,237)
	• Village Meetings/Program	-	14(2,969)	38(7,125)	52(10,094)
	• UP, Upazilla and District level meetings	3(1,950)	2(861)	6(4,500)	11(7,311)
2	Day observance/Art & Quiz competition/Fish week (Fish Fortnight)/Field day	15(8,150)	4(2,481)	6(4,020)	25(14,651)
3.	Boul Song, Video Shows and community miking	29(21,921)	40(25,388)	40(48,099)	109(95,408)
	Total	217(37,616)	236(35,708)	227(68,377)	680(141,701)

Activities	IH	H	T	B	KN	I	To	tal	All Total
	CNRS	Caritas	CNRS	Caritas	CNRS	Caritas	CNRS	Caritas	
Para Level/Uthan Baithak	100(1345)	70(2352)	20(289)	70(1545)	166(1670)	16(440)	286(3304)	156(4337)	442(7641)
Village Level	124(3431)	1	12(635)	I	141(3041)	7(297)	277(7107)	7(297)	284(7404)
UP Level	3(50)	1	13(204)	I	6(53)	1	22(307)	1	22(307)
Upazila level/District level	1	1	12(113)	I	-	1	12(113)	-	12(113)
School Programs	64(675)	1	15(674)	I	47(159)	1	126(1508)	1	126(1508)
Drama	1	1	8(4000)	1	-	1	8(4000)	1	8(4000)
Day Observance	1(550)	1	2(1600)	I	3(1225)	1	6(3375)	1	6(3375)
Knowledge/Experience	1(22)	156(3074)	2(28)	139(2242)	3(465)	106(2034)	6(515)	401(7350)	407(7865)
sharing/discussion on									
formation of URUC at									
group level									
L. Others(Fish week, Field	2(9000)	1	4(5000)	1(800)	14(6780)	1	20(20780)	1(800)	21(21580)
day, Rally, Community									
announcements, Fair,									
Exhibition etc.									
Awareness meeting on	1	-	-	I	4(577)	1	4(577)	-	4(577)
watershed									
Total	295(15073)	226(5426)	88(12543)	210(4587)	384(13970)	129(2771)	767(41586)	565(12784)	1332(54370)
-									

Awareness Program (Participant No.) in three MACH sites (November 2003 – October 2004)

Participant in parenthesis

Public awareness

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	ite	ine C
	S IIA	DOND
CH sites	M	Caritae
i <b>in three MA</b> er 2005)	K	CNDC
<b>articipant No.)</b> r 2004 –Octobe	B	Caritac
<b>ss Program (P</b> (Novembei	T	SONC
Awarene		aritac

Activities	H	I	TE	~	K	A	All S	ite	Total
	CNRS	Caritas	CNRS	Caritas	CNRS	Caritas	CNRS	Caritas	
Para Level/Uthan Baithak (courtyard meeting)	20 (211)	134(2450)	69(948)	150(2857)	189(1894)	10(225)	278(3053)	294(5532)	572(8585)
Village Level awareness program	133 (3058)	1	44(1446)	1	149(3345)	1	326(7849)	1	326(7849)
UP Level awareness program	1	•	21(242)	ı	1	•	21(242)	•	21(242)
Upazila level/District level awareness program	I	I	35(196)	I	I	1	35(196)	I	35(196)
School Programs	1	1	1	1	48(291)	1	48(291)	1	48(291)
Drama show	35(25475)	1	31(14894)	1	30(30000)	1	96(70369)	1	96(70369)
International Day Observance	2(1150)	1	4(3234)	I	3(2070)		9(6454)	ı	9(6454)
RUG discussions on formation of FRUG	I	73(1244)	. 1	106(1959)	I	103(1030)	1	282(4233)	282(4233)
Others (Fish week, Field day, Rally, Community miking, Fair, Exhibition etc.)	9(8938)	2(700)	6(9840)	1(600)	9(11513)	I	24(30291)	3(1300)	27(31591)
Quiz/Art/Essay Competition	1(12)	I	8(136)	1	5(61)	1	14(209)	1	14(209)
Total	200 (38844)	209 (4394)	218 (30936)	257 (5416)	433 (49174)	113 (1255)	851 (118954)	579 (11065)	1430 (130019)
Participant in parenthesis									

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(November 2005 –October 2006)

Activities	H		IT	~	KN	V	All Si	te	Total
	CNRS	Caritas	CNRS	Caritas	CNRS	Caritas	CNRS	Caritas	
Para Level/Uthan Baithak									
(courtyard meeting)	ı	56(1147)	62(665)	55(1074)	191(1823)	16(313)	253(2488)	127(2534)	380(5022)
Village Level awareness program	59(1203)	1	43(1036)	I	194(4424)	1	296(6663)	1	296(6663)
UP Level awareness program	1	1	18(158)	I	27(242)	I	45(400)	1	45(400)
Upazila level/District level									
awareness program	I	I	27(163)	I	3(37)	ı	30(200)	ı	30(200)
School Programs	I	1	17(518)	I	36(294)	I	53(812)	1	53(812)
Drama show		1	1		1	1	•	1	1
International Day Observance	1(350)	1	3(3345)	•	2(760)	1	6(4455)	1	6(4455)
Knowledge sharing/discussion	I	1	10(143)	I	7(556)	1	17(699)	1	17(699)
Others (Fish week, Field day,									
Rally, Community miking, Fair,									
Exhibition etc.)	1(1500)	5(798)	12(12305)	1(550)	10(10768)	ı	23(24573)	6(1348)	29(25921)
Quiz/Art/Essay Competition	5(1200)	1	1	1	1	1	1	1	5(1200)
Total	66(4253)	61(1945)	192(18333)	56(1624)	470(18904)	16(313)	728(41490)	133(3882)	861(45372)
Participant in parenthesis									

r articipant in parenthesis

areness Program (Par	ticipant No.) in three MACH sites	
· ·	areness Program (Pa	

(November 2006–April 2007)

Activities	IH	H	IL	~	KN	V	All Si	te	Total
	CNRS	Caritas	CNRS	Caritas	CNRS	Caritas	CNRS	Caritas	
Para Level/Uthan Baithak									
(courtyard meeting)	1	ı	17(206)	'	49(399)	I	66(605)	ı	66(605)
Village Level awareness program	17(374)	1	29(524)	I	83(1823)	1	129(2721)	1	129(2721)
UP Level awareness program	1	1	15(160)	I	2(20)	1	17(180)	1	17(180)
Upazila level/District level									
awareness program	I	I	I	ı	I	'	ı	1	I
School Programs	1	1	1(35)	1	4(268)	1	5(303)	1	5(303)
Drama show	1	1	I	•	1	1	1	1	
International Day Observance	1	1	4(1725)	•	2(310)	1	6(2035)	1	6(2035)
Knowledge sharing/discussion	1(51)	1	7(114)	1	1(42)	1	9(207)	1	9(207)
Others (Fish week, Field day,									
Rally, Community miking, Fair,									
Exhibition etc.)	1(24)	ı	3(1700)	ı		ı	4(1724)	ı	4(1724)
Quiz/Art/Essay Competition	2(600)	1	I	1	1	I	2(600)	1	2(600)
Total	21(1049)	1	76(4464)	-	141(2862)	I	238(8375)	1	238(8375)
Darticinant in narenthesis									

Participant in parenthesis

# **Strategic Objective 6**

**Indicator 6.4b:** Percentage increase in awareness of wetland resource issues from baseline

June 2007

Management of Aquatic Ecosystems through Community Husbandry (MACH)

