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Updated Fish Fauna of Karpuz and Ilıca Streams in Antalya Region

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Abstract: This research aims to provide an updated account of the fish fauna present in the streams Karpuzçay and Ilıca located in Antalya, southwestern Türkiye. The research was conducted through fish sampling at four strategically selected stations within these rivers, which were chosen for their high representativeness of the overall riverine ecosystem. Records from Ege University Faculty of Fisheries Freshwater Fish Collection (EFSM), and the Zoological Collection of Recep Tayyip Erdoğan University (FFR) were also included in the study, along with published literature, to create an updated fish list for these two rivers. Our findings revealed the presence of multiple families, indicating a diverse fish community within these freshwater systems. Significantly, this study reports the presence of *Tinca tinca* (tench) in Karpuzçay Stream for the first time according to EFSM records, marking a noteworthy addition to the known fish fauna of the region. Karpuzçay and Ilıca rivers are critical components of the Antalya River Basin, contributing substantially to the area's ecological balance, economic activities, and cultural heritage. This study not only updates the fish species list of the Karpuzçay and Ilıca rivers but also discusses the implications of these findings for the health and conservation of these aquatic ecosystems. By compiling and analyzing existing information alongside new data, I aim to provide a comprehensive overview of the rivers' biodiversity and the environmental factors influencing it. The discussion includes recommendations for conservation strategies to mitigate threats and promote the sustainable management of these vital freshwater resources.

Keywords: South Anatolia, Antalya river basin, freshwater fish, ichthyofauna, biodiversity.

Antalya Bölgesi'ndeki Karpuz ve Ilıca Derelerinin Güncellenmiş Balık Faunası

***Sorumlu yazar:**
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Öz: Bu araştırma, Türkiye'nin güneybatısında, Antalya ilinde bulunan Karpuzçay ve Ilıca akarsularında mevcut balık faunasına güncel bir bakış sağlamayı amaçlamaktadır. Araştırma, nehir ekosisteminin genel temsil gücü yüksek olan dört istasyonda balık örneklemeleri yapılarak gerçekleştirilmiştir. Çalışmada, Ege Üniversitesi Su Ürünleri Fakültesi Tatlısu Balıkları Koleksiyonu (EFSM) ve Recep Tayyip Erdoğan Üniversitesi Zooloji Koleksiyonu (FFR) kayıtları ile yayınlanmış literatür de incelenerek bu iki nehir için güncel bir balık listesi oluşturulmuştur. Bulgularımız, tatlı su sistemlerinde çeşitli balık ailelerinin varlığını ortaya koyarak zengin bir balık topluluğuna işaret etmiştir. Özellikle, EFSM kayıtlarına göre, *Tinca tinca* (kadife balığı) türünün Karpuzçay Deresi'nde ilk kez tespit edilmesi, bölgenin bilinen balık faunasına önemli bir katkı sağlamaktadır. Karpuzçay ve Ilıca nehirleri, Antalya Havzası'nın kritik bileşenleri olup, bölgenin ekolojik dengesi, ekonomik faaliyetleri ve kültürel mirası için büyük önem taşımaktadır. Bu çalışma, Karpuzçay ve Ilıca nehirlerinin balık türleri listesini güncelleyerek, bu bulguların bu sucul ekosistemlerin sağlığı ve korunumu üzerindeki etkilerini tartışmaktadır. Mevcut bilgiler ile yeni verileri birleştirerek, nehirlerin biyolojik çeşitliliği ve bunu etkileyen çevresel faktörler hakkında kapsamlı bir bakış sunmayı amaçlıyorum. Tartışma bölümünde, tehditleri azaltmak ve bu değerli tatlı su kaynaklarının sürdürülebilir yönetimini sağlamak için koruma stratejilerine yönelik öneriler sunulmuştur.

Anahtar kelimeler: Güney Anadolu, Antalya nehir havzası, tatlı su balıkları, ihtiyofauna, biyolojik çeşitlilik.

