IMPACT OF COMMUNITY BASED MANAGEMENT APPROACHES ON FISHERY RESOURCE DIVERSITY OF SEVEN FLOWING RIVERS IN BANGLADESH

October 2007

WorldFish
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IMPACT OF COMMUNITY BASED MANAGEMENT APPROACHES ON FISHERY RESOURCE DIVERSITY OF SEVEN FLOWING RIVERS IN BANGLADESH

BOOKLET 7

Prepared by M. G. Mustafa

Edited by Malcolm Dickson

Coordination Md. Muzaffar Ahmed

Title of Project
Community Based Fisheries Management Phase 2

SEPTEMBER 2007

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ABSTRACT

In 1997 the Community Based Fisheries Management Project started a fish catch monitoring study in seven rivers to examine the impact of co-managed approaches on production and species diversity. The study covered fishing activities, fisher's participation, gear-diversification, changes in fishing pattern and overall catch and effort. The study aimed to understand the importance of fisheries resources and explain how community based fisheries management ensures future sustainability of fisheries resources in river systems. Analysis of the results shows that production and species diversity increased over the years due to a management approach that encourages participation of the fishers, beneficiaries and community in managing renewable fishery resources. The study was carried out in the rivers Titas (G-G part), Titas (Ka-part), Kali nodi, Arialkha, Dhaleswari, Ubdakhali and Moisherkandi-Boronpur. Full time professional fishers were dominant in most of the selected rivers. The main categories of gear comprised gill nets, seine nets, traps, cast nets and push nets which harvested most of the main species. The maximum diversity of species occurred in Titas-ka (90 species), followed by Ubdakhali (86 species), Kali nodi (84 species), Arialkha (78 species), Titas G-G (69 species), Moisherkandi (65 species) and Dhaleswari (62 species). Seventeen species namely; *Gudusia chapra*, *Puntius sophore*, *Corica soborna*, *Nematopalaemon spp*, *Nandus nandus*, *Labeo rohita*, *Chanda ranga*, *Mastacembelus pancalus*, *Glossogobius giuris*, *Puntius ticto*, *Mastacembelus armatus*, *Ailia coila*, *Mystus tengara*, *Macrobarchium villosimanus*, *Salmostoma bacaila*, *Wallago attu* and *Xenentodon cancila* contributed the major proportion of overall catches. Estimated MSY for the rivers Titas (G-G part), Titas (Ka-part), Kali nodi, Arial Kha, Dhaleswari, Ubdakhali and Moisherkandi-Boronpur were estimated at 68.0, 73.0, 163.0, 16.0, 46.0, 35.0 and 33.0 tons respectively. The corresponding fishing efforts (f_{msy}) were 3798, 7844, 15571, 12419, 30691, 8727 and 8976 gear day's year^{-1} respectively. The study also traced multiple positive impacts contributing directly towards poverty eradication, food and nutritional security, and sound management of inland fishery resources.

1. INTRODUCTION

Bangladesh is the drainage outlet for a vast river basin complex made up of the Ganges-Brahmaputra-Meghna River system. The inland open waters of Bangladesh include rivers, canals, depressions (beels), floodplains and reservoirs covering about 4.5 million hectares and have created one of the richest fisheries in the World. The livelihoods of the local people depend to a large extent on the productivity of the natural system. Small scale fisheries are a lifeline to these subsistence communities (Silvius *et al,* 2000). Fish assemblages in rivers are highly complex and the number of species in a river is strongly correlated with its basin area. As fishing effort increases characteristic and predictable changes occur in the fish assemblage which has strong implications for sustainability and management (FAO, 1997). Biologically it is very difficult to judge the exploitation level of a multi species fisheries where the same level of catch may be sustained over a wide range of effort but where characteristic changes occur in exploited fish assemblages whereby the larger species and individuals are progressively eliminated from the fishery and there is a resulting downwards drift in the size of fish caught (FAO, 1997). There are 260 indigenous species of finfish in these freshwater habitats (Rahman, 1989). Rural families in Bangladesh consume more than 56 to 73 species of indigenous fish over the course of a year. So they can rely on a wide variety of fish species to get their nutrition (Minkin, 1993). The present paper was prepared based on catch and effort data during 1997-2002 for seven flowing rivers (Mustafa, 2003). The study covered fishing activities, fisher's participation, gear diversification, changes of fishing pattern and overall catch and effort data analysis. Fishers were classified into three categories: i) full time fishers, ii) part time fishers, and iii) subsistence fishers. Gears operated in the river can be broadly classified into: i) gill nets, ii) seine nets, iii) lift nets, iv) push nets, v) traps, hook and lines, vi) long lines and spears. Other fishing methods are also practiced by the local community such as Khata fishing (fish aggregating devices), hand picking, hand line and catching fish juveniles with fine mesh nets.

This paper presents information based on catch and effort data collected over the period 1997-2002, in 7 rivers. The study suggests that there are many positive impacts resulting from the sound management of inland fishery resources through community involvement that directly contribute to poverty reduction, food and nutritional security. It also includes suggestions for ways to improve management interventions so that the resources can be exploited sustainably.

1.1. Management approach and status

Partner NGOs have helped the fishers to develop River Management Committees (RMCs) for fishery resource management. RMCs were formed in all seven rivers through election of members by stakeholders. The RMCs in the seven rivers developed their own resource management plans and rules. Committees have generally adopted simple conservation-based measures under the CBFM (Table 1).

Table 1   **Management interventions under the Community Based Fisheries Management Project**

Name of water body	Management status under CBFM project					
	Closed season	Closed area	Gear/fishing restriction	Habitat restoration	Sanctuary	Approaches
Titas Nodi (Gokon-Goshaipur) JR	May-July	Fishing restriction around fish sanctuary	Monofilament gill net restriction	Some fish aggregating devices withdrawn	Sanctuary of 0.4 ha established in 2003	Fisher Managed Fishery (RMC)
Titas Nodi (Ka)	May-July	Fishing restriction around fish sanctuary	Monofilament gill net restriction	Some fish aggregating devices withdrawn	Sanctuary of 0.4 ha established in 2003	Fisher Managed Fishery (RMC)
Kali Nodi JR	May-July	Fishing restriction around fish sanctuary	Restricted khata Monofilament gill net restriction	Some fish aggregating devices withdrawn	Sanctuary of 1.2 ha established in 2002	Fisher Managed Fishery (RMC)
Arialkha-Gangajoli River	May-July	Fishing restriction around fish sanctuary	Monofilament gill net restriction	Link canal excavated	Two sanctuaries of 0.4 ha established in 2003	Fisher Managed Fishery (RMC)
Dhaleswari Nodi JR	May-July Closed season not adopted	Fishing restriction around fish sanctuary	Monofilament gill net restriction	Some fish aggregating devices withdrawn	Sanctuary of 0.4 ha established in 2003	Fisher Managed Fishery (RMC)
Moisherkandi-Boronpur River	May-July	Fishing restriction around fish sanctuary	Monofilament gill net restriction	Some fish aggregating devices withdrawn	Four sanctuaries of 1.2 ha established in 2002/2003	Fisher Managed Fishery (RMC)
Ubdakhali nodi Jalmahal	May-July	——	——	——	Sanctuary not established	Fisher Managed Fishery (RMC)

RMC: River Management Committee

2. MATERIALS AND METHODS

2.1. The study areas

The water bodies (seven flowing rivers) selected for the present study and the status of River

Management Committees (RMC) are given in Table 2.

Name of WB	District	Type of WB	PNGO	Area (ha) min-max	RMC formed	RMC Members	Total beneficiary
Titas Nodi (Gokon-Goshaipur) JR	B. baria	River	PROSHIKA	185-215	Mar' 03	26	♂=180, ♀=98
Titas Nodi (Ka)	B. baria	River	PROSHIKA	350-425	Mar' 03	30	♂=166, ♀= 165
Kali Nodi JR	Kishorganj	River	PROSHIKA	800-1200	June' 02	30	♂=231, ♀=218
Arialkha-Gangajoli River	Kishorganj	River	CRED	100-150	Feb' 03	18	♂=315
Dhaleswari Nodi JR	B. baria	River	PROSHIKA	550	Jul'02	30	♂=817, ♀=63
Moisherkandi-Boronpur River	Kishorganj	River	PROSHIKA	127	Aug'02	23	♂=225
Ubdakhali nodi Jalmahal		River	CARITAS	50-68		12	♂=146, ♀=121

RMC=River Management Committee, PNGO= Partner NGO

Titas river (G-G part): The river is located in Nabinagar Upazilla of Brahmanbaria district. It is a flowing river and as such fishers have free access to exploit fisheries resources. A catch monitoring survey was conducted in the Goshipur to Gokornaghat section of the river.

Titas Ka: Titas is a secondary river which meanders through Brahmanbaria district and is linked with the Meghna river. For revenue purposes it was subdivided into several blocks, of which Block Ka (Brahmanbaria Sadar) is one. There are 19 villages along the 10 km of this block, including several traditional Hindu fishing villages. This is a flowing river where there is free access for fishing. Fishing pressure has been increasing mainly through the construction of fish aggregating devices by non-traditional fishers. Another notable problem is the construction of bamboo fence-trap systems in khals between the river and floodplains which catch brood fish at the beginning of the monsoon.

Kali nodi: Kali Nodi is located in Gazaria and Shadarpur union of Bhairab and Kuliarchar thanas of Kishoreganj district. The river is linked with the Ghora-utara and Meghna rivers. It is about 8 km long; extending from Manikdi to Mahandipur Tek. Kali nodi is a large open link channel of the river Meghna.

Arial Kha: This is a flowing river in Monohardi Thana of Narshingdi District. The 15 km long section of this river is officially 150 ha in area but it partly dries up during the winter season. This section of river was leased out by the district administrator prior to the change to open access in 1995 and the lessee usually used hired fishers from outside and took a share of the catch from them. The ecosystem of this river supports many species of fish and prawns. The river is now open access.

