

SHORT COMMUNICATION

First record of a coregonid fish species, *Coregonus albula* (Linnaeus, 1758) (Salmoniformes: Salmonidae) in Aktaş Lake shared between Turkey and Georgia

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Abstract

The genus *Coregonus* (Salmoniformes: Salmonidae) was recently considered not to be represented in Turkey. European cisco or vendace, *Coregonus albula* (Linnaeus, 1758) was reported for the first time for Turkey in this article with fifteen samples in Aktaş Lake, Ardahan. This species should be added to the checklist of Turkish fish fauna. Turkish name is proposed as “Akbalık” for this species.

Keywords: *Coregonus albula*, first record, Aktaş Lake, Kartsakhi, alkaline lake, Georgia, Turkey

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Vendace or European cisco *Coregonus albula* (Linnaeus, 1758) is a native species for northern Europe. Berg (1948) reported the distribution of this species its morphological measurements in the former USSR and adjacent countries. Froese and Pauly (2019) summarized the natural distribution of vendace as Baltic basin, several lakes of upper Volga drainage; some lakes of White Sea basin and North Sea basin east of Elbe drainage; anadromous in Gulf of Finland and marine in northernmost freshened part of Gulf of Bothnia between Finland and Sweden; in Lake Inari, northern Finland; lower Rhine (now extirpated).

The vendace was introduced, intentionally in some countries in Europe and United States of America. Vendace was introduced in 1959, 1982-1987 in the Irtysh River Basin and in 1960-61 in Lake Balkhash in Kazakhstan (Mitrofanov and Petr 1999).

There is no record for vendace in neighboring countries, Armenia (Gabrielyan 2001; Hovhannisyan *et al.* 2011) and Iran on the east side of Turkey (Jouladeh-

Roudbar *et al.* 2015). Vendace, however, was introduced from Lake Ladoga (Russia) to Lake Paravani, Georgia in 1930 (Ninua and Japoshvili 2008; Japoshvili 2012). It was easily adapted to Lake Paravani and soon became a primary target for commercial fishery in this lake (Demetrashvili 1960 according to Japoshvili 2012). Lake Jandari in Georgia has also commercial stocks of *Coregonus albula* (Van Anrooy *et al.* 2012).

Coregonus lavaretus (Linnaeus, 1758) and *Coregonus macrophthalmus* Nüsslin, 1882 were imported from Germany and Austria to Turkey in 1954 and introduced to İznik Lake (Geldiay and Balık 2007). Neither species, however, could not establish their own stocks. The check list of Turkey included the records of *Coregonus lavaretus* (Kuru 2004; Kuru *et al.* 2014) on a precautionary basis. On the other hand, another member of Coregoninae, *Stenodus leucichthyes* (Güldenstädt, 1772) from Kura Aras Basin was reported as extirpated for Turkey (Fricke *et al.* 2007; Froese and Pauly 2019). However, in recent years the genus *Coregonus* is considered not to be represented in Turkey.

Aktaş Lake was known as a fishless lake until the 2000's. Then the crayfish (*Astacus leptodactylus*), common/mirror carp (*Cyprinus carpio* Linnaeus, 1758) were introduced, intentionally and/or unintentionally (pers. comm. Yüksel Kılıç 2019). Fish fauna of Aktaş Lake is consisted of common/mirror carp (*Cyprinus carpio*), Prussian carp (*Carassius gibelio* (Bloch, 1782)) (pers. comm. Yüksel Kılıç 2019; TSÜMAE 2013), stone moroko (*Pseudorasbora parva*) (Temminck and Schlegel, 1846) (Japoshvili *et al.* 2019).

The records of the alien species are important in order to monitor their distribution and understand their effects on native species and/or endangered species and water ecosystems. This study confirms the occurrence of *Coregonus albula* (Linnaeus, 1758) in Aktaş Lake in Turkey for the first time as an alien species.