INTRODUCTION

Faunistic studies are of great importance for the health and sustainable management of ecosystems. Fish fauna studies help determine the diversity and distribution of fish species in a region or water bodies, providing valuable data on the food chain, water quality, and habitat health within the ecosystem (Crettaz-Minaglia & Juarez, 2020). Fish populations are sensitive indicators of environmental changes like climate change, water pollution, and habitat loss (Whitfield & Elliott, 2002). Fish fauna studies serve as an important tool for monitoring these changes and understanding ecological responses. Faunistic studies assist in the management of important species for commercial and recreational fishing, ensuring their populations are maintained healthily, thereby providing significant economic and social benefits to local economies and communities.

Antalya is an important region located in the south of Anatolia, characterized by a Mediterranean climate and an extensive coastline (Boyacı, 2018). The region's geomorphological structure, rich biological diversity, and historical background are directly reflected in the ecological and hydrological characteristics of its streams (Ünal & Gökoğlu, 2022). The rivers in the Antalya region are crucial for both the sustainability of local ecosystems and human activities such as agriculture, tourism, and drinking water supply (Çıplak, & Atik, 2022).

The rivers in the region consist of short and fast-flowing streams and brooks that flow into the Mediterranean Sea, typically originating from the high altitudes of the Taurus Mountains. The rivers originating from the Taurus Mountains usually pass through steep valleys with rapid flow, and this flow regime can vary significantly depending on seasonal rainfall. The flow rates of the rivers rise with increased precipitation, especially during the winter and spring months, and decrease in the summer.

The main rivers and streams in the Antalya region include the Aksu River, Manavgat, Köprüçay, Düden, Alara, Dim and Göksu rivers, and Karpuzçay, Ilıca and Boğaçay streams. Each of these rivers possesses unique ecological characteristics and biological diversity. For instance, the Manavgat River is home to one of Türkiye's largest waterfalls and hosts several native and endemic freshwater fish species (İnnal, 2021; Yılmaz et al., 2023).

The rivers of Antalya are important habitats that harbor rich biological diversity. These rivers provide habitats for plankton, various fish species, freshwater crabs, amphibians, and waterfowl (İnnal, 2012). The region's endemic fish species draw attention as indicators of biological richness (Küçük et al., 2020).

In the geographic region in question, the earliest data on freshwater fish were provided by Battalgil (1944), with subsequent, some studies by various researchers in the following decades, including Kosswig (1954, 1965), Kasbauer (1966), Erk'akan & Kuru (1983). Despite these efforts, the research by Balık (1988) and Küçük and İkiz (1993, 2004) remains the only comprehensive studies encompassing the entire basin. This highlights a notable gap in extensive, basin-wide research since then, indicating the need for a more detailed and holistic investigation of the region's freshwater fauna to understand broader ecological dynamics and conservation needs.

Karpuzçay and Ilıca streams, located in the east of Antalya province, are significant rivers in terms of biodiversity conservation and host many endemic species (Küçük et al., 2020). These rivers support a variety of aquatic and riparian habitats, which are essential for numerous species and local communities. Although various studies have been conducted in different scientific fields on the Karpuzçay and Ilıca streams and their basins (Küçük & İkiz, 2004; Küçük et al., 2020; Kaya et al., 2019), the fish fauna of these two rivers has been examined in several studies.

The rivers in the Antalya region, including the Karpuzçay and Ilıca streams, face various pressures resulting from human activities. Despite their importance, rivers face numerous threats including pollution, habitat destruction, water extraction for agriculture, and the impacts of climate change. These pressures underscore the urgent need for effective conservation measures to safeguard the integrity and biodiversity of these river systems. In this context, various measures should be taken to protect and sustainably manage the rivers in the Antalya region. These measures include the protection of natural habitats, monitoring water quality, developing ecosystem-based management strategies, and raising public awareness. The purpose of this article is to contribute to the fish fauna of two important rivers in the Antalya River Basin, namely the Karpuzçay and Ilıca streams, and to draw attention to the protection of these two rivers.

