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Non-selective Fishing Gears and Sustainability Issues in the Hooghly-Matlah Estuary in West Bengal, India

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Abstract

Hooghly-Matlah estuarine system in the state of West Bengal (India) is estimated to cover about 8000 km^2 sustaining important multi-species commercial fishery. A study was undertaken during April 2005, to find out the nature and present status of the fishing gear and practices and the results are presented in this paper. Gill net, bag net, lift net, drag net, purse net, seine net, cast net, skimming net, lines, barriers and traps are the predominant gears operated. *Been jal* or *Behunti jal* is a stationary bag net with a wide mouth of about 27 m and with very small codend mesh size (about 2 mm). *Char-pata jal* is a screen barrier made of netting with very small meshes. *Chat ber* is a fine meshed seine operated for harvesting juveniles. *Sitki jal* is a skimming net made of polyethylene netting of very small mesh size (about 2 mm), used for fry and fingerling collection in the middle reaches of the estuary. All these nets are non-selective and highly destructive in nature. The paper discusses the design, rigging and operational aspects of the important gears in the Hooghly-Matlah estuarine system and suggests improvements required in the context of responsible fishing.

Introduction

Information on the existing fishing gears and methods is a prerequisite for the management of fishery resource system. Hooghly River in the state of West Bengal is a tributary of the Ganga river system in the northeastern India. It is formed by the junction of the Bhagirathi and Jalangi rivers at Nabadwip and it flows about 260 km towards south to the Bay of Bengal. Pillay (1967) reported that the Hooghly-Matlah estuarine system is estimated to cover about 8000 km^2. Pantulu and Bhimchar (1964) reported that in the main channel, Hooghly, the tidal influence is felt to about 290 km from the sea. Several commercially important fishes like hilsa shad (*Tenualosa ilisha*, Clupeidae), fourfinger threadfin (*Eleutheronema tetradactylum*, Polynemidae), other threadfins (*Polynemus* spp., Polynemidae), catla (*Catla catla*, Cyprinidae), rohu (*Labeo rohita*, Cyprinidae), long whiskers catfish (*Mystus gulio*, Bagridae), mullets (*Liza* spp.,

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Mugilidae), pama croaker (*Otolithoides pama*, Sciaenidae), anchovies (*Coila* spp. and *Setipinna* spp., Engraulidae), yellowtail catfish (*Pangasius pangasius*, Pangasiidae), rita (*Rita rita*, Bagridae), Blackfin sea catfish (*Tachysurus jella*, Ariidae), other sciaenids and prawns inhabit in the system and support the commercial fishery of the region.

A wide variety of fishing gears and methods are operated round the year in this estuarine system for commercial and subsistence fishing. Different fishing gears of the estuary have been described by Hornell (1924; 1950; Naidu 1942; Jones 1959a; 1959b; Mitra 1952; Pillay & Ghosh 1962 and Dutta 1973). De (1987) identified 27 types of fishing gears belonging to nine major categories. Based on the mode of operation, fishing gears of Hooghly River have been classified into 11 groups by Mitra et al. (1987). Bag net fishery of lower Hooghly estuary was reported by Karmakar et al. (2005). Details of design and technical specifications of fishing gears from the Hooghly river sytem have not been adequately reported so far. In this paper, the results of the study conducted on the design and methods of operation of different fishing gears, operated in the system, are discussed along with suggestions for their improvements in the context of responsible fisheries.

Materials and Methods

The study on the fishing gears of Hooghly river was undertaken during April 2005. Details of design, fabrication, mode of operation, target species and type of craft employed were collected from eleven fishing villages located along the Hooghly river from Kallyani to Howrah bridge (Table 1).

