Comparison of Seasonal Catch Per Unit Efforts for Mono- and Multi-filament Trammel Nets in Lake Beyşehir

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Abstract

In this paper, catch per unit efforts (CPUEs) of mono- and multi-filament trammel nets were comparatively investigated on capture of fish species in Lake Beyşehir. To determine the CPUEs of the net types fishing experiments were conducted by the nets with mesh sizes of 28, 40, 50 and 60 mm between April and December 1998.

The mean CPUE was calculated to be 22.39 and 11.12 g/m for mono- and multi-filament net types. According to these results the mean CPUE of monofilament nets was 2.02 fold higher than those of multifilament nets. Tench (*Tinca tinca* L., 1758) constituted about 80% of the CPUEs of the net types. These species were followed by carp (*Cyprinus carpio* L., 1758), pikeperch (*Stizostedion lucioperca* (L., 1758)) and chub (*Leuciscus lepidus anatolicus* Bogutskaya, 1997) for monofilament net type. The rate of pikeperch in the multifilament net type was higher than carp. The results of the study showed that both the CPUEs of the net types and difference between the CPUEs were gradually decreased from Spring to Autumn.

Key Words: monofilament, multifilament, trammel net, catch per unit effort, Lake Beyşehir.

Introduction

Due to the rich freshwater resources that consist of an extended network of rivers, 1 million ha of natural lakes, 170 thousand ha of reservoirs, 70 thousand lagoons, 700 small reservoirs, and inland fishery has always had a large production potential with respect to variety in Turkey (Anonymous, 2000a). The production of inland fishery was 50.190 t in 1999 (Anonymous, 2000b).

In Turkey, freshwater fish are caught with gillnets, trammel nets, long-lines, hand-lines, traps and beach seine nets. Gillnets, trammel nets, long-lines, hand-lines and beach seine nets are used for catching fish species in Lake Beyşehir. Fishermen have to have permission to use beach sine from the Ministry of Agriculture and Rural Affairs (Anonymous, 1998).

Gillnets are the most common type of gear, and this is the type of net mostly used for catching pikeperch (*Stizostedion lucioperca* (L., 1758)) in this lake. The second most common type of the gears is trammel nets. Trammel nets are principally used for catching carp (*Cyprinus carpio* L., 1758) and tench (*Tinca tinca* L., 1753), a lesser extend pikeperch. Both trammel nets and gillnets were made in multifilament nylon twine until the middle of 1990s, but after that date the use of monofilament nets has gradually increased. Nowadays, net twins of almost all trammel nets are monofilament because the catching efficiency of monofilament trammel nets is higher than multifilament for catching fish species in Lake Beyşehir.

Efficiency of trammel nets is affected by many factors. One factor is the net twine material (Hamley, 1975; Taşdemir and Timur, 1989). Another factor is the visibility of the nets by the fish (Balık and Çubuk, 2000). Generally low visible nets catch more fish than more visible nets (Backiel and Welcomme, 1980). Typically, multifilament net twine is more visible than monofilament. Therefore, fish more easily notice multifilament nets. Thus, catching efficiency of monofilament trammel nets is mostly higher than multifilament (Karlsen and Bjarnason, 1986).

There are only a few studies about fishing with trammel nets in Turkey. In these studies they investigated catch composition and selectivity of trammel nets used in fishing of *Chalcalburnus tarichi* (Pallas, 1811) in Lake Van by Çetinkaya (1995). Another study was done for the effectiveness of net colour on efficiency for catching sepia (*Sepial officinalis* L., 1758) in İzmir Bay by Kara (1994). The efficiencies of different trammel net types on the capture of tench in Lake Beyşehir by Balık and Çubuk (2000) was also a study done with trammel nets. And last study was done on the selectivity of trammel nets and the effectiveness of the different net twine materials on the selectivity of trammel nets for gold fish *Carassius auratus* (L., 1758) in Lake Eğirdir by Balık and Çubuk (1998-1999).

In order to regulate fisheries properly, the states of the imported fish stocks should be known. In general, the accurate estimation of fish population size in large water bodies such as Lake Beyşehir is problematical. Therefore, evaluation of the states of the fish stocks is mostly based on the official

authorities' own experiences, and on interviews with fishermen. Instead of this circumstantial evidence, the CPUE by species and by gear could serve as a useful and objective index (Hyvärinen and Salojärvi, 1991). CPUE is widely accepted as an index of the fish stock size (Prouzet and Dumas, 1988; Hyvärinen and Salojärvi, 1991; Pawson, 1991). The fishing effort and the CPUEs of gear types or fishing boats should be well known in Lake Beyşehir. The changing efficiency of trammel nets may be observed because of the over-fishing on fish stocks. Therefore, in this paper the seasonal CPUEs of mono- and multi-filament trammel nets and the effect of net twine types on the CPUEs were investigated for some fish species in Lake Beyşehir.