MATERIAL AND METHOD

The study is based on fieldwork, existing literature, and collection records. However, since the field sampling conducted within the scope of the study is not experimental in nature, it does not require ethical committee approval (According to the official letter numbered B.18.0.DMP.0.03.445.01.01/109/2970 from Republic Of Türkiye Ministry Of Agriculture And Forestry General Directorate Of Nature Conservation And National Parks). To update and to give a fish fauna list of the fish fauna of Karpuzçay and Ilıca streams, sampling was conducted by

using SAMUS 1000 portable electrofishing device in May 2023 via 4 stations of the Karpuzçay and Ilıca streams (Figure 1, Table 1). All individuals were anesthetized using MS-222 (Tricaine methanesulfonate) and euthanized by fixation in a 10% formalin solution. The samples were identified to the species level and recorded in the Ege University Faculty of Fisheries. The study incorporated data from the Ege University's Faculty of Fisheries Freshwater Fish Collection and the Zoological Collection at Recep Tayyip Erdoğan University (FFR), alongside published literature (Küçük & İkiz, 2004; Kaya et al., 2019; Küçük et al., 2020), to compile an updated list of fish species found in these two rivers. Species identification was carried out following the guidelines provided in Freyhof et al. (2025).

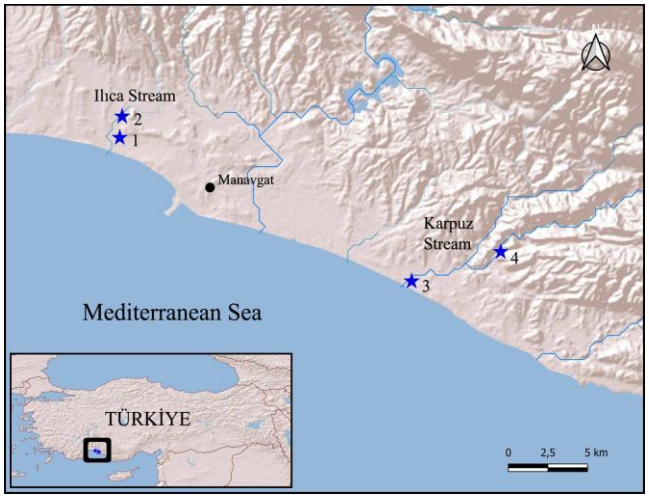

Figure 1. Sampling sites in the studies area.

Table 1. The collection numbers of EFSM.

Stream	EFSM Records	Collection Codes
Ilıca	*Capoeta capoeta angorae*	1977/054
Ilıca	*Mugil cephalus*	1977/056
Ilıca	*Alburnus balıki*	1992/012
Ilıca	*Anguilla anguilla*	1992/013
Ilıca	*Blennius fluviatilis*	1992/014
Ilıca	*Leuciscus borysthenicus*	1994/024
Ilıca	*Pseudophoxinus alii*	2005/016
Karpuzçay	*Capoeta capoeta angorae*	1976/059
Karpuzçay	*Cyprinus carpio*	1976/061
Karpuzçay	*Capoeta capoeta angorae*	1977/064
Karpuzçay	*Mugil cephalus*	1977/066
Karpuzçay	*Chalcalburnus chalcoides*	1996/008
Karpuzçay	*Gambusia holbrooki*	2016/Uncategorized
Karpuzçay	*Knipowitschia caucasia*	2016/Uncategorized
Karpuzçay	*Salariopsis burcuae*	2016/Uncategorized
Karpuzçay	*Tinca tinca*	2016/Uncategorized
Ilıca	*Alburnus escherichii*	2023/Uncategorized
Ilıca	*Garra rufa*	2023/Uncategorized
Ilıca	*Capoeta calestis*	2023/Uncategorized
Ilıca	*Alburnus baliki*	2023/Uncategorized
Ilıca	*Anguilla anguilla*	2023/Uncategorized
Ilıca	*Salariopsis burcuae*	2023/Uncategorized
Karpuz	*Alburnus escherichii*	2023/Uncategorized
Karpuz	*Capoeta antalyensis*	2023/Uncategorized
Karpuz	*Capoeta calestis*	2023/Uncategorized
Karpuz	*Mugil cephalus*	2023/Uncategorized
Karpuz	*Alburnus baliki*	2023/Uncategorized

RESULTS

The ichthyofaunal surveys conducted in 2023 on Karpuzçay and Ilıca streams in the Antalya region have yielded significant findings regarding the diversity of fish species in these water bodies. The following species were identified in each stream that was given in Table 2. Some of these species were illustrated in Figure 2.

Table 2. The fish species recorded from rivers from the sampling.

