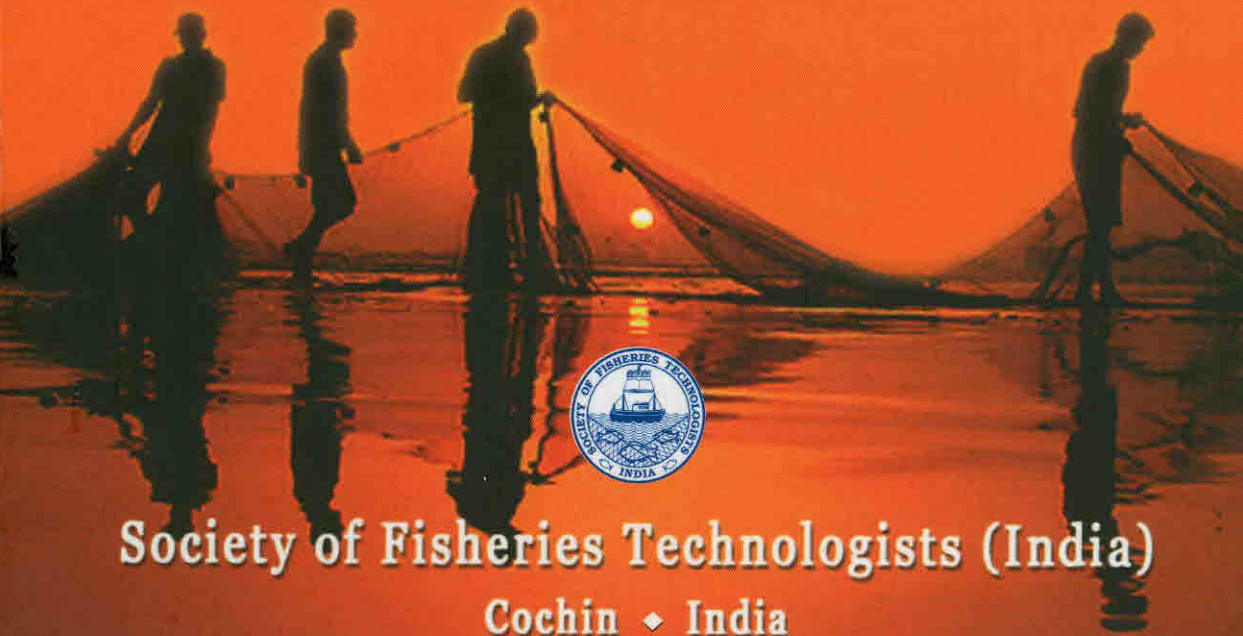


# Coastal Fishery Resources of India

• Conservation and Sustainable Utilisation



Society of Fisheries Technologists (India)

Cochin ♦ India

## **Coastal Fishery Resources of India: Conservation and Sustainable Utilisation**

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# Evaluation of Square Mesh Codends for Bycatch Reduction in Demersal Trawling, off Andhra Pradesh, India

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## Introduction

Due to poor selectivity of commercial trawls, large quantities of fish are discarded in the sea. Impact of codend mesh size on trawl fishery has been studied by Rajeswari *et al.* (1998). The discards often consist of juveniles of commercially important species, which may impact on the yields of commercial species. Mesh size regulations for trawl gears aim to reduce fishing mortality by allowing small sized fishes and juveniles to escape. The shape of the mesh affects the selectivity of codend. The mesh lumen of the diamond mesh closes up under tension during towing operation and prevent escapement of fish. In the square mesh codends, the mesh will remain open and facilitate escapement of juveniles small sized fishes (Robertson, 1983; Robertson and Ferrow, 1988; Robertson and Stewart, 1988; Kunjipalu *et al.*, 1994, Varghese *et al.*, 1996; Prakash *et al.*, 2008). Selectivity information is an important tool for fishery managers for regulating the mesh sizes to determine the minimum mesh sizes of target fish species.

