

Determination of the Conchological Features of *Unio elongatulus eucirrus* (Bourguignat, 1860) (Mollusca: Bivalvia) Living in Karakaya Dam Lake

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Abstract

In this study, depending on the weight shell length, shell height and shell width as conchological properties were investigated of freshwater mussels (*Unio elongatulus eucirrus* Bourguignat 1860) collected from Karakaya Dam Lake. It has been found that the age distribution of *Unio elongatulus eucirrus* in range of II to VI. It was recorded on average weight 67.54±22.82 g, shell length of 78.49±9.11 mm, shell height 38.73±4.75 mm and shell width 31.60±4.61 mm as of all mussels analyzed during the study. Also it has been examined correlation between shell length-weight, shell height-weight and shell width-weight. Accordingly, it was determined relationship between weight with conchological properties of that were shell length=0.0003*^{2.839} (r=0.944), shell height=0.0116*^{2.3586} (r=0.841), shell width=0.2869*^{1.5684} (r=0.615) respectively. It was found that an allometric relationship between shell length, shell height and shell width depending on the weight.

Keywords: *Bivalvia*, conchometric, Karakaya Dam Lake, *Unio elongatulus eucirrus*

Karakaya Baraj Gölü'ndeki Tatlı Su Midyesi (*Unio elongatulus eucirrus* Bourguignat 1860)'nin Bazı Konkolojik Özelliklerinin Belirlenmesi

Özet

Bu çalışmada, Karakaya Baraj Gölü'nden toplanan tatlı su midyesi (*Unio elongatulus eucirrus* Bourguignat 1860)'nin ağırlığa bağlı olarak kabuk uzunluğu, kabuk yüksekliği ve kabuk genişliği gibi konkometrik özellikleri incelendi. *Unio elongatulus eucirrus*'un yaş dağılımı II-VI arasında değişim göstermiştir. Çalışma süresince incelenen midyelerin tamamının ortalama ağırlığı 67.54±22.82 g, ortalama kabuk uzunluğu 78.49±9.11 mm, ortalama kabuk yüksekliği 38.73±4.75 mm ve ortalama kabuk genişliği 31.60±4.61 mm olarak kaydedildi. Ayrıca, kabuk uzunluğu-ağırlık, kabuk yüksekliği-ağırlık ve kabuk genişliği-ağırlık arasındaki korelasyon incelenmiş olup buna göre, kabuk uzunluğu- ağırlık arasındaki ilişki Kabuk uzunluğu=0.0003*^{2.839} (r=0.944), kabuk yüksekliği-ağırlık arasındaki ilişki Kabuk yüksekliği=0.0116*^{2.3586} (r=0.841), kabuk genişliği- ağırlık arasındaki ilişki ise Kabuk genişliği=0.2869*^{1.5684} (r=0.615) olarak tespit edildi. Ağırlığa bağlı kabuk uzunluğu, kabuk yüksekliği ve kabuk genişliği arasında allometrik bir ilişkinin olduğu belirlendi.

Anahtar Kelimeler: *Bivalvia*, konkometrik, Karakaya Baraj Gölü, *Unio elongatulus eucirrus*

INTRODUCTION

Although the consumption of freshwater mussels is not very common in our country, it is a high nutritional water product with an average protein value of 41% and an oil value of 6% (Başçınar et al., 2003; Şereflişan, 2003). In addition, the mussels are also a major contributor to filtration of pollutants in the aquatic environment and to increase water quality. With the presence of toxic chemicals in their shells

and tissues, they have great roles in reflecting the environmental quality of water basins and they have great ecological importance (Şahin et al., 2016; Yalçın, 2006). The geographical distribution of freshwater mussels in Turkey is divided into four groups, mostly in Turkey's west showing species distribution (2 Union spp. and 1 Anadont sp.), Turkey's southwest, from Antalya to Hatay, especially the Asi River, Amik Lake and species distributed in

Cukurova (3 *Potomida* spp., 4 *Unio* spp., 2 *Leguminaia* spp. and 1 *Gabillotia* sp.), species (2 *Unio* spp., 1 *Pseudodontopsis* sp., 1 *Legumina* sp. and 1 *Sinanodonta* sp.) were distributed in the upper part of the South Anatolian and Euphrates River, species (3 *Unio* spp., 1 *Pseudoanodonta* sp. and 4 *Anodonta* spp.) were distributed from the west of the Sakarya River to the east of Turkey (Çetinkaya, 1996; İşcan and Şereflisan, 2014). In this study, important mussel species *Unio elongatulus eucirrus* were examined and this species collected from Karakaya Dam Lake and in the upper part of Euphrates River.

