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The Fish Fauna of the Büyük Menderes River (Turkey): Taxonomic and Zoogeographic Features

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Abstract

In order to establish the taxonomic and zoogeographic features of the fish fauna of the Büyük Menderes River basin, fish samples were collected using electrofishing equipment, gill nets, trammel nets, seine nets and cast nets from 2010 to 2011. Among the samples, 34 (19 endemic and 6 non-native species) species belonging to 13 families were identified. The most dominant family in the river and its branches is the Cyprinidae with 20 species. *Rhodeus amarus*, Büyük Menderes River has been reported for the first time.

Keywords: Anatolia, Great Meander River, ichthyofauna, endemic, non-native.

Büyük Menderes Nehri (Türkiye) Balık Faunası: Taksonomik ve Zoocoğrafik Özellikler

Özet

Büyük Menderes Nehri balık faunasının taksonomik ve zoocoğrafik özelliklerinin belirlenmesi amacıyla 2010-2011 yılları arasında yapılan bu çalışmada balık örneklemeleri; elektroşoker cihazı, solungaç ağları, uzatma ağlar, ığrıp ve serpme ağı kullanılarak yapılmıştır. Örneklemeler sonucunda 13 familyaya ait 34 (19 endemik ve 6 yabancı tür) takson belirlenmiştir. Nehir ve kollarında en baskın familyanın 20 takson ile Cyprinidae familyası olduğu tespit edilmiştir. *Rhodeus amarus*, Büyük Menderes Nehri'nden ilk defa bildirilmiştir.

Anahtar Kelimeler: Anadolu, Büyük Menderes Nehri, ihtiyofauna, endemik, yabancı tür.

Introduction

The Anatolian Plateau is composed of 5 geological units, namely Kırşehir, the Pontides, Sakarya continent, and the Menderes-Taurus and East Taurus blocks (Görür et al., 1984, Hrbek et al., 2002). These geological blocks were also suggested to have had significant impact on the formation of the phylogenetic clades (Hrbek et al., 2002). The accuracy of this theory has also been studied, especially through the phylogenetic relationships of endemic terrestrial and freshwater animals. In recent years, the results of genetic studies carried out on the species of *Aphanius* (Cyprinodontidae) and *Pseudophoxinus* (Cyprinidae), which inhabit similar limnetic habitats of Turkey, have increased the accuracy of this theory (Hrbek et al., 2002, 2004).

A recent review of the literature by Kuru (2004) concerning the ichthyological research carried out in Anatolia since 1856 has shown that thus far 236 taxa, belonging to 26 families, have been reported from the inland waters of Turkey. In recent years, faunistic and taxonomic studies were conducted in various regions of Turkey. However, the taxonomy and classification of grades is not certain yet that constantly emphasized (Balık, 1979; Erk'akan and Kuru, 1982; Wildekamp et al., 1999; Erk'akan et al., 1999, 2007; Küçük and İkiz, 2004; Sarı et al., 2006; Küçük et al., 2007; İlhan and Balık, 2008; Turan et al., 2008, 2009; Özuluğ and Freyhof, 2011).

During the period from 1984 to the present day, some of the branches of the Büyük Menderes River fish fauna studied (Dipsiz-Çine Creek, İkizdere Creek, Bafa Lake), but there has not been work ichthyofauna covering the whole river basin (Sarı et al., 1999; Barlas and Dirican, 2004; Pülhan, 2008). The aim of the present study is to fill this gap by documenting the taxonomic features of the Büyük Menderes River ichthyofauna.

Materials and Methods

The Büyük Menderes River (historical name as the Maeander or Meander) is a river in southwestern Turkey. It rises in west central Turkey near Dinar before flowing west through the Büyük Menderes graben until reaching the Aegean Sea in the proximity of the ancient Ionian city Miletus. Küfi Stream, Hamam, Banaz and Dokuzsele streams, Çürüksu Stream, Dandalas, Akçay, Çine, İkizdere and Sarıçay streams are branches of the Büyük Menderes River (Figure 1). Length of the river is 560 km and the flow rate 3800 hm/year.

The fish were collected using electrofishing equipment (AC/DC 220/12V, 2 Hp portable electrical generator and with 2 circular 10 cm diameter electrodes), gill nets (mesh size of 9x9 mm and 12x12 mm), trammel nets (various mesh seize), seine nets (2 mm) and cast nets. The samples were fixed and preserved in a 4% formalin solution. Metric measurements were carried out with 0.01 mm sensitive calipers. Meristic characters such as number of gill rakers, pharyngeal teeth, dorsal and anal fin rays, total lateral line scales were counted under a stereomicroscope. The last two branched dorsal and anal fin rays are counted "1/2" (Kottelat and Barbieri, 2004). The number of vertebrae in the Cyprinidae and Nemacheilidae was determined by radiography. The nomenclature used herein is based on the checklists of Eschmeyer (2013).

Abbreviations. SL, standard length. D, dorsal fin rays. A, anal fin rays. P, pectoral fin rays. V, pelvic fin rays. C, caudal fin rays. IFC-ESUF, Inland Fishes Collection, Eğirdir Fisheries Faculty of Süleyman Demirel University, Turkey.