Materials and Methods

Experiments were conducted in the fishing areas of Akburun, Gölkaşı and Çiftlik villages in Lake Beyşehir. Lake Beyşehir, the largest natural fresh water lake of Turkey has a surface of 690 km^2, and its mean depth is 6 m. The lake is situated at 37°33'-37°59'N, 31°19'-31°44'E, in the Lakes Region of Turkey. In Lake Beyşehir, there were 916 boats and 1519 fishermen in 1996 (Balık, 1997a). The fish population of the present day comprises five species: Carp, pikeperch, tench, chub (*Leuciscus lepidus anatolicus* Bogutskaya, 1997) and nose (*Chondrostoma regium* Hec., 1843). The nose could not be sampled with our experimental nets. Carp, chub and nose are the native species of the lake, but pikeperch and tench were introduced into the lake in 1978 (Erdem *et al*., 1985) and at the beginning of 1990s (Balık *et al*., 1997).

In the experiments, a total of 8 trammel nets comprising of two net types (mono- and multi-filament trammel nets) were tested for catching tench, carp, pikeperch and chub. Each type had four nets with mesh sizes of 28, 40, 50 and 60 mm (bar length of inner wall). Individual nets had a length of 100 m and hanging ratio of each net was E=0.50. The twine diameters of monofilament inner walls were 0.18 mm for 28 and 40 mm mesh sizes, and 0.23 mm for 50 and 60 mm mesh sizes. The diameters of multifilament inner and outer walls were 210x2 and 210x6 denier. The height of the outer walls/the height of the inner walls were 0.57 for 28 mm, 0.60 for 40 and 50 mm, and 0.58 for 60 mm mesh-sized nets. Except for the net twine, all characteristics of the same mesh-sized trammel nets were similar. The key features of the nets belonging to each net type are shown in Table 1.

Experiments were conducted simultaneously in the same area of the lake to give approximately similar fishing conditions between April and December 1998.

A total of 28 trials were carried out to calculate and compare the CPUEs of mono- and multi-filament trammel net types in Spring, Summer, and Autumn.

In winter the trial was not conducted because the weather was very cold and the surface water of the lake had been frozen from time to time. In all the experiments the nets were joined to one another with 2 m. intervals from their float and lead lines, and in each experiment the positions of the nets were changed in turn. In all the fishing experiments usually the nets were set at the bottom after 12·00 pm and lifted the next morning. On landing, the fish caught in each net were removed separately from each net and the body weight (nearest g) of each of the fish were weighted to determine and compare the CPUEs of trammel net types for catching tench, carp, pikeperch and chub. The CPUEs was calculated from the following equation:

$$CPUE=\Sigma(Y/L)/N$$

CPUE is the mean catch per unit effort for a given species, Y is the catch in weight of a given species in one lift, L is the length (m) of nets lifted and N is the number of lifts (Hyvärinen and Salojärvi, 1991). The CPUEs of both net types were separately compared for each fish species and season. Differences in the CPUE between seasons were determined through analysis of variance for both net types. The Students-Newman-Keuls test was applied for comparison of pairs of the mean CPUEs for seasons (Çömlekçi, 1988).

Table 1. Some of the key features of the mono- and multi-filament nets used in experiments.

	Inner wall		Outer walls	
	mesh size (mm)	high [mesh number (cm)]	mesh size (mm)	high [mesh number (cm)]
Mono-filament	28	100(487)	230	7(280)
	40	50(348)	240	5(209)
	50	50(435)	250	6(261)
	60	50(522)	250	7(305)
Multi-filament	28	100(487)	230	7(280)
	40	50(348)	240	5(209)
	50	50(435)	250	6(261)
	60	50(522)	250	7(305)

Results

During the trials, 325.9 kg tench, 42.2 kg carp, 25.8 kg pikeperch, and 9.7 kg chub were caught with 8 trammel nets belonging to two net types. By weight, over 80% of the total fish catch composed of tench for both net types. In general, these species were followed by carp, pikeperch, and chub. The ratios of carp in the total catches of the net types were 12.6% for monofilament and 6% for multifilament nets. Ratios of pikeperch and chub caught in monofilament nets were lower than those of multifilament (Table 2).

The mean CPUEs of the net types, by fish species and seasons, were shown in Table 3. The CPUEs of the net types were gradually decreased from Spring to Autumn. Differences in the total CPUEs of monofilament nets between Spring and Autumn were significant ($P<0.05$), but not significant ($P>0.05$) between Spring-Autumn, and Summer-Autumn. The total CPUEs of multifilament nets between seasons were not found statistically different ($P>0.05$).

Regarding the mesh sizes, the monofilament trammel nets with mesh sizes of 50 and 60 mm caught most of the tench and carp. On the other hand, the best catching rates for pikeperch and chub were with the mesh size of 28 mm for the monofilament trammel nets. The highest CPUE was calculated for 50 mm mesh size for both net types. The multifilament trammel net with the mesh size of 50 mm captured more tench, pikeperch, and chub than the other mesh sizes, but most of the carp were caught by the 60 mm mesh-sized multifilament net (Table 4). The mean CPUEs of monofilament trammel nets were 22.39 g/m and 17.97 g/m of this amount consisted of tench; Carp, pikeperch and chub, followed this species. The mean CPUE of multifilament trammel nets was found to be 11.12 g/m, but the rate of pikeperch was higher than carp for multifilament net type.