Aktaş Lake is a transboundary lake shared between Georgia and Turkey, almost in half. The lake has a surface area about 27 km². It is a shallow tectonic lake. The maximum depth of the lake is about 2-3 m. Maximum altitude is 1800 m. The catchment area of the lake is 158 km² and the ratio of the surface area to the catchment area is 1:6. It is fed by seasonal inflows and groundwater. The lake is frozen from December to March. The lake has one outflow on northwest side and one drainage canal on the south side. Water quality is alkaline, nearly, all year around pH of lake water is over or close 9 (Özbay and Kılınc 2008). In 2014, pH changes were recorded as summer mean 8.71; autumn mean 8.36 (DKMP 2014). The consecutive measurement of water quality parameters is not available. There are no point of pollution sources in its surroundings, but non-point sources are available like small rural settlements, agriculture and animal

husbandry. Georgian side of Aktaş Lake is covered by Javakheti Protected Area as Kartsakhi Managed Reserve.

Fifteen specimens of coregonid fish from Lake Aktaş (Figure 1) were collected by local fishermen in September 2019. Samples were fixed in formaldehyde and stored in the Ichthyology Collection (HUIC-ARA-7519) of the Hacettepe University in Ankara.

Species identification of the specimens was determined according to Whitehead, (1984) as *Coregonus albula* (Linnaeus, 1758) (Figure 2). Morphometric measurements of those specimens from Aktaş Lake are given in Table 1.

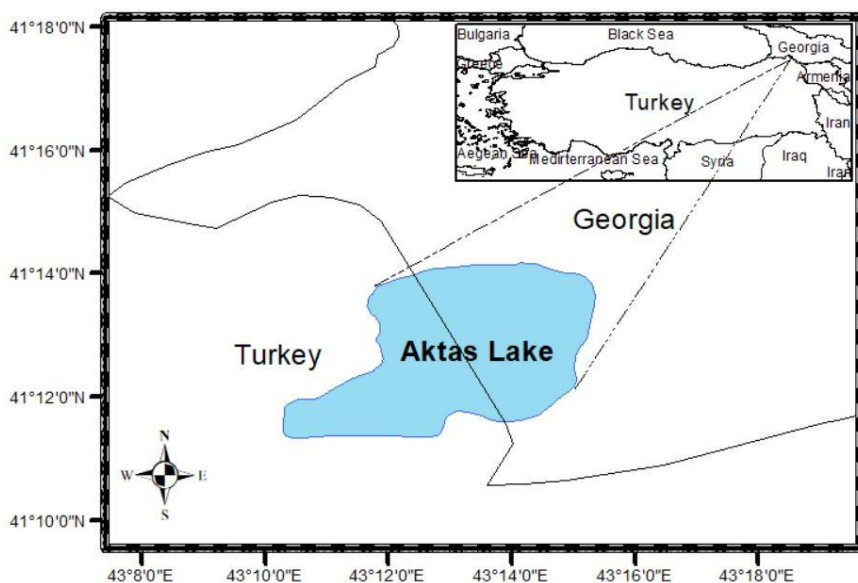


Figure 1. Aktaş Lake
(modified from Google Maps, accessed December 11, 2019)



Figure 2. *Coregonus albula* from Lake Aktaş, Turkey, female, 257 mm in Standard Length (HUIC-ARA-7519)

Taxonomic hierarchy of *Coregonus albula* is as follows (ITIS 2019).

Phylum: Chordata
 Subphylum: Vertebrata
 Infraphylum: Gnathostomata
 Superclass: Actinopterygii
 Classis: Teleostei
 Superordo: Protacanthopterygii
 Order: Salmoniformes
 Family: Salmonidae
 Subfamily: Coregoninae
 Genus: *Coregonus* Linnaeus, 1758
 Species: *Coregonus albula* (Linnaeus, 1758)

English name vendace, European cisco
 Russian name ryapushka
 Turkish name akbalık

Table 1. Morphometric measurements of *Coregonus albula* from Aktaş Lake (n=15)

