



Mudskipper Fishery and Indigenous Fishing Devices in Narmada Estuary, Gujarat

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Mudskippers form a lucrative fishery for the artisanal fishers in the middle and lower stretches of the Narmada estuarine region and offers sustainable livelihood to the fishermen community throughout the year. Mudskipper comes under the subfamily Oxudercinae of the family Gobiidae found in the tropical, subtropical and temperate regions with high nutritive value. Mudskippers are amphibious fish adapted to live in the intertidal environment and used to be very active when they are outside the water. The mudskippers usually inhabit the mudflats of estuaries and tidal zones of rivers in India, China and the Mekong Delta of Vietnam and are distributed from East to West Africa, South Pacific islands and Northern Australia. The Narmada estuary of Gujarat is one of the most productive estuaries in the west coast of India. This paper attempts to document the traditional fishing devices used to catch mudskipper in the Narmada estuary of Gujarat, and their fishery status. Mudskipper fishery is an important fishery resource for the livelihood of the rural fishers of Narmada estuarine region and contributed 17.68% of the total estuarine fish production during 2014-15. Three species were encountered in the Narmada estuary, namely, *Boleophthalmus dussumieri*, *Periophthalmodon schlosseri* and *Pseudapocryptes elongatus* during the study period (2014-2015). The fish is mainly caught by the traditional fishing devices developed by the local fishers like *fanda*, *sorpan*, *golava*, *kandari* and *chogia*. Out of several fishing devices, *fanda* (stick-traps) was found to be the most common and economical fishing device.

(Key words: Mudskipper fishery, Traditional fishing device, Narmada estuary)

Mudskippers are amphibious fish belonging to family Gobiidae from subfamily Oxudercinae and 34 species of mudskippers were reported worldwide (Murdy, 1989). Mudskippers are euryhaline and air-breathing species that live on mudflat areas. The mudskippers inhabit the mudflats of estuaries and tidal zones of rivers in India, China and the Mekong Delta of Vietnam (Rainboth, 1996). Out of 34 species, nine species are available in India and seven of them being reported from Gujarat water bodies (Kanejiya *et al.*, 2017; Shukla *et al.*, 2014). Few works have been reported on culture, population dynamics, fishing practices of mudskippers in different regions (Bahija and Hussain, 2010; Bhakta *et al.*, 2017; Hoda, 1991; Kanejiya *et al.*, 2017; Minh *et al.*, 2010; Udoh *et al.*, 2013).

Mudskipper locally known as 'Levta' is an important fishery resource for livelihood security of rural fishers of Narmada estuary and contributed 17.68% (2014-15) (Anon, 2015) of the total estuarine fish production. A total of three mudskipper species is recorded from the Narmada estuary during the study period (2014-2015), namely, *Boleophthalmus dussumieri*, *Periophthalmodon schlosseri* and *Pseudapocryptes elongatus*.

A wide variety of traditional fishing gears is being used in inland open water, out of them few have been documented while many need to be documented properly. Successful fishing operation largely depends upon the comprehensive understanding of the fish biology, the habitat of the fish, selection of appropriate fishing methods and correctly designed fishing devices. Documentation of crafts and gears in the freshwater sector of India is scanty (Bhakta *et al.*, 2016). Several fishing gears used in estuarine waters namely gill net, bag net, cast net, drag net, stake net, scoop net, ring net, pole and line, hook and line etc. and are reported by authors like Bhakta *et al.*, (2017); Dutta (1973); Gokulkrishnan and Moses (2014); Jhingran (1963); Kanejia *et al.*, (2017); Krishnamurthy and Rao (1970); Mitra (1952); Mitra *et al.*, (1987); Mukhi and Ramu (2000); Pillay and Ghosh (1962); Remesan *et al.*, (2009); Shaji and Laladhas (2013); Koleker (2009); and Kundu *et al.* (2012). Documentation of traditional fishing devices for harvesting mudskipper is rare. In this paper, an attempt has been made to document the fishing devices used for catching mudskipper at Narmada estuary and their fishery status.