Results

34 species belonging to 13 families (Anguillidae (1), Cyprinidae (20), Siluridae (1), Esocidae (1), Nemacheilidae (2), Cobitidae (1), Cyprinodontidae (2), Poeciliidae (1), Gobiidae (1), Centrarchidae (1), Atherinidae (1), Mugilidae (1) and Syngnathidae (1)) were identified from the Büyük Menderes River samples.

Family: Anguillidae

***Anguilla anguilla* (Linnaeus, 1758)**

Material examined: Lake Bafa-Muğla (13.07.2010, 2 specimens, SL: 15-21 cm), Topçam Dam Lake-Aydın (13.07.2010, 2 specimens, SL: 20-22 cm), Akçay DSI pomp-Nazilli-Aydın (12.07.2010, 1 specimens, SL: 16 cm).

Diagnostic characters: D 241-260, A 178-196, P 17-18, C 9-11.

Family: Cyprinidae

***Cyprinus carpio* Linnaeus, 1758** (Common carp)

Material examined: Dipsiz Creek-Muğla (13.07.2010, 1 specimens, SL: 14.6 cm), Çine Creek-Çiftlikburnu Bridge-Aydın (13.07.2010, 2 specimens, SL: 14.0-17.3 cm).

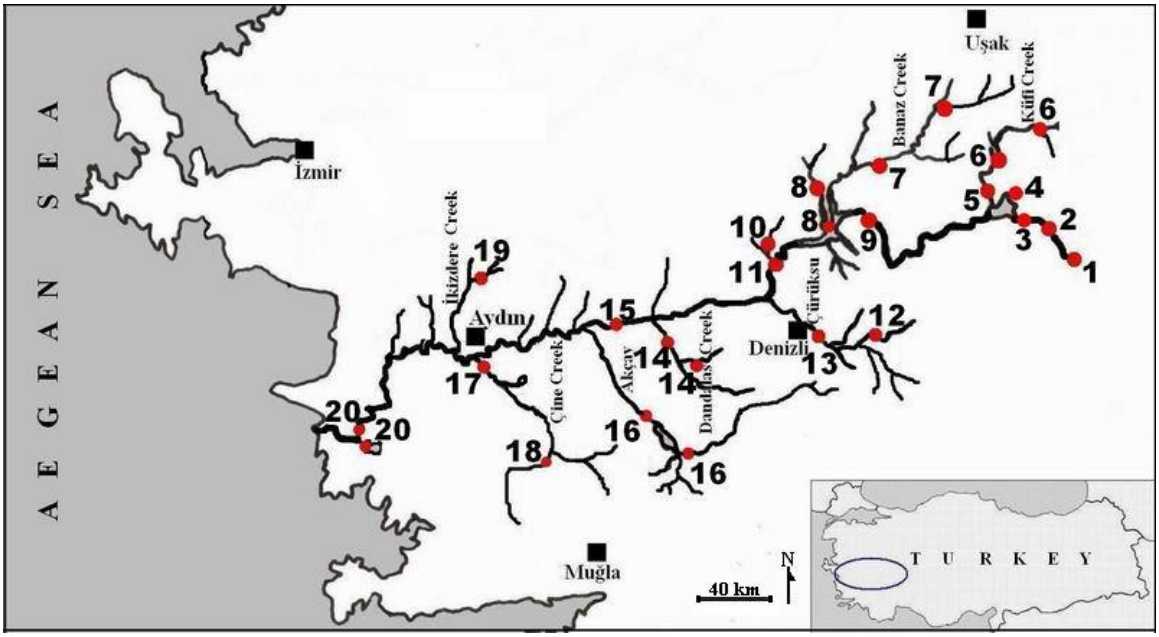

Figure 1. The map of Büyük Menderes River and sampling stations; 1- Suçıkan Spring-Dinar- Afyon, 2- Karaköprü-Dinar-Afyon, 3- Lake Gökgöl-Dinar-Afyon, 4- Lake Çivril-Çivril-Denizli, 5- Işıklı Spring-Çivril-Denizli, 6- Küfi Creek-Çivril-Denizli, 7- Banaz Creek-Uşak, 8- Adıgüzel Dam Lake-Hanönü-Uşak, 9- Hasköy-Hamam Bridge-Banaz Creek-Uşak,10- Yenicekent DSİ pomp-Buldan-Denizli, 11- Ahmetli Bridge-Sarayköy-Denizli, 12- Kaklık Cave Spring-Kaklık-Denizli, 13- Aksu Creek-Pınarkent-Denizli, 14- Dandalas Creek-Yeniceköy-Karacasu-Aydın, 15- Akçay DSİ pomp-Nazilli-Aydın, 16- Topçam Dam Lake-Çine-Aydın, 17-Çine Creek-Çiftlikburnu Bridge-Çine-Aydın, 18- Dipsiz Creek-Muğla, 19- Şirindere-İncirliova-Aydın, 20- Lake Bafa-Milas-Muğla

Diagnostic characters: DIII 18-20$_{1/2}$, A II-III 5-6$_{1/2}$, lateral line scales 36-39, transverse scales 6-7/5-7, pharyngeal teeth 1.1.3-3.1.1, gill rakers 26-30, vertebrae 36-37.

