E-ISSN 2602-4292

Istanbul University Center for
Research and Practice in Natural Riches

Turkish Journal of Bioscience and Collections

VOLUME 6 ISSUE 1 YEAR 2022

İSTANBUL UNIVERSITY PRESS

Turkish Journal of Bioscience and Collections
Volume 6, Number 1, 2022
E-ISSN: 2601-4292

Indexing and Abstracting / Dizinler
CAB Abstracts - CABI
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Turkish Journal of Bioscience and Collections
Volume 6, Number 1, 2022
E-ISSN: 2601-4292

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Publisher / Yayıncı
Istanbul University Press / İstanbul Üniversitesi Yayınevi
İstanbul Üniversitesi Merkez Kampüsü, 34452 Beyazıt,
Fatih / İstanbul, Türkiye
Telefon / Phone: +90 (212) 440 00 00

The publication languages of the journal are Turkish and English.
Yayın dili Türkçe ve İngilizce'dir.

This is a scholarly, international, peer-reviewed and open-access journal published biannual times a year in February and August.
Şubat ve Ağustos aylarında, yılda iki sayı olarak yayımlanan uluslararası, hakemli, açık erişimli ve bilimsel bir dergidir.

Publication Type / Yayın Türü
Periodical / Yaygın Süreli

Turkish Journal of Bioscience and Collections
Volume 6, Number 1, 2022
E-ISSN: 2601-4292

Turkish Journal of Bioscience and Collections
Volume 6, Number 1, 2022
E-ISSN: 2601-4292

İSTANBUL UNIVERSITY PRESS

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E-ISSN: 2601-4292

RESEARCH ARTICLE/ARAŞTIRMA MAKALESİ

Fırat ve Dicle Nehirlerinde Yaşayan *Carassius gibelio* (Bloch, 1782) Türünün Aminoasit Profilinin Araştırılması

Arif Parmaksız[1], Necati Eneş[1], Kadir Eği[2], İsmail Koyuncu[3]

Öz

Amaç: Bu çalışmada Fırat ve Dicle Nehir sistemlerinde yaşayan ve istilacı bir balık olan *C. gibelio* türünün besin olarak tüketilen kas dokusunun aminoasit profiline ait veriler elde edilmiştir.

Materyal ve Yöntem: Analiz için kullanılan kas dokusu örnekleri, yöre balıkçıları tarafından ağ yardımıyla avlanan ve satılan balıklardan alınmıştır. Toplamda 29 birey olmak üzere her balıktan 100 mg/ml olacak şekilde alınan kas dokusundan aminoasit profili analizi LC-MS/MS 8045 cihazında yapılmış olup, Jasem LC-MS/MS aminoasit analiz kiti kullanılmıştır. Bu cihazın verdiği sonuçlardan elde edilen absorbans değerleri için sonuçlar analiz edilip değerlendirilmiştir.

Bulgular: Fırat ve Dicle grubundaki 100 mg/ml oranında balık kaslarında tespit edilen en düşük, en yüksek değerler ve aminoasitler sırasıyla; Dicle grubu için 0,241 ile Carnosine, 668,176 ile Lizin; Fırat grubu için ise 0,445 ile 3_MHIS, 9192,287 ile Valin'dir.

Sonuç: Bu çalışma sonucunda Fırat ve Dicle Nehir sistemlerinde yaşayan *C. gibelio* türünün aminoasit profili ortaya çıkarılarak protein diyeti için önemli bir veri seti elde edilmiştir.

Anahtar Kelimeler: *Carassius gibelio*, Cyprinidae, aminoasit, Fırat Nehri, Dicle Nehri

Investigation of the Amino Acid Profile of the Species of Carassius gibelio (Bloch, 1782) Living in Euphrates and Tigris River

Abstract

Objective: In this study, data on the amino acid profile of the muscle tissue consumed as food of *C. gibelio*, an invasive fish living in the Euphrates and Tigris River systems, were obtained.

Material and Methods: Muscle tissue samples used for analysis were taken from fish caught and sold with the help of nets by local fishermen. The amino acid profile analysis of the muscle tissue taken as 100 mg/ml from each fish, 29 individuals in total, was made in the LC-MS/MS 8045 device and Jasem LC-MS/MS amino acid analysis kit was used. The results were analyzed and evaluated for the absorbance values obtained from the results of this device.

Results: The lowest and highest values and amino acids detected in the fish muscles at a rate of 100 mg/ml of the Euphrates and Tigris groups, respectively; Carnosine with 0.241, Lysine with 668.176 for the Tigris group; For the Euphrates group, it is 3_MHIS with 0.445 and Valin with 9192.287.

Conclusion: As a result of this study, an important data set for protein diet was obtained by revealing the amino acid profile of the *C. gibelio* species living in the Euphrates and Tigris River systems.

Keywords: *Carassius gibelio*, Cyprinidae, amino acid, Euphrates River, Tigris River

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Başvuru: 28.10.2021
Revizyon talebi: 27.12.2021
Son revizyon teslimi: 09.01.20212
Kabul: 21.01.2022

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Atıf: Parmaksiz, A., Enes, N., Egi, K. ve Koyuncu, I. (2022). Fırat ve Dicle Nehirlerinde Yaşayan *Carassius gibelio* (Bloch, 1782) Türünün Aminoasit Profilinin Araştırılması. *Turkish Journal of Bioscience and Collections, 6*(1), 1–5. https://doi.org/10.26650/tjbc.20221013455

Giriş

Günümüzde dünya nüfusunun büyümesiyle birlikte toplumun beslenmesinde önemli bir gereksinim olan proteinlere ihtiyaçta gün geçtikçe artmıştır. Protein ihtiyacını karşılamakta yetersiz kalan karasal ürünlere karşılık, tatlı su balıkları alternatif bir protein kaynağı haline gelmiştir (Parmaksız, 2020). Fırat ve Dicle Nehirleri balık çeşitliliği ve balıkçılık potansiyeli açısından önemli doğal kaynaklardan olup besin açığını karşılama bakımından büyük bir potansiyel oluşturmaktadır (Oymak vd., 2009; Bilici, 2013). Ayrıca karasal ürünlerin fiyatlarındaki artışlar özellikle düşük gelirli insanların tatlı su balıklarına yönelmesine neden olmuştur. Balıklar dünyadaki milyonlarca yoksul aileler için en ucuz hayvansal protein ve mineral kaynağı olarak kabul edilmektedir. Özellikle balıkların fiyatları lezzetten daha çok önem arz etmekte ve tercih sebebi olabilmektedir. Fırat ve Dicle Nehir sistemlerinden avlanan ve balıkçı tezgâhlarında satılan en düşük fiyatlı balıklardan biri *Carassius gibelio* türüdür. Bu tür, nehir sistemlerinde bulunan doğal türlerle besin ve habitat rekabetine girmesi ve yüksek yumurta verimliği gibi özellikleriyle, durgun ve akarsularda kolaylıkla baskın balık türü olup, girdiği ortamlar için istilacı bir özellik göstermektedir (Paulovits vd., 1998; Yerli vd., 2014). İstilacı türler girmiş oldukları habitatlarda yaşayan canlıları etkileyen ve onlara zarar vererek kendi sayılarını arttırıp yaşamlarını devam ettirme çabasındadırlar. Genellikle genetik çeşitlilikleri yüksek ve adaptasyon yetenekleri de oldukça fazladır. Bu nedenle *C. gibelio* türünün populasyon yoğunluğunun artmasından dolayı balıkçı tezgâhlarında bol miktarda görülmekte ve fiyat olarak da ucuz satılan balıktır. Ülkemizde genellikle avcılık yolu ile elde edilen bu balık türünün tüketimi gün geçtikçe artış göstermekte ve diğer ülkelere ihraç edilerek değerlendirilmektedir (Atalay vd., 2017; Genç & Diler, 2019).

Çalışmamıza konu olan mevcut tür ile ilgili olarak; *C. gibelio* kas dokusundaki yağ asitlerinin mevsimsel değişimi (Özdemir, 2021), parazitlerinin incelenmesi (Samancı, 2011), iç su balıkçılığına etkisinin araştırılması (Aydın, 2021), büyüme ve üreme özellikleri (Çınar vd., 2007; Gaygusuz vd., 2007; Yazıcıoğlu vd., 2013; Erdoğan vd., 2014) ve yaşam döngüsü özellikleri (Kırankaya & Ekmekçi, 2013) gibi bir çok alanda çalışmalar yapılmıştır. Fakat bu tür ile ilgili olarak aminoasit profili ile ilgili bir çalışma mevcut değildir. Bu çalışmanın amacı; iki farklı nehir sisteminde istilacı tür olarak yaşayan *C. gibelio* türünün içerdiği besin değerinin aminoasit profili bakımından belirlenmesidir. Çünkü protein kullanımının etkinliğini etkileyen en önemli faktör aminoasit profili olup proteinlerin diyet miktarı ve kalitesi, gıda maddesinin kaynağına bağlıdır. Bu nedenle bu türün insanlar tarafından tüketilen kas dokusu için analizler gerçekleştirilerek aminoasit profillerinin tespit edilmesi hedeflenmiştir.

Şekil 1. *C. gibelio* türüne ait birey ve kas dokusunun alınması

Materyal ve Yöntem

Çalışmamızda kullanılan balık materyalleri yöre balıkçıları tarafından ağ yardımıyla avlanan balıklardan oluşmaktadır. Rastgele seçilmek üzere 15 adet Dicle, 14 Adet ise Fırat Nehirlerine ait toplamda 29 birey olmak üzere her balıktan 100 mg/ml olacak şekilde alınan kas dokusu numaralandırılan 2 ml'lik mikrosantrifüj tüplerine alınmıştır (Şek. 1). Daha sonra içerisine steril edilmiş, filtrelenmiş 1X PBS eklenerek metal bilyeler yardımı ile homojenizatörde 2 saat +4 ºC'de karıştırılarak kas dokularının homojenize edilmesi sağlanmıştır. 2 saatlik karıştırma işleminin ardından solüsyonu partikülerden arındırılmak için 15000 rpm de 15 dk santrifüj işlemi gerçekleştirilmiştir. Santrifüjün ardından süpernatant yeni mikrosantrifüj tüplerine alınmış ve bu karışım aminoasit profili için kullanılmak üzere -80 ºC' de muhafaza edilmiştir. Aminoasit profili analizi LC-MS/MS 8045 cihazında yapılmış olup, Jasem LC-MS/MS amino asit analiz kiti kullanılmıştır. Homojenize edilen kas örneklerinden yeni mikrosantrifüj tüplerine 50 µl alınarak üzerlerine 50 µl aminoasit internal standartı eklenip örnekler vorteksleneren karıştırılmıştır. Tüplerdeki karışımın üzerine 700 µl aminoasit reagent 1 eklenerek mikrosantrifüj tüpler tekrar karıştırılarak bu tüpler 5 dk 3000 rpm de santrifüj edilmiştir. Santrifüj edilen tüplerdeki süpernatanttan 150-200 µl arası süpernatant alınarak insörtlü vial şişelere aktarılmıştır. Daha sonra LC-MS/MS-8045 cihazının tepsi bölmesine yerleştirilerek cihaza verilmiş ve her örnek 5 dakika boyunca analiz edilmiştir. Bu cihazın verdiği sonuçlardan elde edilen absorbans değerleri değerlendirilmiştir. Verilerin normal dağılıma uygunluğu Shaphiro wilk testi ile test edilmiştir. Sayısal değişkenlerin bağımsız iki grup karşılaştırmalarında Mann-Whitney U testi, normal dağılmayan özellikler için ise Kruskal Wallis testi kullanılmıştır. Tanımlayıcı istatistik olarak sayısal değişkenler için ortalama±standart sapma, kategorik değişkenler için ise sayı ve % değerleri verilmiştir. İstatistiksel analizler için SPSS Windows version 25.0 paket programı kullanılmış ve $P<0.05$ istatistiksel olarak anlamlı kabul edilmiştir.

Bulgular

Bu çalışmada, Fırat ve Dicle Nehrinde yaşayan, yöre balıkçıları tarafından avlanan, insanlar tarafından protein kaynağı olarak tüketilen ve istilacı olarak yaşayan *C. gibelio* türünün kas dokusunda (100 mg/ml) LC-MS/MS cihazı ile gerekli olan koşullar uygulanarak aminoasit profili ilk kez belirlenmiştir (Tablo 1). Buna göre Dicle ve Fırat grubundaki balık kaslarında tespit edilen en düşük, en yüksek değerler ve aminoasitler sırasıyla; Dicle grubu için 0,241 ile Carnosine, 668,176 ile de Lizin; Fırat grubu için ise 0,445 ile 3_MHIS, 9192,287 ile Valin'dir.

Tablo 1'deki değerler üzerinde yapılan analizlerde Dicle ve Fırat gruplarında arasında; 1 MHIS, 2 aminoadipic acid, Alanin, Arjinin, Asparjin, Cystine, Glisin, Fenilalanin, Prolin, Serin, Tirozin, Carnosine, Gaba, Norvaline, Sarcosine ve Glutamic acid ölçümlerinin ortalamaları bakımından istatistiksel olarak anlamlı düzeyde bir farka rastlanmıştır ($p<0,05$). Ayrıca Dicle grubundaki 1 MHIS, 2 aminoadipic_acid, Arjinin, Asparjin ve Carnosine değerlerinin ortalamaları Fırat grubuna göre anlamlı düzeyde daha yüksek bulunmuştur ($p<0,05$). Fırat grubundaki Alanin, Cystine, Glsin, Fenilalanin, Prolin, Serin, Tirozin, Gaba, Norvaline, Sarcosine ve Glutamic acid değerlerinin ortalamaları Dicle grubuna göre anlamlı düzeyde daha yüksek bulunmuştur ($p<0,05$).

