

TWO NEW RECORDS FOR THE FISH FAUNA OF LAKE SAPANCA BASIN (SAKARYA, TURKEY)

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Abstract: Two freshwater fish species, *Phoxinus phoxinus* (Linnaeus, 1758) and *Gambusia holbrooki* Girard, 1859, were recorded for the first time from Lake Sapanca Basin. *P. phoxinus* were captured from Mahmudiye stream while *G. holbrooki* was captured from Maşukiye stream. The mesural and meristic characters of the specimens were similar to those reported elsewhere for the species. *P. phoxinus* known as predator of trout's eggs was caught in big numbers in same stream with *Salmo trutta macrostigma*. The inclusion of these species has increased the species list of fish fauna of Lake Sapanca.

Keywords: Lake Sapanca, new records, fish fauna, streams

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Introduction

Lake Sapanca is one of the most important lakes in the Marmara Region of Turkey. Its water is used as a source of drinking water by the city and district of Adapazarı and as a recreational area. Although Lake Sapanca's water is enriched by water from trout farms, which are common in this region, with more than thirty in the vicinity of the lake, it has an oligotrophic character (Albay et al., 2003).

Although its high species richness and importance of fisheries, fish fauna of Lake Sapanca has poorly been studied. First fish records were given in 1926 by Karekin Deveciyan who reported the fish species which were brought to İstanbul Fish Market from Lake Sapanca (Deveciyan, 1926). Then, Kosswig and Battalgil (1943), Kosswig (1952), Numann (1958), Ladiges (1960), Ongan (1982), Rahe and Worthmann (1986), Karabatak and Okgerman (2002) and Okgerman et al. (2006) gave more detailed lists of fish species from the lake. However, there has not been any study conducted on the fishes inhabiting the streams which feed the lake.

Phoxinus phoxinus (Linnaeus, 1758) is a cyprinid fish which prefers clear and cold running waters, occurs occasionally in lakes. This fish species is known as predator of trout's eggs and can consume them in high numbers. It may easily ascend the trout zones in running waters and become a significant threat for trout populations (Geldiay and Balık, 1996). *Gambusia holbrooki* Girard, 1859 and *Gambusia affinis* (Baird & Girard, 1853) are possibly one of the earliest deliberate introductions of freshwater fish in Turkey although there are no exact records of early introductions (İnnal and Erk'akan, 2006). *Gambusia* species were introduced to Lake Amik to control malaria (Öztürk and İkiz, 2004). These fish species were then distributed to all suitable water bodies in Turkey (Geldiay and Balık, 1996).

Our aim is to report these two unrecorded fish species for Lake Sapanca Basin. These fish species were obtained from ongoing project aimed to determine fish fauna of the streams flowing into the lake.

Materials and Methods

Study site

Lake Sapanca is located in the Marmara region of north-west Turkey (40°41' to 40°30' N, 30°09' to 30°20' E) and one of the most important lakes in the region in terms of fisheries, recreation and drinking water resource (Fig. 1). Its surface area is 46.8 km² with a maximum depth of 55 m. It is 30 m above sea level. 13 streams mainly flow into the lake namely, Karaçay, Yanık, Kurtköy, Mahmudiye, İstanbul, Maşukiye, Keçi, Sarp, Balıkhan, Eşme, Limon, Maden and Arifiye. The lake has one outlet (Çark).

The specimens examined in present study were collected by electroshocker and gill nets from Maşukiye and Mahmudiye streams.

We have chosen two or three different sampling stations on the streams based on their physical properties (i.e. stone or sandy, high or low velocity, slope situation). The samples were fixed and preserved in a 5% formaldehyde solution. Meristic counts and mensural measurements were made on the left side of each specimen.

Measurements were made with dial caliper and recorded to 0.1 mm. Meristic counts were made under a binocular dissection microscope. Standard length (SL) was measured from the tip of upper lip to the end of hypural complex (this procedure was also followed for *G. holbrooki* which has dorsal shape mouth, i.e. lower lip is longer than upper lip). The length of the caudal peduncle was measured from behind the base of the last anal-fin ray to the end of hypural complex, at mid-height of caudal-fin base. Gill rakers were counted on the anterior gill arch. The last two branched rays articulating on a single pterygiophore in the dorsal and anal fins are noted as "1½". Many different sources (Berg, 1949a, 1949b; Banarescu, 1964; Rauchenberger, 1989) were used for definition and determination of the genera and species of the fish samples. Species names were attributed according to Eschmeyer (1998). The specimens have been deposited in the collection of İstanbul University, Faculty of Fisheries, Department of Freshwater Biology and İstanbul University Science Faculty Hydrobiology Museum (IUSHM).

