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SELECTIVITY OF LESSEPSIAN FISH, RANDALL'S THREADFIN BREAM (*NEMIPTERUS RANDALLI* RUSSELL, 1986) IN THE GULF OF ANTALYA, EASTERN MEDITERRANEAN

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Abstract

Size selectivity of sorting grid was studied for Randall's threadfin bream in the Gulf of Antalya, Mediterranean Sea. Trawling's were carried out in October - December 2012, with a traditional bottom trawl net (600 mesh around the mouth). The fish totally retained in upper codend (catches) and bottom codend (escapes) were used to estimate the selectivity. Selectivity data analyzed as covered cod-end method by means of a logit function of Maximum Likelihood Method. The Kolmogorov – Smirnov test (KS – test) was applied in order to determine the difference between size groups of escapes and catches codends. The percentages of the total catch in terms of weight were 68% retained and 32% escaped. Mean L_{50} value of Randall's threadfin bream was calculated as 13.19 ± 0.48 cm. Total weight of Randall's threadfin bream caught in hauls was 12.996 kg. The results confirm that using sorting grid fixed mesh codend gave higher L_{50} value than size selectivity studies by using Hand-Woven Slack Knotted mesh codend.

Key words: *Size selectivity, Lessepsian, Randall's threadfin bream, Antalya gulf, Eastern Mediterranean.*

INTRODUCTION

Members of the family *Nemipteridae* are abundantly distributed in coastal waters, and occur mainly on muddy or sandy ground between 5 to 80 m depths usually in schools (Russell, 1990). They are carnivorous, feeding on small fish, crustaceans, molluscs, (mainly cephalopods), polychaetes and echinoderms.

Randall's threadfin breams *Nemipterus randalli* Russell, 1986 is widely distributed in the western Indian Ocean, especially off India, Pakistan, and Persian Gulf and in the Gulf of Aden. Additionally, the species is known off the east African coast and in waters surrounding Seychelles and Madagascar (Russell, 1990). *N. randalli* is reported in the Red Sea including the Gulf of Aqaba (Baranes and Golani, 1993; Golani and Bogorodsky, 2010). The first Mediterranean record of *N. randalli* was reported in the eastern Levantine Basin by Golani and Sonin (2006), but wrongly identified as *Nemipterus japonicas* (Bloch, 1791). At present, the species appears to be up to date successfully established in some areas of the eastern Mediterranean such as the Turkish marine waters (Erguden et al., 2010) and the close coast of Lebanon (Lelli et al., 2008).

Improved selectivity can be achieved in different ways, by modifying the gear design and/or operation and by using alternative fishing gears. In trawls mesh size and by inserting filtering grids in front of codend is a well-known measure to regulate the size of captured organisms. Successful separation of targets and non-targets species can also be achieved by using grid devices (Valdermarsen, 2005).

Mediterranean fisheries are remarkable for the large number and variety of commercially important species caught and the wide range of fishing methods employed, from artisanal to industrial (Stewart, 2002). Management of fishing stocks in the Mediterranean Sea is mainly based on defining closed areas and seasons, Minimum Landing Sizes (MLS), Minimum Mesh Sizes (MMS) and limiting effort (Sala and Luchetti, 2010; Tokaç *et al*., 2014). Trawl catches contribute 90% of the total landing in the Turkish demersal fishery (Metin et al., 2004). Presently Turkish Fisheries Regulations (TFR) defines a minimum codend mesh size of 40 mm for the Black Sea, 44 mm for the Aegean Sea and the Mediterranean for demersal trawls. Additionally, the use of 40 mm square mesh codend is left to fishermen's preference (Anonymous, 2012). Many studies published

during the last decade have clearly shown that the selectivity of commercially used codends are rather poor in Turkish demersal trawl fisheries (Tosunoğlu et al., 2007; Ateş et al., 2010; Tokaç et al., 2010; Aydın et al., 2011; Özbilgin et al., 2012).

Gulf of Antalya is predominantly overfished by vessel from Iskenderun and Mersin. Most of commercially fish species live at a depth of 30-200 m. *Mullus barbatus barbatus* Linnaeus, 1758 (Red mullet), *Mullus surmuletus* Linnaeus, 1758 (Surmullet), *Upeneus moluccensis* (Bleeker, 1885) (Goldband goatfish), *Saurida undosquamis* (Richardson, 1848) (Brushtooth lizardfish), *Boops boops* (Linnaeus, 1758) (Bogue), *Pagellus erythrinus* Linnaeus, 1758 (Common pandora), *Spicara flexuosa* (Linnaeus, 1758) (Picarel), are main demersal commercially important species of Mediterranean coast of Turkey.

