

Comparison of the Catching Efficiency of Monofilament Gillnets with Different Mesh Size

¹Murat Pala and ²Fahrettin Yuksel

¹Aquatic Products Branch Office of DSI, 23119 Elazig, Turkey

²Faculty of Fisheries, Tunceli University, 62100 Tunceli, Turkey

Abstract: This study was conducted in Keban dam lake Cemisgezcek region during 2000-2001 fishing season. In the study, the effect of mesh size on catching efficiency was analyzed. For this reason, a total length of 800 m gillnet was used, particularly two monofilament gillnets with 50, 60, 70 and 90 mm mesh size, each being 100 m long. During the research, *Cyprinus carpio* and *Squalius cephalus* was indicated with own species names, which are caught on 22 hunting attempts. *Barbus esocinus*, *Barbus capito pectoralis* and *Barbus mystaceus* species regarded as *Barbus* sp., *Capoeta trutta* and *Capoeta umbla* species regarded as *Capoeta* sp. The most frequently caught species in the research were *Capoeta* sp. on 50 and 70 mm mesh sizes, *Barbus* sp. on 60 mm mesh size and *Cyprinus carpio* on 90 mm mesh size. The species that is least frequently fished on all gillnets was *Squalius cephalus*. When the catch per unit effort was analyzed taking into account all species, it was observed that with 83.1 g m⁻¹ catch per unit effort, 60 mm gillnet was more efficient than all other gillnets. This gillnet was followed by 79.9, 41.0 and 31.8 g m⁻¹ catch per unit efforts for 50, 70 and 90 mm mesh sizes, respectively. In conclusion, it has been found out that in the study region, gillnets with 50 and 60 mm mesh sizes are more effective than gillnets with 70 and 90 mm mesh sizes.

Key words: Keban Dam Lake, gillnet, catching efficiency, CPUE, fisheries, mesh size

INTRODUCTION

Gillnets are fishing gears used to catch fish by preventing them to swim through mesh openings and back out once their head pass through the opening by enabling their gills to become caught. In order to trap fish in the net, mesh size should be larger than the head of the fish and smaller than its body. Thus, the selectivity of gillnets is very high (Mengi, 1977). High selectivity of gillnets gains even more significance in fisheries management especially in inland waters with limited area. In the light of the studies conducted, the fishery may be oriented towards the certain size range of the targeted species.

It is a widespread opinion that catch-per-unit effort applied in lakes is considered as the indicator of fish stock (Nikolsky, 1969; Ricker, 1975; Prouzet and Dumas, 1988; Pawson, 1991; Balik and Cubuk, 2001). It is possible to carry out an easier and sustainable stock management by determining the annual amount of fish obtained from each lake and following the catch-per-unit effort, rather than stock assessment studies, which are difficult to perform and very costly especially in inland waters (Balik and Cubuk, 2001). It is known that the structure, material, mesh size, fiber thickness, color and hanging ratio of the nets to

be used in fishing are effective on catch efficiency (Millner, 1985). The use of either thin or thick material is one of the important factors affecting catch efficiency in gillnets (Turunen, 1996). It is reported that the thickness and color of the fiber used in gillnets have an effect on catch efficiency rather than on size selectivity, yet they create a significant effect also on species selectivity due to the eyesight ability of different species and the difference in their body structure (Ozdemir and Erdem, 2006).

Only gillnets are used in the commercial fishery at Keban Dam Lake (Celayir *et al.*, 2006). In this study, the effect of mesh size, which is one of the important factors in fisheries management, on catch efficiency was investigated.

MATERIALS AND METHODS

This study was conducted at 5 different stations in Keban Dam Lake during 2000-2001 fishing season. A total of 800 m gillnet, two from each monofilament gillnet with a length of 100 m and mesh size of 50, 60, 70 and 90 mm was used in this research and the nets were equipped according to 0.50 hanging ratio and in the form of bottom net. The expression of mesh width here refers to the

distance from the middle of nodal point or joint in a stretched net to the middle of one of the closest nodal points or joints (Mengi, 1989). A total of 22 fishing trials were performed during the research. Gillnets were set shortly before sunset and hauled early in the morning. The species caught in fishing trails include *Cyprinus carpio carpio*, *Squalius cephalus*, *Barbus esocinus*, *Barbus pectoralis*, *Barbus mystaceus*, *Capoeta trutta* and *Capoeta umbla*. In the evaluations, species of *Barbus* and *Capoeta* were expressed as *Barbus* sp. and *Capoeta* sp., respectively. The fish removed from gillnets were classified according to their species and their body weights were measured. Catch-Per-Unit Effort (CPUE) of each gillnet was calculated for each species and for total catch according to mesh widths. The following formula was used in calculating the catch-per-unit effort (Hyvarinen and Salojarvi, 1991; Balik and Cubuk, 2001).

$$CPUE = \sum (Y/n)/N$$

Y = The amount of caught fish (g)

N = Gillnet length (m)