Stream	This study (2023)
Karpuzçay Stream	*Alburnus escherichii*
	Alburnus baliki
	Capoeta calestis
	Mugil cephalus
	Capoeta antalyensis
Ilıca Stream	*Alburnus baliki*
	Alburnus escherichii
	Anguilla Anguilla
	Capoeta calestis
	Garra rufa
	*Salariopsis burcuae**

*First records.

Figure 2. Live form of some important fishes in the study area: a, *Anguilla anguilla*, Ilıca Stream; b, *Garra rufa*, Ilıca Stream; c, *Salariopsis burcuae*, Ilıca Stream; d, *Capoeta antalyensis*, Ilıca Stream; *Pseudorasbora parva*, Ilıca Stream; *Alburnus baliki*, Karpuzçay Stream; *Alburnus escherichii*, Ilıca Stream.

DISCUSSION

This study aims to analyze the temporal changes and species diversity in the freshwater fish assemblages of the Karpuzçay and Ilıca streams. By comparing data from EFSM records, previous studies by Küçük & İkiz (2004), Kaya et al. (2019), Küçük et al. (2020) and the current study conducted in 2023, it can identify trends, shifts in species presence. These studies recorded 3 species in stream Karpuzçay and 5 species in Stream Ilıca (Table 3). This comprehensive review will enhance our understanding of ecological dynamics within these streams and inform conservation and management strategies for maintaining biodiversity and ecosystem health.

These findings highlight the presence of both native and endemic species in these streams. The identification of species such as *Alburnus escherichii* and *Alburnus baliki* in both streams indicates their broad distribution in the region.

Additionally, the presence of *Garra rufa* and *Anguilla anguilla* in Ilıca Stream, as well as *Capoeta antalyensis* in Karpuzçay Stream, underscores the ecological uniqueness of each stream. Notably, the discovery of *Salariopsis burcuae* in Ilıca Stream adds a new dimension to the biodiversity of this water body. These results underscore the ecological importance of the Karpuzçay and Ilıca streams and provide a foundation for future conservation efforts in the region.

The research area is in the Western Taurus Mountains, one of Türkiye's most significant karstic regions (Küçük, 1997; Munsuz & Ünver, 1983). In this region, underground waters emerge from approximately 1300 meters above sea level, forming the sources of streams. This situation endows the upper basins of these streams with the characteristic of being trout habitats. In the upper basins, the streams naturally host the trout species.

Table 3. Species presence in freshwater fish assemblages of Karpuzçay and Ilıca streams (1976-2023).

Stream	EFSM records (1976-2016)	Küçük & İkiz (2004)	Küçük et al. (2020)	Kaya et al. (2019)	This study
Karpuzçay	*Gambusia holbrooki*				*Gambusia holbrooki*
Karpuzçay	*Knipowitschia caucasia*				*Knipowitschia caucasia*
Karpuzçay	*Salariopsis burcuae**				*Salariopsis burcuae**
Karpuzçay			*Anguilla anguilla*		*Anguilla anguilla*
Karpuzçay	*Tinca tinca**†				*Tinca tinca**
Karpuzçay			*Alburnus esherichii*		*Alburnus esherichii*
Karpuzçay					*Capoeta antalyensis*
Karpuzçay	*Cyprinus carpio*	*Cyprinus carpio*	*Cyprinus carpio*		*Cyprinus carpio*
Karpuzçay	*Capoeta capoeta angorae*			*Capoeta calestis*	*Capoeta calestis*
Karpuzçay	*Mugil cephalus*				*Mugil cephalus*
Karpuzçay	*Chalcalburnus chalcoides*				*Alburnus baliki*
Ilıca			*Alburnus escherichii*		*Alburnus escherichii*
Ilıca					*Garra rufa**
Ilıca	*Capoeta capoeta angorae*			*Capoeta calestis*	*Capoeta calestis*
Ilıca					*Capoeta antalyensis**
Ilıca	*Alburnus baliki*	*Alburnus baliki*	*Alburnus baliki*		*Alburnus baliki*
Ilıca	*Anguilla anguilla*	*Anguilla anguilla*			*Anguilla anguilla*
Ilıca	*Blennius fluviatilis*	*Salaria fluviatilis*			*Salariopsis burcuae*
Ilıca	*Leuciscus borysthenicus*				
Ilıca	*Pseudophoxinus alii*				*Pseudophoxinus alii*
Ilıca					*Pseudorasbora parva**
Ilıca	*Mugil cephalus*				*Mugil cephalus*

