

# FISHING TRAILS WITH MODIFIED TWO-SEAM OVERHANG TRAWL- INTRA-SPECIFIC SELECTIVITY STUDIES

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## ABSTRACT

*A two-seam overhang trawl is modified by incorporating the square mesh panels of 45mm mesh size in forward part of upper belly and 28mm mesh size in codend and fishing trails were carried out during day time, off Karwar coast to study the intra-specific selectivity of some important finfishes and shellfishes. The fishing ground was chosen at random, based on the operation of the other commercial trawlers in the vicinity. The retention lengths ( $L_{50\%}$ ) of some important different finfishes such as Mackerels, Pomfrets, Soles and Ribbon fishes (*Trichiurus* spp.), clupeids (*Sardinella* spp.) and Silver bellies (*Leiognathus* spp.) and some shell fishes such as *Metapenaens* sp. and *Parapenopsis* sp. were estimated and compared those with their size at sexual maturity for intra-specific selectivity.*

**Key words:** Two-seam over hang trawl; Square mesh; Finfishes, shellfishes 50% of retention length (i.e.  $L_{50\%}$ ). and sexual maturity

## 1. INTRODUCTION

Selective fishing refers to a fishing method's ability to target and capture organisms by size and species during the fishing operation allowing non-targets to be released unharmed. The mesh size and shape of codend meshes are selected so as to exploit the desired size groups and avoid capture of smaller ones in order to conserve the fishery resources. Chun Chun et al. (1991) observed that the diamond mesh becomes narrow at the middle of the codend causing the mesh lumen to be almost closed during trawling and hence the probability of escapement of undersized and juveniles are in remote. Similar Robertson & Stewart (1988) observed that the codend when filled assumes bulbous shape and the fish escape through a small area of open meshes in front of the bulb, while forward of this point most of the meshes are stretched and closed. Pope (1966) stated that the shape of mesh affects the selectivity of codend. Further; the flow of water also depends on the shape of mesh. Hence for improving the filtering efficiency of mesh, the mesh has to remain open, facilitating more water flow and easy escape of young ones of fish. This can be achieved by using square mesh codends as this will remain open while in operation. The superiority of square mesh over diamond mesh in facilitating escapement of smaller ones has been proven by many workers (Robertson, 1982; 1983; 1986a, & b; Robertson et al., 1986; Robertson & Stewart, 1988; Kunjipalu & Varhese, 1989; Kunjipalu et al., 1994; Talwar & Sheshappa, 1996 and Talwar et al., 2006)

The present fishing trials were carried out to study the intra-specific selectivity of some important finfishes and shellfishes by estimating their 50% of retention lengths (i.e.  $L_{50\%}$ ) caught in modified two-seam over hang trawl and compared those with their size at sexual maturity.

## 2. MATERIALS AND METHODS

A two-seam over hang trawl of size 25.26m/35.76m (headline/fishing line) was modified by rigging with square mesh panels of 45mm mesh size in forward part of upper belly and 28mm at codend. The specifications of this modified trawl were represented in data sheet and the dimensions and construction characteristics of net was shown in figure.1

The 13.36m OAL wooden stern trawler, fitted with Ruston engine developing 102 BHP at 1800r.p.m. was used for fishing trials. Flat rectangular otter doors measuring 1500mm x 750mm and weighing 65kg each made up of wood and iron were used. A set of nine spherical aluminum floats each of 18.2cm diameter and 2.62kgf buoyancy force and equal number of sinkers weighing 50kgs each were used for the trawl to get the adequate buoyancy force and sufficient sinking force respectively.

Fishing cruises were conducted randomly off Karwar between 24 and 34 isobaths. The towing duration of one and half hour, towing speed of 2 knots and scope ratio of 5: 1 was maintained throughout the course of study for all samples.

Total twelve hauls were made throughout season. The catch composition as well as lengths of individuals of different dominant finfishes and shellfishes obtained during each haul and their co-efficient of variations were recorded.

In order to determine the 50% of retention lengths (i.e.  $L_{50\%}$ ) of dominant fin fishes and caught, the length frequency distribution were calculated, where the median lengths of the dominant finfishes and shellfishes were considered instead of mean lengths because any chances of occurrence of few large size fishes in the catch will not affect the medial length.