Dhaleswari: This river divides two districts, Brahmanbaria and Kishoreganj in north-east Bangladesh. It flows along the north side of Nasirnagar Thana. The river covers approximately 715 ha in the monsoon and 666 ha in the dry season. A large floodplain connects with this river on the north under Austagram Thana in Kishoreganj district and a dead river "Mongla khal" is connected with the river. Before 1995, the river was leased out to the highest bidder. Since 1995, open access has been established in this river which has caused an increase in the numbers of *katha* (fish aggregating devices) built by local farmers. Catch monitoring data from the adjacent Patuni beel was also incorporated for analysis.

Moisherkandi-Boronpor river: This is a section of the Ghora Utra river which flows into the river the Meghna. It flows past Mithamoin Thana in Kishoreganj district and covers about 127 ha. Since it is within a *haor* area, the surrounding area remains under water for around six months of the year. The river was controlled by local influential persons. In 1995, along with all other flowing rivers, this river was declared

to be open access and free of revenue collection. It was reported that local fishers have been able to manage and retain their control of the river for fishing. Traditional fishers use fine mesh seine nets to catch juvenile fish. The number of fishers has increased.

Ubdakhali river: Ubdakhali is a flowing river in Kalmakanda Thana, Netrokona district in northern Bangladesh. The total area of the river section is about 60 ha including a small beel "Hogla Beel" adjoining the river. A small part of the river dries up during the dry season. It was reported that over fishing and fishing during breeding periods are common practices in this river.

Catch monitoring and gear survey
Fishing activity was observed for four to eight days per month, per site, continuously for 72 months. Gear surveys involved a regular spot survey for a sample of gears in operation, and the total catch from each gear type. A gear census covered the number and types of gear operating in the study sites. Species-wise catch statistics for each gear type were also recorded.

The average number of gear units per day was used to estimate total gear-wise fishing effort for that month as well as for the whole year. Mean gear-wise catch rate was used to estimate total catch for that month, as well as for the whole year.

Year-wise as well as gear-wise overall species distributions were calculated from catch statistics. Overall production was estimated by summing all estimated production for all gear types in each year.

Khata (Fish aggregation device) census
A census of all *khatas* in the study sites was undertaken from 1997 to 2002. Data, including information on species composition and abundance, were collected from fishers during the harvest season. Annual catches from *khatas* were based on the total seasonal harvest and expressed as catch per hectare of *Khata* per year.
The surplus production model of Schaefer (1954) was used to estimate Maximum Sustainable Yield (MSY) and corresponding fishing effort (f_{msy}).

Gear characteristics
Various types of fishing gear are used in inland open water bodies of Bangladesh. Their specification varies according to target species, type of water body, labour intensity, fabrication, cost, available materials and profitability. There are more than 100 types of fishing gear used by professional fishermen communities. Cast nets, spears, lift nets and gill nets are operated both day and night. Trap units, long-lines and hook and lines are operated only at night time while push nets and seine nets are operated only during the daytime. The operation of spears and lift nets are occasional and seasonal. The most common gears in operation in flowing rivers are given in Table 3.

Table	3	Most commonly operated fishing gears in river fisheries in Bangladesh

Name of gears	Local Bengali names used in different districts of Bangladesh
Gill net	Pata Jal, Fash Jal, Poa Jal, Current Jal, Dacon Jal
Seine net	Ber jal, Jagat ber jal, Moia jal, *Khata* ber jal, Gamcha jal
Set bag net	Bada jal
Lift net	Bheshal jal, Dharma jal
Cast net	Utar jal, Khepla jal, Toira jal, Jhaki jal
Push net	Thela jal, Hanga jal
Trap	Kholsun, Anta, Polo, Charai, Ghuni, Fala, Bair
Long-line	Chara Barshi, Taja Barshi
Hook and Line	Barshi, Dati Barshi, *C. striatus*a borshi
Spear	Achra, Aro, Jutya, Koch, Teta
Others	Bana, *Khata*, Kua, by Hand

3. RESULTS AND DISCUSSION

3.1. Titas river (G-G part)

3.1.1. Main species and gear efficiency

The main fishing gears operated in the river Titas (G-G part) are not selective gears, that is they catch most of the fish species present in the river. These species are subject to high fishing pressure. In contrast to this, selective gears such as hook and line and spears catch only a few target species. The main species caught by each gear are presented in table 3.1:

Table 3.1 Composition (%) of main species caught by all gear types in the river Titas G-G part

Gill net	Seine net	Set Bag	Small lift	Cast net	Trap	Spear	Hook & line	Push net	*Khata* catch
P. sophore	*C. soborna*	*P. sophore*	*G. chapra*	*G. chapra*	*M. villosimanus*	*M. armatus*	*C.marrulius*	Small prawn	*M. tengra*
N. nandus	*G. chapra*	*N. nandus*	*P. sophore*	*L. rohita*	*M.aculeatus*	*C.marrulius*	*W. attu*	*P. ticto*	*W. attu*
M. pancalus	Small prawn	*C. ranga*	*C. ranga*	*P. sophore*	*M.rosenbergii*	*M. pancalus*	*M. armatus*	*M.aculeatus*	*C. marrulius*
H.fossilis	*P. sophore*	*M. tengra*	*M. tengra*	*N.notopterus*	*P. sophore*	*C. striata*	*G. giuris*	*C. fasciatus*	*L. rohita*
M.seenghels	*L. rohita*	*X. cancila*	*B. batasio*	*M.seenghels*	*M.seenghels*	*Nemacheilus sp*	*O. bimaculatus*	*Chanda sp*	Small prawn
G. chapra	*X. cancila*	Small prawn	*C. fasciatus*	*W. attu*	Small prawn	*M.bleekeri*	*C. punctatus*	*P. sophore*	*M.seenghels*
G. giuris	*C. ranga*	*M.aculeatus*	*M.aculeatus*	*M. bleederi*	*M. tengra*	*M.aculeatus*	*H.fossilis*	*G. giuris*	*N. notopterus*
L. rohita	*M.aculeatus*	*Mystus sp*	*Chanda sp.*	*M. armatus*	*M.malcolmsonii*	*N. nandus*		*M.pancalus*	*C. striata*
M. tengra	*W. attu*	*M. pancalus*	*O. pabda*	*M. pancalus*	*M. armatus*	*H.fossilis*		*N. nandus*	*M. armatus*
W. attu	*Chanda sp.*	*G. chapra*	*X. cancila*	*M. tengra*	*Nemacheilus sp*	*G. giuris*			*P. sophore*

A total of 69 species of fish/prawn was recorded during the study period (1997-2002). *C. soborna* was the most common species followed by *P. sophore*, *G. chapra* and Small prawn. The contribution of *Chanda spp* in the catch increased gradually in 2001. The contribution of *Labeo rohita* declined gradually up to 2001 but increased in 2002. Catches of *C. soborna* showed a declining trend from 1997, which suggests overexploitation of this species.

3.1.2. Changes in catch composition and diversity

Among the most dominant species, six species; *Gudusia chapra*, *Puntius sophore*, *Nandus nandus*, *Mystus tengra*, *Mystus armatus* and *Glossogobius giuris* showed positive catch trends representing 35.07% of catches. Three species; *Chanda spp.*, *M. aculeatus* and *Notopterus notopterus* showed stable trends with a combined contribution of 9.75% and seven species; *C. soborna*, small prawn, *Labeo rohita*, *X. cancila*, *W. attu*, *Chanda ranga* and *M. pancalus* showed negative trends with a combined contribution of 32.99% towards the catch. *C. soborna* was the species with the highest contribution towards catches in 1997 and 1998, and was the 2nd most dominant species in 1999, however catches gradually decreased so that it appeared as the 6th most common species by the end of the study period. Among the dominant species, *G. chapra* and *P. sophore* together contributed about 23% of total production during 1997 to 2002 which confirmed their presence as ecologically successful species. The percentage compositions of catches of the main species from 1997 to 2002 are presented in Table 3.2.

Table 3.2 Composition (%) of main species caught by all gear types in the river Titas G-G part

Fishes	1997	1998	1999	2000	2001	2002	Overall	Annual trend
G. chapra	12.35	9.95	9.52	14.05	16	10.59	11.94	Slowly increasing
P. sophore	4.14	9.7	15.79	12	12.05	9.08	10.94	Slowly increasing
C. soborna	16.23	14.96	14.53	7.3	6.85	4.47	9.69	Sharply-decreasing
Small prawn	7.57	7.83	7.34	5.27	7.79	5.7	6.85	Decreasing

Fishes	1997	1998	1999	2000	2001	2002	Overall	Annual trend
N. nandus	5.3	2.92	4.1	6.38	4.77	6.96	5.11	Increasing
L. rohita	8.85	8.03	2.89	3.44	2.14	6.54	5.11	Decreasing
Chanda spp	2.86	3.4	6.69	7.61	5.23	1.87	4.44	Steady
X. cancila	4.91	3.9	2.63	4.73	3.79	3.3	3.71	Decreasing
M. aculeatus	3.44	3.19	3.52	3.55	5.49	1.47	3.33	Slowly decreasing
W. attu	6.21	2.32	3.21	3.62	3.01	3.48	3.31	Decreasing
M. tengra	0.93	2.12	5.11	4.21	1.86	1.9	2.70	Slowly increasing
C. ranga	1.73	6.3	0.16	0.98	1.52	2.73	2.48	Decreasing
M. armatus	1.29	0.48	4.46	2.46	3.49	1.99	2.41	Increasing
N. notopterus	1.69	3.23	1.34	1.56	1.99	1.69	1.98	Slowly decreasing
G. giuris	1.9	0.64	2.08	2.52	3.1	1.78	1.97	Increasing
M. pancalus	2.24	1.44	3.05	1.63	1.09	1.97	1.84	Decreasing
Others	18.36	19.59	13.57	18.69	19.83	34.48	22.17	Increasing

3.2. Titas Ka

3.2.1. Main species and gear efficiency

The main fishing gears operated in the river Titas Ka are not selective and harvested most of the available species in the river. Some species are caught selectively by different gears such as hook and line and spear. The main species contributed by each gear are presented in table 3.3.