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MATERIALS AND METHODS

The data were collected by a personal visit to the different landing sites, group discussion with the local fishers by covering the whole estuary from Bharuch to Ambetha in bi-monthly visits during 2014-2015. A questionnaire was used to collect field data mentioning different points like local name, materials use, the method of operation, the season of operation, cost, etc. Different mudskipper fishing practices observed were noted down

years at Narmada estuary is presented in Fig. 10.

Fanda / Fando (Stick-traps)

This is an indigenous fishing device used in the lower stretch of Narmada estuary only for catching mudskipper (Fig.1-4). The devices consists of one foot long nylon thread tied to a bamboo split (one foot length). The cost of constructing the devices is very negligible. The gear is operated singly by

Table 1. General features of traditional devices used to catch mudskipper at Narmada estuary

Local name	<i>Fanda/Fando</i>	<i>Sorpan</i>	<i>Golava</i>	<i>Kandari</i>	<i>Chogia</i>
Construction Materials	Bamboo stick and nylon	Bamboo / wooden pool and nylon net	Wooden pole, nylon and coconut rope	Wooden pole, nylon and coconut rope	Nylon or cotton
Manpower involved	1	1-2	4-12	4-12	1
Cost of construction cost (in Rs.)	<1	600-2500	45000-110000	12000-60000	1200-4000
Fishing season	Throughout the year during low tides	Oct-May	Oct-May	Throughout the year	Throughout the year
CPUE	0.3-2.0 (kg h ⁻¹)	0.2-3.5 (kg day ⁻¹)	2.5-17 (kg tide ⁻¹)	0.5-20 (kg tide ⁻¹)	0.2-2.0 (kg h ⁻¹)

in the field. Collected data were properly cross-checked by the experts constituting of age-old fishers and local fishery officials. A survey sheet was also made to collect field data on different mudskipper fishing devices including local name, materials used for construction, cost and catch per unit effort (CPUE). Gear wise CPUE was calculated, which was an indirect method of the abundance of the respective species. The formula used to calculate CPUE = Total catch/total fishing effort, in a given period.

RESULTS AND DISCUSSIONS

The mudskipper fishes at Narmada estuary is mainly harvested by using traditional gears like *fanda* (stick-traps), *sorpan* (scoop net), *golava* (bag net), *kandari* (stake net) and *chogia* (cast net). *Fanda*, *stake net* and *scoop net* were found to be the most popular and easy means of exploitation of mudskipper. Mainly three species constituted the catch viz., *Boleophthalmus dussumieri*, *Periophthalmodon schloseri* and *Pseudapocryptes elongates* with *Boleophthalmus dussumieri* dominating in the catch composition. General features of traditional devices used to catch mudskipper at Narmada estuary is provided in Table 1. The production trend of mudskipper for the last ten

a man or woman during low tides. The fisherman first makes a small circular '*fanda*' or '*fando*' (stick traps) with the nylon thread then the bamboo stick is inserted nearby a mudskipper hole by further inserting the *fanda* few centimeters into the hole. Whenever, a mudskipper tries to come out from the hole for food, respiration, etc., it gets caught in the *fanda*. This is a very cost effective device and fishermen can catch 1-3 kg fish within a period of 2-3 hours.

Sorpan (Scoop net)

This is also called as push net and is made by triangular or rectangular bamboo/wooden frame with small mesh size net, preferably with mosquito net and also with nylon net (Fig. 5 & 6). Small size triangular framed net is operated by single hand and bigger ones are often operated by two men. These net are always operated in the shallow marginal areas and targeted species are prawn larvae and especially mudskipper during low tides.

Golava (Bag net)

Golava is a seasonal net used in the middle stretch of Narmada estuary and is mainly operated during winter and

post-monsoon season (mid-October to mid-June). This is a bag type stationary net operating on the basis of tidal currents. A series of 10-12 sets of the net are connected together by a common head rope and foot rope tied with *Khutta* (wooden pole) in certain intervals. Sufficient numbers of *Khutta* are fixed in such a way that the nets should not be disturbed during tidal currents. The length of such nets varies from 50 to 70 feet with 10 mm cod end mesh size. Smaller size stationary bag net are sometimes operated from the boat also to catch surface moving fishes. Mixed numbers of species are caught along with mudskipper like Mullet, sciaenids, *Harpodon nehereus*, *Sillago sihama*, *Arius arius* etc. (Fig. 7).

