FISH FAUNA OF ILISU AREA ON THE TIGRIS RIVER, BEFORE IMPOUNDMENT OF THE ILISU DAM (TURKEY)

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ABSTRACT

The Ilisu Dam is a large hydroelectric power plant that started to collect water in 2019 on the Tigris River in Turkey. This study was done during the period 2010 to 2014 to determine fish fauna of the Tigris River and its tributaries related to the potential reservoir area of the Ilisu Dam before its foundation. 35 fish species belonging to 10 families have been identified in the main river and its tributaries to be covered by the dam reservoir. One of these species, *Glyptothorax steindachneri* was recorded for the first time from the Turkish part of the Tigris River. 22 species were found widely distributed. At least 16 species were found to be endemic to the Tigris and Euphrates basins. Three species were already recommended with some level of international protection as per IUCN Red List. *Cobitis kellei* and *Paraschistura chrysicristinae* species, whose type localities were reported as upper Tigris, were not recorded.

RÉSUMÉ: Ichtyofaune de la zone d'Ilisu sur le Tigris River, avant la mise en cale du barrage d'Ilisu (Turquie).

Le barrage d'Ilisu est une grande centrale hydroélectrique qui a commencé à recueillir de l'eau en 2019 sur la rivière Tigris en Turquie. Cette étude a été réalisée entre 2010 et 2014 pour déterminer la faune des poissons de la rivière Tigris et de ses affluents liés à la zone du réservoir potentiel du barrage Ilisu avant sa fondation. 35 espèces de poissons appartenant à 10 familles ont été identifiées dans la rivière principale et ses affluents pour être couverts par le réservoir du barrage. Une de ces espèces, *Glyptothorax steindachneri*, a été enregistrée pour la première fois dans la partie turque du Tigre. 22 espèces ont été trouvées largement réparties. Au moins 16 espèces ont été trouvées endémiques du bassin du Tigre et de l'Euphrate. Trois espèces ont déjà été recommandées avec un certain niveau de protection internationale, conformément à la Liste Rouge de l'UICN. Les espèces *Cobitis kellei* et *Paraschistura chrysicristinae*, dont les localités types ont été signalées comme le Tigre supérieur, n'ont pas été consignées dans cette étude.

REZUMAT: Fauna ihtiologică din zona Ilisu de pe râul Tigru, înainte de realizarea barajului Ilsu (Turcia).

Barajul Ilisu este o hidrocentrală de mari dimensiuni care a început să colecteze apă în 2019 pe râul Tigru din Turcia. Acest studiu a fost realizat în perioada dintre 2010 şi 2014 pentru a determina fauna ihtiologică din zona Ilisu a râului Tigru în amonte de barajul Ilisu înainte de construirea acestuia. 35 de specii de peşti aparţinând a 10 familii au fost identificate în râul principal şi afluenţii săi ce sunt acoperite de rezervorul barajului. Una dintre aceste specii, *Glyptothorax steindachneri* a fost înregistrată pentru prima dată pe partea turcească a râului Tigru. 22 de specii au fost găsite distribuite pe scară largă. Cel puţin 16 au fost găsite endemice în bazinele Tigru şi Eufrat. Trei specii au fost deja recomandate cu un anumit nivel de protecţie internaţională conform Listei Roşii a IUCN. Speciile *Cobitis kellei* şi *Paraschistura chrysicristinae*, ale căror locaţii tipice au fost raportate ca fiind Tigrul superior, nu au fost înregistrate în acest studiu.

INTRODUCTION

Dams built on rivers, water pollution and excessive use of water due to agricultural activities, are among the most important threats on fish biodiversity (Akama, 2017). While dams provide economic benefits due to flood protection, water supply, and renewable energy contributions, they also cause adverse effects as they cause hydrological change of freshwater ecosystems. In the impounded area of the dams, the main impact is the change from lotic to lentic water, which influences aquatic fauna, including fishes (Jackson and Marmulla, 2001; Agostinho et al., 2008). In addition, the river downstream differs completely from it's old structure in terms of water quality entering its reservoir, water flow, sediment load, and water temperature (Granzotti et al., 2018). As a result, completely new riverside vegetation is formed and natural fish species are highly affected by this new structure of the river. (Collier et al., 1996). Dams also threaten the future of the species by preventing the movement or migration of fish along the river to spawn and feed (Larinier, 2001; Barbarossa et al., 2020). In addition, they prevent the distribution and spread of fish species in the aquatic ecosystem and their tendency to new habitats. In order to evaluate the effects of changes in current and future freshwater ecosystems on fish biodiversity and to take necessary precautions, it is very important to determine the current fish species, to reveal their distribution and habitat structures, to identify and evaluate conservation needs.

Tigris River rises from Hazar Lake in the Tauras Mountains in southeastern Turkey. Fed by many streams coming from the Taurus Mountains the river flows along Turkey-Syria border before entering into Iraq. By joining with the Euphrates River near Al-Qurnah in Iraq, it takes the name Shatt Al-Arab and flows into the Persian Gulf (Al-Ansari et al., 2018). Within the borders of Turkey, Kralkiz, Dicle, and Ilisu dams and hydropower projects are in operation on the Tigris River. The largest of these, Ilisu, is located on the main river course, 65 km upstream from the border line between Iraq and Syria (Eberlein et al., 2010; Al-Madhhachi et al., 2020).