***Carassius gibelio* (Bloch, 1782)** (Prussian carp) non-native (Figure 2)

Material examined: Küfi Creek-Çivril-Denizli (14.07.2010, 3 specimens, SL: 10.2-12 cm), Yenicekent DSI pomp-Buldan-Denizli (14.07.2010, 2 specimens, SL: 10-14.1 cm), Ahmetli Bridge-Sarayköy-Denizli (14.07.2010, 1 specimen, SL: 10.1 cm).

Diagnostic characters: D III 18-19$_{1/2}$, A III 16$_{1/2}$, lateral line scales 28-31, gill rakers 39-50.

***Squalius fellowesii* (Günther, 1868)** (Chub) endemic (Figure 3)

Material examined: Küfi Creek-Çivril-Denizli (14.07.2010, 10 specimens, SL: 9.34-16.84 cm), Adıgüzel Dam Lake-Hanönü-Uşak (14.11.2010, 2 specimens, SL: 5.85-7.61), Banaz Creek-Uşak (14.07.2010, 10 specimens, SL: 5.50-10.95 cm), Ahmetli Bridge-Sarayköy-Denizli (19.05.2011, 4 specimens, SL: 9.05-13.18 cm), Yenicekent DSI pomp-Buldan-Denizli (19.05.2011, 9 specimens, SL: 8.37-19.46), Aksu Creek-Pınarkent-Denizli (14.11.2010, 5 specimens, SL: 4.29-6.17 cm), Şirindere Creek-İncirliova-Aydın (19.05.2011, 5 specimens, SL: 9.31-12.10 cm), Dandalas Creek-Yeniceköy-Karacasu-Aydın (14.07.2010, 25 specimens, SL: 9.29-18.56 cm), Çine Creek-Çiftlikburnu Bridge-Çine-Aydın (13.07.2010, 1 specimen, SL: 6.41 cm), Hasköy-Hamamköy-Banaz Creek-Uşak IFC-ESUF 114A (04.06.1998, 1 specimen, SL: 12.51 cm), Yenicekent DSI pomp-Buldan-Denizli IFC-ESUF 151 (11.06.1998, 4 specimens, SL: 9.68-18.80), Dandalas Creek-Yeniceköy-Karacasu-Aydın IFC-ESUF 138A (05.06.1998, 3 specimens, SL: 7.98-17.39 cm), Topçam Dam Lake-Çine-Aydın IFC-ESUF 131A (06.06.1998, 3 specimens, SL: 5.82-9.11 cm).

Diagnostic characters: D III 7$_{1/2}$-9$_{1/2}$, A III 6$_{1/2}$-9$_{1/2}$, lateral line scales 40-43, transverse scales 7-8/3, pharyngeal teeth 2.5-5.2, gill rakers 6-10.

Dorsal-fin origin above posterior half of pelvic-fin base; upper lip projecting beyond lower lip.

***Squalius carinus* Özuluğ and Freyhof, 2011 endemic (Figure 4)**

Material examined: Işıklı Spring-Çivril-Denizli (14.07.2010, 5 specimens, SL: 4.48-10.41 cm).

Diagnostic characters: D III 8$_{1/2}$-9$_{1/2}$, A III 7$_{1/2}$-8$_{1/2}$, P I 15-16, V I 9, lateral line scales 40-43+2, scales lateral series 40-43, transverse scales 7-8/2-3, pharyngeal teeth 2.5-5.2, gill rakers 8-10.

Squalius carinus is immediately distinguished from all other species of *Squalius* in Anatolia by its dark brown pigmentation in life. It is further distinguished by the combination of: lower lip projecting beyond tip of upper lip (equal to tip of upper lip in few specimens); uppermost point of

Figure 2. *Carassius gibelio*, Küfi Creek (SL:11.4 cm).

Figure 3. *Squalius fellowesii*, Banaz Creek (SL: 7.64 cm).

mouth cleft about at level between middle of eye and lower margin of pupil.

***Alburnoides* cf. *smyrnae* Pellegrin, 1927** endemic (Figure 5)

Material examined: Aksu Creek-Denizli (19.05.2011, 1 specimen, SL: 6.44 cm), Banaz Creek-Uşak (14.07.2010, 7 specimen, SL: 6.84-8.57 cm).

Diagnostic characters: D III $8_{1/2}$, A III 12-$14_{1/2}$, P I 14-16, V I-II 7-9, lateral line scales 42-47, transverse scales 9-12/4, abdominal vertebrae 41-42, caudal vertebrae 20-21, pharyngeal teeth 2.5-5.2.