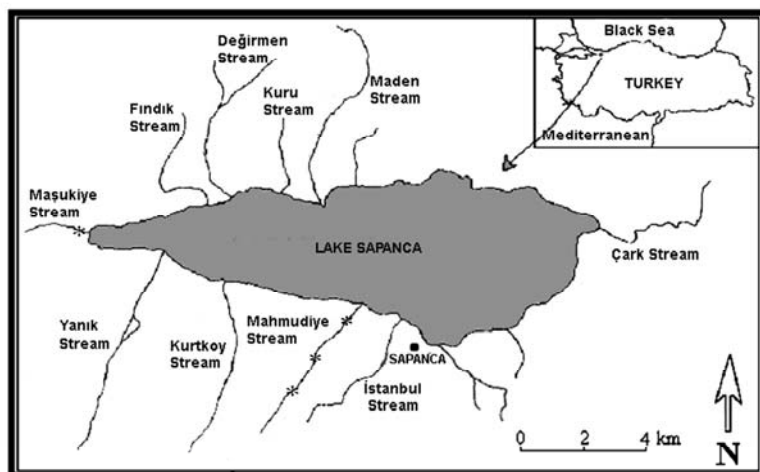


Figure 1. Map of Lake Sapanca, *=sampling localities for to new records.

Results and Discussion

We found two new fish species from two streams which flow into the Lake Sapanca namely; *P. phoxinus*, and *G. holbrooki*. *P. phoxinus* was captured from Mahmudiye stream in 14 July 2006 while *G. holbrooki* from Maşukiye stream in 02 June 2006. Studies on the fish fauna in Lake Sapanca done by different researchers were tabulated in Table 1. Fish species reported in the present study were not previously recorded from Lake Sapanca Basin, and thus constitutes new records.

The individuals had all the distinguishing features of the species, including metric and meristic characters that agree with those reported for the species. See Figures 2-4 for general appearances and Table 2 for morphometric data of two new species recorded for the first time in the present study. Some of their diagnostic features are as following;

Phoxinus phoxinus (Linnaeus, 1758)

Material examined: 14 July 2006, 11 specimens, Length: 39.6-55.8 mm SL

Diagnostic characteristics: Body elongate. Mouth small and subterminal. Upper jaw is a little longer than lower jaw. Head length longer than body depth. Dorsal and anal fins are slightly rounded. Caudal peduncle is long. 10 gill rakers on the first branchial arch; pharyngeal teeth 5.1-1.5, dorsal fin rays III 71½; anal fin rays III 71½; pelvic fin rays I 13-15; ventral fin rays II 7. Colour: Body greenish, speckles

on whole body, randomly distributed black dots on flanks, belly light-yellow.

Ecology and Distribution: Lives in cold, running or still, yet well oxygenated waters over gravel substrate. Feeds on algae, plant debris, mollusks, crustaceans and insects. Spawning period is between May and June and reaches mature size at 2 or 3 years. Its distribution range is Eastern Europe and Northern Asia (Geldiay and Balık, 1996).

Gambusia holbrooki Girard, 1859

Material examined: 02 June 2006, 1 specimen, Length: 19.8 mm SL

Diagnostic characteristics: Small fishes. Scales are large. Mouth is large and lower jaw is prominent. Eyes are large. Dorsal fin rays II 6; posterior edge of the joins of the first elongate anal fin ray in the males distinctly serrated (Fig. 3); lateral line scales 32. Colour: Body light grayish-brown; small speckles on body, dorsal and anal fins.

Ecology and Distribution: Inhabits warm, still waters typically seen shoaling at the edges of the streams and lakes (Allen et al., 2002). Feeds on small terrestrial insects usually in the drift and amongst aquatic plants, actively selecting very small prey (Arthington, 1989). Feeds also on mosquito larvae (Rupp, 1997). Native range probably was the Atlantic Coastal Plain from the Delaware River drainage south through Florida, and the Gulf Coastal Plain of Florida and perhaps to western Alabama (Wooten et al., 1988; Rauchenberger, 1989).

