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REVIEW

FISH BIODIVERSITY IN INLAND WATERS OF TURKEY

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ABSTRACT
Fish biodiversity in inland waters of Turkey has been prepared by reviewing of recent records. First review of systematic status for Turkey fish fauna dealt with between the years of 1856 and 2004, and about 236 fish species were listed in the inland water of Turkey (Kuru 2004). In this study; a total of 371 fish species belonging to 27 families and 92 genera was determined. More than half of the existing species were member of Cyprinidae family. Nemacheilidae, Gobiidae, Cobitidae and Salmonidae were also rich families by species. Following this review species number of fish fauna for Turkey has increased at a rate of 57% during the last decade. Fast increase of species number and possible reasons were discussed in terms of systematical approaches, zoogeography and uncertainties. On the other hand, species conservation status for each species has also been evaluated based on available information including some biological findings belonging to species.

Key words: Fish, biodiversity, inland water, Turkey

TÜRKİYE İÇSULARINDA BALIK BİYOLOJİK ÇEŞİTLİLİĞİ

ÖZET
Türkiye'nin balık çeşitliliğinin yeni kayıtlar gözden geçirilerek değerlendirilmesi amaçlanmıştır. Türkiye balıklarının ilk kapsamlı değerlendirmesi 1856 ile 2004 yılları arasını kapsamakta olup, iç sular için 236 tür rapor edilmiştir (Kuru 2004). Bu çalışma ile 27 familyaya ait 92 cins, 371 tür belirlenmiştir. Türlerin yarısından fazlasının Cyprinidae familyası üyesi olduğu tespit edilmiştir. Nemacheilidae, Gobiidae, Cobitidae ve Salmonidae familyaları da yüksek tür çeşitliliği ile dikkat çekmektedir. Bu çalışma ile son on yılda tür çeşitliliğinin %57 oranında arttığı gözlenmiştir. Bu artışın muhtemel sebepleri temel sistematik yaklaşımlar, zoocoğrafya ve belirsizlikler üzerinden tartışılmıştır. Balık tür çeşitliliği, belirlenen türlere ait koruma statüleri ile bunların bazı biyolojik özellikleri rapor edilmiştir.

Anahtar kelimeler: Balık, biyolojik çeşitlilik, içsular, Türkiye

INTRODUCTION
Turkey is in the Palearctic Region of Eurasia and positioned as a bridge between Europe and Asia. It is surrounded by the Black Sea from the south, Mediterranean Sea from the North and Aegean Sea from the west. It is divided into two main regions, Thrace and Anatolia, by the Marmara Sea and the straits (Dardanelles and Bosphorus). In addition to neighbouring different seas Turkey is rich in terms of inland water system diversity, and is divided to 26 basins, each showing different characteristic and having different flow regimes (Figure 1). Turkey has a rich biodiversity in terms of both flora and fauna with high level of endemism. This rich biodiversity also reflects to inland fish species diversity compared to many countries in European and the world. Number of fish species in inland waters of Turkey has increased at a ratio of 57% in the recent years between 2004 (Kuru

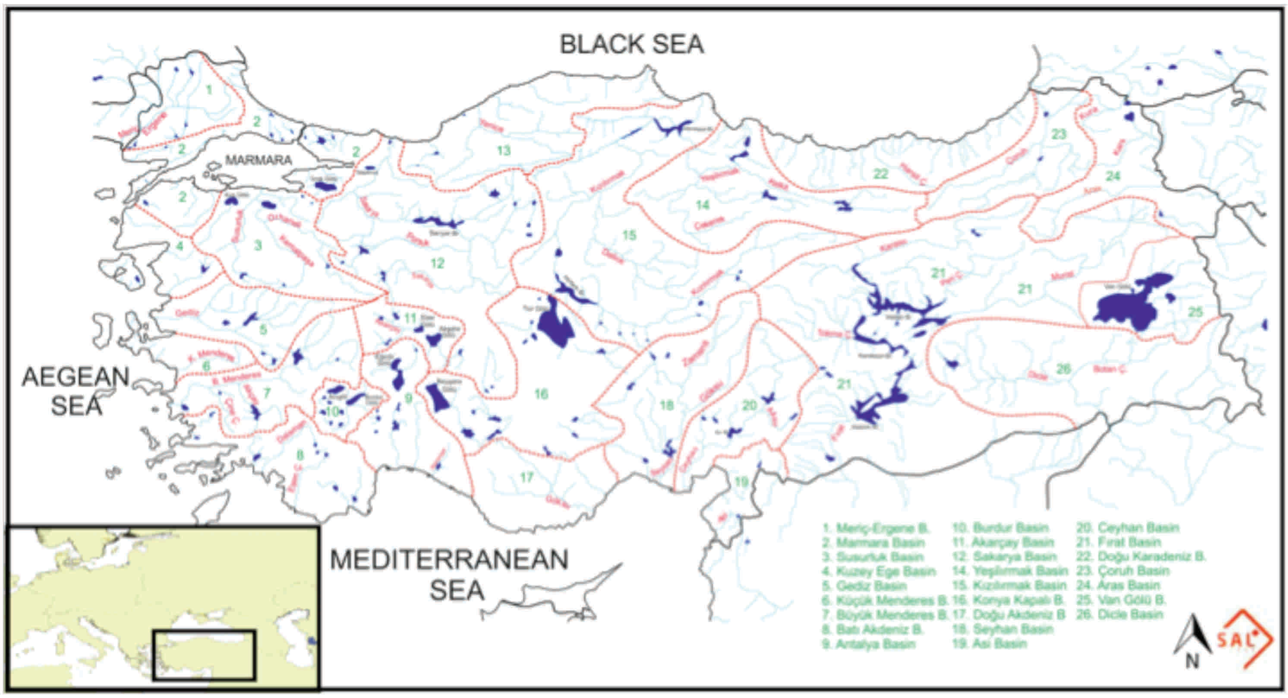

Figure 1. Water basins of Turkey

2004) and 2014 (this study). The reason of rich fish diversity of Turkey was summarised in this review with a species list of inland water fishes and their actual conservation status. Zoogeography of the region was summarised and the actual fish fauna revision was considered under the possible uncertainties and conflicts of basic species terms.

INLAND FISH DIVERSITY OF THE REGION

In order to understand the zoogeographic patterns in a particular region, it is necessary to know the geological history of that region. Therefore, indicating the regional changes in the area during geological periods with special emphasis on the Tethys Sea is necessary.

I. The Metamorphoses of Anatolia During Geological Periods

Until the end of the Permian period, approximately 250 million years ago (mya), the world's land mass was joined together into a single supercontinent called Pangea. Different spin velocities of Sial (crust) and Sima (magma) layers due to density and the paleo magnetism of the poles that supercontinent started to break apart and the earth eventually changed into its current state. This metamorphosis of the region is summarised in this section according to Kosswig (1954, 1955), Kuru (1971, 1975) and Demirsoy (2002). In the Mesozoic era (approx. 150 mya), Pangea was separated into two continents; Laurasia in the north and Gondwana in the south. Between these two continents, the Tethys Sea surrounded the Earth like a belt, from today's Mediterranean extending to India over Syria and Iraq in the east and Central America over Egypt in the west. The Tethys Sea is considered as an important factor in the formation of the Anatolian fauna, especially the inland water fish fauna. The fact that Anatolia lies to the north of the Tethys Sea, at the Laurasia continent, would be enough to explain why the Anatolian fauna has more fish with European and Asian origins than African origin. Gondwana also started to break apart later in the Mesozoic era and Australia, Preindia, Africa, Antarctica and South America were formed. Meanwhile, Laurasia in the north also started to break apart forming North America and Eurasia (Europe and Asia). The Alpine-Himalayan orogenic belt was formed as a result of northern movement of African plate and compressing the sediments at the bottom of the Tethys Sea, which kept its presence until the Oligocene period (approx. 35 mya). After these geological incidents, Northern Anatolian and Taurus (Toros) mountain ranges were formed and Tethys was split into two. From these; the one in the north is Paratethys, starting from the Rhone Valley in today's France, and extending east to Hungary, the Black Sea, Caspian Sea and Aral Sea. The part of Tethys, which was in the south, existed until the upper Oligocene (approx. 21 mya) and prevented the terrestrial fauna and flora to spread from north to south and from south to north by separating Eurasia from Africa and the Arabian peninsula. In contrast, a spread of aquatic fauna, especially the inland water fishes from east to west and from west to east was possible to a great extend. Furthermore, an inner lake surrounded by the Taurus Mountain Range from the south and Black Sea Mountain Range from north was formed when the sea was backed away from Anatolian plate as a result of an ascending due to formation of Alpine-Himalayan orogenic belt during the Oligocene (36-24 mya). In the Miocene (24-5 mya), pieces of land started to form at the north and west of Paratethys. The remaining part later became the Sarmatian Sea-Lake enclosing the Black Sea, the Caspian Sea and the Aral Sea. The Sarmatian Sea turned gradually into brackish water and later on into fresh water after the late Miocene. As a result, some fishes were adapted to the brackish and some to fresh waters of the Black Sea and the Caspian Sea (see Figure 2 for fish species originating from the Sarmatian Sea). Anatolian plate was connected to Europe via a land bridge over the Adriatic, Greece and Italy in the Miocene. The branches of the Egeopotamus River, which resided on this land, were covering the areas occupied by today's Vardar River and Belgrade forests, İstanbul. Fish were able to pass from Anatolia to Europe (and vice versa) via the Egeopotamus River, disemboguing to the region of Tethys Sea between today's islands Kos and Crete (see Figure 2 for fish species originating from Central and Western Europe). Connection of the Mediterranean Sea with Indian Ocean through İskenderun and lower Mesopotamia was cut off due to gradual decrease of it towards Miocene (5-1.7 mya). Volcanic activities between mid-Miocene (approx. 12 mya) and Quaternary (from 1.7 mya to today) caused the formation of Eastern Anatolian Mountains and uplift of Eastern Anatolian Region; thus cutting the connection between the Middle Anatolian inner lake and the rivers Murat and Karasu. These rivers started to flow towards Mesopotamia, merging with the Euphrates and Tigris Rivers,which is their current route (Figure 2). Meanwhile, the Van Lake System was formed in the place of a large freshwater lake which used to be in the Muş plains and its connection with the Murat and Karasu Rivers were cut off. Due to its previous connection with the Middle Anatolian inner lake, this new lake system hosts fish species originated from Europe and Western Asia rather than Mesopotamia. With the collapse of the Aegean Region, Tethys invaded this region towards north and the Aegean islands were formed by the end of the Pliocene (5-1.7 mya). Europe, which used to have a tropical climate until the end of the Pliocene cooled down gradually; thus making the climate temperate and causing the latest ice age which reigned between about 2.5 mya and approximately 10 000 years ago. Some of the fish species preferring cold water which were dispersed to the Mediterranean from the Atlantic during the ice age, escaped to the cold waters at the mountains in the surrounding area after the Mediterranean warm up following the ice age (see Figure 2 for fish species originating from the Mediterranean). Water level of the Paratethys increased due to a heavy precipitation in the Pleistocene (1.7-0.01 mya) and the Aegean Sea waters reached the Black Sea by filling valleys forming Çanakkale Strait and the Bosphorus reconnecting the Aegean Sea with the Black Sea. Furthermore, as a result of the geological events that took place in the Pleistocene, streams originating from Menderes and Uludağ which used to flow towards the south and the north, started to flow to the west. Some rivers such as Kızılırmak, Yeşilırmak, Kelkit and Çoruh emerged during the Pliocene and sustained their presence until today.