***Alburnus* cf. *demiri* Özuluğ & Freyhof, 2008** endemic (Figure 6)

Material examined: Çine Creek-Çiftlikburnu Bridge-Aydın (13.07.2010, 12 specimens, SL: 4.93-8.65 cm), Topçam Dam Lake- Çine-Aydın (13.07.2010, 4 specimens, SL: 3.90-6.25 cm), Yenicekent DSI pomp-Buldan-Denizli (14.07.2010, 14 specimens, SL: 6.24-8.75 cm), Hasköy-Hamam Bridge-Banaz Creek-Uşak (14.07.2010, 2 specimens, SL: 4.50-4.85 cm), Adıgüzel Dam Lake-Hanönü-Uşak (14.07.2010, 2 specimens, SL: 5.62-6.20 cm), Ahmetli Bridge-Sarayköy-Denizli (19.05.2011, 6 specimens, SL: 5.24-7.96 cm).

Diagnostic characters: D III $8_{1/2}$, A III 11-$15_{1/2}$, P I 15-16, V I 8-9, lateral line scales 44-56, transverse scales 8-9/5-6, pharyngeal teeth 2.5-5.2.

Although *A.demiri* have slightly darker colored band on the sides, the band does not samples of the Büyük Menderes River.

Figure 4. *Squalius carinus*, Işıklı Spring-Denizli (SL: 10.41 cm).

Figure 5. *Alburnoides* cf. *smyrnae*, Banaz Creek (SL: 6.84 cm).

Figure 6. *Alburnus* cf. *demiri*, Yenicekent DSI pomp (SL: 7.05 cm).

Capoeta bergamae **Karaman, 1969** endemic (Figure 7)

Material examined: Yenicekent DSI pomp-Buldan-Denizli (19.05.2011, 3 specimens, SL: 10.25-14.56 cm), Dandalas Creek-Yeniceköy-Karacasu-Aydın (14.07.2010, 8 specimens, SL: 13.12-16.45 cm), Çine Creek-Çiftlikburnu Bridge-Aydın (13.07.2010, 4 specimens, SL: 12.58-16.69 cm).

Diagnostic characters: D III 7-8$_{1/2}$, A III 5$_{1/2}$, P I 15-18, V I 9-10, lateral line scales 60-69, transverse scales 11-13/7-9, pharyngeal teeth 2.3.5-5.3.2, gill rakers 19-24.

Mouth slightly inferior, with single pair very short barbels.

Ladigesocypris mermere **(Ladiges, 1960)** endemic (Figure 8)

Material examined: Yenicekent DSI pomp-Buldan-Denizli (14.07.2010, 6 specimens, SL: 2.98-3.52 cm), Akçay DSI pomp-Nazilli-Aydın (12.07.2010, 4 specimens, SL: 2.12-2.86 cm).

Diagnostic characters: D III 7-8$_{1/2}$, A III 7-9$_{1/2}$, lateral line scales 22-25, scales lateral series 30-32, pharyngeal teeth 2.5-5.2.

Vimba mirabilis **Ladiges, 1960** endemic (Figure 9)

Material examined: Yenicekent DSI pomp-Buldan-Denizli (14.07.2010, 4 specimens, SL: 9.15-11.25 cm), Çine Creek-Çiftlikburnu Bridge-Aydın (13.07.2010, 3 specimens, SL: 8.24-13.67 cm).

Diagnostic characters: D III 9$_{1/2}$, A III 16$_{1/2}$, lateral line scales 50–53, pharyngeal teeth 5-5, gill-rakers 16–18.

This species, which previously *Acanthobrama* genus (Ladiges, 1960), by Perea et al. (2010) have been included *Vimba* genus.

Barbus pergamonensis **Karaman, 1971** endemic (Figure 10)

Material examined: Adıgüzel Dam Lake-Hanönü-Uşak (14.11.2010, 83 specimens, SL: 5.95-7.34 cm), Suçıkan Spring-Dinar-Afyon (14.07.2010, 1 specimen, SL: 8.20 cm), Karaköprü-Dinar-Afyon (14.07.2010, 7 specimens, SL: 3.33-8.73 cm), Küfi Creek-Çivril-Denizli (14.07.2010, 20 specimens, SL: 5.01-9.52 cm), Aksu Creek-Pınarkent-Denizli (19.05.2011, 9 specimens, SL: 2.99-9.29 cm), Yenicekent DSI pomp-Buldan-Denizli (19.05.2011, 2 specimens, SL: 7.96-11.39 cm), Ahmetli Bridge-Sarayköy-Denizli (19.05.2011, 2 specimens, SL: 8.28-11.20 cm), Kaklık Cave Spring-Kaklık-Denizli (19.05.2011, 8 specimens, SL: 5.78-10.25 cm), Akçay DSI pomp-Nazilli-Aydın (12.07.2010, 3 specimens, SL: 7.11-7.34 cm), Şirindere-İncirliova-Aydın (19.05.2011, 11 specimens, SL: 8.30-14.84 cm), Dandalas Creek-Yeniceköy-Karacasu-Aydın (14.07.2010, 46 specimens, SL: 5.01-16.92 cm), Banaz Creek-Uşak (14.07.2010, 7 specimens, SL: 6.19-9.37 cm).