Tartışma ve Sonuç

Yıllardır balıkçılık yaparak geçinen tecrübeli yöre balıkçılarından alınan bilgilere göre; çoğu zaman atılan ağlardan çıkan balıklardan yarısına yakınının *C. gibelio* olduğu ve bu türün birey sayısının her geçen gün hızla arttığı, eğer bu şekilde devam ederse önümüzdeki zamanlarda ağlarda sadece bu balığa rastlanma ihtimalinin yüksek olduğu belirtilmiştir. Balıkçılık ve biyolojik çeşitlilik için önemli bir tehdit olan istilacı balık türleri yerel ve endemik türlerin hızla yok olmasına ve havzalardaki balıkçılık üretiminin sona ermesine neden olabilmektedir (Erdem vd., 2014). Bu nedenle bu tür ile bir mücadele programı yapılmalı ve türün artan birey sayısının azaltılması planlanmalıdır. Yeterli önlemler alınmazsa *C. gibelio* türü doğal türlerin yerine geçecek başta endemik ve ekonomik balık türlerinin populasyonları olmak üzere, birçok balık türünün popülasyonu azalacak hatta yok olma tehlikeleri ortaya çıkacaktır (Parmaksız vd., 2017). Bu istilacı tür ile mücadele etmenin yollarında biri besin olarak tüketilmesinin arttırılması ve birey sayısının azaltılmasıdır. Bu türün etinin tadı çok lezzetli olmasa da fiyatı ucuz olduğu için genellikle düşük gelirli vatandaşlar tarafından tercih edilmektedir. Fakat protein kaynağı olarak kullanılıp, işlenerek tadının lezzetli hale getirilmesi bir alternatif olarak düşünülmesi önem arz etmektedir. Bu nedenle bu türün protein kalitesinin bilinmesi için öncelikle aminoasit içeriğinin bilinmesi ve araştırılması gerekmektedir. Mevcut çalışmada, *C. gibelio* türünün aminoasit profili ilk kez

Tablo 1. *C. gibelio* türünün kas dokusunda tespit edilen aminoasit miktarları (100 mg/ml)

	Grup				
	Dicle		Fırat		
	Mean	SD	Mean	SD	p
1_MHIS	3,110	1,844	1,195	1,038	**0,036***
2_aminoadipic_acid	2,745	1,518	2,031	1,406	**0,008***
3_MHIS	0,270	0,194	0,445	0,252	0,694
4_oh_proline	0,902	0,748	11,330	4,688	0,132
Alanin	174,069	86,279	376,625	310,996	**0,001***
Arjinin	63,055	31,105	61,328	42,976	**0,017***
Asparjin	10,876	6,146	5,113	3,426	**0,005***
Aspartik asit	0,783	1,750	967,557	739,496	0,052
Sitrulin	2,567	1,012	3,552	2,784	0,106
Cystine	0,649	0,308	0,682	0,418	**0,001***
Cystathionine	3,168	2,695	2,328	1,377	0,359
Glutamin	6,271	4,649	15,074	10,536	0,196
Glisin	429,990	344,627	704,989	603,434	**0,002***
Histidin	433,509	330,379	620,191	427,044	0,272
Lizin	668,176	491,022	636,522	354,065	0,622
Metiyonin	22,675	11,208	39,475	21,616	0,810
Ornitin	6,348	4,830	44,968	31,248	0,315
Fenilalanin	25,695	11,933	68,265	53,556	**0,001***
Prolin	37,427	16,594	122,269	83,636	**0,008***
Serin	52,705	29,733	68,359	46,646	**0,001***
Treonin	16,103	13,128	12,707	6,375	0,662
Triptofan	5,576	2,332	14,798	10,643	0,178
Tirozin	15,246	6,982	21,887	10,064	**0,032***
Valin	72,027	34,188	9192,287	3823,762	0,048
Carnosine	0,241	0,165	0,483	0,284	**0,004***
Gaba	1,841	1,574	5,660	4,548	**0,024***
Homocitruline	5,508	4,288	136,997	88,579	0,228
Norvaline	1,896	0,849	3,182	2,171	**0,038***
Sarcosine	87,252	63,462	360,408	188,151	**0,001***
Glutamic_acid	425,314	273,004	1107,360	314,019	**0,001***
Ortophosphoryletanolamin	4,186	3,038	4,736	2,010	0,965

çalışılarak daha sonra yapılacak çalışmalar için de önemli bir veri seti elde edilmiştir.

Fırat Nehri'nde avlanan, balıkçılarda satılan ve en çok tercih edilen *Arabibarbus grypus* ve *Cyprinus carpio* türlerinde de aminoasit profili Palalı (2020) tarafından çalışılmıştır. Buna göre balık kaslarında tespit edilen en yüksek değerlere sahip üç aminoasit sırasıyla; *Arabibarbus grypus* için, Histidin > Gylsin >Aspartik asit; *Cyprinus carpio* için, Histidin > Gylsin > Glutamik asittir. Bu çalışmada ise bu sıralama Valin > Glutamik asit > Aspartik asit şeklindedir. Total olarak incelendiğinde *Arabibarbus grypus* ve *Cyprinus carpio* türlerine ait değerler birbirine yakın ve benzer olduğu, *C. gibelio* türüne ait değerlerin ise her iki türe göre daha farklı olduğu tespit edilmiştir. Bundan dolayı bazı protein diyetlerinin hazırlanmasında bu türden faydalanması aminoasit bakımından daha zenginlik kazandırabilir. Özellikle sporcuların yoğun olarak tükettikleri ve ülkemize yurt dışından ithal edilen aminoasit takviyeli ürünlere dönüştürülürken içeriğin zenginleştirilmesinde kullanılabilir.

Hakem Değerlendirmesi: Dış bağımsız. C
Çıkar Çatışması: Yazarlar çıkar çatışması bildirmemiştir.
Finansal Destek: Bu çalışma Harran Üniversitesi Bilimsel Araştırma Projeleri Koodinatörlüğü (Proje numarası 19181) tarafından desteklenmiştir.
Yazar Katkıları: Konsept ve dizayn çalışması: A.P., N.E., İ.K.; Veri Toplama: A.P., N.E., İ.K.; Veri Analizi/ Yorumlama: A.P., N.E., İ.K., K.E.; Makale Taslağı: A.P., N.E., İ.K., K.E.; Makalenin Eleştirel Revizyonu: A.P., İ.K.; Nihai Onay ve Sorumluluk: A.P., N.E., İ.K., K.E.

Peer-review: Externally peer-reviewed.
Conflict of Interest: The authors declare that they have no conflicts of interest.
Financial Disclosure: This study was supported by Harran University Scientific Research Projects Coordination Unit (Project number 19181).
Author Contributions: Conception/Design of study: A.P., N.E., İ.K.; Data Acquisition: A.P., N.E., İ.K.; Data Analysis/ Interpretation: A.P., N.E., İ.K., K.E.; Drafting Manuscript: A.P., N.E., İ.K., K.E.; Critical Revision of Manuscript: A.P., İ.K.; Final Approval and Accountability: A.P., N.E., İ.K., K.E.

Kaynakça/References

Atalay, M.A., Kırankaya, Ş. G. & Ekmekçi, F.G. (2017). The current status of gibel carp and sand smelt in Turkey's inland fisheries. *Yunus Research Bulletin*, 17(1), 41-57.

Aydın, E. (2021). İstilacı gümüşi havuz balığının (*Carassius gibelio* Bloch, 1782) Sakarya ilindeki iç su balıkçılığına etkisinin araştırılması. *Doktora Tezi. Atatürk Üniversitesi, Fen Bilimleri Enstitüsü*.

Bilici, S. (2013). Dicle Nehrinde Yaşayan *Carasobarbus luteus*, *Capoeta trutta* ve *Garra variabilis* Türlerinin Biyolojisi Üzerine Araştırmalar. *Doktora Tezi, Dicle Üniversitesi, Fen Bilimleri Enstitüsü*.

Çınar, Ş., Çubuk, H., Özkök, R., Tümgelir, L. & Çetinkaya, S. (2007). Beyşehir Gölü'ndeki Gümüşi Havuz Balığı (*Carassius gibelio* Bloch, 1782) Populasyonunun Büyüme Özellikleri. *Turkish Jornal of Aquatic Life*, 3(8), 401-409.

Erdem, Y., Samur, M. & Özdemir, S. (2014). İçsularda istilacı balık türleriyle mücadelede seçici avlama yöntemlerinin etkinliği. *Istanbul University, Journal of Fisheries & Aquatic Sciences*, 29(2), 49-63.

Erdoğan, Z., Koç, T.H., Güngör, S. & Ulunehir, G. (2014). Age, growth and reproductive properties of an invasive species *Carassius gibelio* (Bloch, 1782) (Cyprinidae) in the İkizcetepeler Dam Lake (Balıkesir) Turkey. *Periodicum Biologorum*, 116, 285-291.

Gaygusuz, Ö., Tarkan, A. S. & Gaygusuz, Ç. G. (2007). Changes in the fish community of the Ömerli Reservoir (Turkey) following the introduction of non-native gibel carp *Carassius gibelio* (Bloch, 1782) and other human impacts. *Aquatic Invasions*, 2(2), 117-120.

Genç, İ.Y. & Diler, A. (2019). Soğuk şartlarda (4±1°C) depolanan gümüşi havuz balığı *Carassius gibelio*'da meydana gelen kalite değişimleri ve aşamalı çoklu regresyon yöntemine göre raf ömrü tahmin modelinin geliştirilmesi. *Acta Aquatica Turcica*, 15(3), 365-377.

Kırankaya, Ş. G. & Ekmekçi, F. G. (2013). Comparison of growth and reproduction of mirror carp and scaled carp introduced into Gelingüllü Reservoir, Yozgat, Turkey. *Turkish Journal of Veterinary and Animal Sciences*, 37, 636-640.

Oymak, S. A., Karadede, H. & Dogan, N. (2009). Heavy metal in tissues of Tor grypus from Ataturk Dam Lake, Euphrates River-Turkey, *Biologia*, 64 (1), 151-155.

Özdemir, L. (2021). *Carassius auratus, Carassius gibelio* ve *Capoeta umbla*'nın yağ asitlerinin mevsimsel değişimi. *Yüksek Lisans Tezi, Mardin Artuklu Üniversitesi, Lisansüstü Eğitim Enstitüsü*.

Samancı, İ. (2011). Karacaören II Baraj Gölü'nde yaşayan sazan (*Cyprinus carpio* L.,1758) ve havuz balığı (*Carassius carassius* L., 1758)'ndaki parazitlerin incelenmesi. *Yüksek Lisans Tezi, Süleyman Demirel Üniversitesi, Fen Bilimleri Enstitüsü.*

Palalı, A. (2020). Fırat nehrinde yaşayan *Arabibarbus grypus* (Heckel, 1843) ve Cyprinus carpio (Linnaeus,1758) türünde aminoasit profilinin araştırılması. *Yüksek Lisans Tezi Harran Üniversitesi, Fen Bilimleri Enstitüsü.*

Parmaksiz A., Oymak. S. A., Doğan, N., Darlina, N. & Ünlü, E. (2017). Reproductive characteristics of an invasive species *Carassius gibelio* (Bloch,1782) in Atatürk Dam Lake, Turkey. *Indian Journal of Fisheries*, 64(4), 28-33.

Parmaksiz, A. (2020). Population Genetic Diversity of Yellow Barbell (*Carasobarbus luteus*) from Kueik, Euphrates and Tigris Rivers Based on Mitochondrial DNA D-loop Sequences. *Turkish Journal of Fisheries and Aquatic Sciences*, 20, 79-86.

Paulovits, G., Tatrai, I., Matyas, K., Korponai, J. & Kovats, N. (1998). Role of Prussian carp (*Carassius auratus gibelio* Bloch) in the nutrient cycle of the Kis-Balaton Reservoir. *International Review of Hydrobiology*, 83, 467-470.

Yazıcıoğlu, O., Yılmaz, S., Yazıcı, R. & Polat, N., (2013). Ladik Gölü (Samsun, Türkiye)'nde Yaşayan Havuz Balığı, Carassius gibelio (Bloch, 1782)'nın Kondisyon Faktörü, Boy Ağırlık ve Boy-Boy İlişkileri. *Karadeniz Fen Bilimleri Dergisi*, 3(9),72-80.

Yerli, S. V., Mangıt, F., Emiroğlu, Ö., Yeğen, V., Uysal, R., Ünlü, E. & Zengin, M. (2014). Distribution of invasive *Carassius gibelio* (Bloch, 1782) (Teleostei: Cyprinidae) in Turkey. *Turkish Journal of Fisheries and Aquatic Sciences*, 14, 581-590.

Turkish Journal of Bioscience and Collections
Volume 6, Number 1, 2022
E-ISSN: 2601-4292

RESEARCH ARTICLE

The Catalog of Aquatic Mollusca (Bivalvia and Gastropoda) in the Limnology Museum of Çanakkale Onsekiz Mart University (COMULM)

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Received: 01.11.2021
Revision Requested: 16.12.2021
Last Revision Received: 28.01.2022
Accepted: 28.01.2022

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Citation: Bicer, S., Odabasi, D. A., Ozturk, B. (2022). The Catalog of Aquatic Mollusca (Bivalvia and Gastropoda) in the Limnology Museum of Çanakkale Onsekiz Mart University (COMULM). *Turkish Journal of Bioscience and Collections, 6*(1), 7–13. https://doi.org/10.26650/tjbc.20221017242

Abstract

Objective: Natural History Museums are important organizations that increase the awareness of the public on biodiversity, nature, and its conservation. Museums or collections like these, enable the recognition of organisms that are now extinct or that cannot always be seen in nature. Thus, the establishment of such collections can be very useful for the formation of nature consciousness. In this study, the aquatic Mollusca Catalog of the Limnology Museum of Çanakkale Onsekiz Mart University (COMULM) is presented.

Materials and Methods: The specimens of the collection were identified according to the identification references under a stereomicroscope and fixed with 80 % alcohol or remained dry in glass vials or plastic tubes. All the materials were labeled and transferred to the multi-drawer archive cabinet in the Marine and Inland Water Laboratory, Faculty of Marine Science and Technology. This catalog, which contains 53 taxa, includes local endemics and common taxa as well as invasive-exotic taxa mainly from Türkiye. The list of the Mollusca catalog was presented by following the current taxonomic nomenclature.

Results: According to the results, nine of the Mollusca belong to Bivalvia and the 44 of which are Gastropoda. In total, 2301 specimens were counted in the catalog, and the species with the highest specimen number (419 individuals) is *Physella acuta*. Considering the geographical distributions of the Mollusca species in this catalog, the eleven species of freshwater gastropods in the catalog are endemic to Türkiye, whereas three of the freshwater gastropods are endemic to the Middle East, Balkans, and some of the Greek Islands in the Aegean Sea. On the other hand, some gastropod species are not naturally found in our aquatic systems, which were collected from ornamental purpose aquariums.

Conclusion: In this context, the Mollusca museum of the COMULM is capable of contributing to Turkey's faunistic studies by enabling taxonomic comparisons and investigations to the scientists.