II. Anatolian Inland Water Fish Fauna

Under the light of the geological history of the region, seven different origins of Anatolian inland water fish fauna can be identified (Kosswig 1954, Kuru 1971, 1975, Balık 1974, Geldiay and Balık 1988);

1. Fish Species with Tethys Sea Origins

These fish species were dispersed to Anatolia from the sea during the period of the Tethys Sea and later distributed to the east up to the Hazar Lake (Elazığ) by means of central Anatolian freshwater or brackish lakes. Today they are represented by *Aphanius* genus. One of these species, *Aphanius asquamatus* lives in the Hazar Lake (Elazığ) (Akşıray 1948, Wildekamp et al. 1999).

2. Fish Species with the Mediterranean Sea Origins (Glacier Relicts)

Glacier relicts in the Anatolian freshwater fish fauna are *Salmo* species, *Syngnathus abaster*, *Gasterosteus aculeatus* and *Atherina (Hespetia) boyeri*. *Salmo* species originated from Scandinavia, Northern Europe, was dispersed to the Mediterranean when water temperature was decreased as a result of the climate change during the Pleistocene. Following the warming of the Mediterranean Sea with the end of glacial period *Salmo* species was dispersed to the rivers that flow into the Mediterranean and inhabited the cold rivers and springs at various countries at the Mediterranean coast (Figure 2). Another theory suggests that *Salmo labrax*, which currently inhabits the Eastern Black Sea entered this region via the Danube River and the Sarmatian Sea, which has partial freshwater characteristics. Today they are represented in Anatolia by 15 species (Table 1) with recently reported six species (*S. chilo, S. labecula, S. opimus* (Turan et al. 2012), *S. kottelati, S. okumusi, S. euphrataeus* (Turan et al. 2014)). *Sygnathus abaster, Gasterosteus aculeatus* and *Atherina (Hepsetia) boyeri* inhabited the Black Sea through Marmara Sea during the post glacier period and later widened their distribution to the Caspian Sea.

3. Fish Species with Central and Western Europe Origins

The earliest fish species arriving in Anatolia were species orginated from Central and Western Europe. Inland water fish species of Central and Western Europe were originated from Southeast Asia.They first inhabited Central and Western Europe through Siberian glacier lakes and northern coast of the Sarmatian Sea, which at that time had freshwater, and later they inhabited Anatolia. According to Kosswig (1954) the dispersal of the fishes from Europe into Anatolia took place directly from the north instead of over the Aegean region. Another theory suggests that some of the fishes originating from Central and Western Europe entered to Western Anatolia through the Egeopotamus River, which at the time was originated from Europe and disembogued into the Tethys Sea (Figure 2). These species commonly inhabit various water systems in Anatolia today. Example to these species are *Abramis brama, Alburnoides* species, *Leuciscus vorax, Blicca bjoerkna, Cyprinus carpio, Esox lucius, Carassius carassius, Gobio species, Perca fluviatilis, Rhodeus amarus, Rutilus frisii, Scardinius erytrophthalmus, Silurus glanis, Tinca tinca, Vimba vimba* and species of genus *Alburnus, Cobitis* and *Squalius* (Kuru et al. 2001, Kuru 2004). These species, regardless of originating from Egeopotamus or over today's Thrace, were distributed to the inner lake system in Central Anatolia and all the way to Eastern Anatolia until the Pleistocene. *Squalius cephalus* is classically described as an element of the Danubian ichthyofauna (Banarescu 1990). However, the assumption of a Danubian north-European origin for the chub is not consistent with the results obtained from mitochondrial DNA analysis. The middle and lower part of the Danube river have

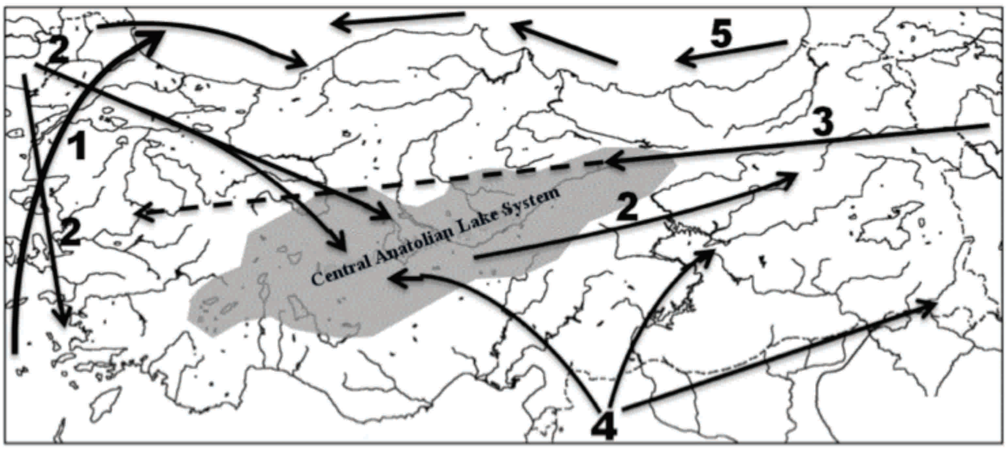

Figure 2. The entry paths of fish species from different origins to Anatolia during past geological periods: (1) Fish Species Originating from the Mediterranean, (2) Fish Species Originating from Central and Western Europe, (3) Fish Species Originating from Central and Western Asia, (4) Fish Species Originating from Mesopotamia, (5) Fish Species Originating from the Sarmatian Sea (Redrawn from Kuru (1975)).

played an important role in the evolutionary history of the chub, particularly during the Pleistocene glaciations since it was a refugium for the chub (Durand et al. 1999), but the origin of this species was probably located more eastward in Turkey, Tigris-Euphrates basin (Durand et al. 2000). Taking into account the fact that the Murat and Karasu rivers also had connections to the inner lake system of Central Anatolia in the past, dispersal of species such as *Alburnus mossulensis* and *Chondrostoma regium* originating from Central and Western Europe to the eastern regions into the Euphrates and Tigris Rivers can be easily comprehended. Van Lake, which formed as a result of volcanic activity in the place of a freshwater lake at the Muş plains, was also connected to the Central Anatolian inner lake system and therefore has been hosted by fish species with Europe and Asia origins instead of Mesopotamian origin (Kuru 1980, Elp et al. 2013). The distribution of *Alburnoides* species to Eastern Iran and the Aral Sea as well as the distribution of *Gobio* species to the Kura and Arax Rivers also took place through the Central Anatolian inner lake systems. Species which belong to genera such as *Abramis, Blicca, Carassius, Cyprinus, Rutilus, Scardinius* and *Rhodeus* are known as the Danube Elements and are common especially in Central Europe as well as in the west of Yeşilırmak. However they are non-existent in the east of that river. This is not a result of zoogeographical consequences but due to ecological conditions as western streams being slower (Kuru 1975).

4. Fish Species with Central and Western Asia Origins

The dispersal of these fish species which were originally distributed in Central and Western Asia, into Anatolia took place through the graben (rift valley) stretching southward towards Kahramanmaraş, through Iran to the Dead Sea (Lut Gölü) Jordan (Figure 2). According to Karaman (1969), *Capoeta* (Varicorhinus), which was dispersed to Anatolia via this way have been represented with various species in various river systems. Species list presented in this study lists with 19 *Capoeta* species further supports the situation. These species could not distribute to Europe because they reached in Western Anatolia through Central Anatolian inner lake system after the Aegean Sea came into existence; therefore their distribution is limited to the Aegean region. *Capoeta trutta* on the other hand, entered to the Euphrates and Tigris Rivers over Mesopotamia. *Barbus* genus, which is originated from Western Asia, is represented in Anatolia with 30 species (12 *Barbus*, 4 *Carasobarbus* and 14 *Luciobarbus*). Additionally, some *Barbus* species came to Anatolia from the north according to Kosswig (1954). *Glyptothorax* genus which lives in the fast streams of the high mountain ranges of Himalayas and Central Asia, probably entered to the Eastern Anatolia Region after the formation of Euphrates-Tigris river system along the shore of the Indian Ocean, which became partial freshwater during the ice ages. These fish are adapted only to the relatively fast flowing regions of the Euphrates-Tigris river system but not distributed to any other parts of Anatolia. The highest recorded altitude among the distribution range of these fish, which prefer the lower parts of the Euphrates-Tigris river systems, is reported as Baloluk Village (Ağrı), the Murat River and Serçeme Brook (Erzurum) of the Karasu River (Kuru 1975).

5. Fish Species with Mesopotamia Origins

They were distributed in Africa, Arabia, southern Iran and parts of India before dispersion to Anatolia. Before the Pliocene, Mesopotamia elements entered to the Euphrates-Tigris river system through a corridor connecting the Mediterranean to the Indian Ocean via Hatay, Syria, Iraq and southern Iran (Figure 2). These fish are *Acanthobrama marmid, Cyprinion macrostomum, Garra rufa, Arius cous, Clarias gariepinus* (African origin), *Carasobarbus luteus, Carasobarbus kosswigi, Barbus grypus, Barilius mesopotamicus* and *Mastacembelus mastacembelus* (Kuru 1975, Liao et al. 2011). However, with the descent of Mediterranean water levels during ice ages, a freshwater connection occurred between Hatay and newly developing the Seyhan and Ceyhan Rivers hence enabling a passage for some Mesopotamian elements, such as *Garra rufa*.

6. Fish Species with Sarmatian Sea Origins

Some of the species were dispersed to the Caspian and Sarmatian seas following glacier lakes from Western and Central Asia and all the species inhabiting the Sarmatian Sea were distributed to Anatolia via Black Sea (Figure 2). True relicts of the Sarmatian Sea are found near the coastal zone even today. With

Mediterranean waters flooding Marmara, Sarmatian forms which are euryhaline, were retracted to Manyas, Apolyont, İznik and Sapanca lakes and the mouths of streams disemboguing to the Black Sea. *Alosa (Caspialosa), Clupeonella* and *Gobius* species, *Proterorhinus marmoratus* and *Sander lucioperca* are some examples of such fish. Some of the species passing to the Caspian Sea, the remainder of the ancient Sarmatian Sea, by means of the Black Sea were dispersed to Anatolia after the Kura and Arax Rivers were formed. Therefore they are distributed only in the Kura and Arax river systems. Some examples of these species are *Alburnus filippii* and *Leucalburnus satunini*. In addition, *Ponticola constructor* (*Gobius cephalarges constructor*) is an important species, which arrived in the Kura River by means of the Caspian Sea, still lives at 3 000 m in the mountain streams (Damal, Hanak-Ardahan) along with trout (Kuru 1975).

7. Fish Species Entering Inland Waters from the Seas

They entered to Anatolia from the seas surrounding the peninsula from every direction. Among the most important fish entering to inland waters from the seas are *Anguilla anguilla* and Mugillidae family members. *Liza abu* originating from the Indian Ocean was reported in the springs of the Habur River (Ceylanpınar D.Ü.Ç-Urfa) for the first time in 1975 (Kuru 1975). This species is commonly found in the Euphrates and Tigris river systems nowadays. Dispersal to Anatolia all the way from the Indian Ocean, travelling thousands of kilometers shows how high the ecological tolerance of this fish species is.