Diagnostic characters: D III 7-9$_{1/2}$, A III 5$_{1/2}$, P I 15-17, V: I 8-9, lateral line scales 52-60, transverse scales 11-12/7-9, pharyngeal teeth 2.3.5-5.3.2, gill rakers 8-11.

Luciobarbus kottelati **Turan, Ekmekçi, İlhan & Engin, 2008** endemic (Figure 11)

Material examined: Yenicekent DSI pomp-Buldan-Denizli (19.05.2011, 6 specimens, SL: 7.76-23.98 cm), Adıgüzel Dam Lake-Hanönü-Uşak (14.07.2010, 2 specimens, SL: 12.02-13.27 cm), Hasköy-Hamam Bridge-Banaz Creek-Uşak IFC-ESUF -112A (04.06.1998, 1 specimen, SL: 10.87 cm) Küfi Creek-Çivril-Denizli (14.07.2010, 9 specimens, SL: 6.60-9.79 cm), Aksu Creek-Pınarkent-Denizli (19.05.2011, 3 specimens, SL: 4.03-6.54 cm), Çine Creek-Çiftlikburnu Bridge-Aydın (13.07.2010, 16 specimens, SL: 8.45-23.64 cm), Çine Creek-Çiftlikburnu Bridge-Aydın IFC-ESUF 44F (06.06.1998, 2 specimens, SL: 15.37-15.67 cm), Dandalas Creek-Yeniceköy-Karacasu-Aydın IFC-ESUF 139A (05.06.1998, 1 specimen, SL: 13.47 cm).

Diagnostic characters: D II-III 7-8$_{1/2}$, A III 8$_{1/2}$, P I 17-18, V I-II 7-8, lateral line scales 43-46, transverse scales 6-7/5-6, pharyngeal teeth 2.5-5.2 or 2.5-5.1., gill rakers 14-15.

L.kottelati is distinguished from all other species of *Luciobarbus* in Anatolia and Europe by the position of the dorsal-fin origin conspicuously behind the pelvic-fin origin. Other characters useful for identification are; lips thin, lower lip with a swollen median pad margined by a shallow groove in some specimens, last simple ray of the dorsal fin well ossified, with moderate serrae along psterior edge.

Petroleuciscus smyrnaeus **Boulenger, 1896** endemic (Figure 12)

Material examined: Yenicekent DSI pomp-Buldan-Denizli (19.05.2011, 3 specimens, SL: 5.34-8.07 cm).

Diagnostic characters: D II-III 7-8$_{1/2}$, A III 8$_{1/2}$, P I 13-15, V I-II 7-8, lateral line scales 32-35, transverse scales 6-7/3-4, pharyngeal teeth 2.5-5.2 or 2.5-5.1.

Hemigrammocapoeta kemali **(Hanko, 1924)** (Ereğli minnow) endemic (Figure 13)

Material examined: Lake Çivril-Çivril-Denizli (14.07.2010, 35 specimens, SL: 3.80-5.53 cm), Lake Çivril-Çivril-Denizli IFC-ESUF 247 (03.06.1998, 13 specimens, SL: 4.51-6.08 cm), Lake Gökgöl-Dinar-Afyon IFC-ESUF 69 (03.06.1998, 13 specimens, SL: 2.45-5.47 cm).

Diagnostic characters: D III 7½, A III 5½, lateral line scales 7-17, scales lateral series 38-46 (47), predorsal scales 15-17, pharyngeal teeth 3.3.5-5.3.3, gill rakers 13-16.

Figure 7. *Capoeta bergamae*, Dandalas Creek (SL:14.5 cm).

Figure 8. *Ladigesocypris mermere*, Yenicekent DSI pomp (SL: 3.52 cm).

Figure 9. *Vimba mirabilis*, Yenicekent DSI pomp (SL: 11.25 cm).

Figure 10. *Barbus pergamonensis*, Dandalas Creek (SL: 14.80 cm).

Figure 11. *Luciobarbus kottelati*, Çine Creek (SL: 21.68 cm).

Figure 12. *Petroleuciscus smyrnaeus*, Yenicekent DSI pomp (SL: 5.34 cm).

Figure 13. *Hemigrammocapoeta kemali*, Lake Çivril (SL: 4.00 cm).

***Pseudorasbora parva* (Temminck and Schlegel, 1842)** (Stone moroko) non-native (Figure 14)

Material examined: Topçam Dam Lake-Çine-Aydın (13.07.2010, 3 specimens, SL: 4.3-5.2 cm).

Diagnostic characters: D II-III 7-8$_{1/2}$, A III 6$_{1/2}$, P I 8-12, V I 7-8, lateral line scales 35-38, transverse scales 4-6/4-5, pharyngeal teeth 5-5.

***Rhodeus amarus* (Pallas, 1776)** (Bitterling) (Figure 15)

Material examined: Çine Creek-Çiftlikburnu Bridge-Aydın (13.07.2010, 5 specimens, SL: 2.59-3,78 cm).

Diagnostic characters: D III 9-10$_{1/2}$, A III 8-10$_{1/2}$, P I 12-13, V II 5-7, lateral line scales 4-7.

