Sustainable Aquatic Research (2022) 1(3):165-170
DOI: 10.5281/zenodo.7409025
e-ISSN: 2822-4140

SUSTAINABLE AQUATIC RESEARCH
www.saquares.com

RESEARCH PAPER

A multivariate study on the biometric parameters of *Unio pictorum* (Linnaeus, 1758) in Demirköprü Dam Lake, Turkey

Filiz Kutluyer Kocabaş[1*], Mehmet Kocabaş[2], Ayşe Akça[3]

[1*] *Munzur University, Fisheries Faculty, Tunceli, Turkey.*

[2]*Karadeniz Technical University, Faculty of Forestry, Department of Wildlife and Fisheries, Trabzon, Turkey,*

[3]*Muğla Sıtkı Koçman University, Kavaklıdere Şehit Mustafa Alper Vocational School, Muğla, Turkey.*

Citation

Kutluyer Kocabas, F., Kocabas, M. & Akca, A. (2022). A multivariate study on the biometric parameters of *Unio pictorum* (Linnaeus, 1758) in Demirköprü Dam Lake, Turkey. *Sustainable Aquatic Research, 1*(3), 165-170.

Article History

Received: 17 June 2022
Received in revised form: 19 November 2022
Accepted: 20 November 2022
Available online: 24 December 2022

Corresponding Author

Filiz Kutluyer Kocabaş
E-mail: filizkutluyer@hotmail.com
Tel: +90 5544078065

Keywords

Unio pictorum
Freshwater mussel
Demirköprü Dam Lake
Biometric

Abstract

The study focused on the assessment of some morphometric characteristics in freshwater mussel *Unio pictorum* (Linnaeus, 1758) from Demirköprü Dam Lake, Manisa province, Turkey. Shell length (SL) (mm), shell width (SW) (mm), shell height (SH) (mm) and weight (W) (g) were measured in individual. A multivariate statistical evaluation was performed to determine morphological relationships. Mean of SL, SW, SH and W of *U. pictorum* were determined as 64.92±9.46 mm, 32.32±4.66 mm, 23.88±3.96 mm and 31.40±13.92 mm, respectively. Principal components analysis (PCA) indicated a strong relationship between SL, SW and W.

Introduction

In aquatic ecosystems, freshwater molluscs have a key component role and they are consumed by many fish species and vertebrates. In addition, they have an importance economically and medicinally. Humans use mussels in different ways (e.g. food, jewellery, tools, pets). Moreover, they play significant role in veterinary and public health. Turkey has a rich flora and fauna in terms of Bivalvia species as a result of topographical, hydrographic and climatological developments (Altun et al., 2016; Hacisalihoğlu et al., 2017). Due to their filtration abilities, freshwater mussels play an important role in improving water quality (Coşkun et al., 2019). The order Unioniformes includes freshwater mussels and 800 species (Bogan, 2008; Yılmaz and Barlas, 2016) and *Unio pictorum* is one of these species. In the *U. pictorum* species, the shell is convex, elongated elliptical and greenish yellow in color. Its larvae are called glochidium and need fish as hosts to

complete their development. *U. pictorum* uses the gills of *Rhodeus sericeus amarus* as a host (Demirci Demirbaş, 2016). Kocabaş and Kutluyer Kocabaş (2022) reported first record and some biometric parameters of *Unio pictorum* (Millet, 1813) from Demirköprü Dam Lake. In this study, the relationships and differences between species and morphometric characteristics of the samples from different stations were determined with different strategies of multivariate analysis of morphometric characteristics for interpretation a data base in freshwater mussel *U. pictorum* from Demirköprü Dam Lake.

Materials and Methods

The representative samples were obtained at three sites (38° 39’ 40” N-28° 23’ 29” E, 38° 40’ 38” N-28° 23’ 55” E, 38° 40’ 47” N-28° 21’ 40” E). A total of 37 freshwater mussels (*U. pictorum*) were collected from the wild population (July, 2022) and washed for elimination of encrusted organisms. The shell width (SW) (mm), shell length (SL) (mm), shell height (SH) (Figure 1) and weight (W) (g) were measured using calipers (Figure 2) and precision balances in *U. pictorum* (n: 37).