Keywords: Collection, Museum, Mollusca, Türkiye, Limnology

Introduction

As Türkiye has three of the 34 bio-geographical regions considered as biodiversity hotspots, namely the Euro-Siberian, the Mediterranean, and Irano-Turanian, it is home to a wide variety of organisms in terrestrial, marine, and inland water ecosystems (Mittermeier, *et al*., 2005; Şekercioğlu, *et al*., 2011; Küçük & Ertürk, 2013). The main threat of the unique biological diversity might be listed as habitat loss, pollution, invasive species, and climate change; therefore, they are being destroyed faster than we can document them or understand their significance (McNeely, *et al*., 1990). As the level of consciousness of the societies increases, the knowledge, conservation, and maintenance of biological diversity have become important to society. Natural History Museums are one of the institutes that raise the awareness of the public on nature, biodiversity, and its conservation and provide a rich source of data for various fields including biology, biogeography, paleontology (Lister, *et al*., 2011), and education (Mujtaba, *et al*., 2018). However, the importance of such collections in Türkiye seems to have been better understood in recent years. There are several examples of the scientific and visual-scientific museum set by the departments of universities in recent years such as Ege University (Salman & İzmirli, 2020; Tezcan, *et al*., 2020), İstanbul University (Meriç, *et al*., 2007; Kaya & Özuluğ, 2017; Kaya, *et al*., 2018; Özuluğ & Saç, 2019), Çanakkale Onsekiz Mart University (Baycan & Tosunoğlu, 2017), and Recep Tayyip Erdogan University (Kaya, *et al*., 2021). On the other hand, some visual museums established by the governmental institutions i.e. the Ministry of Culture and Tourism and The Institute of Mineral Research and Exploration of Türkiye are pioneers.

The aim of the study is to present the catalog of the Mollusca under the Limnology Museum of Çanakkale Onsekiz Mart University (COMULM). In this context, authors declare opening the Mollusca catalog at the Faculty of Marine Science and Technology, Çanakkale Onsekiz Mart University (ÇOMU) to the scientists and graduate students.

Figure 1. The Mollusca Catalog of COMULM in the multi-drawer archive cabinet.

Material and Method

Mollusca specimens in the COMULM catalog were put into glass vials or plastic tubes depending on the material's dimension and preserved by ethyl alcohol at the grade of 80%. Only shell specimens are cataloged as dry. A labelling system was developed for materials belong to the museum catalog starting a code consisting of the capital letters of the housing institute, the name of the museum, and the taxonomic order (Classis) of the material that is COMULM-B or G. Following the code, a number was assigned according to its registration rank. The code is produced to be used in research articles to meet the requirements of International Code of Zoological Nomenclature. There is some additional information following the material code that is individual number (*ind*), fixative (*acl*) referring alcohol or dry preservation (*dry*). In a case the material was belong to a juvenile specimen, "*juv*" the statement was placed between individual number and fixative. Further information on the material, e.g. the person who donates or collects the specimen and on the sampling location including coordinates (if present), was kept confidential in this study.

This museum catalog is kept in the multi-drawer archive cabinet in the Laboratory of Marine and Inland Water Biology of the Faculty of Marine Science and Technology, Çanakkale Onsekiz Mart University, Türkiye (Fig. 1). Materials of the museum catalog have been checked bi-annually for changing fixatives.

The publication of Bank & Neubert (2017) was followed in the taxonomic nomenclature of the Mollusca catalog. The specimens of the catalog were identified using Schütt (1964), Radoman (1983), Öztürk, *et al*. (2008), Glöer (2019) for Gastropoda, Araujo & Korniushin (1998), Beran & Horsak (1998), and Zettler & Glöer (2006) for Bivalvia.

Result and Discussion

There are a total of 53 taxa, 9 of which are Bivalvia and 44 of which are Gastropoda, in the Mollusca catalog of COMULM. A total of 2301 specimens belonging to taxa in the collection were counted. The highest individual number (419 ind.) belongs to *Phsella acuta*, which has invader character (Dillon, Wethington, Rhett & Smith, 2005) and a very common and abundant species in the region where the material is obtained (Odabaşı, *et al*., 2019a; Bal, *et al*., 2021). Besides, there are several endemic species in the collection which were deposited as holotype or paratype materials including *Theodoxus gloerii* Odabaşı & Arslan, 2015, *Bythinella kazdaghensis* Odabaşı & Georgiev, 2014, *Bythinella gokceadaensis* D. A. Odabaşı, 2019, *Grossuana kayrae* D. A. Odabaşı, 2019, *Pseudamnicola cirikorum* D. A. Odabaşı, 2019, *Pseudamnicola radeae* D. A. Odabaşı, 2019, *Pseudamnicola thalesi* D. A. Odabaşı & Akay 2020, *Bithynia kayrae* Odabaşı & Odabaşı, 2017, *Bithynia timmi* D.A. Odabaşı & Arslan, 2015, *Pseudobithynia yildirimi*

Odabaşı, Kebapçı & Akbulut, 2013, and *Valvata kebapcii* Odabaşı, Glöer & Yıldırım, 2015.

The majority of taxa obtained from the scientific studies carried out in the streams of Northern Aegean Basin (e.g. Odabaşı, *et al*., 2013; Odabaşı & Georgiev, 2014; Odabaşı, *et al*., 2015; Odabaşı & Arslan, 2015a; Odabaşı & Arslan, 2015b; Odabaşı & Odabaşı, 2017; Odabaşı, *et al*., 2019a; Odabaşı, *et al*., 2019b; Odabaşı, *et al*., 2020; Bal, *et al*., 2021), whereas several materials are transferred from the domestic or foreign museums (e.g. *Bithynia tentaculata* (Linnaeus, 1758), *Bythinella charpentieri* (J. R. Roth, 1855), *Theodoxus anatolicus* (Récluz, 1841), *Melanopsis costata* (Olivier, 1804) etc.) or collected from ornamental purpose aquariums (e.g. *Melanoides tuberculate* (O. F. Müller, 1774), *Anentome Helena* (von dem Busch, 1847), *Planorbella duryi* (Wetherby, 1879)).

In conclusion, it is thought that the museum catalog of COMULM will be very useful in terms of providing comparison material for future scientific studies. In addition, it will also be used as educational material for undergraduate students.

List of the Mollusca Taxa

Phylum Mollusca Cuvier, 1795
Classis Bivalvia Linnaeus, 1758
Subclassis Heterodonta Neumayr, 1884
Ordo Cardiida Ferrusac, 1822
Superfamilia Tellinoidea Blainville, 1814
Familia Semelidae Stoliczka, 1870

Abra alba (W. Wood, 1802)
COMULM-B107, 1 ind, dry. COMULM-B133, 2 ind, dry.

Ordo Myida Stoliczka, 1870
Superfamilia Stoliczka, 1870
Familia Dreissenidae Gray, 1840

Dreissena polymorpha (Pallas, 1771)
COMULM-B1, 24 ind, alc. COMULM-B105, 7 ind, alc. Additional Materials: COMULM-B117, B121, B122, B125, B126, B127, 40 ind, dry.

Ordo Sphaeriida Lemer, Bieler & Giribet, 2019
Superfamilia Sphaerioidea Deshayes, 1855
Familia Sphaeriidae Deshayes, 1855
Subfamilia Sphaeriinae Deshayes, 1855

Musculium lacustre (O. F. Müller, 1774)
COMULM-B66, 1 ind, alc. COMULM-B102, 3 ind, alc.

Pisidium casertanum (Poli, 1791)
COMULM-B20, 8 ind, alc. COMULM-B31, 10 ind, alc. COMULM-B34, 18 ind, alc. COMULM-B38, 5 ind, alc. Additional Materials: COMULM-B75, B78, B82, B118, 55 ind, alc, 03.08.2018.

Pisidium subtruncatum (Malm, 1855)
COMULM-B35, 1 ind, alc. COMULM-B36, 7 ind, alc. COMULM-B53, 11 ind, alc. COMULM-B65, 3 ind, alc. Additional Materials: COMULM-B69, B72, B76, B80, B94, B110, 22 ind, alc.

Pisidium annandalei Prashad, 1925
COMULM-B17, 4 ind, alc. COMULM-B103, 3 ind, alc. COMULM-B104, 5 ind, alc. COMULM-B108, 12 ind, alc.

Pisidium nitidum Jenyns, 1832
COMULM-B3, 4 ind, alc. COMULM-B70, 3 ind, alc. COMULM-B79, 9 ind, alc. COMULM-B112, 6 ind, alc.

Spaherium sp.
COMULM-B86, 1 ind, alc. COMULM-B90, 2 ind, dry.

Familia Mytilidae Rafinesque, 1815
Subfamilia Brachidontinae F. Nordsieck, 1969

Mytilaster marioni (Locard, 1889)
COMULM-B2, 2 ind, alc. COMULM-B106, 2 ind, alc.

Phylum Mollusca Cuvier, 1795
Classis Gastropoda Cuvier, 1795
Subclassis Neritimorpha Koken, 1896
Ordo Cycloneritida Frýda, 1998
Superfamilia Neritoidea Rafinesque, 1815
Familia Neritidae Rafinesque, 1815
Subfamilia Neritininae Poey, 1852

Theodoxus anatolicus (Récluz, 1841)
COMULM-G248, 4 ind, alc.

Theodoxus gloerii Odabaşı & Arslan, 2015
COMULM-G52, 1 ind, dry. COMULM-G53, 16 ind, dry. COMULM-G225, 10 ind, dry. COMULM-G229, 3 ind, dry.

Theodoxus sp.
COMULM-G5, 14 ind, alc. COMULM-G27, 7 ind, alc. COMULM-G156, 5 ind, alc. COMULM-G232, 12 ind, alc.

Subclassis Caenogastropoda Cox, 1960
Ordo Cerithiimorpha Golikov & Starobogatov, 1975
Superfamilia Cerithioidea J. Fleming, 1822
Familia Cerithiidae J. Fleming, 1822
Subfamilia Bittiinae Cossmann, 1906

Bittium reticulatum (da Costa, 1778)
COMULM-G58, 2 ind, dry.

Familia Thiaridae Gill, 1871 (1823)
Subfamilia Thiarinae Gill, 1871 (1823)

Melanoides tuberculata (O.F. Müller, 1774)
COMULM-G2, 36 ind, dry.

Familia Melanopsidae H. Adams & A. Adams, 1854

Melanopsis buccinoidea (Olivier, 1801)
COMULM-G1, 34 ind, alc. COMULM-G10, 7 ind, alc. COMULM-G26, 42 ind, alc. COMULM-G40, 9 ind, alc. Additional Materials: COMULM-G42, G45, G46, G47, G54, G88, G101, G111, G113, G119, G121, G128, G137, G140, 140 ind, dry.

Melanopsis costata costata (Olivier, 1804)
COMULM-G8, 4 ind, dry. COMULM-G203, 2 ind, dry.

Ordo Littorinimorpha Golikov & Starobogatov, 1975
Superfamilia Rissooidea Gray, 1847
Familia Rissoidae Gray, 1847

Rissoa splendida Eichwald, 1830
COMULM-G61, 2 ind, dry. COMULM-G94, 1 ind, dry.

Superfamilia Truncatelloidea Gray, 1840
Familia Bythinellidae Locard, 1893

Bythinella kazdaghensis Odabaşı & Georgiev, 2014
COMULM-G135, 22 ind, alc.

Bythinella gokceadaensis D. A. Odabaşı, 2019
COMULM-G80, 1 ind, alc. COMULM-G81, 10 ind, alc. COMULM-G109, 20 ind, alc. COMULM-G112, 15 ind, alc. Additional Materials: COMULM-G114, G123, G124, G125, G129, 50 ind, alc.

Bythinella charpentieri (Roth, 1855)
COMULM-G132, 5 ind, alc.

Familia Hydrobiidae Stimpson, 1865
Subfamilia Belgrandiinae de Stefani, 1877

Grossuana kayrae D. A. Odabaşı, 2019
COMULM-G79, 1 ind, alc. COMULM-G177, 13 ind, alc.

Grossuana sp.
COMULM-G35, 1 ind, alc.

Subfamilia Hydrobiinae Stimpson, 1865

Ecrobia ventrosa (Montagu, 1803)
COMULM-G108, 10 ind, alc. COMULM-G28, 38 ind, alc. COMULM-G36, 15 ind, alc. Additional Materials: COMULM-G59, G235, G242, 55 ind, dry.

Subfamilia Pseudamnicolinae Radoman, 1977

Pseudamnicola cirikorum D. A. Odabaşı, 2019
COMULM-G77, 1 ind, alc. COMULM-G, 1 ind, alc.

Pseudamnicola radeae D. A. Odabaşı, 2019
COMULM-G78, 1 ind, alc. COMULM-G103, 34 ind, alc. COMULM-G103, 16 ind, alc.

Pseudamnicola thalesi D. A. Odabaşı & Akay 2020
COMULM-G102, 3 ind, alc.

Pseudamnicola sp.
COMULM-G160, 1 ind, dry. COMULM-G255, 5 ind, dry.

Familia Truncatellidae Gray, 1840
Familia Bithyniidae Gray, 1857

Bithynia kayrae Odabaşı & Odabaşı, 2017
COMULM-G161, 16 ind, alc. COMULM-G204, 15 ind, alc.

Bithynia tentaculata (Linnaeus, 1758)
COMULM-G259, 2 ind, dry. COMULM-G270, 1 ind, dry. COMULM-G273, 4 ind, dry. COMULM-G134, 1 ind, dry. COMULM-G253, 6 ind, alc. COMULM-G143, 3 ind, dry. COMULM-G166, 1 ind, alc.

Bithynia timmi D.A. Odabaşı & Arslan, 2015
COMULM-G258, 7 ind, alc. COMULM-G267, 5 ind, alc.

Bithynia sp.
COMULM-G38, 3 ind, alc.

Pseudobithynia yildirimi Odabaşı, Kebapçı & Akbulut, 2013
COMULM-G30, 11 ind, alc. COMULM-G33, 6 ind, alc. COMULM-G84, 8 ind, alc.

Subfamilia Truncatellinae Gray, 1840

Truncatella subcylindrica (Linnaeus, 1767)
COMULM-G29, 1 ind, dry.

Familia Tateidae Thiele, 1925

Potamopyrgus antipodarum (Gray, 1843)
COMULM-G228, 25 ind, alc.

Ordo Neogastropoda Wenz, 1938
Superfamilia Buccinoidea Rafinesque, 1815
Familia Nassariidae Iredale, 1916
Subfamilia Anentominae E. E. Strong, Galindo & Kantor, 2017

Anentome helena (von dem Busch, 1847)
COMULM-G3, 12 ind, dry.

Subfamilia Nassariinae Iredale, 1916

Tritia neritea (Linnaeus, 1758)
COMULM-G44, 1 ind, dry. COMULM-G55, 2 ind, dry.

Subclassis Vetigastropoda Salvini-Plawen, 1980
Ordo Trochida
Superfamilia Trochoidea Rafinesque, 1815
Familia Trochidae Rafinesque, 1815
Subfamilia Cantharidinae Gray, 1857

Steromphala adansonii (Payraudeau, 1826)
COMULM-G56, 5 ind, dry. COMULM-G211, 3 ind, dry.

