



An Account of Indigenous Fishing Gears of Narmada Estuary, Gujarat, India

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A wide variety of traditional fishing gears are employed throughout the Narmada estuarine region owing to its rich fish biodiversity, but with certain limitations. Documentation of such devices is a need for scientific improvement, and for better socio-economic upliftment of the fishers involved. A total of 12 numbers of traditional fishing techniques was encountered during the study period (2014-15). Catch per unit effort from all of the fishing devices are reportedly declining over the years due to over fishing, habitat destruction, pollution etc. Reduction in fish catching efficiency, income generation through fishing activities gradually decreasing resulting in reduction of active fishermen population. The present paper is an attempt to document all kinds of fishing gears that evolved through indigenous technical knowledge (ITK) used in the Narmada estuary.

(Key words: Indigenous fishing devices, Narmada estuary)

River Narmada is one of the largest (1312 km) west flowing rivers of the country originating from Maikala highlands near Amarkantak under Shahdol District, Madhya Pradesh that culminates into Arabian Sea in District Bharuch, Gujarat State, India. The funnel-shaped 72 km-long estuarine occupies an area of 6,346 km². The entire estuarine system is estimated to be about 14,250 ha. The total fish production of the estuary was reported as 1618 t during 2014-15 (Anon, 2015). The dominant species of Narmada estuary was found to be, *Tenualosa ilisha*, *Mugil cephalus*, *Liza macrolepis*, *L. parsia*, *Lates calcarifer*, *Harpodon neherius*, *Eleutheronema tetradactylum*, *Arius arius*, *Polynemus indicus*, *Cynoglossus cynoglossus*, etc. and prawn species comprised mainly of *Macrobrachium rosenbergii* and *Penaeus indicus*.

At Narmada estuary fishers uses varieties of traditional gears to catch fish for subsistence. Knowledge of fishing gear, crafts and fishing methods is very essential for scientific and judicious exploitation including the management of any capture fishery (Koleker, 2009). Manna *et al.* (2011) reported few works on documentation of crafts and gears in freshwater sector of India. Several researchers have studied the types of fishing gears used in estuarine waters (Hornell, 1950; Jones 1959a and 1959b; Mitra 1952; Pillay & Ghosh 1962; Dutta 1973; De, 1987; Jhingran, 1963; Mitra *et al.*, 1987; Koleker, 2009; Remesan *et al.*, 2009).

In Indian rivers, fishing nets and traps operated in the middle stretch of Ganga river system, fishing crafts and gears in river Krishna is well established (Saxena, 1966 and Manna *et al.*, 2011). Mohan (1983) studied the indigenous fishing gears used for catching squids and cuttle fish along the south west coast of India. Bhakta *et al.* (2016) studied traditional fishing crafts and gears of Ukai reservoir, Gujarat, India but the documentation of fishing crafts and gears in the estuarine region of Gujarat has not been attempted by the researchers in recent past. Thus, the present investigation was undertaken to document the traditional fishing gears of Narmada estuary, Gujarat.

MATERIALS AND METHODS

The present investigation was carried out in 72 km stretch of Narmada estuary, from Bharuch to Ambetha. Data were collected by personal visit to four different landing centres wherein 15-20 numbers of fishers were randomly selected from each landing sites and after group discussion data were tabulated in the survey sheet. Collected data were properly cross checked by the experts constituting of age old fishers, local fishery officials etc. Secondary data were also collected from the Department of Fishery to match the data and to remove discrepancies, if any so that a better outcome can be achieved. A survey sheet was made to collect field data on different fishing devices incorporating local name, materials used for construction, dimensions, person involved for operation, method of operation, season of

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operation, cost, life span, type of species caught and catch per unit effort (CPUE). Gears wise CPUE was calculated, which was an indirect method of the abundance of the respective species. Formula used to calculate CPUE = Total catch/total fishing effort, in a given period.

RESULTS AND DISCUSSIONS

A wide variety of traditional fishing devices are in vogue in the Narmada estuary based on the tidal

influence. Brief discussion of individual gears is given in Table 1.