Strategic Objective 6: Improved Management of Open Water and Tropical Forest Resource	ces		
Intermediate Result 6.4: Public Awareness of Key Issues Increased through expanded our	reach and p	ublic education	ion effort
Indicator 6.4b: Percentage increase in awareness of wetland resource issues from baseline		0/ .1.	· · · ·
A. Description Provise Definition of Indicator: The percentage increase in overspace is estimated	Unit of me	asure: % cha	ange in
based on changes in scores given for awareness of key messages and activities introduced	awareness	score	
through MACH and is limited to the three project sites. This survey based measure is	Vear	Planned	Actual <sup>1</sup> /
complemented by records of attendance and participation in events.	Baseline	Tanneu	Actual 7
<b>Unit of Measure:</b> % households aware of issues	2004	20%	N/A (not
Disaggregate by: N/A		, .	measurable)
Justification/Management Utility: This is an output indicator that will be measured			
over the life of the SO. Its limitations are well understood.	2005	30%	74%*
B. Plan for Data Collection	2006	100/	1000/*
<b>Data Collection Method:</b> Survey of samples of participants and other local	2006	40%	128%*
stakeholders			
<b>Data Source(s):</b> consultancy contracted by Winrock.			
Timing/Energy of Data Collections Semi-semuel			
Estimated Cost of Collection: Moderate			
Responsible Individual(s) at USAID: Team Leader			
Responsible individual(s) at USAID. Team Leader			
C. Data Quality Issues			
Date of Initial Data Quality Assessment:			
Known Data Limitations (if any): does not measure real impact			
Actions Taken or Planned to Address Data Limitations: survey design revised in			
2005 to overcome limitations in baseline			
Date of Future Data Quality Assessments:			
Procedures of Future Data Quality Assessments:			
D. Plan for Data Analysis, Reporting, and Review			
Data analysis: N/A Descentation of Data: Table			
<b>Presentation of Data:</b> Table <b>Device:</b> A provide the second seco			
review with recipient			
<b>Reporting Data:</b> Internal mission report R-4 report and CBI report			
Reporting Duta. Internal inteston report, it is report and Obs report.	* increase in awareness score for		
E. Other Notes:	nroject obj	ectives for F	MO&RUG
Notes on the Baselines/Targets: Baseline conducted in 2004, so indicator only covers	members.	Awareness s	cores of other
changes during MACH-II. Already all participants of RMOs and RUGs are aware of	villagers h	ave remaine	d static.
MACH, objective is to quantify changes in understanding of key messages and concepts	(average s	core = heard	l about
for sustainable wetland management.	activity bu	t little recall	ed).
	100% of R	MO and RU	G
Location of Data Storage: P:\MissionShareable\EGFEpub\Environment\PMP	participant	s are aware	of MACH
<b>Comments:</b> Sample surveys of RMO, RUG and non-members were conducted in 2004	activities (	most particij	pated in
(baseline), 2005 and 2006 to assess their awareness of key MACH related activities and	measures s	such as sanct	uaries), 72%
messages. Problems with the methodology of the baseline survey whereby the basis for	of other vi	llagers are a	ware of
scores given to awareness is not detailed in the contractor report and so is not replicable	MACH act	tivities.	
have minimum the value of this indicator. The 2003 survey altempted to overcome this and has a more explicit method that was repeated for the final 2006 survey.			
has a more explicit method that was repeated for the final 2000 survey.			

#### **Strategic Objective 6:**

# Indicator 6.4b: Percentage increase in awareness of wetland resource issues from baseline

MACH conducted this survey through independent organizations. As this indicator was not one of the original MACH I indicators, the first survey established a baseline in May 2004. From this baseline the actual percentage change was to be determined on a yearly basis. This gives a measure of the change in awareness of the stakeholders of the MACH project. The first impact survey was conducted in July 2005, and the second and last impact survey was conducted in August 2006.

#### Comparative analysis of MACH Awareness Surveys

#### Summary

A significant component of MACH has been to raise local awareness of the need for and the activities required for sustainable wetland use and management. This has formed a basis for the community participation in and compliance with management decisions made by RMOs. During MACH-II a reported 256,000 attendance/participation person days were reported for awareness raising activities of various types across the three sites. Of these live dramas were a major activity: more than 60,000 people attended the live dramas during this period. Other mass participation activities have been observance of notable days (World Wetland and World Environment days), and village meetings. Changes in awareness are expected to be a result of these activities.

A base line study on MACH – II awareness activities was completed in June 2004. Repeat surveys to see the trend in awareness of the target communities were conducted during July-September 2005 and August-September 2006. These substantial surveys in 2005 and 2006 each covered 225 project participants (RMO and RUG), 90 general villagers, and 10 officials spread through the three sites (in 2005 30 project staff were also interviewed). The samples in all three years were independent of one another (no repeat interviews) since the interviews themselves might affect awareness of issues. Almost all the respondents knew of MACH (all participants and 83% of other villagers in 2005, rising to 100% of participants and other villagers in 2006) and recognized that wetland management had improved in the last few years as a result of MACH activities.

MACH awareness messages have reached many people in the communities. In 2005 only 28% of general villagers could recall messages from the project, rising to 58% in 2006, compared with 90% of project participants in 2005 and 92% in 2006, indicating that messages spread more widely among the communities during MACH-II. Signboards, posters, T-shirts and educational materials were reported by respondents to be more effective than other communication media/materials that they had encountered from the project, but the effectiveness ratings of all materials produced by the project were modest suggesting that future projects should investigate further the materials and messages that they use to maximize effectiveness in the eyes of local target audiences and resource users.

Comparing data from 2004, 2005 and 2006 surveys (different samples), there was a 74% increase between 2004 and 2005 and a further 31% increase between 2005 and 2006 in the awareness score for project objectives for RMO and RUG members, giving a combined increase of 128%. Much of the survey concentrated on changes in awareness scores for communication activities of MACH, these were very low in 2004, and rose by 106% in 2005 and 135% by 2006 for RMO and RUG members), and by 213% for other villagers (no change between 2005 and 2006). However, the 2006 average scores indicate that the respondents have heard about activities but could recall little of the content and had not necessarily changed behavior.

Awareness of local government officials and UP chairmen about MACH goals and objectives was high in 2006, averaging 57% above the 2004 levels, having dropped in 2005 almost certainly due to

turnover of individuals. This highlights the need for continually informing and working with officials and UP chairmen or their support may be lost. Recommendations from the study included:

- Segmentation of the target audience with communication selectively targeted and greater use of interactive approaches including meetings and dramas.
- Greater repetition of messages to achieve behavioral change.
- More use of pictoral methods supplemented by miking if it is repeated.
- Greater targeting of local government and UP chairmen.

#### Findings of the 2005 and 2006 surveys

#### Awareness about MACH project

The studies made an attempt to assess the level of awareness about MACH project and its various elements. All respondents - both project participants and general villagers - were aware of MACH project. Regarding RMOs and RUGs, over 96% of project participants (all of whom belong to these organizations) were aware of them. General villagers' awareness about RMOs and RUGs was higher in the 2005 sample than the 2006 sample – the RMOs and RUGs may be becoming more inward looking rather than reaching out to the wider community. All project participants were found to be aware of project activities while over 85% of general villagers were aware of MACH activities (Table 1).

Area of awareness	Project Par (n=22	rticipant 25)	General (n=	Villagers 90)	Tot (n=3	al 15)
	2005	2006s	2005s	2006	2005	2006
About MACH Project	100	100	100	100	100	100
About RMO	96	97	71	64	89	88
About RUG	97	99	67	53	89	86
About MACH activities	100	100	83	72	95	86
Total (Average)	98	99	80	72	93	90

Table 1: Percentage of respondents who said they were aware about MACH and its components

#### Participation in MACH activities

MACH project promoted participation of project participants and general villagers in various grass roots level activities. As might be expected, 92-93% of project participants participated in MACH activities while only 28% in 2005 and 34% in 2006 of other villagers had participated in any MACH-related activities. Participation in MACH activities was highest in Hail Haor and similar in both years in the other two sites (Fig. 1).

Figure 1a: Site wise involvement in MACH activities by respondent type in percent (2005 Survey)



Figure 1b: Site wise involvement in MACH activities by respondent type in percent (2006 Survey)



The survey looked at the level of awareness about MACH activities among the respondents. It is evident from Table 2 that project participants could mention relatively more activities than general villagers. Excavation, sanctuary establishment, and plantations are more visible activities than the IGA and RUG activities, so more of the wider community are aware of the key resource management interventions. However, awareness of these activities appears to be short lived and many participants did not mention activities in 2006, even though they had taken place in earlier years.

Activities	Project Participant $(n=225)$		General V	illagers	Total	
	2005	2006	2005	2006	2005	2006
Excavation & plantation	100	42	98	35	100	40
Group formation & supplementary income generating activities through training & credit	86	58	56	45	71	54
Sanctuary establishment & sustainability	57	45	51	37	54	43
Indigenous threatened fish species re- introduction	35	20	37	13	36	18
Awareness created through meeting	32	17	16	12	24	16
Provide additional support (seed, tube-	10	Not	6	Not	8	Not
well etc)		asked		asked		asked
Stopped illegal fishing	4	12	3	7	3	10
Stopped bird hunting	2	12	1	7	1	10

Table 2: Awareness about MACH activities by respondents type (percentage of respondents

#### Awareness about MACH messages

The respondents were asked about MACH messages during the survey (Fig. 2). In 2005, 52% of respondents could recall 1-3 messages, 20% could recall 4 or more messages and 28% could not recall any message, this latter groups comprised of 74% general villagers and 26% project participants. By 2006 only 18% could recall no messages, of whom 68% were general villagers and 32% project participants.



