

A Study On Catching Freshwater Crayfish, *Astacus leptodactylus* Eschscholtz 1823, and Its Some Population Characteristics

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Abstract

This study was carried out between July 2009 and March 2010, which is the first scientific survey on catching freshwater crayfish in the Keban Dam Lake Pertek region (38°49'271" N - 39°17'057" E), Catch per unit effort (CPUE) was 0.2 number/fyke net/number of trial. The most efficiently catching was in November (20 crayfish) and the least efficiently catching was in March (4 crayfish). The catching depth was between 3 and 16 meters. The sex ratio was 0.42/1 (female/male). The mean total length for males and females were 112.93 mm and 100.38 mm, respectively. The mean weight for males was 50.32 ± 4.34 g, for females was 35.82 ± 5.76 . The legal length for freshwater crayfish is 100 mm. In this study was determined 76.6 % of samples total length higher than 100 mm, 23.4 % of samples total length lower than 100 mm. Caught crayfish had a linear relationship between carapace length and total weight in both gender ($r^2_{\text{male}}=0.946$, $r^2_{\text{female}}= 0.704$). According to the regression analysis, male crayfish had a positive allometric growth, females had a negative allometric growth ($b_{\text{male}}=3.018$, $b_{\text{female}}=2.338$). It was determined that abdomen of females was statistically wider than male's abdomen ($p<0.05$). On the other hand, chelae width and chelae length for males were statistically higher than females ($p<0.05$). It can be said that population of crayfish in the region is not sufficient for commercially catching; however, it will be able to supply an important economic benefit by getting increase in the future.

Key Words: *Astacus leptodactylus*, Catching crayfish, Fyke Net, Pertek Region

Tatlı Su İstakozu *Astacus leptodactylus*, 1823 Avcılığı ve Bazı Populasyon Özellikleri Üzerine Bir Ön Çalışma

Özet

Kerevit (*Astacus leptodactylus*) avcılığı üzerine ilk bilimsel çalışma özelliğini taşıyan bu araştırma, Temmuz 2009 - Mart 2010 tarihleri arasında Keban Baraj Gölü Pertek Bölgesi'nde gerçekleştirildi (38°49'271" N - 39°17'057" E). Birim çabadaki av miktarı (CPUE) 0,2 adet kerevit/pinter/deneme sayısı olarak hesaplandı. En verimli avcılık Kasım ayında (20 adet), en az avcılık Mart ayında (4 adet) gerçekleşti. Pinterler 3-16 m arasındaki derinliklere atıldı. Populasyondaki dişi / erkek oranı 0,42/1,00 olarak belirlendi. Kerevitlerin ortalama boyları erkek kerevitlerde 112,93 ve dişi kerevitlerde 100,38 olarak saptandı. Erkek kerevitlerin ortalama ağırlığının 50.32 ± 4.34 g, dişilerin ortalama ağırlığının ise 35.82 ± 5.76 g olduğu tespit edildi. Avlanabilir boydaki (≥ 10 cm) bireylerin oranı % 76,6, 100 mm'nin altındaki bireylerin oranı % 23,4 olarak hesaplandı. Avlanan erkek ve dişi kerevitlerde (*Astacus leptodactylus*) karapaks uzunluğu ile vücut ağırlığı arasında doğrusal bir ilişkinin olduğu ($r^2_{\text{erkekler}}= 0.946$ ve $r^2_{\text{dişiler}}= 0.704$) saptandı. Bununla birlikte, regresyon analizlerinden erkek kerevitlerde pozitif allometrik bir büyümeyi, dişilerde ise negatif allometrik bir büyümenin olduğu tespit edildi (eğim $_{\text{erkekler}}= 3,018$ ve eğim $_{\text{dişiler}}= 2,338$). Dişilerin erkeklere göre abdomenlerinin istatistiksel olarak önemli derecede geniş olduğu ($P < 0.05$), erkeklerin ise dişilere göre kısa genişliğinin ve kısa ile kısa ayaklarının istatistiksel olarak önemli derecede uzun olduğu saptandı ($P < 0.05$). Sonuç olarak, *A. leptodactylus* türü kerevitlerin bu bölgede zaman içerisinde populasyonlarındaki artışla birlikte ülke ve yöre ekonomisine katkıda bulunacağı düşünülmektedir.