Ribbonfishes are widely distributed throughout tropical and temperate waters. It forms a major component of trawl catches from Visakhapatnam coast. The large head cutlassfish, *Trichiurus lepturus* (Linnaeus, 1758) form the major component of the ribbonfish catches along Visakhapatnam coast, while savala hairtail, *Lepturacanthus savala* (Cuvier, 1829) and other species of ribbonfishes occur occasionally. The total landings of ribbonfishes in the country was about 1,11,000 tonnes in 1992 which constituted 4.8% of the total marine fish production and 9.3% of the pelagic resources exploited during that year (Reuben *et al.*, 1997). *T. lepturus* is caught by commercial trawlers using demersal trawls and drift gill nets.

Large quantities of juveniles of these species are landed by trawlers. It has a good market value in fresh and dry product forms.

### Material and Methods

Square mesh codends of 30 mm, 40 mm and 50 mm were fabricated out of 1 mm dia polyethylene (PE) netting. The experiments were carried out onboard research vessel CIFTECH-I (15.5m  $L_{OA}$ ; 122 hp) in commercial fishing grounds off Visakhapatnam coast (17°40'-17°42' lat.; 83°21'-83°30' long.), between 40 and 50 m. A 26 m multi seam demersal trawl fitted with experimental square mesh codends were used and overall performance of the codends during the experimental tows were evaluated. The covered codend method was used to assess the selectivity of the codends (Pope *et al.*, 1975; Sparre., *et al.*, 1989). Small mesh cover of 20 mm PE netting greater than 1.5 times the size of codend was used for the experiments. Forty hauls of one hour duration were taken and the towing speed was maintained at 2.3-2.5 kn. The quantity and size of the fishes retained in the square mesh codend and excluded were recorded.

The logistic model commonly used to describe trawl selectivity ogive (Sparre *et al.*, 1989) was used in the study.

$$S_L = 1 / 1 + \exp (S_1 - S_2 * L)$$

where  $S_L$  is the function of the ogive defining for each length  $L$ , the fraction of fish retained in the codend.  $S_1$  and  $S_2$  are constants determined by linear least square estimation for each species.

$L_{25}$ ,  $L_{50}$ ,  $L_{75}$ , selection range, selection factor and selection ratio were calculated as below:

$$L_{50} = (S_1 / S_2),$$

$$L_{25} = (S_1 - \ln 3) / S_2$$

$$L_{75} = (S_1 + \ln 3) / S_2$$

$$\text{Selection range} = L_{75} - L_{25}$$

$$\text{Selection factor} = L_{50} / \text{Mesh size}$$

$$\text{Selection ratio} = \text{Selection range} / \text{mesh size}$$

## Results and Discussion

Percentage of exclusion and retention in respect of total and group-wise bycatch from 30 mm, 40 mm and 50 mm square mesh codends is given in Fig. 1 and 2. About 10% of the total catch which has entered the codend was excluded from 30 mm square mesh codend, 24% from 40 mm codend and 37% from the 50 mm codend.

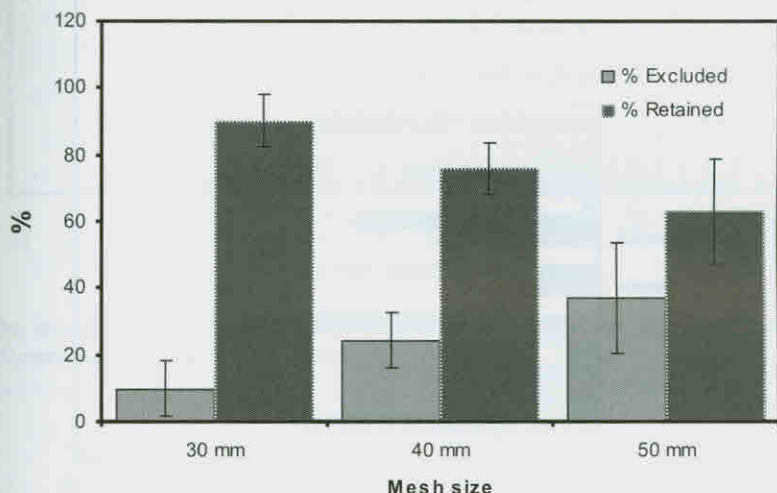


Fig. 1. Retained and excluded catches (%) from 30 mm, 40 mm and 50 mm square mesh codends