Fig. 2 Percentage of respondents recalling different numbers of MACH messages

The most common messages that the respondents could recalled differed considerably between years, reflecting the communication and awareness messages that had been extended (these are broken down by site in Table 3), overall the main messages recalled by local people were:

- Establish sanctuary, ensure the habitat of fishes
- Plantation in cannel side, prevent beel sedimentation
- Increase fish production, increase income by proper management of sanctuary
- Increase supplementary income, reduce pressure on fishing
- Do not catch spawning fish
- Stop hunting birds

- Stop using current jal, and
- Organize groups for alternative livelihoods.

#### Table 3a: Percentage of respondents recalling messages (2005) out of 226 respondents recalling at least one message

Types of massages	MACH	I Project	Site	Total	
	HH	KM	TB	No.	%
Establish sanctuary, ensure the habitat of fishes	81	74	71	226	100
Plantation in cannel side, let protect beel sedimentation	54	52	58	164	72
Increase fish production, increase income by proper management of sanctuary	49	59	46	154	68
Increase supplementary income, reduce pressure on fishing	18	29	17	64	28
Stop using current net, save the lineage of fish	18	15	11	44	19
Shall not drain out all beels, shall not catch all fish	10	2	7	19	8
Save fish, save wetlands - live a happy life round the year	0	3	16	19	8
Stop hunting birds, save all varieties	0	3	15	18	8
Save fish by optimum fishing	2	2	12	16	7
Shall not catch fish fries, shall not break the law	4	4	6	14	6
Save bio-diversity, save the environment	1	0	6	7	3
Increase alternative income for reduce pressure on fishing	3	0	3	6	3
Haor, beel, wetlands and fish are our gold mines	1	2	1	4	2
Reduce environment pollution, ensure balance environment	0	0	1	1	0

#### Table 3a: Percentage of respondents recalling messages (2006) out of 259 respondents recalling at least one message

Types of massages	MACH	I Project	Site	Total	
	HH	KM	TB	No.	%
Shall not catch spawn fish	83	79	83	259	82
Stop hunting birds, save all varieties	63	67	54	193	62
Shall not catch brood fish, shall not break the law	50	46	33	136	43
Stop using current net, save the lineage of fish	33	33	29	100	32
Group organize, live by alternative income	21	50	25	100	32
Plantation in cannel side, let protect beel sedimentation	54	21	17	96	31
Increase alternative income for reduce pressure on fishing	1	46	21	87	28
Establish sanctuary, ensure the habitat of fishes	29	25	0	57	18
Shall not drain out all beels, shall not catch all fish	25	13	0	39	13
Management of sanctuary, increase fish increase income	13	13	13	39	13
Catch no fish in Chitra, Baishak and Jaishta, a happy life follows for twelve	8	17	8	35	12
months					
Haor, beel, wetlands and fish are our gold mines	13	0	17	30	10
Cultivate fish & happy live 12 months	8	8	8	26	9

#### Awareness about MACH objectives

MACH has an overall program goal and three specific project objectives. In the 2004 baseline, awareness level of the three specific objectives was averaged to get an awareness level of overall MACH objective, and general villagers were excluded. However, in the 2005 and 2006 surveys general villagers were covered (Table 4). The comparison of awareness level among the project participants showed substantial improvements of 74% by 2005 and another 31% by 2006. The 2006 awareness level was found to be 2.6 in a 5-point scale compared to 1.13 in the baseline. RMO members had attained a slightly higher level of awareness than the RUG members. The pattern was the same in all three sites.

#### Table-4: Awareness about MACH overall objectives (2004-2006)

Site	RMO Member				RUG Member				Total Project participants				General	
			1										vinage	15
	2004	2005	2006	Change	2004	2005	2006	Change	2004	2005	2006	Change	2005	2006
HH	1.41	2.17	2.73	25.8%	.90	1.96	2.55	30.1%	1.16	2.06	2.65	28.6%	1.16	1.18
KM	0.97	2.20	2.64	20.0%	.74	1.65	2.34	41.8%	0.86	1.92	2.52	31.3%	1.24	1.25
TB	1.00	2.10	2.65	26.2%	.89	1.82	2.63	44.5%	1.41	1.96	2.64	34.7%	1.34	1.32
Total	1.13	2.16	2.67	23.6%	.84	1.81	2.51	38.1%	1.14	1.98	2.60	31.3%	1.25	1.25

Scale interpretation of objective level responses: 0 = Not at all, 1 = Very Little, 2 = Average, 3 = High, 4 = Very High

Change is percentage increase in score between 2005 and 2006 No baseline data for general villagers Table 5 shows an increasing trend towards scores of 2 and 3, and in most cases a fall in those scoring 0 and 1 during the 12 months.

<i>a)</i> 2005 survey												
Score		Percent o	f Respon	ses - RMC	) Membe	ers	Percent of Responses - RUG Members					
	Objective - 1		Objective - 2		Objective - 3		Objective - 1		Objective - 2		Objective - 3	
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
Very High (4)	0.0	0.0	0.0	0.0	0.0	4.7	0.0	0.0	0.0	0.0	0.0	5.0
High (3)	0.0	34.7	0.0	40.3	0.0	45.0	0.0	26.9	0.0	32.6	0.0	42.0
Average (2)	19.4	41.3	50.0	47.6	44.4	32.2	4.6	45.1	18.9	52.5	27.3	30.9
Very Little (1)	30.6	13.3	41.7	4.7	38.9	2.0	22.7	14.8	60.6	7.7	56.8	3.9
Not at All (0)	50.0	10.7	8.3	7.4	16.7	16.1	72.7	13.2	20.5	7.2	15.9	18.2
Total	100	100	100	100	100	100	100	100	100	100	100	100

#### Table 5: Change in Awareness about MACH objectives - RMO and RUG members

b) 2006 survey

a) 2005 survey

Score		Percent of Responses - RMO Members						Percent of Responses - RUG Members					
	Objective - 1		Objective - 2		Objective - 3		Objective - 1		Objective - 2		Objective - 3		
	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	
Very High (4)	0.0	5.9	0.0	8.1	4.7	5.9	0.0	5.6	0.0	4.4	5.0	6.7	
High (3)	34.7	60.7	40.3	55.6	45.0	57.8	26.9	43.3	32.6	44.4	42.0	50.0	
Average (2)	41.3	31.9	47.6	35.6	32.2	31.9	45.1	48.9	52.5	44.4	30.9	41.1	
Very Little (1)	13.3	0.7	4.7	0.7	2.0	0.7	14.8	1.1	7.7	2.2	3.9	1.1	
Not at All (0)	10.7	0.7	7.4	.0	16.1	3.7	13.2	1.1	7.2	4.4	18.2	1.1	
Total	100	100	100	100	100	100	100	100	100	100	100	100	

Objective-1: Raise awareness about the importance of natural flood plain resources to secure food and income security;

**Objective-2:** Maintain and recover the selected natural flood plain ecosystems and associated fisheries;

**Objective-3:** Identify activities to generate alternative income that result in a reduction of pressure from fishing and agriculture.

Awareness for each of the three objectives has increased for both RMO members and RUG members. In the baseline, relative awareness on objective-1 was the lowest for both RMO and RUG members. In the follow up, awareness score for objective -1 still remained the lowest, though the score has improved considerably (Table 6). Improvement in awareness on other two objectives also increased somewhat.

Specific	1	RMO (EC &	c GB) membe	er	RUG member				
Objective	Baseline	Follow-	End –	Change	Baseline	Follow-up	End –	Change	
	2004	up 2005	line 2006	%	2004	2005	line 2006	%	
Objective - 1	0.69	2.04	2.70	32.35	0.32	1.64	2.51	53.04	
Objective - 2	1.42	2.28	2.71	18.85	0.98	1.83	2.42	32.24	
Objective - 3	1.28	2.18	2.61	19.72	1.11	1.97	2.60	31.97	

Table 6: Objective wise change in awareness level of RMO and RUG members

#### Awareness level of MACH activities:

A large part of the communication activities of MACH were targeted to the project participants i.e. RMO and RUG members. Besides some communication activities also targeted the general villagers directly or through RMO and RUG activities and their members. The follow up assessment shows a steady growth of awareness level of MACH communication activities across the board. In the baseline, overall awareness score among the project participants were very low (only 0.66) which had increased to 1.36 a year later, and 1.55 in 2006, but this was still below the mid-point (2) of the scale. The awareness level score among the general villagers was almost nil (0.29) in the baseline and rose to 0.91 in 2005 and 0.9 in 2006, meaning that they still had very little awareness about MACH communication activities and on average had just heard something. Nevertheless the relative increase

in awareness was significantly greater (t-test, p < 0.05) for the general villagers than for the RMO and RUG members in the period 2004-2005 in all three sites (Table 7).