Anahtar Kelimeler: *Astacus leptodactylus*, Kerevit avcılığı, Pinter, Pertek Bölgesi

1. Introduction

Freshwater crayfish has had an economic importance in Turkish aquatic food market. Naturally, it is widely distributed in plenty of Turkish lakes. However, Turkish freshwater crayfish production was 5000 tonnes in 1980s, the total production of freshwater crayfish decreased due to crayfish plague (*Aphanomyces astaci*) [6]. Recently, there has been an increase, gradually. In 1990s, the annual crayfish production was between 300 and 500 tonnes. In 2011, crayfish production in Turkish freshwater was 1681 tonnes. 609.6 tonnes crayfish were caught from Turkish freshwater [5, 20].

Naturally, crayfish is inhabited in plenty of Turkish freshwater. The most important freshwater sources for crayfish in Turkey are Eğirdir, Beyşehir, Akşehir, Eber, Çivril, Apolyont and Manyas Lakes [10]. Because of crayfish plague and its economic importance, crayfish was transferred in to different Turkish freshwater [14]. 16 fisheries cooperatives get into the act in 16 different regions of Keban Dam Lake [2, 3]. Crayfish is caught commercially in Ağın, Çemizşgezek and Kemaliye Regions of Keban Dam Lake. There is no commercially crayfish catching in the Pertek Region of Keban Dam Lake (Fig. 1).

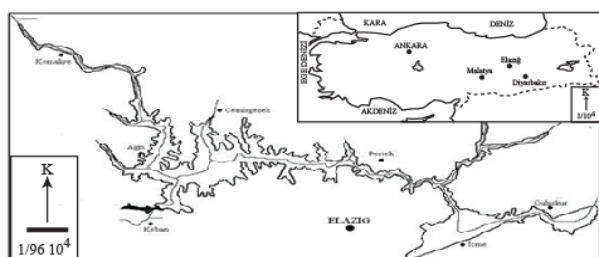


Figure 1. Research area

The main goal of this study was determination of the present situation of crayfish population in the region and its some biological characteristics. Also, meat yield of crayfish in gender was given. By this study, the investigation of whether the crayfish population is suitable for commercial catching in the region or not was aimed.

2. Material and Methods

This study was carried out between November 2009 and March 2010 in Pertek Region of Keban Dam Lake (38°49'271" N - 39°17'057" E). Fifty multi-filament fyke nets were used for catching. The mesh size of fyke nets was 18 mm and they were in D form (input form of fyke net). Fyke nets were checked and crayfish harvested and they were set again in the water on 3rd, 7th and 10th days monthly. This study was not caught 3rd, 7th days crayfish (*Astacus leptodactylus*).

This study was carried out the remaining 10 days in water fyke net. This study was carried out one monthly. Catch per unit effort (CPUE) was determined crayfish number/fyke net/number of trial. Caught crayfish was transferred to Fırat University Laboratory. Total weight was measured (W) to the nearest 0.1 g. Carapase length (CL), carapase width (CW), abdomen width (AW), abdomen length (AL), total length (TL), chelae width (ChW), chelae length (ChL) and the differences between male and female bodies were measured by stick. Obtained data was recorded on the tables that were prepared before [1, 13-18]. The relation between length and weight was analyzed with $\log y = \log (a) + b \log (x)$. r^2 values were obtained from regression analysis. b values were used for the determination of growth type ($b > 3$ shows positive allometric growth and $b < 3$ shows negative allometric growth) [4, 13].

The meat yield was investigated in genders. SPSS 15 statistic program was used for statistical analyzes.

3. Results

Pertek Region of Keban Dam Lake Caught number of crayfish in months was given (Table 1).

The sex ratio was 0.42 (female/male). The most efficiently catching was in November (20 crayfish) and the least efficiently catching was in March (4 crayfish).

Table 1. Number of samples in months

Months	♀+♂	♀	♂	♀/♂
July	5	1	4	0.25
August	7	2	5	0.4
September	11	5	6	0.83
October	15	6	9	0.66
November	20	6	14	0.42
December	13	3	10	0.3
January	9	2	7	0.28
February	6	2	4	0.5
March	4	0	4	0
Total	90	27	63	0.42

This study was determined catch per unit effort (CPUE) was 0.2 number/fyke net/ number trial. The comparison of caught crayfish (males and females) and their statistical relationship were showed (Table 2).

