

Distribution of the topmouth gudgeon, *Pseudorasbora parva* (Cyprinidae:Gobioninae) in Lake Eğirdir, Turkey

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Abstract

Topmouth gudgeon, *Pseudorasbora parva* was firstly recorded in Europe in southern Romania and Albania. This species was firstly determined from the Thrace region of Turkey in 1984 in the River Meriç. In this research, samples collected from four different stations between March 2010 and June 2011. A total of 81 *P. parva* individuals were caught by using drift-nets with a mesh-size of 10 mm, and 24 *P. parva* individuals were caught by using seine nets with a mesh-size of 0.9 mm. The fork length of individuals which were caught (FL) were between 6.1 and 11.1 cm, and their weights (W) were ranged between 3.52 and 25.49 g. Dorsal fin-ray: III/8, anal fin-ray: III/ (6-7), pelvic fin-ray: I/7-8, pectoral fin-ray: I/12-15, Linea lateral: 35-37, Linea transversal: 4-6/4. It has spread into many natural lakes, ponds, and reservoirs in recent years.

Keywords: Invasive, Topmouth gudgeon, *Pseudorasbora parva*, Lake Eğirdir.

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Introduction

The topmouth gudgeon *Pseudorasbora parva* (Temminck et Schlegel, 1846) is a cyprinid of the subfamily Gobioninae. Cyprinidae are represented by 116 species and 33 genus (Kuru, 2004). *P. parva* is a small Cyprinus species which lives in shallow lakes, pools, irrigation canals, and rivers. It prefers especially planted areas (Witkowski, 2006). Topmouth gudgeon has spread into 32 countries, from North Africa to Eastern Asia, as an invasive species in less than 50 years. It is both omnivorous and planktivorous. While topmouth gudgeon juveniles in the River Amur in Asia were found to feed on phytoplankton and zooplankton, small crustaceans, copepods, diatoms, and other small algae, adult individuals feed on planktons and benthic organisms. Generally it prefers to eat copepods, cladocerans ostracods, mollusks, chironomid larvae, rotifers and detritus.

It was stated that individuals with a length between 2.5 and 6.4 cm in the population in Belgium prefer chironomid larvae as a food, and those in China and Germany prefer the larvae and eggs of native fish species as a food (Gozlan et al., 2010). It was stated that when the water temperature reaches 15–19°C, in the River Amur in May and August; in Europe during April–June, they reproduced and tubercles appear on the heads of the male individuals in the breeding season (Witkowski, 2006). At the beginning, it was determined in Nagasaki, Japan and Siberia. *P. parva* was also found Japan, Korea and China. Nichols (1943) gave more information about its existence in China. These species

were recorded in Romania for the first time in the early 1950s (Wildekamp et al., 1997; Kotusz and Witkowski, 1998), and subsequently identified in various parts of Europe and Asia since 1960. After a few years, it was recorded in Uzbekistan in 1961; in the River Danube in Hungary, in 1967; in River Dniester, in Moldavia, in 1972; in Lake Skadar, in Serbia, in 1981; in River Pinka, in Austria, in 1982; in East and West Germany in 1985; in River Aliakmon, in Greece, in 1988; in River Vegre, in France, in 1988; in River Po, in Italy, in 1990; in River Kebir, in north Africa, in 1990; in Lake Mikri Prespa, in the northwestern region of Greece, in 1993 (Perdices and Doadrio, 1992; Rosecchi et al., 1993), and in the northwestern Kyushu Island of Japan, in 2013 (Onikura and Nakajima, 2013). *P. parva* occurred in the Far East in Amur drainage area; the inland waters of Japan; the Yangtze and Huang-ho Rivers, in Taiwan and Korea; in the western and southern regions of the Korean Peninsula; and in the Huang He river systems in the north of China, in Albania. It subsequently spread into the River Danube and other European countries over a period of 40 years (Banerescu, 1999; Gozlan et al., 2010; Grabowska et al., 2010). *P. parva* was accidentally introduced into the waters of Poland (Witkowski, 1991) by means of pond fish and Cyprinus that were probably imported from Hungary in the late 1980s. Kotusz and Witkowski (1998) were also recorded its occurrence at Ruda Sulowska and Stawno fish farms, near Milicz in Poland, in 1990.