	Project Par	ticipants		General V	Villager		Total Average			
Site	Baseline	Follow-Up	Change	Baseline	Follow-Up	Change	Baseline	Follow-Up	Change %	
		2005	%		2005	%		2005		
НН	0.71	1.44	103	0.28	0.94	239	0.5	1.3	163	
КМ	0.67	1.44	115	0.32	0.99	209	0.5	1.31	165	
ТВ	0.6	1.19	98	0.26	0.8	207	0.43	1.08	151	
Average	0.66	1.36	106	0.29	0.91	218	0.47	1.23	160	

Table 7a: Overall awareness score for MACH communication interventions (2005 survey)

Table 7D: Overall awareness score for MACH communication interventions (2000 survey)	Table	7b:	Overall	awareness	score for	MACH	communication	interventions	(2006	survey)
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	Project Par	ticipants		General V	Villager		Total Average			
Site	2005	2006	Change	2005	2006	Change	2005	2006	Change %	
			%			%				
нн	1.44	1.55	7.63	0.94	0.85	0.94	1.3	1.35	3.84	
КМ	1.44	1.46	1.38	0.99	0.93	0.99	1.31	1.30	-0.76	
тв	1.19	1.65	38.65	0.8	0.93	0.8	1.08	1.44	33.33	
Average	1.36	1.55	13.97	0.91	0.90	0.91	1.23	1.36	10.56	

Score on range: 0 = know nothing, to 4 = very high (attended/saw product and remember messages)

Table 8 shows the awareness status of the respondents about specific communication interventions. Baseline data in such classified form was not available, so no comparison is possible. The respondents rated very highly certain interventions like courtyard meetings, live drama, rallies, observing important days, and miking.

	% Very High (4)-	Average (2)- Very	Not at all	
MACH Communication Intervention	High $(3)$ (%)	little (1) (%)	(0) %	Total
1. Courtyard Meeting	58.7	39.7	1.6	315
2. Miking	58.1	38.1	3.8	315
3. Rally	35.9	54.6	9.8	315
4. MACH Project Introductory Meeting	15.6	73.3	11.1	315
5. Live Drama	50.8	37.8	11.4	315
6. Community Level Meeting	29.5	58.1	12.4	315
7. Important Day Observance	35.9	61.9	18.7	315
8. TV Program	11.1	63.2	25.7	315
9. Briefing Session for Different Stakeholders	13.0	34.6	52.4	315
10. Environment Education in School	9.5	37.2	53.3	315
11. Video show on Wetland Resources	8.9	27.6	63.5	315
12. Fair/Exhibition	10.8	21.9	67.3	315
13. Folk song	7.0	22.5	70.5	315
14. Quiz competition	2.9	13.0	84.1	315
15. Drawing Competition	0.6	5.7	93.7	315
16. Essay Competition	0.3	3.8	95.9	315
Overall	20.6	37.1	42.2	315

Table: 8a	Distribution	of respondents by	average awareness	score for each	communication	intervention (	(2005)
1 4010. 04	Distribution	or respondents by	average amareness	score for cach	communication	much vention (	(2005)

	Very High (4)-	Average (2)-	Not at all	
MACH Communication Intervention	High (3) %	Very little (1) %	(0) %	Total
1. Courtyard Meeting	67.6	30.8	1.6	315
2. Miking	61.9	33.7	4.4	315
3. Rally	49.8	40.6	9.5	315
4. Important Day Observance	37.8	48.6	13.7	315
5. Live Drama	43.8	40	16.2	315
6. Community Level Meeting	30.5	50.8	18.7	315
7. MACH Project Introductory Meeting	30.5	46	23.5	315
8. Folk song	29.2	42.5	28.3	315
9.Briefing Session for Different Stakeholders	20	43.5	36.5	315
10. RMO petition / gathering	26.4	25.8	47.8	315
11. Video show on Wetland Resources	23.2	28.3	48.6	315
12. Fair/Exhibition	17.1	34	48.9	315
13. TV Program	10.5	32.4	57.1	315
14. MACH Workshop	14	23.5	62.5	315
15. Visits to other sites & networking	16.5	19	64.4	315
16. Environment Education in School	6.7	25.4	67.9	315
17. Drawing Competition	2.9	11.4	85.7	315
18. Essay Competition	1.3	7.9	90.8	315
19. Quiz competition	1.3	6.7	92.1	315
Overall	25.84	31.1	43.06	315

Table: 8b Distribution of respondents by average awareness score for each communication intervention (2006)

#### Effectiveness of MACH communication activities:

Respondents expressed their view on the effectiveness of MACH communication activities. While the reported effectiveness of various communication activities differs quite significantly, the overall effectiveness of MACH communication activities was rated quite low (1.08) by the respondents in the follow up. However, some improvements had been achieved since the baseline (0.52).

Table 9 shows that the project participants perceived a higher level of effectiveness of communication activities than the general villagers. However, the rate of improvement was higher for general villagers from the baseline. The more effective interventions of those considered here were live dramas, miking and courtyard meetings (it may be noted that the survey did not cover children and students so education related activities and materials would not be expected to score highly.

Site	Project Participants			General Villager			Total Average		
5110	2004	2005	Change %	2004	2005	Change %	2004	2005	Change %
Hail Haor	0.88	1.28	45	0.34	0.81	138	0.61	1.15	89
Kangsha-Malijee	0.73	1.31	81	0.35	0.86	147	0.54	1.18	120
Turag-Bangshi	0.59	1.01	73	0.26	0.62	136	0.42	0.9	113
Average	0.73	1.2	64	0.32	0.76	140	0.52	1.08	106

 Table 9a: Effectiveness of MACH communication interventions by site and respondent type (2005 survey)

Table 9b: Effectiveness of M	IACH communication interv	entions by site and	respondent type (2006	survey)
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Sita	Project Participants			General Villager			Total Average		
Sile	2005	2006	Change %	2005	2006	Change %	2005	2006	Change %
Hail Haor	1.28	1.55	21	0.81	0.84	4	1.15	1.35	17
Kangsha-Malijee	1.31	1.46	11	0.86	0.92	7	1.18	1.3	10
Turag-Bangshi	1.01	1.65	63	0.62	0.93	50	0.9	1.44	60
Average	1.2	1.55	29	0.76	0.89	18	1.08	1.36	26

*Effectiveness uses 5-point ladder scale from 0 not at all effective/couldn't understand, to 4 highly effective – changed my opinions. Scoring was not applicable for the respondents who scored zero (0) on awareness about the above communication activities of MACH project.* 

The respondents were also asked to assess the usefulness/effectiveness of various materials produced by the project, considering only those people who were aware of each material, the effectiveness ratings were still relatively low, it would appear that of the materials tried only posters, signboards and educational materials are likely to change people's opinions, along possibly with T-shirts and caps which were appreciated in 2006 by RMO and RUG members (Table 10).