Subclassis Heterobranchia Gray, 1840
Ordo Allogastropoda Haszprunar, 1985
Superfamilia Valvatoidea Gray, 1840
Familia Valvatidae Gray, 1840

Valvata (*Tropidina*) *kebapcii* Odabaşı, Glöer & Yıldırım, 2015
COMULM-G25, 12 ind, alc. COMULM-G41, 5 ind, alc. COMULM-G50, 10 ind, alc. COMULM-G78, 13 ind, alc. Additional Materials: COMULM-G95, G148, G151, G155, G165, G167, G175, G176, G179, G181, G186, G189, G192, G198, G207, G208, G209, G217, G241, 60 ind, dry.

Valvata (*Tropidina*) *macrostoma* Mörch, 1864
COMULM-G264, 1 ind, dry.

Valvata (*Cincinna*) *piscinalis* (O.F. Müller, 1774)
COMULM-G249, 1 ind, alc. COMULM-G271, 8 ind, alc.

Borysthenia naticina (Menke, 1845)
COMULM-G170, 1 ind, alc. COMULM-G266, 1 ind, alc. COMULM-G268, 5 ind, alc. COMULM-G269, 2 ind, dry.

Infraclassis Euthyneura
Subterclass Tectipleura
Superorder Hygrophila Férussac, 1822
Superfamilia Lymnaeoidea Rafinesque, 1815
Familia Lymnaeidae Rafinesque, 1815
Subfamilia Amphipepleinae Pini, 1877

Radix auricularia (Linnaeus, 1758)
COMULM-G19, 16 ind, alc. COMULM-G73, 4 ind, alc.

Radix labiata (Rossmässler, 1835)
COMULM-G11, 6 ind, alc. COMULM-G20, 8 ind, alc. COMULM-G39, 11 ind, alc. COMULM-G48, 4 ind, alc. COMULM-G272, 1 ind, dry. Additional Materials: COMULM-G52, G62, G64, G68, G70, G71, G74, G82, G85, G90, G99, G105, G115, G118, G120, G126, G130, G133, G136, G147, G158, G163, G169, G173, G174, G191, G199, G213, G219, 270 ind, dry.

Subfamilia Lymnaeinae Rafinesque, 1815

Galba (*Galba*) *truncatula* (O. F. Müller, 1774)
COMULM-G18, 6 ind, alc. COMULM-G23, 8 ind, alc. COMULM-G32, 11 ind, alc. COMULM-G57, 4 ind, alc. Additional Materials: COMULM-G69, G215, G243, G262, 7 ind, dry.

Lymnaea stagnalis (Linnaeus, 1758)
COMULM-G22, 4 ind (juv.), alc.

Stagnicola palustris (O.F. Müller, 1774)
COMULM-G9, 1 ind (juv.), dry.

Familia Physidae Fitzinger, 1833
Subfamilia Physinae Fitzinger, 1833
Physella acuta (Draparnaud, 1805)
COMULM-G12, 11 ind, alc. COMULM-G15, 28 ind, alc. COMULM-G17, 32 ind, alc. COMULM-G43, 18 ind, alc. Additional Materials: COMULM-G53, G63, G65, G66, G67, G72, G75, G79, G83, G89, G92, G94, G96, 330 ind, dry.

Familia Planorbidae Rafinesque, 1815
Subfamilia Ancylinae Rafinesque, 1815
Tribus Ancylini Rafinesque, 1815

Ancylus fluviatilis O.F. Müller, 1774
COMULM-G13, 2 ind, alc. COMULM-G14, 3 ind, alc. COMULM-G138, 12 ind, alc. COMULM-G149, 1 ind, dry. COMULM-G206, 4 ind, alc.

Tribus Helisomatini F.C. Baker, 1928

Planorbella duryi (Wetherby, 1879)
COMULM-G4, 25 ind, dry.

Tribus Planorbini Rafinesque, 1815

Gyraulus (*Armiger*) *crista* (Linnaeus, 1758)
COMULM-G159, 1 ind, alc. COMULM-G202, 1 ind, alc. COMULM-G238, 1 ind, alc.

Gyraulus piscinarum (Bourguignat, 1852)
COMULM-G21, 8 ind, alc. COMULM-G24, 15 ind, alc. COMULM-G31, 5 ind, alc. COMULM-G77, 22 ind, alc. Additional Materials: COMULM-G86, G93, G97, G100, G102, G107, G110, G116, G117, G122, G127, G131, G146, G152, G162, G164, G168, G171, G172, G182, G188, G197, G200, G212, G218, G220, G234, G240, G256, 65 ind, dry.

Planorbis intermixtus Mousson, 1874
COMULM-G6, 8 ind, alc. COMULM-G7, 5 ind, alc. COMULM-G49, 3 ind, alc. COMULM-G51, 12 ind, alc. Additional Materials: COMULM- G150, G153, G180, G190, G196, G202, G210, G254, 30 ind, dry.

Tribus Segmentinini F.C. Baker, 1945

Hippeutis complanatus (Linnaeus, 1758)
COMULM-G239, 5 ind, alc.

Peer-review: Externally peer-reviewed.
Conflict of Interest: The authors declare that they have no conflicts of interest.
Financial Disclosure: No financial support was requested for this study.
Author Contributions: Conception/Design of study: D.A.O.; Data Acquisition: S.B., B.Ö.; Data Analysis/Interpretation:S.B., B.Ö., D.A.O.; Drafting Manuscript: D.A.O., B.Ö.; Critical Revision of Manuscript: D.A.O, S.B.; Final Approval and Accountability: D.A.O., S.B., B.Ö.
Acknowledgment: The data of the present study was derived from the MSc. thesis of Songül BİÇER, School of Graduate Studies, Çanakkale Onsekiz Mart University.

References

Araujo, R. & Korniushin, A.V. (1998). Microsculpture of *Pisidium casertanum* (Poli, 1791) and some related species and forms (Bivalvia: Sphaeriidae). *Malakologische Abhandlungen*, 19(7), 59-69.

Bal, D., Odabaşı, D. A. & Zilifli, A. (2021). Kavak Çayı (Gelibolu, Çanakkale) Mollusca Faunası ve Bazı Su Kalitesi Özelliklerinin Belirlenmesi. *Journal of Advanced Research in Natural and Applied Sciences*, 7(3), 393-407.

Bank, R. A. & Neubert, E. (2017). Checklist of the land and freshwater Gastropoda of Europe. Last update: July 16th.

Baycan, B. & Tosunoğlu, M. (2017). The Catalog of Amphibia and Reptilia Specimens in The Çanakkale Onsekiz Mart University Zoology Museum (COMU-ZM). *Turkish Journal of Bioscience and Collections*, 1(1), 38-55.

Beran, L. & Horsak, M. (1998). Aquatic molluscs (Gastropoda, Bivalvia) of the Dolnomoravský úval lowland, Czech Republic. *Acta Societatis Zoologicae Bohemicae*, 62(1), 7-23.

Kaya, C., Baycelebi, E. & Turan, D. (2021). Illustrated type specimens catalogue of Recep Tayyip Erdogan University Zoology Museum of the Faculty of Fisheries. *Zootaxa*, 4996(3), 401-442.

Kaya, N. & Özuluğ, O. (2017). The herpetological collection of Zoology Museum, Istanbul University. *Anadolu University Journal of Science and Technology C-Life Sciences and Biotechnology*, 6(2), 55-63.

Kaya, N., Bacak, E., Özuluğ, O. & Arslangündoğdu, Z. (2018). The Bird Collection of İstanbul University Biology Department (Turkey). *Turkish Journal of Bioscience and Collections*, 2(2), 19-31.

Küçük, M. & Ertürk, E. (2013). Biodiversity and protected areas in Turkey. *Sains Malaysiana*, 42(10), 1455-1460.

Lister, A. M. et al. (2011). Natural history collections as sources of long-term datasets. *Trends in ecology & evolution*, 26(4), 153-154.

McNeely, J. A., Miller, K. R., Reid, W. V., Mittermeier, R. A., Werner, T. B. (1990). *Conserving the world's biological diversity*. Switzerland: International Union for Conservation of Nature and Natural Resources.

Meriç, N., Eryılmaz, L. & Özuluğ, M. (2007). A catalogue of the fishes held in the Istanbul University, Science Faculty, Hydrobiology Museum. *Zootaxa* 1472: 29–54.

Mittermeier, R.A., Gil, P.R., Hoffman, M., Pilgrim, J., Brooks, T., Mittermeier, J.C., Lamoreux, J., da Fonseca, G.A.B., (2005). *Hotspots Revisited: Earth's Biologically Richest and Most Endangered Terrestrial Ecoregions*. Amsterdam: Amsterdam University Press.

Mujtaba, T., Lawrence, M., Oliver, M. & Reiss, M. J. (2018). Learning and engagement through natural history museums. *Studies in science education*, 54(1), 41-67.

Odabaşı, D. A. & Arslan, N. (2015a). A new species of *Bithynia* (Gastropoda: Bithyniidae) from an eutrophic Lake Uluabat (south Marmara region), northwest of Turkey. T*urkish Journal of Fisheries and Aquatic Sciences*, 15(2), 365-369.

Odabaşı, D. A. & Arslan, N. (2015b). Description of a new subterranean nerite: *Theodoxus gloeri* n. sp. with some data on the freshwater gastropod fauna of Balikdami Wetland (Sakarya River, Turkey). *Ecologica Montenegrina*, 2(4), 327-333.

Odabaşı, D. A. & Georgiev, D. (2014). *Bythinella kazdaghensis* sp. n.(Gastropoda: Rissooidea) from the Mount Ida (Kaz Dağı)-Northwestern Turkey. *Acta Zooogica Bulgarica*, 66(1), 21-24.

Odabaşı, D. A., Akay, E. & Koyuncuoğlu, S. (2020). *Pseudamnicola thalesi* sp. n.(Gastropoda: Truncatelloidea: Hydrobiidae), a new freshwater gastropod species from Western Turkey. *Zoology in the Middle East*, 66(2), 140-144.

Odabaşı, D. A., Glöer, P. & Yıldırım, M. Z. (2015). The *Valvata* Species of Turkey with a Description of *Valvata kebapcii* n. sp.(Mollusca: Valvatidae). *Ecologica Montenegrina*, 2(2), 135-142.

Odabaşı, D. A., Kebapçı, Ü. & Akbulut, M. (2013). Description of a new *Pseudobithynia* n. sp. (Gastropoda: Bithyniidae) from Northwest Turkey. *Journal of Conchology*, 41(4), 527-532.

Odabaşı, S. & Odabaşı D. (2017). *Bithynia kayrae* n. sp (Gastropoda: Bithyniidae), a new species from freshwaters of Biga Peninsula (northwestern Anatolia, Turkey). *Archive für mollukenkunde*,146(1) 3-8.

Odabaşı, S., Arslan, N., Özdilek, Ş. Y. & Odabaşı, D. A. (2019a). An invasion report of the New Zealand mud snail, *Potamopyrgus antipodarum* (Gray, 1843) in Turkish freshwaters: Delice River and Kocabaş Stream. *Journal of Limnology and Freshwater Fisheries Research*, 5(3), 213-219. doi: 10.17216/LimnoFish.486626

Odabaşı, S., Odabaşı, D. & Acar, S. (2019b). New species of freshwater molluscs from Gökçeada (northeastern Aegean Sea), Turkey (Gastropoda: Hydrobiidae, Bythinellidae). *Archive für mollukenkunde*,148(2) 185-195.

Özuluğ, M. & Saç, G. (2019). İstanbul İli (Türkiye) tatlısu balık faunası. *Turkish Journal of Bioscience and Collections*, 3(1), 19-36.

Radoman, P. (1983). *Hydrobioidea a superfamily of Prosobranchia (Gastropoda): systematics*. Belgrad: Serbian academy of sciences and arts. (Vol. 1).

Salman, M. & Izmirli, C. (2020). Ege University Faculty of Fisheries Museum (ESFM) cephalopod inventory. *Su Ürünleri Dergisi*, 37(4), 357-361.

Schütt, H. (1965). Zur Systematik und Ökologie Türkischer Süsswasserprosobranchier. *Zoologische Mededelingen*, 41(3), 43-72.

Şekercioğlu, Ç. H., Anderson, S., Akçay, E., Bilgin, R., Can, Ö. E., Semiz, G., .. & Dalfes, H. N. (2011). Turkey's globally important biodiversity in crisis. *Biological Conservation*, 144(12), 2752-2769.

Tezcan, S., Karsavuran, Y., Pehlivan, E. & Özdikmen, H. (2020). Catalogue of Longhorned Beetles of LEMT (Lodos Entomological Museum, Turkey) (Coleoptera:Cerambycidae) Part I: Prioninae, Lepturinae, Aseminae, Saphaninae, Spondylidinae, Cerambycinae and Stenopterinae. *Munis Entomology & Zoology*, 15 (1): 39-65.

Zettler, M. L. & Glöer, P. (2006). Zur Ökologie und Morphologie der Sphaeriidae der Norddeutschen Tiefebene. *Heldia*, 6(8), 1-61.

Turkish Journal of Bioscience and Collections
Volume 6, Number 1, 2022
E-ISSN: 2601-4292

RESEARCH ARTICLE

New record and rare occurrence of European eel (*Anguilla anguilla*) from freshwater bodies in Karaburun Peninsula (İzmir, Türkiye): Anthropogenic pressures on the fish movements

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Received: 08.03.2022
Revision Requested: 16.03.2022
Last Revision Received: 20.03.2022
Accepted: 22.03.2022

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Citation: Agdamar, S., & Acar, U. (2022). New record and rare occurrence of European eel (*Anguilla anguilla*) from freshwater bodies in Karaburun Peninsula (İzmir, Türkiye): Anthropogenic pressures on the fish movements. *Turkish Journal of Bioscience and Collections, 6*(1), 15–20. https://doi.org/10.26650/tjbc.20221084791

Abstract

Objective: Fish can be used as bio-indicators to determine whether freshwater habitat has been altered. As habitat discontinuity occurs due to the presence of mechanical barriers, species composition can be altered upstream and downstream. Since the beginning of the 1980s, the amount of European eel *Anguilla anguilla* entering inland waters in Türkiye and European countries has decreased significantly. Our study describes for the first time the presence of *A. anguilla* from the freshwater bodies in the Karaburun Peninsula.

Materials and Methods: From November 2020 to August 2021, fish specimens were collected through electrofishing in one lotic system and three transitional waters of the study area. Clove oil was used to anesthetize live fish specimens after capture. Total length (TL) was measured for each sample to the nearest 1.0 mm. With a digital balance that was accurate to 0.01 g, we weighed the total body weight (W).

