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Research Article / Araştırma Makalesi

Five New Records for the Ichthyofauna of Miliç River in Turkey

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Abstract

This study was carried out seasonally by three months intervals in the flood channel associated with Miliç River (Terme-Samsun) between 2014 and 2015. Some of the fish sampled in this study have not been recorded in the previous studies. These newly recorded species were *Petroleuciscus borysthenicus* (Kessler, 1859), *Alburnus derjugini* Berg, 1923; *Gasterosteus aculeatus* Linnaeus, 1758; *Atherina boyeri* Risso, 1810 and *Gambusia holbrooki* Girard, 1859, placed in Cyprinidae, Gasterosteidae, Atherinidae and Poecilidae families.

***Keywords*:** Taxonomy, New record, Inland waters, Biodiversity, Fish fauna

Miliç Irmağı (Türkiye) İhtiyofaunası İçin Beş Yeni Kayıt

Öz

Bu çalışma, Miliç Irmağı (Terme-Samsun) ile bağlantılı taşkın kanalında 2014-2015 yılları arasında mevsimsel olarak üç aylık periyotlarda gerçekleştirilmiştir. Elde edilen balık türlerinin daha önceki çalışmalarda bildirilmemiş olduğu tespit edilmiştir. Buna göre, familyasında mensup iki tür, *Petroleuciscus borysthenicus*, *Alburnus derjugini* ve Cyprinidae, Gasterosteidae, Atherinidae ve Poecilidae familyalarından birer tür, *Gasterosteus aculeatus*, *Atherina boyeri* ve *Gambusia holbrooki* olmak üzere listeye beş yeni tür eklenmiştir.

***Anahtar Kelimeler*:** Taksonomi, Yeni kayıt, İç sular, Biyoçeşitlilik, Balık faunası

Introduction

In a previous study, the number of identified fish taxa, either at species or subspecies levels in different freshwater types in Turkey, stated as 236 (Kuru 2004) and this number was revised as 371 by Kuru et al (2014). More recently Çiçek et al (2015; 2016) reported the presence of 377 taxa in inland waters of which close to 42% (153 species) were endemic even if this has been stated as 384 species in total by another reference (FishBase 2017). It is clear that the inland waters of Turkey possess a significant biodiversity both in terms of species richness and number of endemic species. A number of new fish species have been identified in studies carried out until present time (Kuru et al 2004; Kuru et al 2014; Çiçek et al 2015; 2016) and new record species have been recorded by many researchers such as Bayçelebi et al (2015), Ekmekçi et al (2015), Turan et al (2016) and others for Turkish freshwater fish fauna.

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Many ichthyo-faunal studies have been carried out in the literature related to river Miliç and its adjacent region (Kosswig & Battalgil 1942; Ladiges 1960; Kuru 1972; Kuru 1975; Erk'akan & Akgül 1986; Uğurlu Helli & Polat 2002; 2003; Uğurlu & Polat 2006). The ichthyofauna of Samsun Province latest revealed by Polat et al (2008); 34 rivers, 11 ponds, 5 reservoirs, a lake and five lagoons were sampled in this comprehensive faunistic exploration and 41 genera, 48 species and 4 subspecies of 19 families were identified (Polat et al 2008). There were also three more taxonomic studies in Miliç River conducted by Kuru (1972), Uğurlu & Polat (2006) and Polat et al (2008), in which 20 species of 6 families (Cyprinidae, Esocidae, Mugilidae, Syngnathidae, Blenniidae and Gobiidae) listed.

This study recorded the presence of new fish species of the families Cyprinidae, Atherinidae, Poeciliidae, and Gasterosteidae, which were not recorded in previous studies of Miliç River.

Material and Method

It was reported that the channel, in which the research was conducted, constructed parallel to the seaside to avoid torrent, in about 450 m of the sea from the merger of two streams (Miliç and Kocaman Streams were shown in official maps) which were the tributaries of the Miliç River (Polat et al 2008). The channel deepens along the axis and the length of the channel is about 11-12 km. The channel flows into the sea from one other side to the other during periods of heavy precipitation and stagnates in the non-precipitation periods, hence becomes a drainage channel with shallow, marsh and reed features. The study was conducted seasonally, sampling with three months intervals in five fixed stations (3-4 km in the west-east direction) in 2014-2015 (Figure 1). Coordinates of the sampling points (from the west to the east: 41°10'45.944"N 37°2'24.687"E, 41°10'23.818"N 37°3'5.788"E, 41°9'56.254"N 37°4'20.284"E, 41°9'41.889"N 37°5'5.495"E) were detected by a GPS.