The total catch was recorded during different hauls and efficiency was judged by Mann Whitney 'U' test (Weber, 1973, Daniel 1977).

### DATA SHEET: Specifications of modified Two-Seam overhang trawl

Details of the Gear							
	TOP WING1	SQAURE-1	BUNT-1	BELLY-1	SQ. MESH PANEL	BELLY-2	SQ. MESH CODEND
MESH TOP	60	450	50	450	200	200	110
MESH BASE	150	450	150	150	200	100	110
MESH DEEP	270	130	400	300	100	100	350
MESH SIZE(MM)	48.0	45.0	45.0	45.0	45.0	28.0	28.0
TWINE NOTATION	0.75	0.75	0.75	0.75	0.75	0.75	0.75double
CUTTING RATE	1N.4Bx90	All N	1N.5Bx100	1N.2Bx150	All B	1N.2Bx50	AllB
BATING RATE	-	-	-	1in 3x50	1in 10x10	-	-

### LINES AND ROPES

	Details		
	HEAD LINE	FISHING LINE	WING LINE
MATERIALS	Polypropylene(PP)	Polypropylene(PP)	Polypropylene(PP)
DIAMETER	12mm	12mm	12mm
LAY	Regular	Regular	Regular
LENGTH	25.26m	35.76m	3.822m
EXTENSION	1.00m	1.00m	1.00m

### PARTICULAR OF OTHERACCESSORIES

	FLOATS	SINKERS	OTTER DOORS
MATERIAL	Aluminum	Galvanised iron	Iron and wooden
NUMBER	9	-	One pair
SHAPE	Spherical	Link chain	Rectangular Flat
SIZE	18.2cm dia	Cross-sect.l area is $11.4 \times 10^{-4} \text{m}^2$	1500mmx750mm
WEIGHT IN AIR	-	55Kg	65Kg
OTHER PROPERTIES	Total Buoyancy is 23.48 kgf	Weight in sea water is 46.2 Kg	-

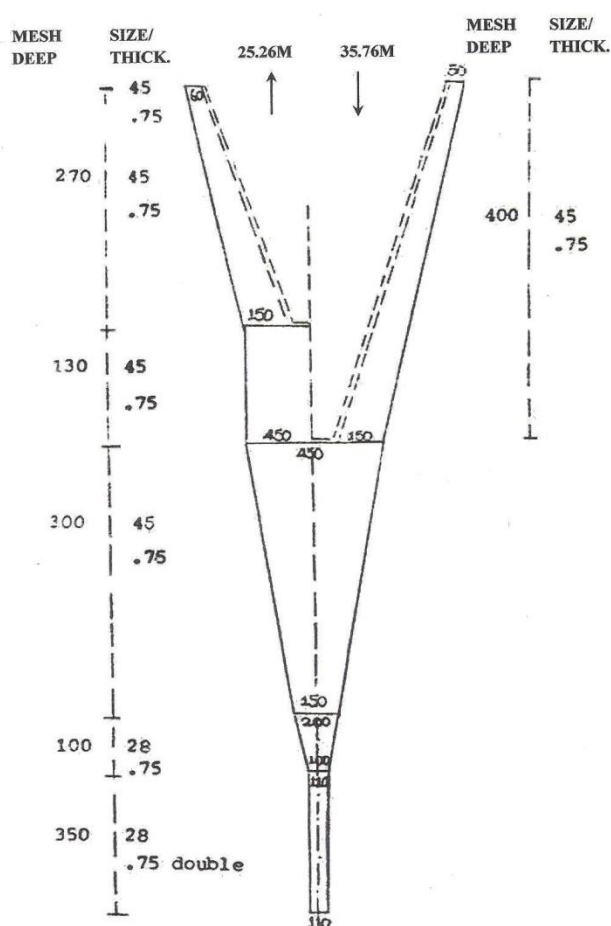


Figure 1: The Dimensions and Construction Characteristics of modified Two-seam overhang Trawl.

### 3. RESULTS AND DISCUSSION

Result of Mann Whitney 'U' test for total catch during different hauls in modified two-seam overhang trawl shown that there was no significant difference between the average catches obtained during different hauls at 5% level.