In the upper section of the Tigris River in Turkey, a few studies on fish fauna of the river have made contributions on the taxonomy and distribution of fish species (Kuru, 1975, 1979; Ünlü, 1999; Ünlü, 2006; Ünlü et al., 2011; Ünlü, 2014; Ünlü et al., 2017). Many new species have been identified in this section of the River (Bănărescu and Nalbant, 1964; Nalbant, 1998; Bogutskaya, 1995; Erk'akan et al., 1998; Turan et al., 2011, 2016; Freyhof and Özuluğ, 2017; Freyhof et al., 2017, 2018). Recently, 40 species of fish belonging to 10 families have been recorded in the upper basin of the Tigris River in Turkey (Kaya et al., 2016).

Despite the high fish diversity of the Tigris River, there have been significant changes in fish distribution and community structure due to dams. There are no fish passes on the Ilisu Dam that allow for fish migrations. For this reason, it is thought that there are potential changes in fish populations in the future, as fish migration to upper and lower basins is prevented. Identifying fish species prior to river impoundment not only provides important information on understanding of changes in the biotic communities of the river caused by dams, but also helps in designing strategies to conserve natural fish communities even in a changing ecosystem (Affonso et al., 2015).

Therefore, the purpose of this research was to determine the existing fish fauna including natives, endemics, exotics, and introduced species species from the main course of the Tigris River and its tributaries to be covered by the dam reservoir before construction of Ilisu Dam in southeast of Turkey. The information obtained will contribute to planning strategies for the conservation of fish species of Tigris River in Turkey.

MATERIAL AND METHODS

This study was carried out between 2010 and 2014 in the Ilisu reservoir of the Tigris River and its tributaries flowing into this area (Fig. 1). Fish specimens were collected with DC electrofishing device, cast net, and small gill nets in the shallow small streams. On the main course of the river, fishing nets suitable for river fishing (18, 24, 32, 45 and 60 mm porous and 50-100 m long) were used with a rubber boat during day and night.

The identification of the fish species was made according to Coad (2010) and Kaya et al (2016). The checklist is arranged by family following Van der Laan (2018). Valid species names, authorities, and year of publication follow Van der Laan et al (2014) and Fricke et al. (2021); genera and species within families are arranged in alphabetical order. English and Turkish names of the species were based on Ünlü (2014) and Jouladeh-Roudbar et al. (2020).

Red list categories are used as published by IUCN (2021). Species abundance has been revealed by making species identification and individual counts of each species in the field. The species caught were categorized in four groups according to their abundance status; year-round species (A), less common species (LA), rare species (R) and very rare species (VR). Their commercial importance has been derived from local fishermen. The coordinates of the areas monitored and the species detected were taken with a GPS.

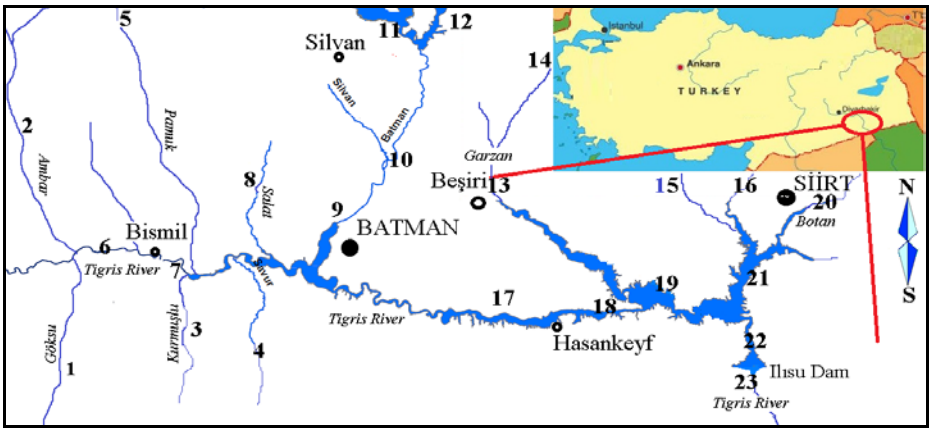

Figure 1: Map of the Ilisu Dam area on the Tigris River and sampled sites (Tab. 2).

RESULTS AND DISCUSSION

Lately, Kralkizi and Dicle Dams have been constructed on the main body of the Tigris River and put into operation for power generation and irrigation purposes respectively. Then Ilisu Dam started operation in 2019. Freshwater systems are highly threatened by massive changes in streams such as habitat loss, pollution, the emergence of non-native species, water consumption, dam construction, and require immediate action to ensure their protection for future generations (Collier et al., 1996; Cooper et al., 2016). In general, an intensive organic pollution is observed in the river as a result of agricultural activities in Bismil district and Batman province, which is the starting point of the Ilisu reservoir (Varol et al., 2010; Varol and Şen, 2012). At the same time, wild irrigation in this region leads to increased river sedimentation and heavy metals accumulation (Karadede-Akin and Ünlü, 2007; Varol, 2013). This situation causes adverse effects on fish species (Alrubayi et al., 2011).

In this study made before impoundment of the Ilisu Dam, 35 fish species belonging to 10 families were identified in the main course of the Tigris River, in the estimated reservoir area of the designed dam and in the tributaries joining this area (Tab. 1).

Table 1a: The natural, endemic, and exotic fish species in the main body of the river and the tributaries joining this area before impoundment of the Ilisu Dam; abundant (A), less abundant (LA), rare (R), and very rare (VR).