Because trawling and casting nets were not effectively used for sampling due to the fact that a large part of the drainage channel was covered with reeds, swamps or aquatic plants especially, *Myriophyllum spicatum*, defined as invasive species by Hussner & Champion (2012) and GISD (2015). Therefore fishes were collected by an electroshocker device (Samus 725MP) on local fishing boats.

After the fixation with a 4% formalin solution, fish species were identified according to metric and meristic characters indicated by Bănărescu & Bogutskaya (2003), Kottelat & Freyhof (2007). Metric and meristic characters used in fish specimens. These morphological characters were as follows: D- Dorsal fin, A- Anal fin, P- Pectoral fin, V- Ventral fin (Pelvic fin), K- Caudal fin, LL- Lateral line scales; Standart length (*Sl*)**,** Predorsal distance (*pD*)**,** Length of head (*lc*), Preorbital distance (snout length) (*prO*)**,** Horizontal diameter of eye (*Oh*)**,** Postorbital distance (*poO*)**,** Length of dorsal head (*Dhl*)**,** Length of pectoral fin (*lP*)**,** Depth of dorsal fin (*hD*), Length of dorsal fin base (*lD*), Postdorsal distance (*poD*), Preventral distance (*pV*), Length of ventral (pelvic) fin (*lV*), Preanal distance (*pA*), Depth of Anal fin (*hA*)**,** Length of anal fin base (*lA*), Length of caudal peduncle (*lpc*), Depth of caudal peduncle (*hpc*), Body depth (*H*), Interorbital

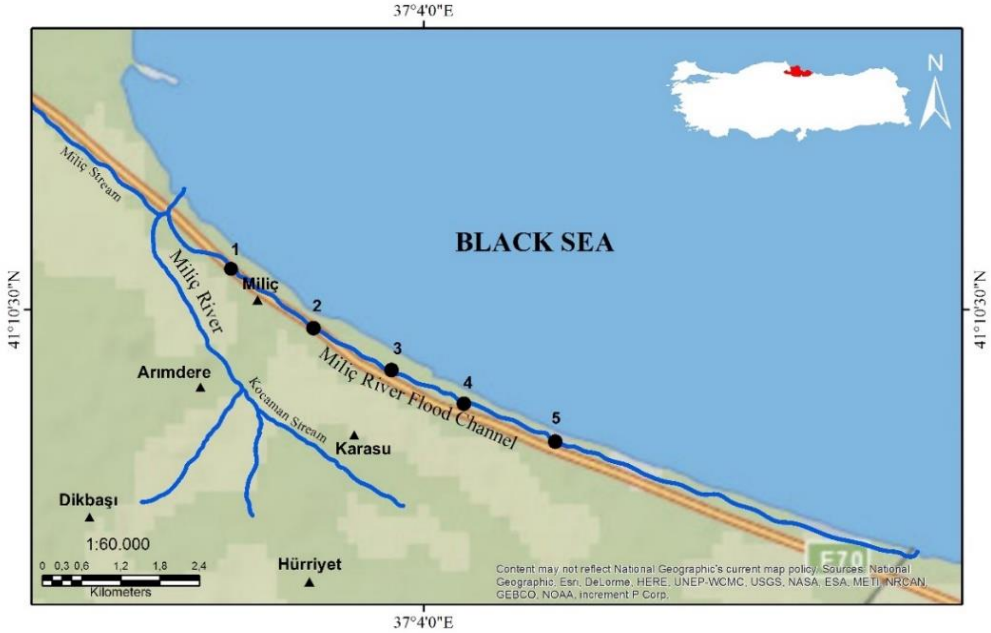

Figure 1. Sampling stations in drainage channel of Miliç River (Terme- Samsun)

distance (*io*). Although some metric characters vary depending on fish species, above most of the parameters were measured and mean values ($\bar{x}$) were given in Table 1 for each species separately. In addition the proportion of some morphometric measurements to the standard length (*Sl*) and head length (*lc*) were calculated, and corresponding standard deviation "SD" ($\pm$) was obtained in terms of some characters used by Bănărescu & Bogutskaya (2003), Turan et al (2009), Petrtýl et al (2014). Taxonomic classification of fish species, which were detected for the first time in this study, were done according to Van Der Laan et al (2014) and Nelson et al (2016).