Table 1 shows the length ranges with their co-efficient variation of some finfishes and shellfishes caught in modified two-seam trawl with square mesh panels of 45mm mesh size in forward part of upper belly and 28mm at codend. Figure 2a,b,c and 3 gives the percentage cumulative frequency curves for the some important finfishes and shellfishes respectively from which the median lengths ( $L_{50\%}$ ) are measured. All these curves are of sigmoid or S-shape indicating the normal distribution of finfishes and shellfishes in the length range.

#### 3.1 FINFISHES

##### Mackerels (*Rastrelliger kanagurtha*):

The length range of mackerel caught in modified two seam over hang trawl codend was from 12 to 26cm (Table 2).The ogive curve indicates the median length of mackerels ( $L_{50\%}$ ) caught in square mesh codend was 15.8cm (Fig.2a).Bal and Rao (1990) have reported that, the size of Indian mackerel (*R. kanagurtha*) at first sexual

maturity in 22.4 cm and all fish below size are to regarded as juvenils.The mackerel fishery is mostly supported by juveniles. However, from its median lengths ( $L_{50\%}$ ), it is evident that the modified two seam trawl is not regarded as suitable for caching mackerel and cannot be judged as index of size selectivity for this species. In other words it can be concluded that the square mesh openings of 45mm at forward part of upper belly and of 28mm at codend are not enough to escape the juveniles of mackerels.

##### Clupeids (*Sardinella spp.*):

The length range of clupeids (*i.e.Sarinella spp.*) caught in two- seam trawl with square mesh panels of 45mm mesh size in forward part of upper belly and 28mm at codend ranging from 10 cm to 18 cm .It can be seen from the table 2 that the 50% retention of fishes caught in codend was around 10.5 cm (Fig.2a).

Mature and spawning individual of clupeids are of the size range of 10-10.9 cm in length (Nair, 1951). Attainment of sexual maturity at even smaller length of 8 cm or 9 cm has been reported (Chidambaram and Venkataraman, 1946). The length ranges as well as the median lengths ( $L_{50\%}$ ) caught in the gear indicates that, the modified two-seam overhang trawl catches matured clupeids only which shown better selectivity of this species.

##### Pomfrets (*Pampus spp.*):

Good numbers of pomfrets (*Pampus spp.*) were caught in two-seam over hang trawl with square mesh panels of 45mm mesh size in forward part of upper belly and 28mm at codend. The length ranges recorded were i.e.10-26 cm and their co-efficient variation is 27.2% (Table 2). The medial lengths ( $L_{50\%}$ ) of fishes are found to be 16.4cm. (Fig.2b). Kuthalingum (1963) has reported that size at maturity of *Pampus argentus* ranges from 16 to 18 cm and matured specimens have a length range of 10-21 cm .Thus, the trawl with square mesh panels of 45mm mesh size in forward part of upper belly and 28mm at codend is not selective on these species because body shape is oval and escapement through this mesh size is difficult.

##### Silver bellies (*Leiognathus spp.*):

The length ranges of silver bellies (*Leiognathus spp*) were caught in this trawl with square mesh panels of 45mm mesh size in forward part of upper belly and 28mm at codend are i.e.8-16cm. (Table 1 and 2).and median lengths ( $L_{50\%}$ ) are around 9.2cm (Fig.2b).

Balan (1967) has reported that the minimum size at first sexual maturity for Silver bellies (*L.bindus*) is 8.7 cm.Form the present investigation, it is clear that the gear with square mesh panels of 45mm mesh size in forward part of upper belly and 28mm at codend catch matured size of Silver bellies (*Leiognathus spp.*).In other words it could interpret that there will be enough openings of square meshes of 45mm size at forward part of upper belly and at codend of 28mm size to escape the juveniles.

### **Soles (*Cynoglossus.spp*):**

The length ranges of soles caught in the trawl with square mesh panels of 45mm mesh size in forward part of upper belly and 28mm at codend are 10-24cm (Table 1). But the 50% retention lengths (median lengths) of these species are 11 cm (Fig.2c). Sheshappa and Bhichachar (1954) reported that the minimum size at first maturity of Malabar sole is 12cm. Hence, it is evident that this gear has tendency to catch immature ones and it may be concluded that modified two seam overhang trawl with its openings of 45mm square meshes at forward part of upper belly and 28mm at codend are not ideal for selectivity of this species.