Measurement	Min	Max	Mean	SD
Total Length (cm)	24.90	33.50	29.30	1.98
Fork Length (cm)	22.00	30.00	26.37	1.85
Standard Length (cm)	20.40	28.00	24.62	1.74
Predorsal Length (%SL)	0.44	0.49	0.46	0.01
Postdorsal Length (%SL)	0.39	0.46	0.42	0.02
Body Height (Dorsal Fin) (%SL)	0.21	0.28	0.24	0.02
Prepelvic Length (%SL)	0.43	0.52	0.48	0.02
Preanal Length (%SL)	0.69	0.80	0.75	0.03
Head Length (%SL)	0.19	0.23	0.20	0.01
Snout Length (%HL)	0.18	0.25	0.22	0.02
Eye Diameter (%HL)	0.24	0.29	0.27	0.01
Postorbital Length (%HL)	0.49	0.60	0.55	0.03
Interorbital (%HL)	0.26	0.32	0.30	0.02
Dorsal Fin Length (%SL)	0.15	0.20	0.17	0.01
Dorsal Fin Base Length (%SL)	0.10	0.13	0.11	0.01
Pectoral Fin Length (%SL)	0.14	0.17	0.16	0.01
Pelvic Fin Length (%SL)	0.14	0.17	0.15	0.01
Anal Fin Length (%SL)	0.09	0.13	0.11	0.01
Anal Fin Base Length (%SL)	0.11	0.16	0.13	0.01
Caudal peduncle length (%SL)	0.07	0.08	0.07	0.00
Caudal peduncle depth (%SL)	0.13	0.16	0.14	0.01

*Standard Length SL; Head Length HL

The sources of this species are probably Georgian lakes, such as Lake Paravani and/or Lake Jandari, then *C. albula* was introduced intentionally and/or unintentionally in Aktaş Lake.

CABI (2019) evaluated the invasive effects of vendace in the order as “reduced zooplankton diversity, reduced individual zooplankton size, reduced zooplankton densities, lowered zooplankton availability for planktivorous fish, and displaced native planktivores from the pelagic fish communities through exploitative competition”. This species also has great tolerance to brackish water although it is a freshwater fish species (Froese and Pauly 2019).

The ecological effects of vendace invasion on the trophic structure of the lake through the increase of primary production due to pressured grazing effects of zooplankton in Aktaş Lake are considerable.

It seems that *C. albula* has established a commercial stock in Aktaş Lake. *C. albula* is the second fish species in the lake as an alien fish, but it has commercial value. It already has market value in Georgia and other countries. Therefore, monitoring and management of the stock are necessary. On the other hand, the expansion of *C. albula* to other water ecosystems should be prevented.

This study indicates the necessity of joint management of Aktaş Lake which is shared with Georgia in terms of sustainable use and protection of the aquatic biodiversity as well as monitoring of the alien fish species and pollution of the lake. A joint survey by Turkey and Georgia can be useful for better understanding biota of the lake, which is very poorly known due to the lack of interest and to the research gap in recent years.

In conclusion, *Coregenus albula* should be added to the check list of Turkish fish fauna. Turkish name is proposed as “Akbalık” for this species.

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Türkiye ve Gürcistan arasında paylaşılan Aktaş Gölü'nde Coregonid bir balık türü, *Coregonus albula* (Linnaeus, 1758) (Salmoniformes: Salmonidae) ilk kaydı

Öz

Coregonus (Salmoniformes: Salmonidae) cinsinin, halen Türkiye'de temsil edilmediği düşünülmektedir. Ardahan, Aktaş Gölü'nden on beş örnek ile Türkiye'de ilk kez European cisco veya vendace, *Coregonus albula* (Linnaeus, 1758)'nin varlığı bu makale ile rapor edilmektedir. Bu tür, Türk balık faunası control listelerine ilave edilmelidir. Bu türün Türkçe adı olarak, Akbalık önerilmektedir.

Anahtar kelimeler: *Coregonus albula*, ilk kayıt, Aktaş Lake, Kartsakhi, alkali göl, Gürcistan, Türkiye

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