



Improved Crab Trap as Attachment of Bag Net: a Novel Fishing Practice in Lower Ganges

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Received: 23.03.2016

Accepted: 17.06.2016

Bag net is the main fishing gear in Hooghly-Matlah estuary, the lower stretch of river Ganga in India. Catch of the bag net is reportedly declining day by day especially in upper estuary due to various factors. During our recent survey, it was observed that a trap named as 'Chak jal' was attached to the caudal region of the existing bag net that catching riverine cat fish 'Arius gagora' in some sector and thereby substantially increasing the income of fishers. The trap is the modified version of a similar trap also named as 'Chak jal' used to catch crab 'Scylla serrata' in upper Sundarban region. In the present paper, detail about the crab trap is given as it is hitherto unreported from Sundarban water in the light of other crab traps reported from different water bodies of India. Improvisation of the crab trap 'Chak jal' as attachment with the bag net to catch riverine catfish is discussed and analyzed.

(**Key words:** *Arius gagora*, Bag net, Been jal, Chak jal, Crab trap, Ghurni jal, Hooghly estuary, ITK, Scylla serrata, Sundarban, The Ganges,)

Fishing using traps is an age-old practice to lure the fishes to enter inside an enclosure and then preventing them from going out and thus getting caught. Among different fishing gear, trap is one type of 'passive' gear. It is one of the lower energy gears as it does not require much involvement or continuous monitoring. Trap has its advantage of catching fish alive in an undamaged condition. It also requires less investment as compared to other common fishing gears. Traps can fish any time in day or night and most of them are highly selective in nature. Those are operated both with and without bait. Various kinds of traps are in practice in open water fisheries of India (Bhattacharjya *et al.*, 2005; George, 1971; Job and Pantulu, 1953; Pravin *et al.*, 2011; Ramamurthy and Muthu, 1969). Technological intervention with time is changing some indigenous traps of India (Manna and Bhattacharjya, 2009). During recent survey in Hooghly-Matlah estuary, two similar traps were recorded, which are hitherto unreported. Both the traps are named as 'Chak jal' but one is used to catch crabs whereas the other is catching riverine cat fish 'Arius gagora' when used as attachment to caudal region of bag net, the most common fishing gears used in Hooghly estuary. The catfish trap has only recently been introduced in the system. The improvisation made in the crab trap to be used as catfish trap as attachment of bag net is discussed in the paper.

MATERIALS AND METHODS

Survey was made in selected areas of Hooghly-Matlah estuary including Sundarban for existing fishing gears and fishery related issues associated with them. Sampling for crab trap 'Chak jal' was made at Kalinagar-Najat area (22°25'59"N, 88°51'13"E) of upper Sundarban. Sampling for improvised *Chak jal* attached with bag net was made at Godakhali (22°24'17"N, 88°08'22"E) in Hooghly river system, whereas it was made at Panchmukhani (Junction of Bidya and Herobhanga river) (22°00'38"N, 88°44'35"E) in Matlah river system. Trap dimensions were recorded. Information regarding various aspect of the original crab trap 'Chak jal' and improvised 'Chak jal' attached with bag net was collected through scheduled questionnaire during personal interaction with the fishers.

RESULTS AND DISCUSSION

The paper deals with the bag net fishery, its recent modification with the use of a trap 'Chak jal' as attached to caudal portion of the net. The trap inherits its origin from a similar gear (also same name) used to catch crab in upper Sundarban region of the same estuary. Details of the 'Bag net fishery', 'Chak jal: crab fishery', modification of *Chak jal* for use as attachment to bag net to harvest catfishes and its possible implication are discussed below.

