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## DESIGN AND OPERATIONAL PARAMETERS OF DOL NETS OPERATED IN BHAYANDER ESTUARY, MAHARASHTRA

Suraj Kumar Pradhan<sup>1\*</sup>, S. Abuthagir Ibrahimi<sup>1</sup>, Latha Shenoy<sup>1</sup>, Ram Singh<sup>1</sup> and A. D. Nakhawa<sup>2</sup>

<sup>1</sup>ICAR- Central Institute of Fisheries Education, Mumbai - 400 061, India.

<sup>2</sup>ICAR- Central Marine Fisheries Research Institute, Mumbai Research Centre, Mumbai - 400 061, India.

\*e-mail : 1pradhansuraj@gmail.com

(Accepted 27 December 2018)

**ABSTRACT :** Bhayander estuary is a very sensitive ecosystem due to the disposal of industrial effluents and heavy load due to urbanisation, but still it hold stand firmly as the breeding and nursery ground for many commercially important species of Maharashtra and the dol net fishery in this region provides a source of livelihood to the traditional fishermen. The overall size of dol net operated in this estuary varied from 12 to 14 m and the numbers of dol nets/vessel varied from one to three. The mesh size of the dol nets varied between 8 to 160 mm across its different parts from cod end towards mouth of the net. The average number of fishing days of single-day dol netters per month varied from 12 to 16 days. Maximum distance of dol net station was 1.4 km from the landing jetty and mean distance travelled by dol netters was 0.8 km. The present study highlights the detail structural design and the operational parameters of the dol net operated in this estuary.

**Key words :** Dol net, estuary, design, operational parameter.

### INTRODUCTION

An estuary is a semi-enclosed coastal body of water which has a free connection with the open sea and within which sea water is measurably diluted with freshwater derived from land drainage (Cameron and Pritchard, 1963). Due to tidal action and the changes in the current pattern, the estuarine ecosystem is highly fluctuates and the species which depends on the estuary are euryhaline in nature. The estuarine habitat is now facing challenges of habitat degradation due to the heavy population rise in mega cities which leads to industrialisation and urbanisation (Kulkarni *et al*, 2010). The pressure on estuary is increasing day by day, so the profit of coastal fishermen reduces over the years.

Dol net is type of set bag net which is operated in various countries by small-scale fishermen of Bangladesh, India, Indonesia, Malaysia, Myanmar and Thailand, but with some regional variations in design and operation methods. Bangladesh and India lead in the usage of this net in coastal fisheries (Islam *et al*, 1993). Bag net of north-west coast of India is locally called as *Dol net*, *Bokshi jal*, *Kavi jal* whereas north-east coast it is called as *behundi jal*. In Kerala, it is named as "*Ooni vala*". It is mostly operated by the poor fishermen to exploit the juveniles from the coastal and estuarine waters (Islam *et al*, 2004). In the context of declining fish resources of Maharashtra such as Bombay duck, silver pomfret,

elasmobranchs and lobsters, there is a need for sustainable management of fisheries by adopting appropriate measures (Deshmukh, 2006). The catches by the dol netters did not respond positively to the effort expended and any change in the effort may not have any impact on the landings (Srinath *et al*, 1987). The dol net is labour intensive and the effort is regulated depending on the catch/haul and the type of weather condition (Khan, 1989). Due of non-selective nature of dol net fishing, risk of long-term aggregate environmental impact far outweighs the short-term economic benefits. Usage of dol net was not banned in north- west coast of India due to lack of alternative livelihood for the poor fishermen operating it (Ahmed and Troell, 2010).

### MATERIALS AND METHODS

The Bhayander estuary located in Thane district (19° 18' 02" N to 19° 21' 23" N, 72° 34' 55" E to 72° 53' 16" E), Maharashtra is a transitional zone of Arabian Sea and the river Ulhas discharge the freshwater to the sea.

The operated dol net designs documented during the fishing season from September, 2016 to May, 2017. The period signifies one complete season of dol net fishery status except period of closed season (monsoon fishing ban) from 10<sup>th</sup> June to 15<sup>th</sup> August or "*Narayali Poornima*".

A questionnaire was formulated and detail information



**Fig. 1 :** Area of dol net fishing ground.

on the type of vessel used based on the construction material such as plank built, or Fibre Reinforced Plastic (FRP) and overall length with their registration status, dimension of dol nets with respect to single day operation, number of dol nets per dol-netter information collected from the fishing ground documented. Mesh size of different kind of cod ends measured by using “Digimatic calliper”. The month-wise number of fishing days in single day fishing was observed. The distance travelled by single day dol-netters from the coast and the depth of operation details collected month-wise. Secondary data collected from the Department of fisheries, Thane, Government of Maharashtra and Maharashtra marine fisheries census, 2010 published by CMFRI, Cochin.