Up to the present, within Turkey, *P. parva* has been determined in the River Meriç (Erk'akan, 1984); Sarıyer Dam Lake (Ekmekçi, 2000); Karacaören I and II Reservoirs, Brook Aksu, Karaöz-Antalya, Gülluluk-Antalya (Wildekamp et al., 1997; Küçük and İkiz, 2004); Topçam Reservoir (Şaşı and Balık, 2003); Brook Dipsiz-Çine (Barlas and Dirican, 2004); Lake Gölcük (Yeğen et al., 2006); the basins of Rivers Sakarya, Kızılırmak and Bakırçay in Central and Western Anatolia (Ekmekçi and Kırnkaya, 2006); Sarıçay-Dipsiz-Çine (Yılmaz et al., 2006); Pond Bekdiğin (Uğurlu and Polat, 2007); Brook Felek-Brook Ağačköy (İlhan and Balık, 2008); Kızılırmak River (Gaffaroğlu et al., 2009); Ponds Göğen, Üçpınar and Mesudiye (Anonymous, 2010). This species is known to be an introduced invasive fish in Turkey as well, and its distribution has spread from the Thrace region of Turkey. The aim of the current study was to determine the distribution of *P. parva* in Lake Eğirdir (Temminck et Schlegel, 1846), which

continues to spread rapidly in the inland waters of Turkey.

Materials and Methods

Lake Eğirdir is the second largest freshwater in Turkey. It is a tectonic lake, located at an altitude of 924 m above the sea level, and divided into two main parts, Eğirdir and Hoyran by a strait. It is 48 km and its wide is between 2.6 km and 16 km, with an average depth of 8–9 m and a surface area of approximately 500 km². The water income of the lake is provided from rain, snow water, springs in the lake and the small brooks around the lake. Water outlets of the lake are evaporation, water which is sent into Kovada Canal, water which is taken for irrigation, dolines and potable water is provided for Eğirdir and Isparta City Centre (Lahn, 1948; Numann, 1958). Fishing was carried out in Lake Eğirdir in four different stations (Fig. 1).

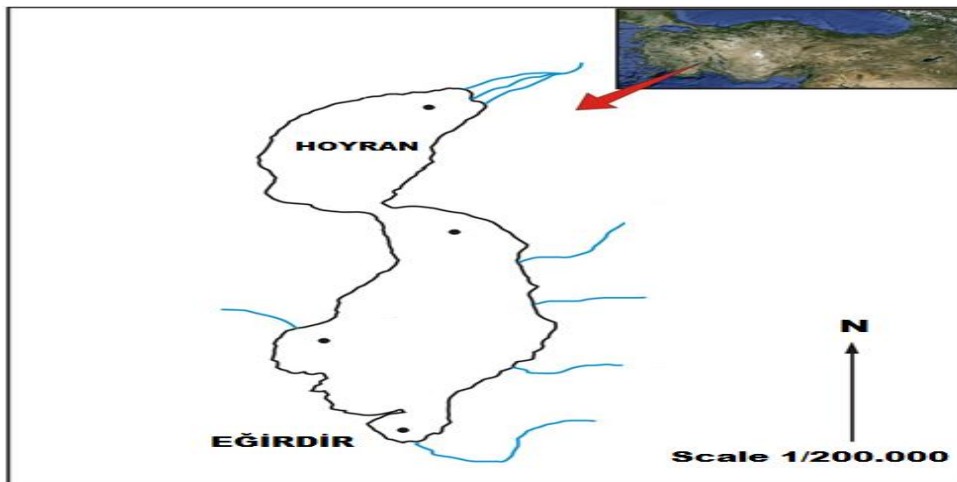


Figure 1: Study Area

The samples were preserved in 4% formaldehyde solution and transported to the limnology laboratory of the Fisheries Research Institute and measured weight to the nearest 0.001 g and total, fork and standard length to the nearest 0.01 mm. A total of 105 topmouth gudgeon specimens were analyzed. In terms of morphometric features, caudal peduncle length (CPL), caudal peduncle height (CPH), dorsal fin height (DFH), dorsal fin length (DFL), body height (BH), pre-dorsal length (PD), head length (HL), eye diameter (ED), nose tip (NT) and head depth from behind the eyes (HD) were measured by using a caliper with a sensitivity of 0.1 mm (Balık and Ustaoglu, 2001). In terms of meristic features, the numbers of dorsal fin-ray, anal fin-ray, pelvic fin-ray and pectoral fin-ray, the number of the scales on the lateral line, the number of the scales on the transversal line, and the pharyngeal teeth were counted.

Results

Pseudorasbora parva has a long body that is slightly flattened at sides. Male individuals are larger than females (Fig. 2). It has two rows of pharyngeal teeth (arranged 5-5) (Fig. 3), the edges of them are slightly curved. The fins are transparent and straw yellow. Dorsal and anal fins are short, whereas the tail fin is large and deeply forked and the tips of the lobes are circular. The scales are quite large and cycloid. Male individuals are bluish-black and female individuals are yellowish-green. Its ventral surface is gray-black on bright parts and yellowish-green or silver-gray on other transition parts. There are half-moon-shaped spots on the scales in the tail part. Its mouth is very small and terminally located; the lips are thin; the upper lips are underdeveloped while lower lips are wide. The most distinctive characteristic of the fish is a black stripe that ranges from the back of the head to the tail. Morphometric and meristic characteristics of *P. parva* were showed (Fig. 4, Table 1).