Fishing gears

Jal (Gill net)

Jal is the most popular and commonly used gear by the fishers of Narmada estuary (Fig. 1 & 2). It is a single wall nets with specific mesh size for targeting different species and operates both in day and night hours. Jal kept its position in more or less vertical by using float-line and

Table 1. Particulars of fishing gears used in Narmada estuary

Local name	Jal	Chogia	Mahajal	Golava	Mandara
Materials used for construction	Nylon/cotton	Nylon/cotton	Nylon/coconut rope	Wooden pole/ Nylon/coconut rope	Wooden pole/ Nylon/coconut rope
Dimensions (m)	100-500 x 10-17	30-50 x 4.5-5.5	200-300 x 15-30	15-22 (L)	100-500 x 10-20
Manpower involved to operate	1-5	1	6-12	4-10	4-10
Construction cost (in Rs.)	1000-5000	1500-3000	45000-60000	50000-100000	10000-50000
Longevity (years)	2-3	2-5	2-3	1-3	2-4
Fishing season	Throughout the year	Throughout the year	Oct-May	Oct-May	June- Sep (for hilsa), throughout the year for other small fishes
Species caught	All types of fishes	Small fishes	Small weed fishes, juveniles etc.	All types of fishes	<i>Tenualosa ilisha</i> , <i>Otolithoides pama</i> , <i>Harpodon neherius</i> , Mulletts, catfishes, etc.
CPUE	1.0-15.0 (kg day ⁻¹)	0.2-1.0 (kg hour ⁻¹)	2.0-50.0 (kg/day)	2-15 (kg tide ⁻¹)	0.2-20 (kg tide ⁻¹)
Local name	Sorpan	Kheda	Waga	Gul	Fanda
Materials used for construction	Bamboo/nylon	Bamboo/iron nylon	Iron/bamboo/nylon	Iron/plastic/nylon	Bamboo stick/nylon
Dimensions (m)	3-25 x 2-5	0.4-0.6 m dia	—	—	—
Manpower involved to operate	1-2	1	1	1-2	1
Construction cost (in Rs.)	500-2000	200-500	100-200	500-2000	<1
Longevity (years)	2-3	3-5	2-6	2-3	Single time operation
Fishing season	Oct-May	Throughout the year	Throughout the year	Throughout the year	Throughout the year during low tides
Species caught	Small fishes	Big fishes	Major carps, minor carps, catfishes etc.	Major carps, minor carps, catfishes etc.	Mudskippers
CPUE	0.2-3.0 (kg/day)	Nil-5.0 (kg day ⁻¹)	1-10 (kg day ⁻¹)	0.1-5.0 (kg day ⁻¹)	0.2-1.5 kg hour ⁻¹

Contd.

Local name	Geri	Roshi
Materials used for construction	Iron rod/wood/bamboo	Nylon
Dimensions (m)	0.5-0.75 m (L)	1-3
Manpower involved to operate	1	1-2
Construction cost (in Rs.)	50-100	50-200
Longevity (years)	4-6	2-5
Fishing season	Throughout the year	Throughout the year
Species caught	Crabs	Major carps, minor carps, catfishes etc.
CPUE	1-3 kg	–

ground-line. The net is set in the surface, mid-water or bottom and kept in stationary position by means of anchors or weights on both sides of the nets. These nets are of high interest to artisanal fishery with its low operational cost. The size of the net stretches from 50 m to 2000 m in length and mesh size ranges from 20 to 130 mm. Jal is used to target species like *Tenualosa ilisha* with specific mesh size of 50-60 mm for male and 100-130 mm for female and other species like, *Otolithoides pama*, other Sciaenids, mullets, etc.

Golava (bag net)

Golava is a fixed net with wide mouth and a small cod end used in moderate tidal fluctuated waters in Narmada estuary. In the middle stretch of the estuary a series of 16 numbers of bags net were installed with average individual length of the net being around 25-27 m (Fig. 5-6). The net is installed in the current driven area at night and harvested at early morning depending upon the current movement. Operation including installation and harvest of the catch is done by eight fishermen with two numbers of motorized boats. The operational time of the bag net is around 10-12 hours. On an average, 2-12 kg of fish is harvested by individual net. The dominant fishes in the bag net composition were mullets, *O. pama*, *Lates calcarifer*, *M. rosenbergii*, Catfishes, *H. neherius*, *Cynoglossus cynoglossus*, *Eleutheronema tetradactylum*, *T. ilisha* (young), etc.