## RESULTS

A total of twelve motorized dol-netters were operating in the Bhayander estuary. Motorized dol-netters of OAL between 5.2 to 12.5 m fitted with two-cylinder engines of 12-15 HP were used.

### Design of dol net

The size of dol nets ranged between 12-14 m. The total dol nets operated per dol-netter varied from one to three. The numbers of dol net were more operated during September-November.

### Operational parameters of dol net

The month wise number of fishing days engaged in single day fishing and number of trips engaged in dol net fishing from Bhayander estuary region showed that September to November is the peak season of dol net fishing operations. The numbers of fishing trips of single

day dol-netters were varied from 12-16 in a month.

## DISCUSSION

The fishers of Bhayander estuary used a special plank built or FRP boat which is locally called as *Hoondy/Tony* with OAL between 5.2-12.5 m and the boats are fitted with two-cylinder engines of capacity 8-15 HP. Raje and Ramamurthy (1990) categorised the dol netters used at Versova into small dol netters having length between 7.5 to 9.0 m and medium size dol netters with length ranging from 9.1 to 12.0 m. Hotagi *et al* (2007) reported that the dol netters used at Bassien Koliwada, Maharashtra had length of 15 m. Thus, it is observed that the size of dol netters varied from locality to locality. The registration number was displayed on the stern side of boats.

Usually two-cylinder inboard engines with 12 to 15 horse power (HP) were used by the dol-netters. Sehara and Karbhari (1987) observed that dol netters of Navedar – Navgaon, Madh and Navabunder had 2 to 4 cylinder diesel engines. Raje and Deshmukh (1989) recorded the engine power which ranged from 5 to 25 HP, 30 to 35 HP and 50 to 100 HP in Mumbai, Maharashtra. Hotagi *et al* (2007) observed that the 90 HP engine was used in Bassien Koliwada, Maharashtra. Thus, it was observed that the engine power of dol-netters operating from Bhayander was very low, whereas higher horsepower engines were fitted to dol netters in other regions where the dol nets are set towards sea with depth of more than 20 m. Kirlosker, Lister, H. T. C diesel engines were mostly used and their cost ranged between 1.25 to 1.50 lakhs.

**Table 1 :** Specification of the dol-netter.

Type of Vessel	Motorised dolnetter
Length of Keel (m)	4-8
Overall Length (m)	5.2-12.5
Cost of vessel	2-2.5 lakhs

**Table 2 :** Specification of engine of selected dol-netters.

1	Name of Company (Make)	Lister, Kirlosker, H.T.C Diesel Engines
2	Year of installation	Varies with boats
3	Number of cylinder	2
4	Stroke	2
5	Engine power (BHP)	12-15
6	Cooling Medium	Air
7	Average fuel Consumption (L/hr)	1
8	Cost of engine	1.25 lakhs