This is first selectivity study for Randall's threadfin bream by using horizontal bar spacing from the eastern Mediterranean Sea. Although, there are many selectivity studies carried out by using different shape (diamond, square, hexagonal) and sizes (40, 44, 50 mm) of codends in the Mediterranean coast of Turkey (Ferretti and Froglia, 1975; Kınıkarslan, 1976; Livadas, 1988; Jukic and Piccinetti, 1988; Gurbet, 1992; Stergiou et al., 1994; Gurbet et al., 1997; Lök et al., 1997; Tokaç and Tosunoğlu, 1997; Tosunoğlu et al., 1997; Tokaç et al., 1998; Tosunoğlu, 2000; Akyol et al., 2000; Kınacıgil et al., 2001; Fiorentini and Leonori, 2002; Özbilgin and Tosunoğlu, 2003; Tosunoğlu et al., 2003), there are no selectivity study by using sorting grid in the Mediterranean coast of Turkey.

MATERIALS AND METHODS

In total 14 towing were conducted in the Gulf of Antalya (northeastern Mediterranean Sea), at depths of 30 – 200 m (36.840724°N 30.935353°E, 36.827437°N 31.072305°E – 36.887438°N 30.887438°E, 36.816852°N 31.048630°E), in October - December 2012 with a traditional bottom trawl net (600 mesh around the mouth).

The towing speed varied between 2 and 3 knots. The mean effective towing duration was 106 min (range 90 – 120 min). The research vessel (R/V Akdeniz Su) has a length overall of 26.5 m and 2 x 450 HP engines. Sorting grid was attached aft belly of the net. After each haul, fishes caught from both codends were sorted by species and were separately weighed. The fish totally retained in upper codend (catches), and bottom codend (escapes) were used to estimate the selectivity (Figure 1). All taxa were determined to the species level whenever possible and the respective weights recorded from the codends.

Selectivity data was collected by using commercial demersal trawl gear of the research vessel with the trouser codend technique for Randall's threadfin bream. All individuals (without using subsamples) were immediately weighed (total wet weight) to the nearest 0.1 g and measured to the nearest cm in the laboratory of the research vessel.

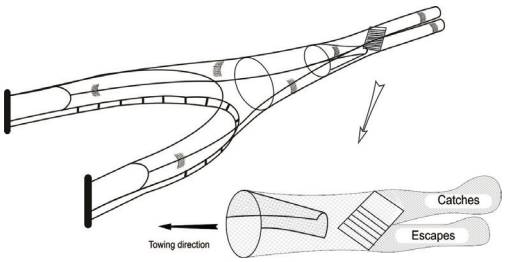

Figure 1. General view of the sorting grid and codends

Selectivity curves of the individual hauls were obtained by fitting the logit function: $r(l) = \exp(v_1 + v_2 l) / [1 + \exp(v_1 + v_2 l)]$ by means of the maximum likelihood method as given in Wileman et al. (1996), where the parameters v_1 and v_2 are the intercept and slope of the linear logistic function, respectively. The mean selectivity curves were estimated from the individual hauls which were fitted taking into account the between haul variation. The Kolmogorov – Smirnov test (K - S test) was applied in order to determine the difference between size groups of escapes and catches codends (Aydın et al., 2007).

RESULTS AND DISCUSSIONS

Selectivity of sorting grid for lessepsian fish species was studied in the gulf Antalya. The present study is first selectivity study by using

horizontal grid bars for Randall's threadfin bream in the gulf of Antalya, Turkey.

Total 14 hauling were carried out during the trials and in total, 317 for Randall's threadfin bream entered the codends (total weight 12.996 kg) Randall's threadfin bream was caught (Table 1).

Table 1. Weights, numbers, and percentages of total numbers of Randall's threadfin bream retained in codends

Species	Amount
Randall's threadfin bream	
Weight in catches codend (kg)	8.816 (68%)
Weight in escapes codend (kg)	4.180 (32%)
Number in catches	152 (48%)
Number in escapes	165 (52%)

Table 1 shows the weight and number of the investigated species. Other species usually present in the catch were *Solea solea* (Linnaeus, 1758), *Chelidonichthys lucerna* (Linnaeus, 1758), *Trachurus mediterraneus* (Steindachner, 1868), *Trachurus picturatus* (Bowdich, 1825), *Pagrus pagrus* (Linnaeus, 1758), *Nemipterus randalli* (Russell, 1986), *Merluccius merluccius* (Linnaeus, 1758), *Citharus linguatula* (Linnaeus, 1758), *Chelidonichthys lastoviza* (Bonnaterre, 1788), *Spicara flexuosa* (Linnaeus, 1758), *Boops boops* (Linnaeus, 1758), *Serranus hepatus* (Linnaeus, 1758), *Serranus cabrilla* (Linnaeus, 1758), *Diplodus annularis* (Linnaeus, 1758), *Dentex maroccanus* (Valenciennes, 1830), *Pagrus caeruleostictus* (Valenciennes, 1830), *Sillago sihama* (Forsskål, 1775), *Trichiurus lepturus* (Linnaeus, 1758), *Bothus podas* (Delaroche, 1809) and *Zeus faber* (Linnaeus, 1758) from the Gulf of Antalya.