Table 1. Sampling centers and major fishing gears operated in Hooghly river

No.	Name of village	Local name fishing gear	Type of gear
1	Bichali ghat	*Katni jal/ Moi jal/ trawl*	Drag net
		Been jal	Bag net
		Dholi	Gill net
		Sanglo	Purse net
2	Devithala	*Cord jal/ Phash jal*	Surface drift gill net
		Gonodholi	Surface drift gill net
		Chat ber/ Charpata jal	Shore seine/ barrier
		Sitki jal	Skimming net
3	Navaganga	*Phash jal*	Surface drift gill net

4	Chandan nagar	*Basal jal*	Lift net (mobile)
5	Bupenloth nagar	*Pilkhana/ Tana jal*	Seine
		Kavla jal	Cast net with pocket
		Ghuni	Prawn trap
		Cheep	Pole and line
		Bat jal	Scoop net
		Tana jal	Seine
6	Basudevapur/ Triveni	*Sadi jal / Currentjal*	Gill net
		Been jal	Bag net
		Sol jal	Seine
7	Kunti ghat	*Khatal / Kumad*	Fish Aggregating Device
		Chai / Pelli	Fish trap
		Dhuar	Prawn trap
		Thopa jal	Scoop net
8	Gandi ghat	*Pata jal/ Ghera jal*	Barrier
9	Titali ghat	*Down*	Long line
		Jag/ dal / Kathas	Bush park
10	Bag Bazar	*Been jal*	Bag net
		Phash jal	Surface drift gill net
		Kata	Bottom drift gill net
			Hook and line
		Cheep	Pole and line
11	Bada bazaar/ Howrah	*Been jal*	Bag net

Design details were collected based on the methods suggested by Miyamoto (1962). Data was collected by examining representative samples of gears as well as interviewing fishermen and net makers. The design drawings were made following Nedlec (1975).

Results

Ten major groups of fishing gears were identified from the 11 villages surveyed

during the study. Bag nets, gill nets, purse nets, lift nets, drag nets, seine nets, barriers, traps, cast nets and lines are the prevalent fishing gears

Main fishing seasons for important gears and the target species of each gear are given in Tables 2.

Table 2. Main seasons and target species of different gears

No	Type of gear	Main season	Major species caught
1	Bag net	November - June	*Setipinna* spp., *Otolithoides pama, Pangasius pangasius,* prawns, *Polynemus*, sp, *Coila* spp.
2	Gill nets	All seasons	*Tenualosa ilisha, Pangasius* sp., *Polynemus* sp., *Rita* sp., *Mystus* spp. *Catla catla, Labeo rohita*
3	Purse net	All seasons	*Tenualosa ilisha*
4	Lift net	All seasons	Prawns and small fishes
5	Drag net	All seasons except monsoon	Prawns and small fishes
6	Cast net	All seasons	Prawns and small fishes
7	Hooks and lines	All seasons	*Pangasius pangasius, Otolithoides pama, Polynemus* sp, *Rita rita*
8	Seines	December- April	*Tenualosa ilisha, Tachysurus jella, Setipinna* spp., *Otolithoides pama,*
9	Screen barrier	All seasons	*Otolithoides pama, Pangasius pangasius, Lisa* spp., *Catla catla, Wallago attu, Mystus gulio,* prawns
10	Traps	All seasons except monsoon	Prawns

Source: Mitra et al. (1987)

Bag net

Been jal* or *Bhhunti jal

The *been jal* is a long bag net with a wide mouth and narrow codend made of small meshed netting designed for operation in tidal areas (Fig. 1). The net is about 25

m long, 7 m wide at the mouth portion with long wings of about 10 m length and 2 m width on both side of mouth. It is made of polyethylene netting with 40 mm mesh size near the mouth, which reduced to 10 mm in the codend. There is a flap inside of the bag, near the codend to prevent the fish from swimming out. The smaller version in vernacular is known as *thor jal.*

Two fishermen and a canoe are required for the net operation. It is operated like other fixed bag nets by fixing it where the tidal current is strong. The net is operated throughout the season and the peak season is during November – June. The mouth of the net is kept open by means of two bamboo poles, which are fastened to the upper and lower margins of the net mouth. In deeper areas instead of poles, two heavy wooden anchors or stout wooden spikes driven into the river bed are used to fix the net. Two large drums are tied to the upper wing on either side of the mouth to keep the mouth open.