In 50 mm mesh square mesh codend, more than 80% of the sardines and anchovies and nearly 70% of the goatfishes were excluded. Silver bellies, ribbonfishes and carangids were excluded at levels between 55 and 57% and sciaenids, *Thryssa* spp., squids, barracudas, *Lactarius* sp., *Saurida* spp., nemipterids and poynemids at levels between 20 and 47%. In the case 40 mm codend, exclusion rates for different species varied from 9 to 49%. In the case of 30 mm square mesh codend, while bycatch exclusion ranged from 31% for anchovies and 1% for ribbonfishes, species such as *Lactarius* sp. polynemids, sciaenids and *Saurida* spp. Were not excluded.

The length frequencies of *Trichiurus lepturus* retained and excluded from 40 mm square mesh cod end is given in Fig. 3. The selectivity curve of *T. lepturus* with 40mm square mesh codend is given in Fig. 4 and selectivity parameters are given Table 1. The  $L_{25}$ ,  $L_{50}$  and  $L_{75}$  values in respect of *T. lepturus* for 40 mm codend were 30.75, 36.2 and 41.65,

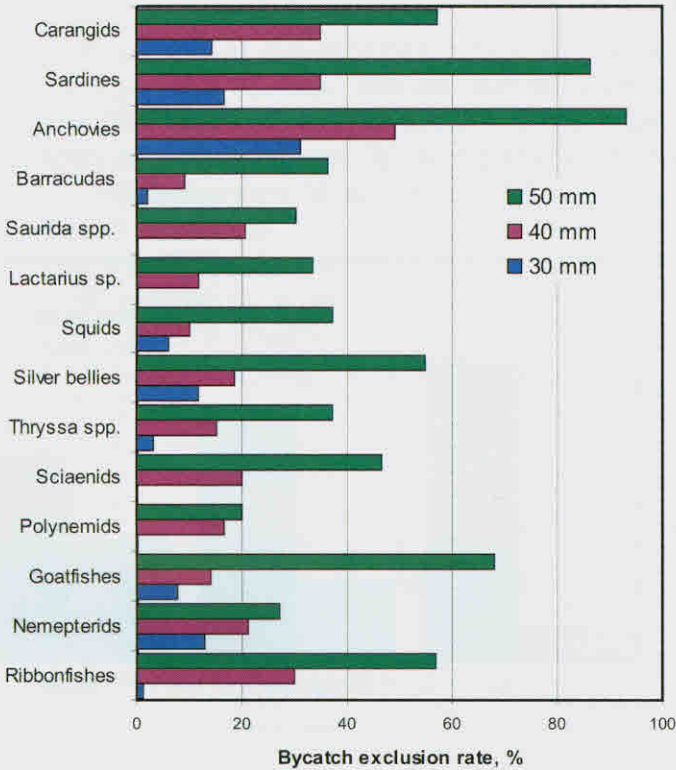


Fig. 2: Species group-wise exclusion rates (%) from 30 mm, 40 mm and 50 mm square mesh codends

respectively. The selection range and selection factor were 10.9 and 9.05, respectively. The length frequencies of *T. lepturus* retained and excluded from 50 mm square mesh cod end is given in Fig 5. Selectivity curves of *T. lepturus* with 50 mm square mesh codend is given in Fig. 6 and selectivity parameters are presented in Table 1. The  $L_{25}$ ,  $L_{50}$  and  $L_{75}$  for 50 mm codend in respect of *T. lepturus* were 33.51, 40.71 and 47.91 cm, respectively. The selection range and selection factor were 14.4 cm and 8.14, respectively.