A linear relationship between carapace length and weight was investigated ($r^2_{\text{male}}=0.946$, $r^2_{\text{female}}= 0.704$). The formulas of length-weight relationship for both sexes were obtained (Figure 2).

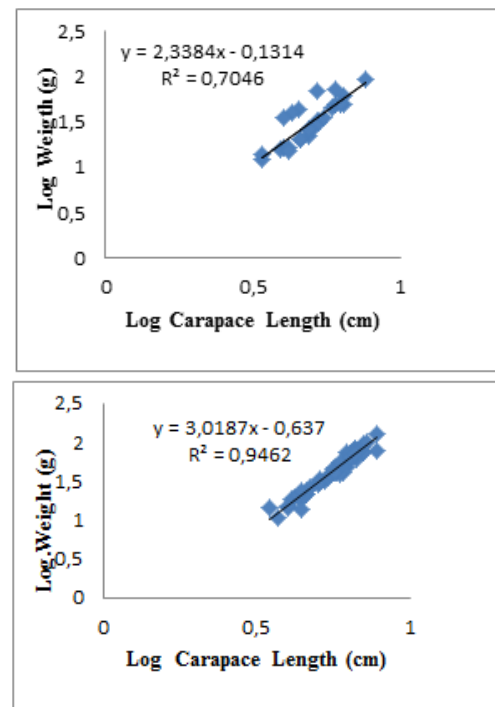

Figure2. The carapace length-weight relationship in female (a) male (b) of crayfish.

Table 2. The comparison of body lengths of male and female crayfish, and statistical significance levels of differences between them

Body Lengths	Number of specimens (N)	Average (mm)	Standard Deviation	Statistical Significance
Carapace Width				
Males	63	28.31	1.99	P > 0.05
Females	27	26.51	2.11	
Abdomen Length				
Males	63	55.31	4.56	P > 0.05
Females	27	57.29	4,67	
Abdomen Width				
Males	63	21.07	2.12	P > 0.05
Females	27	22.44	3.76	
Total Length				
Males	63	112.93	11.29	P > 0.05
Females	27	100.38	10.62	
Chalea Length				
Males	63	43.62	5.92	P < 0.05
Females	27	31.96	5.31	
Chalea Width				
Males	63	17.88	2.10	P < 0.05
Females	27	12.65	1.31	
Chalea Feet Length				
Males	63	94.62	13.2	P < 0.05
Females	27	68.96	8.23	

$\log y_{\text{female}} = \log (-0131) + 2.338 \log (x)$, $y_{\text{male}} = \log (-0.637) + 3.018 \log (x)$. According to the b values, male crayfish showed a positive allometric growth ($b=3.018$) and female crayfish

showed a negative allometric growth ($b=2.338$). The mean weight for male and female crayfish were 50.323 g (SD= 4.345), 35.828 g (SD= 4.131), respectively. It was determined that

abdomen of females was statistically wider than male's abdomen ($p<0.05$). On the other hand, chelae width and chelae length for males were statistically higher than females ($p<0.05$). Length frequency belongs to total of 90 crayfish (63 male, 27 female) was given (Table 3).

Table 3. According to legal catching length of crayfish finding frequency

TL (mm) ≤ 100	Frequency (N)	TL (mm) > 100	Frequency (N)
50-55	0	101-103	2
56-61	0	104-109	4
62-67	0	110-115	8
68-73	0	116-121	5
74-79	6	122-127	8
80-85	2	128-133	5
86-91	5	134-139	7
92-97	6	140-145	8
98-100	2	146-151	10
		152-157	5
		158-163	7

The legal length for freshwater crayfish is 100 mm [16, 20-21]. This study was determined 76.6 % of samples total length were higher than 100 mm, 24.4 % of samples total length were lower than 100 mm.

4. Discussion and Conclusion

Freshwater crayfish is not natural species for Keban Dam Lake; however, it was transferred to Ağın Region of the Keban Dam Lake. It has adapted to Keban Dam Lake and spreaded. It was caught commercially in the Ağın Region and after that it was started to catch in Çemişgezek and Kemaliye Regions. Although it has an economic importance for fishermen in Keban Dam Lake, there is no scientific survey on catching crayfish.