Depending on the age, the size of fish varies. However, when the morphometric ratios were compared (e.g., head length/total length), a lot can be learned about fish. For example, compared to head-to-body, fins may be smaller in length but in benthic species, these ratios may be larger (Elnabris 2014). Some researchers in Turkey used such ratios for the morphometric characters of the species in the ichthyo-faunistic studies (Uğurlu Helli & Polat 2002; 2003; Uğurlu & Polat 2006; 2007; Uğurlu et al 2008; 2009; Bostancı et al 2016). These rates were declared by Torcu and Mater (2000) as follows, standard length/body depth (*Sl/H*), standard length/length of head (*Sl/lc*), length of head/ horizontal diameter of eye (*lc/Oh*), length of head/ interorbital distance (*lc/io*), interorbital distance/ horizontal diameter of eye (*io/Oh*). These ratios symbols were arranged as to our abbreviations used in this work. In some species, these ratios were compared with results of other works, although these ratios were not used in the world taxonomic literature.

Results

At the end of sampling studies, a total of 9 species belong to Cyprinidae, Gasterosteidae, Atherinidae, Mugilidae, Poecilidae and Gobiidae families were obtained

in the Miliç River drainage channel. These species were identified as follows: *Carassius gibelio*, *Alburnus derjugini*, *Petroleuciscus borysthenicus*, *Rhodeus amarus*, *Gasterosteus aculeatus*, *Atherina boyeri*, *Mugil cephalus*, *Gambusia holbrooki* and *Proterorhinus marmoratus*. It was determined that five of these species were not listed in the previous studies. These species were *P. borysthenicus* and *A. derjugini* from Cyprinidae, *A. boyeri* from Atherinidae, *G. aculeatus* from Gasterosteidae and *G. holbrooki* from Poecilidae.

The proportions, according to standard length (*Sl*) and head length (*lc*), of some morphometric measurements of the newly recorded fish species in the study, were calculated according to Table 1 and given in Table 2, for each species. Species information was summarized as follows.

Familia: Atherinidae

***Atherina boyeri* Risso, 1810**

Common Name: Big-scale sand smelt **Turkish Name:** Aterina, Gümüş Balığı

One sample of big-scale sand smelt was obtained during the sampling studies (in station 3). Metric features were shown in this specimen in Table 1. Some of the diagnostic results were identified as D1 VI, D2 II / 11, A II / 12, P II / 14, V I / 5. This single sample was found to have a standard length of 50 mm (Figure 2a). The percentages (%) of some morphometric metrics of *A. boyeri* according to *Sl* and *lc* were shown in Table 2. Some morphometric ratios of a single *A. boyeri* specimen were determined as 4.35 (*Sl/H*), 2.94 (*Sl/lc*), 1.31 (*lc/Oh*), 3.09 (*lc/io*), 2.62 (*io/Oh*) and 0.42 (*lc/prO*).