Table 3.3 Composition (%) of main species caught by all gear types in the river Titas Ka part

Gill net	Seine net	Lift net	Push net	Long line	Hook & line	Spear	Set Bag net	*Khata* catch
N. nandus	Small prawn	Small prawn	*M.malcolmsonii*	*C.punctatus*	*M. armatus*	*M. armatus*	*P. sophore*	*C. marrulius*
A.testudineus	*M. puncalus*	*C.marrulius*	Small prawn	*M. seenghels*	*G. giuris*	*C .marrulius*	*G. chapra*	*W. attu*
P. sophore	*P. sophore*	*L. rohita*	*C.punctatus*	*C. garua*	*W. attu*	*M. malcolmsonii*	*C. punctatus*	*Mystus sp*
B. badis	*C. soborna*	*P. sophore*	*M. pancalus*	*W. attu*	*M. pancalus*	*M. puncalus*	Mixed fish	*C. striata*
C .punctatus	*G. chapra*	*C.ranga*	*P. sophore*	*M. armatus*	*M. seenghels*	*N. nandus*		*N. notopterus*
G. chapra	*M. tengra*	*G. chapra*	Mixed fish	*N. notopterus*	*M. tengra*	*Nemacheilus sp*		*L. rohita*
M. tengra	*C. ranga*	*W. attu*	*C.ranga*	*A. aor*	*N. nandus*			*B.batasio*
A. aor	*Chanda sp*	*M. tengra*	*C. marrulius*	*G. giuris*	*C .punctatus*			*M. bleekeri*
M. armatus	*G. giuris*	*N. notopterus*	Small fish	*H.fossilis*	*C. striata*			*A. aor*
N. notopterus	*S.bacaila*	*C. striata*	*C .faciatus*	*N. nandus*	*N .notopterus*			*L. gonius*

3.2.2. Changes in catch composition and diversity

The common species caught by all types of gears were small prawn, *P. sophore*, *C. soborna*, *G.chapra*, *Mastacembelus pancalus* and *L. rohita* representing 11.02%, 7.79%, 7.36%, 7.31%, 6.13% and 5.05% of catches respectively. Annual catch analysis revealed that the 18 main species contributing the maximum proportion of the catch and all together contributed 76.23%, 89.07%, 95.46%, 65.78%, 90.3% and 85.02% for the years 1997 to 2002 respectively. There was an increasing trend in catches of *Chanda spp* over the study period. The percentage compositions of main species from 1997 to 2002 are presented in Table 3.4. *M. pancalus* and *M. malcolmsoni* were the highest contributing species in 1997. The contribution of *M. pancalus* and *M. malcolmsoni* declined gradually. Among the major contributing species there were fluctuations in abundance species over the study years.

Table	3.4	Percentage composition of main species caught by all gears in the river Titas Ka.							
Name of species	1997	1998	1999	2000	2001	2002	Overall	Annual trend	
Small prawn	9.94	16.13	14.03	3.59	15.59	10.2	11.03	Slowly decreasing	
P. sophore	9.69	7.89	7.00	6.72	8.02	8.36	7.79	Steady	
C. soborna	3.30	7.87	14.31	1.12	12.96	7.98	7.36	Slowly increasing	
G. chapra	2.43	6.53	5.74	2.61	13.96	15.99	7.31	Sharply increasing	
M. puncalus	12.37	7.34	6.43	4.44	4.03	3.57	6.13	Decreasing	
L. rohita	1.93	15.05	8.10	0.89	1.18	3.61	5.05	Fluctuating, decreasing	
M. tengra	5.07	3.95	3.67	6.14	5.34	4.72	4.93	Steady	
Chanda sp	3.82	10.0	14.54	0	0.08	0.07	4.48	Sharply decreasing	
C. ranga	6.62	1.66	0.88	1.68	11.6	5.16	4.26	Slowly increasing	
G. giuris	4.43	5.16	2.79	3.55	2.71	3.97	3.76	Slowly decreasing	
N. nandus	1.92	0	0.12	7.74	3.43	4.53	3.34	Fluctuating, decreasing	
M. armatus	1.38	0	0	9.97	1.68	2.46	3.26	Fluctuating, increasing	
S. bacaila	3.55	1.83	5.72	2.38	2.97	2.25	3.01	Slowly decreasing	
W. attu	2.87	4.70	5.57	1.71	1.22	2.28	2.97	Slowly decreasing	
N. notopterus	0.23	0.45	1.59	3.82	2.95	5.01	2.42	Sharply increasing	
C. punctatus	2.84	0.01	0	4.79	0.75	0.86	1.80	Fluctuating, steady	
A. aor	1.02	0.43	2.32	3.77	1.48	0.05	1.74	Fluctuating, steady	
M. bleekeri	2.76	0.02	2.61	0.77	0.28	3.88	1.49	Fluctuating, steady	
Others	23.77	10.93	4.54	34.22	9.7	14.98	17.82	Fluctuating, steady	

3.3. Kali nodi

3.3.1. Main species and gear efficiency

The main fishing gears operated in the river are not selective gears, that is they harvest most of the fish species present in the river. These species are subject to high fishing pressure. In contrast to this, selective gears such as hook and line and long line catch only a few target species. The main species caught by each gear are presented in table 3.5.

Table	3.5	Composition (%) of main species caught by all gear types in the river Kali nodi.								

Gill net	Seine net	Set Bag	Lift net	Cast net	Push net	Trap	Hook & line	Long line	Pen/other	*Khata*
G.chapra	*C.soborna*	Small prawn	Small prawn	*P.sophore*	Small prawn	*M.malcolmsonii*	*G.giuris*	*G.giuris*	*M.malcolmsonii*	*M.malcolmsonii*
P.sophore	*G.chapra*	*G.giuris*	*P.sophore*	*W. attu*	*M.malcolmsonii*	*M.villosimanus*	*M.armatus*	*W.attu*	*P.sophore*	*W. attu*
X. cancila	*C. ranga*	*M.malcolmsonii*	*M.pancalus*	*C.marulis*	*M.puncalus*	*M.birmanicum*	*P.sophore*	*M.aculeatus*	*M.tengra*	*M.tengra*
M.tengra	*P.sophore*	*P.sophore*	*M.malcolmsonii*	*P. ticto*	*P.sophore*	*G.giuris*	*W. attu*	*M.pancalus*	*G.giuris*	*L.rohita*
G.giuris	Small prawn	*C. ranga*	*G.giuris*	*G.giuris*	*M.villosimanus*	Small prawn	*M.aculeatus*	*M.armatus*		*M.bleekeri*
L. boggur	Kajuli	*G.chapra*	*X.cancila*	*C.stiata*	*G.giuris*	*M.pancalus*	*B.badis*	*P.sophore*		*C.marulis*
M.malcolmsonii	*M.malcolmsonii*	*N.nandus*	*C. ranga*	Small prawn	*Mystus sp*	*P.sophore*	*M.puncalus*	*C.punctatus*		*M.villosimanus*
M.pancalus	*G.giuris*	*A.mola*	*M.villosimanus*	*L.rohita*	*C. ranga*	*M.malcolmsonii*	*C.punctatus*	*N.notopterus*		*N.notopterus*
L.rohita	*M.pancalus*	*S. bacaila*	*M.tengra*	*L. calbasu*	*C.faciatus*	*C. ranga*	*G.chapra*	*B.badis*		*B.batasio*
S. bacaila	*S. bacaila*	*M.pancalus*	*C.fasciatus*	*M.pancalus*	*Nemacheilus sp*	*C.punctatus*		*A.testudineus*		*Mystus sp.*

3.3.2. Changes in catch composition and diversity

A total of 91 species of fish and prawns were recorded from Kali Nodi during 1997 to 2002. The variation of abundant species in different years and their impacts in the Kali Nodi revealed that six species, *G. chapra*, Small prawn, *P. ticto*, *Hisha spp.*, *M. villosimanus* and *M. tengra* showed positive catch trends with an overall contribution to catches of 35.38%. Two species, *C. soborna* and *G. giuris* showed moderate impact (between lower decreasing and lower increasing trend), contributing 46.33%. Six species *P. sophore*, *Chanda spp*, *M. pancalus*, *Ailia coila*, *S. bacaila* and *L. rohita* showed negative catch trends, contributing 11.85%. The percentage compositions of catches of the main species from 1997 to 2002 are presented in table 3.6.

C. soborna and *Chanda spp* were the highest contributing species in 1997. The highest contributing species in 1998 was *C. soborna*; *A. coila* also appeared in the list of major species in 1998 and sustained as a major contributing species. *Chanda spp* was a dominant species in 1997 and its contribution was sustained up to 2000 but declined in 2001. *P. ticto* was an abundant species in 2001. However the contribution of *S. bacaila* to the fishery declined gradually. *Hisha spp* suddenly appeared in the list of major species in 2002.

