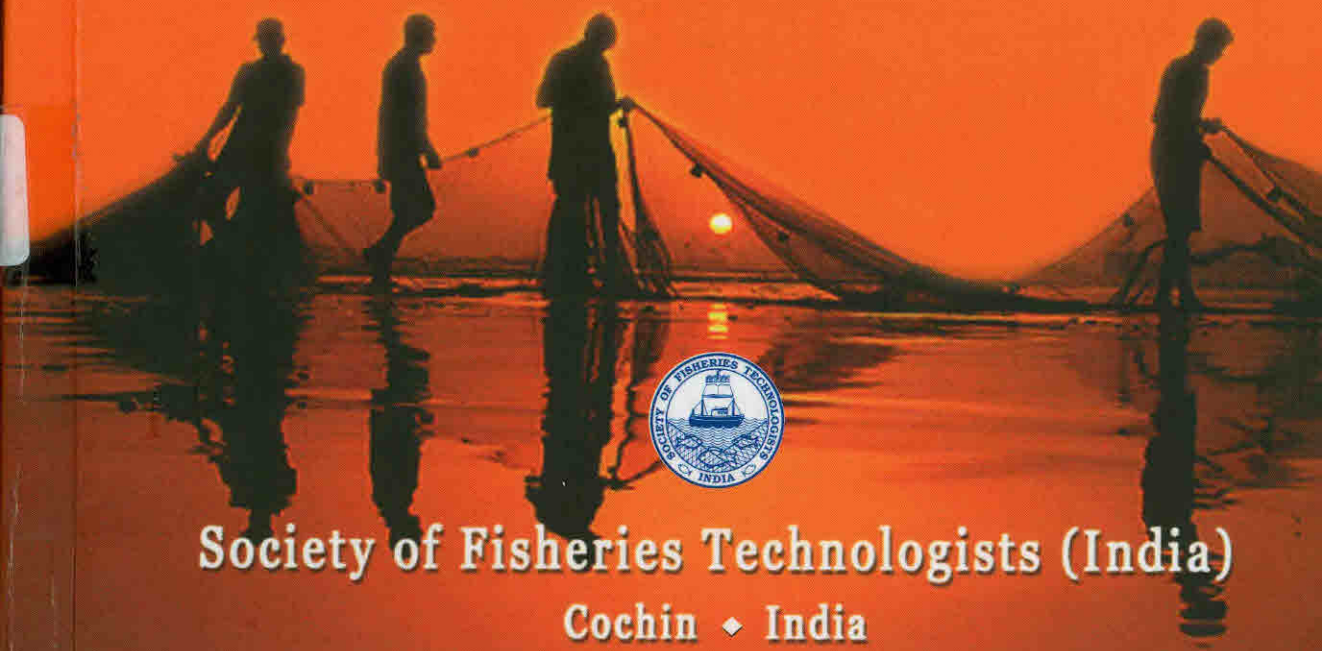
Coastal Fishery Resources of India

Conservation and Sustainable Utilisation



Society of Fisheries Technologists (India)
Cochin ◆ India

Coastal Fishery Resources of India: Conservation and Sustainable Utilisation

Proceedings of the National Seminar on Conservation and Sustainability of Coastal Living Resources of India, 1-3 December 2009, Cochin

Organised by

Society of Fisheries Technologists (India), Cochin
and
Centre for Ocean and Environmental Studies, New Delhi

In association with

Ministry of Earth Sciences (New Delhi)
Central Marine Fisheries Research Institute (Cochin)
National Institute of Oceanography (Goa) and
Central Institute of Fisheries Technology (Cochin)





ISBN: 978-81-901038-7-9

Published by

Society of Fisheries Technologists (India)
P.O. Matsyapuri, CIFT Junction, Cochin - 682 029, India

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Citation:

Rao, G.S. (2010) Current status and prospects of fishery resources of the Indian continental shelf, In: Coastal Fishery Resources of India: Conservation and Sustainable Utilisation (Meenakumari, B., Boopendranath, M.R., Edwin, L., Sankar, T.V., Gopal, N. and Ninan, G., Eds.), p. 1-13, Society of Fisheries Technologists (India), Cochin

Cover design: Vineethkumar, P., CIFT, Cochin

Printed at PAICO, Cochin - 682 035, India

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2010

Trawl Codend Selectivity Estimates for Goldband Goatfish

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Introduction

The knowledge of selectivity of commercially important gears is vital for effective monitoring, management and sustainable exploitation of fishery resources. Using selective gears help to minimize the capture of juveniles by regulating the length at first capture, increasing the yield per recruit of targeted species and also by helping in the reduction of discards generated by the fishery (Armstrong *et al.*, 1990; MacLennan, 1992). Demersal otter trawls contribute more than a quarter of the global landed marine catch (estimated at approximately 86 million tonnes in 2004) (Kelleher, 2005). Due to the frequent use of small mesh size and operating in the near shore areas, these vessels generate disproportionately high quantities of bycatch (Andrew and Pepperell, 1992; Kelleher, 2005). Numerous studies have been carried out to test the utility of alterations to the size and or shapes of mesh used in the trawls to reduce the bycatch (Broadhurst, 2000; Madsen, 2007). Mesh opening of the codend (Wileman *et al.*, 1996), twine diameter (Sala *et al.*, 2007), material used for the fabrication of the codend (Tokac *et al.*, 2004), speed of the tow (Dahm *et al.*, 2002), seasonal changes (Özbilgin and Wardle, 2002), codend circumference (Broadhurst and Kennelly, 1996; Broadhurst and Millar, 2009), catch weight (Erickson *et al.*, 1996) and the shape of the mesh opening (Broadhurst and Kennelly, 1996; He, 2007) are the main factors that affect the selectivity of the codends. In addition to the above factors, considerable amount of between-haul variations in selectivity can occur when the experiments are carried out in replicate hauls (Fryer, 1991). This variability need to be taken into account so as to make the selectivity estimates more reliable (Macbeth *et al.*, 2005). Overdispersion in the data can be quantified using the replication estimate of dispersion (REP), which

accounts for the overdispersion due to scaling up of sub-samples and the between-haul variations (Millar *et al.*, 2004).