Family	Species	English name	Turkish local name	IUCN criteria	Status	Commercial value	Abundance
Cyprinidae	*Acanthobrama marmid* Heckel, 1843	Bream-Like.	Kızılkanat	LC	[N]	Medium	A
Cyprinidae	*Alburnus caeruleus* Heckel, 1843	Black spotted bleak	Benekli incibalığı	LC	[E]	Low	A
Cyprinidae	*Alburnus sellal* Heckel, 1843	Mossul bleak	Musul incibalığı	LC	[E]	Medium	A
Cyprinidae	*Arabibarbus grypus* Heckel, 1843)	Shabout	Şabot	VU	[N]	High	R
Cyprinidae	*Barbus lacerta* Heckel, 1843	Lizard barbel	Benekli bıyıklıbalık	LC	[N]	Medium	A
Cyprinidae	*Barilius mesopotamicus* Berg, 1932	Mesopotamian minnow	Mesopotamya minikbalığı	LC	[E]	Low	LA
Cyprinidae	*Capoeta trutta* (Heckel, 1843)	Long spine scraper	Berat	LC	[N]	High	A
Cyprinidae	*Capoeta umbla* (Heckel, 1843)	Tigris scraper	Şah	LC	[N]	High	A
Cyprinidae	*Carasobarbus kosswigi* (Ladiges, 1960)	Kiss–lip himri	Beyaz karagöz	VU	[E]	Low	VR
Cyprinidae	*Carasobarbus luteus* (Heckel, 1843)	Mesopotamian Himri	Himri, Karagöz	LC	[N]	High	A
Cyprinidae	*Carassius gibelio* (Bloch, 1782)	Prussian carp	Gibel sazanı	NE	[I]	High	A
Cyprinidae	*Chondrostoma regium* (Heckel, 1843)	King nase	Zereke, kababurun	LC	[N]	High	A
Cyprinidae	*Cyprinion kais* Heckel, 1843	Smallmouth lotak	Küçükağızlı bunni	LC	[E]	Medium	A
Cyprinidae	*Cyprinion macrostomus* Heckel, 1843	Largemouth lotak.	Bunni balığı	LC	[N]	Medium	A
Cyprinidae	*Cyprinus carpio* Linnaeus, 1758	Carp	Sazan	LC	[I]	High	A
Cyprinidae	*Garra rufa* (Heckel, 1843)	Common garra	Vantuzlu balık,	LC	[N]	Low	A
Cyprinidae	*Garra variabilis* (Heckel, 1843)	Smallmout garra	Yağlıbalık	LC	[N]	Low	A
Cyprinidae	*Leuciscus vorax* (Heckel, 1843)	Tigris asp	Sis balığı	LC	[E]	High	R
Cyprinidae	*Luciobarbus esocinus* Heckel, 1843	Mangar, Tigris barbel	Cero, Caner	VU	[E]	High	R
Cyprinidae	*Luciobarbus mystaceus* (Pallas, 1814)	Euphrates barbel	Nakkor, Sırink	NE	[E]	High	LA
Cyprinidae	*Luciobarbus subquincunciatus* (Günther, 1868)	Leopard barbel	Leopar sazan	CR	[E]	High	VR
Cyprinidae	*Squalius berak* Heckel, 1843	Mesopotamian chub	Tatlısu kefali	LC	[N]	Medium	A
Cyprinidae	*Squalius lepidus* Heckel, 1843	White chub	Kuzu, Akbalık	LC	[N]	High	A

Table 1b: The natural, endemic, and exotic fish species in the main body of the river and the tributaries joining this area before impoundment of the Ilisu Dam; abundant (A), less abundant (LA), rare (R), and very rare (VR). CR: (critically endangered): extremely high risk of extinction species in the wild. VU: (vulnerable): species that possess a very high risk of extinction as a result of rapid population declines. LC: (least concern): species that are pervasive and abundant after careful assessment. DD: (data deficient): Species with insufficient information on them. NE: (not evaluated): Species that have not been evaluated until now to meet the above criteria. [E]: Endemic species for Tigris and Euphrates Basin. [N]: Natural species. [I]: Alien introduced species

Family	Species	English name	Turkish local name	IUCN criteria	Status	Commercial value	Abundance
Mugilidae	*Planiliza abu* (Heckel, 1843)	Abu mullet	Dicle kefali	LC	[N]	High	A
Mastacembelidae	*Mastacembelus mastacembelus* (Banks and Solander, 1794)	Mesopotamian spiny eel	Mezopotamya yılanbalığı	LC	[N]	High	A
Sisoridae	*Glyptothorax steindachneri* (Pietschmann, 1913)	Euphrates sucking catfish	Vantuzlu kedibalığı	NE	[E]	Low	VR
Sisoridae	*Glyptothorax kurdistanicus* (Berg, 1931)	Mezopotamian sucking catfish	Mezopotamya vantuzlu kedibalığı	DD	[E]	Low	LA
Nemacheilidae	*Oxynoemacheilus kurdistanicus* Kamangar, Prokofiev, Ghaderi and Nalbant, 2014	Tigris loach	Tigris Çöpçü balığı	LC	[E]	Low	A
Nemacheilidae	*Oxynoemacheilus frenatus* (Heckel, 1843)	Tigris loach	Tigris Çöpçü balığı	LC	[E]	Low	A
Nemacheilidae	*Turcinoemacheilus kosswigi* Bănărescu and Nalbant, 1964	Zagros loach	Zagros çöpçübalığı	LC	[E]	Low	R
Siluridae	*Silurus triostegus* (Heckel, 1843)	Mezopotamian catfish	Mezopotamya yayını	LC	[E]	High	A
Heteropneustidae	*Heteropneustes fossilis* (Bloch, 1794)	Asian stinging catfish	Zehirli kedibalığı	LC	[I]	Low	R
Bagridae	*Mystus pelusius* (Solander, 1794)	Tigris mystus	Tahtakafa balığı	LC	[E]	Low	LA
Poeciliidae	*Gambusia holbrooki* Girard, 1859	Eastern mosquitofish	Sivrisinek balığı	LC	[I]	Low	A
Salmonidae	*Oncorhynchus mykiss* (Walbaum, 1792)	Rainbow trout	Gökkuşağı alabalığı	NE	[I]	High	R

Glyptothorax steindachneri caught from Tigris River is a new record for this area in Turkey (Fig. 2g).