The obtained sex ratio from the present study showed similarities with previous studies. Our sex ratio result was 0.42/1.00 (female/male). According to Bolat [6], the sex ratio of crayfish in Eğirdir Lake was 0.60/1. Duman and Pala [7], determined the rates of female and male crayfish were 40.78%, 59.22% respectively in Keban Dam Lake. Harlioğlu [13], reported the female and rates 53.77, 46.23 respectively in Ağın Region of Keban Dam Lake. Yüksel and Duman [22], stated the sex ratio of crayfish 0.81 (female/male) in Keban Dam Lake.

Harlioğlu [13], reported the carapace length between 46- 58 mm, and mean weight of female crayfish 29.02 ± 6.09 g and male crayfish 34.90 ± 6.77 g. In the present study, we determined the carapace lengths for males were 35- 78 mm and for females were 34- 76 mm, the mean weight of female 35.82 ± 5.76 g and male 50.32 ± 4.34 g.

Bolat [6], stated that 73.83 % of the crayfish population in Eğirdir Lake was longer than legal catching length (100 mm). This rate was figured out 76.6 % in Pertek Region.

In Pertek Region, total length of crayfish for males was 74-152 mm, for females was 72-157 mm and abdomen lengths for males were 37- 74 mm and for females were 38- 81 mm. The mean total length for males and females was 112 ± 1.94 mm and 103.85 ± 2.15 mm. The mean carapace length for males was 57.5 ± 1.03 mm and for females was 50.03 ± 1.06 mm. The carapace length/ total length rate for males was 0.509 and for females was 0.482. The total and mean weight for males and females 10.9- 128.7, 12.1- 91.4 and 50.32 ± 4.34 g, 35.82 ± 5.76 were given respectively. There was no difference of total length between males and females; however, males were weightier than females because of having bigger chelae. Same result was reported in a previous study in Ağın Region of Keban Dam Lake. On the other hand in the same study was reported that in the reproduction season females were weightier than males due to carrying eggs [13].

$\log y_{\text{female}} = \log (-0.131) + 2.338 \log(x)$,
 $y_{\text{male}} = \log (-0.637) + 3.018 \log(x)$. According to the b values, male crayfish showed a positive allometric growth ($b=3.018$, $r^2= 0.946$) and female crayfish showed a negative allometric growth ($b=2.338$, $r^2= 0.704$).

These results showed similarities with Harlioğlu [13], Yüksel and Duman [22], Barım [4], Duman and Pala [7], had different results on the growth type of crayfish in different regions of Keban Dam Lake. Duman and Pala [7], reported positive allometric growth for both sexes of crayfish ($b_{\text{males}}= 3.3772$ and $b_{\text{females}}= 3.0187$). The differences of b values among these studies can be due to the differences of sampling region, sample size and sampling time.

In the present study, the percent of meat yield from abdomen for males was 14.60 % and for females was 15.71 %. The meat yield rate of abdomen for females was higher than males. On the other hand meat yield of chelae for males (7.53 %) higher than females (5.16%). There are some studies that were conducted in different regions of Keban Dam Lake about the meat yield of crayfish.

Harlioğlu [13], stated that for male crayfish average meat yield of abdomen was 3.723 ± 0.753 g and the chelae meat yield was 1.805 ± 0.654 g, for female crayfish meat yield of abdomen was 3.471 ± 0.549 g and the meat yield of chelae was 0.893 ± 0.572 g. Gürel and Patır [11], recorded that the meat yield of abdomen for males was $11.18 \pm 2.67\%$ and for females was $14.22 \pm 2.32\%$. Also, the chelae meat yield for males was $7.20 \pm 2.01\%$ and for females was $3.31 \pm 1.10\%$.

Barım [4], posited meat yield of the abdomen and chelae for males and females 15.58 %, 14.93 %, 2.89% and 1.32% respectively.

Gürel İnanlı and Emir Çoban [12] investigated total meat yield of crayfish males and females $21.02 \pm 2.72\%$ and $21.42 \pm 3.60\%$. Additionally, in the same study the meat yield of abdomen for males and females, the meat yield of chelae for males and females $14.6 \pm 0.704\%$ and $15.71 \pm 0.631\%$, $7.53 \pm 0.506\%$ and $5.16 \pm 0.426\%$ were given, respectively.

In the present study, catching properties, some biological characteristics and meat yield rate of freshwater crayfish *A. leptodactylus* were given. It can strongly said that population of crayfish in the region is not sufficient for commercially catching; however, it will be able to supply an important economic benefit by getting increase in the future.

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