Results: We collected four adult specimens of *A. anguilla* from the study area. Total lengths and body weights of the specimens were 311 mm and 62.4 g for Balıklıova Stream; 360 mm and 95.3 g for Küçükbahçe Stream; 325 mm 56.3 g for Salman Reservoir and 280 mm and 34.7 g for Yelkentaş Stream, respectively.

Conclusion: We could not discuss our findings since no study has been done in the study area before, but it is thought that the low number of individuals caught may be related to the habitat degradation and different types of constructions at the stream mouths. The construction of fishways suitable for the study area can be a start to solving the distribution problem of this species.

Keywords: Habitat destruction, Barriers, Inland water, Fish passages

Introduction

Habitat degradation is one of the major causes of biodiversity loss. Various ecosystem services, including maintenance of natural habitats, provision of food, recreation, and food cycling are negatively affected by river disruption caused by human-made barriers (Birnie-Gauvin, *et al*., 2017). Through mechanical barriers, backwater impoundments change upstream river hydraulics, resulting in pond-like habitats that are favorable to the species (Parasiewicz, *et al*., 2022). A barrier can alter the composition of species upstream and downstream due to habitat discontinuity (Jones, *et al*., 2020). Thus, over a million artificial barriers cut off the waters of European rivers, limiting or blocking aquatic species' migration and causing freshwater habitats to be lost (Belletti, *et al*., 2020).

Bio-indicators such as fish can provide information about habitat alteration of freshwaters (Pont, *et al*., 2006). Despite their geographical differences, many species share similar habitats. It is common for aquatic organisms, including fish, to be well adapted to specific environments based on location and time (Parasiewicz, *et al*., 2022). Aquatic fauna and flora in different habitat mosaics exhibit unique community structures (Poff & Ward, 1990). Even though human actions are acceleratingly shaping local habitats either directly or implicitly, catchment-level characteristics independent of human actions are what are needed to predict the status and structure of ichthyofauna on a country scale (Britton, *et al*., 2021; Parasiewicz, *et al*., 2022). It is possible to reduce the impact of human activities on aquatic species if these characteristics are known and considered.

According to their life cycles, diadromous fish prefer to live both in freshwater and marine habitats. These fish are divided into anadromous and catadromous fishes. The term catadromous fish refers to fish that reproduce in marine environments but then transition to freshwater for growth/development until they reach back to their breeding zones. Catadromous fish include the European eels, *Anguilla anguilla*. This species constitutes one of the most spectacular migrations in the animal world, and comprise one of the most important fisheries in Europe (Gross, *et al*., 1998; Starkie, 2003).

At the end of its journey that lasts about two years to the east along with the ocean flows, *A. anguilla*, which began as a larva in the Sargasso Sea, enters all rivers with a coast on the Western European coasts, West African coasts, and the Mediterranean (Weber, 1986; Dekker, 2003). However, the population of *A. anguilla* has declined drastically since the 1980s, making this species critically endangered according to the IUCN Red List (Drouineau, *et al*., 2018; Pike, *et al*., 2020). Although the exact reason for the decline is uncertain, habitat changes, artificial barriers, and overfishing may have contributed to the decline (Starkie, 2003). When the European Union recovery plan constituted in 2007 ends, it will be important to know the migration strategies adopted by early life cycles of this species in order to predict recruitment of the species to freshwater (Dekker, 2018; Cresci, 2020).

In Türkiye, besides the Aegean Sea, the Black Sea, the Marmara Sea, the Mediterranean Sea, and their associated lakes, there is also *A. anguilla* populations in freshwater resources that drain into these seas (Memiş, *et al*., 2020). This fish has been found in several Turkish freshwater resources, according to the previous studies (e.g., Oray, 1987; Geldiay & Balık, 1988; İkiz, *et al.*, 1998; Güven, *et al*., 2002; Yalçın Özdilek, *et al.*, 2006; Güven, *et al*., 2016; Küçük, *et al*., 2016). In this study, we report for the first time, the occurrence of *A. anguilla* from Turkish freshwater bodies in a Peninsula (Karaburun, İzmir). Additionally, we attempted to emphasize whether human-induced factors restrict the movement of this species in the study area.

Material and Methods

Study area: The localities where the field studies were conducted were shown in Figure 1. Various sizes of agricultural irrigation and utility water reservoirs are located in the Karaburun Peninsula, and the largest of one is Eğlenhoca Reservoir, which is built in 2007 and approximately 0.05% of the surface area of the district (İZKA, 2014). There are also three reservoirs built between 2014 and 2018, Bozköy, Karareis, and Parlak Reservoirs, which are used for the same purposes (İZKA, 2014). Salman Reservoir was built in 2017 for the purpose of providing irrigation, drinking, and utility water. Although Salman Reservoir and Küçükbahçe Stream seem to be connected to each other, there is a barrier between them. Furthermore, Balıklıova Stream and Yelkentaş Stream have a direct connection with the sea.

Sampling: Although all localities in the study area were visited between November 2020 and August 2021, fish samples (e.g. Fig. 2) were only obtained using a portable electro-shocker (SAMUS 1000; frequency 55-60 Hz) from one lotic ecosystem (Salman Reservoir) and three transitional waters (Balıklıova Stream, Küçükbahçe

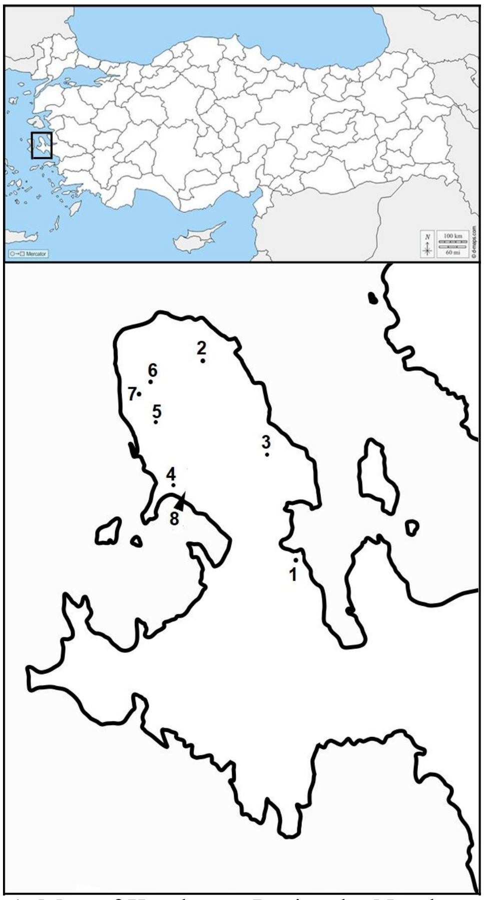

Figure 1. Map of Karaburun Peninsula. Numbers refer to studied water bodies in the peninsula (1: Balıklıova Stream, 2: Bozköy Reservoir, 3: Eğlenhoca Reservoir, 4: Karareis Reservoir, 5: Küçükbahçe Stream, 6: Parlak Reservoir, 7: Salman Reservoir, 8: Yelkentaş Stream).

Stream, and Yelkentaş Stream) of Karaburun Peninsula (Fig. 1 and Fig. 3). After capturing, alive fish specimens were anaesthetized with clove oil. Each fish sample was measured to the nearest 1.0 mm for total length (TL) and total body weight (W) was weighed on a digital balance with a 0.01 g accuracy. After examination, fish samples were released back to the water bodies. Fish data on the sampling locations were listed in Table 1.

Figure 2. *Anguilla anguilla* specimen caught in Salman Reservoir, İzmir, Türkiye on 31 May 2021. Photograph by Ümit Acar.

Figure 3. Sampling locations where fish samples were caught in Karaburun Peninsula. Water bodies are indicated by numbers (1: Balıklıova Stream, 2: Küçükbahçe Stream, 3: Salman Reservoir, 4: Yelkentaş Stream). Photograph by Ümit Acar.

Results and Discussion

As a result of the field surveys carried out in eight localities in the Karaburun Peninsula, four adult specimens of *A. anguilla* were collected from one lotic ecosystem and three transitional waters (one specimen for each sampling location) of Karaburun Peninsula (Table 1). The total lengths and body weights of the individuals were 311 mm and 62.4 g for Balıklıova Stream; 360 mm and 95.3 g for Küçükbahçe Stream; 325 mm 56.3 g for Salman Reservoir and 280 mm and 34.7 g for Yelkentaş Stream, respectively.

A fragmented river system can have serious consequences for fish species that migrate long distances, leading to their eventual extinction for species such as *A. anguilla* (Larinier & Travade, 2002; Callen & Greenberg, 2009). Additionally, through structural modifications to fish habitats, turning flowing waters into semi-lentic systems, and blocking fish movements, instream structures (i.e., dams, weirs, culverts) can negatively impact fish populations (Buisson, et al., 2008; Taylor, et al., 2008). The world's freshwater migratory fish population has declined by 96% over the last 50 years - the biggest decline of any vertebrates (Deinet, et al., 2020). The rising fragmentation of rivers has contributed to this decline (Belletti, et al., 2020). Thus, to implement corrective activities such as dam removal and construction of fishways, it is essential to understand how fish composition changes in rivers are disrupted by artificial barriers (Kornis, *et al*., 2015).

Considering some studies on the occurrence of *A. anguilla* in the marine habitats of Karaburun Peninsula (Sunlu & Egemen, 1998; Veryeri, 2006), this species had not previously recorded from the freshwater bodies of Karaburun Peninsula, therefore, this is the first occurrence of the species from these water resources of the peninsula. It is thought that this species has not been recorded since no studies have been carried out in the freshwater resources of the Karaburun Peninsula before, but because it is a part of the life cycle of the species, it is thought to have entered suitable habitats in the peninsula for feeding and survival. However, *A. anguilla* was rarely found in

Table 1. Fish data on the sampling locations of *Anguilla anguilla* in Karaburun Peninsula.

Sampling sites			Sampling dates
Locality no	**Locality name**	**Coordinates**	
1	Balıklıova Stream	38.420043, 26.589001	May 2021
2	Bozköy Reservoir	38.626234, 26.465123	-
3	Eğlenhoca Reservoir	38.526560, 26.559442	-
4	Karareis Reservoir	38.495556, 26.427778	-
5	Küçükbahçe Stream	38.562778, 26.367500	November 2020
6	Parlak Reservoir	38.613056, 26.406667	-
7	Salman Reservoir	38.583611, 26.389167	May 2021
8	Yelkentaş Stream	38.476944, 26.438333	August 2021

the freshwater bodies on the Karaburun Peninsula. Due to habitat modification and water pollution, the current situation seems compatible with the worldwide extinction of this species (Küçük, *et al*., 2018). Conversely, it can be argued that *A. anguilla* may reach the inland waters of the peninsula before the dams and physical barriers were built on the streams. There are no *A. anguilla* specimens were found in any of the four reservoirs studied (i.e., Bozköy Reservoir, Eğlenhoca Reservoir, Karareis Reservoir, and Parlak Reservoir), suggesting that the reservoirs may be preventing this species from accessing the freshwater bodies of the peninsula. As a result of the build of culverts, weirs and barriers, *A. anguilla* now inhabits only in the streams between the reservoirs and the sea. Hence, this species can't migrate across the dams built on rivers since these dams do not have fish passages.

ICES (2017) and Wgeel (2017) reports indicate that fishing and aquaculture activities represent the two most direct anthropological pressures on *A. anguilla* stocks. Furthermore, turbines of hydroelectric power plants and pumps indirectly affect fish migration, while water pollution and altered habitats contribute to the problem (Küçük, *et al*., 2018). The main reasons for the rare occurrence of *A. anguilla* stocks in the study area may be habitat loss due to human activities (e.g. Fig. 4) such as water pollution, excessive decrease in water level, destructions such as sand removal and streambed arrangements, artificial barriers such as regulators and dams, the regulation of river mouths for tourism purposes, and motor water vehicles (Küçük, *et al*., 2018). A decrease in *A. anguilla* stocks may also be attributed to the lack of fish passages, which are absent at all of the sites used in this study on the Karaburun Peninsula, where freshwater resources are quite limited.

Figure 4. An example of habitat degradation in the Karaburun Peninsula. Photograph by Sevan Ağdamar.

As a result of the present study, *A. anguilla* was described for the first time in the freshwater bodies of the Karaburun Peninsula. In total, only four fish samples were determined during the field surveys. We suggest to all stakeholders, as a solution-providing model application, that fish passages suitable for the study area are built, reform of up-down migrations, and reconstruction of the population of the species.

Author Contributions: Conception/Design of study: S.A., Ü.A.; Data Acquisition: S.A., Ü.A.; Data Analysis/Interpretation: S.A., Ü.A.; Drafting Manuscript: S.A., Ü.A. Final Approval and Accountability: S.A., Ü.A.

Acknowledgement
This study was financially supported by the T.C. Ministry of Environment, Urbanisation and Climate Change; General Directorate for Protection of Natural Assets. Fish samples gathered in this study were obtained from the project named "The Terrestrial Biodiversity Research Project of Karaburun-Ildır Bay Special Environmental Protection Area". The authors thank the T.C. Ministry of Environment, Urbanisation and Climate Change; General Directorate for Protection of Natural Assets for permission of the article publication.
Conflict of interest: The authors declare that they have no conflicts of interest.

References

Belletti, B., Garcia de Leaniz, C., Jones, J., Bizzi, S., Börger, L., *et al.* (2020) More than one million barriers fragment Europe's rivers. *Nature*, 588, 436–441. https://doi.org/10.1038/s41586-020-3005-2

Birnie-Gauvin, K., Tummers, J. S., Lucas, M. C. & Aarestrup, K. (2017). Adaptive management in the
context of barriers in European freshwater ecosystems. *Journal of Environmental Management*, 204, 436–441. https://doi.org/10.1016/j.jenvman.2017.09.023

Britton, E., Domegan, C.T., & McHugh, P. (2021). Accelerating sustainable ocean policy: The dynamics of multiple stakeholder priorities and actions for oceans and human health. *Marine Policy*, 124, 104333. https://doi.org/10.1016/j.marpol.2020.104333

Buisson, L., Thuiller, W., Lek, S., Lim, P., & Grenouillet, G., (2008). Climate change hastens the turnover of stream fish assemblages. *Global Change Biology*, 14, 2232–2248. https://doi.org/10.1111/j.1365-2486.2008.01657.x

Calles, O., & Greenberg, L. (2009). Connectivity is a two-way street–The need for a holistic approach to fish passage problems in regulated rivers. *River Research and Applications*, 25, 1268–1286. https://doi.org/10.1002/rra.1228

Cresci, A. (2020). A comprehensive hypothesis on the migration of European glass eels (*Anguilla anguilla*). *Biological Reviews*, 95, 1273-1286. https://doi.org/10.1111/brv.12609

Deinet, S., Scott-Gatty, K., Rotton, H., Twardek, W.M., Marconi, V., *et al*. (2020*). The living planet index (LPI) for migratory freshwater fish. technical report*. World Fish Migration Foundation, Groningen, The Netherlands.