***Chondrostoma meandrense* Elvira, 1987** endemic (Figure 16)

Material examined: Yenicekent DSI pomp-

Figure 14. *Pseudorasbora parva*, Topçam Dam Lake (SL: 4.30 cm).

Figure 15. *Rhodeus amarus*, Çine Creek (SL: 3.78 cm, Male).

Figure 16. *Chondrostoma meandrense*, Çine Creek (SL: 11.20 cm).

Buldan-Denizli (19.05.2011, 1 specimen, SL: 8.23 cm), Çine Creek-Çiftlikburnu Bridge-Aydın (13.07.2010, 17 specimens, SL: 4.71-13.85 cm), Lake Çivril-Çivril-Denizli (19.05.2011, 1 specimen, SL: 8.95 cm), Küfi Creek-Çivril-Denizli (19.05.2011, 19 specimens, SL: 6.36-12.75 cm).

Diagnostic characters: D II-III 8-$9_{1/2}$, A III $9_{1/2}$, P I 13-15, V I-II 7-8, lateral line scales 56-60, transverse scales 9-10/5, pharyngeal teeth 6-5 or 6-6, abdominal vertebrae 25, caudal vertebrae 17, total vertebrae 42, gill rakers 23-28

Pseudophoxinus maeandricus **(Ladiges, 1960)** endemic (Figure 17)

Material examined: Küfi Creek-Çivril-Denizli (19.05.2011, 6 specimens, SL: 6.07-10.44 cm).

Diagnostic characters: : D III $8_{1/2}$, A III 7-$8_{1/2}$, lateral line scales 58-65, scales lateral series 66-67, pharyngeal teeth 5-5, abdominal vertebrae 20-21, caudal vertebrae 16, total vertebrae 36-37, gill rakers 11-13.

Pseudophoxinus maeandri **(Ladiges, 1960)** endemic (Figure 18)

Material examined: Işıklı Spring-Çivril-Denizli (14.07.2010, 3 specimens, SL: 4.21-8.84 cm), Işıklı Spring-Çivril-Denizli IFC-ESUF 447 (03.06.1998, 9 specimens, SL: 5.74-6.68 cm).

Diagnostic characters: D III 7-$8_{1/2}$, A III $7_{1/2}$, lateral line scales 19-27, scales lateral series 41-45, pharyngeal teeth 5-4, abdominal vertebrae 19-20, caudal vertebrae 15-16, total vertebrae 35-36, gill rakers 8-9.

Tinca tinca **(Linnaeus, 1758)** (Tench)

Material examined: Lake Çivril-Çivril-Denizli

Figure 17. *Pseudophoxinus maeandricus*, Küfi Creek (SL: 8.04 cm).

Figure 18. *Pseudophoxinus maeandri*, Işıklı Spring (SL: 4.21 cm).

(14.07.2010, 5 specimens, SL: 16.56-17.60 cm)

Diagnostic characters: D III 8-$9_{1/2}$, A III 7-$8_{1/2}$, P I 16-17, V I-II 8-9, lateral line scales 98-102, transverse scales 22/20-23, pharyngeal teeth 5-4 or 5-5.

***Gobio maeandricus* Naseka, Erk'akan & Küçük, 2006** endemic (Figure 19)

Material examined: Lake Çivril-Çivril-Denizli (19.05.2011, 1 specimen, SL: 12.00 cm), Küfi Creek-Çivril-Denizli (19.05.2011, 7 specimens, SL: 6.02-9.54 cm).

Diagnostic characters: D III 7-$8_{1/2}$, A III 6-$7_{1/2}$, P I 14-15, V I 7-8, lateral line scales 48-49, pharyngeal teeth 2.5-5.2, total vertebrae 38-39.

Familya: Esocidae

***Esox lucius* Linnaeus, 1758** (Pike)

Material examined: Lake Çivril-Çivril-Denizli (14.07.2010, 1 specimen, SL: 28.61 cm).

Diagnostic characters: D V 14, A IV 15, lateral line scales 128, transverse scales 16/13.

Family: Cyprinodontidae

***Aphanius anatoliae* (Leidenfrost, 1912)** (Anatolian Killifish) endemic (Figure 20)

Material examined: Lake Çivril-Çivril-Denizli (14.07.2010, 72 specimens, SL: 2.01-3.95 cm), Işıklı Spring-Çivril-Denizli (14.07.2010, 50 specimens, SL: 2.47-3.58 cm), Akçay DSI pomp-Nazilli-Aydın (12.07.2010, 8 specimens, 2.10-3.14 cm), Kaklık Cave Spring-Kaklık-Denizli (19.05.2011, 36 specimens, SL: 2.89-3.69 cm).

Diagnostic characters: D II 10-12, A I-II 9-11, V I 5-6, P I 14-16, scales lateral series 29-31, maxillary teeth 13-16, vertical bars (male) 7-8.

***Aphanius fasciatus* (Valenciennes, 1821)** (Killifish)

Material examined: Lake Bafa-Milas-Muğla IFC-ESUF 329 (06.06.1998, 8 specimens, SL: 2.63-5.73 cm).