The length frequencies of *Leputracanthus savala* retained and excluded from 40 mm square mesh codend is given in Fig 7. The selectivity curve of *L. savala* with 40 mm is given in Fig 6 and selectivity parameters are given in Table 1. The  $L_{25}$ ,  $L_{50}$  and  $L_{75}$  values in respect of 40 mm for *L. savala* were 27.21, 35 and 42.78 cm, respectively. The selection range and selection factor was 15.57 cm and 8.75 respectively. The length frequencies of *L. savala* retained and excluded from 50 mm square mesh

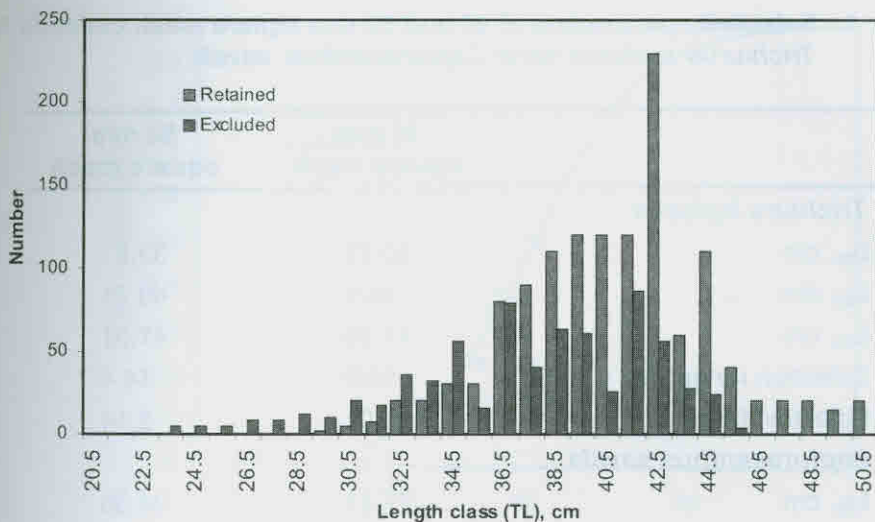


Fig. 3: The length frequencies of *Trichiurus lepturus* retained and excluded from 40 mm square mesh cod end

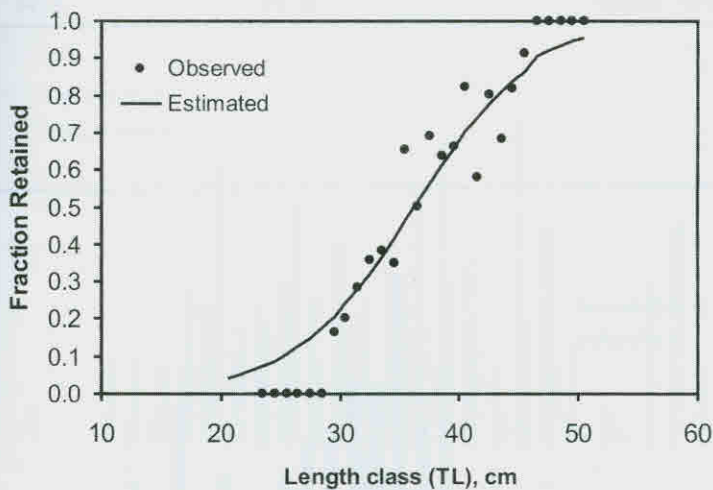
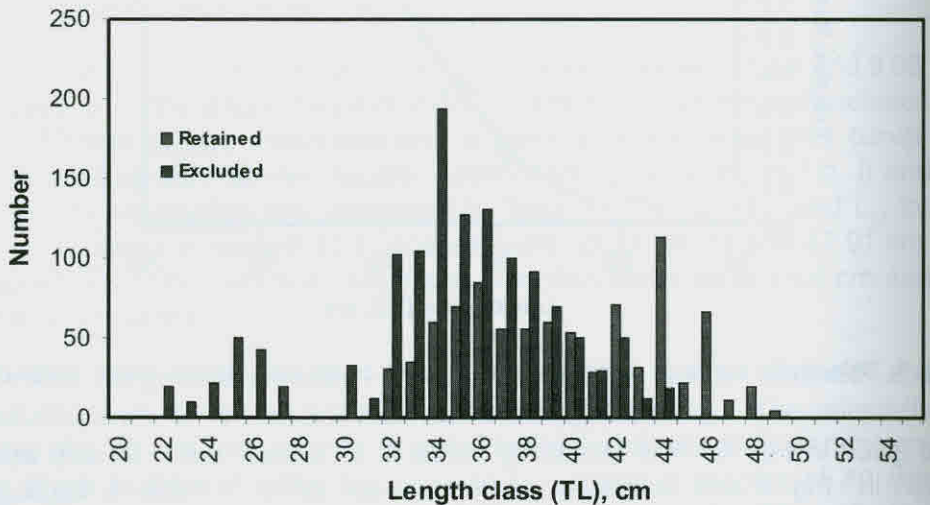


