Fishery Technology
2002, Vol. 39(1) pp : 6 - 10

Effect of Square Mesh Panels on Catches of Stationary Bag Net in Hooghly Estuary

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Effect of incorporation of square mesh panels in stationary bag nets operated in Hooghly estuary (West Bengal) on fish landings was studied through comparative fishing experiments. The results showed that catches of juveniles of prawns and finfishes was significantly lower in the experimental gear with square mesh panels of 20 mm bar mesh size, compared to the control net. 50% retention lengths (L_{50}) of *Metapenaeus* sp. and *Macrobrachium mirable*, *Macrobrachium lamerri* and sciaenids were also higher in the experimental bag net compared to the control net. Results indicated that provision of square mesh panels in bag nets would help in the conservation and management of estuarine fishery resources

Key words: Square mesh, bag net, prawn fishery, Hooghly estuary, West Bengal

Stationary bag nets, known as *been jal* in vernacular, are operated in Hooghly estuary (West Bengal) for exploitation of fishery resources. Bag net operations are generally carried out from the end of October to mid February. However, in certain pockets of Hooghly estuary, bag nets are operated throughout the year. Prawns are one of the most valuable components of estuarine fishery and contribute roughly to 10% of total bag net landings. Codend mesh size of 10-15 mm is used in commercial bag nets leading to fishing mortality of juvenile prawns. According to Paul *et al.* (1997) the current level of prawn landings in Hooghly estuary is declining year by year due to exploitation of undersized prawns.

A practical approach to sustain fish productivity with main thrust on conservation of juvenile prawns and finfishes is necessary (Sinha, 1999). By increasing the mesh size or mesh opening in the codend, it is possible to catch prawn and finfish of optimum size (Pope *et al.*, 1976). Fishing experiments to compare catch rates of fishing gears of different mesh types and relative escapement from codend have also been conducted by Kunjipalu *et al.* (2001), Pillai *et al.* (1996) and others. International Council for Exploration of the Sea (ICES) has recommended the use of larger mesh size to reduce juvenile catch for the fisheries of Northern Europe (Anon, 1933). Talwar & Sheshappa (1996) studied the effect of square mesh in trawl, off Mangalore coast. The present investigation was undertaken to find out the effect of incorporation of square mesh panels in bag nets operated in Hooghly estuary on prawn and finfish landings.

Materials and Methods

Two bag nets with a head rope length of 20.27 m were fabricated based on design details given in Fig. 1. In the experimental gear, lower panel sections of the aft part of belly and codend were replaced with square mesh panels of 20 mm bar mesh size (Fig. 1). The other gear with the conventional diamond mesh was used as the control.

The lower legs of the bag net were fixed close to the ground level with the help of two wooden poles. Upper legs of the bag net were attached to the same poles to obtain a vertical height of about 3.5 m. The nets