MATERIAL AND METHOD

Study area

This study was carried out in the Karakaya Dam Lake. The dam was built on the Euphrates River within the boundaries of Çungus District of Diyarbakır Province as part of the Southeastern Anatolia Project, it was built to produce electricity. The dam volume is 2.000.000 m³, the capacity of the lake at normal water level is 9.580.00 hm³, and the lake area at normal water level is 268.00 km². The dam provides 102 hm³ drinking and tap water per year (Küçükyılmaz et al., 2010). The study area is shown in Figure 1.

Between March and April 2015, 47 freshwater mussels (*Unio elongatulus eucirrus* Bourguignat 1860) were collected from three different stations, Battalgazi, Arguvan and Doğanyol of Karakaya Dam Lake. Mussels were gathered with fishing nets and buckets from depths between 3-5 m.

The concretometric measurements of each of the freshwater mussels transported to the laboratory were determined.

The shell length, shell height and shell width were measured with the aid of a caliper with a precision of 0.01 mm (Figure 2) while the weights were determined with 0.001 g precision balance. The age of the *Unio elongatulus eucirrus* individuals were determined using the growth rings. In this study, the relationship between shell length-weight, shell width-weight, crust height-weight were determined by the formulas $KU = a * Ab$, $KG = a * Ab$ and $KY = a * Ab$ in mussel samples.

Where, A: Weight, a and b coefficients the values were calculated according to the least squares method (Schaperclaus, 1967; Lagler, 1969). In addition, the physicochemical parameters of water samples were measured taken from three different stations, Battalgazi, Arguvan and Doganyol, of Karakaya Dam Lake.

The position in systematic categories of species is given as follows (Çağlar, 1974; Demirsoy, 1999; URL- 1).