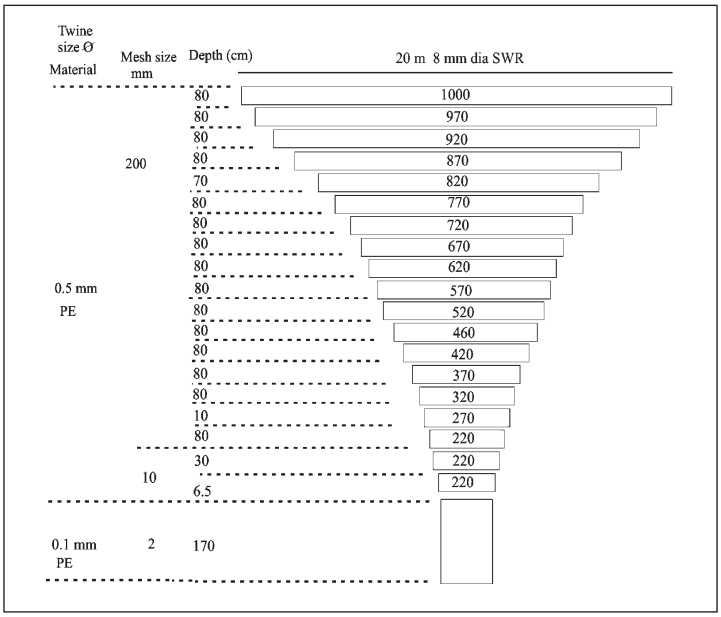

Figure 1. Design of a bag net

Gill nets

Gill nets are the most common fishing gear found in the river. The net is made of Polyamide (PA) multifilament or monofilament. At present gill nets made of monofilament are maximum in number. Technical specifications of different gill nets and the target species are given in Table 3. Design details of *Hilsa* and *Pangasius* gill nets are shown in Fig. 2 and 3. De (1987) has broadly classified the gill net as gill net with foot rope and set gill net with foot rope.

Table 3. Specification of gill nets used in the estuary

Local name	Type of operation	Material (mm)	Mat. Size/ specific. (No)	Mesh size	Mesh in depth	Hang. Coeft.	Target species
Dholi	Surface drift	PA mono, PA multi	0.2, 210Dx1x3	50	100	0.5 - 0.6	*Tenualosa ilisha*
Phash jal	Surface drift	PA multi	210Dx3x3	200	70	0.5	*Pangasius pangasius, Mystus* sp.,*Rita rita*
Gonodholi	Surface & bottom drift	PA mono	0.16mm	30-35	100	0.4 - 0.6	*Clupeids, Setipinna* sp. *Gobids, Mystus* sp.
	Surface drift	PA mono	0.2	100	100	0.4 - 0.65	*Tenualosa islisha,Pangasius. pangasiusCatla catla, Labeo rohita*