Chogia (Cast net)

Chogia is very common and popular at Narmada estuary when it comes as means of livelihood to catch fishes. Cast net is operated in marginal water areas using boats as platform or from land. It is operated by a single man and uses net with different mesh and pockets size to catch fishes like prawns, mullets, sciaenids, etc. throughout the year (Fig. 3).

Mahajal (Drag net)

The use of Mahajal in the estuarine region is very limited. The net was found to be operating mainly during

rainy season in the upper stretches of the estuary where minimal tidal fluctuation are prevalent mainly for catching fish and prawn juveniles. The average length of Mahajal is around 100-150 m with width 12-16 m. The head rope of the net is made of 2 mm diameter coconut wire and foot rope by 0.5 to 1 mm diameter nylon (Fig. 4). The net is usually dragged by 6 to 12 man/women and cost of such net is around Rs. 30,000-50,000.

Kandari (Stake net)

Kandari jal commonly known as stake net is very common and popular in middle and lower parts of Narmada estuary for catching targeted species like, *Tenualosa ilisha* during monsoon season and prawns, sciaenids, mullets, etc. throughout the year. Kandari jal in other words also known as fixed gill net, is made of mono filament twines. A wide ranges of mesh size is used which ranges from 10-130 mm for different targeted species. Khutta (wooden pole) at a distance of 3-4 feet are inserted in the soil-bed to support the net during tides. Kandari jal are fixed for about 7-8 days in a fortnight and its efficiency totally depends upon tidal influence and water current. This is one kind of a community fishing whereby 5-12 fishermen are involved in the total process. The length of each set of Kandari jal ranges from 100-500 m and a single group of fishermen operated 2-4 sets of net (Fig. 7-8).

Sorpan (Scoop net)

This is also known as push net and is made by triangular or double frame bamboo with small mesh size (10-40 mm mesh size). Small size scoop net is operated by single handy and bigger one is often operated by two men/women (Fig. 9-11). Such types of net is usually operated in the shallow marginal area during low tides and targeted species like prawns, mullets, juveniles of shrimps, etc. (Table 2).

Kheda (Ring net)

Ring net is either with handle (steel or iron) or without handle (Fig. 12-13). The diameter of the net is

around 0.4 to 0.6 m with nylon or coconut coir meshed and usually catches slow moving fishes and crabs. These nets also used to scope out the big fishes from gill net, mahajal catch.

Gul (Pole and line)

Pole and line is a traditional fishing methods followed by the local fishers (Fig. 15). Pole and line consists of a hook attached with fishing line and rod. Baits are used to lure the fishes; live baits like earth worms, insects, mulluscs muscle are used to catch cat fishes like *Sperata seenghala*, *S. aor*, *Wallagu attu*, etc. during monsoon season.

Waga (Hook and line)

Hook and line is mainly used to catch cat fishes by using baits and is operated throughout the year at Narmada estuary (Fig. 14). Both fishermen and women are involved in hook and line fishing operated from boat and marginal areas of the estuary. Earth worm, small fish, molluscs flesh used as bait to hook the fishes and prawns.

Fanda

This is an indigenous fishing gear used in the lower stretch of Narmada estuary only for catching of mudskippers. The gear consists of a one foot long nylon