III. Species List

Species list is mainly based on Kuru (2004), Tekeli et al. (2006), Fricke et al. (2007) and IUCN (2014). A list (Table 1) and its summary (Table 2) is given in this section. Valid names and authorities were checked with the Fishbase (Froese and Pauly 2014) and classification follows Catalog of Fishes (Eschmeyer 2014). Cytochrome oxidase I (COI) region sequences considered as a barcode area for animals (Hebert et al. 2003, Ward et al. 2005, Peng et al. 2009), were checked within GenBank (NCBI 2014). It is given in Table 1 to inform availability of the data rather than confirm reliability of the species. IUCN criteria of the species were checked with the IUCN website (IUCN 2014). All tables were rechecked before publication of this article. A detailed material method with abbrevations is given in Supplementary Section.

Table 1. Species list

				Genetic Data		IUCN		
Kuru (2004)	**Species**	**Author**	**COI**	**Country**	**Reference**	**Status**	**Criteria**	**Pop. Trend**
PETROMYZONTIFORMES - Petromyzontidae								
-	*Caspiomyzon wagneri*	(Kessler, 1870)	+	USA	April et al. (2011)	NT		unknown
Lampetra fluviatilis	*Lampetra fluviatilis*	(Linnaeus, 1758)	+	DEU	Geiger et al. (2014)	LC		unknown
Lampetra lanceolata	*Lampetra lanceolata*	Kux & Steiner, 1972	+	TUR	Geiger et al. (2014)	EN	B2ab(i,ii,iii,iv)	decreasing
ACIPENSERIFORMES - Acipenseridae								
Acipenser gueldenstaedtii	*Acipenser gueldenstaedtii*	Brandt & Ratzeburg, 1833	+	TUR	Keskin and Atar (2013)	CR	A2bcde	decreasing
Acipenser nudiventris	*Acipenser nudiventris*	Lovetsky, 1828	+	TUR	Keskin and Atar (2013)	CR	A2cde	decreasing
-	*Acipenser persicus*	Borodin, 1897	+	?	Ghadirnejad et al. (unp)	CR	A2cde	decreasing
Acipenser ruthenus	*Acipenser ruthenus*	Linnaeus, 1758	+	?	Kempter et al. (unp)	VU	A2cde	decreasing
Acipenser stellatus	*Acipenser stellatus*	Pallas, 1771	+	TUR	Keskin and Atar (2013)	CR	A2cde	decreasing
Acipenser sturio	*Acipenser sturio*	Linnaeus, 1758	+	FRA	Geiger et al. (2014)	CR	A2cde+B2ab(ii,iii,v)	decreasing
Huso huso	*Huso huso*	(Linnaeus, 1758)	+	?	Ghadirnejad et al. (unp)	CR	A2bcd	decreasing
ANGUILLIFORMES - Anguillidae								
Anguilla anguilla	*Anguilla anguilla*	(Linnaeus, 1758)	+	TUR	Keskin and Atar (2013)	CR	A2bd+4bd	decreasing
ATHERINIFORMES - Atherinidae								
Atherina (Hepsetia) boyeri	*Atherina boyeri*	Risso, 1810	+	ITA	Geiger et al. (2014)	LC		unknown
-	*Atherina pontica*	Eichwald, 1831	+	TUR	Geiger et al. (2014)	NE		

Table 1. (Continued)

CLUPEIFORMES - Clupeidae

Kuru (2004)	Species	Author	COI	Genetic Data: Country	Genetic Data: Reference	IUCN: Status	IUCN: Criteria	Pop. Trend
Alosa fallax nilotica	*Alosa agone*	(Scpoli, 1786)	+	ITA	Geiger et al. (2014)	LC		unknown
Alosa caspia	*Alosa caspia caspia*	(Eichwald, 1838)	-			LC		unknown
-	*Alosa fallax*	(Lacepède, 1803)	+	FRA	Geiger et al. (2014)	LC		stable
Alosa pontica	*Alosa immaculata*	Bennett, 1835	+	TUR	Geiger et al. (2014)	VU	B2ab(v)	decreasing
Alosa maeotica	*Alosa maeotica*	(Grimm, 1901)	-			LC		unknown
Alosa tanaica	*Alosa tanaica*	(Grimm, 1901)	-			LC		unknown
Clupeonella cultrivensis	*Clupeonella cultriventris*	(Nordmann, 1840)	+	TUR	Geiger et al. (2014)	LC		unknown
Clupeonella abrau muhlisi	*Clupeonella muhlisi*	Neu, 1934	-			VU	B1+2c	
Sardina pilchardus	*Sardina pilchardus*	(Walbaum, 1792)	+	TUR	Keskin and Atar (2013)	NE		
-	*Sardinella aurita*	Valenciennes, 1847	+	?	Jerome and Martinson (unp)	NE		
Sprattus sprattus	*Sprattus sprattus*	(Linnaeus, 1758)	+	TUR	Keskin and Atar (2013)	NE		

CYPRINIFORMES - Cobitidae

Kuru (2004)	Species	Author	COI	Genetic Data: Country	Genetic Data: Reference	Status	IUCN: Criteria	Pop. Trend
-	*Cobitis battalgili*	Bacescu, 1962	+	TUR	Geiger et al. (2014)	EN	B2ab(i,ii,iii,iv,v)	decreasing
Cobitis (Beysheria) bilseli	*Cobitis bilseli*	Battalgil, 1942	+	TUR	Geiger et al. (2014)	EN	B1ab(ii,iii)+2ab(ii,iii)	decreasing
Cobitis elazigensis	*Cobitis elazigensis*	Coad & Sarieyyüpoglu, 1988	-			LC		stable
-	*Cobitis evreni*	Erk'akan, Özeren & Nalbant, 2008	+	TUR	Geiger et al. (2014)	EN	B2ab(i,ii,iii,iv,v)	decreasing
Cobitis fahirae	*Cobitis fahirae*	Erk'akan, Atalay-Ekmekçi & Nalbant, 1998	+	TUR	Geiger et al. (2014)	LC		decreasing
Cobitis kellei	*Cobitis kellei*	Erk'akan, Atalay-Ekmekçi & Nalbant, 1998	-			CR	B1ab(i,ii,iii,iv)+2ab(i,ii,iii,iv)	unknown
Cobitis kurui	*Cobitis kurui*	Erk'akan, Atalay-Ekmekçi & Nalbant, 1998	-			LC		decreasing
Cobitis levantina	*Cobitis levantina*	Krupp & Moubayed, 1992	+	SYR	Geiger et al. (2014)	EN	B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v)	decreasing
Cobitis phrygica	*Cobitis phrygica*	Battalgazi, 1944	+	TUR	Geiger et al. (2014)	EN	B2ab(i,ii,iii,iv)	decreasing
-	*Cobitis pontica*	Vasil'eva & Vasil'ev, 2006	+	TUR	Geiger et al. (2014)	LC		unknown
Cobitis puncticulata	*Cobitis puncticulata*	Erk'akan, Atalay-Ekmekçi & Nalbant, 1998	+	TUR	Geiger et al. (2014)	EN	B2ab(iii)	unknown
-	*Cobitis satunini*	Gladkov, 1935	-			LC		decreasing
Cobitis simplicispina	*Cobitis simplicispina*	Hankó, 1925	-			LC		stable

Table 1. (Continued)

			Genetic Data			IUCN		
Kuru (2004)	**Species**	**Author**	**COI**	**Country**	**Reference**	**Status**	**Criteria**	**Pop. Trend**
Cobitis splendens	*Cobitis splendens*	Erk'akan, Atalay-Ekmekçi & Nalbant, 1998	+	TUR	Geiger et al. (2014)	CR	B1ab(iii,v)	decreasing
Cobitis strumicae	*Cobitis strumicae*	Karaman, 1955	+	GRC	Geiger et al. (2014)	LC		unknown
Cobitis turcica	*Cobitis turcica*	Hankó, 1925	+	TUR	Geiger et al. (2014)	EN	B2ab(i,ii,iii,iv,v)	decreasing
Cobitis vardarensis	*Cobitis vardarensis*	Karaman, 1928	+	GRC	Geiger et al. (2014)	LC		unknown
-	*Sabanejewia aurata*	(De Filippi, 1863)	-			LC		decreasing
-	*Sabanejewia balcanica*	(Karaman, 1922)	+	GRC	Geiger et al. (2014)	LC		unknown
-	*Sabanejewia caucasica*	(Berg, 1906)	-			LC		unknown

CYPRINIFORMES - Cyprinidae

			Genetic Data			IUCN		
Kuru (2004)	**Species**	**Author**	**COI**	**Country**	**Reference**	**Status**	**Criteria**	**Pop. Trend**
Abramis brama	*Abramis brama*	(Linnaeus, 1758)	+	TUR	Geiger et al. (2014)	LC	-	Unknown
Acanthobrama centisquama	*Acanthobrama centisquama*	Heckel, 1843	-			CR	B1ab(i,ii,iii,iv)	unknown
Acanthobrama marmid	*Acanthobrama marmid*	Heckel, 1843	-			LC		stable
Acanthalburnus microlepis	*Acanthobrama microlepis*	(De Filippi, 1863)	-			LC		unknown
-	*Acanthobrama orontis*	Berg, 1949	+	TUR	Geiger et al. (2014)	NE		
-	*Acanthobrama thisbeae*	(Freyhof & Özulug, 2004)	-			NE		
-	*Acanthobrama tricolor*	(Lortet, 1883)	-			EN	B1ab(i,ii,iii,iv)+2ab(i,ii,iii,iv)	unknown
Alburnoides bipunctatus eichwaldii	*Alburnoides eichwaldii*	(De Filippi, 1863)	-			LC		unknown
-	*Alburnoides emineae*	Turan, Kaya, Ekmekçi & Dogan, 2014	-			NE		
Alburnoides bipunctatus fasciatus	*Alburnoides fasciatus*	(Nordmann, 1840)	-			LC		decreasing
-	*Alburnoides manyasensis*	Turan, Ekmekçi, Kaya & Güçlü, 2013	-			LC		decreasing
-	*Alburnoides recepi*	Turan, Kaya, Ekmekçi & Dogan, 2014	-			NE		
-	*Alburnoides velioglui*	Turan, Kaya, Ekmekçi & Dogan, 2014	-			NE		
Alburnus sellal adanensis	*Alburnus adanensis*	Battalgazi, 1944	-			NE		
Alburnus akili	*Alburnus akili*	Battalgil, 1942	-			EX		
Alburnus alburnus alburnus	*Alburnus alburnus*	(Linnaeus, 1758)	+	TUR	Geiger et al. (2014)	LC		unknown
-	*Alburnus attalus*	Özulug & Freyhof, 2007	+	TUR	Geiger et al. (2014)	EN	B2ab(i,ii,iii,iv)	decreasing
Alburnus baliki	*Alburnus baliki*	Bogutskaya, Küçük & Ünlü, 2000	+	TUR	Geiger et al. (2014)	EN	B2ab(i,ii,iii,iv,v)	decreasing

Table 1. (Continued)