Table 3.6   Percentage composition of main species caught by all gear types in Kali Nodi

Fishes	1997	1998	1999	2000	2001	2002	Overall	Annual trend
C. soborna	46.35	55.3	58.77	43.83	47.97	43.03	43.04	Slowly decreasing
C. ranga	12.43	2.43	4.74	5.54	1.91	5.46	5.46	Decreasing
G. chapra	8.66	12.74	9.96	18.26	16.49	18.21	18.21	Sharply increasing
P. sophore	8.18	3.34	3.87	4.13	2.67	2.42	2.42	Sharply decreasing
G. giuris	4.49	3.37	2.74	2.51	4.22	3.29	3.29	Slowly decreasing
Small prawn	4.39	2.54	3.67	4.35	5.65	4.76	4.77	Increasing
M. pancalus	3.93	1.68	1.42	2.62	2.35	2.08	2.08	Decreasing
Ailia coila	0.22	4.14	5.61	7.03	2.35	0.8	0.80	Decreasing
P. ticto	0.21	2.91	2.29	2.45	6.55	6.63	6.63	Sharply Increase
Hisha spp	1.49	0.3	0.29	0.41	0.38	2.62	2.62	Increasing
M.vollosimanus	0.95	0.48	0.16	1.4	1.98	1.66	1.66	Increasing
Mystus spp	0.7	0.12	0.08	1.03	1.25	1.49	1.49	Sharply increasing
S. bacaila	0.64	2.07	2.18	0.34	0.69	0.8	0.78	Decreasing
L. rohita	0.56	1.14	0.34	0.51	0	0	0.31	Sharply decreasing
Others	6.80	7.44	3.88	5.59	5.54	6.75	5.62	Slowly decreasing

3.4. Arial Kha river

3.4.1. Main species and gear efficiency

The main fishing gears operated in the Arial Kha river are not selective gears, that is they harvest most of the fish species present in the river. These species are subject to high fishing pressure. In contrast to this selective gears such as hook and line and long line catch only a few target species. The main species caught by each gear are presented in table 3.7.

Table 3.7   Composition (%) of main species caught by all gear types in the Arial Kha river

Gill net	Seine net	Lift net	Cast net	Push net	Trap	Hook & line	Long line	Hand	*Khata* catch
P.sophore	*P.sophore*	*P.sophore*	*P.sophore*	Small prawn	Small prawn	*W. attu*	*A. coila*	*X. cancila*	Small prawn
C. mrigala	*P. ticto*	*P. ticto*	Small prawn	*P.sophore*	*P.sophore*	*M. armatus*	*C. garua*	*N. nandus*	*Mystus sp*
M. aor	*M.tengra*	*C. mrigala*	*P. ticto*	*P. ticto*	*P. ticto*	Mrigel	*E. vacha*	*P. ticto*	*C. mrigala*
M. bleekeri	Small prawn	*M.tengra*	*C. punctatus*	*M. pancalus*	*M. pancalus*	*M. aor*	*R. rita*	*G. giuris*	*W. attu*
S. bacaila	*G. chapra*	Small prawn	*M. pancalus*	*C. punctatus*	*R. rasbora*	*C. marulius*	*W. attu*	*P.sophore*	*L. boga*
G. chapra	Kajuli	*G. chapra*	*M.tengra*	*G. giuris*	*M. armatus*	*C. punctatus*	*M. armatus*		*M. villosimanus*
M. seenghala	*C. mrigala*	*C.catla*	*M. armatus*	Mixed fish	*M. malcolmsonii*	*L. rohita*	*G. giuris*		*P. sophore*
M. armatus	*M. pancalus*	*M. pancalus*	*C. mrigala*	*Chanda sp*	*G. giuris*	*M. seenghala*			*M. vittatus*
M.tengra	*S. bacaila*	*G. giuris*	*G. giuris*	*C.soborna*	*M. villosimanus*	*L. calbasu*			*L.rohita*
P. ticto	Chanda sp	*C. punctatus*	Mixed fish	*M. malcolmsonii*	*M. tengra*	*M. pancalus*			*L. calbasu*

3.4.2. Changes in catch composition and diversity

A total of 78 species of fish and prawns were recorded from Arialkha river during 1997 to 2002. The variation of the main 16 species in different years and their impacts reveals that seven species (small prawn, *P. ticto*, *M. armatus*, *A. coila*, *M. pancalus*, *C. punctatus*, and *M. aor*) showed positive catch trends, six species (*P.sophore*, *C. mrigala*, *Chanda spp*, *S. bacaila*, *W. attu* and *L. rohita*) showed negative catch trends and catches of three species (*M. tengra*, *G. chapra* and *G. giuris*) did not change (between lower decreasing and lower increasing trend). The abundant fish and prawn species caught by different types of gears and their annual percentage contribution towards catches are presented in table 3.8.

Small prawns were the 2nd highest contributing species in 1997 and 2002. *P. sophore* was the highest contributing species in 1997-1999 and 2001. *P. ticto* was the highest contributing species in 2000 and the 3rd highest contributing species in 2001-02. *M. armatus* showed its highest contribution in 2002. *A. coila* appeared as 2nd highest contributing species in 1999.

Table 3.8 **Composition (%) of main species caught all gear types in Arial kha**

Fishes	1997	1998	1999	2000	2001	2002	Overall	Annual trend
Small prawn	13.33	8.35	4.84	15.04	12.08	14.82	12.20	Slowly increasing
P. sophore	17.01	17.15	17.97	7.79	14.21	6.72	11.54	Slowly decreasing
P. ticto	2.62	0.00	1.00	14.35	11.18	14.10	9.59	Sharply increasing
M. armatus	1.64	1.07	2.49	1.35	4.67	20.38	6.69	Sharply increasing
A. coila	0.00	3.64	9.71	2.02	1.33	12.38	5.66	Fluctuating, Slowly increasing
M. tengra	2.67	6.54	6.76	5.52	8.04	1.90	5.15	Fluctuating, Steady
C. mrigala	12.64	11.73	4.42	2.19	3.14	3.65	4.68	Sharply decreasing
G. chapra	0.63	6.55	7.39	3.63	4.15	2.58	4.17	Fluctuating, Steady
M. pancalus	2.51	1.67	1.57	7.29	6.63	0.97	3.90	Fluctuating, Slowly increasing
G. giuris	1.71	1.73	2.07	4.55	1.38	1.51	2.49	Fluctuating, Steady
Chanda spp	4.90	2.80	3.46	1.50	1.37	2.47	2.33	Slowly decreasing
S. bacaila	2.67	2.48	3.52	2.39	3.35	0.35	2.22	Slowly decreasing
W. attu	3.90	2.90	6.77	1.88	0.93	0.00	2.20	Decreasing
C. panctatus	2.59	0.81	0.55	1.52	4.95	2.19	2.04	Slowly increasing
M. aor	0.00	0.72	0.63	1.61	6.50	0.86	1.83	Slowly increasing
L. rohita	2.22	2.57	2.56	2.00	1.61	0.31	1.68	Slowly decreasing
Others	28.97	29.30	24.29	25.39	14.48	14.82	21.62	Decreasing

3.5. Dhaleswari river

3.5.1. Main species and gear efficiency

The main fishing gears operated in the Dhaleswari river are not selective gears and harvest almost all the abundant species present in the river. These species are subject to high fishing pressure. In contrast to this, selective gears such hook and line, spear and long line catch only a few target species. The main species caught by each gear are presented in table 3.9.

Table 3.9 **Composition (%) of main species caught by all gear types in the Dhaleswari river**

Gill net	Seine net	Lift net	Cast net	Push net	Hook & line	Spear	Long line
W. attu	*W. attu*	*L. calbasu*	*P. sophore*	Small prawn	*M. armatus*	*M. armatus*	*C. striatus*
L. calbasu	*P. sophore*	*W. attu*	Small prawn	*P. sophore*	*W. attu*	*L. gonius*	*M. tengra*
P. sophore	*Chanda spp*	*P. ticto*	*M. pancalus*	*C. ranga*	*M.seenghala*	*N.notopterus*	*M. armatus*
S. bacaila	Small prawn	*Chanda spp*	*M. tengra*	*Chanda spp*	*C.punctatus*	*C. striatus*	*P. sophore*
X. cancila	*C. soborna*	*P. sophore*	*G. giuris*	*Chanda sp*	*M. tengra*	*Mystus spp*	
C. garua	*B. batasio*	*C. ranga*	*S. bacaila*	*P. ticto*	*C. striatus*	*M. pancalus*	
M. pancalus	*M. tengra*	*S. bacaila*	*L. calbasu*	*M. pancalus*	*M. pancalus*	*M. tengra*	
M. tengra	*M. aor*	*C. carpio*	*Chanda spp*	*C. lalius*	*G. giuris*	*M. seenghala*	
M. armatus	*S. bacaila*	*C. fasciatus*	*G. chapra*	Mixed fish	*P. canius*		
M. aculeatus	*M. pancalus*	*G. chapra*	*M. malcolmsonii*	*C. soborna*	*M. cuchia*		

3.5.2. Changes in catch composition and diversity

A total of 76 species of fish/prawn were recorded from the river Dhaleswari during the study period 1997-2000. *M. villosimanus* represented the highest contributing species in catches followed by *C. soborna*, *G. chapra*, Small prawn, *G. giuris* and *P. sophore*. The contribution of *M. villosimanus* to the catch gradually increased up to 2000 however catches fluctuated in recent years. The contribution of *C. soborna* towards

catches was very high in 1998 however they gradually decreased up to 2001 and sharply decreased in 2002 compared to the previous year. This abundance pattern suggests that over-exploitation of *C. soborna* is taking place in this river. Table 3.10 presents the variation in dominant species in different years and their impacts in the Dhaleswari river. Among the most dominant species, seven species, *M. villosimanus*, *P. sophore*, *G. chapra*, *Hilsha spp*, *M. birmanicum*, *A. coila* and *Rohtee chola* showed increasing catch trends with an overall contribution of 49.88%. Three species, *C. garua*, *S. bacaila* and *M. tengra* catches were stable with a combined contribution of 4.71% and four species *C. soborna*, Small prawn, *G. giuris* and *Nemacheilus spp* showed negative catch trends with a combined contribution of 34.25% of the catch. Among the 14 dominant contributing species, positive catch trends were shown for 7 species, negative catch trends were shown for 4 species, and 3 species swung between positive and negative trends. *C. soborna* was the dominant species in 1997-99 and the 3rd most dominant contributing species in 2000. In 2001 it was the 2nd contributing species, however its abundance suddenly declined in 2002 makin it the 6th most dominant species in the river system. Among the dominant contributor species *M. villosimanus* and *G. chapra* contributed about 33.71% of total production during 1997 to 2002 which confirms their presence as the most dominant species. The annual contribution of other species were 16.82%, 6.44%, 6.93%, 7.73%, 5.58% and 14.93% for the years 1997-02 respectively. The average contribution of other species (combination of 62 species) was 11.19%.