Figure 2: *Pseudorasbora parva* samples(a) female (b) male



Figure 3: Pharyngeal teeth of *Pseudorasbora parva* samples in Lake Eğirdir

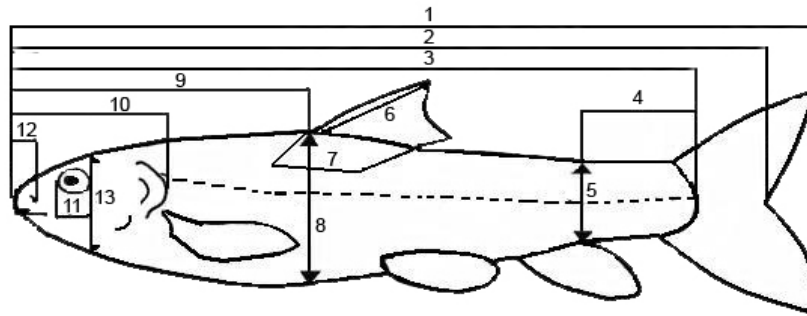


Figure 4: Morphometric measures = 1. TL: Total length; 2. FL: Fork length; 3. SL: Standard length; 4. CPL: Caudal peduncle length; 5. CPH: Caudal peduncle height; 6. DFH: Dorsal fin height; 7. DFL: Dorsal fin length; 8. BH: Body height; 9. PD: Pre-dorsal length; 10. HL: Head length; 11. ED: Eye diameter; 12. NT: The distance until the nose tip; 13. HD: Head depth from behind the eyes

Table 1: The average values of *P.parva* for the morphometric and meristic characteristics (cm) in Lake Eğirdir

Measures	Mean	Standard deviation	Range
TL	8.47	0.13	6.6-12.1
FL	7.79	0.11	6.1-11.1
SL	6.91	0.10	5.4-9.9
W	7.85	0.46	3.52-25.49
CPL	1.61	0.06	1.4-1.9
CPH	0.88	0.02	0.8-1
DFH	1.47	0.04	1.3-1.7
DFL	0.81	0.03	0.7-0.9
BH	1.52	0.03	1.4-1.7
PD	3.23	0.08	2.7-3.6

Continue Table 1

HL	1.51	0.05	1.2-1.8
ED	0.35	0.02	0.3-0.4
NT	0.31	0.01	0.3-0.4
HD	0.83	0.02	0.7-0.9

The monthly distributions of the species are showed in fig. 5. The highest species were collected at the fourth station (40 individuals).