Dekker, W. (2003). Did lack of spawners cause the collapse of the European eel, *Anguilla anguilla*? *Fisheries Management and Ecology*, 10, 356-376. https://doi.org/10.1111/j.1365-2400.2003.00352.x

Dekker, W. (2018). The history of commercial fisheries for European eel commenced only a century ago. *Fisheries Management and Ecology*, 26, 6–19. https://doi.org/10.1111/fme.12302.

Drouineau, H., Durif, C., Castonguay, M., Mateo, M., Rochard, E., *et al.* (2018). Freshwater eels: a symbol of the effects of global change. *Fish and Fisheries,* 19, 903–930. https://doi.org/10.1111/faf.12300

Geldiay, R., & Balık, S. (1988). *Türkiye tatlı su balıkları*. Ege Üniversitesi Fen Fakültesi Kitaplar Serisi, 97, 1-159.

Gross, M. R., Coleman, R. M., & McDowall, R. M. (1988). Aquatic productivity and the evolution of diadromous fish migration. *Science*, 239(4845), 1291–1293. https://doi.org/10.1126/science.239.4845.1291

Güven, E., Çolak, S., & Çolak, A. (2002). Türkiye'nin Batı Akdeniz ve Ege kıyılarındaki bazı içsulara Avrupa Yılanbalığı (*A. anguilla* L., 1758) elverlerinin giriş dönemlerinin saptanması. *Ege Üniversitesi Su Ürünleri Dergisi*, 19(3-4): 329–335.

Güven, E., Yıldız, M., & Baltacı, M. A. (2016). Kırmızı benekli (*Salmo trutta* sp.) alabalık yumurtalarının inkübasyonu ve yavruların beslenmesi üzerine bir araştırma, *Ege Journal of Fisheries and Aquatic Sciences*, 33(3), 209–216. https://doi.org/10.12714/egejfas.2016.33.3.04

ICES (2017, March). *Report of the Workshop on Designing an Eel Data Call (WKEELDATA)*. Report of the meeting of the CM 2017/SGIEOM, Rennes, France.

İkiz, R., Küçük, F., Gülyavuz, H., & Gülle, İ. (1998). *Antalya Korfezi'ndeki akarsulara (Manavgat Irmağı, Köprüçay Irmağı, Aksu ve Alara Çayları) giren yılan balığı (A. anguilla L., 1758) elverlerinin giriş mevsimlerinin tespiti ve yakalama metotları*. TÜBİTAK, YDABÇAG-314.

İZKA (2014, July). *Yarımada Sürdürülebilir Kalkınma Stratejisi*. İzmir Kalkınma Ajansı, İzmir, Turkey.

Jones, P., Consuegra, S., Börger, L., Jones, J., & Garcia de Leaniz, C. (2020). Impacts of artificial barriers on the connectivity and dispersal of vascular macrophytes in rivers: A critical review. *Freshwater Biology*, 65, 1165–1180. https://doi.org/10.1111/fwb.13493

Kornis, M. S., Weidel, B. C., Powers, S. M., Diebel, M. W., Cline, T. J., *et al.* (2015). Fish community dynamics following dam removal in a fragmented agricultural stream. *Aquatic Sciences*, 77, 465–480. https://doi.org/10.1007/s00027-014-0391-2

Küçük, F., Gülle, İ., Güçlü, S. S., & Atalay, M. A. (2016, November). *Antalya havzası'ndaki elver göçleri ve habitatları üzerine antropojenik baskılar*. Paper presented at the meeting of the Balık Geçitleri ve Göçleri Çalıştayı, İstanbul, Turkey.

Küçük, F., Gülle, İ., & Güçlü, S. S. (2018). Antalya Havzası akarsularındaki yılan balığı göçleri üzerine antropojenik baskılar. *Mehmet Akif Ersoy Üniversitesi Fen Bilimleri Enstitüsü Dergisi*, 9(1), 285–296. https://doi.org/10.29048/makufebed.466673

Larinier, M. & Travade, F. (2002). Downstream migration: Problems and facilities*. Bulletin français de la pêche et de la pisciculture*, 364, 181–207. https://doi.org/10.1051/kmae/2002102

Memiş, D., Yamaner, G., Tosun, D. D., Tunçelli, G., & Tınkır, M. (2020). Current status of economically important diadromous fish species of Turkey; European eel, Black Sea trout and sturgeon species. *Aquatic Research*, 3(4), 188–196. https://doi.org/10.3153/AR20017

Oray, I. R. (1987). Research on European eel (*A. anguilla*) catching in inland waters of East Mediterranean Region. *İstanbul Üniversitesi Su Ürunleri Fakültesi Dergisi*, 1(1), 43–69.

Parasiewicz, P., Belka, K., Lapinska, M., Lawniczak, K., Prus, P., *et al*. (2022) Over 200,000 kilometers of river-fish habitat is lost to impoundments in Europe. *PREPRINT*, available at Research Square. https://doi.org/10.21203/rs.3.rs-1287087/v1

Pike, C., Crook, V., & Gollock, M. (2020). *Anguilla anguilla*. The IUCN Red List of Threatened Species 2020, e.T60344A152845178. (Downloaded on 04 March 2022).

Poff, N. L., & Ward, J. V. (1990). Physical habitat template of lotic systems: Recovery in the context of historical pattern of spatiotemporal heterogeneity. *Environmental Management*, 14, 629. https://doi.org/10.1007/BF02394714

Pont, D., Hugueny, B., Beier, U., Goffaux, D., Melcher, A., *et al.* (2006). Assessing river biotic condition at a continental scale: a European approach using functional metrics and fish assemblages. *Journal of Applied Ecology*, 43, 70–80. http://dx.doi.org/10.1111/j.1365-2664.2005.01126.x

Starkie, A. (2003). Management issues relating to the European eel, *Anguilla anguilla*. *Fisheries Management and Ecology*, 10, 361–364. http://dx.doi.org/10.1111/j.1365-2400.2003.00351.x

Sunlu, U., & Egemen, Ö. (1998). Homa Dalyanı ve Izmir Körfezinin (Ege Denizi) farklı bölgelerindeki kirlenme durumu ile bazı ekonomik balık türlerinde ağır metal düzeylerinin araştırılması. *Ege Journal of Fisheries and Aquatic Sciences*, 15(3-4), 241–261.

Taylor, C. M., Millican, D. S., Roberts, M. E., Slack, W. T. (2008). Long-term change to fish assemblages and the flow regime in a southeastern US river system after extensive aquatic ecosystem fragmentation. *Ecography*, 31, 787–797. https://doi.org/10.1111/j.1600-0587.2008.05526.x

Veryeri, N. (2006). *İzmir Körfezi, Karaburun Yarımadası'nda Akdeniz Foku ((Monachus monachus (Hermann, 1779) habitat biyolojik çeşitlilik analizi* (Doctoral Dissertation). Hacettepe University, Institute of Natural and Applied Sciences.

Weber, M. (1986). Fishing method and seasonal occurrence of glass eels (*A. anguilla*) in the Rio Minho, West Coast of the Iberian Peninsula. *Vie Milieu*, 36: 243–250.

Wgeel (2017, October). *Ices Wgeel Report*. Report of the Joint EIFAAC/ICES/GFCM Working Group on Eels (Wgeel), Kavala, Greece.

Yalçın-Özdilek, S., Gümüş, A., & Dekker, W. (2006). Growth of European eel in a Turkish river at the south eastern limit of its distribution. *Electronic Journal of Ichthyology*, 2, 55–64.

Turkish Journal of Bioscience and Collections
Volume 6, Number 1, 2022
E-ISSN: 2601-4292

RESEARCH ARTICLE

Length-weight relationships and condition factors of three fish species in the Karamenderes Stream (Çanakkale, Türkiye)

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Received: 04.03.2022
Revision Requested: 08.03.2022
Last Revision Received: 14.03.2022
Accepted: 15.03.2022

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Citation: Yalcin Ozdilek, S., & Partal, N. (2022). Length-weight relationships and condition factors of three fish species in the Karamenderes Stream (Çanakkale, Türkiye). *Turkish Journal of Bioscience and Collections, 6*(1), 21–25. https://doi.org/10.26650/tjbc.20221082587

Abstract

Objective: The aim of this study is to determine the length-weight relationships and condition factors of two native freshwater fish species and the invasive *Carassius gibelio* in the Karamenderes Stream (Çanakkale, Türkiye).

Materials and Methods: Fish specimens were caught monthly from August 2007 to July 2008 using cast nets in Karamenderes Stream's Pınarbaşı location. The length-weight relationship was calculated according to $W = aL^b$ and the Fulton's condition factor was calculated according to $K = 100*W/L^3$ equations.

Results: The *b* (slope) values of the length-weight relationships are 3.026, 3.201, and 3.255, respectively, for *Barbus oligolepis*, *Squalius cii*, and *C. gibelio*. The growth was isometric in *B. oligolepis* and positive allometric in *C. gibelio* and *S. cii*. The Fulton's condition factor varied between 0.51 and 2.08 in *C. gibelio*, 0.76 and 1.25 in *B. oligolepis*, and 0.59 and 1.44 in *S. cii* specimens.

Conclusion: This study is the first report that presents the length-weight relationship of two native *species, B. oligolepis* and *S. cii*, in the presence of invasive *C. gibelio*. The length and weight distribution pattern through the year indicated that there was seasonality in the utilization of this section of the stream by juvenile and adult stages of three species. The lowest condition factor and b value in *B. oligolepis* led us to the conclusion that the competitive exclusion risk of this species. The effect of invasive *C. gibelio* on the natives should be further researched focusing on species interactions. From the fact that there are limited data on the length-weight relationship and biology of *B. oligolepis* and *S. cii*, there is a need for further research.

Keywords: Growth, Condition, Invasive species, Native species, Çanakkale

Introduction

In general, length-weight relationships in fisheries biology aid to determine the regional or habitat-specific biological characteristics of the species (Gonçalves et al., 1997). Additionally, the length-weight relationships are useful for determining the stock assessment, sexual maturation of fishes (Ogle, 2018; Wottoon, 1990) and are a time-saving tool in the fieldwork (Martin-Smith, 1996). It has been assumed that the length-weight relationships of fish species sharing the same habitat will shed light on interspecific relationships in the community (Robinson et al., 2010). *Barbus oligolepis* (Battalgil, 1941) and *Squalius cii* (Richardson, 1857) are two native freshwater fish species that share the same habitat with invasive *Carassius gibelio* (Bloch, 1782) in Karamenderes Stream. The length-weight relationship and condition factor values of these native species with an invasive species may give interesting data because of possible food or habitat competitions that may have to arise due to the interaction of species with each other. When studying length-weight relationships, it is important to keep in mind that they are influenced by a variety of biotic and abiotic factors (Froese, 2006). In addition to physical or chemical constitutes, there is limited study on the length-weight relationships of native *B. oligolepis* and *S. cii* species in the presence of invasive competitors. Therefore, the aim of this study is to determine the length-weight relationships, length, weight, and condition factor distributions of two native freshwater fish species and invasive *C. gibelio* in the Karamenderes Stream's Pınarbaşı location.

Material and Methods

Field studies were carried out with monthly surveys between August 2007 and July 2008. Sampling was carried out along nearly to 2 km section at Pınarbaşı location (39°53′28″ N, 26°17′32″E and 39°54′07″N, 26°16′28″E) of Karamenderes Stream in Çanakkale (Türkiye) with cast nets (12-25 mm mesh size) (Fig. 1). Karamenderes Stream originates from Kaz and Ağı mountain, flows through Troy, and reaches Çanakkale Strait. The stream is 109 km long, nearly 3–15 m wide, and it includes two irrigation reservoirs (Bayramiç and Pınarbaşı Reservoirs). The depth of the study area is nearly 25-80 cm, habitat is run, riffle, and pool characteristic and the bottom type includes gravel, sand, and clay. After sampling, the specimens were kept in clove oil treatment under ethical guidelines then they were carried to the laboratory (Prince & Powell, 2000). In the laboratory, the total length (*TL*) of the fish specimens was measured with a ruler nearest to 0.1 mm. Body weights (*W*) were weighed with a digital balance nearest to 0.1 g. The descriptive statistics were given as mean, standard deviation, minimum and maximum values for *TL, W*, and *K*. The equation of $W = aL^b$; *W*: body weight (g), *a*: regression intercept, *b*: growth coefficient, *L*: total length (cm) equation was used to determine the length-weight relationships of the specimens (Bagenal, 1978; Froese, 2006). In this equation, the growth type was determined based on the *b* value. If this value is greater than 3, it is defined as positive allometric growth, if it is less than 3, it is defined as negative allometric growth, and if it is equal to 3 it is defined as isometric growth (Bagenal, 1978). The linear regression model was used to estimate 95% confidence limits (Cl) of *a* and *b*, and the coefficient of determination (r^2) according to Ogle (2018) in R Software (R Core Team, 2021). The visualization of the figure was produced with the *ggplot2* package (Wickham, 2016) in R Software (R Core Team, 2021). The maps were produced in ArcGIS. Fulton Condition Factor ($K = 100*W/L^3$) equation was used to determine the body condition of specimens (Le Cren, 1951).

Results

A total of 271 specimens were examined of three species whereas 77 specimens were *B. oligolepis*, 117 specimens were *C. gibelio* and 77 specimens were *S. cii*. Even attempts, fish could not be caught in some months (Fig. 2). The species total length, weight and condition factors descriptive are given in Table 1.