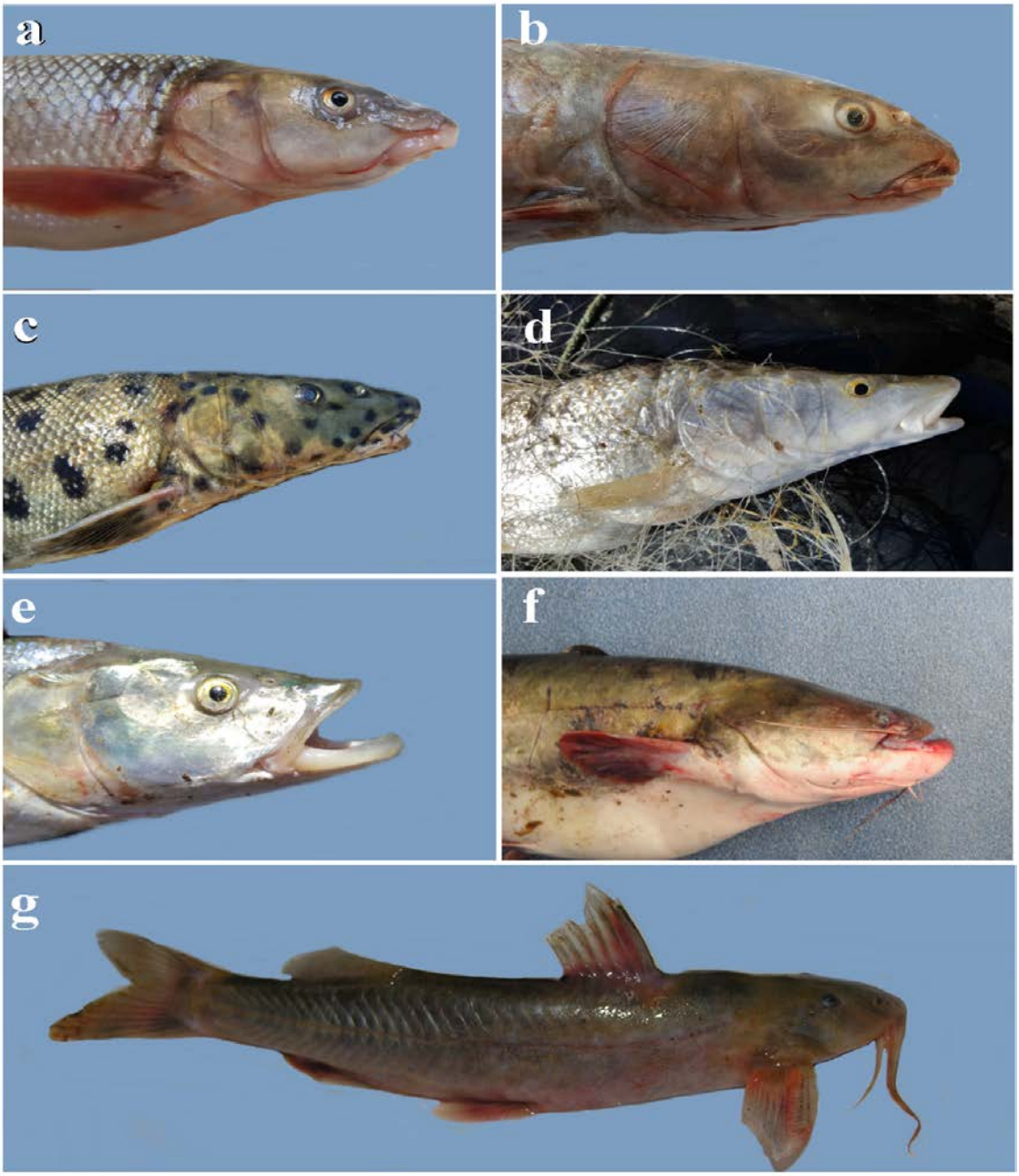

Figure 2: Some Cyprinid species collected in sampling sites. a, *Luciobarbus mystaceus* 502 mm; b, *Arabibarbus grypus* 545 mm; c, *Luciobarbus subquincunciatus*, 545 mm; d, *Luciobarbus esocinus*, 324 mm; e, *Leuciscus vorax* 532 mm; f, *Silurus triostegus* 650 mm; g, *Glyptothorax steindachneri* 18 mm.

22 species were found widely distributed. It is noted that the upper Tigris Basin exhibits rich fish fauna. In the studies conducted during 1970s, 28 species belonging to the eight family were reported (Kuru, 1975). In a recent study, this number was found to increase to 40 species belonging to 10 families (Kaya et al., 2016). The existence of 35 species presented in this study belonging to 10 families in the Ilisu Dam area is a testament to the importance of the fish biodiversity of this part of the river. In addition, the species *Leuciscus vorax*, *Luciobarbus esocinus*, *Luciobarbus subquincunciatus*, and *Carasobarbus kosswigi* are found only in this region of upper Tigris, whose populations have decreased considerably.

Distribution of fish species in the main course of the Tigris River and its tributaries before impoundment of Ilisu Dam according to sampling stations are given in table 2.

Table 2a: Distribution of fish species according to sampling stations in the Tigris River in relation to the Ilisu Dam.