Kuru (2004)	Species	Author	COI	Genetic Data Country	Genetic Data Reference	IUCN Status	IUCN Criteria	IUCN Pop. Trend
-	*Alburnus battalgilae*	Özulug & Freyhof, 2007	+	TUR	Geiger et al. (2014)	VU	B2ab(i,ii,iii,iv,v)	decreasing
Alburnus caeruleus	*Alburnus caeruleus*	Heckel, 1843	-			LC		stable
-	*Alburnus carinatus*	Battalgil, 1941	+	TUR	Geiger et al. (2014)	EN	B2ab(i,ii,iii,iv,v)	decreasing
Alburnus chalcoides chalcoides/mento	*Alburnus chalcoides*	(Gueldenstädt, 1772)	-			LC		unknown
-	*Alburnus demiri*	Özulug & Freyhof, 2008	+	TUR	Geiger et al. (2014)	VU	B2ab(i,ii,iii,iv,v)	decreasing
-	*Alburnus derjugini*	Berg, 1923	-			LC		decreasing
Alburnus escherichii	*Alburnus escherichii*	Steindachner, 1897	+	TUR	Geiger et al. (2014)	LC		stable
Alburnus filippii	*Alburnus filippii*	Kessler, 1877	+	RUS	Perea et al. (2010)	LC		stable
Alburnus heckeli	*Alburnus heckeli*	Battalgil, 1943	-			LC		unknown
Alburnus alburnus hohenackeri	*Alburnus hohenackeri*	Kessler, 1877	+	TUR	Geiger et al. (2014)	LC		unknown
-	*Alburnus istanbulensis*	Battalgil, 1941	+	TUR	Geiger et al. (2014)	LC		stable
Alburnus mossulensis	*Alburnus mossulensis*	Heckel, 1843	+	TUR	Geiger et al. (2014)	NE		
Alburnus nasreddini	*Alburnus nasreddini*	Battalgil, 1943	+	TUR	Geiger et al. (2014)	CR	B1ab(i,ii,iii,iv,v)	decreasing
-	*Alburnus nicaeensis*	Battalgil, 1941	-			EX		
Alburnus orontis	*Alburnus orontis*	Sauvage, 1882	+	TUR	Geiger et al. (2014)	VU	B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v)	decreasing
-	*Alburnus schischkovi*	(Drensky, 1943)	-			EN	B1ab(ii,iii,v)+2ab(ii,iii,v)	unknown
Alburnus sellal sellal	*Alburnus sellal*	Heckel, 1843	-			LC		stable
Alburnus tarichi	*Alburnus tarichi*	(Gueldenstädt, 1814)	+	TUR	Keskin and Atar (2013)	NT		decreasing
Alburnus tımarensis	*Alburnus timarensis*	Kuru, 1980	-			CR	B1ab(i,ii,iii,iv)	decreasing
-	*Barbus barbus*	(Linnaeus, 1758)	+	ITA	Geiger et al. (2014)	LC		unknown
-	*Barbus bergi*	Chichkoff, 1935	-			LC		unknown
-	*Barbus cyclolepis*	Heckel, 1837	+	TUR	Geiger et al. (2014)	LC		stable
Barbus plebejus ercisianus	*Barbus ercisianus*	Karaman, 1971	-			DD		unknown
Tor grypus	*Barbus grypus*	Heckel, 1843	-			VU	A2d+3d	decreasing
Barbus plebejus lacerta	*Barbus lacerta*	Heckel, 1843	-			LC		decreasing
-	*Barbus lorteti*	Sauvage, 1882	+	TUR	Geiger et al. (2014)	DD		unknown
-	*Barbus niluferensis*	Turan, Kottelat & Ekmekçi, 2009	+	TUR	Geiger et al. (2014)	NT		decreasing
-	*Barbus oligolepis*	Battalgil, 1941	+	TUR	Geiger et al. (2014)	LC		decreasing
Barbus plebejus pergamonensis	*Barbus pergamonensis*	Karaman, 1971	+	TUR	Geiger et al. (2014)	LC		decreasing
-	*Barbus plebejus*	Bonaparte, 1839	+	ITA	Geiger et al. (2014)	LC		stable
-	*Barbus tauricus*	Kessler, 1877	-			VU	B1ab(i,ii,iii,v)	unknown

Table 1. (Continued)

				Genetic Data		IUCN		
Kuru (2004)	**Species**	**Author**	**COI**	**Country**	**Reference**	**Status**	**Criteria**	**Pop. Trend**
Barilius mesopotamicus	*Barilius mesopotamicus*	Berg, 1932	-			LC		decreasing
Blicca bjoerkna bjoerkna/transcaucasica	*Blicca bjoerkna*	(Linnaeus, 1758)	+	FRA	Geiger et al. (2014)	LC		unknown
Capoeta capoeta angorae	*Capoeta angorae*	(Hankó, 1925)	+	TUR	Geiger et al. (2014)	NE		
Capoeta antalyensis	*Capoeta antalyensis*	(Battalgil, 1943)	+	TUR	Geiger et al. (2014)	VU	B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v)	decreasing
-	*Capoeta baliki*	Turan, Kottelat, Ekmekçi & İmamoğlu, 2006	-			LC		decreasing
-	*Capoeta banarescui*	Turan, Kottelat, Ekmekçi & İmamoğlu, 2006	-			LC		decreasing
Capoeta barroisi	*Capoeta barroisi*	Lortet, 1894	+	TUR	Geiger et al. (2014)	EN	B2ab(i,ii,iii,iv)	decreasing
Capoeta capoeta bergamae	*Capoeta bergamae*	Karaman, 1969	+	TUR	Geiger et al. (2014)	NT		decreasing
-	*Capoeta caelestis*	Schöter, Özulug & Freyhof, 2009	+	TUR	Geiger et al. (2014)	LC		decreasing
Capoeta capoeta capoeta	*Capoeta capoeta*	(Gueldenstädt, 1773)	+	TUR	Keskin and Atar (2013)	LC		stable
-	*Capoeta damascina*	(Valenciennes, 1842)	+	TUR	Geiger et al. (2014)	LC		decreasing
-	*Capoeta ekmekciae*	Turan, Kottelat, Kirankaya & Engin, 2006	-			NT		decreasing
-	*Capoeta erhani*	Turan, Kottelat & Ekmekçi, 2008	+	TUR	Geiger et al. (2014)	LC		stable
Capoeta capoeta kosswigi	*Capoeta kosswigi*	Karaman, 1969	-			DD		unknown
-	*Capoeta mauricii*	Küçük, Turan, Sahin & Gülle, 2009	+	TUR	Geiger et al. (2014)	EN	B2ab(i,ii,iii,iv,v)	decreasing
-	*Capoeta pestai*	(Pietschmann, 1933)	+	TUR	Geiger et al. (2014)	CR	B1ab(i,ii,iii,iv,v)	decreasing
Capoeta capoeta sieboldi	*Capoeta sieboldi*	(Steindachner, 1864)	-			LC		decreasing
Capoeta tinca	*Capoeta tinca*	(Heckel, 1843)	+	TUR	Geiger et al. (2014)	LC		decreasing
Capoeta trutta	*Capoeta trutta*	(Heckel, 1843)	-			LC		stable
-	*Capoeta turani*	Özulug & Freyhof, 2008	+	TUR	Geiger et al. (2014)	NT		stable
Capoeta capoeta umbla	*Capoeta umbla*	(Heckel, 1843)	-			LC		stable
-	*Carasobarbus canis*	(Valenciennes, 1842)	+	SYR	Geiger et al. (2014)	NT		decreasing
-	*Carasobarbus chantrei*	(Sauvage, 1882)	+	TUR	Geiger et al. (2014)	NT		decreasing
Kosswigobarbus kosswigi	*Carasobarbus kosswigi*	(Ladiges, 1960)	-			VU	A2ce; B2ab(i,ii,iii,iv,v)	decreasing
Carasobarbus luteus	*Carasobarbus luteus*	(Heckel, 1843)	-			LC		stable
-	*Carasobarbus sublimus*	(Coad & Najafpour, 1997)	-			NE		
-	*Carassius auratus*	(Linnaeus, 1758)	+	TUR	Keskin et al. (2013)	LC		unknown
Carassius carassius	*Carassius carassius*	(Linnaeus, 1758)	-			LC		decreasing
Carassius gibelio	*Carassius gibelio*	(Bloch, 1782)	+	TUR	Keskin et al. (2013)	introduced		
Chondrostoma nasus angorense	*Chondrostoma angorense*	Elvira, 1987	+	TUR	Perea et al. (2010)	LC		decreasing
Chondrostoma beysehirense	*Chondrostoma beysehirense*	Bogutskaya, 1997	+	TUR	Geiger et al. (2014)	EN	B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v)	decreasing

Table 1. (Continued)

			Genetic Data			IUCN		
Kuru (2004)	**Species**	**Author**	**COI**	**Country**	**Reference**	**Status**	**Criteria**	**Pop. Trend**
Chondrostoma colchicum	*Chondrostoma colchicum*	Derjugin, 1899	-			LC		decreasing
Chondrostoma oxyrhynchum cyri	*Chondrostoma cyri*	Kessler, 1877	-			LC		decreasing
Pseudophoxinus fahirae	*Chondrostoma fahirae*	(Ladiges, 1960)	+	TUR	Geiger et al. (2014)	EN	B2ab(i,ii,iii,iv,v)	decreasing
Chondrostoma holmwoodii holmwoodii	*Chondrostoma holmwoodii*	(Boulenger, 1896)	+	TUR	Geiger et al. (2014)	VU	A2c; B2ab(i,ii,iii,iv,v)	decreasing
Chondrostoma kinzelbachi	*Chondrostoma kinzelbachi*	Krupp, 1985	+	TUR	Geiger et al. (2014)	EN	B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v)	decreasing
Chondrostoma holmwoodii meandrense	*Chondrostoma meandrense*	Elvira, 1987	+	TUR	Geiger et al. (2014)	VU	B1ab(ii,iii)+2ab(ii,iii)	decreasing
Chondrostoma regium	*Chondrostoma regium*	(Heckel, 1843)	-			LC		decreasing
Chondrostoma vardarense	*Chondrostoma vardarense*	Karaman, 1928	+	GRC	Geiger et al. (2014)	NT		decreasing
-	*Crossocheilus caudomaculatus*	Battalgil, 1942	-			NE		unknown
Ctenopharyngodon idellus	*Ctenopharyngodon idella*	(Valenciennes, 1844)	+	DEU	Geiger et al. (2014)	introduced		
Cyprinion kais	*Cyprinion kais*	Heckel, 1843	-			LC		decreasing
Cyprinion macrostomus	*Cyprinion macrostomum*	Heckel, 1843	-			LC		decreasing
Cyprinion tenuiradius	*Cyprinion tenuiradius*	Heckel, 1847	-			NE		
Cyprinus carpio	*Cyprinus carpio*	Linnaeus, 1758	+	GRC, ITA	Geiger et al. (2014)	VU	A2ce	unknown
Garra rufa obtusa	*Garra rufa*	(Heckel, 1843)	+	SYR	Geiger et al. (2014)	LC		decreasing
Garra variabilis	*Garra variabilis*	(Heckel, 1843)	+	SYR	Geiger et al. (2014)	LC		decreasing
-	*Gobio battalgilae*	Naseka, Erk'akan & Küçük, 2006	+	TUR	Geiger et al. (2014)	DD		unknown
-	*Gobio bulgaricus*	Drensky, 1926	+	GRC	Triantafyllidis et al. (2011)	LC		unknown
-	*Gobio caucasicus*	Kamensky, 1901	-			LC		decreasing
Gobio gobio gymnostethus	*Gobio gymnostethus*	Ladiges, 1960	+	TUR	Geiger et al. (2014)	CR	B1ab(i,ii,iii)	decreasing
Gobio hettitorum	*Gobio hettitorum*	Ladiges, 1960	+	TUR	Geiger et al. (2014)	CR	B1ab(i,ii,iii,iv)	decreasing
Gobio gobio insuyanus	*Gobio insuyanus*	Ladiges, 1960	+	TUR	Geiger et al. (2014)	CR	B1ab(ii,iii)	decreasing
Gobio gobio intermedius	*Gobio intermedius*	Battalgil, 1944	+	TUR	Geiger et al. (2014)	EN	B1ab(i,ii,iii,iv)+2ab(i,ii,iii,iv)	decreasing
-	*Gobio maeandricus*	Naseka, Erk'akan & Küçük, 2006	+	TUR	Geiger et al. (2014)	EN	B1ab(i,ii,iii,iv)+2ab(i,ii,iii,iv)	decreasing
Gobio gobio microlepidotus	*Gobio microlepidotus*	Battalgil, 1942	+	TUR	Geiger et al. (2014)	VU	B1ab(i,ii,iii,iv)+2ab(i,ii,iii,iv)	decreasing
-	*Gobio sakaryaensis*	Turan, Ekmekçi, Luskova & Mendel, 2012	-			LC		decreasing
-	*Hemigrammocapoeta culiciphaga*	Pellegrin, 1927	-			LC		decreasing
Hemigrammocapoeta kemali	*Hemigrammocapoeta kemali*	(Hankó, 1925)	-			EN	B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v)	decreasing
Hemigrammocapoeta sauvagei	*Hemigrammocapoeta nana*	(Heckel, 1843)	-			NT		
-	*Hypophthalmichthys nobilis*	(Richardson, 1845)	+	BRA	Pereira et al. (2013)	introduced		
Ladigesocypris ghigii mermere	*Ladigesocypris mermere*	(Ladiges, 1960)	+	TUR	Geiger et al. (2014)	DD		unknown