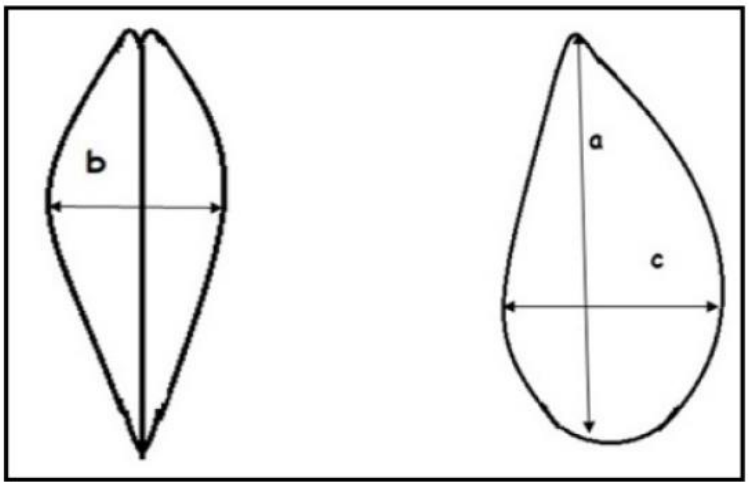

Figure 1. a: shell length, b: shell height c: shell width (Akkuş et al., 2019).

Figure 2. The measurements of freshwater mussels (*U. pictorum*)

A multivariate statistical evaluation and Principal Component Analyses (PCA) were performed to determine morphological relationships with Statgraphics Centurion XV1 (16th version, Virginia, USA) using Kaiser-Meyer-Olkin's measure of sampling adequacy (KMO) was used to validate the usefulness of PCA. The KMO ranges from 0 to 1 and should be above 0.5 if the variables are highly dependent on each other and PCA is beneficial. Also, Bartlett's test measurement was applied to validate the usefulness of PCA. If the data are significant ($p < 0.001$), PCA is useful and the variables are highly interdependent.

Results

Mean of SL, SW, SH and W of *U. pictorum* were determined as 64.92±9.46 mm, 32.32±4.66 mm, 23.88±3.96 mm and 31.40±13.92, respectively. According to PCA, there was a strong relationship between SL, SW and W (Figure 3). It was determined that there is a strong correlation between shell length-shell width, shell length-weight, shell width-weight and shell height-weight (Table 1, Figure 4).

