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Research Article

Design specifications and species composition of bottom set gillnet operated in estuary of Thane district, Maharashtra

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ABSTRACT

Estuaries are the transitional zones of terrestrial and aquatic ecosystems along the coastal region which harbour several diversified species as they function as nursery and breeding grounds for many commercially important species. Data on fishing systems and fisheries resources of Bhayander estuary, an important estuarine ecosystem located in the Thane district of Maharashtra was collected from September 2016 to May 2017. Dol nets and gill nets are the major fishing gears operated in this estuary that supports the livelihood of fishers. The fishing season for bottom set lobster gill nets extended from January to May 2017 with the catch rate gradually declining towards May. Polyamide (PA) monofilaments of diameter 0.24 to 0.28 mm was used for the construction of bottom set gill nets. The average mesh size of the main webbing was 80 mm and the depth of operation ranged from 6-8m. Lobsters comprised 30% and crabs 14% of the total catch. Among lobsters, *Panulirus polyphagus* (Mud spiny lobster) and *Panulirus ornatus* (Ornate spiny lobster) and among crabs, Portunus *pelagicus* (Blue crab) and *Portunus sanguinolentus* (Three spot swimming crab) comprised the major catch. The paper highlights the design and catch composition of bottom set gill nets of Bhayander estuary.

INTRODUCTION

Gillnet is the only gear in which the mesh size of the gear itself serves the dual function for catching as well as selecting the species to be caught (Anon, 1994). As a passive gear, their catching ability relies on the movement or migration of fish through the area where the nets are set and the operculum of fishes get entangled in the meshes of nets when the fishes try to pass through it (Laxmappa *et al.*, 2014; Acosta, 1997). With appropriate selection of mesh size the overexploitation and capture of juveniles can be avoided and the bycatch amount can be minimized (Thomas, 2010; Andreev *et al.*, 1966). Less powered vessels can be used and this makes it fuel-efficient and hence this type of passive fishing system is relatively cheap, cost-effective, and easy to operate (Dar and Thomas, 2015). The minimum investment on nets and requirement of less crew are some of the characteristics of gill net fishing worldwide. The bottom set used in the estuarine area of Thane is seasonal and it depends on the availability of the resource.

Most of the catch in Maharashtra is contributed by the trawl net followed by gillnet and dol net, but in the estuarine region, the fishing activity is mostly predominated by gillnet and dol net (Sreekrishna, and Shenoy, 2001). In the Indian scenario, the catch of lobster shows slight declining over the last three years (Fig. 1). In the estuarine area of Thane, small scale fisheries existing where the bottom set gill nets are mostly used for targeting the lobster resource. In the state of Maharashtra, there is a positive growth rate of lobster landing (Fig. 2), but the contribution to the total crustacean landing is very less (CMFRI annual report, 2018). Mud spiny lobster *(Panulirus polyphagus*) is one of the major fisheries along the north-west coast (Gujarat and Maharashtra) (Bjoringsoy, 1996).

An estuary is a semi-enclosed coastal body of water which has a free connection with the open sea and within which seawater is measurably diluted with freshwater derived from land drainage (Cameron and Pritchard, 1963). But the increase in urbanization and industrialization are the cause of degradation of the habitat particularly close to megacities (Kulkarni *et al.*, 2010). Most of the great estuaries in the world are restricted to tropical regions where a wide range of taxa are closely related and all forming a part of the overall community with ecological links (Blaber, 2002). In the present study, an attempt has been taken to document the catch composition and the design of the bottom set gill net of the Bhayander estuary.