Station No.	Locality	Species
1.	Çınar district Göksu Stream 37°41’21.76’’N 40°26’50.42’’, 668 m	*Alburnus sellal, Capoeta trutta, Capoeta umbla, Carassius gibelio, Garra variabilis, Squalius berak, Oxynoemacheilus kurdistanicus*, and *Gambusia holbrooki.*
2.	Ambar Stream, 37°56’40.91’’N 40°25’21.36’’E, 621 m	*Acanthobrama marmid, Alburnus caeruleus, Alburnus sellal, Capoeta trutta, Capoeta umbla, Carassius gibelio, Chondrostoma regium, Cyprinion kais, Garra variabilis, Squalius berak, Squalius lepidus, Planiliza abu, Mastacembelus mastacembelus, Oxynoemacheilus kurdistanicus, Oxynoemacheilus frenatus*, and *Gambusia holbrooki.*
3.	Kurmuşlu Stream before Bismil Tepe Town 37°46’35.52’’N 40°47'56.82”E, 566 m	*Acanthobrama marmid, Alburnus caeruleus, Alburnus sellal, Barbus lacerta, Capoeta umbla, Carasobarbus kosswigi, Carassius gibelio, Chondrostoma regium, Cyprinion kais, Garra rufa, Squalius berak, Oxynoemacheilus kurdistanicus, Oxynoemacheilus frenatus, Turcinoemacheilus kosswigi, Gambusia holbrooki*, and *Oncorhynchus mykiss*.
4.	Savur Stream after Tepe Village 37°47’25.75’’N 40°52’30.25’’E, 559 m	*Alburnus sellal, Barbus lacerta, Capoeta umbla, Carasobarbus kosswigi, Carassius gibelio, Chondrostoma regium, Cyprinion kais, Garra rufa, Squalius berak, Oxynoemacheilus kurdistanicus, Oxynoemacheilus frenatus, Turcinoemacheilus kosswigi*, and *Oncorhynchus mykiss.*
5.	Pamuk Stream 38°5’47.64’’N 40°35’38.99’’E, 717 m	*Acanthobrama marmid, Alburnus caeruleus, Alburnus sellal, Barbus lacerta, Barilius mesopotamicus, Capoeta trutta, Capoeta umbla, Carassius gibelio, Chondrostoma regium, Cyprinion macrostomus, Garra rufa, Luciobarbus mystaceus, Squalius berak, Squalius lepidus, Planiliza abu, Oxynoemacheilus kurdistanicus, Oxynoemacheilus frenatus*, and *Turcinoemacheilus kosswigi.*

Table 2b: Distribution of fish species according to sampling stations in the Tigris River in relation to the Ilisu Dam.

Station No.	Locality	Species
6.	Tigris River, before Bismil, 37°50'52.07''N 40°36'10.57'E, 546 m	*Acanthobrama marmid, Alburnus caeruleus, Barilius mesopotamicus, Capoeta trutta, Capoeta umbla, Carasobarbus luteus, Carassius gibelio, Chondrostoma regium, Cyprinion kais, Cyprinion macrostomus, Cyprinus carpio, Garra variabilis, Luciobarbus esocinus, Luciobarbus mystaceus, Squalius lepidus, Planiliza abu, Mastacembelus mastacembelus, Silurus triostegus, Heteropneustes fossilis*, and *Gambusia holbrooki.*
7.	Tigris River after Bismil Town (Ilisu Dam lake initial zone) 37°49'15.09''N 40°49'18.51''E, 530 m	*Acanthobrama marmid, Alburnus caeruleus, Barilius mesopotamicus, Capoeta trutta, Capoeta umbla, Carasobarbus luteus, Carassius gibelio, Chondrostoma regium, Cyprinion kais, Cyprinion macrostomus, Cyprinus carpio, Garra variabilis, Luciobarbus esocinus, Luciobarbus mystaceus, Squalius lepidus, Planiliza abu, Mastacembelus mastacembelus, Silurus triostegus, Mystus pelusius*, and *Gambusia holbrooki.*
8.	Salat Stream, 37°52'39.67''N 40°52'7.91''E, 540 m	*Acanthobrama marmid, Alburnus caeruleus, Capoeta umbla, Carassius gibelio, Chondrostoma regium, Cyprinion macrostomus, Garra rufa, Squalius berak, Planiliza abu, Mastacembelus mastacembelus, Oxynoemacheilus kurdistanicus*, and *Gambusia holbrooki.*
9.	Batman Stream, Batman 37°53'24.37''N 41°2'36.43''E, 530 m	*Alburnus sellal, Capoeta trutta, Capoeta umbla, Carasobarbus luteus, Carassius gibelio, Chondrostoma regium, Cyprinion kais, Cyprinion macrostomus, Cyprinus carpio, Garra variabilis, Luciobarbus mystaceus, Squalius lepidus, Glyptothorax kurdistanicus*, and *Oxynoemacheilus kurdistanicus.*
10.	Malabadi Bridge, 38°9'7.80''N 41°12'24.98''E, 604 m	*Acanthobrama marmid, Alburnus sellal, Arabibarbus grypus, Capoeta trutta, Capoeta umbla, Carasobarbus luteus, Carassius gibelio, Chondrostoma regium, Cyprinion macrostomus, Cyprinus carpio, Garra variabilis, Luciobarbus mystaceus, Squalius lepidus, Glyptothorax kurdistanicus*, and *Mystus pelusius.*
11.	Batman reservuar, 38°12'42.82''N 41°8'31.94''E, 657 m	*Acanthobrama marmid, Alburnus sellal, Arabibarbus grypus, Capoeta trutta, Capoeta umbla, Carasobarbus luteus, Carassius gibelio, Chondrostoma regium, Cyprinion macrostomus, Cyprinus carpio, Squalius lepidus, Planiliza abu*, and *Mystus pelusius.*
12.	Sason Stream, 38°16'38.41''N 41°11'5.31''E, 673 m	*Acanthobrama marmid, Alburnus caeruleus, Alburnus sellal, Barbus lacerta, Barilius mesopotamicus, Capoeta trutta, Capoeta umbla, Carasobarbus luteus, Carassius gibelio, Chondrostoma regium, Cyprinion kais, Garra rufa, Squalius berak, Glyptothorax kurdistanicus, Oxynoemacheilus kurdistanicus, Oxynoemacheilus frenatus.*
13.	Garzan River, Beşiri Town 37°53'56.31''N 41°22'4.57''E, 530 m	*Capoeta umbla, Carassius gibelio, Chondrostoma regium, Cyprinion macrostomus, Garra rufa, Squalius berak, Glyptothorax kurdistanicus*, and *Oxynoemacheilus kurdistanicus.*