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Bag net fishery in Hooghly-Matlah estuary

Bag net, also known as Estuarine Set Bag Net (ESBN) is the main fishing gear in Hooghly-Matlah estuarine system contributing about 70% of the total annual fish catch of approximately 66,000 t (Pillay and Ghosh, 1962; Mitra *et al.*, 1987; Paul *et al.*, 1997; Mitra *et al.*, 2001; Mukhopadhyay *et al.*, 2007; Talwar *et al.*, 2013). Fishing with the bag net is an age-old practice and were reported for use in coastal waters of India to harvest different fishes especially prawns and *Harpodon nehereus* (De, 1910; Datta *et al.*, 1989; Dutta *et al.*, 1973; Dutta *et al.*, 1975; Gupta, 1908; Hornell, 1924; Hora, 1949; Hornell, 1950; Jones, 1959; Mitra, 1952; Mitra *et al.*, 1987; Mitra *et al.*, 1997; Naidu, 1942; Pillay and Ghosh, 1962; Pillay, 1967; Saigal, *et al.*, 1989; Talwar *et al.*, 2013; Von Brand, 1972). In lower stretch of river Ganga in India, also known as Hooghly-Matlah estuary, this net is mainly practiced within ~250 km tidal stretch from Tribeni to Fraserganj where the water current is strong enough to set the net. Beyond tidal stretch, in some places of Bhagirathi river and Feeder canal (Jangipur, Dhulian, Farakka etc), it is also observed to be in use at present. This is also in use in almost all the rivers and creeks of Indian Sundarban. Estuarine Set Bag Net (ESBN) is also a popular fishing gear in neighbouring coastal countries like Bangladesh, Pakistan, Thailand etc (Poonnachit-Korsieporn, 2000; Islam and Haque, 2004; Pitcher and Pramod, 2006).

This nonselective conical shaped fishing gear is a long bag net with a wide mouth (25-27 m long, 6-7 m wide), narrow cod end situated at a length of about 20 m and each wings of about 9 m (Jones, 1959; Pillay and Ghosh, 1962; Remesan *et al.*, 2009). However, sizes widely vary from place to place that was described in details by Pillay and Ghosh (1962). It is a passive gear set against the current that takes advantage of the strong tidal flow to drive fish inside the net. It is operated during start of one tidal cycle and harvested only after 5-6 hrs during the end of that tidal cycle when flow reduced considerably during the turn of the tide. Fishes, prawns and crabs those are driven into the net with the water current are collected at the cod end of the net and harvested at the end of each tide. The gear is made of HDPE netting with 40-45 mm mesh size near the mouth, which reduced to 10 mm or even up to 2 mm at the cod end. Though the gear is reportedly in use throughout the year, its operation is less during monsoon months as its anchoring rope may cause hindrance in drift gill net operation for hilsa fishing.

In Hooghly-Matlah estuary, Bag nets, depending upon their size, place and mode of operation, are variously named as *behundi jal*, *been jal*, *beenti jal*, *thor jal* etc. (Pillay and Ghosh, 1962). Though due to high water current, it is operated at bottom water, in places like Godakhali-Uluberia region of Hooghly estuary, it is also operated at surface water in pair from a horizontally placed bamboo-wooden bar placed over a boat (known as *thor jal*) (Fig. 1&2). Metallic or PVC drums are mostly used as float (buoy), however, thermocol floats are also observed to be used in some places like Kakdwip. It is mostly operated during low tide, but high tide operations have also been recorded from many places where sufficient flow exists. Qualitative and quantitative spectrum of the catch used to vary greatly depending upon its use in high or low tide, surface or bottom set, time of operation (day time operation vs. night time operation), day of operation (lunar day) and month of operation. 52.5% variability in CPUE of the bag net can be explained by tidal amplitude and size of the net (Karmakar *et al.*, 1994).

Monthly variation in bag net catch was reported in detail by Pillay and Ghosh (1962). Bag net used to catch all types of fishes which are driven by the strong current



Fig. 1. *Thor jal* (surface set bag net)



Fig. 2. *Behundi jal* (bottom set bag net)