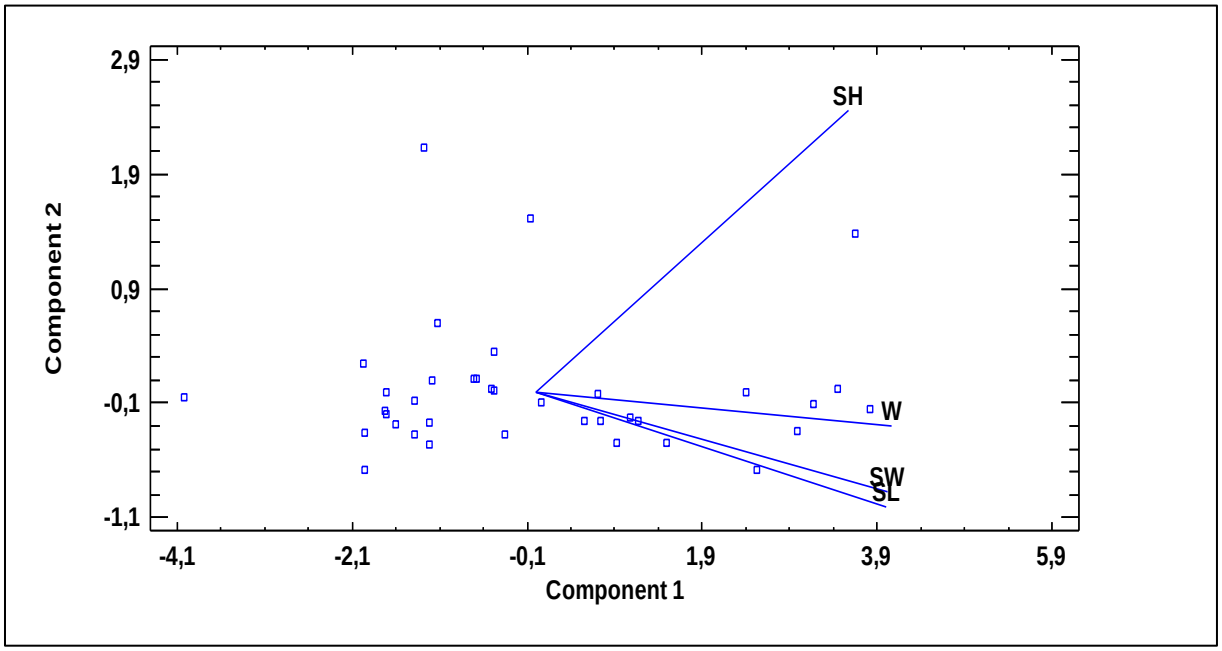

Figure 3. Principal components analysis of variables [Shell length (SL), Shell width (SW), Shell height (SH), Weight (W)]

Table 1. Correlation matrix among the parameters measured for *U. pictorum.*

	SH	SL	SW	W
SH		0,7359	0,7534	0,8169
		-37	-37	-37
		0	0	0
SL	0,7359		0,9692	0,9599
	-37		-37	-37
	0		0	0
SW	0,7534	0,9692		0,9594
	-37	-37		-37
	0	0		0
W	0,8169	0,9599	0,9594	
	-37	-37	-37	
	0	0	0	

*This table shows Spearman rank correlations between each pair of variables. These correlation coefficients range between -1 and +1 and measure the strength of the association between the variables. In contrast to the more common Pearson correlations, the Spearman coefficients are computed from the ranks of the data values rather than from the values themselves. Consequently, they are less sensitive to outliers than the Pearson coefficients. Also shown in parentheses is the number of pairs of data values used to compute each coefficient. The third number in each location of the table is a P-value which tests the statistical significance of the estimated correlations. P-values below 0.05 indicate statistically significant non-zero correlations at the 95.0% confidence level. The following pairs of variables have P-values below 0.05.