Table 1. (Continued)

			Genetic Data			IUCN		
Kuru (2004)	**Species**	**Author**	**COI**	**Country**	**Reference**	**Status**	**Criteria**	**Pop. Trend**
Leucalburnus satunini	*Leucalburnus satunini*	(Berg, 1910)	-			LC		unknown
Leucaspius delineatus	*Leucaspius delineatus*	(Heckel, 1843)	+	TUR	Geiger et al. (2014)	LC		unknown
Aspius aspius aspius/taeniatus	*Leuciscus aspius*	(Linnaeus, 1758)	+	GRC	Geiger et al. (2014)	NE	-	-
-	*Leuciscus idus*	(Linnaeus, 1758)	+	FRA	Geiger et al. (2014)	LC		unknown
Aspius vorax	*Leuciscus vorax*	(Heckel, 1843)	+	SYR	Geiger et al. (2014)	LC		unknown
-	*Luciobarbus brachycephalus*	(Kessler, 1872)	-			VU	A2cd	decreasing
Barbus capito capito	*Luciobarbus capito*	(Güldenstädt, 1773)	+	?	Dong et al. (2013)	VU	A2cd	decreasing
-	*Luciobarbus caspius*	(Berg, 1914)	-			NE		
Barbus plebejus escherichi	*Luciobarbus escherichii*	(Steindachner, 1897)	-			LC		decreasing
Barbus esocinus	*Luciobarbus esocinus*	Heckel, 1843	-			VU	A2de	decreasing
-	*Luciobarbus kersin*	(Heckel, 1843)	-			DD		unknown
Barbus plebejus kosswigi	*Luciobarbus kosswigi*	(Karaman, 1971)	-			NE		
-	*Luciobarbus kottelati*	Turan, Ekmekçi, Ilhan & Engin, 2008	+	TUR	Geiger et al. (2014)	VU	B1ab(i,ii,iii,iv)+2ab(i,ii,iii,iv)	decreasing
-	*Luciobarbus lydianus*	(Boulenger, 1896)	+	TUR	Geiger et al. (2014)	LC		decreasing
Barbus mursa	*Luciobarbus mursa*	(Gueldenstädt, 1773)	-			LC		decreasing
Barbus rajanorum mystaceus	*Luciobarbus mystaceus*	(Pallas, 1814)	-			NE		
Barbus capito pectoralis	*Luciobarbus pectoralis*	(Heckel, 1843)	+	TUR	Geiger et al. (2014)	LC		stable
Barbus subquincuncinatus	*Luciobarbus subquincunciatus*	(Günther, 1868)	-			CR	A2cde	decreasing
Barbus xanthopterus	*Luciobarbus xanthopterus*	Heckel, 1843	-			VU	A2cde	decreasing
Leuciscus borystenicus	*Petroleuciscus borysthenicus*	(Kessler, 1859)	+	TUR	Pereira et al. (2013)	LC		unknown
Leuciscus kurui	*Petroleuciscus kurui*	(Bogutskaya, 1995)	-			DD		unknown
Leuciscus smyrnaeus	*Petroleuciscus smyrnaeus*	(Boulenger, 1896)	+	TUR	Geiger et al. (2014)	LC		decreasing
-	*Phoxinus colchicus*	Berg, 1910	-			LC		unknown
Phoxinus phoxinus	*Phoxinus phoxinus*	(Linnaeus, 1758)	+	DEU	Knebelsberger et al. (2014)	LC		unknown
-	*Phoxinus strandjae*	Drensky, 1926	+	TUR	Geiger et al. (2014)	EN	B1ab(ii,iii)	unknown
-	*Pseudophoxinus alii*	Küçük, 2007	+	TUR	Geiger et al. (2014)	EN	B2ab(i,ii,iii,iv)	decreasing
Pseudophoxinus anatolicus	*Pseudophoxinus anatolicus*	(Hankó, 1925)	+	TUR	Geiger et al. (2014)	EN	B2ab(i,ii,iii,iv,v)	decreasing
Pseudophoxinus antalyae	*Pseudophoxinus antalyae*	Bogutskaya, 1992	+	TUR	Geiger et al. (2014)	VU	D2	decreasing
Pseudophoxinus battalgilae	*Pseudophoxinus battalgilae*	Bogutskaya, 1997	+	TUR	Geiger et al. (2014)	LC		decreasing
-	*Pseudophoxinus burduricus*	Küçük, Gülle, Güçlü, Çiftçi & Erdogan, 2013	+	TUR	Geiger et al. (2014)	EN	B1ab(i,ii,iii)	decreasing
Pseudophoxinus crassus	*Pseudophoxinus crassus*	(Ladiges, 1960)	+	TUR	Geiger et al. (2014)	EN	B2ab(i,ii,iii,iv)	decreasing

Table 1. (Continued)

Kuru (2004)	Species	Author	COI	Genetic Data Country	Genetic Data Reference	IUCN Status	IUCN Criteria	IUCN Pop. Trend
Pseudophoxinus egridiri	*Pseudophoxinus egridiri*	(Karaman, 1972)	+	TUR	Geiger et al. (2014)	EN	B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v)	decreasing
-	*Pseudophoxinus elizavetae*	Boğutskaya, Küçük & Atalay, 2006	+	TUR	Geiger et al. (2014)	CR	B1ab(i,ii,iii,v)+2ab(i,ii,iii,v)	decreasing
-	*Pseudophoxinus evliyae*	Freyhof & Özulug, 2010	+	TUR	Geiger et al. (2014)	EN	B2ab(i,ii,iii,iv)	decreasing
-	*Pseudophoxinus fahrettini*	Freyhof & Özulug, 2010	+	TUR	Geiger et al. (2014)	EN	B2ab(ii,iii)	decreasing
-	*Pseudophoxinus firati*	Boğutskaya, Küçük & Atalay, 2006	-			EN	B2ab(v)	decreasing
Pseudophoxinus handlirschi	*Pseudophoxinus handlirschi*	(Pietschmann, 1933)	-			EX		
-	*Pseudophoxinus hittitorum*	Freyhof & Özulug, 2010	+	TUR	Geiger et al. (2014)	EN	B2ab(i,ii,iii,iv)	decreasing
Pseudophoxinus kervillei	*Pseudophoxinus kervillei*	(Pellegrin, 1911)	+	SYR, LBN	Geiger et al. (2014)	EN	B2ab(i,ii,iii)	unknown
Pseudophoxinus maeandricus	*Pseudophoxinus maeandricus*	(Ladiges, 1960)	+	TUR	Geiger et al. (2014)	CR	B1ab(i,ii,iii,iv,v)	decreasing
Pseudophoxinus meandri	*Pseudophoxinus meandri*	(Ladiges, 1960)	+	TUR	Geiger et al. (2014)	EN	B2ab(ii,iii)	decreasing
-	*Pseudophoxinus ninae*	Freyhof & Özulug, 2006	+	TUR	Geiger et al. (2014)	CR	B1ab(ii,iii)	decreasing
-	*Pseudophoxinus zekayi*	Bogutskaya, Küçük & Atalay, 2006	+	TUR	Geiger et al. (2014)	VU	B2ab(ii,iii)	decreasing
-	*Pseudophoxinus zeregi*	(Heckel, 1843)	+	TUR	Geiger et al. (2014)	LC		decreasing
Pseudorasbora parva	*Pseudorasbora parva*	(Temminck & Schlegel, 1846)	+	GRC, ITA	Geiger et al. (2014)	LC		unknown
Rhodeus sericeus amarus	*Rhodeus amarus*	(Bloch, 1782)	+	TUR	Geiger et al. (2014)	LC		unknown
-	*Rhodeus sericeus*	(Pallas, 1776)	+	USA	April et al. (2011)	LR/lc		
-	*Romanogobio macropterus*	(Kamensky, 1901)	-			LC		decreasing
Gobio persa	*Romanogobio persus*	(Günther, 1899)	-			NE		
Rutilus frisii caspicus	*Rutilus caspicus*	(Yakovlev, 1870)	-			LC		unknown
Rutilus frisii frisii	*Rutilus frisii*	(Nordmann, 1840)	+	BGR	Geiger et al. (2014)	LC		unknown
-	*Rutilus heckelii*	(Nordmann, 1840)	+	GRC	Geiger et al. (2014)	LC		unknown
Rutilus rutilus	*Rutilus rutilus*	(Linnaeus, 1758)	+	TUR	Geiger et al. (2014)	LC		unknown
Scardinius erytrophthalmus elmaliensis	*Scardinius elmaliensis*	Bogutskaya, 1997	+	TUR	Geiger et al. (2014)	EN	B1ab(i,ii,iii,iv)+2ab(i,ii,iii,iv)	decreasing
-	*Scardinius erythrophthalmus*	(Linnaeus, 1758)	+	TUR	Geiger et al. (2014)	LC		unknown
Scardinius erytrophthalmus scardafa	*Scardinius scardafa*	(Bonaparte, 1837)	+	ITA	Geiger et al. (2014)	CR	A3e	unknown
Schizothorax prophylax	*Schizothorax prophylax*	Pietschmann, 1933	-			NE		
-	*Squalius adanaensis*	Turan, Kottelat & Dogan, 2013	+	TUR	Geiger et al. (2014)	NT		unknown
Leuciscus lepidus anatolicus	*Squalius anatolicus*	(Bogutskaya, 1997)	+	TUR	Geiger et al. (2014)	LC		decreasing
-	*Squalius aristotelis*	Özulug & Freyhof, 2011	+	TUR	Geiger et al. (2014)	LC		decreasing
-	*Squalius berak*	Heckel, 1843	-			LC		decreasing
-	*Squalius cappadocicus*	Özulug & Freyhof, 2011	+	TUR	Geiger et al. (2014)	CR	B1ab(i,ii,iii)	decreasing

Table 1. (Continued)