Fig. 4: Selectivity curve of *T. lepturus* in respect of 40 mm square mesh codend

are given in Fig. 8. The selectivity curve of *L. savala* with 50 mm are given in Fig. 8 and selectivity parameters are given in Table 1.  $L_{25}$ ,  $L_{50}$  and  $L_{75}$  values in respect of 50 mm for *L. savala* were 34.36, 36.73 and 39.1 respectively. The selection range and selection factor were 4.74 cm and 7.34, respectively.

**Table 1: Selectivity parameters of 40 and 50 mm square mesh codends for *Trichiurus lepturus* and *Lepturacanthus savala***

	40 mm square mesh	50 mm square mesh
<b><i>Trichiurus lepturus</i></b>		
L <sub>25</sub> , cm	30.75	33.51
L <sub>50</sub> , cm	36.2	40.71
L <sub>75</sub> , cm	41.65	47.91
Selection range, cm	10.9	14.4
Selection factor	9.05	8.14
<b><i>Lepturacanthus savala</i></b>		
L <sub>25</sub> , cm	27.21	34.36
L <sub>50</sub> , cm	35.00	36.73
L <sub>75</sub> , cm	32.78	39.10
Selection range, cm	15.57	4.74
Selection factor	8.75	7.34



**Fig. 5: The length frequencies of *Trichiurus lepturus* retained and excluded from 50 mm square mesh cod end**

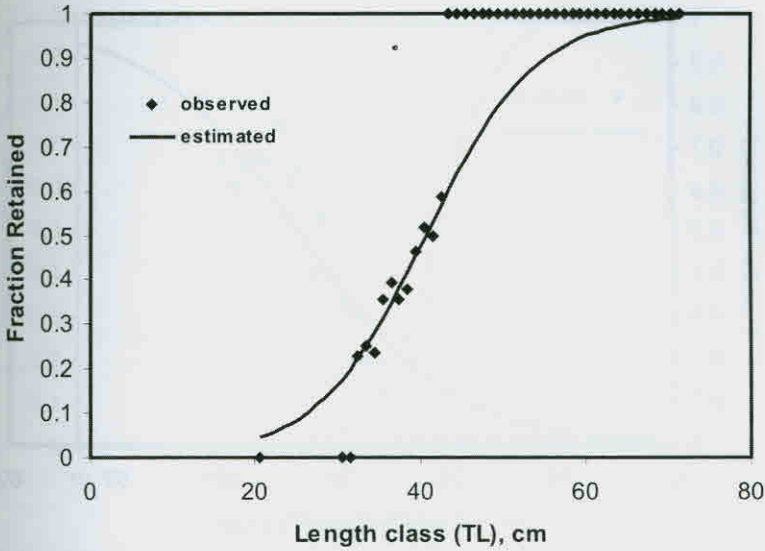


Fig. 6: Selectivity curve of *Trichiurus lepturus* in respect of 50 mm square mesh codend