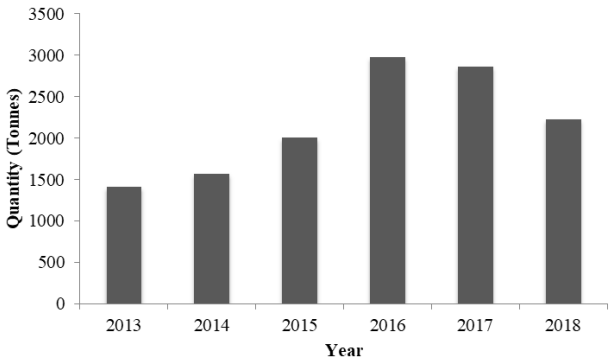

Fig. 1: Lobster catch trend in India

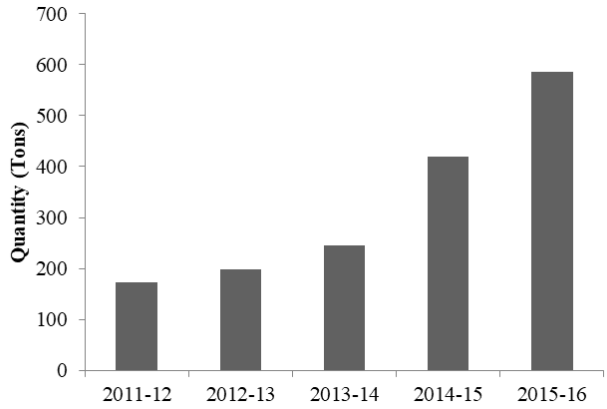

Fig. 2: Lobster catch trend in Maharashtra state

MATERIALS AND METHODS

The location of Bhayander estuary is in between 19° 18' 02" N to 19˚ 21' 23" N and 72° 34' 55" E to 72˚ 53' 16" E. Geographical location of the study area is given in Plate 1. Data for the gill net fishery were collected in the bottom set gillnet fishing season from January to May 2017.

The design of the gear was documented (Nedelec, 1975). Metric system was used for the dimensions. Meter (m) was used for larger dimensions like for the length of foot rope, head rope, float line and millimetre (mm) was used for smaller dimensions such as mesh size, the diameter of ropes and dimensions of floats. The mesh size was represented as stretched mesh i.e., the distance between the centres of the two opposite knots in the same mesh when fully stretched in the normal N direction. Fortnightly onboard sampling and questionnaire-based sampling were carried out to fulfil the objectives of the study. The species were identified in the field (Fischer, 1984; Sparre, 1989).

RESULTS AND DISCUSSION

Design of bottom set gill net

Bottom set gill nets were locally known in Marathi as "*Tartichi jal*". The main webbing of bottom set gill nets were made up of polyamide (PA) monofilament of 0.24-0.28 mm diameter and the mesh size varied between 70 to 80 mm. The total fleet length varied from 115 to 130 m. The numbers of plastic or thermocole floats per unit were 15-20 used on the head rope. Stone or cement brick sinkers of 500 g weight and 10-12 numbers per unit were used on foot rope. The bottom set gill nets were operated in the depth range from 6 to 8 m. The technical specifications for the bottom set gill net shown in Table 1.

Thomas (2001) studied on the gill nets of Kerala where the design of the net (polyamide knotted netting material) and the catch composition discussed. Lobster gill nets operated had a main webbing mesh size of 90 mm made up of PA monofilament netting. The hanging coefficient of the lobster gill net was 0.63. The number of meshes per unit was 2100. The net had hung length of 120 m and hung depth of 4.87 m. The head rope and foot ropes were made up 4 mm Polypropylene. The shelf lives of the nets used were very less (5-15 days) due to the rocky uneven bottom of the fishing ground.

Catch composition of bottom set gill net

Month-wise variations in catch composition in bottom set gillnet were recorded (Fig. 5) and lobsters were the main targeted catch in this net. *Panulirus polyphagus* (Mud spiny lobster), *Panulirus ornatus* (Ornate spiny lobster), *Portunus pelagicus* (Blue crab), *Portunus sanguinolentus* (Three spot swimming crab), *Johnius macrorhynus* (Big snout croaker), *Protonibea diacanthus* (Black spotted croaker) and *Otolithoides biauritus* (Bronze croaker) comprised the major catch. The maximum numbers of species were recorded in May (Fig. 4). *Panulirus polyphagus* was the major species which contributed 23% to the top ten species caught in the net (Fig. 6). The major catch in lobster gill net operated in the Satpati, Maharashtra consisted of *Panulirus polyphagus, Panulirus ornatus, Portunus pelagicus, Portunus sanguinolentus, Johnius macrorhynus, Protonibea diacanthus, Otolithoides biauritus* (Devi *et al.*, 2017). A total of 33 species has been recorded during the study period and month-wise occurrence of species has shown in Table 2. The area of operation for this net was in rocky area, due to the reason of hiding nature of lobster (Radhakrishnan and Vijayakumaran, 2004). So these types of gill net are highly season and area-specific. The main targeted species in this type of gill net was lobster and the highest catch was observed during January.