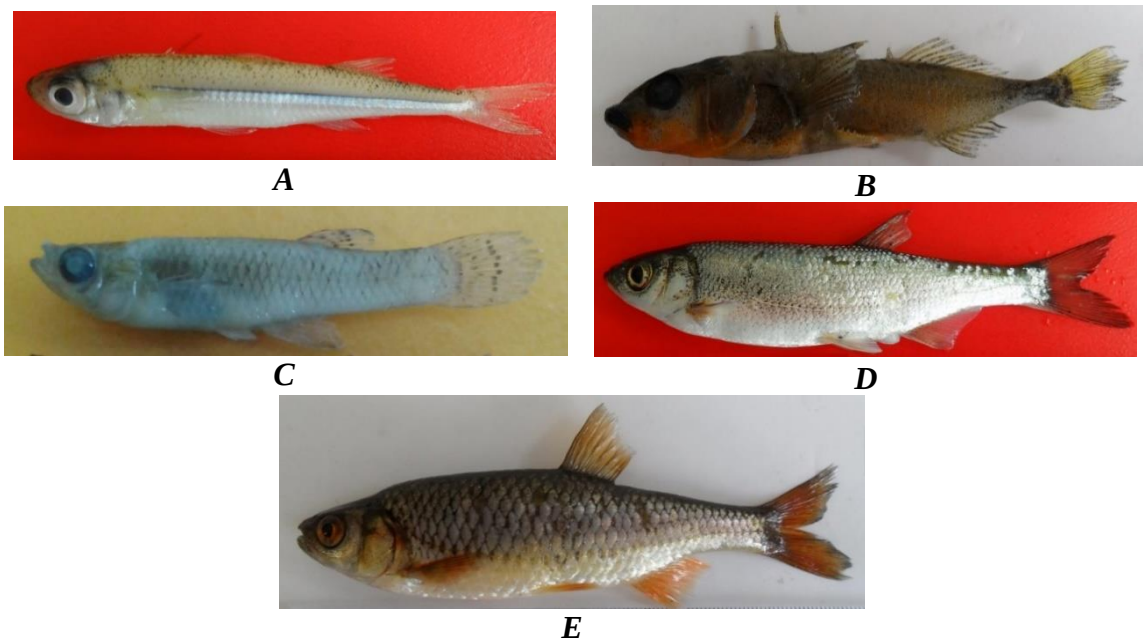

Figure 2. New record fish species determined in the research; ***A*** **-** *Atherina boyeri*, *Sl*: 50 mm, ***B*** **-** *Gasterosteus aculeatus*, *Sl:* 63 mm, ***C*** **-** *Gambusia holbrooki*, *Sl*: 31 mm, ***D*** **-** *Alburnus derjugini*, *Sl*: 97 mm, ***E*** **-** *Petroleuciscus borysthenicus*, *Sl*: 74 mm (Originals)

Familia: Gasterosteidae

***Gasterosteus aculeatus* Linnaeus, 1758**

Common Name: Three-spine Stickleback **Turkish Name:** Dikence

Meristic features of this species were identified as D II-IV / 12-14 A I/8-10, P 9-11 V I/1. In the study, three in dorsal and one pair of spinous rays in the pectoral region of the sticklebacks commonly found in this river channel were identified (Figure 2b). It's observed that three of the five specimens obtained in the river were male individuals, other two were female, and standard lengths (*Sl*) vary between 47 and 58 mm (Table 1). The percentages of some morphometric measures, according to standard length and head length, of *G. aculeatus* were shown in Table 2. Some morphometric ratios of *G. aculeatus* specimens were found to be in the ranges of 3.33-3.87 (*Sl/H*), 2.36-2.97 (*Sl/lc*), 2.57-3.14 (*lc/Oh*), 3.27-3.67 (*lc/io*), 0.79-0.86 (*lc/io*) and 2.88-3.19 (*lc/prO*).

Familia: Poeciliidae

***Gambusia holbrooki* Girard, 1859**

Common Name: Eastern mosquitofish **Turkish Name:** Sivrisinek Balığı

Mosquitofish specimens, obtained in the study area, were determined to be *Gambusia holbrooki* of the Poecilidae family (Figure 2c). It was specified that none of the obtained samples were found to be gonopodium. The metric measurements of the two *G. holbrooki* specimens obtained in the study were shown in Table 1, while the meristic data were specified as D I-II 5-6, A II-III 7-8, P 7, V 4-5, LL 29-31. The percentages of some measured morphometric features of mosquito species according to standard length (*Sl*) and head length (*lc*) were given in Table 2. Ratios of some morphometric measurements of *G. holbrooki* (*Sl*, 26.00-31.00 mm) obtained in the study were found to be in the ranges of 3.71-3.88 (*Sl/H*), 2.60-3.10 (*Sl/lc*), 2.50-2.71 (*lc/Oh*), 2.00-2.11 (*lc/io*), 1.25-1.29 (*io/Oh*) and 2.00-3.33 (*lc/prO*).