Phylum: Mollusca

Classis: Bivalvia

Familia: Unionidae

Genus: *Unio*

Species: *elongatulus*

Subspecies: *eucirrus*

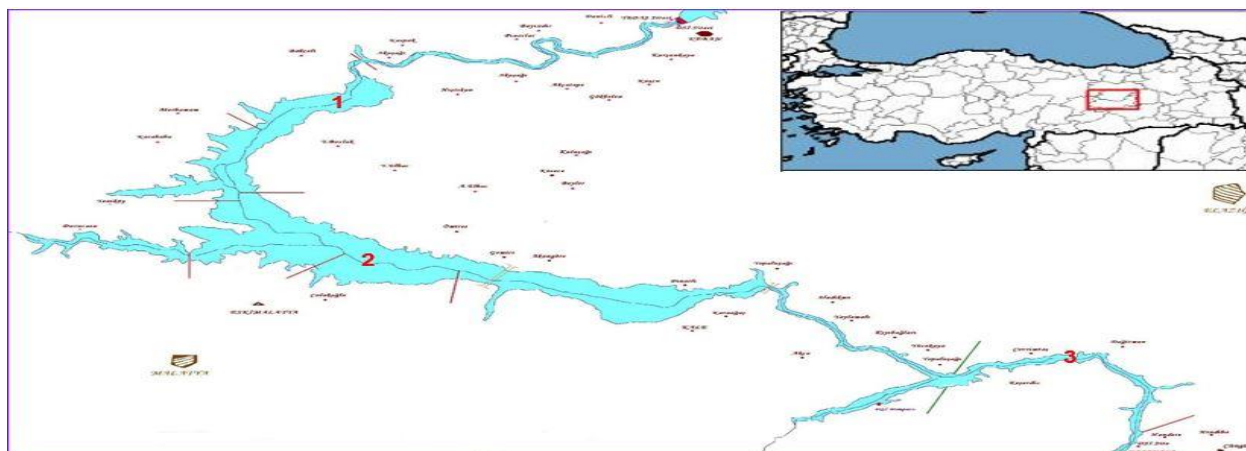


Figure 1. Map of work area

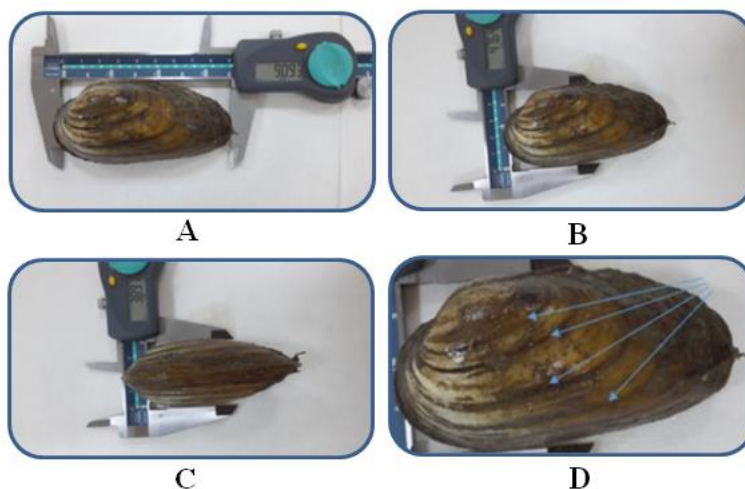


Figure 2. Shell length (A), Shell width (B), Shell height (C) and Age rings (D) of *Unio elongatulus eucirrus*

RESULTS

The mussel samples are collected in the study were firstly identified. They were determined belonging to the maximum age group III. Then the weights of each of the mussels were measured on a precision scale.

The average weight value of all mussel samples was found to be 67.54 ± 22.82 g. It has been determined that at the end of the weighing process, age increase is directly proportional to weight.

The mean shell length, shell height, and shell width were measured as 78.49 ± 9.11 mm, 38.73 ± 4.75 mm and 31.60 ± 4.61 mm, respectively (Table 1).

The relationship between crust length-weight, crust height-weight and crust width-weight of mussel samples collected in the study was determined by regression analysis and positive correlation was observed between the values.

At the end of the study, the relationship between shell length and weight was $KU = 0.0003 * 2.839$ ($r = 0.944$) the relationship between shell height and weight was $KY = 0.0116 * 2.3586$ ($r = 0.841$) $0.2869 * 1.5684$ ($r = 0.615$). It was determined that there is an allometric relationship between the shell length, shell height and shell width depending on the weight (Figure 3-5).

Table 1. Average weight and concretometric measurement values of *Unio elongatulus eucirrus* according to age groups

Age (Year)	Number of samples (n)	Mean weight \pm SD	Mean Shell length \pm SD	Mean Shell height \pm SD	Mean Shell width \pm SD
II	5	34.19 \pm 2.00	63.22 \pm 1.98	31.48 \pm 2.30	24.17 \pm 8.66
III	18	57.63 \pm 16.56	74.88 \pm 5.84	36.53 \pm 3.67	29.69 \pm 2.39
IV	16	73.19 \pm 13.94	82.37 \pm 6.42	39.51 \pm 3.50	32.39 \pm 3.91
V	7	97.60 \pm 6.95	88.17 \pm 2.89	45.31 \pm 0.96	35.75 \pm 1.65
VI	1	111.88 \pm 0	92.16 \pm 0	46.01 \pm 0	37.19 \pm 0
Total	47	67.54 \pm 22.82	78.49 \pm 9.11	38.73 \pm 4.75	31.60 \pm 4.61

