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Size Selectivity of 40 mm Square Mesh Codend with respect to Yellowstriped Goatfish, *Upeneus vittatus* (Forsskal, 1775) and Orangefin Ponyfish, *Leiognathus bindus* (Valenciennes, 1835)

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Yellowstriped goatfish, *Upeneus vittatus* (Forsskål, 1775) and Orangefin Ponyfish, *Leiognathus bindus* (Valenciennes, 1835) are widely exploited by the trawl fishery. Due to the use of codends with conventional small diamond mesh in the trawl nets, large quantities of juveniles of these species are landed along the east coast of India. The size selectivity of 40 mm square mesh codend for *Upeneus vittatus* and *Leiognathus bindus* was studied with a 30 m demersal trawl, following covered codend method. The L25, L50 and L75 values for *Upeunus vittatus* were 10.0, 11.22 and 12.4 cm respectively. Selection factor, selection range and selection ratio for *Upeneus vittatus* were 2.8 and 2.43 and 0.6 respectively. The L25, L50 ,L75 values for *Leiognathus bindus* were 5.52, 7.7 and 9.88 cm respectively. Selection factor, selection range and selection ratio for *Leiognathus bindus* were 1.92, 4.36 and 1.09 respectively.

Key words: Trawl codend selectivity, square mesh selectivity, Mean selection length, Selection factor, *Upeneus vittatus*, *Leiognathus bindus*

Gear selectivity plays a vital role in the development of a sustainable and economically viable fishery. The results of selectivity experiments allow gear technologists to isolate the elements of the gear or the harvesting procedures that permit the escapement of unwanted catch. Selectivity experiments also indicate the size and the species that are removed from the marine environment as well as those species that escape with the use of a particular configuration or a harvest method. This type of information is used by resource biologists to improve stock assessments, make recommendations on exploitation levels, regulate mesh size, minimum landing size and to predict the long term effects of regulatory change on resource and the economic viability of harvesting operations. (Wileman *et al.*, 1996).

Goat fishes form a major component of the catch from trawls from Visakhapatnam which is available throughout the year and the fishery is sustained by *Upeneus vittatus* (65.1%), *U. sulphureus* (26.5 %) and *U. moluccensis* (8.3%) (Hamsa and Rao, 1997). *Upeneus vittatus* constitutes about 4.5 % of the total catch from small trawlers operating along the east coast (Hamsa and Rao, 1997). Majority of the catch comprises of immature individuals, a considerable amount of which is discarded at sea or is used for fish meal. Larger sized species which reach the domestic market form a cheap source of protein for the poor.

The fishes of the family Leiognathidae, known as *karalu* in Telugu language, form an important group of finfishes in the marine fisheries of India. In the year, 2001-02, the estimated landing of this group in India was

62,100 t, which formed 2.35% of the total marine landings (CMFRI 2003). Along the East coast the species, *Leiognathus bindus* is predominant in the trawl catches. They are principally shallow water fishes with a distribution up to 40 m depth. These fishes have little demand in the fresh condition, but there is considerable market for sun-drying and for fishmeal production.

Large quantitities of immature fishes of both the species are landed by trawlers at Visakhpapatnam, due to the use of codends with small diamond mesh of 10-20 mm size. The use of diamond mesh leads to narrowing of the middle of the codend causing the mesh lumen to almost close during trawling preventing smaller fishes to escape and are retained in the codend (Varghese et al., 1996; Pillai *et al.*, 1998; Varghese *et al.*, 1988).

The exploitation of undersized fishes lead to the depletion of stocks. The /shape of the codend effects the selectivity of codends and the superiority of square mesh has been proven by many (Robertson *et al.* 1986; Robertson, 1983; Robertson & Stewart, 1988; Robertson and Ferrow, 1988; Robertson, 1993). In Indian waters, the superiority of square mesh codends was proven by Kunjipalu *et al.* (1994) and Varghese *et al* (1996).

Though taxonomy, biology and population dynamics of *Upeneus vittatus* and *Leiognathus bindus* in Indian waters has been reported (Murty 2003), no work has been attempted on the size selectivity parameters of trawl codend with respect to these species.