Table 2c: Distribution of fish species according to sampling stations in the Tigris River in relation to the Ilisu Dam.

Station No.	Locality	Species
14.	Garzan Stream (Kozluk), 38°9'34.86''N, 41°30'47.70''E, 640 m	*Alburnus sellal, Capoeta trutta, Capoeta umbla, Carassius gibelio, Chondrostoma regium, Cyprinion macrostomus, Garra rufa, Luciobarbus mystaceus, Squalius berak, Planiliza abu,* and *Mastacembelus mastacembelus.*
15.	Başur Stream (Baykan), 37°57'50.60''N 41°47'22.59''E, 521 m	*Capoeta umbla, Carassius gibelio, Chondrostoma regium, Cyprinion macrostomus, Garra rufa, Squalius berak, Glyptothorax kurdistanicus,* and *Oxynoemacheilus kurdistanicus.*
16.	Kayser Stream, 37°56'50.15''N 41°51'14.92''E, 530 m	*Acanthobrama marmid, Alburnus sellal, Capoeta trutta, Capoeta umbla, Carasobarbus luteus, Carassius gibelio, Chondrostoma regium, Cyprinion macrostomus, Garra rufa, Squalius berak, Oxynoemacheilus kurdistanicus,* and *Oxynoemacheilus frenatus.*
17.	Tigris River, Suçeken Village, Hasankeyf, 37°44'15.04''N 41°17'17.00''E, 505 m	*Acanthobrama marmid, Alburnus sellal, Arabibarbus grypus, Capoeta trutta, Capoeta umbla, Carasobarbus kosswigi, Carasobarbus luteus, Carassius gibelio, Chondrostoma regium, Cyprinion macrostomus, Cyprinus carpio, Garra variabilis, Luciobarbus mystaceus, Squalius lepidus, Planiliza abu, Mastacembelus mastacembelus, Glyptothorax steindachneri, Glyptothorax kurdistanicus, Silurus triostegus, Heteropneustes fossilis,* and *Mystus pelusius.*
18.	Tigris River, after Hasankeyf, 37°43'54.63''N 41°30'20.52''E, 501 m	*Acanthobrama marmid, Alburnus sellal, Arabibarbus grypus, Capoeta trutta, Capoeta umbla, Carasobarbus kosswigi, Carasobarbus luteus, Carassius gibelio, Chondrostoma regium, Cyprinion macrostomus, Cyprinus carpio, Garra variabilis, Luciobarbus mystaceus, Squalius lepidus, Planiliza abu, Mastacembelus mastacembelus, Glyptothorax steindachneri, Glyptothorax kurdistanicus, Silurus triostegus, Heteropneustes fossilis,* and *Mystus pelusius.*
19.	Junction area of Tigris River and Garzan Stream, 37°43'58.19''N 41°37'6.51''E, 480 m	*Acanthobrama marmid, Alburnus sellal, Arabibarbus grypus, Capoeta trutta, Capoeta umbla, Carasobarbus kosswigi, Carasobarbus luteus, Carassius gibelio, Chondrostoma regium, Cyprinion macrostomus, Cyprinus carpio, Garra variabilis, Luciobarbus mystaceus, Squalius lepidus, Planiliza abu, Mastacembelus mastacembelus, Glyptothorax steindachneri, Glyptothorax kurdistanicus, Silurus triostegus, Heteropneustes fossilis,* and *Mystus pelusius.*
20.	Botan River, Siirt 37°53'22.78''N 41°56'40.16''E, 480 m	*Alburnus sellal, Arabibarbus grypus, Capoeta trutta, Capoeta umbla, Carasobarbus kosswigi, Carasobarbus luteus, Carassius gibelio, Chondrostoma regium, Cyprinion macrostomus, Leuciscus vorax, Luciobarbus esocinus, Luciobarbus mystaceus,* and *Squalius lepidus.*

Table 2d: Distribution of fish species according to sampling stations in the Tigris River in relation to the Ilisu Dam.