except bigger size fishes like adult hilsa, catfishes etc. (Dutta *et al.*, 1973). However, very small mesh size near the caudal end of this gear made it highly destructive in nature destroying juveniles of many prized fish species like Hilsa, *Polynemus paradiseus*, *Eleutheronema tetradactylum*, *Setipinna phasa*, *Otolithoides pama* etc (Remesan *et al.*, 2009; Manna *et al.*, 2012). Bag net fishers in the upper and middle Hooghly estuary mainly earn from prawn component of the catch whereas fish component is mainly consisted of non-economic fish larvae and juveniles of very less commercial value. Talawar *et al.* (2013) has recently reported about 28% bycatch in winter migratory bag net fishery in lower estuarine zone. Catch volume/ size are sometimes so low that fishers used to stop bag net operation during some seasons as observed. Change in salinity regime in post-Farakka barrage period caused downstream shifting of salinity and its associated prized fish catch consisted of fishes like *Polynemus paradiseus*, *Eleutheronema tetradactylum* etc. (Manna *et al.*, 2013). As expected, in riverine sector of Hooghly estuary, there was a sharp declining trend of the total number of bag net as well as number of associated fishers due to overall low catch and less harvest of those prized fishes (Mitra *et al.*, 2001). Our recent investigation revealed that bag net fishers ingeniously modified a crab trap (known as ‘*Chak jal*’) to attach at the cod end of a bag net which was observed to catch riverine cat fishes especially *Arius gogora* that led to a significant increase in income of the bag net fishers.

Crab fishery in India is mainly dependent on crabs caught from natural waters of estuarine and marine sector. The mud crab, *Scylla serrata* forms the lion's share (estimated 3500 t in 1990's) in total crab landing in India (Sivasubramaniam and Angell, 1992). Mud crab fishery is mainly dependent on export related trade (India's share is 11%, 3rd in the world) though there is a sufficient demand in local market also. Various traps are in use in estuarine waters of all major river systems in India to harvest crabs like *Scylla serrata* or *Scylla tranquebarica* (Chacko *et al.*, 1954; Mahesh Raj, 1992). In Indian Sundarban, *Scylla serrata* is harvested from brackish water mainly by line with bait or hooked iron and steel rods (Hora, 1935). Due to their typical feeding habit, crabs are very much fond of bait made of pieces of fish body parts. In case of any attempt is made to pull the bait out of water, they hold the bait more tightly. This habit of the crab was manipulated to harvest them in Sundarban without any trap but just tying bait with a rope, even without any hook. Those methods of crab

catching were documented long back by Hora (1935) and Chopra (1939). Approximately 1000 t of crab was reported to be produced in Indian Sundarban (Sivasubramaniam and Angell, 1992), though the recent estimate is not available.

Crab is mostly collected from natural waters, however captive rearing for fattening immature crabs are also practiced in a large scale in entire Sundarban region. Crabs are mainly collected using hook-less line. In upper Sundarban, a trap named as ‘*Chak jal*’ is also being used to catch crabs as observed during our recent survey (Fig. 3&4). The harvesting of crab in Sundarban using such trap is hitherto unreported. This ‘*Chak jal*’ has no similarity with the falling gear having same nomenclature described by Hornell (1950) and Pravin *et al.* (2011). The trap is operated using the fish part / prawn as bait put inside. Traps used for crab harvesting was reported from different estuarine water bodies of India. In Chilika, different types of crab catching traps like ‘*Kankada khadia*’, was reported by Mohapatra *et al.* (2011), Behera (2001), Jones and Sujansingani (1952). In Tuticorin waters, two traps viz. ‘*Nandu-thattu*’ and ‘*Nandu-koodu*’ were reported by Shanmugam and Bensam (1980). The crab trap ‘*Nandu katcha*’ is reported from Pulicat Lake and the Killai backwaters in Tamil

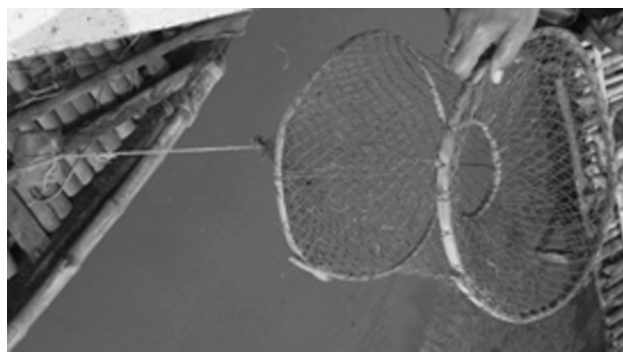


Fig. 3. ‘*Chak jal*’ used for crab fishing in upper Sundarban



Fig. 4. Fisherman with series of crab trap ‘*Chak jal*’

Nadu (Mahesh raj, 1992; Thomas, 1971). Rao *et al.* (1973) compiled various fishing methods including traps used to harvest all types of crabs in saline waters. In coastal waters of Goa, crab trap ‘Cobllem’ is very popular. Similar trap known as ‘Zile’ to catch crab was reported from Ratnagiri coast (Nirmale *et al.*, 2012). However, no crab trap similar in structure and design of ‘Chak jal’ was found in the literature.