Discussion

The mean CPUEs of trammel nets were found to be 22.39 g/m and 11.12 g/m for mono- and multi-filament net twines, respectively. Even though tench was introduced into Lake Beyşehir only a few years ago, over 80% of these CPUEs consisted of tench. These species were not represented in the catch composition of Lake Beyşehir between August 1995

Table 2. Catch composition of mono- and multi-filament trammel nets.

	Monofilament		Multifilament		Mean	
	kg	kg%	kg	kg%	kg	kg%
Tench	218.6	80.6	107.3	81.1	163.0	80.7
Carp	34.2	12.6	8.0	6.0	21.1	10.5
Pikeperch	13.8	5.1	12.0	9.1	12.9	6.4
Chub	4.7	1.7	5.0	3.8	4.9	2.4
Total	271.3		132.3		201.9	

Table 3. The mean CPUEs of the net types by fish species and seasons.

	Monofilament				Multifilament			
	Spring	Summer	Autumn	Mean	Spring	Summer	Autumn	Mean
Tench	29.75	15.23	8.92	17.97	12.76	9.00	5.63	9.13
Carp	3.64	3.08	1.86	2.86	0.70	0.33	0.85	0.63
Pikeperch	0.86	1.64	1.17	1.22	0.74	0.94	1.34	1.01
Chub	0.61	-	0.41	0.34	0.95	-	0.11	0.35
Total	34.86	19.95	12.36	22.39	15.15	10.27	7.93	11.12

Table 4. The mean CPUEs of the net types by mesh size and fish species for three seasons.

	Monofilament					Multifilament				
	28	40	50	60	Mean	28	40	50	60	Mean
Tench	11.98	15.81	24.89	19.17	17.97	8.55	6.04	13.92	8.01	9.13
Carp	0.85	1.23	2.82	6.53	2.86	0.59	0.09	0.3	1.51	0.63
Pikeperch	2.21	0.73	1.81	0.13	1.22	0.66	0.54	1.52	1.29	1.01
Chub	0.98	0.38	-	-	0.34	0.19	0.24	0.97	-	0.35
Total	16.02	18.15	29.52	25.83	22.39	9.99	6.91	16.71	10.81	11.12

and July 1997 (Balık, 1997b; Balık, 1998). It was shown that the tench population rapidly increased in a few years in Lake Beyşehir. Carp, pikeperch and chub for monofilament net type, followed this species. However, the rate of pikeperch in fishing with multifilament trammel net was higher than carp.

The CPUEs of chub in comparison to other species were slightly lower for both net types. The results of the study showed that the mean CPUE of monofilament trammel nets were two folds higher than multifilament trammel nets. In fact, the difference of the mean CPUEs of both net types was the highest (2.30 folds) in Spring. These differences decreased to 1.94 and 1.56 folds in Summer and Autumn. It is clear that the effect of the net twine types for the catching efficiency of the trammel nets was higher in the Spring than in the Summer and Autumn. Some of the other studies results were similar with the results of our study. For instance, Machiels *et al*. (1994) found monofilament gillnets to be more efficient than multifilament for bream (*Abramis brama* L., 1758), but less efficient for pikeperch. For catching pikeperch in Lake Eğirdir (Kuşat, 1996) and Beyşehir (Balık, 1996) monofilament gillnets were more effective than multifilament. This situation may be the result of many factors like the visibility of the nets, etc.

For effective catching, the nets must have low visibility to the fish in water (Klust, 1982). Although fish are known to be myopic, they can see up to 10 m distance in 20 m depth (Taşdemir, 1997). Visibility of the nets is affected by weather conditions, turbidity of the lake water, flow, depth and etc. Especially, the turbidity can vary according to seasonal variations. The fish in clear water can recognise the nets more easily. The water of Lake Beyşehir in Spring is generally more clear than in the Summer and Autumn. This is because in the Springtime there is an inlet water flow of the lake that is generally high, and the temperature of the lake water is normally lower than the other two seasons. Therefore, the abundance of micro-fauna, flora, and vegetation are less in this season. In particular, this situation decreases the visibility of multifilament nets in Summer and Autumn than in the Spring. Additionally, during the experiments this case was observed at the measurement of secchi disk depth. The mean secchi disk depths were found as 296, 262 and 216 cm for Spring, Summer, and Autumn.

In addition, the CPUEs of both the monofilament and multifilament trammel nets gradually decreased from Spring to Autumn. Several factors might have affected the decrease of the catching efficiency according to seasonal variations. For instance, during the study the commercial fishing with the nets had been prohibited in Lake Beyşehir from 1 March to 15 June in 1998 (Anonymous, 1998). The decrease of fish stocks and biological features of fish species can be shown as the other reasons for these aspects.

Consequently, the CPUEs of trammel nets has increased about two folds because of using the monofilament net twine instead of multifilament net twine on construction of the nets in Lake Beyşehir. This type of change with the net twine created more economic fishing activity for the local fishermen, but it may cause over-fishing on stocks of some fish species. It is recommended that official authorities should evaluate this situation. Otherwise, the decreasing of the carp and pikeperch stocks will be unavoidable in the near future.

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