Familia: Cyprinidae

***Alburnus derjugini* Berg, 1923**

Common Name: Georgian shemaya **Turkish Name:** İnci Balığı

Some morphometric characters of *A. derjugini* specimens, a fast and timid fish found in this drainage channel in the study, were given in Table 1. Meristic features were as follows: D I-II/8-9, A I/12-15, P I, 9-13, V I, 8-9, LL 65-70. When the nine *A. dejugini* vouchers, ranging from 57 to 83 mm in standard length (*Sl*), were examined morphologically (Figure 2d). The rates (%) of some morphometric characters of *A. derjugini* according to *Sl* and *lc* were shown in Table 2. The ratios for some morphometric properties of *A. derjugini* vary in ranges of 3.77-6.38 (*Sl/H*), 3.22-3.63 (*Sl/lc*), 2.43-2.93 (*lc/Oh*), 0.07-0.11 (*lc/io*), 0.75-1.00 (*io/Oh*) and 2.71-3.19 (*lc/prO*).

Familia: Cyprinidae

***Petroleuciscus borysthenicus* (Kessler, 1859)**

Common Name: Dnieper chub **Turkish Name:** Tatlısu kefali

Morphometric characteristics of *Petroleuciscus borysthenicus* (Figure 2e), a new record for the Miliç River were given in Table 1. Some of the meristic features obtained from 23 fish specimens ranging from 83-103 mm in standard length were found as D III-IV/8-10 A III-IV/9-10, P I/9-11, V I-II/8-9, LL 33-40. Some morphometric ratios of *P. borysthenicus* specimens were found to vary between 3.33-3.55 (*Sl/H*), 3.61-3.68 (*Sl/lc*), 2.56-3.11 (*lc/Oh*), 2.17-2.33 (*lc/io*), 1.11-1.33 (*io/Oh*) and 3.25-3.50 (*lc/prO*).

Discussion and Conclusion

The first study in Miliç River, conducted by Kuru (1972), ten taxa, including *Abramis brama*, *Leuciscus cephalus* (*orientalis*), *Rhodeus sericeus* (*amarus*), *Rutilus rutilus*, *Scardinius erythrophthalmus*, *Vimba vimba* (*tenella*), *Esox Lucius, Mugil (Liza) auratus*, *Gobius gymnotrachelus* and *Syngathus nigrolienatus* were reported. In other previous work, Uğurlu & Polat (2006) stated that species of *A. brama*, *M. auratus*, *and E. lucius* declared by Kuru (1972) were not found (Table 3), but where 10 additional species were detected in addition to seven taxa except three species in the study of Kuru (1972). According to information learned from local fishermen during this study, it was noted that the Pike (*E. lucius*) was catching often. However, neither in the present study nor in the previous studies, this species was found. The two species of cyprinid, *Alburnus derjugini* and *Petroleuciscus borysthenicus* identified in the study were new recorded species. If it was considered that only a 3-4 km square area of the channel is searched, it would be acceptable to that no species, that inhabits fast and clean waters, were found. *Gasterosteus aculeatus* and *Atherina boyeri*, both of which are euryhaline species and were not also recorded in previous studies, were identified in the river since the sampled channel area was close to the area where the Miliç River split into the sea and is relatively a stagnant stream, this is an unexpected situation.

Gasterosteus aculeatus, which was declared as the first record in some streams and lagoons such as (Kargalı Lagoon, Simenit-Akgöl Lagoon, and Taflan Stream) in Samsun Province by Polat et al (2008) and Uğurlu et al (2008; 2009), was also recorded for Miliç River for the first time. In the finding of meristic examinations, the dorsal spinous rays, which are characteristic for sticklebacks, were designated to be between two and four. Uğurlu et al (2008, 2009) reported that they change between 3 and 4 in the samples they obtained. Despite being away from the sea, the presence of a stickleback (*G. aculeatus*) was also registered in the İznik Lake (Özuluğ et al 2005; Yağcı et al 2008). Ratios of the ranges obtained by Uğurlu et al (2008) were 4.29-4.92 (*Sl/H*), 3.11-3.67 (*Sl/lc*), 2.36-2.96 (*lc/Oh*), 4.72-5.68 (*lc/io*) and 0.52-0.75 (*io/Oh*) and were not similar with ranges of our conducted study.

Table 3. Previous and present fish species records* of Miliç River.