Kuru (2004)	Species	Author	COI	Genetic Data Country	Genetic Data Reference	IUCN Status	IUCN Criteria	IUCN Pop. Trend
-	*Squalius carinus*	Özulug & Freyhof, 2011	+	TUR	Geiger et al. (2014)	EN	B1ab(i,ii,iii,iv)+2ab(i,ii,iii,iv)	decreasing
-	*Squalius cephaloides*	(Battalgil, 1942)	+	TUR	Geiger et al. (2014)	VU	D2	unknown
Leuciscus cephalus	*Squalius cephalus*	(Linnaeus, 1758)	+	FRA	Geiger et al. (2014)	LC		unknown
-	*Squalius cii*	(Richardson, 1857)	+	TUR	Geiger et al. (2014)	LC		decreasing
-	*Squalius fellowesii*	(Günther, 1868)	+	TUR	Geiger et al. (2014)	LC		decreasing
Ladigesocypris ghigii ghigii	*Squalius ghigii*	(Gianferrari, 1927)	+	GRC	Geiger et al. (2014)	NE		
-	*Squalius irideus*	(Ladiges, 1960)	+	TUR	Geiger et al. (2014)	NT		decreasing
-	*Squalius kosswigi*	(Karaman, 1972)	+	TUR	Geiger et al. (2014)	EN	B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v)	decreasing
-	*Squalius kottelati*	Turan, Yilmaz & Kaya, 2009	+	TUR	Geiger et al. (2014)	NT		decreasing
Leuciscus lepidus lepidus	*Squalius lepidus*	Heckel, 1843	-			LC		stable
-	*Squalius orpheus*	Kottelat & Economidis, 2006	+	BGR, GRC	Geiger et al. (2014)	LC		unknown
-	*Squalius pursakensis*	(Hankó, 1925)	-			LC		decreasing
-	*Squalius recurvirostris*	Özulug & Freyhof, 2011	+	TUR	Geiger et al. (2014)	VU	B1ab(i,ii,iii,iv)+2ab(i,ii,iii,iv)	decreasing
-	*Squalius seyhanensis*	Turan, Kottelat & Dogan, 2013	+	TUR	Geiger et al. (2014)	DD		unknown
Leuciscus spurius	*Squalius spurius*	Heckel, 1843	-			DD		unknown
-	*Squalius turcicus*	De Filippi, 1865	-			LC		stable
Tinca tinca	*Tinca tinca*	(Linnaeus, 1758)	+	ITA	Geiger et al. (2014)	LC		unknown
Vimba melanops	*Vimba melanops*	(Heckel, 1837)	+	GRC	Geiger et al. (2014)	DD		unknown
Acanthobrama mirabilis	*Vimba mirabilis*	(Ladiges, 1960)	+	TUR	Geiger et al. (2014)	LC		decreasing
Vimba vimba tenella	*Vimba vimba*	(Linnaeus, 1758)	+	TUR	Geiger et al. (2014)	LC		unknown

CYPRINIFORMES - Nemacheilidae

Kuru (2004)	Species	Author	COI	Genetic Data Country	Genetic Data Reference	IUCN Status	IUCN Criteria	IUCN Pop. Trend
-	*Barbatula bergamensis*	Erk'akan, Nalbant & Özeren, 2007	-			NE		
-	*Oxynoemacheilus anatolicus*	Erk'akan, Özeren & Nalbant, 2008	+	TUR	Geiger et al. (2014)	EN	B2ab(i,ii,iii)	decreasing
Orthrias angorae angorae	*Oxynoemacheilus angorae*	(Steindachner, 1897)	+	TUR	Geiger et al. (2014)	LC		decreasing
Orthrias angorae araxensis	*Oxynoemacheilus araxensis*	(Banarescu & Nalbant, 1978)	-			DD		unknown
Noemacheilus argyrogramma	*Oxynoemacheilus argyrogramma*	(Heckel, 1847)	-			LC		decreasing
-	*Oxynoemacheilus atili*	Erk'akan, 2012	+	TUR	Geiger et al. (2014)	NT		decreasing

Table 1. (Continued)

			Genetic Data			IUCN		
Kuru (2004)	Species	Author	COI	Country	Reference	Status	Criteria	Pop. Trend
-	*Oxynoemacheilus banarescui*	(Delmastro, 1982)	-			NT		decreasing
-	*Oxynoemacheilus bergianus*	(Derjavin, 1934)	-			LC		decreasing
Orthrias brandti brandti	*Oxynoemacheilus brandtii*	(Kessler, 1877)	-			LC		decreasing
Orthrias brandti bureschi	*Oxynoemacheilus bureschi*	(Drensky, 1928)	+	GRC, MKD	Geiger et al. (2014)	LC		unknown
-	*Oxynoemacheilus ceyhanensis*	(Erk'Akan, Nalbant & Özeren, 2007)	+	TUR	Geiger et al. (2014)	DD		unknown
-	*Oxynoemacheilus cinicus*	(Erk'Akan, Nalbant & Özeren, 2007)	+	TUR	Geiger et al. (2014)	DD		unknown
-	*Oxynoemacheilus cyri*	(Berg, 1910)	-			LC		unknown
-	*Oxynoemacheilus ercisianus*	(Erk'akan & Kuru, 1986)	-			EN	B2ab(ii,iii)	decreasing
-	*Oxynoemacheilus erdali*	(Erk'Akan, Nalbant & Özeren, 2007)	-			NE		
Orthrias angorae eregliensis	*Oxynoemacheilus eregliensis*	(Banarescu & Nalbant, 1978)	+	TUR	Geiger et al. (2014)	VU	A2c+3c; B2ab(i,ii,iii,iv,v)	decreasing
-	*Oxynoemacheilus evreni*	(Erk'Akan, Nalbant & Özeren, 2007)	+	TUR	Geiger et al. (2014)	LC		unknown
Noemacheilus frenatus	*Oxynoemacheilus frenatus*	(Heckel, 1843)	-			LC		stable
-	*Oxynoemacheilus germencicus*	(Erk'Akan, Nalbant & Özeren, 2007)	+	TUR	Geiger et al. (2014)	VU	A2ce	decreasing
-	*Oxynoemacheilus hamwii*	(Krupp & Schneider, 1991)	+	TUR	Geiger et al. (2014)	EN	B2ab(i,ii,iii,iv,v)	decreasing
-	*Oxynoemacheilus insignis*	(Heckel, 1843)	+	LBN	Geiger et al. (2014)	NT		decreasing
-	*Oxynoemacheilus kaynaki*	Erk'akan, Özeren & Nalbant, 2008	-			LC		unknown
-	*Oxynoemacheilus kosswigi*	(Erk'akan & Kuru, 1986)	-			LC		decreasing
-	*Oxynoemacheilus mediterraneus*	(Erk'Akan, Nalbant & Özeren, 2007)	+	TUR	Geiger et al. (2014)	LC		decreasing
-	*Oxynoemacheilus mesudae*	Erk'akan, 2012	+	TUR	Geiger et al. (2014)	EN	B2ab(i,ii,iii,iv)	unknown
-	*Oxynoemacheilus namiri*	(Krupp & Schneider, 1991)	+	TUR	Geiger et al. (2014)	LC		decreasing
Orthrias panthera	*Oxynoemacheilus panthera*	(Heckel, 1843)	+	SYR	Geiger et al. (2014)	EN	B1ab(i,ii,iii,iv,v)+2ab(ii,iii,iv,v)	decreasing
-	*Oxynoemacheilus paucilepis*	(Erk'Akan, Nalbant & Özeren, 2007)	-			EN	B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v)	decreasing
-	*Oxynoemacheilus phoxinoides*	(Erk'Akan, Nalbant & Özeren, 2007)	+	TUR	Geiger et al. (2014)	CR	B1ab(ii,iii)+2ab(ii,iii)	decreasing
Orthrias brandti samantica	*Oxynoemacheilus samanticus*	(Banarescu & Nalbant, 1978)	+	TUR	Geiger et al. (2014)	LC		decreasing
-	*Oxynoemacheilus seyhanensis*	(Banarescu, 1968)	+	TUR	Geiger et al. (2014)	CR	B1ab(ii,iii)	decreasing
-	*Oxynoemacheilus seyhanicola*	(Erk'Akan, Nalbant & Özeren, 2007)	+	TUR	Geiger et al. (2014)	EN	B1ab(i,ii,iii,iv)+2ab(i,ii,iii,iv)	decreasing
Orthrias brandti simavica	*Oxynoemacheilus simavicus*	(Balik & Banarescu, 1978)	+	TUR	Geiger et al. (2014)	CR	B1ab(ii,iii,v)+2ab(ii,iii,v)	decreasing
-	*Oxynoemacheilus theophilii*	Stoumboudi, Kottelat & Barbieri, 2006	+	TUR	Geiger et al. (2014)	LC		unknown
-	*Oxynoemacheilus tigris*	(Heckel, 1843)	-			CR	B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v)	decreasing
Noemacheilus tigris	*Oxynoemacheilus tigris*	(Heckel, 1843)	-			CR	B1ab(ii,iii)	decreasing
Noemacheilus malapterusus	*Paracobitis malapterura*	(Valenciennes, 1846)	-			NE		

Table 1. (Continued)

				Genetic Data		IUCN		
Kuru (2004)	**Species**	**Author**	**COI**	**Country**	**Reference**	**Status**	**Criteria**	**Pop. Trend**
-	*Seminemacheilus ispartensis*	Erk'Akan, Nalbant & Özeren, 2007	+	TUR	Geiger et al. (2014)	VU	B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v)	decreasing
Noemacheilus lendlii	*Seminemacheilus lendlii*	(Hankó 1925)	-			VU	A2c	decreasing
Turcinoemacheilus kosswigi	*Turcinoemacheilus kosswigi*	Banarescu & Nalbant, 1964	-			LC		decreasing

CYPRINODONTIFORMES - Cyprinodontidae

				Genetic Data		IUCN		
Kuru (2004)	**Species**	**Author**	**COI**	**Country**	**Reference**	**Status**	**Criteria**	**Pop. Trend**
Aphanius anatoliae anatoliae	*Aphanius anatoliae*	(Leidenfrost, 1912)	+	TUR	Geiger et al. (2014)	NT		decreasing
Aphanius asquamatus	*Aphanius asquamatus*	(Sözer, 1942)	-			LC		unknown
-	*Aphanius chantrei*	(Gaillard, 1895)	-			LC	needs update	
Aphanius danfordii	*Aphanius danfordii*	(Boulenger, 1890)	+	TUR	Geiger et al. (2014)	CR	B1ab(i,ii,iii,v)+2ab(i,ii,iii,v)	decreasing
Aphanius fasciatus	*Aphanius fasciatus*	(Valenciennes, 1821)	+	ITA	Geiger et al. (2014)	LC		stable
Aphanius mento	*Aphanius mento*	(Heckel, 1843)	(+)			LC		decreasing
Aphanius anatoliae splendens	*Aphanius splendens*	(Kosswig & Sözer, 1945)	(+)			EX		
Aphanius anatoliae sureyanus	*Aphanius sureyanus*	(Neu, 1937)	+	TUR	Geiger et al. (2014)	EN	B1ab(ii,iii,v)+2ab(ii,iii,v)	decreasing
Aphanius anatoliae transgrediens	*Aphanius transgrediens*	(Ermin, 1946)	+	TUR	Geiger et al. (2014)	CR	B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v)	decreasing
-	*Aphanius villwocki*	Hrbek & Wildekamp, 2003	+	TUR	Geiger et al. (2014)	LC		