### **Ribbon fishes (*Trichiurus.spp*):**

The maximum size of *Trichiurus.spp* caught in modified two-seam overhang trawl. The median length ( $L_{50\%}$ ) of fishes caught in this gear with square mesh panels in forward part of upper belly and codend is 28.6cm (Table 1 and Fig.2c). Bal and Rao (1990) have reported that the minimum size at maturity is 47-48 cm for *Trichiurus lepturus*. This tends to show that ribbon fishes caught in this gear are not of matured size. Hence 45mm square meshes at forward part of upper belly and 28mm at codend is not selective of *Trichiurus.spp*.

## **3.2 SHELL FISHES**

### ***Metapenaeus sp.*:**

The length of *Metapenaeus sp.* caught in two-seam overhang trawl with square mesh panels of 45mm mesh size in forward part of upper belly and 28mm at codend

ranges from 70mm to 140mm and its median length ( $L_{50\%}$ ) is 9.8cm (Fig. 3). Bal and Rao (1990) have reported that the minimum size of sexual maturity of *Metapenaeus sp.* is 8.86 cm. Hence it is evident that in modified trawl by incorporating the square mesh panels of 45mm mesh size in forward part of upper belly and 28mm at codend catches mature species of *Metapenaeus sp.* So it may be concluded that this gear with square mesh openings at forward part of upper belly and codend could be selective for this species of penaeids

### ***Parapenopsis sp.*:**

The length of *Parapenopsis sp.* caught in modified two-seam overhang trawl ranges from 70mm to 150mm and its median length ( $L_{50\%}$ ) is 10.0cm (Fig. 3). Bal and Rao (1990) have reported that the minimum size of sexual maturity of *Parapenopsis sp.* is 6.5cm in males and 7.0cm for females and their maximum growth rate is 9-10 cm in the first year. Hence it is clear that this trawl with square mesh panels of 45mm mesh size in forward part of upper belly and 28mm at codend catches matured and maximum sized shrimp of *Parapenopsis sp.* Therefore this gear has well selective for *Parapenopsis sp.*

However, further studies covering all commercially important species of finfishes and shellfishes are required for optimisation of square mesh size with respect to their size at first sexual maturity as well as fishing areas, in order to provide recommendations and informations to the users like fishermen, scientific community, policy makers etc that use the square meshes in different parts of trawl and in codend as management measure.

Table 1: Length Ranges (in cms) of few important fin fishes and shell fishes caught in Modified Two-Seam overhang Trawl.

Name of the fishes	Length Ranges ( in cms) Caught	Co-efficient of Variation (%)
<b><u>Finfishes:</u></b>		
<b>Mackerel</b> ( <i>R. kanagurtha</i> )	12 -26	27.2
<b>Clupeids</b> ( <i>Sardinella spp.</i> )	10-18	18.4
<b>Pomfrets</b> ( <i>Pampus spp.</i> )	10-26	27.2
<b>Silver Bellies</b> ( <i>Leiognathus spp</i> )	8-16	21.7
<b>Soles</b> ( <i>Cynoglossus.spp</i> )	10-24	25.4
<b>Ribbon fishes</b> ( <i>Trichiurus spp.</i> )	14-40	28.9
<b><u>Shell Fishes:</u></b>		
<i>Metapeneaus spp.</i>	2-16	28.7
<i>Parapeneopsis spp.</i>	2-16	28.7

Table 2: Length frequency distribution of few imp. finfishes and shell fishes caught in Modified Two-Seam overhang Trawl.