Table 3.10 **Composition (%) of main species caught all gear types in the Dhaleswari river**

Fishes	1997	1998	1999	2000	2001	2002	Overall	Annual trend
M. villosimanus	8.11	17.35	24.06	30.55	13.76	28.65	23.58	Increasing
C. soborna	19.61	37.80	28.92	10.02	14.28	4.51	14.20	Decreasing
G. chapra	8.51	10.36	5.78	1.04	19.89	11.48	10.13	Slowly increasing
Small prawn	14.67	13.16	5.83	8.08	13.59	8.31	9.77	Slowly decreasing
G. giuris	9.15	4.48	4.37	11.15	3.83	5.87	6.29	Slowly decreasing
P. sophore	1.92	2.48	0.51	3.37	4.18	8.62	5.23	Sharply increasing
Nemacheilus spp	9.34	2.27	4.56	4.15	2.33	3.73	3.98	Decreasing
Hilsha spp	3.20	0.79	4.09	1.29	10.55	2.69	3.45	Increasing
M. birmanicum	0.18	1.01	4.27	7.36	1.47	3.13	3.14	Increasing
A. coila	0.05	0.45	7.15	4.25	3.16	1.62	2.49	Increasing
C. garua	2.77	1.22	1.16	1.13	1.53	2.46	1.90	Steady
R. cotio	1.80	1.03	0.14	3.40	2.90	1.72	1.86	Increasing
S. bacaila	2.17	0.27	1.56	4.62	1.18	0.83	1.52	Steady
M. tengra	1.70	0.89	0.69	1.85	0.76	1.43	1.29	Steady
Others	16.82	6.44	6.93	7.73	6.58	14.93	11.19	Steady

3.6. Moisherkandi-Boronpor river

3.6.1. Main species and gear efficiency

The main fishing gears operated in the Moisherkandi-Boronpor river are not selective gears and harvest almost all the abundant species present in the river. Some species were caught by different gears and some gears are selective such as traps, hook and lines and long line. The most abundant species contributed more than 95% of total catch for each gear type (seine net 85%) and are presented in table 3.11.

Table	3.11	Composition (%) of main species caught by all gear types in the Moisherkandi-Boronpor river

Gill net	Seine net	Cast net	Push net	Trap	Hook & line	Long line	Set Bag	*Khata* catch
P. sophore	*C. soborna*	*M. armatus*	Small prawn	*M. villosimanus*	*M. armatus*	*G. giuris*	*M. villosimanus*	*M. villosimanus*
M. seenghala	*G. chapra*	*P. sophore*	*P. ticto*		*G. giuris*	*C. garua*	*M.malcolmsonii*	*M. aor*
C. garua	*P. ticto*	*P. ticto*	*M. villosimanus*		*M. aor*	*M. aor*		*W. attu*
G. giuris	*Chanda spp*	*G. giuris*	*G. giuris*		*M. seenghala*	*C. punctatus*		*M. seenghala*
M. aor	*S. bacaila*	*M. aculeatus*	*P. sophore*		*P. ticto*	*M. armatus*		*B. batasio*
Small prawn	*M. villosimanus*	*M. villosimanus*	Hilsa sp		*C. garua*	*M. aculeatus*		*M. bleekeri*
M. aculeatus	Small prawn	*M. tengra*	*M. seenghala*					Small prawn
C. punctatus	*P. sophore*	Small prawn						*C. marulius*
Hilsa spp	*G. giuris*	*M. seenghala*						*O. pabda*
M. Bleekeri	*A. Coila*	*M. Pancalus*						*L. Gonius*

3.6.2. Changes in catch composition and diversity

A total of 65 species of fish/prawn were recorded from Moisherkandi-Boronpur during the study period, 1997 to 2002. Catches of *G. chapra, P. ticto, Chanda spp, G. giuris, W. attu, A. coila* and *Hilsha spp* showed positive trends and their overall contribution was 46.64%. Nine species *C. soborna, S. bacaila, P. sophore, M. villosimanus, Small prawn, M. aor, C. garua, M. armatus* and *M. seenghala* showed negative catch trends and had a combined contribution of 47.81%. Annual variations of percentage composition for the 16 most abundant species are presented in table 3.12.

C. soborna was the species with the highest contribution towards catches in 1997-99 and 2001-02 and fourth most abundant species in 2000. *G. chapra* was the most abundant species in 2000 and the third most abundant species in 2001-02. P. ticto was the second highest component of catches in 2001-02 and third most abundant species in 1999-2000. The highest abundance of Chanda spp was in 2000 when it was the second most abundant species. *G. giuris* was the second most abundant species in 1998 while this position was taken by *M. villosimanus* in 1997 and *P. sophore* was the second most abundant species in 1999. The contribution of "other species" was 7.69%, 12.28%, 3.57%, 5.32%, 3.08% and 5.792% and number of species making up this category was 33, 43, 37, 33, 30 and 31 for the years 1997-2002 respectively. The average contribution of "other species" (a combination of 49 species) was 5.58%. Among the top six main species the abundance of *C. soborna* peaked during Oct-Nov and was least during Apr-May. The peak abundance of *G. chapra*, *P. ticto* and *Chanda spp* occurred during pre-winter and winter seasons (Sept-April), however abundance of these three species was very low during 1997-98 but gradually increased in recent years (1999-2002). *G. giuris* and *S. bacaila* were prevalent through-out the study period with peak abundance during the monsoon (Jun-Oct). Catches of *S. bacaila* tended to decrease in recent years (2001-02).

Table	3.12	Composition (%) of main species caught all gears in the Moisherkandi river

Fishes	1997	1998	1999	2000	2001	2002	Overall	Annual trend
C. soborna	27.10	21.85	19.68	13.45	20.90	20.20	19.32	Decreasing
G. chapra	5.59	5.98	10.47	18.62	15.39	13.71	12.70	Increasing
P. ticto	0.16	3.79	11.97	14.82	19.11	14.29	12.15	Increasing
Chanda spp	3.93	8.86	6.75	15.10	10.28	4.47	8.79	Increasing
G. giuris	4.07	11.32	6.32	5.29	5.20	10.25	6.97	Slowly increasing
S. bacaila	11.32	5.49	6.66	8.94	5.59	4.73	6.96	Decreasing
P. sophore	7.10	8.54	14.39	1.79	2.76	3.22	6.75	Decreasing

Fishes	1997	1998	1999	2000	2001	2002	Overall	Annual trend
M. villosimanus	14.30	4.58	3.76	2.07	2.67	6.82	4.68	Decreasing
Small prawn	7.65	5.68	4.43	2.66	2.86	5.60	4.40	Decreasing
W. attu	0.00	0.14	3.61	3.49	0.88	3.25	2.48	Sharply increasing
A. coila	0.39	0.14	3.68	2.08	2.74	0.55	2.00	Increasing
M. aor	4.49	1.98	1.66	1.86	0.47	1.12	1.72	Sharply decreasing
C. garua	1.71	3.46	0.25	2.60	2.24	0.65	1.61	Decreasing
Hilsa spp	1.65	0.09	0.77	0.91	4.16	2.44	1.55	Increasing
M. armatus	1.33	2.77	1.22	0.25	0.78	1.77	1.21	Decreasing
M. seenghala	1.51	3.06	0.80	0.73	0.88	1.13	1.16	Decreasing
Others	7.69	12.28	3.57	5.32	3.08	5.79	5.58	Decreasing

3.7. Ubdakhali river

3.7.1. Main species and gear efficiency

The main fishing gears operated in the river harvested almost all the abundant species however some gears are selective such as hook and line and spears. The most abundant species contributed more than 80% of total catch for each gear type (seine and lift net 64%) and are presented in table 3.13.

Table 3.13 Composition (%) of main species caught by all gear types in the Ubdakhali river

Gill net	Seine net	Lift net	Cast net	Push net	Hook & line	Spear	Long line	*Khata*
W. attu	*W. attu*	*L.calbasu*	*P. sophore*	Small prawn	*M. armatus*	*M. armatus*	*C. striatus*	*B. batasio*
L. calbasu	*P. sophore*	*W. attu*	Small prawn	*P. sophore*	*W. attu*	*L. gonius*	*M. tengra*	*W. attu*
P. sophore	*Chanda spp*	*P. ticto*	*M. pancalus*	*C. ranga*	*M.seenghala*	*N. notopterus*	*M.armatus*	*M. aor*
S. bacaila	Small prawn	*Chanda sp*	*M. tengra*	*Chanda spp*	*C. punctatus*	*C. striatus*	*P.sophore*	*C. chitala*
X. cancila	*C.soborna*	*P. sophore*	*G. giuris*	*Chanda spp*	*M. tengra*	*M.seenghala*		*O. pabda*
C. garua	*B. batasio*	*C. ranga*	*S. bacaila*	*P. ticto*	*C. striatus*	*M. pancalus*		*M.rosenbergii*
M.pancalus	*M. tengra*	*S.bacaila*	*L. calbasu*	*M. pancalus*	*M. pancalus*	*M. tengra*		*M. seenghala*
M. tengra	*M. aor*	*C. carpio*	*Chanda spp*	*C. lalius*	*G. giuris*	*M.seenghala*		*L. calbasu*
M. armatus	*S. bacaila*	*C.fasciatua*	*G. chapra*	Mixed fish	*P. canius*			*C. reba*
M.aculeatus	*M.pancalus*	*G. Chapra*	*M.malcolmsonii*	*C. Soborna*	*M. Cuchia*			*P. Canius*