CYPRINODONTIFORMES - Poeciliidae

				Genetic Data		IUCN		
Kuru (2004)	**Species**	**Author**	**COI**	**Country**	**Reference**	**Status**	**Criteria**	**Pop. Trend**
Gambusia affinis	*Gambusia affinis*	(Baird & Girard, 1853)	+	USA	April et al. (2011)	introduced		
Gambusia holbrooki	*Gambusia holbrooki*	Girard, 1859	+	USA	April et al. (2011)	introduced		

ESOCIFORMES - Esocidae

				Genetic Data		IUCN		
Kuru (2004)	**Species**	**Author**	**COI**	**Country**	**Reference**	**Status**	**Criteria**	**Pop. Trend**
Esox lucius	*Esox lucius*	Linnaeus, 1758	+	FRA,ITA, GRC	Geiger et al. (2014)	LC		stable

Table 1. (Continued)

GASTEROSTEIFORMES - Gasterosteidae

Kuru (2004)	Species	Author	COI	Genetic Data Country	Reference	IUCN Status	Criteria	Pop. Trend
Gasterosteus aculeatus	*Gasterosteus aculeatus*	Linnaeus, 1758	+	EU	Knebelsberger et al. (2014)	LC		stable
-	*Gasterosteus gymnurus*	Cuvier, 1829	-			LC		unknown
Pungitius platygaster	*Pungitius platygaster*	(Kessler, 1859)	+	UKR	Geiger et al. (2014)	LC		unknown

PERCIFORMES - Blenniidae

Kuru (2004)	Species	Author	COI	Genetic Data Country	Reference	IUCN Status	Criteria	Pop. Trend
Salaria fluviatilis	*Salaria fluviatilis*	(Asso, 1801)	+	FRA, ITA, GRC	Geiger et al. (2014)	LC		stable
Salaria pavo	*Salaria pavo*	(Risso, 1810)	-			LC		stable

PERCIFORMES - Centrarchidae

Kuru (2004)	Species	Author	COI	Genetic Data Country	Reference	IUCN Status	Criteria	Pop. Trend
Lepomis gibbosus	*Lepomis gibbosus*	(Linnaeus, 1758)	+	FRA, ITA, GRC	Geiger et al. (2014)	introduced		

PERCIFORMES - Cichlidae

Kuru (2004)	Species	Author	COI	Genetic Data Country	Reference	IUCN Status	Criteria	Pop. Trend
-	*Oreochromis niloticus*	(Linnaeus, 1758)	+	ITA	Geiger et al. (2014)	introduced		
-	*Oreochromis aureus*	(Steindachner, 1864)	+	MAR	Geiger et al. (2014)	introduced		
Tristamella simonis simonis	*Tristramella simonis*	(Günther, 1864)	+	SYR	Geiger et al. (2014)	VU	B1ab(i,ii,iii,iv)+2ab(i,ii,iii,iv)	decreasing
Tilapia zillii	*Tilapia zillii*	(Gervais, 1848)	+	SYR, DZA	Geiger et al. (2014)	introduced		

Table 1. (Continued)

PERCIFORMES - Gobiidae

			Genetic Data			IUCN		
Kuru (2004)	**Species**	**Author**	**COI**	**Country**	**Reference**	**Status**	**Criteria**	**Pop. Trend**
Gobius gymnotrachelus	*Babka gymnotrachelus*	(Kessler, 1857)	-			LC		unknown
Gobius niger	*Gobius niger*	Linnaeus, 1758	+	TUR	Keskin and Atar (2013)	NE		
-	*Knipowitschia byblisia*	Ahnelt, 2011	+	TUR	Geiger et al. (2014)	LC		stable
Knipowitschia caucasica	*Knipowitschia caucasica*	(Berg, 1916)	+	TUR	Geiger et al. (2014)	LC		unknown
-	*Knipowitschia caunosi*	Ahnelt, 2011	-			LC		unknown
-	*Knipowitschia ephesi*	Ahnelt, 1995	+	TUR	Geiger et al. (2014)	CR	B1ab(iii,v)	decreasing
Pomatoschistus longecaudatus	*Knipowitschia longecaudata*	(Kessler, 1877)	-			LC		unknown
Knipowitschia mermere	*Knipowitschia mermere*	Ahnelt, 1995	+	TUR	Geiger et al. (2014)	VU	B2ab(i,ii,iii,iv,v)	decreasing
Gobius batrachocephalus	*Mesogobius batrachocephalus*	(Pallas, 1814)	-			LC		unknown
-	*Neogobius fluviatilis*	(Pallas, 1814)	+	TUR	Geiger et al. (2014)	LC		unknown
Gobius melanostomus	*Neogobius melanostomus*	(Pallas, 1814)	+	TUR	Geiger et al. (2014)	LC		unknown
Pomatoschistus microps leopardinus	*Pomatoschistus marmoratus*	(Risso, 1810)	+	ITA	Geiger et al. (2014)	LC		stable
-	*Pomatoschistus minutus*	(Pallas, 1770)	+	?	Knebelsberger and Thiel (2014)	LC		stable
-	*Ponticola cephalargoides*	(Pinchuk 1976)	-			LC		unknown
Gobius cephalarges constructor	*Ponticola constructor*	(Nordmann, 1840)	-			LC		unknown
-	*Ponticola cyrius*	(Kessler, 1874)	-			LC		stable
Ponticola kessleri	*Ponticola kessleri*	(Günther, 1861)	+	TUR	Keskin and Atar (2013)	LC		unknown
-	*Ponticola platyrostris*	(Pallas, 1814)	-			LC		unknown
Ponticola ratan	*Ponticola ratan*	(Nordmann, 1840)	-			NE		
-	*Ponticola rizensis*	(Kovacic & Engín, 2008)	-			EN	B1ab(ii,iii)+2ab(ii,iii)	decreasing
Ponticola syrman	*Ponticola syrman*	(Nordmann, 1840)	-			LC		unknown
-	*Ponticola turani*	(Kovacic & Engín, 2008)	-			VU	B1ab(i,ii,iii,iv)+2ab(i,ii,iii,iv)	decreasing
Proterorhinus marmoratus	*Proterorhinus marmoratus*	(Pallas, 1814)	+	?	Hubert et al. (2008)	LC		unknown
-	*Proterorhinus nasalis*	(De Filippi, 1863)	-			LC		unknown
-	*Proterorhinus semilunaris*	(Heckel, 1837)	+	GRC	Geiger et al. (2014)	LC		unknown
Zosterisessor ophiocephalus	*Zosterisessor ophiocephalus*	(Pallas, 1814)	-			LC		stable

Table 1. (Continued)

PERCIFORMES - Moronidae

			Genetic Data			IUCN		
Kuru (2004)	**Species**	**Author**	**COI**	**Country**	**Reference**	**Status**	**Criteria**	**Pop. Trend**
Dicentrarchus labrax	*Dicentrarchus labrax*	(Linnaeus, 1758	+	TUR	Keskin and Atar (2013)	LC		unknown

PERCIFORMES - Mugilidae

			Genetic Data			IUCN		
Kuru (2004)	**Species**	**Author**	**COI**	**Country**	**Reference**	**Status**	**Criteria**	**Pop. Trend**
Chelon labrossus	*Chelon labrossus*	(Risso, 1827)	-			LC		unknown
Liza abu	*Liza abu*	(Heckel, 1843)	+	TUR	Geiger et al. (2014)	LC		stable
Liza aurata	*Liza aurata*	(Risso, 1810)	+	TUR	Geiger et al. (2014)	LC		unknown
Liza carinata	*Liza carinata*	(Valenciennes, 1836)	+	TUR	Keskin and Atar (2013)	NE		
Mugil soiuy	*Liza haematocheila*	(Temminck & Schlegel, 1845)	+	?	Durand et al. (2012)	introduced		
Liza ramada	*Liza ramada*	(Risso, 1827)	+	TUR	Geiger et al. (2014)	LC		unknown
Liza saliens	*Liza saliens*	(Risso, 1810)	+	TUR	Geiger et al. (2014)	LC		unknown
Mugil cephalus	*Mugil cephalus*	Linnaeus, 1758	+	TUR	Geiger et al. (2014)	LC		stable
Oedalechilus labeo	*Oedalechilus labeo*	(Cuvier, 1829)	+	?	Durand et al. (2012)	NE		

PERCIFORMES - Percidae

			Genetic Data			IUCN		
Kuru (2004)	**Species**	**Author**	**COI**	**Country**	**Reference**	**Status**	**Criteria**	**Pop. Trend**
Gymnocephalus cernua	*Gymnocephalus cernua*	(Linnaeus, 1758)	+	FRA	Geiger et al. (2014)	LC		unknown
Perca fluviatilis	*Perca fluviatilis*	Linnaeus, 1758	+	GRC, ITA, FRA	Geiger et al. (2014)	LC		unknown
Sander lucioperca	*Sander lucioperca*	(Linnaeus, 1758)	+	TUR	Keskin and Atar (2013)	LC		unknown

PLEURONECTIFORMES - Pleuronectidae

			Genetic Data			IUCN		
Kuru (2004)	**Species**	**Author**	**COI**	**Country**	**Reference**	**Status**	**Criteria**	**Pop. Trend**
Platichthys fleus	*Platichthys fleus*	(Linnaeus, 1758)	+	TUR	Keskin and Atar (2013)	LC		decreasing

Table 1. (Continued)

SALMONIFORMES - Salmonidae

					Genetic Data	IUCN		
Kuru (2004)	**Species**	**Author**	**COI**	**Country**	**Reference**	**Status**	**Criteria**	**Pop. Trend**
Coregonus lavaretus	*Coregonus lavaretus*	(Linnaeus, 1758)	+	?	Miya and Nishida (2000)	introduced		
Oncorhynchus mykiss	*Oncorhynchus mykiss*	(Walbaum, 1792)	+	TUR	Keskin (unp)	introduced		
Salmo trutta abanticus	*Salmo abanticus*	Tortonese, 1954	-			NE		
Salmo trutta caspius	*Salmo caspius*	Kessler, 1877	-			NE		
-	*Salmo chilo*	Turan, Kottelat & Engin 2012	+	TUR	Geiger et al. (2014)	NE		
-	*Salmo coruhensis*	Turan, Kottelat & Engin, 2010	-			NE		
-	*Salmo euphrataeus*	Turan, Kottelat & Engin 2014	-			NE		
-	*Salmo kottelati*	Turan, Doğan, Kaya, & Kanyılmaz, 2014	-			NE		
-	*Salmo labecula*	Turan, Kottelat, Engin 2012	+	TUR	Geiger et al. (2014)	NE		
Salmo trutta labrax	*Salmo labrax*	Pallas, 1814	-			LC		unknown
Salmo trutta macrostigma	*Salmo macrostigma*	(Duméril, 1858)	-			DD		
-	*Salmo okumusi*	Turan, Kottelat & Engin 2014	-			NE		
-	*Salmo opimus*	Turan, Kottelat & Engin 2012	+	TUR	Geiger et al. (2014)	NE		
Salmo platycephalus	*Salmo platycephalus*	Behnke, 1968	+	TUR	Geiger et al. (2014)	CR	B1ab(v)+2ab(v)	unknown
-	*Salmo rizeensis*	Turan, Kottelat & Engin, 2010	-			NE		
Salmo salar	*Salmo salar*	Linnaeus, 1758	+	TUR	Keskin (unp)	LC	needs update	
-	*Salmo tigridis*	Turan, Kottelat & Bektaş, 2011	-			NE		