Kolmogorov - Smirnov test showed that differences between length groups of catches codend and escapes codend for Randall's threadfin bream wasn't significant (*K - S* test, D: 0.1765; $P = 0.930$) ($p > 0.05$).

Selectivity parameters of Randall's threadfin bream

The total number of 317 are taken to be evaluated for Randall's threadfin bream and 152 (48%) of these were retained on the catches codend; 165 (52%) of these were retained on the escapes codend. The length distribution was between 6 and 22 cm and showed a peak at 13 cm. While fish size groups retained on the catches codend were ranging 10 – 22 cm, escapes codend groups were 6 – 15 cm (Figure 2). L_{25}, L_{50}, L_{75} selection ranges and selection factor are calculated for Randall's threadfin bream. Lengths at fifty percent retention (L_{50}) values for Randall's threadfin bream was found as 13.19 ± 0.48 cm. Selection range (SR) and selectivity factor (SF) were found as 2.9, 3.77, respectively (Table 2).

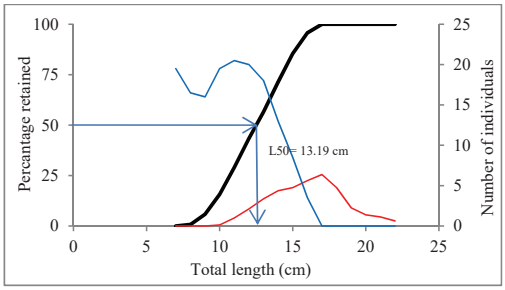

Figure 2. Selectivity curves and length distribution (red line: catches; green line: escapes) of Randall's threadfin bream

Table 2. Selectivity parameters of sorting grid system for Randall's threadfin bream

Catches	152
Escapes	165
SR	2.9 cm
SF	3.77
L_{25}	11.72 cm
L_{50} ± SE	13.19 ± 0.48 cm
L_{75}	14.66 cm
v_1 ± SE	9.85± 0.47 cm
v_2 ± SE	-0.74 ± 0.11 cm
MLS/SFM	(There are no published studies yet)

L_{25}, 25% retention length; L_{50}, 50% retention length; L_{75}, 75% retention length; SR, selection range; SF, Selection factor; v_1 and v_2, regression parameters, SE, standard errors; SFM, size at first maturity; MLS, minimum landing size

There was found only one study for Randall's threadfin bream by using Hand-Woven Slack Knotted mesh codend in the Mediterranean coast of Turkey and there isn't any size for the first maturity length of *N. randalli* in the Mediterranean Sea and no minimum landing size for Turkish Fisheries Regulations (TFR).

Although there wasn't found any reproduction study on estimating minimum size at maturity or the size of the smallest mature of *N. randalli* in the Mediterranean Sea, in total length 10 cm was found in Kerala, India (Mohamed et al., 2014). Eryaşar et al. (2014) was found the lengths at fifty percent retention values for Randall's threadfin bream as 2.01 ± 1.32 cm for standard mesh codend (300 meshes around its circumference) and 5.92 ± 0.11 cm for narrow mesh codend (300 meshes around its circumference) by using hand-woven slack knotted codend, in Mersin Bay. Both values are smaller than minimum size at maturity. L_{50} value found in present study as 13.19 ± 0.48 cm is higher than minimum size at maturity and mesh codends by using hand-woven slack knotted codend.

It is considered that these differences include the location of the research, differences in net materials, different hang-in ratios, and using different mesh size in codends. Besides these, the differences between L_{50} sizes may be occurred fishing the populations of different size groups in localities or a lesser intensive fishing pressure on this species may have occurred in the gulf of Antalya.

Also a different size at first maturity can be found for lessepsian fish, Randall's threadfin bream in the Mediterranean Sea.

It is clear that selectivity study by using hand-woven slack knotted codend, in Mersin Bay gave lower L_{50} size than present study by using sorting grid bar fixed 44 mm codends. According to Sarda et al. (2004) and Aydın, (2008); size selectivity studies made with sorting grids are more successful than size selectivity studies with different mesh size and shapes.

In the successfully selectivity studies, it is waiting that number of fish individuals larger than minimum length size or size at first maturity retained in the catches codend would be expected low. Only 1 (1%) individual larger than L_{50} size was retained in catches codend. This show that sorting grid fixed trawl codend gave high selectivity results.

A total of 17 individuals smaller than L_{50} size were retained in catches codend. The rate of fish groups belong Randall's threadfin bream should be retain in escapes codend but retained catches smaller than L_{50} value were found as 10%. It is considered that some very large pet bottles, garbage bags, twigs, tires, and very large fishes such as stingrays and groupers may have caused to off the selectivity grids during the hauls.

CONCLUSIONS

For a sustainable fishing management, fishing immature individuals and discard species should decrease. Because of this reason, size selectivity of trawl nets should improve. This can apply only by using different shape and size of mesh or by using sorting grids for. There are no published studies for *N. randalli* yet. The L_{50} size found in this study can be used for minimum length size.

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