

# Diversity of Selective and Non-Selective Fishing Gear and their Impact on Inland Fisheries in Bangladesh

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## Abstract

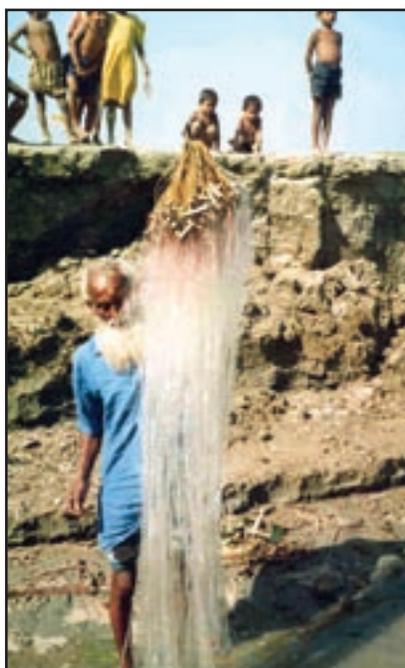
The paper describes the wide range of traditional fishing gear used by subsistence and professional fishers in the inland waters in Bangladesh as well as their impact on the fisheries and the environment. The negative impacts indicate the need for regulation of specific types of fishing gear at particular times of the year. An awareness/training program should be extended to the fishermen to create awareness of the long-term effects of their fishing practices and to impart knowledge of fishing laws.

## Introduction

Bangladesh is blessed with vast diversified inland waters. The inland waters are classified in two different forms—open waters and closed waters. It has a total inland water area of 4.3 million ha., of which 94% is used as open water capture fisheries and 6% for closed water culture fisheries. The inland open waters are further classified into primary and secondary rivers, natural depressions (*beels*), flood plains, oxbow lakes, borrow-pit canals and natural canals. Situated in the delta of the enormous Brahmaputra-Jamuna, the Padma (Ganges) and the Meghna river and their tributaries, Bangladesh has one of the largest and richest floodplain systems in the world. The three main rivers and the 700 smaller rivers and streams stretch over 22 100 km. An estimated 1.03 million ha. of rivers and estuaries, 0.82 million ha. of floodplains, 0.11 million ha. of *beels* and the 0.06 million ha. Kaptai lake offer tremendous scope and potential to augment current fish production.

These inland open water fishery resources have played a significant role in the economy, culture, tradition and food habits of the people of Bangladesh. The country's tropical climate, alluvial soils, productive waters and vast flood plains

are highly favorable to inland fisheries and aquaculture and Bangladesh ranks first (467 kg/km<sup>2</sup>) in the world in open water fish production (Ahmed et al. 1997). Open water fish production used to provide sufficient fish for consumption in Bangladesh. However, due to various natural and man made changes the catch from inland waters has declined alarmingly over the last few decades.



A view of "Punti Jal" which are mainly operated in the floodplain.

As the types of water body in Bangladesh are diverse, so too are the species that inhabit them. A number of traditional and recently introduced fishing gear are used for harvesting. The Government of Bangladesh (GOB) and the Overseas Development Administration (ODA), now the Department for International Development (DFID) UK, jointly carried out a study of fisheries in four regions of Bangladesh under the 'Flood Action Plan (FAP-17)' between 1992 and 1994. During this survey, a number of fishing methods and gear types were observed and their effects on the fisheries and the environment were recorded. The fishing methods, the types of gear encountered and their impacts on the fishery are described below (Table 1).

## Fishing practices and their impacts

### Fish nets

#### Gill nets

Gill nets are panels of netting held vertically in the water column by a series of floats attached to their upper edge (the float line or cork line) and weights attached to their lower edge (the foot rope or lead line). These nets are either staked or anchored in shallow water

Table 1. A detailed list of selective and non-selective fishing gear used on the inland waters of Bangladesh.

