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Effect of Water Temperature on the Selectivity of Monofilament Gill Nets (PA)

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Abstract: In this study, the selectivity feature of monofilament gill nets used in the Keban Dam Lake, varying with water temperature changing with the seasons was investigated in this research. The research was conducted between 20.07.2001 and 02.07.2002 (13 months) on the Keban Dam Lake (Elazig/Turkey). Two, monofilament (PA) gill nets with 100 m length and 100 mesh height with two different mesh widths (50 and 60 mm) were used in the research. During this research with the gill nets, two fish species (*Capoeta trutta* and *Barbus rajanorum mystaceus*) were most often caught and these with high economic value were taken into account. Important changes depending on the temperature were determined particularly on monofilament gill nets made out of thin material (0.23 mm) and having a mesh width of 50 mm. The *Capoeta trutta* species showed significant differences with monofilament gill nets with both 50 and 60 mm mesh width in relation to the water temperature.

Key words: Gill net, polyamide, selectivity, temperature

INTRODUCTION

From the point of the performance of nets and fishing management the selectivity of gill nets is very important (Yokota *et al*., 2001). Subjects as duration and sort of application, the resistance against elongation and breaking strength under various loads are important properties of gill nets (Sala *et al*., 2004).

The selectivity of fishing gears are affected by technical specification, biological and environmental factors. The net material's thinness and the equipment factor are technical factors that are affecting the selectivity very much. Selectivity increases with increasing thickness of the net material (Hamley, 1975).

Various researches were made to reveal application features of polyamide (PA) nets (Al-Oufi *et al*., 2004; Tokaç *et al*. 2004; Sala *et al*., 2004). PA nets were left in the sun to research their resistance against elongation and breaking strength (Al-Oufi *et al*., 2004). It was discovered that the sun light has a short-term effect on the elongation and breaking strength resistance of PA gill nets.

Application features of synthetic PA and PE material selected by deep trawler for the trawler bag has been researched by Tokaç *et al*. (2004). It was found here, that the selectivity features of PA nets were better than that of the PE trawler bag. The extension capacity of PA nets were found to be better.

Gill nets are providing a fairly high selectivity among fishing gears, if the mesh width is chosen right. This again is quite important for the management of fish populations (Thomas *et al*., 2003).

Sala *et al*. (2004) on the other hand the changes of the physical specifications of PA nets before and after the utilization were investigated and changes in the extension after the use of the nets were discovered, but no relevant changes in the tensile strength were found.

The efficiency of gill nets can change with the material used. The thickness, color and knot type for example can lead to this (Brandt, 1984)

Twine thickness in wet PA multifilament nets are shrinking a little bit. This leads to 2% shortening of non-fixed nets (Mengi, 1989).

Light density and water temperature in special are the environmental factors that are changing the reaction of the fish against the net by affecting their sense of sight and swimming speed (Hamley, 1975).

This alteration feature and the diversity in utilization of synthetic fibers are subjects, that are important for fishers and have to be considered in regard to the fishing management.

The selectivity feature of monofilament gill nets used in the Keban Dam Lake, varying with water temperature changing with the seasons was investigated in this research.

MATERIALS AND METHODS

The research was conducted between 20.07.2001 and 02.07.2002 (13 months) on the Keban Dam Lake. Two, monofilament (PA) gill nets with 100 m length and 100 mesh height with two different mesh widths were used in the research. The mesh width of the nets were 50 and 60 mm. The material thicknesses were number 0.23 and

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0.25, respectively. The hanging ratios feature of 0.50 preferred by the fishers was chosen as the hanging ratio for the use of the gill nets.

The gill nets with this features were put in the water, left there on average for 8 h pulled out afterwards and used for fishing. The total length (cm) and body circumference (cm) of the caught fish were measured in mm, where they were caught in the net. During this work with the gill nets, two fish species (*Capoeta trutta* and *Barbus rajanorum mystaceus*) were most often caught and these with high economic value were taken into account.

The water temperature of the dam lake was measured water with a 1°C scaled mercury thermometer at least 50 cm below the water line, while the nets were thrown out into the water and pulled out of the.

The relation between consecutively the temperatures and total length and body circumference of the fish caught, the temperature dependence has been tried to explain statistically by performing a t-test.

RESULTS AND DISCUSSION

In Table 1 and 2 the number of the *C. trutta* and the *B.r. mystaceus* species caught by two different mesh sized gill nets, respectively net mesh width of 50 and 60 mm, is shown in dependence of the water temperatures, their total sizes (cm), the regions where they were caught in the nets.

Taking into account the net mesh widths of 50 and 60 mm, the number, total length (cm), body circumference (cm) of the two species *C. trutta* and *B.r. mystaceus* caught with the gill nets, with two different mesh widths are shown in relation to the water temperature in Table 1 and 2.