As gill net fishing in this estuary is a seasonal fishing method, so most of the bottom set gillnetters are operated during the wintertime to get the catch of lobster and crabs which has higher demand and fetching a good price in the local market. After the month of May, the fishermen shifted to drift gillnet fishery by using the same boats (Pradhan *et al.*, 2017).

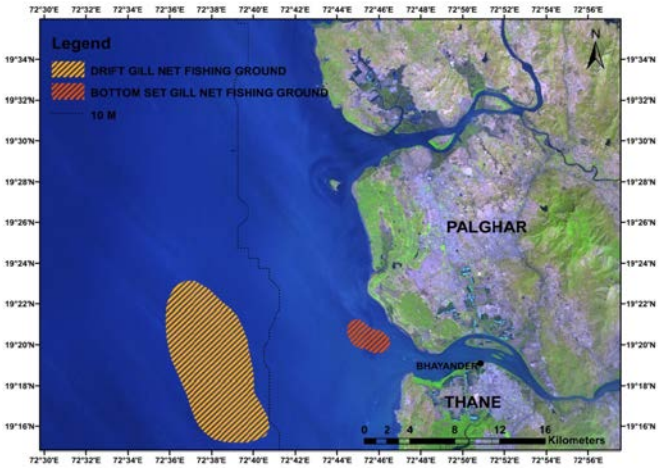

Plate 1: Study area- Drift gill net and bottom set gillnet fishing ground

Table 1: Technical specification of bottom set gill net operated from Bhayander estuary

Particulars	Name/No.
Station	Bhayander
Local name	*Tartichi jal*
Average main webbing mesh size (mm)	70
Twine type	PA monofilament
Twine diameter (mm)	0.24-0.28
Number of meshes in depth	60-65
Staple to staple length (m)	2
Number of meshes between staple to staple	60
Average horizontal hanging coefficient (E)	0.48
Average vertical hanging coefficient $\sqrt{(1-E^2)}$	0.85
Length of head rope (m)	58-65
Number of meshes per unit	1600-1800
Mean number of meshes per unit	1700±100
Average hung length (m)	53.33
Average hung depth (m)	3.69
Colour of webbing	White, green
Head rope material	PP
Head rope diameter (mm)	4-6
Float material	Plastic, thermocole
Float dimension (mm)	125 x 85
Number of floats per unit	15-20
Mean number of floats per unit	17.5±2.52
Foot rope material	PP
Foot rope diameter (mm)	4-6
Sinker material	Stone
Sinker weight (g)	500
Number of sinker per unit	10-12
Mean number of sinkers per unit	11.17±0.75
Total fleet length (m)	115-130
Mean total fleet length (m)	122.5±7.64
Depth of operation (m)	6-8