3.7.2. Changes in catch composition and diversity

A total of 86 species of fish/prawn were recorded from Ubdakhali river and the adjoining Hogla beel during the study period 1997-2002. The common species caught by all types of gears were *P. sophore*, Small prawn, *W. attu*, *M. armatus*, *Chanda spp* and *X. cancila* contributing 12.55%, 9.06%, 7.11%, 5.34%, 5.32% and 5.32% of catches, respectively. Analysis of annual catch statistics reveals that 14 main species contributed the maximum proportion of the catch, all together contributing 75.93%, 72.65%, 74.42%, 65.68%, 69.44% and 60.38% in years 1997-2002 respectively. Biodiversity showed wide variations over the years with total species numbers of 53, 49, 44, 38, 38 and 59 in the years 1997-2002 respectively. The percentage compositions of main species in catches from 1997 to 2002 are presented in table 3.14. *P. sophore* was the species making the highest contribution in 1997 and 2000 and the second most abundant species in 1998 and 2001. The highest contribution of Small prawn occurred in 1998 and 2002. *W. attu* was the 2nd highest contributing species in 1999-2000. The highest abundance of *M. armatus* occurred in 2001, and *Chanda spp* made its highest contribution in 1999. Among the major contributing species there were positive catch trends for five species; *M. armatus*, *G. chapra*, *M. tengra*, *G. giuris* and *M. pancalus*;

there was moderate impact (between lower decreasing and lower increasing trend) for four species; Small prawn, *W. attu*, *X. cancila* and *M. aor* and negative trends for five species; *P. sophore*, *Chanda spp*, *Salmostoma bacaila*, *C. soborna* and *M. seenghala*. The annual contribution of other species was 24.07%, 27.35%, 25.58%, 34.32%, 30.56% and 39.62% and the number of species present was 39, 35, 30, 24, 24 and 45 for the years 1997-2002 respectively. The overall contribution of other species (combination of 72 species) was 29.76%. Among the main six contributor species, abundance of *P. sophore* appeared during the pre winter season, the peak abundance of small prawn also occurred during pre winter and was least during the winter season. Catches of *W. attu* fluctuated during the winter season. The main catches of *M. armatus* were during Oct-Dec, and there were exceptionally high catches in 1997 and 2001. The main catches of *Chanda spp* occurred during Oct-Dec and the peak catch of this species was recorded in 2002. Two very high catches of *X. cancila* were recorded in 1997 and 2002, one during Sept-Nov and other in April.

Table 3.14   **Percentage composition of main species caught all gear types in the Ubdakhali**

	1997	1998	1999	2000	2001	2002	Overall	Annual trend
P. sophore	18.01	15.65	6.82	10.13	11.24	7.13	12.55	Decreasing
Small prawn	6.65	20.57	4.52	5.95	4.21	14.24	9.06	Steady
W. attu	8.55	1.47	9.46	7.85	6.71	6.63	7.11	Steady
M. armatus	5.72	1.46	3.68	2.70	13.23	3.04	5.34	Slowly increasing
Chanda spp	2.82	13.10	10.25	0.73	1.58	7.69	5.32	Decreasing
X. cancila	6.72	2.77	2.88	6.45	5.13	5.29	5.32	Steady
G. chapra	10.22	0.94	1.26	0.74	0.30	3.10	4.31	Sharply decreasing
M. tengra	1.77	1.88	9.21	6.84	6.32	4.26	4.28	Increasing
S. bacaila	2.52	8.38	4.69	5.07	3.99	3.15	4.02	Slowly decreasing
M. aor	4.21	0.01	3.07	2.65	5.28	0.78	2.94	Steady
G. giuris	1.39	0.54	3.03	6.83	7.22	0.78	2.80	Increasing
M. pancalus	1.44	0.71	3.54	7.36	3.89	1.07	2.49	Increasing
C. soborna	0.26	4.69	9.40	2.33	0.33	2.84	2.45	Slowly decreasing
M. seenghala	5.66	0.49	2.62	0.05	0.01	0.38	2.26	Sharply decreasing
Others	24.07	27.35	25.58	34.32	30.56	39.62	29.76	Increasing

4. COMBINED ANALYSIS OF SEVEN FLOWING RIVERS

4.1. Fishing activity

Analaysis of the variation in the numbers of the three main types of fishers in the seven rivers showed that in most rivers, there were more professional full time fishers, except in Titas G-G and Kali nodi where there were many part time fishers. The highest proportion of subsistence fishers occurred in Arialkha, however in Titas G-G, the proportion of subsistence fishers also high. The numbers of fishers of different types in the seven rivers are given in table 4.1.

Table 4.1 **Fisher types in the seven rivers**

			Name of rivers				
Fisher type	Titas G-G	Titas Ka	Kali nodi	Arialkha	Dhaleswari	Moisherkandi	Ubdakhali
Full time fisher	14	81	42	23	52	77	68
Part time fisher	57	13	47	29	45	12	21
Subsistence fisher	29	6	10	48	3	11	11

4.2. Overall gear intensity

In Titas G-G, the most commonly used gear type were seine nets (47%) followed by, gill nets (20%), lift nets (8%) traps (4%). Other types of gear were small lift nets, push nets, hook and line, cast nets, long lines, spears and set bag nets. In Titas Ka, Kali nodi, Moisherkandi and Ubdakhali the dominant category of gear is seine nets, while in Arialkha, trap units were more common and in Dhaleswari nodi set bag nets predominated. Since fish catches differ according to the type of fishing gear operated, differences in the gear composition also influence catch distribution among fishers. Based on survey results the overall gear proportions (%) are presented in table 4.2.

Table 4.2 **Overall gear proportion (% in number) in the seven rivers.**

Gears type	Composition of gears (% in number) in seven rivers						
	TitasG-G	Titas Ka	Kali nodi	Arialkha	Dhaleswari	Moisherkandi	Ubdakhali
1. Gill nets	20	10	13	15	5	10	21
2. Seine nets	47	56	67	8	29	61	27
3. Large lifts	8	6	-	2	-	-	4
4. Small lifts	1	3	2	12	1	-	2
5. Push nets	2	10	8	16	1	3	16
6. Trap units	4	2	3	20	3	10	5
7. Hook& line	1	6	2	9	-	5	12
8. Cast net	3	1	2	13	3	6	10
9. Long line	6	3	2	2	2	5	2
10. Spear	3	2	-	-	-	-	1
11. Set bag	6	1	-	1	56	-	-
12. Hand	-	-	-	1	-	-	1

4.3. Biodiversity

Among the seven rivers, the maximum number of species was caught in Titas Ka in 2002. More species were caught in all 7 rivers in 2002 than in 2000. There was substantial variation in species in Titas ka, Dhaleswari, Moisherkandi and Ubdakhali, however species variations were lower in Titas G-G, Kali nodi and Arialkha. Variations in species in the seven flowing rivers are presented in table 4.3.

Table 4.3 **Species trends (number) in the seven rivers.**

	1997	1998	1999	2000	2001	2002	Overall
Name of rivers	Number of species	Number of species	Number of species	Number of species	Number of species	Number of species	Number of species
Titas G-G	52	59	45	46	45	51	69
Titas Ka	54	38	34	58	50	71	90
Kali nodi	52	60	55	56	55	60	84
Arialkha	42	45	53	48	56	50	78
Dhaleswari	41	31	19	15	37	40	62
Moisherkandi	33	43	37	33	30	31	65
Ubdakhali	53	49	44	38	38	59	86

4.4. Gear efficiency and species number

Analysis of the number of species caught by different types of gear in the seven rivers reveals that the maximum numbers of species were caught by gill nets and seine nets. Lift nets caught a higher number of species in Titas G-G, Titas Ka, Arialkha and Ubdakhali, while cast nets caught a higher number of species from Titas G-G, Kali nodi, Arialkha, Dhaleswari and Ubdakhali. In the Titas G-G and Dhaleswari set bag nets caught a higher number of species. The total numbers of species caught by different types of gears during the study period are presented in table 4.4.

Table **4.4** **Number of species caught by different types of gear in seven rivers.**

Number of species caught by main gears in seven rivers

Gears type	Titas G-G	Titas Ka	Kali nodi	Arialkha	Dhaleswari	Moisherkandi	Ubdakhali
1. Gill nets	47	51	53	60	34	25	24
2. Seine nets	61	80	78	57	62	59	68
3. Lift net	47	47	20	39	-	-	32
5. Push nets	9	30	21	41	1*	7	13
6. Trap units	23		23	31	9	1*	
7. Hook& line	7	24	18	28	2*	8	18
8. Cast net	29		29	44	23	19	41
9. Long line	-	15	13	7		6	4
10. Spear	11	6					8
11. Set bag	41	4	17		48	2*	
12. Pen/other			4		9		
13. Hand				5			

* Some data missing

4.5. Annual catch trends

The annual catch trends for the Titas G-G tended to increase over the study period. Annual catches in the rivers Titas Ka, Kali and Arialkha increased during 1997-2000 but declined in recent years. The annual catch in the river Dhaleswari swung between 47.7 and 61.6 tons over the years 1997-2001, but increased sharply in 2002. In the Ubdakhali and Moisherkandi rivers the annual catch fluctuated, with the highest catch occurring in 1997 and 1998. Trends in annual catches and percentage contribution (% by weight) from different gear types are presented in table 4.5 and 4.6 respectively.