Mid Class interval	Percentage Cumulative Frequency							
	Finfishes						Shell fishes	
	Mackerel ( <i>R. kanagurtha</i> )	Clupeids ( <i>Sardinella spp.</i> )	Pomfrets ( <i>Pampus spp.</i> )	Silver Bellies ( <i>Leiognathus spp</i> )	Soles ( <i>Cynoglossus. spp</i> )	Ribbon fishes ( <i>Trichiurus spp.</i> )	<i>Metapeneaus spp</i>	<i>Parapeneopsis spp</i>
7							0.6	1.8
9	-	-	-	22.9	0.0	0.0	35.4	25.5
11	0.0	22.9	0.0	77.1	10.6	4.90	87.3	73.3
13	7.3	61.4	14.0	97.9	47.0	11.0	98.9	97.6
15	40.0	94.0	33.3	100.0	66.7	15.9	100.0	100.0
17	80.0	100.0	52.6	22.9	78.8	20.7	-	-
19	96.4	-	66.7	-	84.8	23.2	-	-
21	98.2	-	77.2	-	97.00	39.0	-	-
23	98.2	-	92.1	-	100.0	42.7	-	-
25	100.0	-	98.2	-	-	60.0	-	-
27	-	-	100.0	-	-	70.7	-	-
31	-	-	-	-	-	82.3	-	-
33	-	-	-	-	-	92.7	-	-
35	-	-	-	-	-	96.3	-	-
37	-	-	-	-	-	100.0	-	-

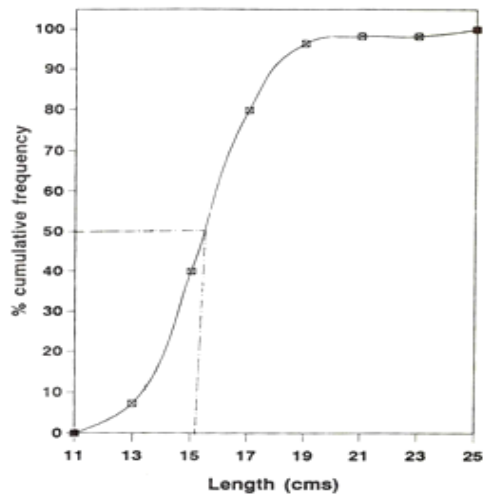
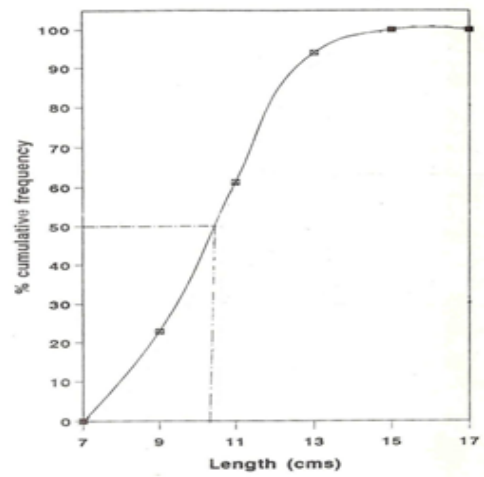
**Mackerels (*Rastrelliger kanagurtha*)****Clupeids (*Sardinella spp.*)**

Figure 2a: Percentage cumulative frequency curves for some important fin fishes caught in modified two-seam overhang trawl.

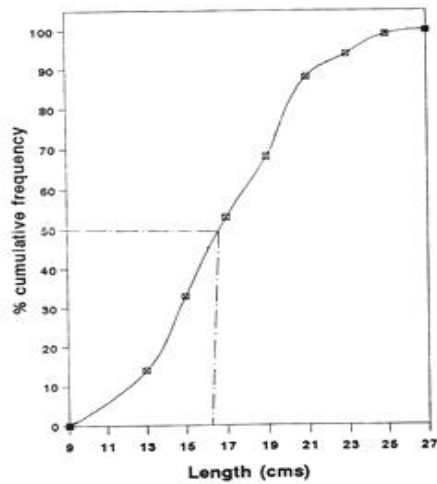
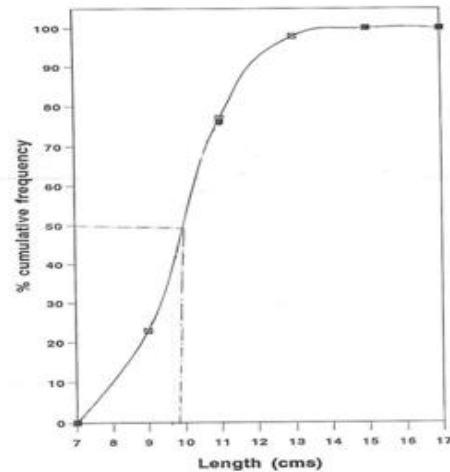
**Pomfrets (*Pampus spp.*)****Silver bellies (*Leiognathus spp.*)**

Figure 2b: Percentage cumulative frequency curves for some important fin fishes caught modified in two-seam overhang trawl.