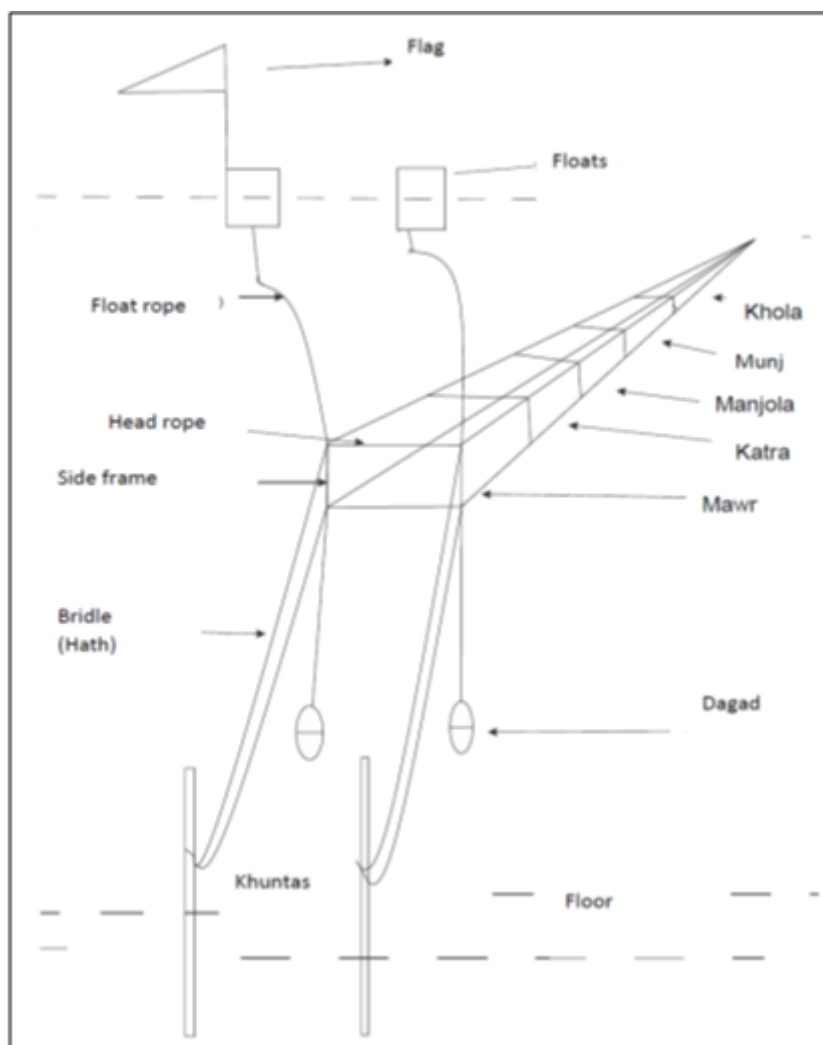


Fig. 2 : Design of dol net of Bhayander region (by Corel draw).



Plate 1 : Dol-netter used for dol net operation.

Dol nets were operated in the depth range less than 4 to 8 m in estuarine waters in Bhayander. Rao and Bindu (1976) reported that depth of operation of ‘kav’ was 5 to 6 m. Josekutty and Sundaram (2004) observed that dol nets off Mumbai were generally limited to the fishing grounds having depth of 10 to 30 m. As per the study conducted by Raje and Deshmukh (1989), dol nets were operated at a maximum depth of 30 to 40 m at Versova. Rajan *et al* (1982) reported that dol netters were operated at a depth of 30 to 40 m at Versova and at 10 to 15 m at Sassoon Docks. Hotagi *et al* (2007) recorded that the nets were operated at a depth of 30 to 35 m at Bassien Koliwada, Maharashtra. Depth of operation for offshore dol-netters was more unlike the restricted depth in this

Table 3 : Mesh size of different sections of dol net.

Sections	Mawr				Katra					Manjola			Moonj			Khola		
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
Mesh size (mm)	160	150	140	130	120	110	100	90	80	70	60	50	45	35	25	15	10	8
Upper edge mesh numbers	900	850	800	750	700	650	600	550	500	450	400	350	300	300	300	250	250	250
Lower edge mesh numbers	900	850	800	750	700	650	600	550	500	450	400	350	300	300	300	250	250	250

**Table 4 :** Technical specification of dol net operation.

S. No.	Specifications	Status
1	Local name	Dol net
2	Colour of the net	Blue
	Total Number of sections	5
	Total Number of Panels	5
3	Length of Float line (m)	14-16
4	Length of sinker line (m)	14-16
6	Weight of the net: With rigging (kg)	35-40
7	Without rigging (kg)	28-30
8	Total weight of the net (kg)	38-45
9	Cost of net: With rigging (Rs)	33,000.00
10	Without rigging (Rs)	30,000.00
	Number of main days for construction of gear	Machine constructed net purchased by fishermen, they spent 5 days to assemble the net
	Treatment, if any	Just placing the net in shade

area.

There is a variation in the number of bagnets used for fishing operation. The average number of nets used by single-day bag-netters varied from one to three at Bhayander estuary. Numbers of nets were determined by the current pattern and local conditions. The maximum number of dol nets per vessel was observed during September to October (2 to 3 numbers). The present study found that average number of dol nets per vessels operated in this estuary was somewhat equal to that of the reports of earlier researchers *i.e.* 2 to 3 at Versova (Raje and Deshmukh, 1989) and low compared to 5 or 7 at Bassein Koliwada, Madh, Alibag and Bankot (Kumawat *et al*, 2015).