Table **4.5** **Trends in annual catches by weight in seven rivers**

Total catch (tons) in seven rivers

Name of rivers	1997	1998	1999	2000	2001	2002
	Catch (t)	Catch (t)	Catch (t)	Catch (t)	Catch (t)	Catch (t)
Titas G-G	40.9	87.2	95.9	95.3	92.6	136.4
Titas Ka	95.8	115.5	110.7	193.9	125.7	109.7
Kali nodi	148.0	151.9	177.0	174.4	114.5	206.0
Arialkha	5.3	11.8	10.6	22.1	11.6	18.0
Dhaleswari	54.9	53.0	47.7	61.6	53.8	**127.4
Moisherkandi	12.7	17.5	43.0	36.8	21.6	26.9
Ubdakhali	*104.5	37.6	31.1	29.5	47.4	62.2

Over estimated, ** High catch of prawn

Table 4.6 **Trends in percentage contribution (% by weight) in seven rivers.**

Contribution (% by weight) from different gear types in the study area

Gears type	Titas G-G	Titas Ka	Kali nodi	Arialkha	Dhaleswari	Moisherkandi	Ubdakhali
1. Gill nets	8.54	2.43	2.13	10.3	2.27	5.9	11.7
2. Seine nets	42.55	29.14	83.11	34.64	18.63	85.51	70.52
3. Large lifts	9.09	5.33	0.08	2.45			1.74
4. Small lifts	.01	0.35	0.48	9.43			
5. Push nets	0.12	0.33	0.68	3.49		0.45	5.47
6. Trap units	1.22	0.75	0.99	11.66	2.72		3.73
7. Hook& line	0.02	0.68	0.26	5.47	0.23	2.09	1.96
8. Cast net	2.19	0.15	0.13	4.14	1.47	1.26	3.93
9. Long line	2.56	0.54	0.31	2.73	0.78	4.58	1.48
10. Spear	0.33	0.21					
11. Set bag	3.8	0.05	0.07	1.36	31.58	0.19	
12. Pen/other			6.37		2.89		
13. Hand		0.001		0.05			
Khata	29.68	60.0	5.39	14.3	39.42	*	*

* Time series continuous data for Khata (fish aggregating brush pile) fishing not available

4.6. Status of main species and total annual catch

Trends in average catch rates, the contributions of the top four important species and total catches (including fish aggregating brush pile catches) in the seven flowing rivers are given below. The total catch trend, with the four top-most species caught, including using the Khata catches in the seven flowing rivers are given in table 4.7. Local, English and scientific name of fish and prawn species recored in seven rivers are given in Appendix-1.

Table 4.7 **Catch trends (tons) in six rivers and contributions of main species.**

Name of rivers	Study years	Total catch (gears)	Annual open catch (tons)				
			P.sophore	*G.chapra*	*C.soborna*	Small prawn	Others fishes incl. *Khata* catch
Titas G-G	1997	40.9	1.13	3.52	4.98	2.16	29.13
	1998	87.1	6.63	6.95	9.09	4.95	59.48
	1999	96.0	10.41	6.28	7.81	3.84	67.62
	2000	95.3	7.09	8.85	4.71	2.80	71.89
	2001	92.6	7.06	9.07	3.93	4.46	68.11
	2002	136.5	9.33	11.36	4.79	6.26	104.71
Titas Ka	1997	95.8	6.06	1.52	2.06	6.21	79.91
	1998	115.5	6.79	5.62	6.77	13.88	82.43
	1999	110.7	4.87	4.00	9.96	9.77	82.12
	2000	193.8	7.95	3.08	1.33	4.25	177.22
	2001	125.7	6.15	10.71	9.93	11.95	86.95
	2002	109.7	5.07	9.69	4.83	6.18	83.96
Kali nodi	1997	148.0	11.54	12.08	67.08	5.34	51.97
	1998	152.0	4.13	17.34	85.23	3.76	41.52
	1999	177.0	6.85	15.97	94.99	5.50	53.73
	2000	280.5	6.99	32.44	71.27	7.05	162.70
	2001	114.5	2.82	17.59	51.54	5.99	36.55
	2002	213.7	4.07	36.96	91.16	8.20	73.26

Name of rivers	Study years	Total catch (gears)	Annual open catch (tons)				
			P.sophore	*G.chapra*	*C.soborna*	Small prawn	Others fishes incl. *Khata* catch
Arialkha	1997	3.5	0.60	0.02	0.01	0.47	2.42
	1998	7.8	1.34	0.51	0.29	0.65	5.03
	1999	9.6	1.73	0.71	0.04	0.46	6.68
	2000	19.3	1.50	0.70	0.17	2.90	14.03
	2001	10.1	1.439	0.420	0.249	1.22	6.79
	2002	16.5	1.111	0.426	0.080	2.44	12.46
Dhaleswari	1997	54.9	0.370	1.636	3.773	2.82	46.30
	1998	52.7	0.706	2.944	10.472	3.73	34.87
	1999	47.7	0.127	1.445	7.234	1.45	37.41
	2000	61.6	1.124	0.346	3.338	2.69	54.12
	2001	53.8	1.264	6.015	4.320	4.11	38.08
	2002	161.6	21.504	36.253	38.779	32.09	33.02
Moisherkandi Boronpur	1997	12.7	0.902	0.711	3.444	0.97	6.68
	1998	17.5	1.494	1.046	3.824	0.99	10.14
	1999	43.0	6.193	4.505	8.469	1.90	21.96
	2000	15.8	0.658	6.859	4.956	0.98	2.38
	2001	21.6	0.596	3.323	4.511	0.62	12.54
	2002	26.9	0.865	3.687	5.432	1.51	15.40
	1997	51.6	0.064	5.679	0.183	0.03	45.63
Ubdakhali	1998	13.0	1.514	0.193	1.137	0.0	10.11
	1999	16.4	0.478	0.284	2.122	0.005	13.51
	2000	15.3	1.399	0.164	0.400	0.0	13.37
	2001	22.0	1.608	0.066	0.046	0.0	20.26
	2002	24.0	1.315	1.209	1.214	0.0	20.26

Khata= Brush piles

4.7. Annual catch rates

Income derived from fishing activities is influenced by several factors, such as the catch rates of different species, ownership of fishing gears, family participation in the work process, the number of active fishing days and fish prices. Annual variations of average catches (kg) per gear per day and catches per person per day in the seven flowing rivers are presented in table 4.8.

Table	4.8	Average catches rates (kg) per gear per day, number of person days and catch per person per day during 1997-2002.

Name of rivers	Study years	Av. Catch rates (kg)	No of person days	Catch/person/day (kg)
Titas G-G	1997	7.0	14658	1.99
	1998	12.6	18214	3.81
	1999	11.9	14154	4.46
	2000	10.6	17108	3.65
	2001	10.1	17723	3.31
	2002	9.2	38424	2.67
Titas Ka	1997	9.0	31442	1.99
	1998	12.4	41526	2.07
	1999	10.0	38492	1.81
	2000	7.7	60213	2.41
	2001	7.7	44194	1.74
	2002	6.5	36474	1.66
Kali nodi	1997	12.5	47778	2.92
	1998	13.4	45155	3.16
	1999	13.8	51917	3.20
	2000	11.2	57031	2.90
	2001	5.7	62318	1.71
	2002	11.6	61909	3.34

Name of rivers	Study years	Av. Catch rates (kg)	No of person days	Catch/person/day (kg)
Arialkha river	1997	1.2	5391	0.66
	1998	2.4	6451	1.2
	1999	2.3	9571	1.0
	2000	1.7	17101	1.2
	2001	1.2	11815	0.7
	2002	1.5	15111	0.9
Dhaleswari river	1997	2.5	20613	0.91
	1998	2.7	30245	0.87
	1999	1.9	37980	0.66
	2000	2.3	45676	0.81
	2001	2.8	17044	1.8
	2002	2.1	83571	1.2
Moisherkandi-Boronpur nodi	1997	3.5	10849	1.17
	1998	3.5	16891	0.95
	1999	7.6	22355	1.93
	2000	7.7	23989	1.7
	2001	4.7	18484	1.2
	2002	2.8	20639	1.3
Ubdakhali nodi	1997	11.1	12575	4.1
	1998	3.3	10744	1.21
	1999	8.1	7204	2.28
	2000	6.1	15367	1.0
	2001	6.5	6003	4.25
	2002	7.6	9933	2.6

4.8. Estimated MSY

The Surplus production model of Schaefer (1954) was used to estimate the maximum sustainable yields (MSY) for the fisheries. The rough MSY values obtained for fisheries and the corresponding effort (f_{msy}) required achieving these are presented in table 4.9.

Table 4.9   **MSY values for fisheries and corresponding fishing effort in seven rivers**

Rivers	Titas G-G	Titas Ka	Kali	Arialkha	Dhaleswari	Moisherkandi	Ubdakhali
MSY*	68.0	73.0	163	16.0	46.0	35.0	33.0
$f_{(msy)}$**	3798	7844	15571	12419	30691	8727	8976

*tons ** gear days*

It should be noted that in seven rivers, namely; Titas G-G, Titas Ka, Kali nodi, Arialkha, Dhleswari, Moisherkandi and Ubdakhali effort increased in recent years. Present estimates for the seven rivers suggest that the exploitation level (gear days) needs to be reduced to minimize overexploitation. Exploitation levels in 2002 were about 200% higher than the estimated MSY for Titas G-G, 20% higher for Titas Ka, 15% higher for Kali nodi, 58% higher for Dhaleswari, 11% higher for Moisherkandi and 32% higher for Ubdakhali. Moreover, exploitation levels in 2001 were also higher in most of the rivers. This may create diverse effects in the river systems that will reduce biodiversity and the survival of brood stock. In the river Arialkha, the fishery was operated very close to MSY level and effort increased in recent years. Present estimates for Arialkha suggested 16.0 tons (MSY) and annual corresponding effort of 12419 gear days, which is very close to the MSY level.