Diagnostic characters: D II 8-10, A I-II 8-11, V I 5-6, P I 13-15, scales lateral series 25-29, maxillary teeth 14-15, vertical bars (male) 8-15.

Family: Cobitidae

***Cobitis* cf. *simplicispina* Hanko, 1925** endemic (Figure 21)

Material examined: Küfi Creek-Çivril-Denizli (19.05.2011, 8 specimens, SL: 5.25-6.58 cm), Lake Çivril-Çivril-Denizli (19.05.2011, 3 specimens, SL: 5.33-9.11 cm), Yenicekent DSI pomp-Buldan-Denizli (19.05.2011, 3 specimens, SL: 5.33-7.56 cm).

Diagnostic characters: D II 6-7, A II 5-6, P I 7-8, V: I 5-6.

Family: Poecilidae

***Gambusia holbrooki* (Baird and Girard, 1853)** (Mosquitofish) non-native (Figure 22, 23)

Material examined: Akçay DSI pomp-Nazilli-Aydın (12.07.2010, 8 specimens, SL: 2.4-4.2 cm), Topçam Dam Lake-Çine-Aydın (13.07.2010, 11 specimens, SL: 3.4-4.8 cm), Işıklı Spring-Çivril-Denizli (19.05.2011, 19 specimens, SL: 3.8-5.0 cm),

Figure 19. *Gobio maeandricus*, Lake Çivril (SL: 12.00 cm).

Figure 20. *Aphanius anatoliae*, Işıklı Spring (SL: 3.45 cm, Male).

Figure 21. *Cobitis cf simplicispina*, Yenicekent DSI pomp (SL: 5.33 cm).

Figure 22. *Gambusia holbrooki*, Lake Çivril (SL: 4.50 cm, Female)

Lake Çivril-Çivril-Denizli (14.07.2010, 25 specimens, SL: 4.50-5.00 cm).

Diagnostic characters: D I-II 6-7, A I-II 7-8, scales lateral series 28-32.

Family: Atherinidae

***Atherina boyeri* (Risso, 1810)** (Big scale sand smelt) non-native (Figure 24)

Material examined: Lake Bafa-Milas-Muğla (13.07.2010, 16 specimens, SL: 4.5-7.4 cm).

Diagnostic characters: DI VIII, D II 10-12, A II 12-14, scales lateral series 53-54.

Family: Gobiidae

***Knipowitschia caucasica* (Berg, 1916)** (Caucasian dwarf goby) non-native (Figure 25)

Material examined: Lake Çivril-Çivril-Denizli (19.05.2011, 4 specimens, SL: 3.37-4.25 mm), Lake Bafa-Milas-Muğla (13.07.2011, 6 specimens, SL: 3.10-3.58 cm).

Diagnostic characters: D1 VIII, D2 I 8-9, A I 7-9, V 11-12, P I 14-16.

Family: Centrarchidae

***Lepomis gibbosus* (Linnaeus, 1758)** (Pumpkinseed) non-native (Figure 26)

Material examined: Çine Creek-Çiftlikburnu Bridge-Çine-Aydın (13.07.2010, 4 specimens, SL: 4.62-5.41 cm), Topçam Dam Lake-Çine-Aydın (13.07.2010, 6 specimens, SL: 4.12-4.96 cm).

Diagnostic characters: D X-XI 11-12, A III 10-11, P I 10-11, V I-II 5-6, lateral line scales 36-44, transverse scales 7-9/11-15.

Family: Siluriidae

***Silurus glanis* (Linnaeus, 1758)** (Wels catfish)

Material examined: Yenicekent DSI pomp-Buldan-Denizli (19.05.2011, 2 specimens, SL: 18.0-19.2 cm).

Diagnostic characters: D X-XI 11-12, A III

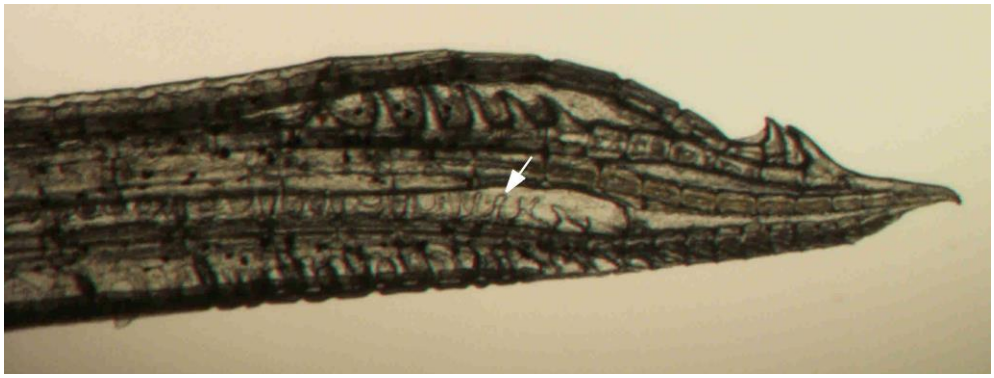

Figure 23. *Gambusia holbrooki* gonopodium (SL: 2.20 cm, Male).