Fig. 1. Gill net with targeted harvest, **Fig. 2.** Mending of gill net, **Fig. 3.** Harvest with cast net, **Fig. 4.** Drag net ready to operate, **Fig. 5.** Bag net fixed during low tide, **Fig. 6.** Catches from bag net, **Fig. 7.** Stake net fixed for targeted species of *T. ilisha*, **Fig. 8.** Fixing of stake net for small indigenous species, **Fig. 9.** Push net operated by men, **Fig. 10.** Push net in operation by women, **Fig. 11.** Single man/woman operated push net, **Fig. 12.** Ring net without handle, **Fig. 13.** Ring net with handle, **Fig. 14.** Hook and line, **Fig. 15.** Pole and line with harvest, **Fig. 16.** Mud skipper fishing by fanda, **Fig. 17.** Fishers with mud skipper harvested by fanda, **Fig. 18.** Fisherman with geri to catch crabs, **Fig. 19.** Hand picking of crabs, **Fig. 20.** Fishes tied with roshi for live selling

thread tied with a bamboo split (one feet length). The cost of construction of this gear is very negligible. The gear is operated by a single man and women during low tides. Fisherman first make a small circular “fanda” (hang) with the nylon thread and then inserts the bamboo stick nearby a hole made by a mudskipper, the fanda is then further inserted a few cm into the hole. Whenever, a mudskipper tries to come out of the hole for food, respiration etc., it is caught in the fanda. This is a very cost effective gear and fishermen can catch 1-3 kg of fish within a period of 2-3 hours (Fig. 16-17).

Geri (Hand rod)

Geri is an indigenous fishing device made by local fisherman with the help of iron rod with a bend at top and is use for catching mud crab, *Scylla serrata*. The gear is made by iron rod of 3-4 mm diameter on one side and the other side of a wooden or bamboo handle. The lower part of the device is “J” shaped which helps to pull out the crabs from the holes (Fig. 18). During the search operation of crab, whenever fishermen encountered any crab hiding holes, they gently insert the iron stick inside the hole. As soon as the “J” shaped part of the stick stuck the crab hard parts, fishermen pull out the crab hiding in the holes by grabbing the crabs with “J” shaped part. The gear is cost effective and is simple to make, a fishermen can catch 1-5 kg crabs in a single day. This gear mainly operates in the middle and lower parts of the Narmada estuary during low tides throughout the year, especially in winter.

Fish tied with roshi

Big fishes both carps and catfishes after harvesting in live condition using gears such as gill net, hook and line, pole and line etc. are tied with nylon or coconut coir rope to sell them in live condition for better price (Fig. 20).

In estuaries occurring in India, Paul *et al.* (1997) reported dominance of migratory bag net fishery at lower Hooghly estuary. Nath and Shrivastava (1999) reported that, in Narmada estuary fishing was conducted mainly by cast net, gill net and long line and the use of scare line and drag net was found occasional. Mitra *et al.* (2001) found that bagnets and drift-gill nets constituted the most dominant gears at Hooghly-Matlah estuarine system. Remesan *et al.* (2009) observed that gill net, bag net, lift net, drag net, purse net, seine net, cast net, skimming net, lines, barriers and traps are the dominated non-selective fishing gears used at Hooghly-Matla estuary. Shrivastava *et al.* (2009) reported that gillnets, dragnets and cast nets were the main fishing gears operated in the Krishna

estuary for commercial fishery whereas use of hooks and lines, crab nets and stake nets used were restricted to certain areas only. Singh (2009) mentioned that gill net, drag net, cast net, hook and line, scoop net, gul were the dominant fishing devices at Narmada river. Bhaumik and Sharma (2012) reported that gill net, boat seine, clap or purse net were the most important gears for exploitation of hilsa at Hooghly estuary. The present findings establishes that gill net, bag net, stake net were the most dominated gears in Narmada estuary unlike others estuarine system with some specific indigenous fishing devices like, fanda, gul etc.

CONCLUSION

Fishermen of the Narmada estuarine region use a wide variety of fishing gears for fishing practices and their livelihood security. Among the several fishing devices gill nets was found to be the most effective means for fish exploitation. It is also noticed that, fishermen of the region are still following the traditional methods of fishing for their economic and nutritional security. Bag net with small mesh cod end (10 mm) and certain stake net (<30 mm mesh size) which indiscriminately catches the smaller sized fishes and prawns was observed to be detrimental from a viewpoint of conservation of diversity and fisheries resources. With the help of local fishers, stakeholders of fishery including fish merchants, traders and village level administration, a plan should be formulated to protect the traditional knowledge and to ensure conservation of biodiversity of the region with a goal for the sustainability of fishery.

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