N = The number of trials

RESULTS AND DISCUSSION

A total of 1133 fish were caught in 22 fishing trials performed during the research. Total amount of catch is 1037 kg in weight. In the trials, the greatest amount of fish caught by weight was *Capoeta* sp. in 50 and 70 mm nets, *Barbus* sp. in 60 mm nets and *Cyprinus carpio carpio* in 90 mm nets. The lowest catch in all nets was observed to be *Squalius cephalus*. It was determined that catch amount of *Capoeta* sp. decreased with the increase in mesh size and revealed the lowest amount in 90 mm nets. Catch per unit effort of *Barbus* sp. was found to be relatively high in 50 and 60 mm nets and quite low in other nets. On the contrary, catch per unit effort of *Cyprinus carpio carpio* was low in 50 and 60 mm nets, higher in 70 mm net and the highest in 90 mm nets. *Squalius cephalus* did not yield any catch that can be economically evaluated (Table 1-4).

When catch per unit effort calculated on the basis of all species were considered, 60 mm nets was observed to be more efficient with a catch efficiency of 83.1 g m⁻¹ compared to other nets. It was followed by 50, 70 and 90 mm nets with catch per unit effort of 79.9, 41.0 and 31.8 g m⁻¹, respectively. In the fishing trials, 351.5, 365.8, 180.2 and 139.5 kg fish were caught by 50, 60, 70 and 90 mm nets, respectively (Table 1-4).

In the calculation made on the basis of all nets used in the research, the species with the highest catch per unit

Table 1: Mean CPUE values of the gillnet with 50 mm mesh size (g m⁻¹)

Species	N	W (kg)	Percentage	CPUE (g m ⁻¹)
<i>Capoeta</i> sp.	222	180.5	51.4	41.0
<i>Barbus</i> sp.	189	158.4	45.1	36.0
<i>C. carpio carpio</i>	17	8.2	2.3	1.9
<i>Squalius cephalus</i>	5	4.4	1.2	1.0
Total	433	351.5	100.0	79.9

Table 2: Mean CPUE values of the gillnet with 60 mm mesh size (g m⁻¹)

Species	N	W (kg)	Percentage	CPUE (g m ⁻¹)
<i>Capoeta</i> sp.	163	172.7	47.2	39.2
<i>Barbus</i> sp.	146	179.9	49.2	40.9
<i>C. carpio carpio</i>	16	4.8	1.3	1.1
<i>Squalius cephalus</i>	7	8.4	2.3	1.9
Total	332	365.8	100.0	83.1

Table 3: Mean CPUE values of the gillnet with 70 mm mesh size (g m⁻¹)

Species	N	W (kg)	Percentage	CPUE (g m ⁻¹)
<i>Capoeta</i> sp.	78	119.3	66.2	27.1
<i>Barbus</i> sp.	33	17.9	9.9	4.1
<i>C. carpio carpio</i>	70	37.7	20.9	8.6
<i>Squalius cephalus</i>	3	5.3	3.0	1.2
Total	184	180.2	100.0	41.0

Table 4: Mean CPUE values of the gillnet with 90 mm mesh size (g m⁻¹)

Species	N	W (kg)	Percentage	CPUE (g m ⁻¹)
<i>Capoeta</i> sp.	1	0.8	0.6	0.2
<i>Barbus</i> sp.	15	6.4	4.6	1.5
<i>C. carpio carpio</i>	168	132.3	94.8	30.1
<i>Squalius cephalus</i>	0	0.0	0.0	0.0
Total	184	139.5	100.0	31.8

Table 5: Mean CPUE values on the basis of all gillnets (g m⁻¹)

Species	N	W (kg)	%	CPUE (g m ⁻¹)
<i>Capoeta</i> sp.	464	473.3	45.6	26.9
<i>Barbus</i> sp.	383	362.6	35.0	20.6
<i>C. carpio carpio</i>	271	183.0	17.6	10.4
<i>Squalius cephalus</i>	15	18.1	1.8	1.0
Total	1133	1037.0	100.0	58.9

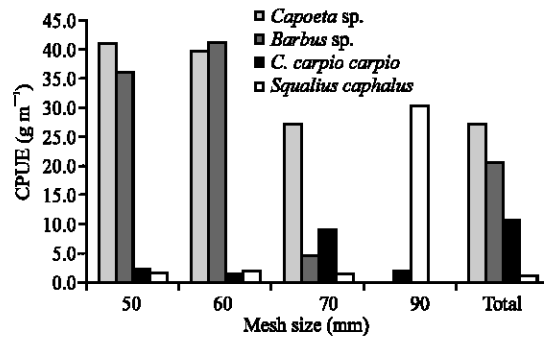


Fig. 1: CPUE (g m⁻¹) distribution of species according to mesh size

effort was determined to be *Capoeta* sp. (26.9 g m⁻¹), which was followed by *Barbus* sp. (20.6 g m⁻¹), *Cyprinus carpio carpio* (10.4 g m⁻¹) and *Squalius cephalus* (1.0 g m⁻¹) (Table 5). Distribution of CPUE (g m⁻¹) according to mesh sizes is shown in Fig. 1. As shown in the graphic, the highest catch per unit effort was observed in *Capoeta* sp. (41.0 and 39.2 g m⁻¹) and *Barbus*