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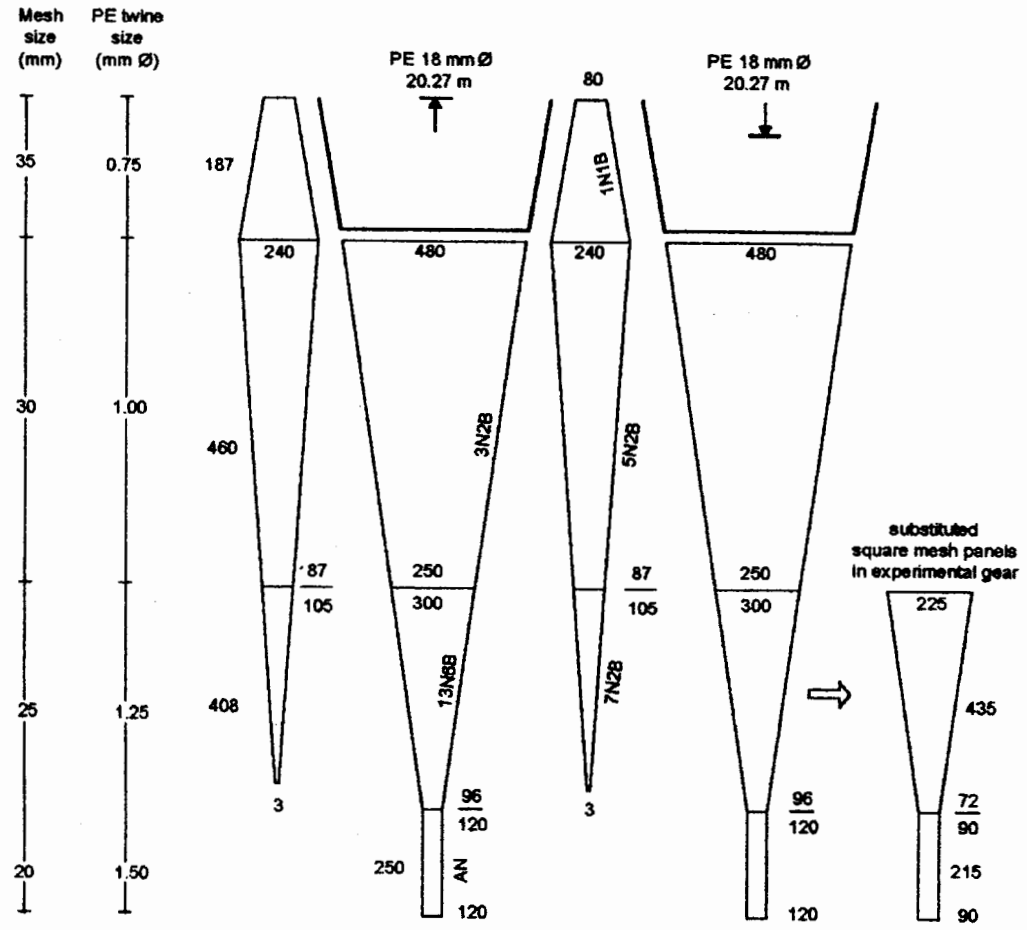

Fig. 1. Design of 1440 x 30 mm stationary bagnet

were set at the start of low tide period and hauled before the start of high tide, for a duration of five hours. The experimental and control nets were set side by side to keep the operational conditions similar. A total of 45 comparative operations were conducted between January and March 2001 in Diamond Harbour region of the Hooghly estuarine system, where commercial bag net fishing takes place throughout the year. The landings were sorted into various groups and species. The average catch per haul for each species group and the length frequency distribution were recorded.

Results and Discussion

The average catch of both experimental net with square mesh panel and conventional bag net are given in Table 1. The average catch of the experimental bag net was 27.28 kg.haul^{-1} and that of conventional bag net was 33.68 kg.haul^{-1}. Paul *et al.* (1997) recorded a catch of 34.28 kg.haul^{-1} in Hooghly estuary. Further, they found that CPUE has been decreasing year by year. The prawn catches in the bag net fishery of Hooghly estuary include *Metapenaeus* spp. *Macrobrachium lamerri* and *Macrobrachium mirable* contributing 12 to 15% of total catch of bag net (Table 1). The experimental net caught 3.49 kg.haul^{-1} of prawn, while conventional net caught 5.08 kg.haul^{-1}. But, the mean length of prawns was higher in the experimental bag net compared to the conventional bag net. The average catch rate of small sized sciaenids was 12.74 kg.haul^{-1} in experimental bag net and 16.73 kg.haul^{-1} in the control net. The reduction in catch of undersized sciaenids was about 23.8% in the

Table 1. Average catch rate and composition of catch obtained in experimental and control bag nets

	Group	Average catch rate (kg.haul^{-1})		Catch composition (%)	
		Square mesh	Diamond mesh	Square mesh	Diamond mesh
1.	Prawns	3.49	5.08	12.80	15.09
	Metapenaeus spp.	1.42	1.73	5.21	5.14
	Macrobrachium lamerri	1.02	1.42	3.74	4.22
	Macrobrachium mirable	1.05	1.93	3.85	5.73
2.	Crabs	0.95	1.00	3.48	2.97
3.	Sciaenids	12.74	16.73	46.70	49.68
4.	*Harpodon nehereus*	3.75	4.02	13.74	11.93
5.	*Setipinna* spp.	2.15	2.50	7.88	7.42
6.	*Trichiurus* sp.	3.00	3.10	11.00	9.20
7.	*Coilia* sp.	0.42	0.50	1.54	1.48
8.	*Eleutheronema tetradactylum*	0.78	0.75	2.86	2.23
	TOTAL	**27.28**	**33.68**	**100**	**100**

experimental net, which is clearly due to the incorporation of the square mesh panels. The catch of other finfishes such as *Harpodon nehereus*, *Setipinna* spp., *Trichiurus* sp., *Coilia* sp. and *Eleutheronema tetradactylum* did not show any significant differences between experimental bag net and control (Table 1), due to their larger body sizes.