Table 10: Mean score for effectiveness of MACH communication materials by respondents type (with percentag	e
change 2005-2006)	

		RMO		RUG			General Villagers		
MACH Communication Materials	2005	2006	Change %	2005	2006	Change %	2005	2006	Change %
1. Posters (4 types)	2.00	2.33	17	1.70	2.00	18	1.30	1.47	13
2. Folders (2 types)	0.11	0.72	555	0.09	0.28	211	0.07	0.00	-100
3. Booklet	0.26	0.36	39	0.06	0.13	117	0.11	0.04	-64
4. Coat Pin	0.02	0.52	2500	0.02	0.18	800	0.03	0.03	0
5. T-shirt	0.48	1.71	256	0.38	1.46	284	0.26	0.78	200
6. Signboards (4 types)	2.21	1.63	-26	1.91	1.26	-34	1.71	1.81	6
7. MACH Documentary (Bangla)	0.49	1.10	125	0.34	0.59	74	0.13	0.21	62
8. Handbills (3 types)	0.38	0.79	108	0.34	0.40	18	0.18	0.14	-22
9. MACH Cap	1.21	1.92	59	1.08	1.47	36	0.68	0.63	-7
10. Wall Painting	0.08	1.06	1225	0.06	0.97	1517	0.03	0.23	666
11. Education Materials (Wetland Messages)	2.06	1.93	-6	1.78	1.69	-5	1.30	1.10	-5
12. MACH Bag	-	1.03		-	0.73		-	0.10	
13. Newsletters	-	0.43		-	0.18		-	0.00	
14. Leaflets (6 types)	-	1.01		-	0.59		-	0.06	
15. RMO produced leaflets, books & others	-	1.22		-	0.70		-	0.13	
Total	0.85	1.18	39	0.71	0.84	18	0.53	0.52	-2

*Effectiveness uses 5-point ladder scale from 0 not at all effective/couldn't understand, to 4 highly effective – changed my opinions. Scoring will not be applicable for the respondents who score zero (0) on awareness about the above communication activities of MACH project.* 

# **Strategic Objective 6**

Indicator 6.5a: Number of local government (Upazila and Union level) meetings where resource management issues discussed

June 2007

Management of Aquatic Ecosystems through Community Husbandry (MACH)

Strategic Objective 6: Improved Management of Open Water and Tropical Forest Resources								
Intermediate Result 6.5: Improved Institutional Capacity								
Indicator 6.5a: Number of local government (Upazila and Union level) meetings wh	ere resource 1	nanagement	issues					
discussed	TT : A		1 0					
A. Description	Unit of measure: number of							
Precise Definition of Indicator: To be defined		meetings						
Unit of Measure: meeting number								
Disaggregate by: none	Year	Planned	Actual					
Justification/Management Utility: Institutional capacity enhancement, particularly		MACH-I						
at the local level, is critical to improved resource management over the long term.								
R. Plan for Data Collection								
Data Collection Method: site office keeps records of meetings	2000	-						
Data Confection Method. She office keeps feedbas of meetings								
Method of Collection by USAID: reports from Winrock	2001							
Timing/Frequency of Data Collection: semi-annual								
Estimated Cost of Collection: negligible								
Responsible Individual(s) at USAID. Team Leader	2002							
Responsible individual(s) at USAID. Tealli Leader								
C. Data Quality Issues								
Date of Initial Data Quality Assessment: none	2003							
Known Data Limitations (if any): None								
Actions Taken or Planned to Address Data Limitations: N/A	MACH-II							
Date of Future Data Ouality Assessments:								
Procedures of Future Data Quality Assessments:	2004	100	130					
D. Plan for Data Analysis, Reporting, and Review	2005							
Data analysis: comparison with expected meetings as per committee/parishad	2003	100	206					
bylaws								
Presentation of Data: table								
Review of Data: Semi-annual mission portfolio review, individual activity	2006	100	175					
monitoring.								
Reporting Data: Semi-annual report, R4 and CBJ reports.								
	2007		(0)					
E. Other Notes:	2007	-	00					
Notes on the Baselines/Targets: Local level resource management skills were very								
limited at the beginning of the project.								
Location of Data Storage: M:\EGFEpub\Environment\PMP\Data								
Comments: At the RMO level MACH-II has a detailed process and set of indicators								
which quantify and qualitatively assess the performance and capacity of the RMOs.								
This indicator targeted Union and Upazila levels, a process of report cards has been								
developed for the LGC/UFC, while the linkage with Union Parishads is covered by								
indicator 6.5b.								
<b>2004:</b> These meetings were held at the Upazila and Union levels; with 19 at the								
Turog Bangshi site, 52 at the Kangsha Malijhee, and 59 at the Hail Haor site).								
<b>2005:</b> LGC meetings, UP meetings, and Upazila jalmohal committee meetings. For								
consistency this is corrected from the 224 reported in the 2005 annual report, but								
additional special meetings were held involving the set up and establishment of the								
endowment fund.								
<b>2006:</b> These meetings were held at different levels such as Upazila, Union and								
district levels. 175 meetings were held during the period.								
<b>2007:</b> Up to April 2007 a total of 60 meetings were held at different levels.								

#### **Strategic Objective 6: Intermediate Result 6.5:** Improved Institutional Capacity Indicator 6.5a: Number of Local Government meetings where resource management issues discussed and processes institutionalized.

#### Improved Wetland Management Organizational Capacity

**Introduction:** The 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. To achieve sustainable local management of wetland resources, MACH has helped form Resource Management Organizations (RMOs) made up of members from the local user communities of the resource. These resource management organizations manage the natural wetland resources within their locality in a sustainable manner and continue to derive benefits even after the project support is over. The RMOs participate in a co-management setup with local government and manage the resources with local government.

**The RMOs** have been formed for each wetland area where MACH made interventions for restoration, enhancement and conservation of wetland biodiversity and productivity. The RMOs are heterogeneous consisting of people from different social and occupational hierarchies, but all having a stake in the respective wetlands. However, to adopt a pro-poor resource management strategy, higher numbers of poor and fishers are incorporated in the RMOs. As a rule, the target is that each RMO should not have less than 60% of RUG members who are fishers, and not less than 25% women. The respective UP Chairmen are associated with RMOs as adviser.

**Good Practices**: Over the period of the project the RMOs adopted some good practices towards improved management of wetland resources in their respective areas. As of now, the accomplishment of the RMOs in sustainable natural resource management includes:

- Establishment and management of sanctuaries
- Periodical closing of fishing (breeding season)
- Stopping of use of destructive gears for fishing
- Conflict resolution at the community level
- Re-introduction and conservation of locally threatened species
- Preparation wetland resource management plan
- Habitat restoration through re-excavation and tree plantation
- Institutional linkages with UP, UZ and district levels
- Awareness building among the communities about the wetlands

MACH has worked toward institutionalizing these practices and good governance into the RMOs and in developing their linkages and co-management with local government through various local government meetings. MACH has taken up various initiatives and interventions to make each of the RMOs capable so that they can continue to mange their own resources on sustainable manner. The RMOs are linked with RUGs and local government bodies and agencies.

**Sustainability of RMOs** MACH is a process project demonstrating community-based wetland resource management approaches. MACH-II was designed to give the 7 years of support that it was estimated would be needed for building the RMO capacity (although most were actually formed in 2000-2001) while keeping close observation of their performance towards sustainable wetland management. A major focus has thus been on providing support services for building capacity of RMOs in their own operations and governance and in improved management of wetland resources.

#### Organizational aspects of RMO

- Registered with government agencies and have legal status
- Perform regular organizational activities, viz. meetings, group and community actions .
- Have fund flow and financial activities
- Maintain transparent financial management
- Rapport and linkage development with concerned agencies viz. UPs, UZs & district administration and GOB agencies, NGOs and other related bodies

#### Technical aspects of the RMO

- Understand wetland resources management problems and issues
- Skills in identifying problems and making consensual interventions plans
- Capable of implementing wetland management interventions
- Capable of monitor changes in productivity (quality and quantity) due to management interventions
- Capable to generate community awareness about sustainable use of resources

#### Governance aspects of the RMO

- Adopt and practice pro-poor management and benefit distribution of approaches
- Ensure access to wetland resources by the poor and fishers
- Accountable and transparent in all aspects
- Wider acceptance among the communities as their own institutions
- Practice and value participatory decision making for all aspects of management issues

The RMO meets at two levels. The first being the general body consisting of anywhere from 50-300 individuals from the community of the target area. At the second RMO does most of its planning and building capacity through executive committee meetings and training sessions. Decisions and plans are approved by the general body with quite often the Union Chairman is an advisor to this body. Special meetings of the UP are held to secure plans and gain support for the measures to be placed before the local government committee which includes all the UP chairmen, RMO representatives and the Upazila officials including the UFO and the UNO. During the LGC/UFC or Local Government Committee/Upazila Fisheries Committee meetings the resource users, the local elected officials (UP chairmen) and the upazila authorities increase their capacity to manage wetland resources by discussion and planning. Their knowledge and capacity is enhanced through meeting procedures established first by the project and now taken on by them.

This indicator reports on the members of those on the job capacity building experiences (meetings) for local government officials and community based management organization members. Data on the number is maintained in the resolution books of the RMOs, at the sites and also in the MIS of HQ.