Type of fishing gear	English name	Local name	Target species	Mesh size (mm)	Catch/haul (kg) CPUE	Operation period	Habitat
<b>Fish nets</b>							
Gill nets							
a) <i>Punti jal</i> (YRG)	Monofilament gill net	<i>Puti Jal*</i>	Puti, kholisha	22-32	0.5-1.0	Day+night	F
b) <i>Koi jal</i> (YRG)	Multifilament fixed gill net	<i>Koya Jal</i>	Koi	14	0.5-1.0	Day+night	F
c) <i>Current jal</i> (YRG)	Monofilament fixed gill net	<i>Current jal</i>	Juveniles of Indian major carps	10-50	–	Day+night	RR, R, F
Lift nets							
a) <i>Veshal/khara jal</i> (SG)	Triangular lift net	<i>Khara jal / Tong Jal</i>	Baila, puti	5-15	0.4-1.0	Day+night	RR, F
b) <i>Tar jal</i> (SG)	Square lift net (with otter)	<i>Tar Jal</i>	Veda, puti, bain, shol	5-15	–	Day	RR
Seine nets							
a) <i>Ber jal</i> (YRG)	Encircled net	<i>Ber jal</i>	Rui, catol, tengra	5-23	2-4	Day+night	RR, R, F
b) <i>Fash/piya jal</i> (OG)	Monofilament nylon seine net	<i>Fash jal</i>	Kalibous, bacha, ilish	15-150	–	Day+night	RR, F
<b>Fish traps</b>							
a) <i>Dughair/ Koi dughair</i> (YRG)	Conical trap	<i>Doir/Koi dughair</i>	Koi, climbing perch, cat fish	–	0.25-0.5	Day+night	RR, R, F
b) <i>Thaga</i> (SG)	Fish barrier	<i>Thaga</i>	Different types of fresh water fish	16-33	15-30	Day+night	RR
<b>Fish aggregating devices (FADs)</b>							
a) <i>Katha</i> (UG)	Brush shelter	<i>Jhag/Katta/Jhata</i>	Mola, chanda, taki	5-7	–	Day+night	RR, R, F
b) <i>Kua</i> (UG)	Deep pit	<i>Khad/Pukur/ Dunga</i>	Puti, chanda, gutum	–	–	Day+night	RR, F

\**Jal*: Local name for fishing net.

R = Reservoir; F = Flood plain; RR = River; YRG = Year round gear; SG = Seasonal gear; UG = Unusual gear; OG = Occasional gear.

or set to drift in open water. As passive gear, their catching ability relies on the movement or migration of fish through the area where the nets are set.

**a) *Punti jal***

Commonly operated in flood plains, this gill net is made of cotton twine or monofilament. It is known as *punti jal* because it catches mainly small puti and kholisha. The net is 10-30 m long and 0.5-1.0 m wide. Mesh size varies between 22 and 32 mm. Most *punti jals* have both floats and weights attached to them, though some have only floats. The net is usually set in the morning in flooded paddy fields or in the open part of a floodplain. Fish are removed periodically. Nets of large

mesh size are used throughout the year and nets with a small mesh are used during the monsoon period. Puti is the target species but kholisha, singi, taki, baim, chapila and veda are also caught with this gear type (Table 2).

Although this gear is very selective for puti (*Puntius* spp.) and the size of stocked carp caught by this gear were similar to puti, it is not clear how stocked fingerlings avoid these nets. One possible answer is that fingerlings move in schools and if any of the members get caught by the net, others change course to avoid it. This gear was not found to be destructive in the Chanda and BSKB *beel* in the Khulna region of Bangladesh. Though *punti jal* caught a negligible percentage of carp, it is

recommended that its use be restricted from June to September in stocked flood plains (Table 3).

**b) *Koi jal***

Capturing koi (*Anabas testudineus*) as a target fish, this gear is aptly named *koi jal* and is operated in the southwestern region of Bangladesh. It is a multifilament fixed gill net fabricated with nylon or cotton twine, with a mesh size of 38-45 mm. A *koi jal* is 15-30 m long and 1-2 m wide. Some nets are equipped with both float and sinkers. A single piece or a number of pieces of net joined together are set in the paddy fields or an open area of floodplain. The net is set in the evening and the fish are hauled at dawn the next

Table 2. Common and scientific names of fish (in order mentioned in text).

Common name	Scientific name
Puti	<i>Puntius</i> spp.
Kholisha	<i>Colisha fasciatus</i>
Singi	<i>Heteropneustes fossilis</i>
Taki	<i>Channa punctatus</i>
Baim	<i>Mastacembelus</i> spp. e.g., <i>M. armatus</i> ; <i>M. pancalus</i>
Chapila	<i>Gudusia</i> spp.
Veda	<i>Nandua nandus</i>
Koi	<i>Anabas testudineus</i>
Rohu	<i>Labeo rohita</i>
Catol	<i>Catla catla</i>
Boal	<i>Wallagonia attu</i>
Air	<i>Mystus aor</i>
Mrigal	<i>Cirrhinus migala</i>
Silver carp	<i>Hypophthalmichthys molitix</i>
Tatkini	<i>Cihinus reba</i>
Bata	<i>Labeo bata</i>
Tengra	<i>Mystus vittatus</i>
Tara baim	<i>Macragnathus aculeatus</i>
Puti	<i>Puntius sophore</i>
Shol	<i>Channa striatus</i>
Baila	<i>Glossogobius giurus</i>
Kajuli	<i>Ailia coila</i>
Kalibaush	<i>Labeo calbasu</i>
Bacha	<i>Eutropiichthys vacha</i>
Ilish	<i>Hilsa ilisha</i>
Garua	<i>Clupisoma garua</i>
Mola	<i>Amblypharyngodon mola</i>
Chanda	<i>Chanda nama</i>
Gutum	<i>Lepidocephalus guntea</i>
Chela	<i>Chela cachius</i>



The *current jal* gill net.