The specimens of *B. oligolepis* were found to be smaller between August and October (2007) than in other months in terms of overall length and weight (Fig. 2). The largest specimens in the population were sampled in March, April, and July 2008. In terms of the condition factor, it was

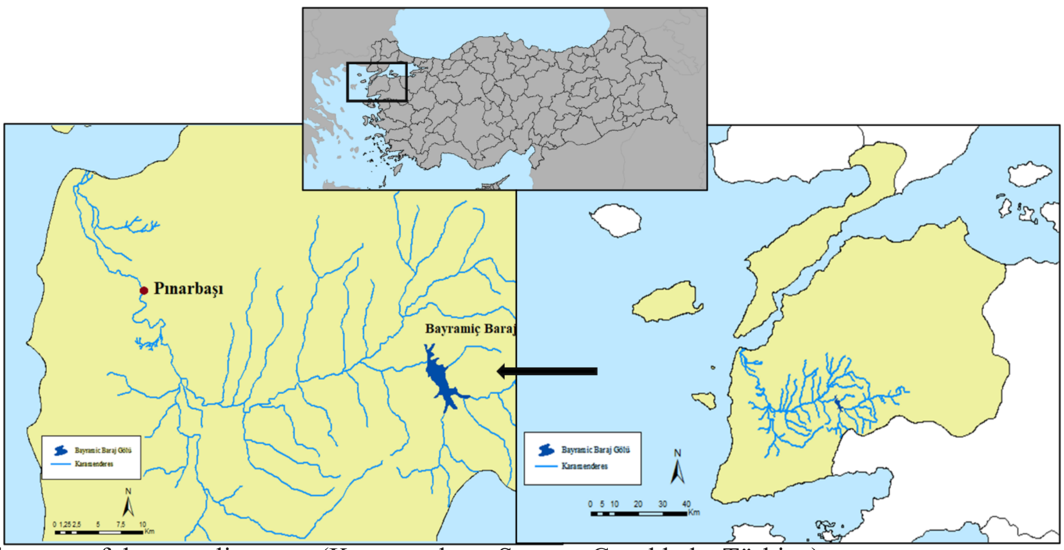

Figure 1. The map of the sampling area (Karamenderes Stream, Çanakkale, Türkiye).

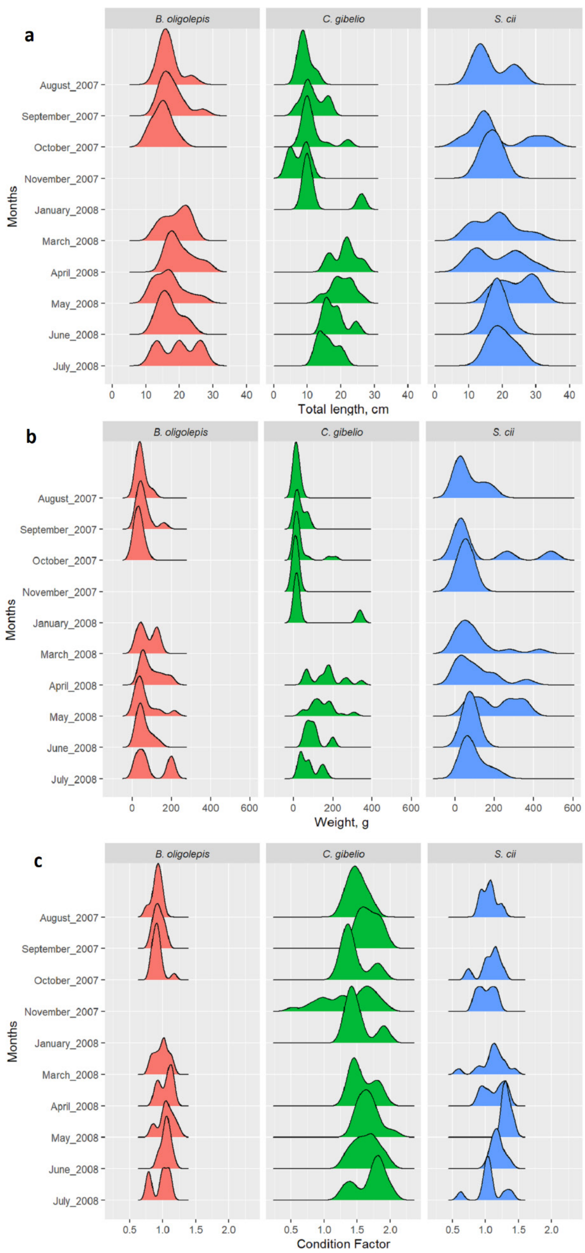

Figure 2. a:Total length (cm), b:weight (g), and c:condition factor values of three species.

determined that the condition was low in August-October 2007. Based on total length and weight by month, the *C. gibelio* population was smaller in August-October 2007 than in other months (Fig. 2). The largest specimens in the population were sampled in April-June 2008. The condition factor was found to be higher in *C. gibelio* specimens than in other species specimens. In November 2007 and June 2008, the specimens in the *S. cii* population were smaller than in other months in terms of total length and weight by month (Fig. 2). The largest specimens in the population were sampled in October 2007 and April-May 2008. In terms of condition factors for *S. cii* specimens, it was determined that the highest condition factor was in May and June 2008 (Fig. 2).

The growth characteristics and descriptive statistics of the three species were given in Table 1. The growth equation of the examined *B. oligolepis* specimens was $W=0.0091L^{3.0256}$, the growth equation of *C. gibelio* specimens was $W=0.0079L^{3.2552}$ and the growth equation of *S. cii* specimens was $W=0.0062L^{3.2006}$. According to the growth equations of the examined specimens, the growth was isometric in *B. oligolepis* and positive allometric in *C. gibelio* and *S. cii*. (Table 1). The highest growth coefficient (*b* value) out of the three species was found in *C. gibelio* specimens (Table 1).

Discussion

In this study, the length-weight relationships and condition factors of three freshwater fish species have been examined. The *b* values for all three species were within the predicted range (2.5–3.5) (Froese, 2006). The feeding behaviours, reproductive characteristics, seasonality, and habitat characteristics can be given among the elements that affect the length-weight relationship and the condition factor (Froese, 2006; Wootton, 1990). The predicted range of *b* values should be evaluated by various elements of species' life-history traits. As it is known, the gonads of freshwater fish mature during the spawning season, which causes an increase in body weight (Nikolsky, 1963; Wootton, 1990). The high condition values in three species in

Table 1. Length-weight relationships parameters and descriptive statistics for three species (*TL*: Total length; *W*: Body weight; *K*: Condition factor; n: Number of specimens; SD: Standard deviation; *a*: Intercept of linear regression; *b*: Slope of linear regression; CI: Confidential interval; r^2: Coefficient of determination (R<0.05)).

		TL (cm)			*W* (g)			*K*			Parameters of the length-weight relationships						
Species	n	mean±SD	min	max	mean±SD	min	max	mean±SD	min	max	*a*	95% CI of *a*		*b*	95% CI of *b*		r^2
B. oligolepis	77	17.3±3.9	11.1	28.1	59.4±45.6	12.1	213.4	0.99±0.11	0.76	1.25	0.0091	0.007	0.013	3.026	2.907	3.144	0.9733
C. gibelio	117	14.7±6.4	4.0	32.5	77.9±84.4	0.6	344.1	1.55±0.26	0.51	2.08	0.0079	0.007	0.009	3.255	3.194	3.317	0.9898
S. cii	77	18.8±5.4	7.8	33.8	97.8±96.5	3.5	487.6	1.12±0.17	0.59	1.44	0.0062	0.004	0.009	3.201	3.084	3.318	0.9754

the spawning season (spring and beginning of summer) might be explained by maturity.

In the literature there are many well documented studies on the length-weight relationship and condition features of invasive *C. gibelio* (Ağdamar & Gaygusuz, 2021; Birecikligil et al., 2016; Bostancı et al., 2007; Erguden, 2016; Güçlü & Küçük, 2021; Ilhan & Sari, 2015; Kırankaya & Ekmekçi, 2013; Saç & Okgerman, 2016; Şaşı, 2015; Yazıcıoğlu et al., 2013). Based on these studies it can be said that there were spatial variations in length-weight relationships and the condition factor values depending on local conditions and community structure. In Kocabaş Stream (Biga Peninsula), the *b* values of *B. oligolepis* specimens are higher (3.17 and 3.31) than that in Karamenderes population (Ertürk Gürkan & Yalçın Özdilek, 2020). On the other hand, when this study is compared to the study in Kocabaş Stream, *b* values for *S. cii* specimens were similar with the downstream population (3.21) but lower than the upstream population (3.41, see Ertürk Gürkan & Yalçın Özdilek, 2020). The *b* values of *B. oligolepis* and *S. cii* reported by İlhan et al (2012) are similar to the present results.

This study is the first report that presents the length-weight relationship of two native species, *B. oligolepis* and *S. cii*, in the presence of invasive *C. gibelio*. The fact that *C. gibelio* had a high *b* value and the high condition factor is compatible with the previous studies that have been reported invasive characteristics of this species. For instance, the characteristics of the invasive species include high plasticity (Yalçın Özdilek & Jones, 2014), rapid spreading through the gynogenesis and reproductivity characteristics (Paschos et al., 2004), altering the native species niches (Yalçın Özdilek et al., 2019), and filling the vacant niches (Karlson et al., 2015).

As a conclusion of this study, the section of Karamenderes Stream was used for both juvenile and adult stages by three species. The length and weight distribution pattern through the year indicated that there was seasonality in the utilization of this section by juvenile and adult stages of three species. The lowest condition factor and *b* value in *B. oligolepis* led us to the conclusion that the competitive exclusion risk of this species. The effect of invasive *C. gibelio* on the natives should be further researched focusing on species interactions. From the fact that there are limited data on the length-weight relationship and biology of *B. oligolepis* and *S. cii*, there is a need for further research.

Fund: This study was funded by Çanakkale Onsekiz Mart University BAP 2007/51 project.

Conflict of Interest: The authors declare no conflict of interest.

Acknowledgement: This study was funded by Çanakkale Onsekiz Mart University BAP 2007/51 project. We would like to thank fisherman Selahattin Erol for specimen collection on the field.

Author Contributions: Conception/Design of study: S.Y.O., N.P.; Data Acquisition: S.Y.O.; Data Analysis/Interpretation: N.P.; Drafting Manuscript: N.P., S.Y.O.; Critical Revision of Manuscript: N.P., S.Y.O.; Final Approval and Accountability: N.P., S.Y.O.

References

Ağdamar, S., & Gaygusuz, Ö. (2021). Condition, Length-Length and Length-Weight Relationships for Four Introduced Freshwater Fish Species from an Island Ecosystem (Gökçeada, Turkey). *Journal of Anatolian Environmental and Animal Sciences*, *6*(3), 403–408.

Bagenal, T. (1978). *Method for assessment of fish production in freshwaters*. Blackwell Sci.

Birecikligil, S. S., Çİçek, E., Öztürk, S., Seçer, B., & Celepoğlu, Y. (2016). Length-length, length-weight relationship and condition factor of fishes in Nevşehir Province, Kızılırmak River Basin (Turkey). *Actabiologicaturcica.Com*, *29*(3), 72–77.

Bostancı, D., Polat, N., Kandemir, Ş., & Yılmaz, S. (2007). Determination of Condition Factor and Length-Weight Relationship of the Crucian Carp, *Carassius gibelio* (Bloch, 1782) Inhabiting Bafra Fish Lake. *SDÜ Fen Edebiyat Fakültesi Fen Dergisi (E-Dergi)*, *2*(2), 117–125.

Erguden, S. A. (2016). Length-weight relationships for six freshwater fish species from the Seyhan Reservoir (south-eastern Anatolia, Turkey). *Journal of Applied Ichthyology*, *32*(1), 141–143. https://doi.org/10.1111/jai.12905

Ertürk Gürkan, S., & Yalçın Özdilek, Ş. (2020). Circumstantial evidence of effect of trout farming on length-weight relations of native fish species : *Barbus oligolepis* (Battalgil , 1941) and *Squalius cii* (Richardson , 1857). *Journal of Aquaculture & Marine Biology*, *9*(3), 87–90.

Froese, R. (2006). Cube law, condition factor and weight-length relationships: History, meta-analysis and recommendations. *Journal of Applied Ichthyology*, *22*(4), 241–253. https://doi.org/10.1111/j.1439-0426.2006.00805.x

Gonçalves, J. M. S., Bentes, L., Lino, P. G., Ribeiro, J., Canário, A. V. M., & Erzini, K. (1997). Weight-length relationships for selected fish species of the small-scale demersal fisheries of the south and south-west coast of Portugal. *Fisheries Research*, *30*(3), 253–256. https://doi.org/10.1016/S0165-7836(96)00569-3

Güçlü, S. S., & Küçük, F. (2021). Length-weight relationships of fishes in the Gediz River basin lentic systems (Turkey). *Journal of Limnology and Freshwater Fisheries Research*, *7*(2), 166–170. https://doi.org/10.17216/limnofish.798820

İlhan, A., & Sari, H. M. (2015). Length-Weight Relationships of Fish Species in Marmara Lake, West Anatolia, Turkey. *Croatian Journal of Fisheries*, *73*(1), 30–32. https://doi.org/10.14798/73.1.784

İlhan, A., Sarı, H. M., Saygı, H., & Ustaoğlu, M. R. (2012). Length–weight relationships of freshwater fishes in the Biga Peninsula (northwestern Anatolia, Turkey). *Journal of Applied Ichthyology*, *28*, 857–858.

Karlson, A. M. L., Gorokhova, E., & Elmgren, R. (2015). Do deposit-feeders compete? Isotopic niche analysis of an invasion in a species-poor system. *Scientific Reports*, *5*, 1–8. https://doi.org/10.1038/srep09715

Kırankaya, Ş. G., & Ekmekçi, F. G. (2013). Life-history traits of the invasive population of Prussian carp, *Carassius gibelio* (Actinopterigi: Cypriniformes: Cyprinidae), from Gelingüllü reservoir, Yozgat, Turkey. *Acta Ichthyologica et Piscatoria*, *43*(1), 31–40. https://doi.org/10.3750/AIP2013.43.1.05

Le Cren, E. D. (1951). The Length-weight relationship and seasonal cycle in gonad weight and condition in the perch (*Perca fluviatilis*). *Journal of Animal Ecology*, *20*, 201–219.

Martin-Smith, K. M. (1996). Length/weight relationships of fishes in a diverse tropical freshwater community, Sabah, Malaysia. *Journal of Fish Biology*, *49*(4), 731–734. https://doi.org/10.1006/jfbi.1996.0201

Nikolsky, G. V. (1963). *The Ecology of Fishes (Translated by L. Birkett).* UK: Academic Press.

Ogle, D. H. (2018). Introductory Fisheries Analyses with R. *Introductory Fisheries Analyses with R*. https://doi.org/10.1201/9781315371986

Paschos, I., Nathanailides, C., Tsoumani, M., Perdikaris, C., Gouva, E., & Leonardos, I. (2004). Intra and inter-specific mating options for gynogenetic reproduction of *Carassius gibelio* (Bloch, 1783) in Lake Pamvotis (NW Greece). *Belgian Journal of Zoology*, *134*(1), 55–60.