4.9. Recommendations for management

The study indicates that seven species namely; *Gudusia chapra*, *Puntius sophore*, *Corica soborna*, Small prawn, *Nandus nandus*, *Labeo rohita* and *Chanda ranga* contributed 54.0% of the overall production in the river Titas G-G. Among these seven species, four species contributed about 32.43% of total estimated production. In the river Titas Ka, six species namely small prawn, *Puntius sophore*, *Corica soborna*, *Gudusia chapra*, *Mastacembelus pancalus* and *Labeo rohita* contributed 44.68% of the overall catch. While

in Kali nodi six species namely *Corica soborna*, *Chanda ranga*, *Gudusia chapra*, *Puntius sophore*, *Glossogobius giuris* and small prawn contributed 77.19% of the overall catch. In the river Arialkha six species namely small prawn, *Puntius sophore*, *Puntius ticto*, *Mastacembelus armatus*, *Ailia coila* and *Mystus tengara* contributed 50.83% of the overall catch. Six species namely *Macrobrachium villosimanus*, *Corica soborna*, *Gudusia chapra*, small prawn, *Glossogobius giuris* and *Puntius sophore* contributed 69.2% of the overall catch in the river Dhleswari. In the river Moisherkandi six species namely *Corica soborna*, *Gudusia chapra*, *Puntius ticto*, *Chanda ranga*, *Glossogobius giuris* and *Salmostoma bacaila* contributed 66.89% of the overall catch. While in Ubdakhali six species namely *Puntius sophore*, small prawn, *Wallago attu*, *Mastacembelus armatus*, *Chanda ranga* and *Xenentodon cancila* contributed 44.7% of the overall catch.

The study revealed that 17 species, *Gudusia chapra*, *Puntius sophore*, *Corica soborna*, small prawn, *Nandus nandus*, *Labeo rohita*, *Chanda ranga*, *Mastacembelus pancalus*, *Glossogobius giuris*, *Puntius ticto*, *Mastacembelus armatus*, *Ailia coila*, *Mystus tengara*, *Macrobrachium villosimanus*, *Salmostoma bacaila*, *Wallago attu* and *Xenentodon cancila* contributed the major proportion of overall catches in the seven rivers.

Precautionary management should be considered to protect these major species and maintain the sustainablity of the resources. The following suggestions may be considered for proper management of fisheries in the rivers:

i.   The system of allocating fishing rights to fishers of different seasons/areas and which may reduce the effects of competition,

ii.   Reduce the number of seine nets and gill nets (mono filament) during peak fishing season in the river Titas G-G, Titas Ka, Kali nodi, Ubdakhali and Moisherkandi.

iii.   Reduce the number of bag net in the river Dhleswari.

iv.   Establish effective sanctuaries in all rivers

v.   Closed season should be strictly followed through active participation of CBOs such as beel management committees or river management committees.

vi.   The Fish Act should be strictly enforced through active participation of fishers.

vii.   Reduce the number of *khatas* in all rivers.

viii.   Reduce the number of harvests from *khatas*.

Gudusia chapra (**Chapila Mach**): Highest contributor species for poor people's livelihoods around rivers.

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6. APPENDIX 1

Fish and prawn species recorded in seven rivers by fish type

Bangla name	English name	Scientific name
Carp		
Catla	Carp	*Catla catla*
Mrigel	Carp	*Cirrhinus mrigala*
Bata	Reba carp	*Cirrhinus reba*
Bhangon	Carp	*Labeo bata*
Bhangra	Carp	*Labeo boga*
Kalibaus	Carp	*Labeo calbasu*
Goinna	Carp	*Labeo gonius*
Nandil	Carp	*Labeo nandina*
Rui	Carp	*Labeo rohita*
Sharputi	Carp	*Puntius sarana*
Mohashoil	Carp	*Tor tor*
Hilsa		
Ilish	Hilsa shad	*Tenualosa ilisha*
Snakehead and Koi		
Koi	Climbing perch	*Anabas testudineus*
Napit koi	Mud perch	*Badis badis*
Gajar	Snakehead	*Channa marulius*

Gachua	Snakehead	*Channa orientalis*
Cheng	Snakehead	*Channa orientalis*
Taki	Spotted snakehead	*Channa punctata*
Shol	Snakehead murrel	*Channa striata*
Catfish		
Ayre	Long bard catfish	*Aorichthys aor*
Guzi ayre	Catfish	*Aorichthys seenghala*
Bagha ayre	River catfish	*Bagarius bagarius*
Pangus	River catfish	*Pangasius pangasius*
Rita	Long barbed catfish	*Rita rita*
Shillong	River catfish	*Silonia silondia*
Boal	Freshwater shark	*Wallago attu*
Kajuli	River catfish	*Aila coila*
Banspata	River catfish	*Ailia punctata*
Batasi tengra	Catfish	*Batasio batasio*
Chaka	Talking catfish	*Chaca chaca*
Magur	Walking catfish	*Clarias batrachus*
Ghaura	River catfish	*Clupisoma garua*
Bacha	River catfish	*Eutropiichthys vacha*
Kauwa	River catfish	*Gagata cenia*
Gang tengra	Catfish	*Gagata gagata*
Shing	Stinging catfish	*Heteropneustes fossilis*
Golsha tengra	Long bled catfish	*Mystus bleekeri*
Golsha	Catfish	*Mystus cavasius*
Bajari tengra	Long bled catfish	*Mystus tengara*
Tengra	Catfish	*Mystus vittatus*
Kani pabda	Butter catfish	*Ompok bimaculatus*
Pabda	Butter catfish	*Ompok pabda*
Gang magur	River catfish	*Plotosus canius*
Batasi	River catfish	*Pseudeutropius atherinoides*
Knifefish		
Chital	Featherback, Clown knife fish	*Chitala chitala*
Ekthota	Wrestling halfbeak	*Dermogenys pusilla*
Foli	Bronze featherback	*Notopterus notopterus*
Kakila	Garfish	*Xenentodon cancila*
Eel fish		
Bamosh	Freshwater eel, Indian mottled eel	*Anguilla bengalensis*
Tara baim	Spiny eel	*Macrognathus aculeatus*

Guchi baim	Spiny eel	*Macrognathus pancalus*
Bara baim	Spiny eel	*Mastacembelus armatus*
Kuicha baim	Mud eel	*Monopterus cuchia*

Medium sized native fish

Bhol		*Barilius bola*
Tatkini	Gangetic latia	*Crossocheilus latius*
Churi		*Eupleurogrammus muticus*
Baila	Goby	*Glossogobius giuris*
Shankar	Stingray	*Himantura uarnak*
Ghora maach		*Labeo pangusia*
Bhetki	Giant perch	*Lates calcarifer*
Poa	Croaker	*Otolithoides pama*
Choika		*Pellona ditchela*
Tapasi	Paradise threadfin	*Polynemus paradiseus*
Along	Bengal barb	*Rasbora elanga*
Khalla	Mullet	*Rhinomugil corsula*
Fesha	Anchovy	*Setipinna phasa*
Teli phasa	Anchovy	*Setipinna taty*
Tular danti	Whiting	*Sillaginopsis panijus*
Lal chewa	Goby	*Taenioides rubicundus*
Sada chewa	Pouched goby	*Trypauchen vagina*

Exotic fish

Bighead carp	Bighead carp	*Aristichthys nobilis*
Thai sarputi	Thai sarputi	*Barbodes gonionotus*
African magur	African catfish	*Clarias gariepinus*
Grass carp	Grass carp	*Ctenopharyngodon idella*
Common carp	Common carp (Scale carp)	*Cyprinus carpio communis*
Mirror carp	Mirror carp	*Cyprinus carpio specularis*
Silver carp	Silver carp	*Hypophthalmichthys molitrix*
Tilapia	Mozambique tilapia	*Oreochromis mossambicus*
Nilotica	Nile tilapia	*Oreochromis niloticus*

Small native fish

Bud koi	Mottled loach	*Acanthocobitis botia*
Mola	Mola carplet	*Amblypharyngodon mola*
Tin chouka	Top minnow	*Aplocheilus panchax*
Piali	Aspidobara	*Aspidoparia morar*
Rani	Necktie or Bengal loach	*Botia dario*
Putul	Reticulate loach	*Botia lohachata*

Gol chanda	Perch(Glass fish)	*Chanda nama*
Bozri		*Chandramara chandramara*
Kash khaira		*Chela laubuca*
Khalisha	Perch	*Colisa fasciatus*
Kachki	Minnow, Ganges river sprat	*Corica soborna*
Neftani	Perch	*Ctenops nobilis*
Chep chela		*Danio devario*
Anju		*Danio rerio*
Darkina	Minnow	*Esomus danricus*
Chapila	Herring, Indian river shad	*Gudusia chapra*
Gutum	Loach	*Lepidocephalichthys guntea*
Meni	Perch, Gangetic leaffish	*Nandus nandus*
Dhela		*Osteobrama cotio*
Chanda	Perch, Glass fish	Parambassis baculis
Ranga chanda	Perch, Glass fish	*Parambassis ranga*
Balitora	Minnow	*Psilorhynchus balitora*
Chala puti	Swamp barb	*Puntius chola*
Kanchan puti	Rosy barb	*Puntius conchonius*
Jhili puti	Golden barb	*Puntius gelius*
Mola puti	Glass barb	*Puntius guganio*
Phutani puti	Dwarf barb, Spottedsail barb	*Puntius phutunio*
Jat puti	Spot-fin swamp barb, Pool barb	*Puntius sophore*
Teri puti	One spot barb	*Puntius terio*
Tit puti	Ticto barb	*Puntius ticto*
Narkeli chela	Minnow	*Salmostoma acinaces*
Katari	Minnow	*Salmostoma bacaila*
Tepa	Puffer fish	*Tetraodon cutcutia*
Chuna kholisha	Perch	*Trichogaster chuna*
Lal khalisha	Perch	*Trichogaster lalius*
Prawn		
Golda icha	Giant freshwater prawn	*Macrobrachium rosenbergii*
Thengua icha	Prawn	*Macrobrachium birmanicus*
Chatka icha	Prawn	*Macrobrachium malcolmsoni*
Gura icha	Prawn	*Macrobrachium styliferus*
Dimua icha	Prawn	*Macrobrachium villosimanus*

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