A total of 468 fish, 295 *C. trutta* and 173 *B.r. mystaceus*, were caught during the research with the gill net with 50 mm mesh width. 186 *C. trutta* and 107 *B.r. mystaceus* (293) were caught with the monofilament gill net with 60 mm mesh width.

The distribution of the total length and catching circumference of the fish caught with the net with 50 and 60 (mm) mesh width in relation to the water temperature is shown in the Fig. 1-4.

In a comparison of both total length and catching circumference in relation to the water temperature, a statistically significant difference ($p<0.05$) in the total length of the *C. trutta* species caught in the monofilament net with 50 mm mesh width at a water temperature of 1-2 and 21-26°C was found. Important differences

Table 1: *Capoeta trutta* data for 50 and 60 mm mesh width

	Capoeta trutta					
	50 mm mesh width			60 mm mesh width		
Water temp. (°C)	N	Mean total length (cm) ±SD	Mean B. Circum (cm) ±SD	N	Mean total length (cm) ±SD	B. Circum.(cm) ±SD
1	17	41.06±1.88	20.15±0.35	04	47.00±2.65	23.33±0.40
2	21	42.90±1.80	20.39±0.34	16	47.13±2.33	23.56±0.33
4	30	43.52±2.64	20.50±0.32	29	46.14±2.24	23.66±0.35
8	25	43.61±2.27	20.33±0.44	25	48.63±1.69	23.63±0.26
10	44	42.82±3.24	20.35±0.40	36	45.40±3.24	23.62±0.37
13	16	42.19±2.43	20.34±0.46	09	49.50±1.77	23.51±0.14
18	15	41.43±2.17	20.52±0.50	14	44.15±1.52	23.92±0.27
20	10	41.56±4.06	20.57±0.46	16	46.27±2.19	23.77±0.33
21	16	41.53±2.95	20.40±0.33	05	47.50±3.70	24.05±0.21
23	56	44.12±2.47	20.38±0.34	18	47.88±1.96	23.59±0.20
26	24	42.51±3.46	20.36±0.65	09	47.25±2.25	23.59±0.26
28	20	42.90±2.30	20.53±0.17	05	44.25±6.50	23.83±0.26
Total	295	X: 42.52	X:20.29	Total:186	X: 46.82	X: 23.73

Table 2: *Barbus rajanorum mystaceus* data for 50 and 60 mm mesh width

	Barbus rajanorum mystaceus					
	50 mm mesh width			60 mm mesh width		
Water temp. (°C)	N	Mean total length (cm) ±SD	Mean B. Circum (cm) ±SD	N	Mean total length (cm) ±SD	B. Circum.(cm) ±SD
1	20	43.11±2.05	20.26±0.33	11	49.50±2.22	23.68±0.22
2	23	42.14±2.00	20.17±0.47	25	48.32±2.51	23.56±0.31
4	11	42.55±1.65	20.14±0.38	14	47.46±2.37	23.59±0.27
8	03	42.00±1.41	19.95±0.35	-	--	--
10	54	43.33±2.35	20.39±0.33	32	49.05±2.72	23.74±0.34
13	06	44.40±3.13	20.44±0.34	---	---	---
20	05	40.50±0,58	19.71±0.36	---	---	---
21	04	40.67± ---	20.20±0.35	---	---	---
23	24	43.15±2.77	20.22±0.41	13	49.83±21.82	23.73±0.22
26	18	43.48±2.84	20.20±0.52	12	48.55±2.66	23.73±0.20
28	05	45.75±2.30	20.53±3.20	---	---	---
Total	173	X:42.86	X : 20.16	Total 107	X: 48.59	X: 23.68

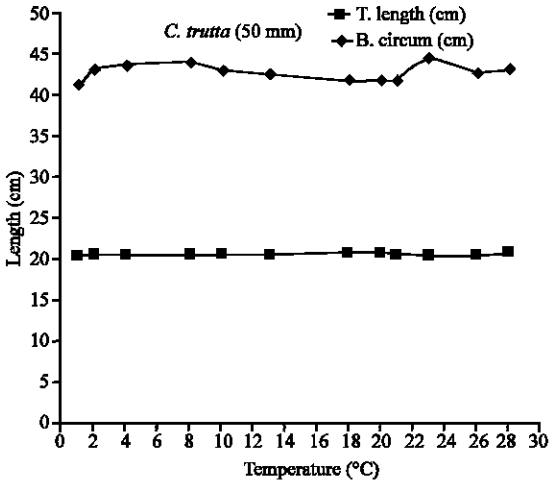

Fig. 1: The total length and body circumference (cm) of *C. trutta in* relation to the water temperature caught in the net with 50 mm mesh width