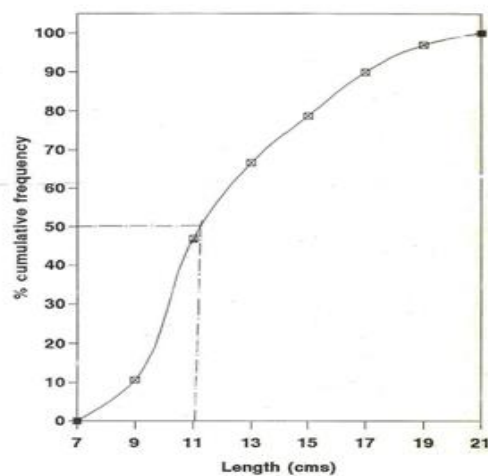
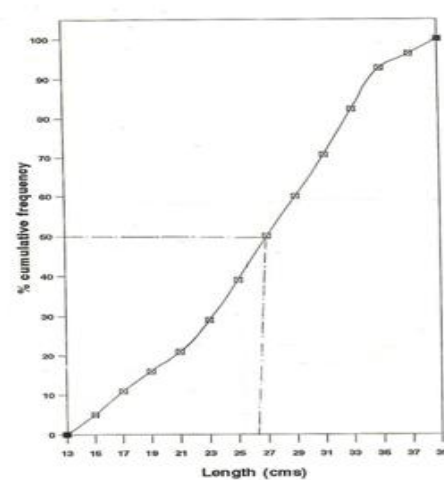
**Soles (*Cynoglossus spp.*)****Ribbon fishes (*Trichiurus spp.*)**

Figure 2c: Percentage cumulative frequency curves for some important fin fishes caught modified in two-seam overhang trawl.

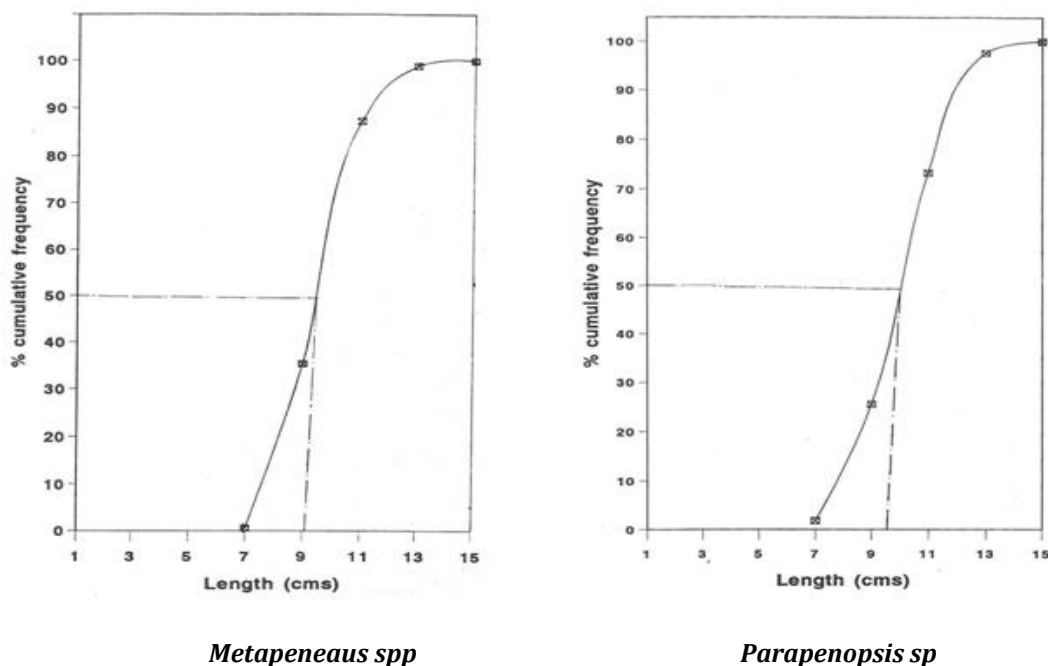


Figure 3: Percentage cumulative frequency curves for some important shellfishes caught in modified two-seam overhang trawl