Species	S^1	S^2	S^3	S^0	Species	S^1	S^2	S^3	S^0
Cyprinidae					**Mugilidae**				
Abramis brama	×	–	–	–	*Mugil cephalus*	–	×	×	×
Barbus tauricus	–	×	×	–	*Mugil auratus*	×	–	–	–
Capoeta tinca	–	×	×	–	**Syngnathidae**				
Carassius gibelio	–	×	×	×	*Syngnathus nigrolineautus*	×	–	–	–
Chalcalburnus chalcoides	–	×	×	–	*Syngnathus abaster*	–	×	×	–
Leuciscus cephalus (*orientalis*)	×	×	×	–	*Syngnathus acus*	–	×	×	–
Rhodeus sericeus (*amarus*)	×	×	×	–	**Blenniidae**				
Rhodeus amarus	–	–	–	×	*Salaria fluviatilis*	–	×	×	–
Scardinius erythrophthalmus	×	×	×	–	**Gobiidae**				
Vimba vimba (tenella)	×	×	×	–	*Neogobius constructor*	–	×	×	–
Rutilus rutilus	×	–	–	–	*Neogobius fluviatilis*	–	×	×	–
Petroleuciscus borysthenicus	–	–	–	×	*Neogobius gymnotrachelus*	×	×	×	–
Alburnus derjugini	–	–	–	×	*Proterorhinus marmoratus*	–	×	×	×
Gasterosteidae					**Esocidae**				
Gasterosteus aculeatus	–	–	–	×	*Esox lucius*	×	–	–	–
Atherinidae					**Poeciliidae**				
Atherina boyeri	–	–	–	×	*Gambusia holbrooki*	–	–	–	×

*S^0: This study, S^1: Kuru (1972), S^2: Uğurlu & Polat (2006), S^3: Polat et al (2008)

Petroleuciscus borysthenicus was first declared to belong to the genus *Squalius* (Bogutskaya 1996). It has been accepted later as valid species belonging to the new genus *Petroleuciscus* by many scientists and authorities (Bogutskaya 2002; Freyhof & Kottelat 2008; Romanov & Luna 2017; GBIF 2017). *P. borysthenicus* was detected only in the Karaboğaz Lagoon in Samsun Province (Polat et al 2008; Uğurlu et al 2008; 2009). The meristic and some metric characters reported in these studies were similar to those found in the Miliç River. Especially, in ratios of 3.39-4.32 (*Sl/H*) 3.19-4.68 (*Sl/lc*), 3.06-3.67 (*lc/Oh*), 2.27-2.59 (*lc/io*) and 1.22-1.53 (*io/Oh*) reported by Uğurlu et al (2008), there were a few differences from the same ratios of this study. Furthermore, *P. borysthenicus* has been noticed to locate in rivers and lakes in the Marmara Region and the Aegean Region except for the Black Sea region (GBIF 2017). For example; it was noted that *P. borysthenicus* is identified in Bakacak Stream (Biga Peninsula) and in Lake Apolyont (Uluabat Lake / Bursa) by Sarı et al (2006) and Berber et al (2011). The results found out by Berber et al (2011) were related to the diagnostic properties of these species, were consistent with the results of this study.

It was seen that the *Alburnus derjugini*, which was defined in this study, was not found in the previous studies conducted in Samsun province. It was reported that *A. derjugini* was in the Çoruh River draining to the Black Sea from Georgia (Bayçelebi et al 2015). Similarities were shown with the meristic characters mentioned in the present study, although the findings of previous studies were not exact. Rates of some morphological measurements found by Özuluğ & Freyhof (2007) were head length (*lc*) 23-27 % *Sl*, predorsal length (*pD*) 54-58 % *Sl*, caudal peduncle depth (*hpc*) 8.2-9.0 % *Sl*, 2.0-2.5 times in its length, eye diameter (*Oh*) 5.9-7.9 % *Sl*, 0.9-1.2 times in interorbital distance (*io*), 26-31 % head length (*lc%*), body depth (*H*) 20-23 % *Sl*. According to the results, even though they were not exactly similar to their values, the percentages of *lc, pD, lpc* and *H* by the *Sl* of *A. derjugini* obtained in this study showed compatibility compared to those mentioned in the Table -3.