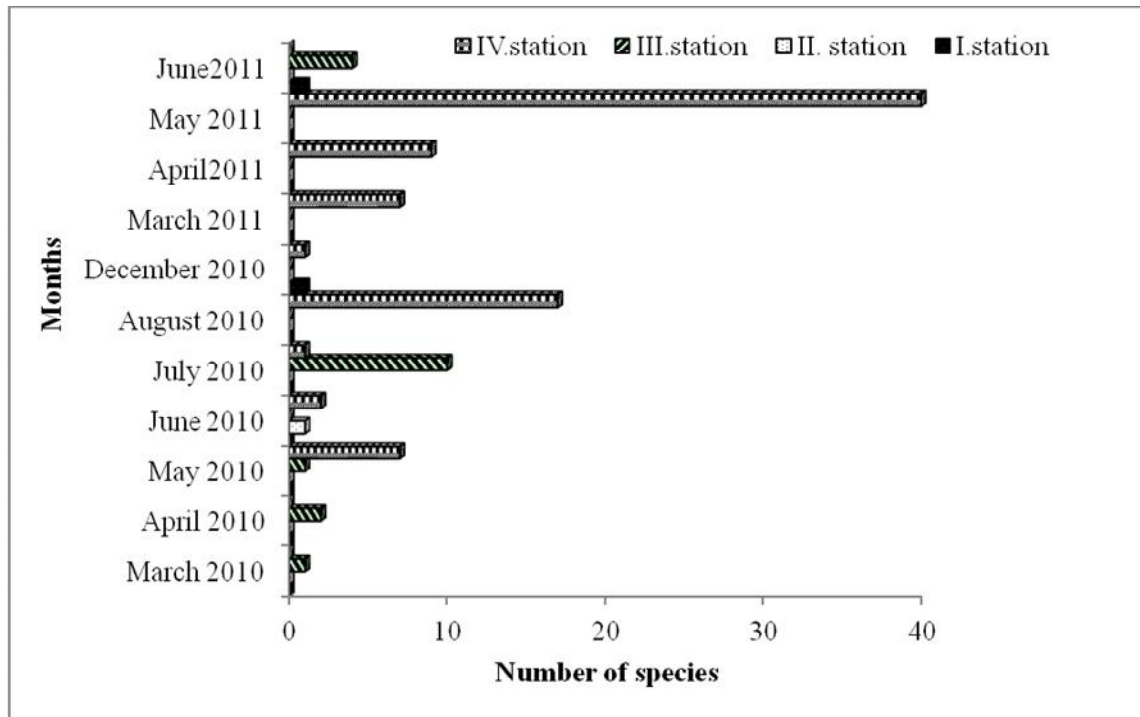


Figure 5: Distribution of *P. parva* in Lake Eğirdir by months

Discussion

P. parva individuals prefer wide, varied environments with abundant food sources, in shallow regions and regions with dense vegetation (Kapusta et al., 2008). According to that; more individuals were obtained in the fourth station and the third station than the others suggests that this is because these regions are shallower and have more

vegetation. This also supports the views of Kapusta et al., (2008).

According to Küçük and İkiz (2004) the length of *P. parva* individuals ranges between 3.6 and 7 cm (TL); according to Kotusz and Witkowski (1998), it ranges between 7.08 and 9.37 cm (TL). Considering these data, the variations in length between *P. parva*

individuals in Lake Eğirdir (6.6–12.1 cm (TL), 5.4–9.9 cm (SL)) are greater than the total values of length presented by the both domestic and foreign studies; this is thought to

indicate that there is abundant food in Lake Eğirdir. The length and lateral line given in this research was compared (Table 2).

Table 2: The length and lateral line of *P. parva* in various areas

Area	Authors	Length	Lateral line
Meriç River-Ipsala	Erk'akan (1984)	4.99-8.34 cm (SL)	-
El Kebir River	Percides and Doadrio (1992)	4.34-9.82 cm (TL)	32-35
Güloluk-Karaöz-Kargı	Wildekamp et al. (1997)	4.63-8.92cm (TL)	-
Ruda Sulowska Fish Farm	Kotusz and Witkowski (1998)	7.08-9.37 cm (TL)	35-37
Topçam Dam Lake	Şaşı and Balık (2003)	9.6-9.7 cm (TL)	36-44
Karacaören I-II Dam Lakes	Küçük and İkiz (2004)	3.6-7 cm (TL)	34-37
Dipsiz-Çine Stream	Barlas and Dirican (2004)	4.9-10.3 cm (TL)	35-38
Bekdiğin Pond	Uğurlu and Polat (2007)	5.2-6.4 cm (TL)	36-38
Lake Eğirdir	Present research	6.6-12.1 cm (TL) 5.4-9.9 cm (SL)	35-37

It was reported that *P. parva* which showed distribution in Karacaören I-II reservoirs and sub-basins of Brook Aksu interfused during the fish reinforcement process; this provides clear evidence that inland water sources have been reinforced with non-native fish species in an uncontrolled way in recent years (Küçük and İkiz, 2004). In addition, a study carried out in Pond Bekdiğin reported that *P. parva* individuals may have mixed with fish which were brought by the State Hydraulic Works as a result of fish reinforcement and may have been added into the local fauna, (Uğurlu and Polat, 2007). *P. parva* have been introduced mainly in Polish inland water. The introduction of non-native fish species has resulted in several negative changes in the aquatic environment, including: 1. Crossbreeding and native species 2. Destruction of the reproduction areas of

freshwater organisms 3. Decrease in the number of native reproduction areas 4. Transmission of parasites and sicknesses from non-native fish species (Grabowska et.al., 2010).

The parasites carried by *P. parva* individuals in European waters include: *Trichodina acuta*, *Chilodonella cyprini* and *Ichthyophthirius multifiliis* which belong to a subgroup of protozoa (Banarescu, 1999). As *P. parva*, it is classified as a harmful species because it shows high reproductive potential in the water sources that it colonizes, due to its competition with the larvae and juveniles of native species (Çetinkaya, 2006). When populations increase in an aquatic ecosystem, they compete with other fish species for food. Larger species generally feed on planktonic crustaceae and this increases the number of the phytoplankton in the environment, potentially

leading to eutrophication in the future (Witkowski, 2006). It was reported that *P. parva* transmits fatal diseases to native fish fauna, limits the reproduction of the endangered native fish species, and influences the decline of native fish species (Ekmekçi and Kırankaya, 2006). There is no data on their potential influence on human health.

In light of the state of its habitat and food preference, the presence of this species in aquatic ecosystems poses a serious threat to endemic ichthyofauna. Therefore, detailed studies, especially about the feeding biology of *P. parva*, should be conducted as soon as possible; and its influence on fish, invertebrates etc. in the aquatic environment should be researched as a matter of priority.

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