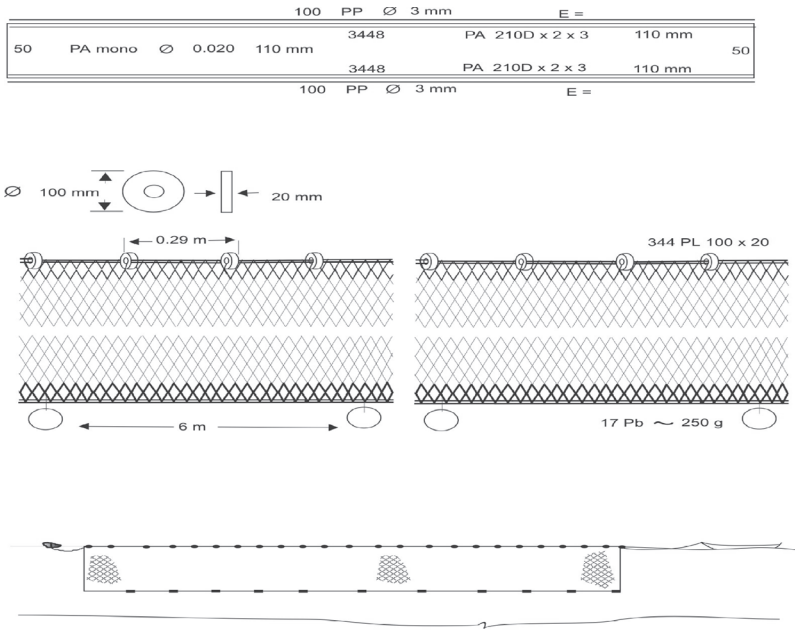

Figure 2. Design of gill net for hilsa shad

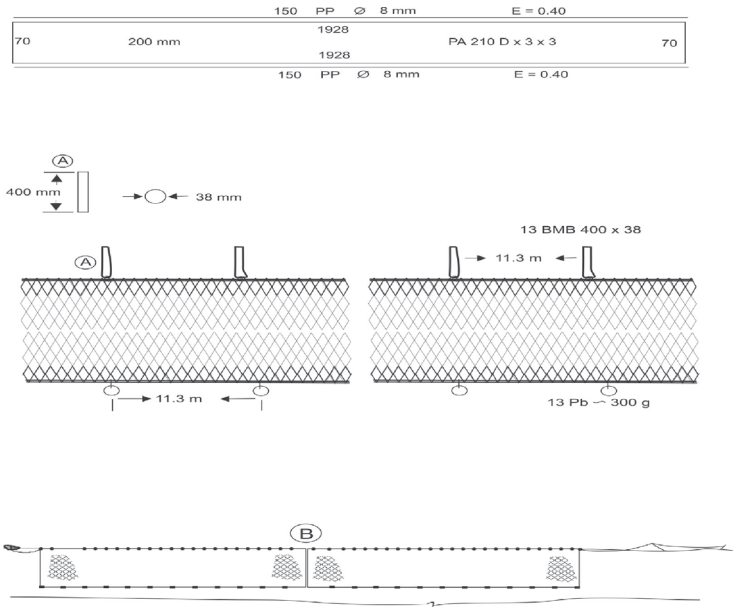

Figure 3. Design of gill net for yellowtail catfish

Drag net

Moi jal

Moi jal is also known as "trawl" in West Bengal. It is a multi-walled drag net of about 8x 1.5 m size. About one third of the lower edge of the netting is doubled up on the front side and sewn along the sides forming a long pocket in the whole width of the net (Hornell, 1924). Front upper panel is made of 2 mm dia polyamide tyre cord with 400 mm mesh size whereas the lower panel is made of polyamide 210Dx1x2 with 15 mm mesh size followed by 12 mm and 10 mm mesh size. A panel made of polyethylene netting with 2 mm twine size and 10 mm mesh size is attached to the lower part of the net for protection. The backside panel of the net is made of small mesh netting with about 4 mm mesh size. Other details of the net are given in Fig. 4.

Barrier net

Char pat jal

The barrier net known as *Char pat jal iksn* is operated in shallow areas where the bottom gets partially or fully exposed during low tide. The net is several meters long and about 3-4 meters wide made of netting with very small meshes. The netting is mounted to a slender rope on the upper side and a stout rope in the lower side.