It was determined that *Atherina boyeri* first encountered at Altınkaya Dam Lake, Kargalı Lagoon and Simenit - Akgöl Lagoon (Polat et al 2008; Uğurlu et al 2008; 2009). However, the studies proved that *A. boyeri* widely spread in the Turkish inland waters. The presence of big scale sand smelt was reported from many localities such as Eşen Brook (Muğla) (Onaran et al 2006) Gölbaşı Pond/Adapazarı (İlhan & Balık 2008), and Lake İznik (Yağcı et al 2008). The detected reproductive biology and growth performance of this species were reported to form Lake (Küçük et al 2012). It was notified that big scale sand smelt is found in the Büyük Menderes River in the Aegean Region (Güçlü et al 2013). Findings of the *A. boyeri*'s meristic features in this study were similar to results of studies conducted in other parts of Turkey (Onaran et al 2006; Güçlü et al 2013). In addition, Uğurlu et al (2008) reported that some morphometric ratios of *A. boyeri* caught in the Lagoons of Kargalı and Simenit-Akgöl were ranged; 6.27-6.64 (*Sl/H*), 4.56-4.80 (*Sl/lc*), 2.22-2.47 (*lc/Oh*), 3.48-3.70 (*lc/io*), 0.58-0.71 (*io/Oh*). Most of these morphometric ratios were not similar to the values stated in this study.

According to studies conducted, mosquito fish (*G. holbrooki*) was declared to be found in 40 different freshwaters localities of Turkey, especially invasive in the Aegean and Marmara regions, and they were less frequent in the Central Anatolia and in the east of the Mediterranean Region (Özuluğ et al 2013). The reason for the high number of these reports were considered to be the releasing of this North America originated species into inland waters of Turkey for the struggle against malaria disease (Polat et al 2008; Özuluğ et al 2013). As it was clear in literature, *G. holbrooki* was widely spread in Turkish inland waters (Vidal et al 2010). The morphometric and meristic findings of *G. holbrooki* obtained in this study particularly agree with some of the results obtained by Uğurlu & Polat (2007) from the Kızılırmak River, Taflan, and Yurtluk Streams. These results were as: 4.00-4.51 (*Sl/H*), 3.98-4.56 (*Sl*/*lc*), 2.23-2.97 (*lc*/*oh*), and 1.89-2.10 (*lc*/*io*). Besides, there was only a little difference in terms of *lc*/*Oh*, between the calculated value of our study and of the study performed by Birecikligil & Çiçek (2011).

As a result, although many taxonomic and faunistic studies were done in the area where the study was conducted, a small contribution to the biodiversity of Turkey has been made with the newly recorded species found. Three species belonging to three different families (Atherinidae, Poecilidae and Gasterosteidae) and two new Cyprinid members were added to the fish fauna of the Miliç River. However, fish taxa with this result in the river have been a total of 26 species, except *Rhodeus sericeus* renewed as *R. amarus* (Bektaş et al 2013, Çiçek et al 2015).

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Table 1. Morphometric measurements (mm) of newly recorded species, $\bar{x}$: mean, ±: Standard Deviation (SD)

Species		*Sl*	*pD*	*lc*	*prO*	*Oh*	*poO*	*Dhl*	*lP*	*hD*	*lD*	*poD*	*pV*	*lV*	*pA*	*hA*
P. borysthenicus	$\bar{x}$	93.67	53.50	25.67	7.67	9.00	12.33	17.33	16.67	18.67	12.17	34.83	48.17	16.67	67.83	13.67
n=3	±	4.75	2.48	1.19	0.27	0.00	0.76	0.98	1.09	0.72	0.59	1.77	3.04	0.98	2.75	0.27
	m	83.00	48.00	23.00	7.00	9.00	10.50	15.00	14.00	17.00	11.00	31.00	41.00	15.00	61.50	13.00
	M	103.00	58.50	28.00	8.00	9.00	13.50	19.00	18.00	20.00	13.50	38.50	53.50	19.00	73.00	14.00
A. derjugini	$\bar{x}$	69.33	42.56	20.33	6.83	7.67	9.89	14.61	14.44	14.39	9.72	26.89	35.56	12.44	49.39	10.33
n=9	±	2.99	2.30	0.84	0.24	0.21	0.35	0.69	0.72	0.48	0.28	1.31	2.36	0.77	2.06	0.50
	m	57.00	35.00	17.00	6.00	7.00	8.50	12.00	11.00	12.00	8.50	21.50	20.00	10.00	41.00	7.00
	M	83.00	56.00	25.50	8.00	9.00	11.50	19.50	18.00	16.50	11.50	35.00	46.00	17.00	60.00	12.00
G. aculeatus	$\bar{x}$	53.00	37.20	20.30	7.50	7.00	10.10	16.80	11.70	8.40	15.00	9.40	30.00	10.30	41.10	7.20
n=5	±	1.62	1.00	0.69	0.20	0.00	0.30	0.64	0.39	0.33	0.75	0.46	0.71	0.33	1.58	0.36
	m	47.00	33.00	18.00	7.00	7.00	9.00	15.00	10.50	7.00	13.00	8.00	27.00	9.00	35.00	6.00
	M	58.00	39.00	22.00	8.00	7.00	11.00	19.00	13.00	9.00	17.00	11.00	31.50	11.00	45.00	8.50
G. holbrooki	$\bar{x}$	28.50	21.00	9.75	4.00	3.75	5.50	7.50	7.75	7.50	4.50	10.75	13.50	5.50	18.00	8.00
n=2	±	0.83	0.67	0.08	0.33	0.08	0.17	0.50	0.08	0.17	0.17	0.08	0.17	0.17	0.67	0.33
	m	26.00	19.00	9.50	3.00	3.50	5.00	6.00	7.50	7.00	4.00	10.50	13.00	5.00	16.00	7.00
	M	31.00	23.00	10.00	5.00	4.00	6.00	9.00	8.00	8.00	5.00	11.00	14.00	6.00	20.00	9.00
A. boyeri n=1	$\bar{x}$	50.00	27.00	17.00	6.50	13.00	11.00	14.00	12.00	2.00	9.00	30.00	23.00	10.00	40.00	9.00