With the use of square mesh panels of 20 mm bar in the experimental net, the juvenile prawn and finfish catch reduced by 19% compared to that of control net with conventional diamond meshes. Casey & Warner (1987) recommended the use of square mesh panels to reduce the catch of undersized and juvenile fishes. Mesh lumen of square mesh in the fishing gear remains open during fishing, unlike that of diamond mesh, facilitating the escapement of juveniles and sub-adults through the opening. Square mesh by virtue of its ability to remain open under operational conditions of the gear would provide better filtration efficiency (Pillai, 1998; Talwar & Shesappa, 1996).

The length frequency distribution of prawn and juvenile sciaenids caught in experimental and conventional bag net are given in Fig. 2-5. Length of *Metapenaeus* sp. caught in experimental gear ranged from 52 to 105 mm, whereas it ranged from 41 to 102 mm in control net. The 50% retention length (L_{50}) for *Metapenaeus* sp. was 64.12 mm in the experimental bag net and 51.25 mm in the conventional bag net. Bal & Rao (1984) reported that the size at first maturity of female *Metapenaeus* sp. is 64 mm, which is close to the L_{50} values obtained for this species in the experimental bag net provided with square mesh panels of 20 mm bar mesh.

Size of *M. mirable* caught in experimental gear and control gear ranged from 36 to 60 mm and 27 to 56 mm, respectively. The L_{50} value for this species was 40.5 mm in the experimental gear, while it was 35 mm in control gear. Most of the *M. mirable* females of 41 mm size group were observed to be in berried condition. Kurian & Sebastian (1993) reported that *M. mirable* grew up to 65 mm and the size at first maturity was 40 mm. The length of *M. lamerri* caught in experimental gear and control gear ranged from 63 to 80 mm and 31 to 80 mm and the L_{50} was 69.23 mm and 48.46 mm, respectively. The lowest size caught in the experimental gear was 63 mm, which is greater than the L_{50} value for this species caught in control gear. This may be due to the slim nature of the body of *M. lamerri*, which helps it to escape easily through 20 mm bar length. Further, *M. lamerri* had egg on their abdominal region at 72 mm in length. A small increase in mesh size is therefore

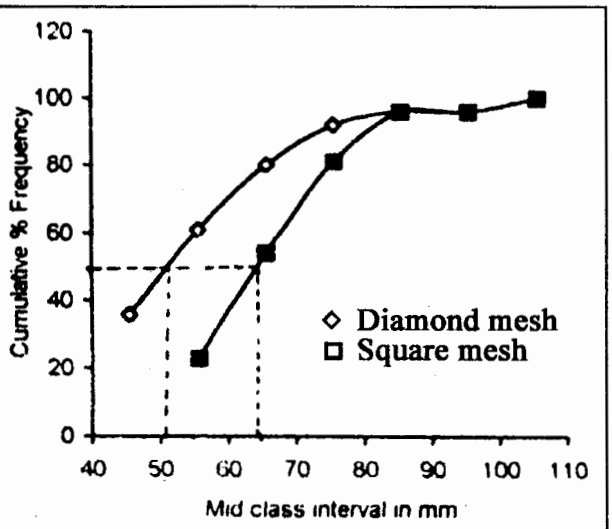

Fig. 2. Cumulative Percentage Frequency curve for *Metapenaous* sp caught in diamond and square mesh nets.

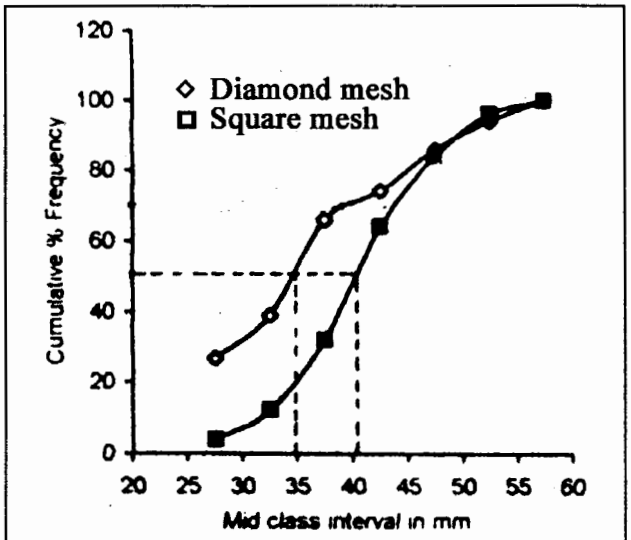

Fig. 3. Cumulative Percentage Frequency curve for *Macrobrachium mirable* caught in diamond and square mesh nets.