Table 3. Selective and non-selective fishing gear that should be regulated for the conservation of fish biodiversity.

Types of fishing gear	English name	Habitat	Number of crew	Restriction period
<b>Fish nets</b>				
Gill nets				
a) <i>Punti jal</i> (YRG)	Monofilament gill net	F	1	June-September
b) <i>Koi jal</i> (YRG)	Multifilament fixed gill net	F	1	June-September
c) <i>Current jal</i> (YRG)	Monofilament fixed gill net	RR, R, F	1-2	Should be banned
Lift nets				
a) <i>Veshal/khara jal</i> (SG)	Triangular lift net	RR, F	1-2	June-September
b) <i>Tar jal</i> (SG)	Square lift net (with otter)	RR	6-7	Should be banned
Seine nets				
a) <i>Ber jal</i> (YRG)	Encircled net	RR, R, F	12-15	June-October
b) <i>Fash/piya jal</i> (OG)	Monofilament nylon seine net	RR, F	7-9	June-October
<b>Fish traps</b>				
a) <i>Dughair/Koi dughair</i> (YRG)	Conical trap	RR, R, F	1-2	June-September
b) <i>Thaga</i> (SG)	Fish barrier	RR	4-5	Should be prohibited
<b>Fish aggregating devices (FADs)</b>				
a) <i>Katha</i> (UG)	Brush shelter	RR, R, F	5-9	Should be prohibited
b) <i>Kua</i> (UG)	Deep pit	RR, F	6	Should be prohibited

R = Reservoir; F = Floodplain; RR = River; YRG = Year round gear; SG = Seasonal gear; UG = Unusual gear; OG = Occasional gear.

day. Along with the target fish, this net also captures singi, kholisha, taki, and baim. Considering the selective range and the composition of carp in the catch, this gear was found to be moderately harmful for stocked carp. The use of this gear should be regulated between June to September (Table 3).

**c) *Current jal***

*Current jal* is a small mesh (25-50 mm) monofilament fixed gill net usually used to catch small species. A number of pieces of net are joined together and set in paddy fields or an open area of floodplain, river or reservoir. Each piece is about 10-25 m long and 0.5-1.0 m wide. Various mesh

sizes are used in different water bodies. *Current jals* with larger mesh sizes (30-50 mm) are used mainly for capturing rohu, catol, common carp, boal and 'air' (*Mystus aor*) while nets with a small mesh (10-20 mm) are used for catching singi, taki, baim, koi, kholisha and fingerlings of common carp, rohu, catol, mrigal, silver carp, air and boal.

The *current jal* is an extremely effective net and has been banned by the government because of its potential to overexploit juvenile carp. It is considered to be one of the most harmful nets and is responsible for the decline in fish populations in rivers, flood plains and reservoirs. The Fish Act 1950 places a

penalty of Taka 1 000 (58 Tk = 1 US\$ April 2002) with one to six months in prison for a first offence by any person using this net in any kind of habitat (reservoir, river or flood plain). The second offence has a penalty of Taka 2 000 with two months to one year in prison.

**Lift nets**

The fish swim or are maneuvered over a flat or bag-like piece of netting and are then caught by lifting the net.

**a) Veshal jal/Khara jal**

This is a triangular lift net fixed with bamboo poles operated from a bamboo platform built along the canal that brings in or drains out water from a *beel* or in a floodplain area with gentle flowing water. In some area of Bangladesh, *Veshal jal* is commonly known as *khara* or *tong jal*. Two sides of the net are attached to two long bamboos and the cod ends of these two bamboos are bent and tied together. The two bamboo poles act as a fulcrum (*dheki kol*) so that when the net is lifted by applying weight at its base, its central portion stands about 1.5 m above the water surface. A thread is attached to the front side of the net and bent with two front ends of the two bamboos. During fishing, fishers drop the net into the water against a gentle current. The front portion is set in water while the conical end remains about 2 m above the water surface. The net forms a conical bag under pressure of the water current. This gear is



Operation of veshal or khara jal on the river.

operated both by day and by night. Fishes like *tatkini*, *rohu*, *bata*, *tengra* and *baim* are caught with this gear.