Table 1. Fish species found in Lake Sapanca according to different sources.

Family	Fish Species	1	2	3	4	5	6	7	8	9
Anguillidae	<i>Anguilla anguilla</i> (Linnaeus, 1758)			X		X	X			
Atherinidae	<i>Atherina boyeri</i> * Risso, 1810		X	X		X	X			X
Clupeidae	<i>Alosa maeotica</i> * Grimm, 1901		X	X		X	X		X	X
	<i>Clupeonella abrau muhlisi</i> * Neu, 1934						X			X
Cobitidae	<i>Cobitis vardarensis</i> * Karaman, 1928			X		X	X			X
	<i>Nemacheilus angorae</i> Steindachner, 1897			X		X	X			
Cyprinidae	<i>Abramis brama</i> (Linnaeus, 1758)			X	X	X	X			
	<i>Alburnus albidus</i> (Costa, 1938)		X		X					
	<i>Alburnus alburnus</i> (Linnaeus, 1758)			X		X	X			
	<i>Alburnoides bipunctatus</i> (Bloch, 1782)						X			
	<i>Alvonus brunner</i> ?			X						
	<i>Aspius aspius</i> (Linnaeus, 1758)		X	X	X	X	X		X	
	<i>Blicca bjoerkna</i> (Linnaeus, 1758)		X	X	X	X	X		X	X
	<i>Carassius carassius</i> (Linnaeus, 1758)			X	X	X	X		X	
	<i>Carassius gibelio</i> (Bloch, 1782)									X
	<i>Chalcalburnus chalcoides</i> (Güldenstädt, 1772)		X	X	X	X	X			X
	<i>Chondrostoma angorense</i> * Elvira, 1987				X					
	<i>Cyprinus carpio</i> Linnaeus, 1758		X	X	X	X	X		X	X
	<i>Petroleuciscus borysthenicus</i> * (Kessler, 1859)		X	X	X	X	X			
	<i>Rhodeus amarus</i> * (Bloch, 1782)		X	X	X	X	X		X	X
	<i>Rutilus rutilus</i> (Linnaeus, 1758)	X	X	X	X	X	X		X	X
	<i>Scardinius erythrophthalmus</i> (Linnaeus, 1758)	X	X	X	X	X	X		X	X
	<i>Squalius cephalus</i> (Linnaeus, 1758)			X		X	X		X	X
	<i>Tinca tinca</i> (Linnaeus, 1758)	X					X		X	X
	<i>Varicorhinus tri</i> ?			X						
	<i>Vimba vimba</i> (Linnaeus, 1758)		X	X	X	X	X		X	X
Esocidae	<i>Esox lucius</i> Linnaeus, 1758	X	X	X		X	X		X	X
Gobiidae	<i>Knipowitschia caucasica</i> * (Berg, 1916)		X			X	X			
	<i>Neogobius gymnotrachelus</i> * (Kessler, 1857)		X	X		X	X			X
	<i>Neogobius melanostomus</i> * (Pallas, 1814)		X	X		X	X			X
	<i>Neogobius syrman</i> * (Nordmann, 1840)						X			
	<i>Neogobius fluviatilis</i> * (Pallas, 1814)		X	X		X				X
	<i>Proterorhinus marmoratus</i> (Palas, 1814)		X			X	X			
Percidae	<i>Lepomis gibbosus</i> (Linnaeus, 1758)									X
	<i>Perca fluviatilis</i> Linnaeus, 1758	X	X	X		X	X			
Petromyzontidae	<i>Lampetra fluviatilis</i> (Linnaeus, 1758)							X		
Salmonidae	<i>Onchorhynchus mykiss</i> * Walbaum, 1792						X		X	X
	<i>Salmo trutta labrax</i> Pallas, 1811			X						
	<i>Salmo trutta macrostigma</i> Dumeril, 1858		X							
Siluridae	<i>Silurus glanis</i> Linnaeus, 1758	X		X		X	X		X	X
Syngnathidae	<i>Syngnathus abaster</i> Risso, 1827			X		X	X			
	<i>Syngnathus tenuirostris</i> Rathke, 1837						X			
	<i>Syngnathus nigrolineatus</i> Eichwald, 1831		X				X			

