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Gillnet selectivity for *Luciobarbus esocinus* (Heckel, 1843) in Keban Dam Lake, Elazig, Turkey

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ABSTRACT

A study was conducted to determine the selectivity of monofilament gillnets with mesh sizes of 50, 60, and 70 mm that are used in Keban Dam Lake for fishing *Luciobarbus esocinus* (Heckel, 1843). During the study, a total of 394 *L. esocinus* were caught. Selectivity parameters were estimated using the indirect estimation method developed by Holt (1963). Optimum selection lengths for *L. esocinus* were calculated to be 36.61, 43.94 and 51.26 cm for gillnets with mesh sizes of 50, 60, and 70 mm, respectively. Common selectivity factor was estimated to be 7.32, with standard deviation 4.58. Length at first maturity of female *L. esocinus* (50 cm) was compared to the optimum selection lengths of gillnets with mesh sizes of 50, 60, and 70 mm. Results indicate that gillnets with mesh size of 70 mm would be appropriate for harvesting *L. esocinus* in the Keban Dam Lake, as the optimum selection length (51.26 cm) is greater than length at first maturity.

Keywords: Gillnet, Keban Dam Lake, *Luciobarbus esocinus*, Selectivity

Gillnets are simple fishing gears that are widely used in aquatic environment all over the world. They are comparatively less damaging to the environment due to their selectivity characteristics. The cost of gillnets is also quite low (Brandt, 1984; Kınacıgil *et al.*, 2000). Lagler (1978) defined the selectivity of a net as effective catching of individuals of a certain size in a population. Gillnets have high degree of selectivity among the fishing gears (Mengi, 1977).

Luciobarbus esocinus is a cyprinid inhabiting the Euphrates and Tigris Rivers in Turkey, Syria, Iran and Iraq (Kuru, 1979; Çoban *et al.*, 2012). It can grow to >100 kg size and is very delicious with a high economic value (Geldiay and Balık, 2007). It is a benthopelagic species living in large rivers and dams but details of environmental requirements are unknown.

Although many studies have been done on the selectivity of gillnets (Petrakis and Stergiou, 1995; Santos *et al.*, 1998; Balık, 1999; Hovgard *et al.*, 1999; Kara and Özekinci, 2002; Kara, 2003; Fonseca *et al.*, 2005; Özekinci *et al.*, 2007; Karakulak and Erk, 2008; Ayaz *et al.*, 2009), none have been done for *L. esocinus*. The purpose of the present study was to estimate optimum mesh size of monofilament gillnets for *L. esocinus*.

Fishing operations for this study were performed in Cemisgezek fishing area of the Keban Dam Lake from January to May 2012. Gillnets with mesh sizes of 50, 60, and 70 mm were used in the study. Two units of gillnets (100 m x 2) were used for experimental fishing. The twine diameter of the monofilament polyamide gillnet material was 0.27 mm. Gillnets were rigged on a float-line and a lead-line with a hanging ratio of 0.50. The nets were set at sunset and retrieved in the early hours, next day. A total of 42 fishing experiments were conducted during the study and 394 *L. esocinus* were caught, along with 562 individuals of non-target species. The fish caught were segregated according to the mesh size of gillnet and grouped in to length groups at 1 cm interval. Selectivity parameters of gillnets in respect of *L. esocinus* fishing were estimated according to the method proposed by Holt (1963) and Sparre *et al.* (1989).

In this study 140, 136, and 118 numbers of *L. esocinus* were caught by gillnets with mesh size of 50, 60, and 70 mm, respectively. Total length (TL) of the fish was in the range of 38-55 cm. It was observed that the TL increased with increasing mesh size. Length frequency distribution of *L. esocinus* for different mesh sizes are given in Table 1 and Fig. 1.

Table 1. Length frequency values and natural logarithms of catch rate of *L. esocinus* caught by the different mesh size (50, 60 and 70 mm).

TL (cm)	Mesh size (mm)			Logarithmic correction	
	50 (a)	60 (b)	70 (c)	Ln (b/a)	Ln (c/b)
38	2				
39	14	1		-2.6391	
40	28	8		-1.2528	
41	36	16		-0.8109	
42	28	18	1	-0.4418	
43	15	32	1	0.7577	-3.4657
44	10	23	9	0.8329	-0.9383
45	4	16	19	1.3863	0.1719
46	2	12	21	1.7918	0.5596
47	1	5	29		1.7579
48		3	16		1.6740
49		1	11		2.3979
50		1	4		
51			3		
52			1		
53			1		
54			1		
55			1		
Total	140	136	118		

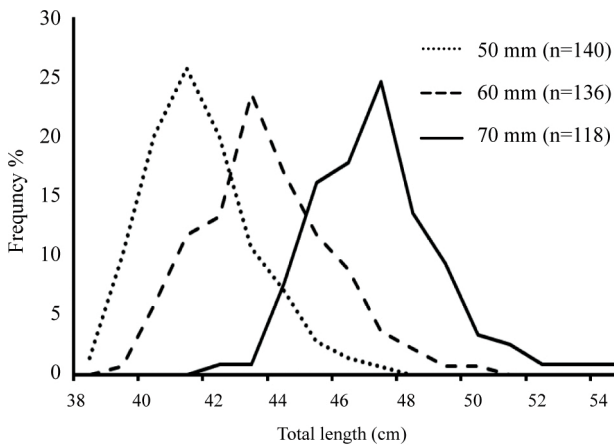


Fig. 1. Length frequency distribution of *L. esocinus* caught in gillnets of 50, 60 and 70 mm mesh sizes.