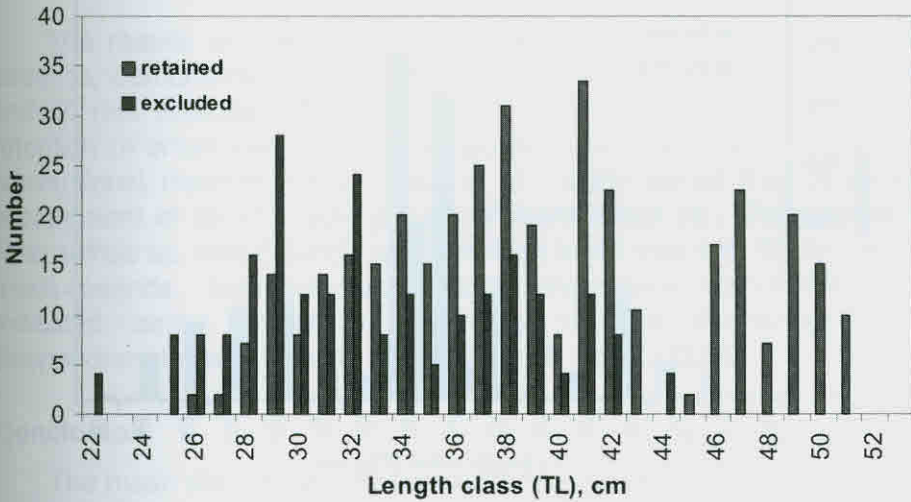


Fig. 7: The length frequencies of *Lepturacanthus savala* retained and excluded from 40 mm square mesh cod end

The size at first maturity of *Trichiurus lepturus* have been reported as 42.5 cm (Reuben *et al.*, 1997.) It attains maximum size of 120 cm. The optimum mesh size estimated for *Trichiurus lepturus*, based on selectivity experiments using 40 and 50 mm square mesh codends are

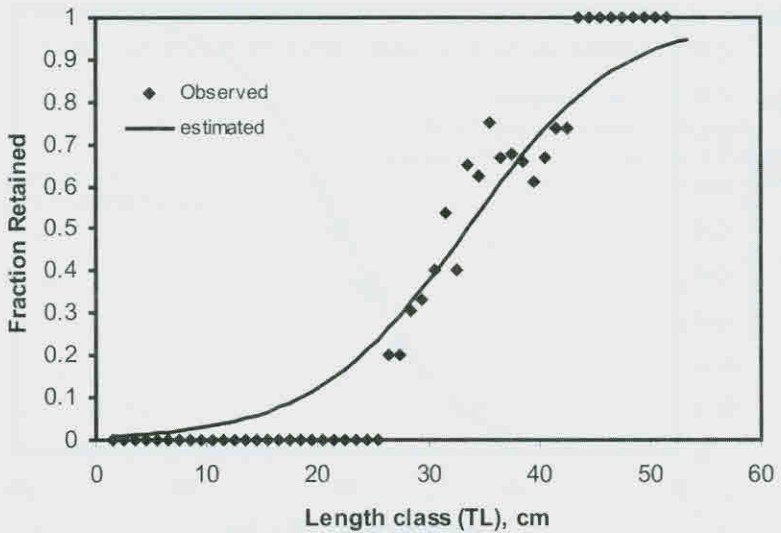


Fig. 8: Selectivity curve of *Leputracanthus savala* in respect of 40 mm square mesh codend