SILURIFORMES - Ariidae

					Genetic Data	IUCN		
Kuru (2004)	**Species**	**Author**	**COI**	**Country**	**Reference**	**Status**	**Criteria**	**Pop. Trend**
Arius cous	*Arius cous*	Hyrtl, 1859	-			NE		

Table 1. (Continued)

SILURIFORMES - Bagridae

				Genetic Data			IUCN	
Kuru (2004)	**Species**	**Author**	**COI**	**Country**	**Reference**	**Status**	**Criteria**	**Pop. Trend**
Glyptothorax sp.	*Glyptothorax armeniacus*	(Berg, 1918)	-			NE		
Glyptothorax cous	*Glyptothorax cous*	(Linnaeus, 1766)	-			NE		
Glyptothorax sp.	*Glyptothorax kurdistanicus*	(Berg, 1931)	-			DD		unknown
Glyptothorax steindachneri	*Glyptothorax steindachneri*	(Pietschmann, 1913)	-			NE		
-	*Mystus pelusius*	(Solander, 1794)	+	TUR	Geiger et al. (2014)	LC		unknown

SILURIFORMES - Clariidae

				Genetic Data			IUCN	
Kuru (2004)	**Species**	**Author**	**COI**	**Country**	**Reference**	**Status**	**Criteria**	**Pop. Trend**
Clarias lazera	*Clarias gariepinus*	(Burchell, 1822)	+	TUR	Keskin and Atar (2013)	LC		unknown

SILURIFORMES - Siluridae

				Genetic Data			IUCN	
Kuru (2004)	**Species**	**Author**	**COI**	**Country**	**Reference**	**Status**	**Criteria**	**Pop. Trend**
Silurus glanis	*Silurus glanis*	Linnaeus, 1758	+	TUR	Keskin and Atar (2013)	LC		unknown
Silurus triostegus	*Silurus triostegus*	Heckel, 1843	-			LC		decreasing

SYNBRANCHIFORMES - Mastacembellidae

				Genetic Data			IUCN	
Kuru (2004)	**Species**	**Author**	**COI**	**Country**	**Reference**	**Status**	**Criteria**	**Pop. Trend**
Mastacembelus simack	*Mastacembelus mastacembelus*	(Banks & Solander, 1794)	-			LC		stable

Table 1. (Continued)

SYNGNATHIFORMES - Syngnathidae

					Genetic Data	IUCN		
Kuru (2004)	**Species**	**Author**	**COI**	**Country**	**Reference**	**Status**	**Criteria**	**Pop. Trend**
Nerophis ophidion	*Nerophis ophidion*	(Linnaeus, 1758)	+	?	Bergsten et al. (unp)	LC		unknown
Syngnathus abaster	*Syngnathus abaster*	Risso, 1827	+	DZA	Geiger et al. (2014)	LC		unknown
Syngnathus acus	*Syngnathus acus*	Linnaeus, 1758	+	ITA	Landi et al. (2014)	NE		
Syngnathus typhle	*Syngnathus typhle*	Linnaeus, 1758	+	?	Bergsten et al. (unp)	LC		unknown

Table 2. Changes in the fish diversity of Turkish inland waters in the last ten years (between 2004 and 2014).

		Kuru (2004)		This study (2014)		Differences	
Order	**Family**	**Genera**	**Species**	**Genera**	**Species**	**Genera**	**Species**
1.Petromyzontiformes	1.Petromyzontidae	1	2	2	3	1	1
2.Acipenceriformes	2.Acipenceridae	2	6	2	7	0	1
3.Angulliformes	3.Anguillidae	1	1	1	1	0	0
4.Atheriniformes	4.Atherinindae	1	1	1	2	0	1
5.Clupeiformes	5.Clupeidae	4	9	4	11	0	2
6.Cypriniformes	6.Cobitidae	1	13	2	20	1	7
	7.Cyprinidae	33	116	36	193	3	77
	8.Nemacheilidae	3	16	5	40	2	24
7.Cyprinodontiformes	9.Cyprinidontidae	1	8	1	10	0	2
	10.Poecilidae	1	2	1	2	0	0
8.Esociformes	11.Esocidae	1	1	1	1	0	0
9.Gasterosteiformes	12.Gasterosteidae	2	2	2	3	0	1
10.Perciformes	13.Blennidae	1	2	1	2	0	0
	14.Centrarchidae	1	1	1	1	0	0
	15.Cichlidae	2	2	3	4	1	2
	16.Gobiidae	6	15	9	26	3	11
	17.Moronidae	1	1	1	1	0	0
	18Mugilidae	4	9	4	9	0	0
	19.Percidae	3	3	3	3	0	0
11.Pleuronectiformes	20.Pleuronectidae	1	1	1	1	0	0
12.Salmoniformes	21.Salmonidae	3	8	3	17	0	9
13.Siluriformes	22.Aridae	1	1	1	1	0	0
	23.Bagridae	1	6	2	5	1	-1
	24.Claridae	1	2	1	1	0	-1
	25.Siluridae	1	2	1	2	0	0
14.Synbranchiformes	26.Mastacembellidae	1	1	1	1	0	0
15.Syngnathiformes	27.Syngnathidae	2	5	2	4	0	0
Total		**80**	**236**	**92**	**371**	**12**	**135**

The fishes in Turkish inland waters comprise 371 species belonging to 92 genera, 27 families and 15 orders. These taxons were reported to be 236 species, 80 genera and 27 families by Kuru (2004). Within the last 10 years period, Turkish inland water fish diversity has increased by 135 species and 12 genera. Diversity of Bagridae and Claridae families diminished with one species while 13 families remained constant and the other families increased in terms of species. The highest increase in the number of species has been in the families of Cyprinidae (77 species increased), Nemacheilidae (24 species increased) and Gobiidae (11 species increased). More than half of the all species (52%) belongs to Cyprinidae family (193 species). In addition, Nemacheilidae (11%), Gobiidae (7%), Cobitidae (5%) and Salmonidae (5%) are the rich families in terms of species (Figure 3).

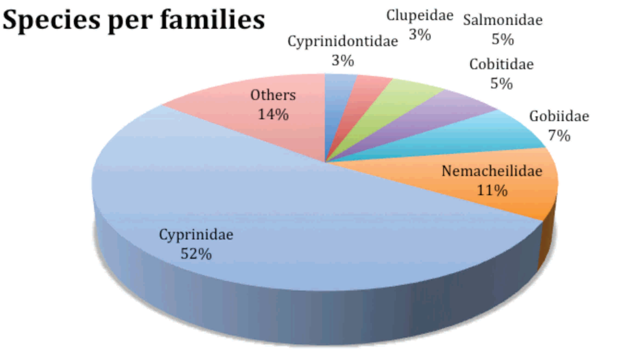

Figure 3. The percent distribution of the fish species in Turkish inland waters according to families.

EVALUATION OF FISH BIODIVERSITY IN INLAND WATERS OF TURKEY

Number of fish species in inland waters of Turkey increased at a ratio of 57% in the recent ten years between 2004 (Kuru 2004) and 2014 (this study). This increase can be explained by several reasons.

1. It can be obviously agreed that the increase in the number of new species reports has resulted from an increase in number of new research facilities, methods and scientists.

2. Generally, descriptions of new fish species have been reported using the tools of the alpha-taxonomy, mainly based upon external morphological characters (Turner 1999). Unreported uncertainties within the description of new fish species can be the main driver and effective factor in determining new species.

3. Conflicts of 'species' term between the scientists is another problem in new species reports. At least 22 species concepts had been available up to 2000's (Mayden 1997) and the number is increasing with unifying concepts (De Queiroz 2007). While it is beyond the aim of this study to evaluate this concepts some examples are typological species concept, Darwinian fish species concept, biological species, recognition species concept, phylogenetic species concept (Turner 1999).

4. It is very well known that many reports for the new species have been resulted in many synonyms in databases. Despite to keeping in mind species description is depended on dynamic characteristics of taxonomy.

5. Another trend appears to be that previous subspecies records have been changing into species. This matter should be explained with new concepts of species and/or some requirements and evidences.

6. It can be expected that increase in new species reports can positively and negatively affect the measures of conservation. It is assumed that many new species occupy relatively smaller areas compared with previous home range of fish species (main taxon). This situation could result in a more effective conservation measure due to anthropogenic effects which are available or planned in small and certain area. On the other hand, splitting the geographical distribution area of the suggested fish species (main taxon), limiting it in a sub basin and/or in national borders is similar to a closed box. It will make distinct hotspots for conservation probably devaluing the buffer zones and/or corridors. When a widely distributed species demonstrates a fragmented distribution due to anthropogenic effects, conservation of this species would need focusing on restoring the gene flow between these fragmented populations (Vrijenhoek 1998). Whereas if these fragments are to be evaluated as species themselves, there will be no need for such an action.

7. There is a limited special effort to check and approval process for the newly declared species. The approved optimum parameters to describe fish species are not clear. Only, a general approach is convenient between the taxonomists on the basis of external morphological characters. The lack of a reliable process will only support the uncertainties.

8. It can be suggested to use of further taxonomic tools based on all available intra and infra characters, intensive sampling, reliable observation, measurement, description, illustration, and information at the cellular or molecular levels etc. especially for the problematic taxa. All descriptions should be also supported by the literature, classification status, ecology, zoogeography, evolution with phylogenetic and phylogeographic studies, taxonomic history and discussion.

9. It is very difficult to evaluate the validity of use of suggested new name of fish species (Baselga et al. 2010). It is strongly recommended to act with precaution. It is expected this situation will bring some difficulties during the registration in terms of genetic resources. A new name should be discussed together with common synonym name.

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SUPPLEMENTARY

Material method of the study is given in this section. Species list is mainly based on Kuru (2004), Fricke et al. (2007), Tekeli et al. (2006) and IUCN (2014). Valid names and authorities were checked with the Fishbase (Froese and Pauly 2014) and classification follows Catalog of Fishes (Eschmeyer 2014) Cytochrome oxidase I (COI) sequences were checked within GenBank (NCBI). Unpublished sequence data were referred as 'unp' instead of year. When there is more than one reference for the sequence, recent one was used as an example. Sampling locality of the data were given in the 'Country' column if it is indicated in the database. Since the main idea of this review is to evaluate the fish diversity of Turkey, GenBank records were checked mainly if there is any records within Turkey. If not other countries were given as examples. ISO 3166-1 alpha-3 codes for countries are given in Table 3.

Table 3. Country codes

Code	Country	Code	Country
BGR	Bulgaria	MAR	Morocco
BRA	Brazil	MKD	Macedonia
DEU	Germany	RUS	Russia
DZA	Algeria	SYR	Syrian Arab Republic
FRA	France	TUR	Turkey
GRC	Greece	UKR	Ukraine
ITA	Italy	USA	United States of America
LBN	Lebanon		

In addition to these codes EU represents European Union in the table and it represents multiple localities for the so called species around Union's borders. IUCN criteria of the species were checked with the IUCN website (IUCN 2014). Abbrevation used for Red List Status is given in Table 4, for detailed information of the status and the criteria see IUCN (2014).

Table 4. Red List Status

EX	Extinct
EW	Extinct in the Wild
CR	Critically Endangered
EN	Endangered
VU	Vulnerable
NT	Near Threatened
LC	Least Concern
DD	Data Deficient
NE	Not Evaluated