Prince, A., & Powell, C. (2000). Clove Oil as an Anesthetic for Invasive Field Procedures on Adult Rainbow Trout. *North American Journal of Fisheries Management*, *20*(4), 1029–1032. https://doi.org/10.1577/1548-8675(2000)020<1029:coaaaf>2.0.co;2

R Core Team. (2021). R: A language and environment for statistical computing. In *R Foundation for Statistical Computing*. https://www.r-project.org/

Robinson, L. A., Greenstreet, S. P. R., Reiss, H., Callaway, R., Craeymeersch, J., De Boois, I., Degraer, S., Ehrich, S., Fraser, H. M., Goffin, A., Kröncke, I., Jorgenson, L. L., Robertson, M. R., & Lancaster, J. (2010). Length-weight relationships of 216 North Sea benthic invertebrates and fish. *Journal of the Marine Biological Association of the United Kingdom*, *90*(1), 95–104. https://doi.org/10.1017/S0025315409991408

Saç, G., & Okgerman, H. (2016). Length-weight relationship, length-length relationship and condition factor of some fish populations in Büyükçekmece Reservoir (İstanbul, Turkey). *Journal of Limnology and Freshwater Fisheries Research*, *2*(1), 43. https://doi.org/10.17216/limnofish-5000169386

Şaşı, H. (2015). Gowth and Condition of Invasive Species Prussian Carp, *Carassius gibelio* (Bloch, 1782) in a Dam Lakes from Büyük Menderes Basin (Turkey). *Mugla Journal of Science and Technology*, *1*(2), 6–10.

Wickham, H. (2016). ggplot2: Elegant Graphics for Data Analysis. In *Journal of the Royal Statistical Society: Series A (Statistics in Society)* (Vol. 174, Issue 1). Springer Nature. https://doi.org/10.1111/j.1467-985x.2010.00676_9.x

Wootton, R. J. (1990). *Ecology of teleost fishes.* Kluwer Academic Publishers.

Yalçın Özdilek, Ş., & Jones, R. I. (2014). The diet composition and trophic position of introduced Prussian carp *Carassius gibelio* (Bloch, 1782) and native fish species in a Turkish river. *Turkish Journal of Fisheries and Aquatic Sciences*, *14*(3), 769–776. https://doi.org/10.4194/1303-2712-v14_3_19

Yalçın Özdilek, Ş., Partal, N., & Jones, R. I. (2019). An invasive species, *Carassius gibelio*, alters the native fish community through trophic niche competition. *Aquatic Sciences*, *81*(2), 1–11. https://doi.org/10.1007/s00027-019-0623-6

Yazıcıoğlu, O., Yılmaz, S., Yazıcı, R., & Polat, N. (2013). Ladik Gölü (Samsun, Türkiye)'nde Yaşayan Havuz Balığı, *Carassius gibelio* (Bloch, 1782)'nın Kondisyon Faktörü, Boy-Ağırlık ve Boy-Boy İlişkileri. *The Black Sea Journal of Sciences*, *3*(9), 72–80.

Turkish Journal of Bioscience and Collections
Volume 6, Number 1, 2022
E-ISSN: 2601-4292

SHORT COMMUNICATION

The New Maximum Length and Depth of *Lagocephalus guentheri* Miranda Ribeiro, 1915 in the Mediterranean Sea

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Received: 27.08.2021
Revision Requested: 08.11.2021
Last Revision Received: 17.12.2021
Accepted: 09.01.2022

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Citation: Kesici, N. B., Dalyan, C., & Gonulal, O. (2022). The New Maximum Length and Depth of *Lagocephalus guentheri* Miranda Ribeiro, 1915 in the Mediterranean Sea. *Turkish Journal of Bioscience and Collections, 6*(1), 27–29. https://doi.org/10.26650/tjbc.2022987421

Abstract
In this study, one specimen of *Lagocephalus guentheri*, the largest individual (536 mm) ever recorded, was obtained from the Iskenderun Bay, Levantine Sea. The specimen was caught from two nautical miles off the Samandağ coast at a depth of 128 m with a commercial trawler. The present finding reports the maximum length and the deepest record of the species for the Mediterranean Sea. Apparently, the distribution of the species in the Mediterranean Sea will expand in the following years.

Keywords: Deepest catch, Maximum length, Lessepsian, Diamondback puffer, Levantine Sea

Introduction

Since the opening of the Suez Canal in 1869, the coastal ecosystems of the Eastern Mediterranean Sea have been subjected to the establishment of many non-indigenous species, including the pufferfish. Pufferfish are among the most invasive species in the marine environment. As the population of the pufferfish continues to grow, so does the public health risk they pose to humans and animals due to their tetrodotoxin production (Beköz, et al., 2013).

With 19 genera and approximately 130 species within the family Tetraodontidae (Nelson, 2016), six species are found in the eastern Mediterranean (Turan, et al., 2018). Among them, the diamondback puffer (*Lagocephalus guentheri* Miranda Ribeiro, 1915) is a demersal species and it is distributed in shallow waters (up to 64 m) of tropical and subtropical zones at latitudes between 30°N and 30°S (Keskin, et al., 2011; Froose & Pauly, 2020). It was previously known as *L. spadiceus* in the Mediterranean Sea, before Matsuura et al. (2011) clarified this conflict.

The first report of *L. guentheri* in the Mediterranean Sea was from Egypt in 2015 (Farrag et al. 2016) and afterwards, the species was caught from the Turkish waters of the Aegean Sea (Akyol and Aydın 2016), as well as the Levantine coasts (Ergüden et al. 2017) and off the coasts of Gökova Bay (Çelik et al. 2018). The species occurs in

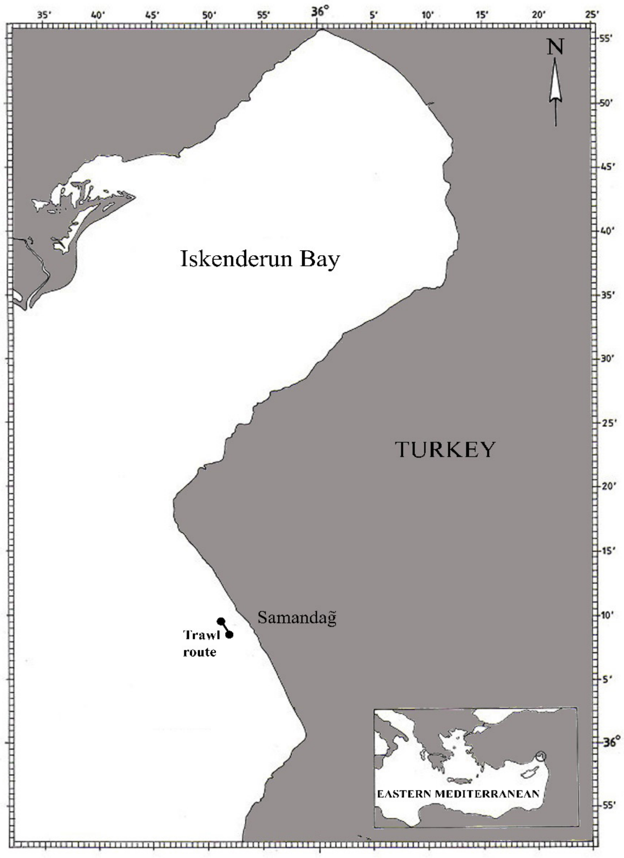

Figure 1. Study area in the İskenderun Bay, Levantine Sea.

Figure 2. The obtained individual of the *L. guentheri* (TL: 536 mm) in the Iskenderun Bay, northeastern Mediterranean Sea.

the Mediterranean Sea as a Red Sea immigrant, and has reached up to the Sea of Marmara (Tuncer, et al., 2008). The present paper provides the largest and deepest record of *L. guentheri* from the Mediterranean Sea.

Material and Methods

A single specimen of *L. guentheri* (Fig. 2.) was caught from two nautical miles off the Samandağ coast (36° 06′ 54" - 35° 53′ 16"N, 36° 06′ 13"- 35° 53′ 44") at a depth of 128 m from sandy bottom with commercial trawl vessel on 20 January 2015 (Fig. 1). The length of the vessel is 23 m, powered by a 400 HP engine with a codend mesh size of 44 mm. All morphometric features and color of the diamondback puffer agree with the descriptions by Matsuura et al. (2011) and Farrag et al. (2016).

Results and Discussion

L. guentheri is among the most common large-sized pufferfish, together with *L. sceleratus* (Gmelin, 1789) in the eastern Mediterranean Sea. It is commonly found in trawl fishing as discard in the eastern Mediterranean Sea (Yemisken, et al., 2014; Keskin, et al., 2011). The biggest individual ever captured was measured as 43.1 cm (Başusta, et al., 2013).In the present study, the total length and weight of the caught individual were measured as 536 mm and 1783 g, respectively. The individual is preserved in 50% ethanol solution and stored in the Istanbul University Science Faculty, Hydrobiology Museum (IUSHM 2021-1465).

Mutlu et al. (2021) mentioned that the length of the species shows a declining trend from shallow waters to deeper zones, and the longest individuals were observed at the depths of 75 m. It is not surprising for the individuals to reach a larger average size in such populations occurring in depths shallower than 60 m, due to the fact that there is not any industrial demersal fishing pressure in such depths, regarding the Mediterranean Sea. However, it is very unusual to obtain the species of this size from a depth of 128 m, a depth contour that is known to be under dramatic fishing pressure. The morphometric characters of the captured individual were measured using a digital compass and the measurements are presented in Table 1.

Table 1. Morphometric features of *L. guentheri* off the Samandag coast (northeastern Levantine Sea)

Morphometric features	Value
Weight (g)	1783
Total length (mm)	536
Standard length (mm)	445
Body depth (mm)	88
Head length (mm)	120
Snout length (mm)	60
Eye diameter (mm)	27
Interorbital distance (mm)	62
Dorsal fin base length (mm)	44
Anal fin base length (mm)	36
Pectoral fin base length (mm)	34
Predorsal length (mm)	273
Preanal length (mm)	285
Caudal peduncle (mm)	23

Conclusion

The range expansion, reproduction, growth and feeding biology of the immigrant species should be monitored to better understand their invasion dynamics. Among the many biological parameters, growth parameter provides the most conspicuous information regarding the status of invasive species population.

This study reports the largest and deepest record of *L. guentheri* ever given from the Mediterranean Sea. Driven by the many effects of human pressure and climate change, it seems likely that the distribution and establishment of the species across the Mediterranean Sea will expand in the following years.

Peer-review: Externally peer-reviewed.
Conflict of Interest: The authors declare that they have no conflicts of interest.
Financial Disclosure: This study was funded by Scientific Research Projects Coordination Unit of Istanbul University (Project number: FBA-2019-30157)
Author Contributions: Conception/Design of study: C.D.; Data Acquisition: C.D., O.G.; Data Analysis/ Interpretation: C.D.; Drafting Manuscript: N.B.K., C.D.; Critical Revision of Manuscript: O.G.; Final Approval and Accountability: O.G., N.B.K.
Acknowledgement: We thank all fishers that provided information about catches and the team that collected this information.

References

Akyol, O. & Aydın, İ. (2016). A new record of Lagocephalus guentheri (Tetraodontiformes: Tetraodontidae) from the north-eastern Aegean Sea. *Zoology in the Middle East,* 62(3), 271-273.

Başusta, A., Başusta, N. & Ozer-Ifakat, E. (2013). Length-Weight Relationship of Two Puffer Fishes, Lagocephalus sceleratus and Lagocephalus spadiceus, From Iskenderun Bay, Northeastern Mediterranean, Turkey. *Pakistan J. Zool.,* 45(4), 1047-1051.

Beköz, A.B., Beköz, S., Yilmaz, E., Tüzün, S. & Beköz, Ü. (2013). Consequences of the increasing prevalence of the poisonous Lagocephalus sceleratus in southern Turkey. *Emergency Medicine Journal,* 30(11), 1-2.

Çelik, M., Deidun, A., Uyan, U. & Giovos, I. (2018). Filling the gap : a new record of diamondback puffer (Lagocephalus guentheri Miranda Riberio, 1915) from the west-eastern Mediterranean Sea, Turkey. *Journal of the Black Sea/Mediterranean Environment,* 24(2), 180-185.

Ergüden, D., Kabaklı, F., Uyan, A., Doğdu, S.A., Karan, S., Gürlek, M. & Turan, C. (2017). New record of diamondback puffer Lagocephalus guentheri Miranda Ribeiro, 1915 from the North-Eastern Mediterranean, Turkey. *Natural and Engineeering Sciences,* 2(3), 67-73.

Farrag Mahmoud, M.S., El-Haweet Alaa, A.K., Akel, El-Sayed kh A. & Moustafa Mohsen, A. (2016). Occurrence of puffer fishes (Tetraodontidae) in the eastern Mediterranean, Egyptian coast - filling in the gap. *BioInvasions Records*, 5(1), 47–5.

Froese, R, & Pauly, D. (2020). FishBase, World Wide Web electronic publication, Available from: http://www.fishbase.org, (08/2020).

Keskin, A.C., Turan, C. & Erguden, D. (2011). Distribution of the Demersal Fishes on the Continental Shelves of the Levantine and North Aegean Seas (Eastern Mediterranean). *Turkish Journal of Fisheries and Aquatic Sciences,* 11, 413-423.

Matsuura, K., Golani, D. & Bogorodsky, V. (2011). The first record of Lagocephalus guentheri Miranda Ribeiro, 1915 from the Red Sea with notes on previous records of L. lunaris (Actinopterygii, Tetraodontiformes, Tetraodontidae). *Bulletin of the National Museum of Nature and Science Series A*, 37, 163–169.

Mutlu, E., De Meo, I. & Miglietta, C. (2021). Spatio-temporal distribution of pufferfish (Tetraodontidae) along the Turkish coast of the Mediterranean Sea. *Mediterranean Marine Science,* 22(1), 1-19. doi:https://doi.org/10.12681/mms.23481

Nelson, J.S., Fishes of the World, 5th Edition. John Wiley & Sons Inc., New Jersey, 2016.

Tuncer, S., Aslan Cihangir, H. & Bilecenoglu, M. (2008). First record of the Lessepsian migrant Lagocephalus spadiceus (Tetraodontidae) in the Sea of Marmara. *Cybium,* 32(4), 347-348.

Turan, C., Gürlek M., Başusta, N., Uyan, A., Doğdu, S.A. & Karan, S. (2018). A Checklist of the Non-indigenous Fishes in Turkish Marine Waters. *Natural and Engineering Sciences,* 3(3), 333-358.

Yemisken, E., Dalyan C. & Eryilmaz, L. (2014). Catch and discard fish species of trawl fisheries in the Iskenderun Bay (North-eastern Mediterranean) with emphasis on lessepsian and chondricthyan species. *Mediterranean Marine Science,* 15, 380-389.

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