*****First records. †Data not previously presented in the articles.

The karstic structure of the region causes water to accumulate underground and emerge at specific points, feeding the streams that are found at high altitudes. These high-altitude areas, with their cool and oxygen-rich waters, provide ideal conditions for trout habitats. As a result, trout is naturally distributed in these areas and plays a significant role in the ecological structure of the region. The karstic structure is also crucial for the continuity and quality of water resources. Therefore, the conservation of the region's ecosystem health and biological diversity is directly related to the sustainable management of water resources.

During recent surveys conducted in Ilıca Stream in 2021 and beyond, no individuals of *Pseudophoxinus alii* were detected. This aligns with the observations by Küçük et al. (2020), who suggested that the population in its type locality had significantly declined due to urbanization, agricultural pollution, and the possible pressure from the invasive species *Alburnus escherichii*. My findings further support this, as *A. escherichii* was found in high densities. Additionally, exotic *Garra rufa*, a species previously recorded in the stream (Kaya et al., 2022), was also observed. The molecular identification of *Garra rufa*, initially documented by Kaya et al. (2022), has not yet been conducted. In the present study, the species is referred to as *Garra rufa*, consistent with the description provided by Kaya et al. (2022). However, it is important to emphasize that this identification should be confirmed through further molecular and morphological analysis in future research. Given the absence of *P. alii* in all my samples, it is possible that this species may have become extinct in its type locality. However, *P. alii* still persists in other water bodies in the region, indicating that its extinction is likely limited to Ilıca Stream.

Anguilla anguilla, the European eel, is crucial for ecosystem balance as both predator and prey, migrating between freshwater and marine habitats to aid nutrient cycling (Denis et al., 2022). Economically, they support fisheries and hold cultural significance in European cuisine and traditions. Monitoring their populations in Ilıca Stream reveals insights into ecosystem health amidst conservation challenges like habitat loss and pollution. Protecting eel populations is vital not only for biodiversity but also for sustaining Ilıca Stream's ecological integrity and cultural heritage.

Garra rufa, also known as the doctor fish or nibble fish, is notable for its unique ecological role and cultural significance. *Garra rufa* is a freshwater fish species known for its distinctive behavior of nibbling on dead skin, aiding in exfoliation for some fish spa treatments. In the wild, they contribute to ecosystem health by consuming algae and organic debris, helping to maintain water quality. Beyond their ecological role,

Garra rufa has gained popularity in spa treatments where they gently remove dead skin cells from clients' feet. This practice, originating in Türkiye, has spread globally, contributing to tourism and local economies. Despite their cultural and economic importance, *Garra rufa* populations face threats from habitat degradation, pollution, and over-collection for the spa industry. Conservation efforts are crucial to ensure their sustainable use and preservation in their natural habitats. *Garra rufa* exempli demonstrates fies the intersection of ecological significance and cultural practices, highlighting the importance of sustainable management to maintain their ecological roles and cultural traditions.

CONCLUSION

In conclusion, the research area is significant within the context of Anatolian zoogeography. This region harbors various endemic taxa whose distribution plays a critical role in preserving biological diversity. *Alburnus baliki*, *Capoeta antalyensis*, *C. caelestis* and *Salariopsis burcuae* are endemic to Türkiye, each adapted to specific habitats within this zoogeographical region. These endemic species are typically restricted to particular habitats and constitute an integral part of the biological and ecological fabric of the area. Their limited distribution underscores the need for effective conservation strategies to protect them and maintain natural balance in their habitats. Moreover, safeguarding endemic species is crucial for ecosystem health and sustainability, as they often play pivotal roles in maintaining habitat quality and ecosystem functions. This study views the current status of Karpuzçay and Ilıca streams' ichthyofauna, though information gaps remain. Certain taxa require thorough surveys at previously sampled locations for confirmation. Both streams are a significant natural asset in Anatolia, which is crucial for ecological and climatic reasons. Key measures include monitoring water quality, promoting sustainable water use, regulating fishing, and developing climate adaptation strategies. Long-term conservation and sustainable management of the streams are essential for maintaining regional biodiversity and ecosystem services.

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