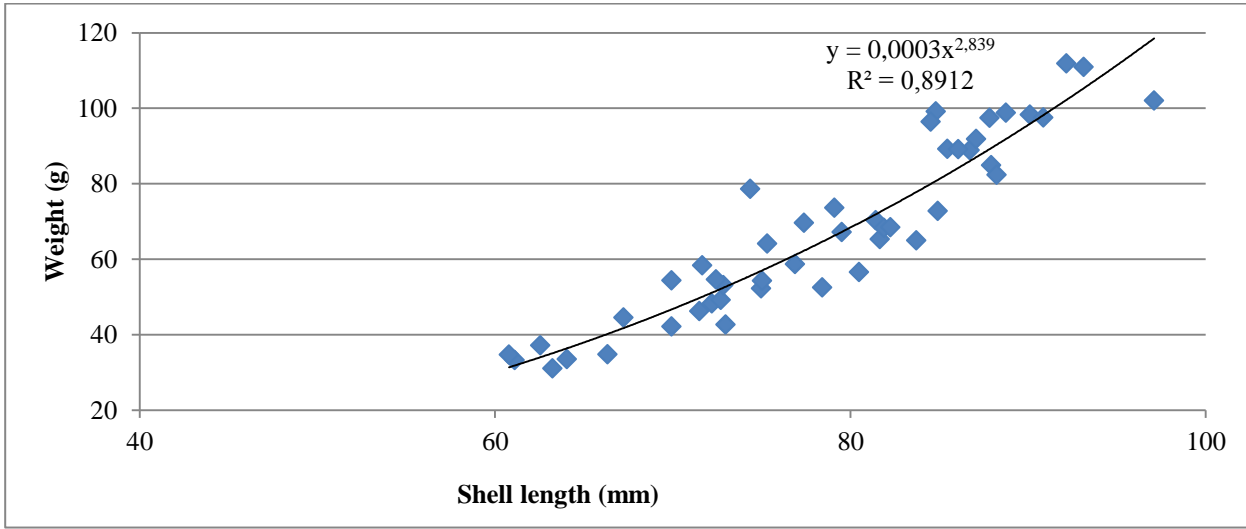


Figure 3. Relationship between weight and shell length of *Unio elongatulus eucirrus*

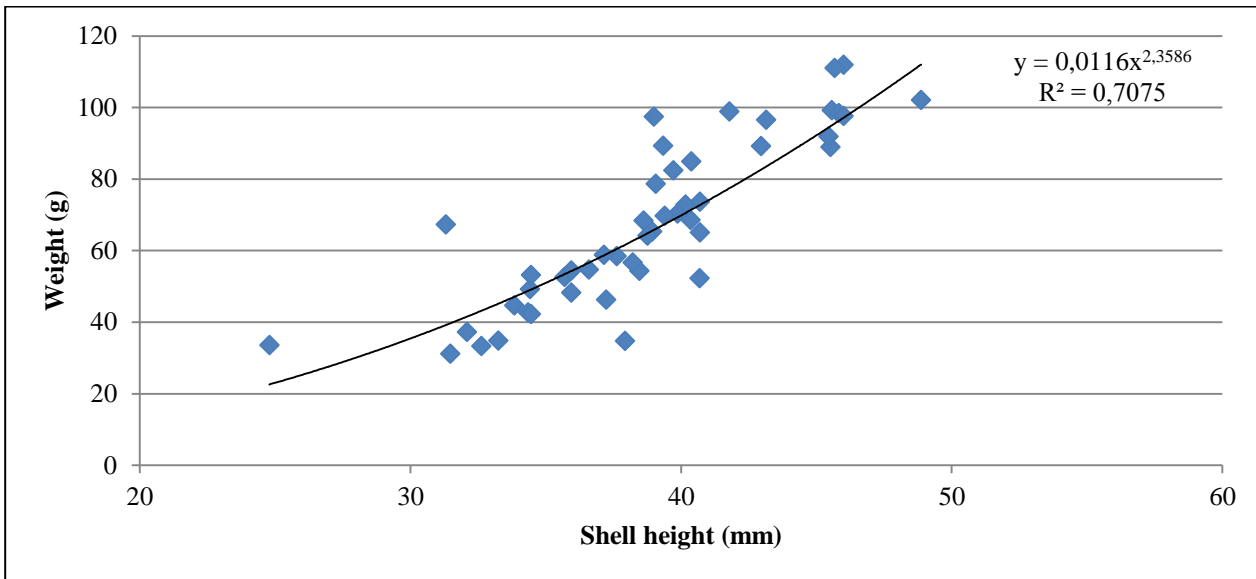


Figure 4. Relationship between weight and shell width of *Unio elongatulus eucirrus*