1= Deveciyan (1926); 2= Kosswig and Battalgil (1943) 3= Numann (1958); 4= Ladiges (1960); 5= Ongan (1982); 6= Rahe and Worthmann (1986); 7= Ergüven (1989); 8=Karabatak and Okgerman (2002); 9= Okgerman et al. (2006)

Recent authorities were used for the fish species presented in the table. Species which the names were changed marked with an asterisk;

**Atherina mochon*=*Atherina boyeri*; *Caspialosa maeotica*=*Alosa maeotica*; *Cobitis taenia*=*Cobitis vardarensis*; *Chalcalburnus chalcoides sapancae*=*Chalcalburnus chalcoides*; *Chondrostoma knerii*=*Chondrostoma angorense*; *Leuciscus boysthenicus*=*Petroleuciscus boysthenicus*; *Leuciscus cephalus*=*Squalius cephalus*; *Rhodeus sericeus*=*Rhodeus amarus*; *Vimba vimba tenella*=*Vimba vimba*; *Gobius lacteus*=*Neogobius fluviatilis*; *Salmo gairdneri*=*Onchorhynchus mykiss*; *Meogobius gymnotrachilus*=*Neogobius gymnotrachelus*; *Gobius melanostomus*=*Neogobius melanostomus*; *Gobius syrman*=*Neogobius syrman*; *Bubyr caucasicus* kosswigi, *Pomatoschistus caucasicus* kosswigi =*Knipowitschia caucasica*.

? = Species which the names could not be found in the literature.

(reference: <http://www.calacademy.org/research/ichthyology/catalog/fishcatsearch.html>)

Table 2. Morphometric data of two new fish species caught from the streams of Lake Sapanca.

	<i>P. phoxinus</i> (n=11)				<i>G. holbrooki</i> (n=1)
	mean	min	max	SD	
SL (mm)	49.2	39.6	55.8	5.13	19.8
in percents of SL					
Head length	24.3	22.5	26.1	0.01	25.6
Body depth at dorsal-fin origin	22.5	19.7	25.3	0.02	17.8
Predorsal length	55.3	51.2	57.0	0.02	57.8
Preanal length	64.8	61.9	66.5	0.01	41.5
Depth of caudal peduncle	10.4	9.1	11.2	0.01	14.5
Length of caudal peduncle	25.9	24.5	27.2	0.01	54.8
in percent of HL					
Head depth at eye	53.7	48.7	56.0	0.03	46.6
Snout length	29.8	25.8	33.0	0.03	31.8
Eye diameter	27.3	23.7	32.2	0.03	33.4
Interorbital width	32.3	26.8	38.7	0.04	29.6



Figure 2. *Gambusia holbrooki*, 19.7 mm SL; Turkey: Lake Sapanca.