Table 2. Morphometric rates of newly recorded species by standard length (*Sl*) and head l
x̄: mean, ±: Standard Deviation (SD), *m*: Minimum, M: Maximum

			Sl%											*lc%*
Species		*Sl*	*lc*	*H*	*pD*	*poD*	*lpc*	*hD*	*lD*	*lP*	*lV*	*hA*	*lA*	*pr*
P. borysthenicus	x̄	93.67	27.42	29.02	57.16	37.19	21.64	19.97	13.00	17.76	17.79	14.66	14.40	29.
n=3	±	4.75	0.13	0.44	0.28	0.14	0.48	0.25	0.15	0.50	0.40	0.49	0.32	0.5
	m	83.00	27.18	28.16	56.80	36.84	20.48	19.42	12.63	16.87	16.84	13.59	13.68	28.
	M	103.00	27.71	30.00	57.83	37.38	22.33	20.48	13.25	18.95	18.45	15.66	15.05	30.
A. derjugini	x̄	69.33	29.38	22.20	61.23	38.75	22.54	20.85	14.14	20.81	17.90	14.91	17.63	33.
n=9	±	2.99	0.40	0.91	1.21	0.57	0.37	0.39	0.43	0.46	0.61	0.43	0.47	0.5
	m	57.00	27.54	15.66	55.07	36.23	21.01	19.28	12.00	18.75	15.22	12.07	15.79	31.
	M	83.00	31.03	26.51	67.47	42.17	24.14	22.73	16.67	22.81	21.21	16.41	19.83	36.
G. aculeatus	x̄	53.00	38.39	27.35	70.27	17.86	17.59	15.84	28.29	22.09	19.45	13.55	18.33	37.
n=5	±	1.62	1.28	0.63	1.15	1.11	1.29	0.37	1.02	0.47	0.38	0.28	0.51	1.1
	m	47.00	33.62	25.86	67.24	13.79	15.45	14.89	24.53	20.69	18.87	12.77	16.98	34.
	M	58.00	42.31	30.00	75.00	20.75	23.08	17.31	30.91	23.64	21.15	14.66	20.00	41.
G. holbrooki	x̄	28.50	34.40	26.36	73.64	37.93	45.66	26.36	16.07	27.33	19.29	27.98	16.07	40.
n=2	±	0.83	0.71	0.19	0.19	0.82	0.17	0.19	1.05	0.51	0.02	0.35	1.05	3.0
	m	26.00	32.26	25.81	73.08	35.48	45.16	25.81	12.90	25.81	19.23	26.92	12.90	31.
	M	31.00	36.54	26.92	74.19	40.38	46.15	26.92	19.23	28.85	19.35	29.03	19.23	50.
A. boyeri n=1	x̄	50.00	34.00	23.00	54.00	60.00	10.00	4.00	18.00	24.00	20.00	18.00	16.00	38.