This gear is seriously harmful to stocked carp populations and its use should be restricted from June to September in carp stocked flood plains.

**b) Tar jal (with otter)**



Tar jal in use on the river.

This gear is not common in all parts of Bangladesh. Square shaped *tar jals* are operated against the current from boats at the mouth of secondary rivers. Two otters are used to drive the fishes into the net. Entangled fishes are removed into the boat. *Bachari* boats with a crew of six to seven are required for the operation of this gear, which is only used in the daytime (Table 1). Fishes caught include *veda*, *tengra*, *tara baim*, *puti* and *shol*. This gear and fishing method is seriously harmful to many species. Restrictions, including bans, should be imposed on the use of this gear.

**Seine nets**

These nets are designed to be towed in an arc around fish shoals to surround them. Fish of both small and large size are vulnerable to such gear but the catch depends mostly on the mesh size. Methods of employing seine nets vary. Frequently one end of the net is attached to a pulley or anchored on the shore and a boat is used to pull the net into a large arc back to the shore before hauling in.

**a) Ber jal**

*Ber jal* is a conventional beach seine net, sometimes called *goga jal* locally. It is commonly used in floodplains, ponds and

ivers. It is also used in *beels* and rivers during the dry season when water flow is minimal. This net is usually hauled by a team of fishers (12-15), the number depending on the size and weight of the net. It is a rectangular net with floats on the head rope and weights on the ground rope. The ground rope is made of thick twisted jute fibers and the head rope is thin nylon or polyethylene. It is very large in size, usually 50-200 m long and 5-6 m wide. Mesh size ranges between 5-23 mm. Length, depth and mesh size vary with the size of the water body and the species to be caught. After surrounding part of a water body with this net, the two ends of the net are drawn together and the ground rope is hauled up from the center of the water body to catch the fish. A large mesh size is used for harvesting *rohu*, *catol*, *boal*, *mrigal* and other large fish, while small mesh nets capture *tengra*, *puti*, *prawn*, *baila*, and *kajuli*. This gear can be operated by day and by night.



Fishermen using ber jal.

This gear catches huge numbers of undersized carp from the stocked flood plains. It is considered very destructive. During operation, this gear destroys the habitat for wild species thus causing multiple harm to all the fish living on the flood plain. Fine-mesh *ber jals* catch fish irrespective of their size or species. The use of this gear should be banned from June to October in stocked flood plains (Table 3).

**b) Fash jal/Piya jal**

This is a rectangular net made of monofilament or nylon twine operated in reservoirs, rivers and flood plains. It is a passive gear commonly known as *net*

*jal*. It is 20-200 m long and 1-6 m wide with mesh of 45-300 mm. Floats are used at the headline, earthen weights for the ground line. This gear is fixed in the water with two bamboo poles to form a large net wall. It is used to catch fishes like kalibaush, bacha, ilish, garua and koi. *Fash jal* with a mesh size greater than 90 mm is not at all harmful to stocked carp. However, *fash jal* with <90 mm mesh catch some carp. Therefore, nets with mesh size <90 mm should be regulated during the period June to October (Table 3).

### Fish traps

Traps are devices designed to encourage the entry of animals, which are then prevented from escaping either by particular aspects of their behavior or by the design of the trap itself. Fish traps are mostly made of split bamboo and cane materials and fall into two categories: baited or not baited. There are three types of fish traps.

#### a) *Dughair/koi dughair*

This is a conical trap made of bamboo sticks and cane in various sizes and shapes. It may or may not contain bait or lure. There is an opening on one side for fish to enter and the other side is covered with a polythene net so that the fish that have entered cannot escape. They are used in running or static water. In running water the mouth of the trap is set against the direction of the water flow. These traps are also fixed along the edges of paddy fields, one after another at small intervals. Catfish and climbing



Fishermen checking for fish in their *dughair*.

perch are caught from February to July. This gear catches a considerable quantity of undersized carp, which is illegal. Use of this gear is seriously harmful to stocked carps and consequently it should be banned between June and September (Table 3).

#### b) *Thaga*

This is a traditional fish barrier trap and is operated in the primary and secondary rivers of Bangladesh. A series of long bamboo sticks are placed across the river with a long seine net attached. All types of fresh water species are caught. This gear is usually operated 24 hours a day. Use of this kind of fish barrier trap in the river is illegal (Fish Act 1950). The barrier disrupts fish migration as well as destroying fish spawning grounds.