Dol net used in this area of study was fabricated with five sections locally known as *mawr*, *katra*, *manjola*, *munj* and *khola*. Mesh size in the first part of the net (mouth area) was 130 to 160 mm, second part (80 to 120 mm), third part (50 to 70 mm), fourth part (25-45 mm) and the last part or the cod end (8 to 15 mm). Raje and Deshmukh (1989) reported that in Mumbai–Saurashtra region, the mesh size varied from 10 to 40 mm at the cod end. Thomas *et al* (2007 and 2008) stated that in Kerala region, the mesh size varied from 8 to 10 mm at the cod end which was in the same range as observed for dol net in Bhayander. This indicates that dol net fishers of estuarine regions use very small mesh size in the cod end perhaps due to lack of minimum mesh size regulations for dol

**Table 5 :** Specifications of lines used in dol net.

S. No.	Specification	Status
1	<b>Float line</b>	
	Material	Nylon Multi filament (5-7 ropes spinned together)
	Length (m)	14-16
	Diameter	13.9 mm
	Twist (S or Z)	S
2	<b>Lead line</b>	
	Material	Nylon (5-7 ropes spinned together)
	Length (m)	14-16
	Diameter	13.9 mm
	Twist(S or Z)	S
3	<b>Hauling line</b>	
	Material	Nylon multifilament
	Length (m)	4-5
	Diameter (mm)	22
	Twist (S or Z)	S
4	<b>Bridle ropes</b>	
	Material	Nylon

nets.

The study carried out at Bhayander revealed that September to October was the peak season of dol net fishing operations. The average number of fishing days per month was 14, which was far less than the sea-operating dol netters. As the fishing trips are totally based upon the tidal and lunar cycle, the time for setting and hauling the catch becomes more important. It was observed that trips mostly coincided with the 12<sup>th</sup> day (*Dwadashi*) to 3<sup>rd</sup> day (*Tritiya*) of lunar cycle. Nirmale *et al* (2007) stated that catches of dol nets were more in between 12<sup>th</sup> to 3<sup>rd</sup> day of lunar cycle. The month-wise distance travelled from the jetty showed that there was no difference in case of the selected dol netters as their stations were fixed. However, variation was observed between other dol-netters because of the locality difference of own dol net stations.

## CONCLUSION

There is a little or no impact of this type of fishing system on the estuarine bed, because it is type of stationary net which is a passive gear as well. The dol nets operated in this estuary need to be modified based on the sustainability of the resources, because the 8 mm cod end used for targeting the *Acetes* sp. (Paste shrimp), whereas the juveniles of other commercially important species caught inside the net, so the community based fishing with conservation approach and alternative livelihood

**Table 6 :** Particulars of fishing gear accessories.

1	Floats	Status
	Types	Thermocole bundle, Empty plastic drums (35 L capacity)
	Shape	Rectangular
	Length (cm)	60
	Breadth (cm)	35
	Total number	3
	Weight of single item (g)	400-500 (35 litre plastic drums)
	Total weight (Kg)	1.2-1.5
	Rigging	By using Nylon ropes
	Other details, if any:	Thermocole made floating raft is used to travel between the shore and the boat
2	Sinkers	
	Types	Stone/Steel/Iron
	Shape	Irregular shape
	Length (cm)	20-25
	Breadth (cm)	8-12
	Total number	2-3
	Weight of single item (kg)	2-2.5
	Total weight (kg)	5-6
3	Spike (Khunts)	
	Types	Wood
	Shape	Cylindrical/tubular shape
	Diameter (cm)	10-14
	Length (m)	4-5
	Total number	2
	Weight of single item (kg)	10-15
	Total weight (kg)	20-25

during the lean period should be provide in order to strengthen the livelihood of the coastal traditional fishermen.

### ACKNOWLEDGEMENT

The author wish to acknowledge our sincere gratitude to Indian Council of Agricultural Research (ICAR), New Delhi for granting Junior Research Fellowship (JRF) and Dr. Gopal Krishna, Director, ICAR-Central Institute of Fisheries Education, Mumbai for providing facilities to complete the research work successfully. Author also acknowledges the support and help extended by Dr. V. V. Singh, former Scientist-in-Charge, Mumbai Research Centre of ICAR-Central Marine Fisheries Research Institute (CMFRI), Mumbai.

**Table 7 :** Details of dol net fishing operation in Bhayander.

1	Fishing Ground	Muddy bottom
2	Type of Operation	Dol net
	a) Based on scale of operation	Small scale
	b) Based on Number of vessels used	One boat
	c) Based on target species	Shrimp, Bombil, Acetes
3	Depth of operation	4-8 m
4	Method of Finding the Fish Shoal	Visual (Current and wind direction)
5	Time Required for	
	a) Setting of net (min)	15-20
	b) Hauling of net (min)	20-30
6	Immersion period (hrs)	4-5 (depending on Lunar cycle)
7	Duration of single trip (hrs)	1-1.5
8	Duration of single operation (hrs)	5-7
9	Average number of operations per trip	1-3 Dol nets per trip
10	Average quantity of fish caught per trip (kg)	10-15 (Excluding bycatch)
11	Average return from sale of fish per trip	800-1200 rupees

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