Station No.	Locality	Species
21.	Tigris River and Botan Stream confluence area 37°42'50.86''N 41°48'29.43'', 436 m	*Acanthobrama marmid, Alburnus sellal, Arabibarbus grypus, Capoeta trutta, Capoeta umbla, Carasobarbus kosswigi, Carasobarbus luteus, Carassius gibelio, Chondrostoma regium, Cyprinion macrostomus, Cyprinus carpio, Garra variabilis, Luciobarbus mystaceus, Squalius lepidus, Planiliza abu, Mastacembelus mastacembelus, Glyptothorax steindachneri, Glyptothorax kurdistanicus, Silurus triostegus, Heteropneustes fossilis,* and *Mystus pelusius.*
22.	Tigris River, before Ilisu Dam, Güçlükonak-Siirt road, 37°36'32.10''N 41°52'1.89''E, 436 m	*Acanthobrama marmid, Alburnus sellal, Arabibarbus grypus, Capoeta trutta, Capoeta umbla, Carasobarbus kosswigi, Carasobarbus luteus, Carassius gibelio, Chondrostoma regium, Cyprinion kais, Cyprinion macrostomus, Cyprinus carpio, Garra rufa, Leuciscus vorax, Luciobarbus esocinus, Luciobarbus mystaceus, Luciobarbus subquincunciatus, Squalius lepidus, Planiliza abu, Glyptothorax steindachneri, Glyptothorax kurdistanicus*, and *Mystus pelusius.*
23.	Tigris River, after diversion tunnels of Ilisu Dam 37°31'18.43''N 41°50'38.99''E, 420 m;	*Acanthobrama marmid, Alburnus sellal, Arabibarbus grypus, Capoeta trutta, Capoeta umbla, Carasobarbus kosswigi, Carasobarbus luteus, Carassius gibelio, Chondrostoma regium, Cyprinion kais, Cyprinion macrostomus, Cyprinus carpio, Garra rufa, Leuciscus vorax, Luciobarbus esocinus, Luciobarbus mystaceus, Luciobarbus subquincunciatus, Squalius lepidus, Planiliza abu, Glyptothorax steindachneri, Glyptothorax kurdistanicus*, and *Mystus pelusius.*

This study recorded 22 species as abundant and among them *Acanthobrama marmid*, *Alburnus sellal*, *Carassius gibelio*, *Cyprinion macrostomus*, and *Chondrostoma regium* were the most common species. This was followed by less abundant species *Capoeta umbla*, *Capoeta trutta*, *Chondrostoma regium, Barilius mesopotamicus*, *Luciobarbus mystaceus*, *Glyptothorax kurdistanicus*, and *Mystus pelusius*. Availability of *Arabibarbus grypus*, *Leuciscus vorax*, *Luciobarbus esocinus*, and *Turcinoemacheilus kosswigi* were found as rare while availability of *Carasobarbus kosswigi*, *Luciobarbus subquincunciatus*, and *Glyptothorax steindachneri* were found as very rare.

The most diverse family recorded in this study was the Cyprinidae with 23 confirmed species (65.7%) (Fig. 3). Five of the species (*Carassius gibelio, Cyprinus carpio, Heteropneustes fossilis, Oncorhynchus mykiss*, and *Gambusia holbrooki*) are exotic. Among these, *Carassius gibelio* and *Gambusia holbrooki* are also invasive species appeared throughout the river.

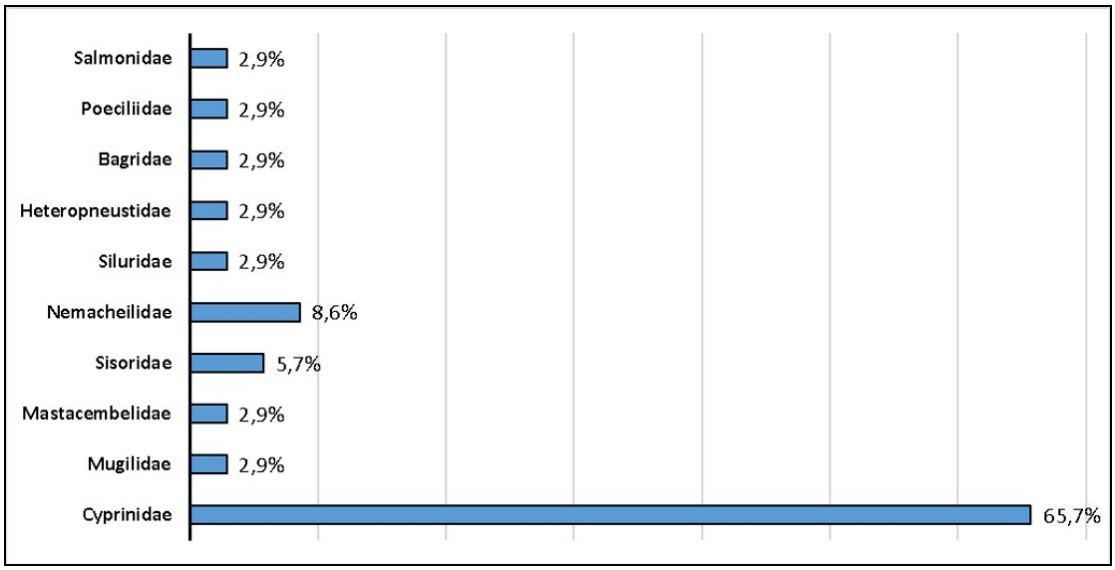

Figure 3: Percentage of species according to family in Ilisu area.

In the area of impact of the Ilisu Dam, at least 16 species were recorded, which are endemic to the Tigris and Euphrat basins (Fig. 4). Furthermore, three species were already recommended with some level of international protection on the IUCN Red List (2021). These species are *Carasobarbus kosswigi* (vulnerable), *Luciobarbus esocinus* (vulnerable), *Luciobarbus subquincunciatus* (critically endangered) (Fig. 5). *Cobitis kellei* and *Paraschistura chrysicristinae* species, whose type localities are reported as upper Tigris River, have not been observed in this tudy.