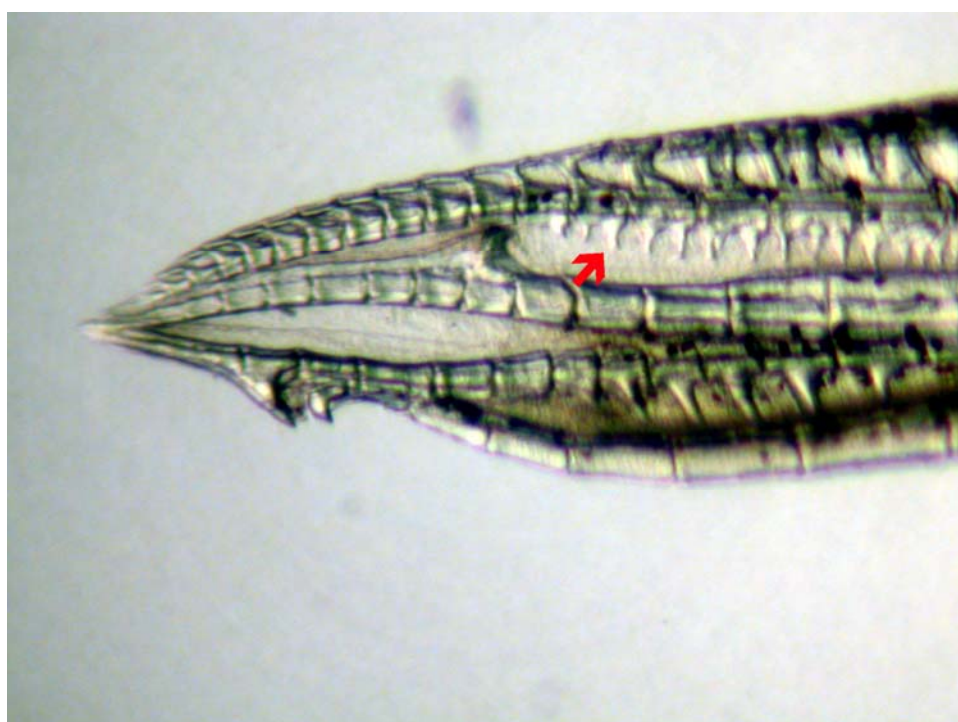


Figure 3. Gonopodium from *Gambusia holbrooki*; Turkey: Lake Sapanca



Figure 4. *Phoxinus phoxinus*, 11.5 mm SL; Turkey: Lake Sapanca.

Two fish species reported in the present study were caught from the streams which flow into the Lake Sapanca. In Turkey, *P. phoxinus* is known from Thrace region and Anatolia (Polonezköy, Sakarya Basin and northeast Black Sea region (Geldiay and Balık, 1996). We found this species in quite big numbers in all zones along the Mahmudiye stream. This finding would suggest that there is a habitat overlap between *Salmo trutta macrostigma* (Dumeril 1858) and *P. phoxinus* in the stream. However, we do not know that occurrence of *P. phoxinus* population has consumed eggs of naturally isolated *S. t. macrostigma* and destructive effect on the population of this species. Further studies are certainly needed to better understand interactions between these co-occurring fish species in the stream.

Gambusia species prefer slow flowing waters and high vegetation (Rupp, 1997). Indeed, we caught one specimen in mouth of Maşukiye stream which had almost stagnant water on that time (02 June 2006). In Turkey, even though there have been many reports on *G. affinis*, only recent studies (Kuru, 2004; Özuluğ et al., 2005a and 2005b; Tarkan et al., 2006) reported presence of *G. holbrooki*. This species separated from *G. affinis* with the posterior edge of the joints of the first elongate anal fin rays in the males was distinctly serrated as proposed by Berg (1949b) and Rauchenberger (1989). These teeth are absent in *G. affinis*. Tortonose (1970) and Spillmann (1961) also described this species-specific characteristic. This feature which distinguishes *G. holbrooki* from *G. affinis* was only men-

tioned in Özuluğ et al. (2005a). This fact suggests that *G. holbrooki* might have been wrongly identified as *G. affinis* so far. For this reason, a comprehensive taxonomic revision is quite necessary for *Gambusia* species living in Turkish waters.

We presume that *P. phoxinus* and *G. holbrooki* have not been found so far due to absence of detailed study in the streams of Lake Sapanca. Some researchers caught several fish species from the streams based on few surveys. For instance; Ergüven (1989) recorded *Lampetra fluviatilis* (Linnaeus, 1758) from Yanık and Kurtköy streams. We found one larval specimen of a *Lampetra* species from Yanık stream during our fish surveys in the streams last year. However, we could not identify it as our sample was not adult individual which is necessary for definite identification. Kux and Steiner (1972) reported only *Lampetra lanceolata* for the first time from Black Sea coast of Turkey. However, *L. fluviatilis* has never been reported from Black Sea coast and Turkey with exception of Ergüven (1989). It has mostly been cited in Europe (coastal waters and rivers of north-western Mediterranean Sea, along European Atlantic coast, North Sea and the whole of Baltic Sea) (Vladykov, 1984). This fact indicates that more detailed studies are needed regarding identification of *Lampetra* species in Lake Sapanca and Turkey as well.

Conclusion

To date, although many reports have been given on the fish fauna of the Lake Sapanca, new fish species still appear from the lake and

its inlets and outlets. Especially, there seems to be a big gap on the fishes inhabiting in the streams of the lake. This suggests that fish fauna of Lake Sapanca Basin should be extensively studied in detail to determine latest situation.

Acknowledgments

We are deeply indebted to Adnan Sümer, Güneş Emir, Murat Aliefendioğlu, Pelin Saliha Çiftçi for their help in sample collection in the field.

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