Table 2. Physical measurement values of water belonging to work stations

Station	pH	Conductivity ($\mu\text{S cm}^{-1}$)	Temperature ($^{\circ}\text{C}$)	Dissolved Oxygen (mg L^{-1})	OD2 Saturation (%)	Secchi Disk (m)
Battalgazi	8.56	294	10.4	10.9	115.1	0.5
Arguvan	8.03	278	9.4	10.3	90.3	1.9
Doğanyol	8.48	289	12.6	11.7	110.2	1.4

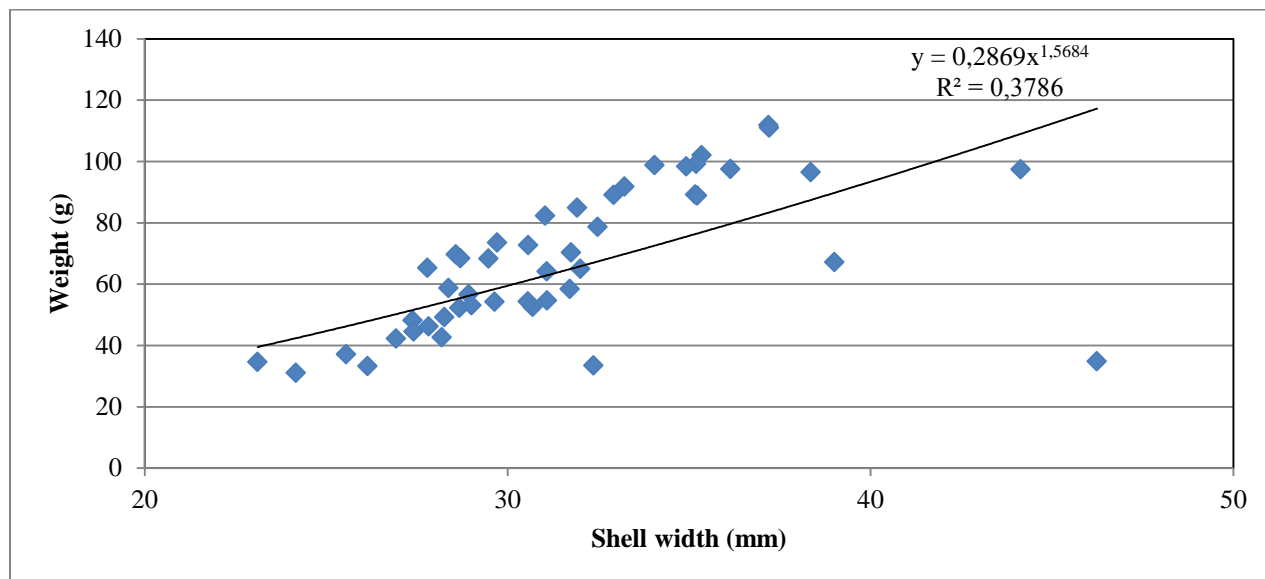


Figure 5. Relationship between weight and shell length of *Unio elongatulus eucirrus*

Table 3. Chemical measurement values of water belonging to work stations

Cation-Anion Values (ppm)	Battalgazi	Arguvan	Doğanyol
Lithium	0.0099	0.0061	0.0050
Sodium	22.5712	18.4420	24.1399
Ammonium	0.0047	0.0509	0.0324
Potassium	2.0399	1.7648	2.1474
Magnesium	16.8303	15.5846	16.7308
Calcium	42.5913	44.3931	40.1516
Fluoride	0.1277	0.1245	0.1627
Chloride	22.4252	16.7438	23.2587
Nitrite-Nitrogen	0.0073	0.0144	0.0090
Bromide	0.0302	0.0189	0.0289
Nitrate-Nitrogen	0.8054	1.4063	0.1178
Phosphate	0.0364	0.0602	0.0354
Sulfate	49.3729	40.7739	48.3825
Alkaline (mg CaCO ₃ L ⁻¹)	8.0995	8.3045	7.9970

Physicochemical measurements of water samples taken from the Battalgazi, Arguvan and Doğanyol sampling stations of Karakaya Dam Lake were also determined and shown in Table 2 and Table 3.