Improvisation of crab trap ‘Chak jal’, for use as attachment at bottom set bag net caudal region

In course of fishing operation of bottom set bag net in Hooghly estuary, the fishermen have observed fraction of fish body in the harvest which might be due to devouring of fish body parts that came out through small mesh net of caudal portion by carnivorous riverine cat fishes from outside. Fishermen have manipulated this predatory habit of those catfishes to catch them by adding the modified ‘Chak jal’ at the caudal end of the bottom set bag net (Fig. 5). In Hooghly river system, the trap ‘Chak jal’ which is attached with the bag net is made of a set of three rings of 75 cm dia made of bamboo strips covered with net of 35 mm mesh. The length of the trap is approximately 280 cm with a circular opening of 75 mm dia to allow catfishes to enter and being trapped. The opening is held by strings from middle rings to keep it inside the trap. However, there is slight variation in the size of different component of Chak jal observed in Matlah river system (Fig. 6 & Table 1). It is also called as ‘Ghurni jal’ in Matlah river system. The catch of the trap is mainly consisted of riverine catfish, *Arius gagora* (Fig. 7). It is a novel device to harvest catfishes from Hooghly–Matlah estuarine system. In Hooghly river system, fishermen operate this modified trap attached



Fig. 5. Modified ‘Chak jal’ attached to caudal region of bag net at Godakahli (Hooghly river system)



Fig. 6. ‘Ghurni jal’ at Panchamukhani on river Vidya (Matlah river system)



Fig. 7. Catch of *Arius gagora* from a ‘Chak jal’ attached to a bag net

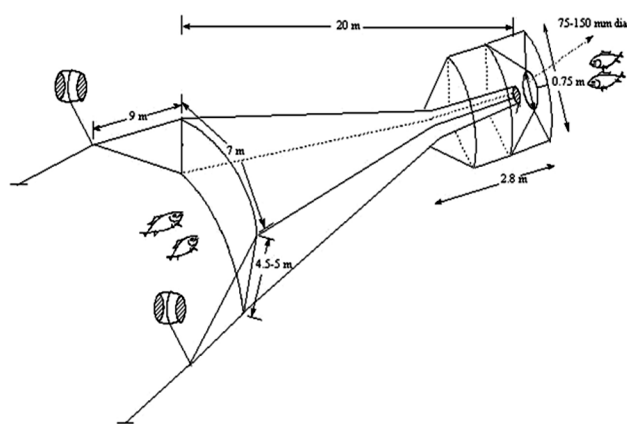
bag net two to four times a day with an average additional catch of approximately 100 kg catfish per month. Thus, it gives an extra income of approximately Rs. 5000/- per month. In Matlah river system, catch as well as income is slightly higher. Though the indigenous gear ‘Chak jal’ is operated for crab fishing in upper Sundarban area, it has been uniquely improvised and suitably modified for catching cat fishes from the river leading to economic benefit of the bag net associated fisher folk.

Due to very high water current, bag net used to go bottom of the water column during most of the time of operation. Only during turn of one tide to another when water current subsides due to reversal of direction of flow of water, the bag net comes up when catch is harvested. During its operation, ‘Chak jal’ attached to the caudal portion of the bag net is also settled at bottom layer of the water column when catfishes enter inside the trap to eat

Table 1. Comparison of *Chak jal* (crab trap) and it's modified one (bag net attachment)