A plot of fish length versus different mesh size combinations indicated a linear relation. Therefore a linear regression was fitted to the data of catch ratios for different mesh size combinations (Fig. 2).

Catch rates of gillnets for each mesh size were calculated in correspondence with the length groups of the fish caught. Selectivity curves were plotted using these values (Fig. 3). The calculations of the selectivity parameters were based on the net pairs of 50-60 and

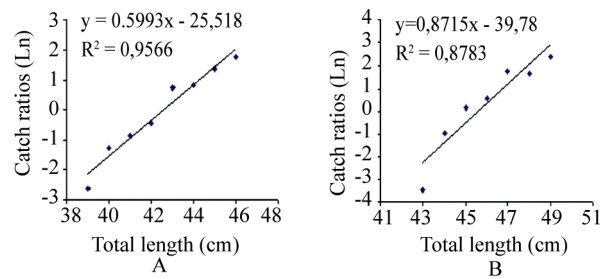


Fig. 2. Plots of logarithm of catch ratios for different mesh size combinations versus total length A: 50 mm and 60 mm combination, B: 60 mm and 70 mm combination.

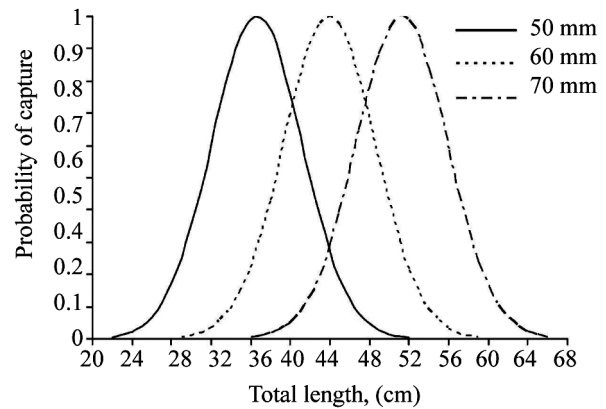


Fig. 3. Selection curves of the 50, 60 and 70 mm gillnets for *L. esocinus*

60-70. The regression slope, intercept and coefficient for optimum lengths and selectivity parameters such as selection factors and standard deviation were assessed from length frequency distributions for each mesh size combination (Table 2). The common selectivity factor, standard deviation and optimum selection lengths of fish for each mesh size of gillnet used in the study were calculated using the formulae proposed by Holt (1963) and given in Table 3.

Fishing gear selectivity studies are important tools for fisheries management and by choosing optimum mesh size of gillnet, minimum catch sizes of the target species can be regulated. Hence, selectivity of gillnets has received wide attention in various parts of the world (Hamley, 1980; Sparre *et al.*, 1989; Ozekinci *et al.*, 2007). In the present study, the optimum selection length for gillnets with mesh sizes of 50, 60, and 70 mm were found to be 36.61 cm, 43.94 cm, and 51.26 cm (total length), respectively (Table 3). Our selectivity estimates for *L. esocinus* in the Keban Dam Lake showed that individual selection factors range between 7.02 and 7.74 (Table 2). Andreev (1962) has maintained that selection factors generally range between 5 and 10. Similarly, the values of the common selection factor and common standard deviation of gillnets were determined as 7.32 and 4.58,

Table 2. Parameters of the regressions of log-transformed *L. esocinus* catch ratios on length-class mid-points for various gillnet combinations (mesh sizes: 50, 60 and 70 mm).

m_1	m_2	a	SE (a)	b	SE (b)	r^2	Lm_1	Lm_2	SF	SD
5.0	6.0	-25.518	2.22	0.5993	0.052	0.9570	38.708	46.449	7.74	3.59
6.0	7.0	-39.780	6.68	0.8715	0.145	0.8783	42.135	49.158	7.02	2.84

Table 3. Common selection factor (SF), common standard deviation (SD) and estimated optimum selection lengths (L_{opt}) of *L. esocinus* for gillnets of 50, 60 and 70 mm mesh sizes, respectively.

SF	SD	Optimum selection length (cm)		
		50 mm mesh size	60 mm mesh size	70 mm mesh size
7.32	4.58	36.61	43.94	51.26

respectively (Table 3). Selectivity factor is directly related to the body structure of the fish. This value is higher in the fish with thin and long body forms whereas it decreases as the body get thicker and the length become shorter (Hovgard and Lassen, 2000; Kara, 2003). Moreover, the observed selectivity factor changes with change in body proportions due to sexual maturity, time and depth of setting nets (Dayaratne, 1988) and swimming speed of species (Borgstrom, 1989) and individual behaviour (Ozekinci *et al.*, 2007).

One of the basic principles of responsible fishing is to ensure that the fish has reproduced at least once, before capture. The optimum selection length of the fishing gear used should ideally be less than the size of the fish at first maturity. Studies on the reproductive biology of *L. esocinus* species are very limited. Eskandary *et al.* (2001) reported the length of *L. esocinus* females at first maturity to be 50 cm. The optimum selection lengths obtained in the present study indicate that gillnets with mesh size of 70 mm would be appropriate for harvesting *L. esocinus* in the Keban Dam Lake, as the optimum selection length (51.26 cm) is greater than length at first maturity.

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