## REFERENCE

- Bal, D.V. and Rao, K.N.**, 1990. Marine Fisheries Tata McGraw Hill publishing company (Books) Ltd, New Delhi 20 (4<sup>th</sup> edition): 459pp.
- Balan, V.**, 1967. Biology of silver belly *Leiognathus bindus* (val) of Calicut Coast: *Indian J.Fish.* **10** (1):118-134.
- \*Chidambaram.K and Venkataraman,R.S.** 1946. Tabular Statements on the fishery of certain marine food fishes of the Madras Presidency-West Coast. Govt. Press.:1-26.
- \*Chun-Chun-Te, Matuda, K and Honda, M.** 1991. *Bull.Jap.Soc.Fish.* **57** (7):1313pp.
- Daniel.W.W.** 1977. Introductory statistics with Application. Houghton Mifflon Company London: pp 473.
- \*Kuthalingum, M.D.K.**, 1963. Observations on the fishery and Biology of the Silver Pomfret *Pampus argentus* (Euphrasen) from the Bay of Bengal: *Indian J.Fish.* **10** (1):59-73.
- Kunjipalu, K.K and Varghese, M.D.** 1989. Paper presented at the First Kerala Science Congress, 26-28 February, 1989. Cochin, India.
- Kunjipalu, K.K., Varghese, M.D and Nair, A.K.K.** 1994. Studies on square mesh codend in trawls-I. Studies with 30mm mesh size. *Fish Technol.Kochi.* **31** (2): 112-117p.
- \*Nair, R.V.** 1951. *Proc. Indo. Pacif. Fish. Coun., Sec.2.* p.103
- Pope, J.A.** 1966. Manual of Methods for Fish Stock Assessment-Part III. Selectivity of Fishing Gear. FAO, Fisheries Technical Paper.No.41.
- Robertson, J.H.B.** 1982. Square mesh codends *Scottish Fisheries Working Paper*, **3**:11p
- Robertson, J.H.B.** 1983 Square net help young fish escape. *Fish. News*, (3652):10-11p
- Robertson, J.H.B.** 1986a Design and construction of square mesh cod ends. *Scott. Fish. Information. Pam.* (12):10pp.
- Robertson, J.H.B.** 1986b. Square mesh codends *Scott. Fish. Bull.*, (49):15-16
- Robertson, J.H.B., Emslie, D.C., Ballantyne, K.A. and Chapman, C.J.** 1986. Square and diamond mesh trawl codend selection trials on *Nephrops norvegicus* Copenhagen-Denmark-ICES-1986/B: **12** (12):14pp
- Robertson, J.H.B. and Stewart P.A.M.** 1988 .A comparison of size selection of haddock and whiting by square and diamond mesh codends. *J.Counc.CIEM* **44** (2):148-161.
- \*Sheshappa.G and Bhichachar.B.S.** 1954. *Indian.J.Fish.* **1**: 145-62.
- Talwar.N.A and Sheshappa.D.S.** 1996 .Effect of square mesh panels in trawls on shrimp fishery off Mangalore. In: *The Fourth Indian Fisheries Forum Proceed.* 24-26. November, 1996, Kochi: 445-447 p.
- Talwar.N.A., Sheshappa. D.S. and Hanumanthappa. B.** 2006. Reduction of by-catch in two-seam over hang trawl using a square mesh panels in forward part of upper belly and codend. *J. Environ. & Sociobiol.* **3**(2): p 143-146.
- Weber.R.** 1973. Non-parametric methods, In: *Bio-statistics in Pharmacology: Vol-2, Dehaunois, A.L. (Ed) and Pergamum .press (New York):* 675-716.
- \* Not refer to original*