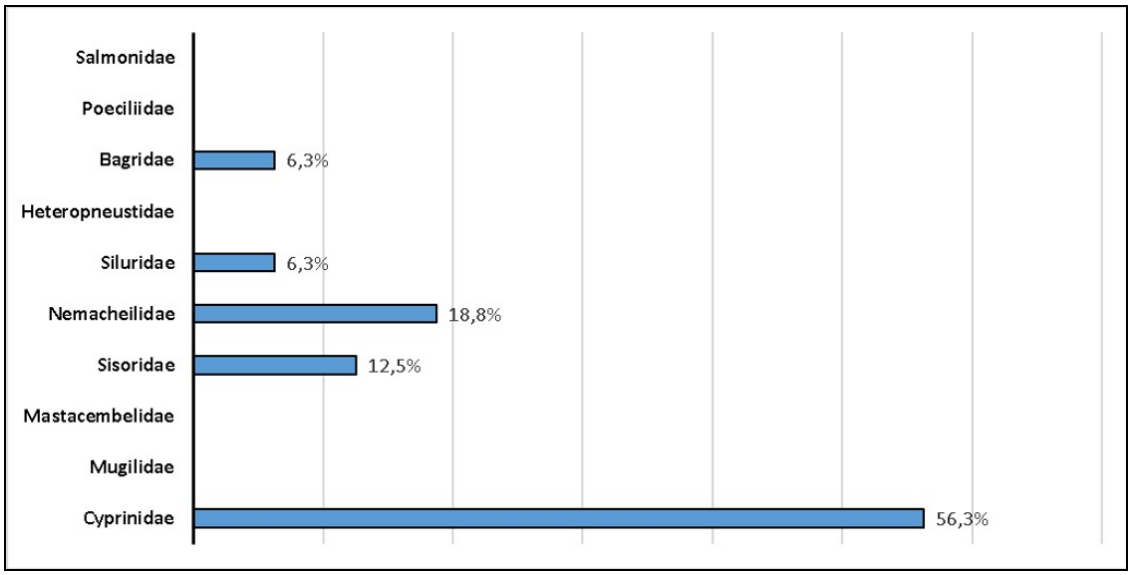

Figure 4: Percentage of endemics according to family in Ilisu area.

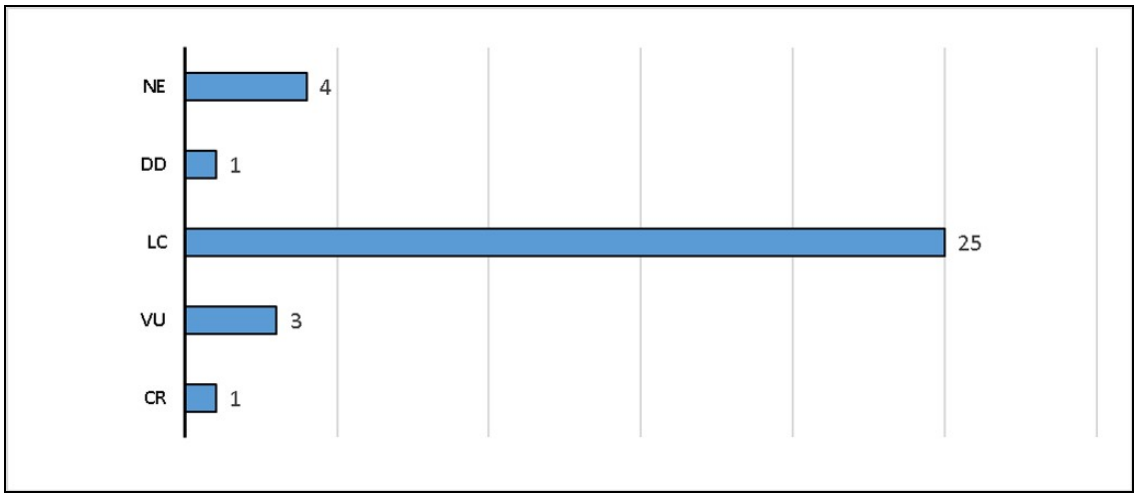

Figure 5: Distribution of species in Ilisu area according to IUCN criteria. CR (critically endangered, VU (vulnerable), LC (least concern), DD (data deficient), NE (not evaluated).

Leuciscus vorax (Heckel, 1843) was described from Tigris River (Mossul) and it was obtained only in the downstream part of the Ilisu Dam. Population of this species has decreased in Tigris River but is still assessed on level of LC of the IUCN Red List (2021). We recommend that it should be included in protected species list as VU.

Cobitis kellei reported from Goksu Stream by Erk'akan et al. (1998) and *Paraschistura chrysicristinae* from Batman Stream by Nalbant (1998) could not be obtained in the present study. Similar situation was also reported by Kaya et al. (2016).

Glyptothorax steindachneri is a little known species from Turkey, only recorded from Euphrates at Kemaliye (Freyhof et al., 2021). In the present study, this species is reported for the first time from the Turkish part of the Tigris River.

Although *Luciobarbus subquincunciatus* and *Luciobarbus esocinus* species was recorded in previous studies (Kuru, 1978; Kaya et al., 2016), it has been obtained very rarely and only in a very limited area of Ilisu Dam, due to overfishing and excessive pollution of the river and subsequent decrease of its population in recent years.

CONCLUSIONS

Large dams and water pollution caused by intensive agricultural activities in the region cause negative effects on aquatic creatures living in the rivers built for electricity and irrigation purposes. In order to minimize these effects and protect the aquatic ecosystem, it should be one of the main objectives to identify the fish fauna of the environment in advance and reveal the species that may be affected by this change. Thus, this study was carried out before the construction of the Ilisu Dam and fish species were determined. Many of the fish species in the Tigris River have adapted to living in the flowing waters of the river ecosystem, and it is recommended that at least the tributaries joining the rivers be streamlined.

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