DISCUSSION

In this study, age range of *Unio elongatulus eucirrus* collected from Karakaya Dam Lake was

determined and it is between II-VI. According to the concretometric measurements of the minimum and maximum values range of mussels the shell length is 60.78-97.09 mm, the shell height is 24.79-48.87 mm and the shell width is 23.11-46.24 mm. The weights are between 31.08-111.88 g. In addition, the relation between shell length-weight, shell height-weight and shell width-weight of collected mussel samples was

determined by regression analysis and positive correlation was observed between the values. At the end of the study, the relationship between shell length and weight $KU= 0.0003 * 2.839^x$ ($r = 0.944$), the shell height and weight $KY= 0.0116 * 2.3586^x$ ($r = 0.841$) and the shell width and weight $KG= 0.2869 * 1.5684^x$ ($r= 0.615$) were determined respectively. It has been identified that there is an allometric relationship between the shell length, shell height and shell width depending on the weight. In different studies, Dörücü and Şeker (2002) found that the average length changes in *Unio elogatulus eucirrus* in Keban Dam Lake (Elazığ) were between 0 and VI age group, mean height values between 19.40 mm and 40.50 mm average live weight values of 38.33 g and 85.5 g were reported. Kara (2004), studied the biological properties of *Unio pictorum*. which lived in Lake Gavur and found that the age distribution of *Unio pictorum* varied between II-IX. In the *Unio pictorum* II age group. the average length was 38.291 mm, while the mean shell weights were 4.234 g. For the individuals in the IX age group, the average length was determined as 81.195 mm and the average shell weights as 32.303 g. Length-shell weight relation, $W = 0.0022L2.1045$ ($r= 0.8679$). length-width relationship. $GEN= 2.4397L1.0444$ ($r= 0.8827$). He noted that there is a linear relationship between length-shell weight and allometric height-width. Gürlek et al. (2014) *Unio terminalis* in Adıyaman Azaplı Lake has found shell length of 93.24 mm, shell height of 47.75 mm, shell width of 33.96 mm, weights of 101.78 g and mean age of 12. In addition, they examined the correlation between shell length-age, shell height-age and shell width-age and the relationship between shell length-age was $KU= 45.857 * x^r$ ($r= 0.815$), the shell height-age was $KY= 27.165 * x^r$ ($r= 0.710$) and the shell width and age was $KG= 19.189 * x^r$ ($r= 0.7441$). Yalçın (2006), The effect of environmental factors on the growth. condition and biochemical parameters of *Unio pictorum* a freshwater mussel collected from Karasu Stream of Sinop for this reason water temperature, oxygen, pH, turbidity, chlorophyll-a, suspended substances are measured by making measurements. The mean value of temperature was determined as 16.28 °C throughout the year, the highest value of dissolved oxygen as 12.37, the pH value as 6.83 and the monthly variability as 795 ntu maximum.

Demircan (2007). The white sand nest, hunted from the western Black Sea region examined the biometric characteristics of *Chamelea gallina*. The average height was found to be 19.35 mm in all the examined individuals. Total weights were found to be 2.187 g. mean height of 17.70 mm and thickness of 9.180 mm. The relationship between 'height-width', 'height-thickness', 'total weight-meat weight' values of *C. gallina* is directly proportional and there is an exponential relationship between 'height-total weight' and 'height-meat weight'. The regression analysis performed a correlation analysis to determine the direction and power of the relationship between the variables and found that the correlation coefficient was between 0.66-0.92. They found a positive and significant relationship between the variables. Water quality; It affects the composition of the species, fertility, abundance and physiological status of aquatic species. Dam reservoirs are affected firstly by environmental pollution because they continuously show the characteristics of receiving environment. This pollution does not only affect the living organisms in the negative, this negative effect reaches human beings through food chain (Yılmaz, 2004; Anonymous, 2015). According to the regulation on water quality parameters, water values in three different stations are generally in the first class. It has been seen that this class of water is suitable water for the life of the mids.

As a result due to their biological properties, freshwater mussels have a great potential in the industry, particularly in the areas of risk of pollution as well as in the living environments and nutrients of fish as well as their shells. It has been found that the same types of mussels obtained from different lakes have different morphometric measurement values. In this study, age distribution and biometric values were determined of *Unio elogatulus eucirrus*. freshwater mussel collected from Karakaya Dam Lake. In future work it was possible to compare this population with populations in different localities.

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