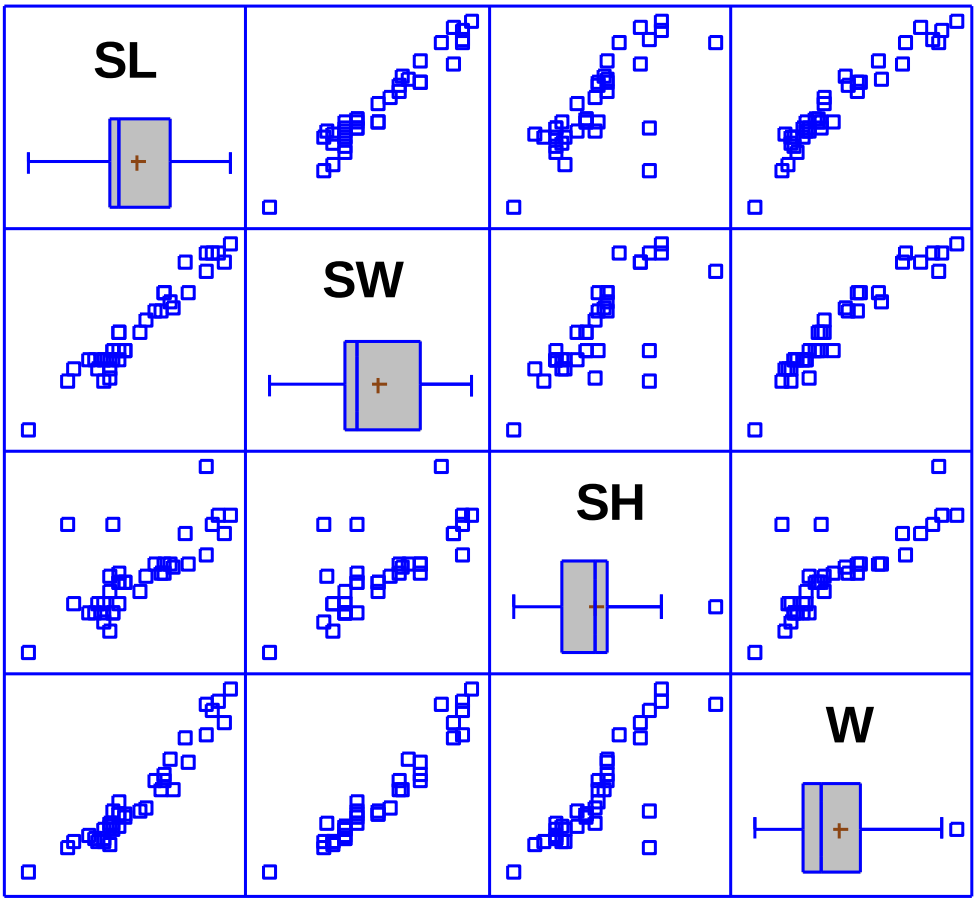

Figure 4. Correlation matrix among the parameters measured for *U. pictorum.*

Discussion

Yalçın (2006) reported the mean weight and the shell length as 50.37±1.89 g and 83.47±1.16 mm for the *U. pictorum*. Keskinbalta (2015) determined the mean shell length, width, height and weight of *U. pictorum* as 55.02±0.16 mm, 27.36±0.08 mm, 18.68±0.67 mm and 20.58±0.27 g, respectively, in their study conducted in the Karasu Stream of Sinop Province. Kutluyer Kocabaş and Kocabaş (2022) reported that the mean shell length of individuals in the *U. pictorum* population is 61.02±7.78 mm (43.02-77.12 mm), shell width 32.01±4.48 mm (22.04-40.11 mm), shell height 17.87±3.43 mm (10.19-26.07 mm) and weight 5.19±0.94 (2.38-7.47 g) and 23.08±2.90 g (17.41-31.39 g). They determined the maximum shell length and weight as 77.12 mm and 31.39 g. In this study, the mean of SL, SW, SH and W of *U. pictorum* were determined as 64.92±9.46 mm (43.17-83.00 mm), 32.32±4.66 mm (22.09-41.00 mm), 23.88±3.96 mm (16.07-35.12 mm) and 31.40±13.92 g (9.30-63.00 g), respectively. The data obtained from this study are similar to previous studies (Yalçın, 2006; Keskinbalta, 2015; Kocabaş and Kutluyer Kocabaş, 2022). A decrease of water level in Demirköprü Dam Lake has adversely affected the living environment of mussels, so it is expected that the weight values will be small as a result of the presence of nutrients and changing water parameters in the environment (Akkuş et al., 2019

Bartlett's test and KMO were used to validate the usefulness of principal components analysis (Principal Component Analysis, PCA). Principal component analysis was useful in summarizing the correlation matrix and Bartlett's test data were found to be significant ($p = 0.000$; $p < .001$). Principal component analysis has been found to be useful and the variables correlated with each other. Kocabaş and Kutluyer Kocabaş (2022) determined that there was a strong correlation between Shell height (KY), Shell width (KG), Shell length (KU) and Weight (A) for *U. pictorum*. Our results are agreed with Kocabaş and Kutluyer Kocabaş (2022).

In conclusion, morphology, and relative proportions are highly influenced by a variety factors. In addition, the relationships between morphometric parameters may change depending on the habitat and physiological conditions that occur especially during the growth, maturation and spawning processes, which affect the shell calcification mechanisms and may cause variation in the shell. *U. pictorum* individuals are useful in preventing eutrophication that may occur due to excessive nutrient salts entering ecosystems, as they feed by filtering the water in the lake. The extinction of this species from the environment may cause an acceleration in its eutrophication and can negatively affect other species in the lake.