Figure 24. *Atherina boyeri*, Lake Bafa (SL: 6.00 cm).

Figure 25. *Knipowitschia caucasica*, Lake Çivril (SL:3.37 cm).

10-11, P I 10-11, V I-II 5-6, lateral line scales 36-44, transverse scales 7-9/11-15.

Familya: Nemacheilidae

***Oxynoemacheilus* cf. *cinicus* Erk'Akan, Nalbant & Özeren, 2007** endemic **(**Figure 27)

Material examined: Küfi Creek-Çivril-Denizli (19.05.2011, 1 specimen, SL: 6.68 cm), Aksu Creek-Pınarkent-Denizli (19.05.2011, 1 specimen, SL: 3.06 cm), Adıgüzel Dam Lake-Hanönü-Uşak (14.11.2010, 3 specimens, SL: 4.15-6.04 cm), Yenicekent DSI pomp-Buldan-Denizli (19.05.2011, 2 specimens, SL: 3.25-4.25 cm), Dandalas Creek-Yenicekent-Karacasu-Aydın (14.07.2010, 12 specimens, SL: 5.47-6.30 cm).

Diagnostic characters: D III 7-8, A III 4-5, P I 10-11, V II 6-7, C 16-17.

***Oxynoemacheilus germencicus* Erk'Akan, Nalbant & Özeren, 2007** endemic (Figure 28)

Material examined: Şirindere-İncirliova-Aydın (19.05.2011, 5 specimens, SL: 5.67-6.65 cm).

Diagnostic characters: D III 7-8, A III 5, P I 9-10, V II 6-7, C 17.

Familya: Syngnathidae

***Syngnathus abaster* Risso,1827 (**Black-striped pipefish**)**

Material examined: Lake Bafa-Milas-Muğla (13.07.2010, 3 specimens, SL: 11.68-11.82).

Diagnostic characters: D 33-34, A 3, P 12-13, C 10.

Family: Mugilidae

***Liza ramada* (Risso, 1810) (**Thinlip grey mullet**)**

Figure 26. *Lepomis gibbosus*, Çine Creek (SL: 5.41 cm).

Figure 27. *Oxynoemacheilus* cf. *cinicus*, Yenicekent DSI pomp (SL: 4.25 cm).

Figure 28. *Oxynoemacheilus germencicus*, Şirindere (SL: 6.65 cm).

Material examined: Lake Bafa-Milas-Muğla (13.07.2010, 3 specimens, SL: 16.2-18.0 cm).

Diagnostic characters: D1 IV, D2 I (II) 7-8, A III 9 (10), scales lateral series 42-47, pyloric appendages 6-8.

Discussion

In the main branch of the river including especially middle and lower basins, pollution load has increased considerably with industrialization and urbanization. However the upper basin and the small arms feeding river are not much affected by this pollution (Küçük, 2007; Koca et al., 2008). At the same time, HES which were built (Kemer, Topçam, Adıgüzel, Çine dams) and are continued to be built (Cindere, Karacasu, İkizdere dams) on the tributaries of the river lead to loss of habitat for some species. This situation will jeopardize Anatolian endemics generations which especially adapt to river's ecology (Sarı and Bilecenoğlu, 2002; Fricke et al., 2007; Özcan, 2008)

When it is looked at zoogeographic features of fishes, diversification of the genus *Psedophoxinus* is interesting. While *P. maeandri*, whose lateral line is not well developed and whose pored scale has decreases, spreads in the source of Lake Çivril, *P. maeandricus* with a complete lateral line and increasing pored scale is in the same basin and Küfi Creek feeding Lake Çivril. Although *P. smyrneus* and *L. mermere* in the basin have morphological similarities, differentiation of lateral line, size of scale and anal fin has made important differences among species (Bogutskaya, 1996). However through morphological and molecular working, we think of redoing the classification of *P. smyrneus*, *L. mermere* and *L. ghigii* which spread over West Anatolia and have close morphological features. There is a morphological similarity between *A. demiri* living in the basin and whose type locality is Tahtalı Dam and Şaşal Stream and *Alburnus* population living Great Meander River.

However a significant difference has been seen between these two populations in terms of anal fin length, number of ray, form of predorsal region and number of gill rakers. This problem should be solved through examination of a large number of examples from these populations. During study time, population density of *V. mirabilis* as a river endemic has been observed decrease. It is thought that this decrease is caused by pollution and loss of habitat. As one of other endemics of river, *C. meandrense* is found to be intense in suitable habitats for itself and different parts of river while *G. maeandricus* is observed to be intense in the upper basin, close to source of the river. As one of local endemics *O. germencicus* is seen to create small populations in a restricted area. *A. anatoliae* and *H. kemali* create healty populations mainly in source of the river, Isıklı Lake. While as one of Anatolian endemics *B. pergamonensis* and *L. kottelati* create intensive popultions in lower and upper basins of river, *C. bergamae* is spread in the middle basin. *R. amarus* is caught in Çine Creek-Çiftlikburnu and reported from Büyük Menderes River for the first time. Also exotic species identified in Büyük Menderes River are considered to be pressure especially over local-sensitive endemics.

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