Materials and Method

Selectivity experiments were carried out onboard Research Vessel CIFTECH 1 (15.5 m LOA; 122 hp), off Visakhapatnam coast, using a 30 m demersal trawl fitted with 40 mm square mesh codend. Covered codend method was followed in the current study (Pope, *et al.*, 1975; Sparre *et al.*, 1989). The square mesh codend was covered with a cover made of polyamide netting of 20 mm diamond mesh size. The codend cover was about one and half times the codend in dimensions. 50 hauls of 1 h duration were made at a depth of 30-40 m. Towing speed was about 2.3 to 2.5 knots. The length frequency data were collected for the catch in the codend and cover. Selectivity can be expressed as the proportion of fish of each length entering the net which are retained in the codend. When these proportions are plotted against the length, selection curve for the particular species is obtained.

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

$$SL = 1/ 1+ \exp(S1-S2*L)$$

where SL is the function of the ogive defining for each length L, the fraction of fish retained in the codend. S1 and S2 are constants determined by linear least square estimation or maximum likelihood estimation for each species.

L50, L25, L75, selection range and selection factor were calculated as below:

$$L50 = (S1/ S2)$$

$$L25 = (S1 - \ln 3) / S2$$

$$L75 = (S1 + \ln 3) / S2$$

Selection range = L75 – L25

Selection factor = L50 / Mesh size

Selection ratio = selection range / mesh size

Results and Discussion

The length frequencies of *U. vittatus* and *L. bindus* retained and excluded from 40 mm square mesh codend are given in Fig 1 and Fig 2. The selectivity curves of *U. vittatus* and *L. bindus* is given are Fig 3 and

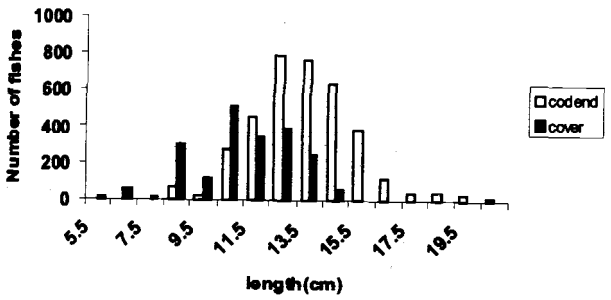

Fig. 1. Length class of Upeneus vittatus retained and escaped from 40 mm square mesh codend

Fig 4. The L25, L50 and L75 values for *U. vittatus* with 40 mm square mesh codend was 10.0, 11.22 and 12.4 cm respectively. Selection factor, selection range and selection ratio for *Upeneus vittatus* were 2.8 2.43 and 0.6 respectively. The L25, L50, L75 values for *L. bindus* was 5.52, 7.7 and 9.88 cm, respectively. Selection factor, selection range and selection ratio for *Leiognathus bindus* were 1.92, 4.36 and 1.09 respectively.

The size at first maturity have been reported as 13.1 cms respectively for *U. vittatus* (Mayers 1991). The optimum mesh size suitable for giving protection to juveniles to sustain the fishery can be calculated from the selection factor as 4.6 cm for U. Vittatus. The size at first maturity for L. bindus have been reported as 9.9 cm (James 1984). The optimum mesh size suitable for giving protection to juveniles to sustain the fishery can be calculated from the selection factor as 5.2 cm for L. bindus

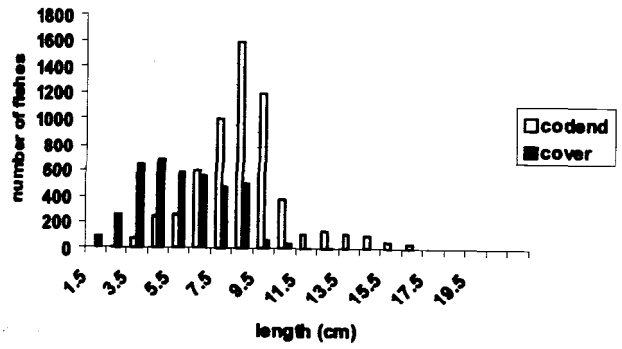

Fig. 2. Length class of Leiognathus bindus retained and escaped from 40 mm square

Smooth sigmoid curves were obtained for *U. vittatus* and *L. bindus*, which is characteristic of most mobile gears like trawls (Wileman *et al.*, 1996). Selectivity information with respect to trawls has been reviewed. Selectivity characteristics of square mesh codend with respect to *Caranx para, Dussumieria acuta, Thryssa purava, Nemipterus japonicus, Saurida tumbil, Metapenaeus dobsoni* and *Parapenaopsis stylifera* have been reported from Indian waters (Varghese *et al.*, 1996; Kunjipalu *et al.*, 2001 . Boopendranath & Pravin, 2005). The factors which influence selectivity of codend meshes are haul duration, net material, contrast of background light, amount of fish in the codend and rigging of the gear as well as actual size of the codend (Isaksen *et al.*, 1990, Isaksen and Valdemarsen, 1994).