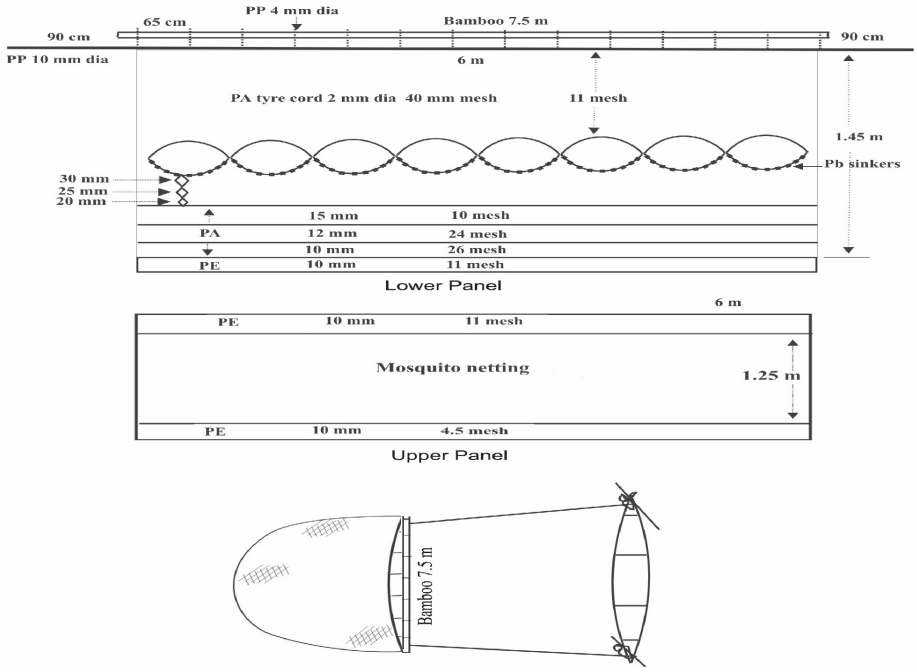

Figure 4. Design and operation of drag net

The net is operated especially during spring tide in the winter season. During low tide fishermen fix a series of poles parallel to the shore. Then the footrope is tied to the base of the poles and the whole net is allowed to flush with the ground, with strings from the head rope attached to the tope of the poles here and enable the net to be raised when required. At the peak of the high tide fishermen go there in boats and raise the head rope and fix it on to the poles above water line. When the tide recedes the fishes get trapped inside the barrier and the fishermen enter inside and collect the fishes.

Lift net

Basal jal

The lift net known as *Basal jal* is operated with the help of fixed fulcra planted on the riverbed, on the high bank of a river or on the side of a boat (Fig. 5) The net is triangular in shape with about 8 m size on all the sides. The net is made of polyamide multifilament with 20 mm mesh size in the front and it increases to 70 mm towards the base. The net is rigged to two long bamboo poles on both sides, the base of which is tied together and fixed to the lifting device in the canoe or platform.

Four fishermen are required for the operation. The canoe moves sidewise and it is operated from the side of a canoe. The net is dipped in water and the canoe moves keeping the net close to the bottom. The net is lifted periodically and catch is collected

from the base of the net. A fixed lift net is dipped for some time and is lifted to remove the catch. Hilsa shad and carps form the main components in the catch.

Figure 5. Stationary lift net (*Basal jal*) operated in Chandan nagar fishing village (West Bengal)

Skimming net

Sitki jal

This net also looks like a small *basal jal* made of netting with very small meshes. The triangular net is mounted to bamboo poles on all sides. It is operated in shallow areas by a man wading in water and pushing the net along the bottom. Periodically the net is lifted to remove the catch. Usually it is operated to collect fish and prawn seed for selling to the fish farmers.

Discussion

Naidu (1942), Jones (1959a) and Pillai & Ghosh (1962) have described the operation of fixed bag nets from the system. In deeper areas, instead of poles two heavy wooden anchors or stout wooden spikes driven into the riverbed are used to fix the net (Pillai & Ghosh, 1962). De (1987) reported that about 4000 bag nets were in operation in the Hooghly rive and contributed more than 60% of the catch from the system. More than half of the catches of the bag nets consist of Bombay duck (*Harpadon nehereus*, Synodontidae) and prawns. Remaining part is constituted by hairtails (*Trichiurus* spp., Trichiuridae), Elongate ilisha (*Ilisha elongata*, Pristigasteridae), anchovies, pama croaker, yellowtail catfish and threadfins. Pillai & Ghosh (1962) reported that the net after hauling may again be set against the then prevailing tide. Recruitment of penaeid prawns from the sea into the backwaters takes place predominantly during high tides and therefore it is important that the existing ban on high tide operation in the backwaters be rigorously implemented (Thomas et al. 2007). Whenever series of bag nets are set, 3-4 m distance between adjacent nets should be maintained.