Subsequently in late 2004 a detailed monitoring/assessment system for the RMOs was developed which could have been a more comprehensive indicator. Up to early 2007 five rounds of 6-monthly assessments using these indicators had been conducted. The results are summarized in Volume 1 under RMOs, and the full findings were reported separately after each assessment. The purpose is firtstly to help direct the project staff in helping RMOs address gaps in capacity, but this also serves as a way for RMOs to gauge their progress, to also indicate overall RMO capacity and potential sustainability, and is a mechanism that is expected to be adopted increasingly (with simplifications as needed) by the LGC/UFC for reviewing its RMOs. In the last assessment the concerned UFOs played an active part.

#### Indicator 6.5a MACH-I

Site	Upazila	2001	2002	2003	Total
HH	Sreemongol	3	4	2	9
ТВ	Kaliakoir	2	4	2	8
	Jhinaigati	3	4	3	10
KM	Sherpur	3	4	3	10
	Sub-Total	6	8	6	20
Total (3 sites)		11	18	8	37

#### Number of Upazila level Local Government Committee meetings

#### Number of Union Parishad meetings attended by RMO/MACH

Site	RMO	2001	2002	2003	Total
	Sananda	3	6	5	14
	Balla	3	4	5	12
	Dumuria	-	6	4	10
HH	Jethua	-	10	9	19
	Kajura	-	9	7	16
	Agari	-	10	8	18
	Sub-Total	6	45	38	89
	Alua	1	2	4	7
тр	Mokosh	3	4	2	9
ID	Turag	2	5	3	10
	Sub-Total	6	11	9	26
	Takimari-	6	10	5	21
	Dharabashia				
ИМ	Bailsha	6	5	3	14
<b>N</b> IVI	Dholi-Baila	6	9	4	19
	Kewta	10	10	5	25
	Sub-Total	28	34	17	79
Total	(3 sites)	40	90	64	194

#### Number of RMO level meetings

Site	2001		2002		2003		Total	
	EC	GB	EC	GB	EC	GB	EC	GB
HH	72	6	96	12	54	23	222	41
ТВ	12	4	18	6	19	8	49	18
KM	36	7	40	12	24	8	100	27
Total (3 sites)	120	17	154	30	97	39	371	86

#### Indicator 6.5a MACH-II

Site	Upazila	2004	2005	2006	2007	Total
HH	Sreemongol	2	3	3	2	10
	Moulvibazar	-	-	-	1	1
	Sadar					
	Sub-Total	2	3	3	3	11
ТВ	Kaliakoir	3	5	5	2	15
	Jhinaigati	3	3	3	2	11
KM	Sherpur	3	3	2	1	9
	Sub-Total	6	6	5	3	20
	Total (3 sites)	11	14	13	8	46

#### Number of Upazila level Local Government meetings

#### Upazilla Jalmohal management co-ordination meeting

Site	Upazilla	2004	2005	2006	2007	Total
HH	Sreemongol	2	2	2	-	6
	Moulvibazar	-	-	-	-	
	Sadar					
	Total	2	2	2	-	6

Site	RMO	2004	2005	2006	2007	Total
	Agari	7	8	9	2	26
	Ramedia	8	11	10	4	33
	Kazura	4	5	5	1	15
	Jethua	5	3	3	2	13
HH	Borogangina	8	3	0	1	12
	Sananda	11	7	7	2	27
	Balla	6	3	10	6	25
	Dumuria	6	7	10	5	28
	Sub-Total	55	47	54	23	179
ТВ	Alua	5	16	16	8	45
	Mokosh	4	19	15	9	47
	Turag	3	20	16	6	45
	Goaliar	4	22	16	4	46
	Sub-Total	16	77	63	27	183
КМ	Takimari-	13	17	11	2	43
	Dharabashia					
	Bailsha	12	16	11	0	39
	Dholi-Baila	11	17	11	0	39
	Kewta	10	16	10	0	36
	Sub-Total	46	66	43	2	157
Total (3 sites)		117	190	160	52	519

#### Number of Union Parishad meetings attended by RMO

#### Number of RMO level meetings

Site	2004		2005		2006		2007		Total	
	EC	GB	EC	GB	EC	GB	EC	GB	EC	GB
HH	83	34	63	43	72	49	38	14	256	140
ТВ	32	11	32	17	34	8	17	3	115	39
KM	21	17	26	22	27	16	16	1	90	56
Total (3 sites)	136	62	121	82	133	73	71	18	461	235

RESOURCE MANAGEMENT ORGANIZATION'S STRUCTURE AND INSTITUTION LINKAGES



9

### **Strategic Objective 6**

Indicator 6.5b: i) Official circulars for UDCC agenda item and ii) Permission for RMO to attend UP meetings as needed

June 2007

Management of Aquatic Ecosystems through Community Husbandry (MACH)

Strategic Objective 6: Improved Management of Open Water and Tropical Forest Resources						
Intermediate Result 6.5: Improved Institutional Capacity						
Indicator 6.5b: i) Official circulars for UDCC agenda item and						
ii) Permission for RMO members to attend UP meetings as needed	1					
A. Description	Unit of measure: Number of					
Precise Definition of Indicator: Indicator of the extent of institutional linkages	official circulars or letters					
between RMO and Union Parishads and UFC/LGC and UDCC						
Unit of Measure: Number of official circulars or letters	Year	Planned	Actual			
Disaggregate by: N/A		MACH-I				
Justification/Management Utility: Institutional capacity enhancement, particularly						
at the local level, is critical to improved resource management over the long term.	2000					
B. Plan for Data Collection	2001					
<b>Data Collection Method:</b> Winrock and partner staff check minutes and observe						
Tunctioning of LGC						
Data Source(s): minutes of RMOs, UPS and LGC	2002					
Timing/Frequency of Data Collection, semi-annual						
Estimated Cost of Collection, minimal (nort of field staff routing support to						
institutions)	2003					
Besponsible Individual(s) at USAID: Team Leader						
Responsible Individual(s) at USAID. Team Leader	-	MACH-II				
C. Data Quality Issues						
Date of Initial Data Quality Assessment: none to date	2004	1+1 = 2	0+1 = 1			
Known Data Limitations (if any): None						
Actions Taken or Planned to Address Data Limitations: N/A						
Date of Future Data Quality Assessments: none planned	2005	1	1			
Procedures of Future Data Quality Assessments: none			-			
D. Plan for Data Analysis, Reporting, and Review	2006	-	-			
Data analysis: none						
Presentation of Data: text						
Review of Data: Semi-annual mission portfolio review, individual activity						
monitoring.						
<b>Reporting Data:</b> Semi-annual report, R4 and CBJ reports.						
E. Other Notes:						
Notes on the Baselines/Targets: Grantee(s) will establish baseline data. Local level						
resource management skills were very limited at the beginning of the project.						
Location of Data Storage: M:\EGFEpub\Environment\PMP\Data						
Comments:						
2004. I) Official circulars for LIDCC agenda item: N/A This was determined to be						
unnecessary as the UEC was suggested and created by the GoB which is composed						
of essentially the same members						
II) Permission for RMO to attend UP meetings as needed: Permission granted at all						
sites RMOs are attending UP meetings and agreements have been reached at the						
Union level.						
<b>2005:</b> This indicator had two items but it has been reduced to one and this has been						
accomplished. UDCC agenda item change was not required.						
6.5b i) no official circular is required as items will be brought up from the UFC by						
the UFO and the UNO.						
6.5b ii) All the 16 RMOs representatives are attending in the UP meetings and UP						
chairmen are acting as advisers to many of the RMOs.						

This sheet last updated on 30 March 2006

#### **Strategic Objective 6:**

# Indicator 6.5b: Official circulars for UDCC agenda item and permission for RMO members to attend UP meetings as needed

Numerous meetings and workshops took place with the Department of Fisheries regarding the institutional setup most suitable and applicable for the Department to replicate countrywide. It was decided that an Upazila Fisheries Committee (UFC) was to be established to guide fisheries resource management in an Upazila. This committee has the same composition as the MACH LGC with a few additional GoB officers. It was decided that it will not be necessary to change the agenda of the UDCC as it already includes the scope to review issues brought up. It is up to the decision of the UFC (which includes most of the officials in the UDCC) whether an item from the UFC meeting needs to be brought up to the UDCC or whether they just go direct to the District level. An official circular was determined to not be required because of this.

All of the RMOs are sending representatives to the UP meetings and the UP chairmen send out notices to all the RMOs of the meeting time. This has been accomplished in all Unions and RMO members are meeting the UP and the Union Chairmen act as advisers to the RMOs.