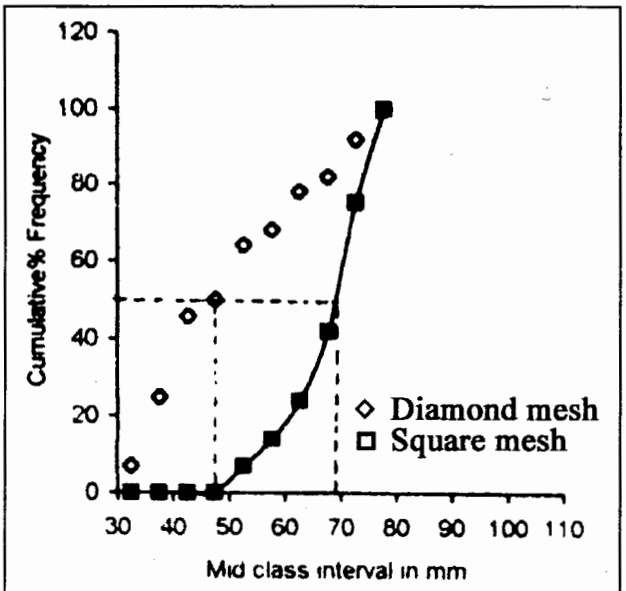

Fig. 4. Cumulative Percentage Frequency curve for *Macrobrachium lamerri* caught in diamond mesh and square mesh nets.

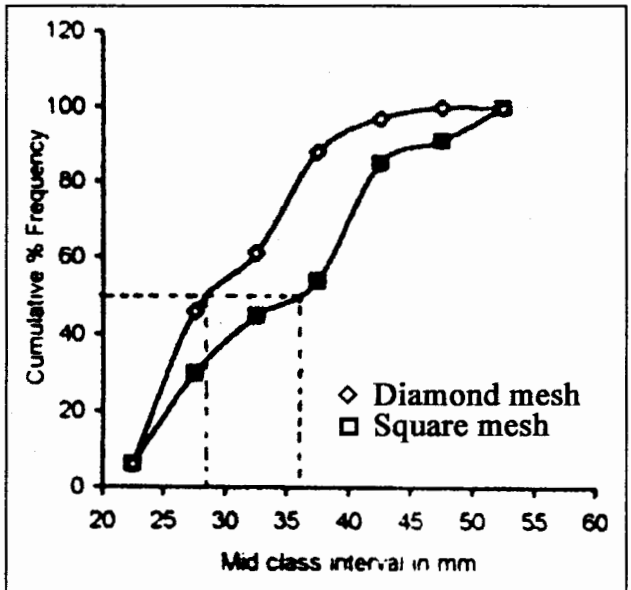

Fig. 5. Cumulative Percentage Frequency curve for sciaenid (*Pama pama*) caught in diamond mesh and square mesh nets.

necessary to restrict the catch to adult sizes of *M. lamerri*.

Sciaenids were the major group of finfishes included in the catch, accounting for 48.2% of the total catch. The size range of sciaenids caught in the experimental and control gears was 25 to 55 mm and 25 to 50 mm and the L_{50} values were 36.28 mm and 28.9 mm, respectively.

The present study has shown that the average catch rate of prawns and finfishes was reduced by 19% through incorporation of square mesh panels in the bag net. The results are in accordance with the observations of Pillai (1998) who observed that about 20% juveniles could be saved by use of square mesh panels in trawls. The present study revealed the effectiveness of square mesh panels of 20 mm bar mesh size

in selectively reducing the percentage of juveniles of prawn and finfishes in bag net fishery of the Hooghly estuary. It is therefore recommended that provision for square mesh panels in bag net would help in the conservation and management of the estuarine prawn fishery resources on a sustainable basis. However, more studies need to be undertaken to evolve a suitable bag net design and to conserve the commercial finfish fishery, particularly the sciaenids of the Hooghly estuarine system.

The authors are grateful to Dr T.J. Abraham and Mr. T.S. Nagesh for their encouragement and valuable help.

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