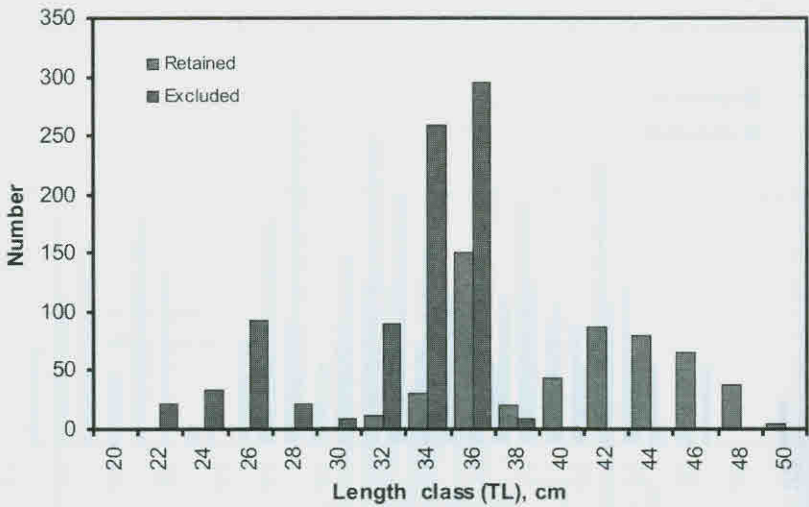


Fig. 9: The length frequencies of *Leputracanthus savala* retained and excluded from 50 mm square mesh codend

47 mm and 52 mm, respectively. Gupta (1967), based on the decline in condition factor, indicated that *Leputracanthus savala* attains maturity at 41 cm length and has a maximum length of 100 cm. The optimum mesh size estimated for *L. savala* based on selectivity experiments using 40 and 50 mm codends work out to be 47 mm and 56 mm, respectively.

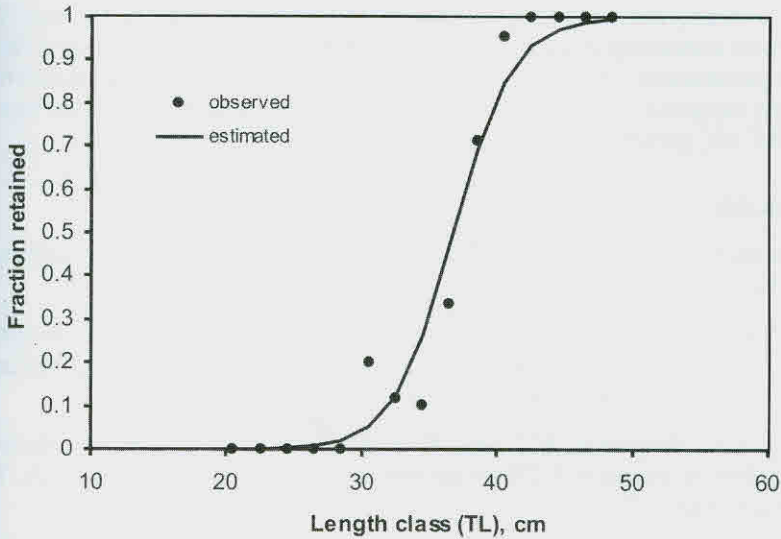


Fig. 10: Selectivity curve of *Lepuracanthus savala* in respect of 50 mm square mesh codend

The results on the selectivity characteristics of three square mesh codends, demonstrate that 30 mm codend is less selective than 40 mm and 50 mm codends. Kunjipalu *et al.* (1989) reported that percentage retention of small sized fishes by square mesh was lower compared to conventional diamond mesh. Pillai *et al.* (1996) stated that percentage escapement of smaller size groups of *Nemipterus sp.*, *Decapterus sp.*, *Priacanthus sp.* and *Saurida sp.* were high in 40 mm and 50 mm square mesh codends. Selectivity experiments using square mesh codends have indicated better selectivity for many species (Robertson, 1983; Boopendranath and Pravin, 2005; Prakash *et al.*, 2008).

### Conclusion

The mesh size of the codend predominantly determines the selectivity of trawl gear in respect of trawl caught resources. The present study shows that the 40 mm and 50 mm square mesh codends have better selective characteristics than 30 mm square mesh codend, with respect to several resource groups caught by trawling off Andhra Pradesh. Based on the results of selectivity experiments, a mesh size not less than 47 mm seems to be appropriate for protection of the juveniles and sustainable harvesting of large head cutlassfish and savala hairtail resources.

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