# **Strategic Objective 6**

# **Indicator 6.5.c:** UFC formed with charters/GoB orders in place linking local government to resource management organizations

June 2007

Management of Aquatic Ecosystems through Community Husbandry (MACH)

Strategic Objective 6: Improved Management of Open Water and Tropical Forest Resources						
Intermediate Result 6.5: Improved Institutional Capacity						
Indicator 6.5c: UFC formed with charters/GoB orders in place linking local government to resource management						
organizations						
A. Description	Unit of me	asure: Num	ber of UFC			
Precise Definition of Indicator: indicator measures formalization of project based	formed w	ith Governm	ent orders			
LGCs as long-term co-management bodies, initially these were proposed to be		issued				
named Upazila wetland Resource Management Committee, but as part of the	<b>N</b> 7					
development of an Infand Capture Fisheries Strategy government preferred to name	Year	Year Planned Act				
Unit of Massurer Number of LEC formed with Covernment orders issued		MACH-I				
Disaggregate by: none						
<b>Disaggiegate by.</b> none <b>Justification/Management Utility:</b> Institutional canacity enhancement and its	2000					
formal recognition particularly at the local level is critical to improved resource						
management over the long term	2001					
management over the long term.						
B. Plan for Data Collection						
Data Collection Method: attending meetings and receipt of letters	2002					
Data Source(s): Government orders						
Method of Collection by USAID: reports from Winrock						
Timing/Frequency of Data Collection: semi-annual	2003					
Estimated Cost of Collection: none						
<b>Responsible Individual(s) at USAID:</b> Team Leader	MACH-II					
C. Data Quality Issues	2004	1	-			
Date of Initial Data Quality Assessment: none to date						
Known Data Limitations (if any): None						
Actions Taken or Planned to Address Data Limitations: N/A	2005	3	-			
Date of Future Data Quality Assessments: none planned						
Procedures of Future Data Quality Assessments: not considered necessary						
	2006	_	5			
D. Plan for Data Analysis, Reporting, and Review	2000		5			
Data analysis: none needed						
Presentation of Data: copy of orders						
Review of Data: Semi-annual mission portfolio review, individual activity						
monitoring.						
Reporting Data: Semi-annual report, R4 and CBJ reports.						
E. Other Notes:						
Notes on the Baselines/Targets: There were no functioning wetland co-						
management bodies at Upazila level at the start of the project, jalmohal committees						
did not address wider wetland issues and had narrower membership.						
Location of Data Storage: M:\EGFEpub\Environment\PMP\Data						
Comments:						
<b>2004:</b> Name of the co-management organization to remain in place after MACHII						
(UFC/LGC) was debated and changed. Workshops held with the DoF to try to gain						
consensus on the name and the people/position at the local govt level to be on the						
committee. Linked up with the DoF's inland fisheries strategy formulation as a						
means of influencing policy and having LGCs/UFCs recognized.						
<b>2005:</b> The proposal was under consideration of GoB for approval. DG DoF						
forwarded the proposal to MoFL. In the mean time LGCs are increasingly						
functioning as if UFCs. The makeup of the LGC is the same and operation is						
ongoing as if they were UFCs. Dependent on final GoB circular.						
2006: It was agreed with GoB to form 5 UFCs. Government order issued						
establishing endowment funds and ensuring LGCs could continue until UFCs						
established.						
<b>2007:</b> Government order establishing UFCs issued.						

**Strategic Objective 6:** 

# Indicator 6.5c: Upazila Fisheries Committee (UFC) formed with charters/GoB orders in place linking local government to resource management organizations

Five Upazila Fisheries Committees (UFC) have been constituted in the five MACH project Upazilas all in accordance with the Government Order produced by the Ministry of Fisheries and Livestock (MoFL) in January of 2007. These UFCs are now fully functioning committees with all powers to recommend up the chain of command and to help resolve all issues at the local level that may occur. They have also been given distinct terms of reference and operating norms which are being followed and monitored by the project for a further year beyond the end of MACH II.

In January of 2006 the MoFL had approved the Inland Capture Fisheries Strategy, which seeks to establish a UFC in each upazila with essentially the same composition as the UFCs previously LGCs of MACH. This recommendation has further been put in to the action plan of the DoF as well as the program approach to inland capture fisheries management. The next step is for the government to establish UFCs in other potentially important wetlands or inland capture fisheries areas.

In addition the MOFL has approved the establishment of endowment funds in the five MACH upazilas. This endowment fund has restrictions on its use and this has all been stated in the order issued in early 2006. Essentially the endowment principle cannot be touched and only the interest can be used for wetland resource management use. Interest from these endowments will start to become available in 2007-2008 for two of the sites but not until 2008-2009 for Hail Haor site.

Any policy matter requiring Upazila level administrative approval or onward transmission for further action can now be placed before the Upazila Development Coordination Committee (UDCC) by the UFC or sent directly to the district or to the respective ministries. For general matters of execution the UNO with the UFC members will take decisions and or pass matters directly to the District Committee if required.

#### Government of the People's Republic of bangladesh Ministry of Fisheries & Livestock Mish-3 Section

#### No. MPM/M-3/MACH-1/2002(Part)/12 16/01/2007

For the management and overall supervision of the Resource Management Organizations-RMOs, Federation of Resource Users Groups – FRUGs, Endowment Fund, Wetland resource management & maintenance etc. in Kalikaoir Upazila of Gazipur district, Sherpur sadar and Jhenaigathi Upazila of Sherpur district and Moulvibazar sadar and Sreemangal Upazila of Moulvobazar dictrict under MACH (Management of Aquatic Ecosystems through Community Husbandry) project Upazila Fisheries Committee- UFCs are formed in place of existing Local Government Committee –LGC:

#### 1. Composition of UFC:

UFC is comprised of the following officials and formed vide circular no. gcg/g-3/gvP-1/2002(Ask)/12 dated 16-01-2007 of the MoFL:

#### Members of the Committee:

1) Upazila Nirbahi Officer	Chairperson
2) Assistant Commissioner (Land)	Member
3) Upazila Agriculture Officer	Member
4) Upazila Livestock Officer	Member
5) Upazila Engineer (LGED)	Member
6) Upazila Social Service Officer	Member
7) Upazila Youth Development Officer	Member
8) Upazila Education Officer	Member
9) Assistant Conservator of Forests	Member
10) Officer in Charge, Concerned Thana	Member
11) Upazila Co-operative Officer	Member
12) Chairmen of concerned Union Parishads	Member
13) One representative from each RMO and FRUG	Member
14) Two women representatives on behalf of all RMOs and FRUGs	Member
15) One representative of NGOs active in wetlands in the Upazila (if any)	Member
16) Sr./Upazila Fisheries Officer	Member-
	Secretary

#### 2. TOR of UFC:

#### **Resource management**

- 1) Monitor and review activities of FCBOs and other waterbody custodians and lessees through meetings and visits to Jalmohals and other wetland areas to ensure their proper management and functioning ;
- 2) Recommendation for extension of lease time subject to proper management of Jalmahals by FCBOs.
- 3) Recommendation for cancellation of lease of Jalmohal where the FCBO is found to be in breach of its management plan or not to be functioning effectively in the interests of fishers.
- 4) Ensure demarcation of Jalmahals managed by/through FCBOs.
- 5) Advise on and encourage sustainable levels of fishing and other wetland uses by fishers and others following approved management plans, including any appropriate national rules and legislation.
- 6) Where possible assist in providing training to the members of FCBOs.
- 7) Approve short and long term management plans made by FCBOs.
- 8) Maintain an inventory of wetland resources and fisher communities.

#### **Coordination**

- 1. Ensure coordination of the management plans and general activities of the different FCBOs and resolve any disputes between FCBOs or with other wetland users.
- 2. Ensure that no public or private development activities are undertaken that result in loss or degradation of wetlands and fisheries such as drainage, blocking of water flows, pollution, etc.
- 3. Assist FCBOs to resolve issues and problems regarding their activities.
- 4. Form Sub-Committees as needed for any special activities for relevant work for wetland resource management, supervision, etc.
- 5. Hold at least one meeting in a quarter and circulate minutes of the meeting to the respective people (including all FCBOs recognized in the Upazila and UDCC).
- 6. Unresolved intersectoral and policy issues are to be raised in UDCC meeting for resolution.
- 7. Keep informed the concerned Deputy Commissioner and District Fisheries Officer of the activities of the Committee.