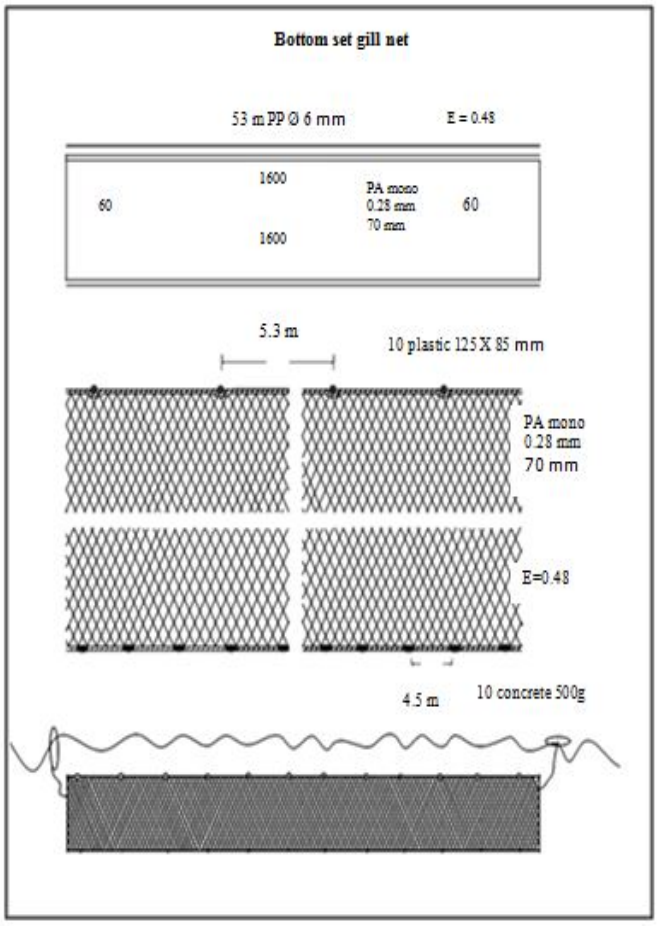

Fig. 3: Design of a typical bottom set gill net of Bhayander estuary

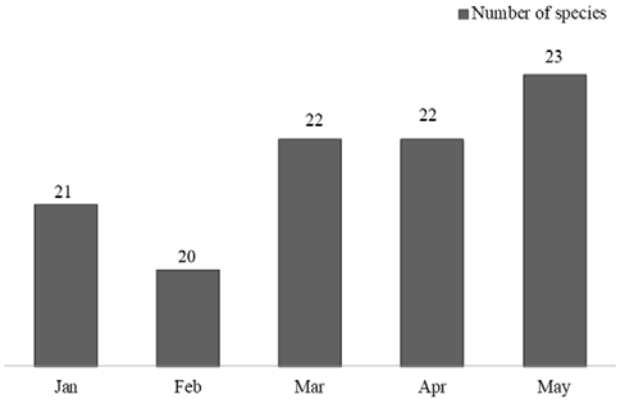

Fig. 4: Monthly data on the number of species in the bottom set gill net

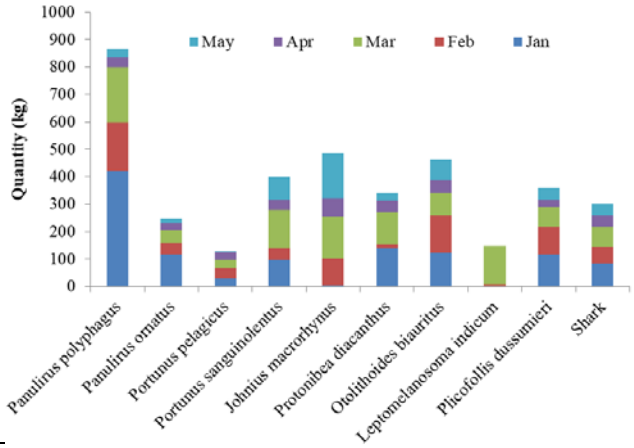

Fig. 5: Month-wise catches of top ten species in Bottom set gill net

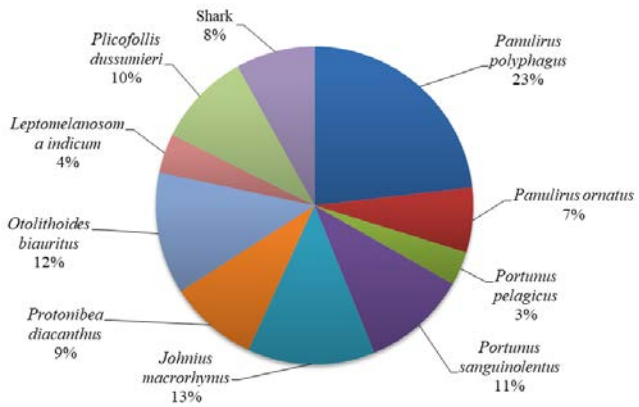

Fig. 6: Percentage contribution of top ten species

CONCLUSION

In the species composition of bottom set gill nets it has observed that lobster contributed maximum to the total catch because the fishermen mostly targeting this highly valued resource to get the profit. Also, the gill net fishery in this estuarine area is seasonal and it depends on the availability of resources. The demand for the lobster due to its high quality meat and taste made the lobster fishery intensive in terms of trawl fishery in the sea. But in the estuarine region as well as in high seas, the selective and energy-efficient gear such as gill net and traps can be the best option to conserve these highly sensitive and slow-growing species. The catch from estuarine regions of India by indigenous gears should be closely monitored temporally

as the estuaries are the nursery grounds for several species (Jha *et al.*, 2004). In the estuarine region of Bhayander, it was also observed that fishermen are not using the logbook. Habitat degradation and change in water quality parameters due to pollution and climate change could be the major factors responsible for the decline in the last few years. The present study highlighted the design of bottom set gill nets and species composition in the Bhayander estuarine area.

Table 2: Month-wise occurrence of species in bottom set gill nets

Fishes	Jan	Feb	Mar	Apr	May