### Fish aggregating devices (FADs)

#### a) *Katha* (brush shelter)

The term *katha* varies regionally with a number of synonyms such as *jhag*, *katta* and *jhata*. This fishing technique is also called *komar* and is operated in the oxbow lakes of Bangladesh (Middendorp et al. 1996). Welcomme (1972) described this fishery system used in the coastal lagoons of west Africa, especially in Benin, where it is known as *acadjas*. In Cambodia these devices are called *samarahs* (Shankar et al. 1998).

For the most part this fishery is operated in secondary rivers, canals, *beels*, floodplains and reservoirs. The fishery lasts for 5-7 months each year (September to March) when the water level decreases and rivers and canals become calm and cool. *Katha* are usually constructed with branches from bushy trees such as the hizole (*Barringtonia* sp.), gamboling (*Eugenia* sp.) or babla (*Acacia* sp.). This type of shelter attracts fish and they accumulate in the *katha* in large numbers. A number of bamboo poles are fixed around the *katha* to preserve its structure. Water hyacinth (*Eichhornia crassipes*) are often used to cover it.



Typical *katha* fishing in the bank of a secondary river.

To fish the *katha*, it is encircled with a *ber jal* or seine net. After 1-2 days (Wahab and Kibria 1994) all the branches and bushes are removed. The fish are caught by *jhaki jal* (cast net) and by hand. Usually 4-5 persons are involved. Finally, the *ber jal* is pulled through the *katha* to remove the remaining fish. Fishes like mola, chanda, gutum, taki, puti, baim, kholisha and chela are caught using this method. The fishery can operate by day or night (Ahmed and Hambrey 1999).

This fishing practice causes serious social and environmental conflicts (Pliya 1980). It creates conflicts between the *katha* owners and river/canal fishermen as the *katha* attracts fishes from the wild stocks; conflicts between *katha* owners and navigation interests since the *katha* occupies considerable space; conflicts resulting from deforestation; and conflicts caused by the depletion of natural fish stocks as the harvest consists mostly of small and brood fishes.

#### b) *Kua* (deep pit)

*Kua* means a fish pit on floodplain *beels*. The *kua* fishery has a number of names like *khad*, *pukur* or *danga*. A large number of *kuas* are found in *beels* and floodplains. There are two types of *kuas*—the natural *kua* and the man made *kua*. Natural *kuas* are relatively small natural depressions, usually seen in floodplains and shallow *beels* or the deeper parts of small seasonal rivers. During the monsoon period, these pits are completely covered in with water but as the water recedes

these *kuas* are exposed. The *kua* fishery begins in late October and continues until late April, with a peak period from December to February.

The landowners may excavate one or more ditches (man made *kuas*) in the floodplain or *beel* areas in order to provide refuge for fish during the dry season. These pits are also used for irrigation and sometimes integrated with rice cultivation. The *kuas* are usually fished by netting or de-watering. Puti, chanda and gutum are caught using this method (Wahab and Kibria 1994).

*Kua* fisheries are also not favorable for sustaining yields because all fish, including brood stock and juveniles, are removed from the floodplain. Unplanned and unregulated use of this type of fishing poses a serious threat both to natural stocks and to the effectiveness of stock enhancement.

## Discussion

The overall objective of increasing fish production by stocking the floodplains with carp is being undermined by indiscriminate use of non-selective fishing gear. This study recorded a decrease in catch per unit effort (CPUE) and in the profitability of the fisheries.

A large number of different types of fishing gear are used, some of which catch large numbers of undersized carp (which is illegal), some catch a few illegal carp and others catch only legal-size carp. Some gear do not catch carp but are very destructive for wild fish populations. The indiscriminate exploitation of fish from inland open waters by complete removal of water from natural depressions (*beels*), floodplains, or canals results in loss of the entire populations of wild fish species,

including brood fish and juveniles. This behavior suggests that biodiversity is sacrificed for short-term economic benefits. Though the use of several types of fishing gear is limited and regulated under the national fishery laws, they are still used.

As the operation of all types of gear cannot simply be suspended to allow the stocked fingerlings to grow out, it is important to identify the gear that can be operated without exploiting undersized fingerlings stocked under the government plan and the gear that should be regulated. The operation of *ber jal*, *veshall khara jal*, *punti jal*, *koi jal*, *fash/piya jal* (up to 90 mm mesh) and fish traps like *dughair/koi dughair* and *thaga* should be restricted from June to September/October. The use of *tar jal* and *current jal* should be banned and the FADs like *katha* and *kua* fishing should be prohibited.

An awareness/training program should be extended to fishers to create an awareness of the factors affecting the health of the fisheries and the rationale for the restrictions on a particular fishing gear in a particular season. This will improve compliance with the regulations and improve yields in the long term.

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