#### <u>Funds</u>

- 1) Access UDCC funds for fishery and wetland management and where possible provide financial assistance to FCBOs for implementing their activities.
- 2) Where FCBOs operate micro-credit funds, ensure proper utilization of that micro-credit by reviewing progress of their operations and advising the FCBOs as needed.
- 3) Where available and established, ensure proper disbursement, use, management, and safety of Upazila Wetland Endowment Fund for the UFC and FCBOs

(Anal Chandra Das) Senior Assistant Secretary Phone:7170052

Distribution:

- 1. Secretary, Finance Division, Ministry of Finance, Bangladesh Secretariat, Dhaka.
- 2. Secretary, Ministry of Land, Bangladesh Secretariat, Dhaka.
- 3. Secretary, Ministry of Agriculture, Bangladesh Secretariat, Dhaka.
- 4. Secretary, Ministry of Fisheries & Livestock, Bangladesh Secretariat, Dhaka.
- 5. Secretary, Local Government Division, Ministry of Local Government, Rural Development & Cooperative , Bangladesh Secretariat, Dhaka.
- 6. Secretary, Ministry of Youth & Sports, Bangladesh Secretariat, Dhaka.
- 7. Secretary, Environment and Forest, Bangladesh Secretariat, Dhaka.
- 8. Secretary, Ministry of Homes, Bangladesh Secretariat, Dhaka.
- 9. Director General, Department of Livestock, Dhaka
- 10. Director General, Department of Fisheries, Matsya Bhaban, Dhaka
- 11. Director General, NGO Affairs Bureau, Matsya Bhaban, Dhaka
- 12. Deputy Commissioner, Moulvibazar/ Sherpur/ Gazipur.
- 13. District Fisheries Officer, Moulvibazar/ Sherpur/ Gazipur.
- 14. Upazila Nirbahi Officer, Kaliakoir, Gazipur/ Sherpur sadar, Jhenaigathi, Sherpur/ Moulvibazar sadar, Sreemangal, Moulvibazar.
- 15. Senior Upazila Fisheries Officer/ Upazila Fisheries Officer, Kaliakoir, Gazipur/ Sherpur sadar, Jhenaigathi, Sherpur/ Moulvibazar sadar, Sreemangal, Moulvibazar.
- 16. Mr. Darrell L. Depprt, Chief of Party, MACH Project, House No.2 (2<sup>nd</sup>, 3<sup>rd</sup> & 4<sup>th</sup> Floor), Road no. 23/A, Gulsha-1, Dhaka-1212.
- 17. Project Director, Investment Support to MACH Project, House No.2, Road No. 23/A, Gulshan-1, Dhaka-1212.

# **Strategic Objective 6**

# **Indicator 6.5d:** Trust Fund established for Institution June 2007

Management of Aquatic Ecosystems through Community Husbandry (MACH)

Strategic Objective 6: Improved Management of Open Water and Tropical Forest Resources					
Intermediate Result 6.5: Improved Institutional Capacity					
Indicator 6.5d: Trust Fund established for Institution					
A. Description	Unit of measure: Number of				
Precise Definition of Indicator: To be defined	Trust Fund established				
Unit of Measure: Number of Trust Fund established					
Disaggregate by: N/A	Year	Planned	Actual		
Justification/Management Utility: Institutional capacity enhancement, particularly at the		MACH-I			
local level, is critical to improved resource management over the long term.					
	2000				
B. Plan for Data Collection					
Data Collection Method: fund transfers to endowment accounts	2001				
Data Source(s): Winrock accounts					
Method of Collection by USAID: Reports from Winrock					
Timing/Frequency of Data Collection: semi-annual	2002				
Estimated Cost of Collection: none					
Responsible Individual(s) at USAID: Team Leader					
	2003				
C. Data Quality Issues					
Date of Initial Data Quality Assessment: none	MACH-II				
<b>Known Data Limitations (II any):</b> None Actions Taken on Planned to Address Data Limitations: N/A		_			
Actions Taken or Planned to Address Data Limitations: N/A	2004	_	_		
Date of Future Data Quality Assessments: none	2001				
Procedures of Future Data Quality Assessments: none					
D. Plan for Data Analysis, Panarting, and Paviaw	2005	1	Dart*		
Data analysis: N/A	2003	-	1 411		
Data analysis. 10/A Presentation of Data: table					
<b>Review of Data:</b> Semi-annual mission portfolio review individual activity monitoring	2006		2**		
<b>Reporting Data:</b> Semi-annual report R4 and CBI reports	2000	-	3		
E. Other Notes:	2007		2***		
Notes on the Baselines/Targets: there have never been any endowments for natural	2007		2		
resource management by co-management bodies in Bangladesh before.					
Location of Data Storage: M:\EGFEpub\Environment\PMP\Data					
Comments:					
<b>2004:</b> Discussed in Steering Committee meeting and approved conditionally on the PP					
being approved with the change. This was dependent on GoB approval of the ISM fund					
use for this and their approval on the fund being set aside as a trust fund or endowment.					
2005: Legal document for operating the fund was submitted to MOFL, DOF agreed to it in					
principle. They approved the use of local currency funds from ISM for this purpose as the					
revised PP was approved with the endowment funds allocated.					
As the funds from this will not accrue until a year after its establishment, agreement was					
reached in the Steering Committee to place project funds with the LGCs so that they could					
operate in the same way as the endowments. All LGCs were oriented. This was in place in					
November 2005.					
<b>2006:</b> A detailed circular or government order on operation guideline of Endowment					
Fund was issued by the MoFL in January 2006. With the availability of fund in ADP					
FDRs of respective amounts were opened for 3 Upazilas and remaining to be placed					
subject to the availability of fund in ADP for the other 2. A second year of LGCs					
operating project funds in the same way as endowment interest started.					
<b>2007:</b> ADP to be available for remaining 2 upazilas from August of 2007. A total of 5					
Upazilas one more than the target will be fully endowed by September 2007.					

\* Trust Fund/Endowment has been established through circular of the Government of Bangladesh.

\*\* Fund placed for 3 Upazilas, but because of ADP fund constraint funds for the other 2 Upazilas were not placed

\*\*\* Fund will be placed for the remaining 2 Upazilas after the 2007-08 ADP allocation is approved.
## Indicator 6.5d: Endowment Fund (Trust Fund) established for Institutions

To make the Upazila Fisheries Committee (UFC) functional and operationally effective after the exit of the MACH project, a provision of endowment funds in each of the 5 Upazilas is being considered. The principal amount is not available for use, only the interest from the principal. The funds from the interest will be used for the organizational expenses, physical development and management of resources by the RMOs and the management of the permanent sanctuaries. This proposal was placed in the Steering Committee meeting of July 2004 and the committee agreed in principle conditionally on approval of the revised PP. Approval has now been received in the revised PP. A detailed operational manual has also been issued by the Ministry of Fisheries & Livestock in January 2006.

The process of developing a government order with details of the operation of the endowment fund involved consultations with site based stakeholders and Ministry of Fisheries and Livestock. Approvals by the local committees and the local government all the way up to Ministerial level.

The Minister for Fisheries and Livestock approved the order in January 2006 and it has been issued. The bank accounts for the endowment fund are opened in 3 of the 5 Upazilas and the remaining two will be opened in 2007. Meanwhile from September 2005 the LGCs have been operating using grant funds for the same purposes and procedures as if this was the income from the endowment. In this way the project was running trial operations of the endowment income funds – bank accounts have been opened by the concerned Upazila officers in each site, processes have been developed and followed for the RMOs to propose small schemes for funding and for LGC to review and approve those. Also the LGCs are managing their own operational budgets.

After issuance of the circular on operation guideline, Endowment Fund has been placed for three UFCs namely Kaliakoir, Sherpur sadar and Jhenaigathi. In 2007-2008 these UFCs will start using the income (accrued interest) from the Endowment Fund. Fund for Sreemangal and Moulvibazar UFCs will be placed as soon as fund will be released by the government for the year 2007-2008. It is expected that by September 2007 fund will be available for them. The accrued interest will be available for the remaining two at the beginning of 2008-2009. Trial EF will be provided to Sreemangal and Moulvibazar UFC to continue their management activities which were supposed to be carried out under EF for the year 2007-08 only. From July 2008 onward they will be able to use earned interest of the EF. RMOs have been implementing wetland management from the trail funds, which has built their capacity.



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