Trawl codend selectivity estimates for commercially important species were carried out along the Kerala coast by (Kunjipalu *et al.*, 1994; Varghese *et al.*, 1996; Kunjipalu *et al.*, 2001) using diamond and square mesh codends. (Prakash *et al.*, 2008) have reported the selectivity estimates for *Upeneus vittatus* and *Leiognathus bindus* along Vizakapatnam coast. Codend selectivity estimates for fishery resources along Gujarat coast are limited.

Goatfishes belonging to the family Mullidae form a sizeable catch along the northwest coast of India. Average annual catch of goatfishes in India, during the years 2007-2008, was 19375 t, which formed 0.63% of the total marine landings (CMFRI, 2009). Sizeable quantities of this group are found in the bycatch of the trawl fisheries along the Gujarat coast (Pravin and Manohardoss, 1996; Zynudheen *et al.*, 2004).

In this paper, results of trawl codend selectivity experiments conducted off Veraval, Gujarat to derive selectivity estimates in respect of goldband goatfish *Upeneus moluccensis,* are reported.

Materials and Methods

Selectivity experiments were carried out onboard the Central Institute of Fisheries Technology, Research Vessel MFV Sagarkripa (15.5 m L_{OA}, 124 hp stern trawler), during October 2005 to May 2006. The study was carried out in the commercial fishing grounds off Veraval, Gujarat, in the depth zone of 20-45 m. A semi-pelagic trawl (RMT-8P) of 18 m head rope, rigged with 50 mm diamond mesh codend and a 34 m high opening bottom trawl (HOBT) rigged with 40 mm diamond mesh codend were used in the study. Vertically cambered otterboards with dimensions of 1150x890 mm and weight of 90 kg each were used with the RMT-8P trawl. V-form otterboards with dimensions of 790x1360 mm and weight of 85 kg each were used with the bottom trawl.

Codend with 40 mm mesh size was constructed of high density polyethylene (HDPE) netting of 1.5 mm twine size and the codend with 50 mm mesh size was constructed of Sapphire (Garware Wall Ropes Ltd., Pune) netting of 1.2 mm dia twine size. The mesh size was determined as the mean of 60 randomly selected meshes measured using a calibrated wedge. Covered codend method (Wileman *et al.*, 1996) was used to

estimate the selectivity of the different codends. The cover was fabricated using 20 mm (1.25 mm dia twine) polyamide netting and proportionately 30% longer and larger than the codend to minimize the masking of codend by cover (Wileman *et al.*, 1996; Lök *et al.*, 1997). All the trawling operations were carried out during day time and similar shooting and hauling procedures were adopted during the entire fishing operations. The duration of a single tow varied from 1.5 to 2.0 h and the speed of trawling varied from 2.0 to 2.2 kn for the bottom trawling and 2.4 to 2.6 kn for semi-pelagic trawling. At the end of each tow, the catches from the cover and codend were sorted, individual species were weighed and the standard length (SL) measured to the nearest 0.5 cm.

"Stacked haul method", which accounts for the between-haul variation was used, since it implicitly keeps replications of length classes from all hauls separately and allows the estimation of replication estimate of dispersion (REP) (Millar *et al.*, 2004). Data from all the hauls were stacked into a single dataset, which was then handled as a single (artificial) haul (Macbeth *et al.*, 2007; Tokac *et al.*, 2009). Scaling of data was carried out wherever necessary. Logistic selection curve was fitted to the stacked data for each species using ccfit (Millar, 2006). The standard error (SE) of all the estimates was REP-corrected for the between-haul variations and represented (Millar *et al.*, 2004; Macbeth *et al.*, 2007). Selectivity parameters were estimated using the coefficients *a* and *b* derived by maximum likelihood method (Wileman *et al.*, 1996; Ragonese *et al.*, 2002). The 50% retention length of a species was calculated as $L_{50} = -a / b$, selection range (SR) = L_{75}-L_{25}, selection factor (SF) = L_{50}/mesh size, and selection ratio (SRA) = SR/L_{50}. Model fits were assessed by comparing REP-corrected deviances and associated degrees of freedom (df) against a χ^2 distribution and the appropriate model was selected (Macbeth *et al.*, 2007). For calculation of the SF and SRA, the mesh size specified by the manufacturer was considered even though the actual mesh size derived by measurement varied slightly.

Results and Discussion

The results of the estimated selectivity curves and the regression parameters (with standard errors and variance matrix values) of the curves are shown in Table 1. The selection ogives and the length frequency distributions of *Upeneus moluccensis* retained and escaped from the 40 mm and 50 mm diamond-mesh codends are also shown along with the selectivity curves in the Fig. 1 and 2, respectively.