	<i>Chak jal</i> (Crab trap) (Fig. 3 & 4)	<i>Chak jal</i> (improvised, bag net attachment) (Fig. 5 & 6)
Dimension	Length 25 cm x Diameter 25 cm	Length 280 cm x Diameter 75 cm (Hooghly) Length 280 cm x Diameter 75 cm (Matlah)
Chamber	Consisted of two layers	Consisted of three layers
Mesh size	40 mm	35 mm (Hooghly) 40 mm (Matlah)
Mouth diameter	120 mm	75-80 mm (Hooghly) 110-150 mm (Matlah)
Bait	Piece of Trash fish / prawn put by fishers	Fishes collected in bag net at caudal portion act as bait
Catch	Mainly consisted of crab, <i>Scylla serrata</i>	Mainly consisted of catfish <i>Arius gogora</i>
Catch variability	Higher catch during full moon / new moon days	Higher catch during 6th to 11th lunar days, not operated during other days due to high water current (Hooghly) Higher catch during full moon / new moon days, not operated during days with less flow due to low catch (Matlah)
Duration of operation	30-45 mins	5-6 hrs
Season	Throughout the year	Throughout the year
Lunar day of operation	All the days	Neap tide operation - Operated only during 6th to 11th days of lunar cycle when water current is low (Hooghly) Spring tide operation - Only during full moon/new moon days and 1-2 days after those days (Matlah)
Time	Only during day	Both day & night, whenever bag net used
Unit	20 units attached to one rope	Single unit attached to a single bag net
Catch	Crab enters in 20-50% <i>Chak jal</i>	6-12 kg cat fish per unit operation (Hooghly) 30-50 kg cat fish per unit operation (Matlah)

the body portion of fishes that comes out through the mesh of the caudal portion net and thus get trapped. A schematic diagram of the '*Chak jal*' attached bag net is given below (Fig. 8).

**Fig. 8.** Schematic diagram of modified '*Chak jal*' attached to a bag net

A comparative table is given below to understand the modifications made into the structure and function of '*Chak jal*' to use it as an attachment of bag net to harvest catfishes (Table 1). There is little difference in dimension; only entry diameter is slightly smaller in Hooghly river system as compared to those in Matlah river system. Also, operation as per lunar day was observed to vary in Hooghly and Matlah river system. This is due to very high water current in Hooghly river system that carries water from upstream of river Ganga. High water current may damage the whole bag net during full / new moon days as attached '*Chak jal*' at the cod end may hold more water. This prevents the fishers of Hooghly river system to use '*Chak jal*' during full moon / new moon days when water current is relatively higher (spring tide). They start using it only after 5th or 6th day of lunar cycle (neap tide) when water current declines. It is operated 2-3 days depending upon the amount of catch

of the *Arius* sp. In Matlah, it receives very less water from upstream, only water from sea enters during high tide and recedes during low tide. Here, bag net with attachment of *Chak jal* is used during full moon / new moon days and maximum 2/3 days after those days (spring tide).

CONCLUSION

As it is observed that the modified '*Chak jal*' attached with the bag net is highly efficient in catching riverine cat fish, it is expected that soon the technique will spread in the entire Hooghly-Matlah estuary for adoption by bag net fishers in other region. There is a scope for extending this ITK to other Indian estuaries also. Original bag net catch is generally devoid of cat fish *Arius gagora*. Hence, large scale catching of this carnivore through the trap *i.e.* improvised '*Chak jal*' will certainly affect the higher trophic level in estuarine water which may cause a distinct change in overall fish assemblage in Hooghly-Matlah estuarine system. However, '*Chak jal*' is a trap that fitted outside the original bag net and hence in no way to influence the original bag net catch that mostly consisted of fish juveniles and hence highly detrimental to the overall sustainable fishery of the estuary.

ACKNOWLEDGEMENT

Guidance and encouragement received from Dr. V. R. Suresh, Head, Riverine Ecology & Fisheries Division, ICAR-CIFRI, Barrackpore is gratefully acknowledged. Help received from Dr. Pranay Parida, Scientist, ICAR-CIFRI during field tour is thankfully acknowledged. Thanks are due to the technical officers and support staff of CIFRI viz., R. C. Mandi, A. Sengupta, D. Saha, A. Barui, S. Mandal for their help through sampling and data collection from the estuary. Financial helps from Indian Council of Agricultural Research, New Delhi and NICRA for implementation of the projects are gratefully acknowledged.

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