sp. (36.0 and 40.9 g m⁻¹) in 50 and 60 mm nets, only in *Capoeta* sp. (27.1 g m⁻¹) in 70 mm net and only in *Cyprinus carpio* (30.1 g m⁻¹) in 90 mm net. Knowing the total catch of a stock provides only qualitative information about the utilization of stock i.e., whether the related stock is utilized to a greater or lesser extent. Therefore, efficiency of a stock may be measured by the catch per unit effort of that stock. This value is used in obtaining quantitative information. Thus, both total catch and unit catch should be taken into account, while considering the stock situation (Avsar, 2005). Gillnets are the most important passive fishing gears with characteristics like different structure, material, color, hanging ratio and mesh size (Ozdemir *et al.*, 2005). When gillnet groups and mesh sizes are considered in areas where active fishing is carried out, it is reported that the number of caught fish decreases with the increase in mesh size (Alaz and Gurbet, 2005). In the study, when the catch per unit of gillnets with 50, 60, 70 and 90 mm mesh size was examined (79.9, 83.1, 41.0 and 31.8 g m⁻¹, respectively), 50 and 60 mm gillnets were found to be relatively more efficient and efficiency was observed to decrease with the increase in mesh size. This difference between the efficiency values of gillnets is thought to derive from the fact that fish sizes selected by the gillnets, which are evaluated as more efficient are more abundant in the environment.

In fishing with gillnets with high selectivity, the more abundant size range of targeted species in the environment is important, provided that legal fishing size is also taken into account. In the study carried out by Pala (2002) in Cemisgezdek area of Keban Dam Lake with gillnets having mesh sizes of 22, 36, 40, 50, 60, 70 and 90 mm, it was reported that the greatest amount of fish was caught in 50 mm net (1091 fish) and 60 mm net (948 fish).

These findings also comply with the results obtained in the study. In the study carried out by Balik and Cubuk (2001) in Ulubat Lake with gillnets having 18, 20, 22, 26, 30 and 36 mm mesh sizes, catch per unit was found to be 181.2, 170.5, 244.6, 123.4, 76.8 and 29.9 g m⁻¹, respectively. However, the environment, mesh sizes and the species caught are different in the mentioned study.

In the research, the species with the highest and lowest catch per unit were detected to be *Capoeta* sp. (26.9 g m⁻¹) and *Squalius cephalus* (1.0 g m⁻¹), respectively. In other studies performed at Keban Dam Lake (Pala, 2002; Pala and Mengi, 2004; Celayir *et al.*, 2006), *Capoeta* sp. was reported to yield the highest amount of catch. On the other hand, in a fishable stock assessment study conducted at Keban Dam Lake (Anonymous, 2004), *Barbus* sp. was determined as the most dominant species in the fishing composition. In fishing with gillnets, fishing activity is affected by several

factors, such as the migration movements and behavior of the targeted fish species, the depths they are found, movements of water and the physical properties of the utilized gillnets, time and duration of fishing (Bjordal, 1981; Akamca *et al.*, 2008). In the study, it was determined that *Capoeta* sp. yielded a good catch in 50, 60 and 70 mm gillnets and *Barbus* sp. yielded a good catch in 50 and 60 mm gillnets, while *Cyprinus carpio carpio* yielded a good catch only in 90 mm gillnet.

Body structure of *Cyprinus carpio carpio* is thought to be more suitable for being caught by a mesh size of 90 mm or more. In the stock assessment studies carried out by Celayir *et al.* (2006) at Keban Dam Lake, the ratio of *Cyprinus carpio carpio* was determined to be 11.5% in the total annual fishable stock. The low catch per unit amount of the gillnet with 90 mm mesh size, which is appropriate for catching *Cyprinus carpio carpio* is thought to result from the restricted number of big sizes of species in the environment other than *Cyprinus carpio carpio*.

CONCLUSION

Consequently, mesh sizes in gillnets were determined to have a significant effect on catch efficiency and composition. Protecting the small sizes of especially *Barbus* species, which have high economic value in Keban Dam Lake will make gillnets with large mesh sizes more efficient and contribute to the better management of the lake. According to the data obtained from the research, gillnet mesh size of <90 mm is observed to be appropriate for *Cyprinus carpio carpio* fishing. A mesh size between 50 and 70 mm is considered to be appropriate for protecting the population in the fishing of *Capoeta* species. It is understood that *Squalius cephalus* population in Keban Dam Lake has decreased to a significant extent in recent years and was reduced to a degree that cannot yield commercial catch. Therefore, *Squalius cephalus* fishing in Keban Dam Lake should be prohibited all the year round.

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