Gill nets are operated through out the season during the high tide predominantly as surface drift mainly for hilsa shad, yellowtail catfish, other catfishes, Rita , anchovies, gobies, threadfins and major carps. Jones (1959a) reported that when drift gill nets are operated at night a light is kept burning on the small raft attached to one end of the head rope to have an idea on the position of the net. *Ilish dholi* (hilsa gill net) is extensively used during winter seasons in the upper reaches of the river to catch migrating hilsa shad. *Barang* is a bottom set net operated in the lower zone to catch barramundi (*Lates calcarifer,* Latidae), threadfins and catfishes. *Shele jal* is a bottom drift net operated for polynemids, catfish and pomfrets (De 1987).

Seine nets are also described as dragnets by some authors. In Hoogly larger version of such nets are reported as *kanti* by Mitra (1987). *Bachuru jal* is a similar net in Brahmaputra.It consists of two horizontal layers of webbing of different mesh size (Joseph & Narayanan, 1965). According to De (1987) *charpata* has a number of pieces, each about 7 m long and 3-4 m wide. Some fishermen use lead sinkers for the foot rope to keep the lower edge in the bottom (Remesan 2006). Though the net is operated continuously the peak fishing season in the system is between December and April. Prawns and small fishes form the major share of the catch (Remesan & Ramachandran, 2007). Adoption of closed area and season can save a large amount of juveniles from being caught since increasing the mesh size is not acceptable to the fishermen.

Long walls of the net fixed in shallow waters along the bank are known as barrier. Hornell (1924); Krishnamurthy & Rao, (1970), Kurian & Sebastian (1986); Mohan Rajan (1993) and Remesan & Ramachandran (2008) reported that screen barriers are extensively used in the backwaters of Malabar and in Hooghly by Jones (1959b). PE netting with very small mesh size is used for the construction of the net. Screens are set along the shore and there is no separate catching chamber for this kind of gear in Hooghly. This type of trap is fixed during the high tide and removed during the next low tide and the fish actively swim up into the barrier. During low tide the enclosed area gets exposed and the fishes get trapped between the shore on one side and screen on the opposite side. A variety of fishes are caught in the net and because of the smaller mesh size juveniles form major portion of the catch.

Fixed lift nets are operated along the course of the river whereas the operation of movable lift net is confined to the lower parts. According to Joseph & Narayan (1965) a hexagonal netting of suitable size is loosely hung to the frame in such a way as to give a miniature bag shape to the rear end of the net. The net forms a conical bag under the pressure of water currents when it is dipped against the current. The two bamboo poles act as a fulcrum so that when the net is lifted by applying weight at the base the central porting comes about 1.5 m above the water surface (Kibria, 2005)

Clap nets

This is actually a trap the oval shaped mouth of which is kept open using two bamboo splinters, each measuring about 16 m length. Clap nets or purse nets (*sanglo*) are operated during winter season to catch hilsa shad migrating towards upper side of the river for breeding. The net is dipped against the current and when the fish strike the net the feeler rope is pulled immediately to close the net mouth and the trapped fish is removed by lifting the net.

Traps, lines, cast net and scoop nets are operated in the middle and upper reaches of the river. Fish aggregating devices made by implanting cut tree branches in shallow areas are also seen in the upper reaches, which are usually harvested after the lapse of a few weeks.

Conclusion

Use of polyethylene netting with very small mesh size of about 2 mm ('mosquito net') for the fabrication of barriers, drag nets, bag nets, lift nets and skimming nets which form the major groups of fishing gears in the system is detrimental to the fishery resources. FAO Code of Conduct for Responsible Fisheries (FAO 1995) highlighted the importance of minimizing waste and discards in fisheries by developing and using selective, environmentally safe and cost-effective fishing gear and techniques. Nets made of very small netting will capture all sizes of fishes, a major share of which are liable to be discarded. Such practices will affect the biodiversity of all the associated water bodies and hence need to be prevented by educating the fishermen. The operation of a fixed bag net during the high tide is harmful as the net captures large quantities juveniles entering into the estuarine system. Since the increase in the codend mesh size is not acceptable to the fishermen, operations during the high tide need to be prohibited. Fishermen usually collect a large quantity of fish and prawn seeds from the river for aquaculture purposes, which is also leading to the decline in the capture of fishery production.

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