Selectivity experiments using square mesh codends have shown that square meshes are more selective for many species than conventional diamond meshes (Robertson, 1983; Robertson & Stewart, 1988; Walsh *et al.*, 1992; Boopendranath & Pravin, 2005). The main reason for improved selectivity is that square mesh remains open all along the codend whereas diamond meshes tend to distort due to longitudinal

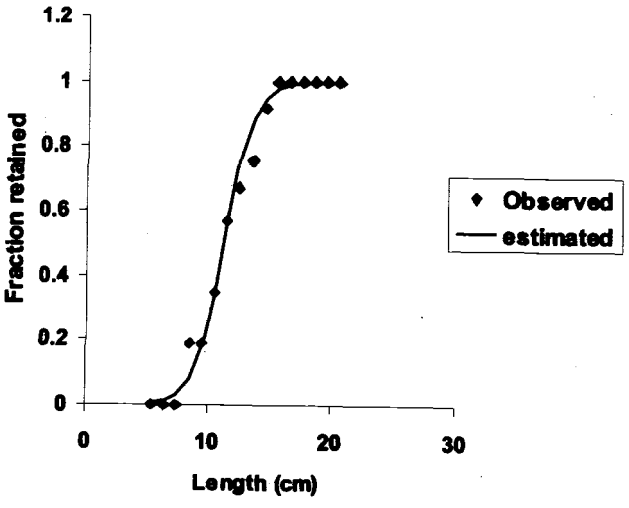

Fig. 3. Selectivity curve for 40 mm Square mesh codend for Upeneus vittatus

and transverse tension on mesh bars depending on catch size, current and other factors. However, the effect of mesh size on codend selectivity primarily depends on body shape of target species. Hence the square mesh codends have generally been found more selective than diamond shaped ones of similar mesh size for round fishes like haddock and whiting (Roberston & Stewart 1988) and Hake (Stergiou *et al.*, 1994). In the case of flat fishes where selection is related to width of the fish rather girth, square mesh codend is seen to be less effective in releasing young ones (Walsh *et al.*, 1992).

In the present study it was observed that the square mesh codend was selective in retaining the larger sized fishes while allowing the smaller sized fishes to escape in the case of both the species. Silvestre (1986) has provided selectivity parameters for 40 mm diamond mesh codend with respect to *Leiognathus bindus*. Mean selection length (L50) reported by him was 6.3 cm which is considerably less than that obtained with square mesh codend in the present study, supporting the efficiency of square mesh codend in excluding juveniles.

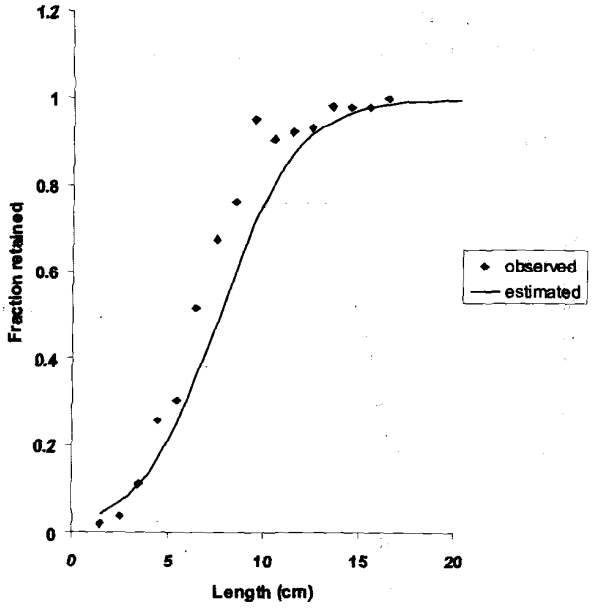

Fig 4. Selectivity curve for 40 mm Square mesh codend for Leiognathus bindus

Selectivity parameters of square mesh codend with respect to *Upeneus vittatus* and *Leiognathus bindus* from Indian waters have been reported for the first time, in this paper. The effect of mesh configuration on the size selection of different species need to be investigated. The factors which effect selectivity like depth, size of codend, catch, duration of drag, and other parameters need to be investigated, further. While implementing the technical measures such as codend mesh sizes knowledge of the survival of the escaping fish, also should be considered.

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