Kandari (Stake net)

Kandari jal commonly known as stake net is very

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



Fig. 1. Inserting fanda to catch mudskipper, **Fig. 2 & 3.** Mudskipper caught by fanda; **Fig. 4:** Fishermen with the catch caught by fanda, **Fig. 5 & 6.** Scoop/push net in operation, **Fig. 7.** Catches from bag net, **Fig. 8.** Stake net ready to operate, **Fig. 9.** Cast net operation in the middle stretch of estuary

Chogia (Cast net)

Chogia is used in the marginal area during low tides. It is single hand operated nets with different mesh and pockets size to catch targeted fishes like mullet, mudskipper, and prawns, throughout the year. The radius of the net used in the Narmada estuary is between 10-12 feet (Fig. 9). Mudskipper is harvested as a by-catch in such types of net.

The present study established that mudskippers harvested from Narmada estuary are mainly restricted on traditional fishing methods. Traditional methods are cost-effective with less manpower involvement. Poor status of the local fishers is also responsible for them to maintain the traditional way rather than going for modernised fishing practices (Islam *et al.*, 2013). The '*fanda*' or stick-trap, stake net and scoop net methods are found to be the most common, popular and cost-effective methods for catching mudskippers in Narmada estuary. Due to easy handling and operation using a single hand, both males and females are engaged in '*fanda*' fishing throughout the year during low tides, which gives them livelihood security. The '*fanda*' fishing to catch mudskipper of northern Gulf of Khambat, Gujarat has been reported by Shukla *et al.* (2014). Bhakta *et al.* (2016) studied mudskipper, the common man fishery in Narmada estuary and mentioned their respective fishing gears. Bhakta *et al.* (2017) studied in details the indigenous fishing devices used in Narmada estuary with fishing season and types of fish caught with respective gears. Kanejita *et al.* (2017) also reported traditional methods of mudskipper fishing in the coast of Bhavnagar, Gulf of Khambhat, Gujarat, India and mentioned three types of mudskipper fishing methods i.e., by using nets, hand catching and stick traps, which resembles those reported within the present study.

The mudskipper is reported to be very active when they are outside of water. Therefore, it needs proper techniques to catch the fishes from the muddy condition. Due to their bottom-dwelling nature, the species can act as bio-indicators for environmental health assessment. The local demands for mudskipper as human consumption is gradually increasing and the species fetch a very good price in local markets. This scenario may create over exploitation of mudskipper in the region. Fishers of Narmada estuarine region has been catching mudskipper for a long time using

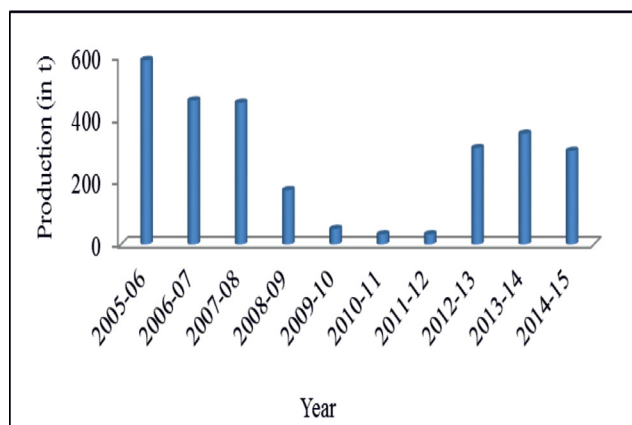


Fig. 10. Production trend of mudskipper in Narmada estuary (Data source: Department of Fisheries, Bharuch district, Gujarat, India)

tradition devices which need to be protected and evolved with time. Mudskipper can act as potential species in coastal aquaculture, which will improve aquaculture development and alternative strategies could be made for fisheries resource management.

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