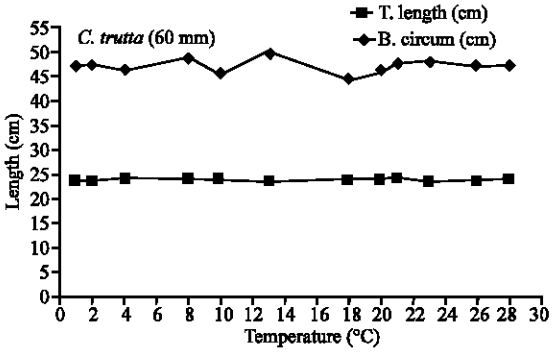

Fig. 2: The total length and body circumference (cm) of *C. trutta in* relation to the water temperature caught in the net with 60 mm mesh width

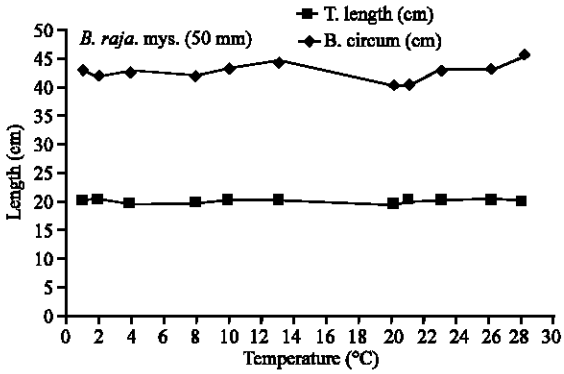

Fig. 3: Total length and body circumference (cm) of *B.r. mystaceus* in relation to the water temperature caught in the net with 50 mm mesh width

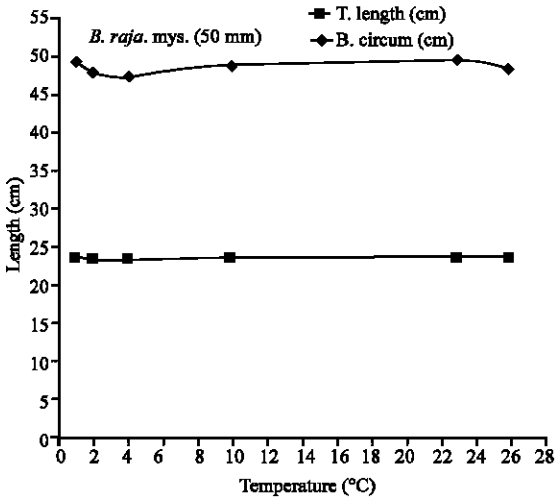

Fig. 4: Total length and body circumference (cm) of *B.r. mystaceus in* relation to the water temperature caught in the net with 60 mm mesh width

($p<0.05$) in the catching circumference of *C. trutta* caught in the same net at the same water temperature were also determined.

On the other hand on the monofilament net with 60 mm mesh width used for catching *C. trutta*, the differences ($p<0.05$) between total length relative to water temperature caught at a water temperature of 1-2 and 4-20°C were found to be significant. Again the difference in the measured catching circumference of the fish caught in the same net at 4-23°C turned out to be significant ($p<0.05$).

In the test conducted for a net with 50 mm mesh width, the total length of the *B.r. mystaceus* product relative to water temperature was in general found to be not significant ($p>0.05$). Relevant difference ($p<0.05$) both in total length and catching circumference was only determined at a water temperature of 10-13°C. On the other hand not significant difference in the total length and the catching circumference was detected with monofilament gill nets with 60 mm mesh width ($p>0.05$).

The significant differences between the length groups of *C. trutta* and *B.r. mystaceus* species and subspecies caught in monofilament polyamide (PA) gill nets in relation to the water temperature especially for the total length of *C. trutta* species individuals caught in monofilament (PA) gill nets with 60 mm mesh width were determined ($p<0.05$).

Researches on the extension capability and tensile strength of the PA nets have shown, that especially changes in the extension capability occurred (Sala *et al*., 2004). Besides with regard to the selectivity attributes, the PA nets showed more selectivity compared to other nets (Tokaç *et al*., 2004).

During this research, environmental factors especially the water temperature brought differences in the selectivity terms on the fish species caught in PA monofilament gill nets. Important changes depending on the temperature were detected particularly on monofilament gill nets made out of thin material (0.23 mm) and having a mesh width of 50 mm. On the other hand no significant differences could be found with gill nets with 60 mm mesh width and 0.25 mm material thickness, especially while fishing *B.r. mystaceus* sub species with regard to total length and catching circumference ($p>0.05$).

As expressed in Hamley (1975), the selectivity of the monofilament gill net (0.25 mm) for the *B.r. mystaceus* sub species fairly increased with increasing material thickness. The biologically high moving capability of the barbel species also affected this.

The *C. trutta* species showed significant differences with monofilament gill nets with both 50 and 60 mm mesh width in relation to the water temperature. One important reason for this is the weak moving capability of this species compared to the barbel species and additionally it is thought, that these results from the 0.23 mm material thickness is stretching to much in selectivity depending on the temperature.

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