Angulliformes					
Pisodonophis boro (Hamilton, 1822)	+	+	-	+	+
Cracharhiniformes					
Scoliodon laticaudus (Müller & Henle, 1838)	+	+	+	+	+
Clupeiformes					
Chirocentrus dorab (Forsskål, 1775)	+	-	-	-	-
Ilisha filigera (Valenciennes, 1847)	-	-	-	+	-
Pellona ditchela (Valenciennes, 1847)	+	-	+	+	-
Sardinella albella (Valenciennes, 1847)	-	-	-	-	+
Sardinella gibbosa (Bleeker, 1849)	-	+	-	-	-
Thryssa hamiltonii Gray, 1835)	-	+	+	+	+
Thryssa mystax (Bloch & Schneider, 1801)	+	+	+	+	+
Thryssa setirostris (Broussonet, 1782)	-	-	+	+	-
Thryssa vitrirostris (Gilchrist & Thompson, 1908)	+	+	+	+	+
Perciformes					
Atropus atropos (Bloch & Schneider, 1801)	-	-	-	-	+
Johnius amblycephalus (Bleeker, 1855)	+	+	+	+	+
Johnius glaucus (Day, 1876)	+	-	-	-	-
Johnius macrorhynus (Lal Mohan, 1976)	+	+	+	+	+
Leptomelanosoma indicum (Shaw, 1804)	-	+	+	-	+
Mugil cephalus (Linnaeus, 1758)	+	+	+	+	+
Otolithes cuvieri (Trewavas, 1974)	+	+	+	+	+
Otolithoides biauritus (Cantor, 1849)	+	+	+	+	+
Pampus chinensis (Euphrasen, 1788)	-	-	-	+	-
Protonibea diacanthus (Lacepède, 1802)	+	+	+	+	+
Scomberomorus commerson (Lacepède, 1800)	-	-	+	-	+
Scomberomorus guttatus (Bloch & Schneider, 1801)	-	-	-	-	+
Terapon jarbua (Forsskål, 1775)	-	-	+	-	+
Terapon theraps (Cuvier, 1829)	-	+	+	-	-
Siluriformes					
Mystus gulio (Hamilton, 1822)	+	+	+	+	+
Plicofollis dussumieri (Valenciennes, 1840)	+	+	+	+	+
Decapoda					
Charybdis feriatus (Linnaeus, 1758)	+	-	+	+	+
Panulirus ornatus (Fabricius, 1798)	+	+	-	-	-
Panulirus polyphagus (Herbst, 1793)	+	+	+	+	+
Portunus (Portunus) pelagicus (Linnaeus, 1758)	+	+	+	+	-
Portunus (Portunus) sanguinolentus (Herbst, 1783)	+	+	+	+	+
Scylla serrata (Forskål, 1775)	+	-	-	+	+

+ Occurrence, - Non-occurrence

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