Ethical approval

The author declares that this study complies with research and publication ethics.

Data availability statement

The authors declare that data are available from authors upon reasonable request.

Funding organizations

No funding available.

Author Contribution

Filiz Kutluyer Kocabaş*:* Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing-original draft, Review and editing.

Mehmet Kocabaş: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing-original draft, Review and editing.

Ayşe Akça: Investigation

References

Aban, S. M., Argente, F. T., Raguindin, R. S., Garcia, A. C., Ibarra, C. E., & Vera, R. B. D. (2017). Length-weight relationships of the asian green mussel, *Perna viridis* (Linnaeus 1758) (Bivalvia: Mytilidae)

population in Bolinao Bay, Pangasinan, Northern Philippines. *PSU Journal of Natural and Allied Science,* 1(1), 6-7

Altun, L., Kezik, U., Kara, O., & Babur, E. (2016). Potential of water purification of Macka forest ecosystems in northeastern Turkey. *Journal of Environmental Protection and Ecology,* 17(2), 557-565

Akkuş, M., Sari, M., & Arabaci, M. (2019). The first record of zebra mussel in Sarımehmet Dam (VAN) and its possible effects on regional fisheries. *Commagene Journal of Biology,* 3(2), 97-102

Bogan, A. E. (2008). Global Diversity of freshwater mussels (Mollusca, Bivalvia) in freswater. *Hydrobiologia,* 595, 139-147

Coşkun, T., Qaranjiki, A. & Doğankaya, L. (2019). Assessment of some biometric parameters of freshwater mussels (*Unio crassus,* Philipsson, 1788) from the Karasu Stream in Sinop Turkey. *Anatolian Environmental and Animal Sciences,* 4(2), 174-181

Demirci Demirbaş, İ. G. (2016). Büyükçekmece Gölü'ndeki *Unio pictorum* (Linnaeus, 1758) 'un organlarında bazı ağır metallerin mevsimsel analizi. *İstanbul Üniversitesi Fen Bilimleri Enstitüsü, İstanbul, Türkiye.*

Hacisalihoglu, S., Misir, M., Misir, N., Yucesan, Z., Oktan, E., Gumus, S., & Kezik, U. (2017). The effects of land use change on soil loss and carbon stock amounts. *Fresenius Environmental Bulletin,* 26, 6007-6016

Keskinbalta, M. A. (2015). Sinop İli Karasu Çayı'nda bulunan tatlı su midyelerinin (*Unio pictorum*, Linnaeus 1758) bazı biyometrik ve biyokimyasal özellikleri. *Sinop Üniversitesi, Fen Bilimleri Enstitüsü, Sinop,* 57s

Kocabas, M., Kutluyer Kocabaş, F. (2022). The first record of *Dreissena polymorpha* (Pallas, 1771) and *Unio pictorum* (Linnaeus, 1758) in Demirköprü Dam Lake and evaluation of some biometric parameters. *Yüzüncü Yıl Üniversitesi Tarım Bilimleri Dergisi*, 31(4), 1011-1019

Yalçın, M. (2006). Tatlı su midyesi (*Unio pictorum* Linnaeus, 1758)'nin büyüme, kondisyon ve biyokimyasal parametreleri üzerine çevresel faktörlerin etkisi, *Ondokuz Mayıs Üniversitesi Fen Bilimleri Enstitüsü, Samsun, 59s*

Yılmaz, Ö., & Barlas, M., (2016). Dipsiz-Çine Çayı (Aydın)'nda yaşayan tatlısu midyesi *Unio crassus* (Philipsson, 1788) populasyonunun morfometrik özellikleri. *Türk Tarım-Gıda Bilim ve Teknoloji Dergisi,* 4(10), 877-881.