



Distribution of Invasive *Carassius gibelio* (Bloch, 1782) (Teleostei: Cyprinidae) in Turkey

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Abstract

Introduction of a new species to a new habitat may lead to a catastrophe. Prussian carp *Carassius gibelio* (Bloch, 1782), by its high reproduction capacity by means of gynogenesis and tolerance to environmental changes, considered as a successful invasive. It can become the dominant species in new habitat in a short time with the help of these attributes. After the first spread report of *Carassius gibelio* from Thrace in 80's, *Carassius gibelio* became to be a problem in inland waters of Turkey as it is in some countries of Europe. This study is a review of distribution of *Carassius gibelio* in Turkey. 39 stream, 33 lake, 67 reservoir and 55 pond records were presented in this study. And according to these results, only four basins (Ceyhan, Göksu, Western Black Sea, Eastern Black Sea and Göksu) out of 26, seems to show no distribution of *Carassius gibelio*.

Keywords: *Carassius gibelio*, invasive fish, distribution, Turkey.

İstilacı *Carassius gibelio* (Bloch, 1782) (Cyprinidae: Teleostei)'nun Türkiye'deki Dağılımı

Özet

Bir türün yeni bir habitata taşınması yıkıma yol açabilir. Gümüşü havuz balığı, *Carassius gibelio* (Bloch, 1782), yüksek üreme kapasitesi ve çevresel değişimlere olan toleransı ile başarılı bir istilacı tür olarak anılmaktadır. Bu özellikleri sayesinde yeni habitatta çok kısa bir süre içerisinde baskın tür haline geçebilmektedir. Türün 80'li yıllarda Trakya Bölgesi'nden verilen ilk kaydı takip eden bazı Avrupa ülkelerinde olduğu gibi Türkiye içsularında sorun olmaya başlamıştır. Bu çalışma ile *Carassius gibelio*'nun Türkiye dağılımı ortaya konulmaya çalışılmıştır. Bu çalışmada 39 akarsu, 33 göl, 67 baraj gölü ve 55 göletten verilen raporlar sunulmuştur. Bu sonuçlara göre, 26 akarsu havzasından sadece dört tanesinde (Ceyhan, Göksu, Batı Karadeniz ve Doğu Karadeniz) *Carassius gibelio* kaydı bulunmamaktadır.

Anahtar Kelimeler: *Carassius gibelio*, istilacı balık, dağılım, Türkiye.

Introduction

Global awareness about species introductions and invasive species are increasing recently. According to International Union for Conservation of Nature (IUCN) 'organisms anthropogenically introduced in new areas out of their natural distribution area and with establishment and dispersion causing a negative impact on local ecosystems and species' are considered as invasive species. Spreading of these non-native species and their impact on local ecosystems were reported by many authors (Holcik, 1991; İnnal and Erk'akan, 2006; Gozlan *et al.*, 2010; Gaygusuz *et al.*, 2007; Tarkan *et al.*, 2012b; Gaygusuz *et al.*, 2013).

As a member of Cyprinidae family *Carassius*

genus is widely distributed in Eurasian continent and generally accepted to be consist of *Carassius auratus* (Linnaeus, 1758), *Carassius carassius* (Linnaeus, 1758), *Carassius cuvieri* (Temminck & Schlegel, 1846), *Carassius gibelio* (Bloch, 1782) and *Carassius langsdorfii* (Temminck & Schlegel, 1846). There has long been a debate about the status (validity and origin) of the *Carassius gibelio*. It is thought to be native to Central Europe or originated from far east and introduced to Europe or even thought to be a result of hybridisation (Kottelat, 1997 and Perdikaris *et al.*, 2012). In the light of recent studies it seems that it can be considered native at least in the eastern parts of Central Europe (Kottelat and Freyhof, 2007; Rylkova, *et al.*, 2013).

First record of the Prussian carp, *Carassius*

gibelio (Bloch, 1782), from Turkey is from Lake Gala in Thrace Region (Baran and Ongan, 1988). Following this record several introduction records from Thrace and other regions were given respectively (Özuluğ, 1999; İlhan et al., 2005; Tarkan et al., 2012a). Because of species' similarity to *Carassius auratus* and possible misidentifications limited the perceptibility of the range expansion of *Carassius gibelio*. Summing up the records of *Carassius gibelio* from Turkey, determination of its distribution range and visualising its current status is the main objective of this study.

Biology and Diagnostics

Carassius gibelio is an omnivorous species (Szczerbowski., 2001; Zhu et al., 2004; Yılmaz et al., 2007) distributed in lentic and lotic habitats. It is a batch spawner, capable of producing 30.000 to 400.000 eggs (Szczerbowski., 2001). Spawning takes place mainly between April and June (Tarkan et al., 2007; Tarkan et al., 2012a) and eggs are released on plants (Szczerbowski., 2001).

As summarized by Perdikaris et al., 2012; Prussian carp seem to show an extreme hypoxia-anoxia (Lushchak et al., 2001), ammonia (Nathanailides et al., 2003) and temperature (Antonova, 2010) tolerance. In addition to this it can adapt to saline water in time (Elger and Hentschel, 1981). These attributes with gynogenesis makes it a successful invasive (Luskova et al., 2010).

Regional names for *Carassius gibelio* in Turkey includes; gümüşi havuz balığı, takoz (Beyşehir), kababurun, korsan (Çıldır), çinimini (Karakeçili). Distinctive characteristics of the species of the genus *Carassius* in Turkey are summarized in Table 1.

Materials and Methods

Data about *Carassius gibelio* distribution were gathered from literature (miscellaneous journal articles, project reports, conference proceedings and thesis dissertations) and field sampling which are indicated as 'In this study' are summarized in Table 2. Localities given in literature were classified as 'Stream', 'Lake', 'Reservoir' and 'Pond'. Date of the first record (if there are more than one record reference) from locality were given in year format. Maps taken from GADM database of Global Administrative Areas (www.gadm.org) are colored according to 'first record in region' and 'number of

reported locality'.

Results

Collected data about *Carassius gibelio* in Turkey is summarized in Table 2. Distribution maps prepared according to introduction date and introduction intensity are given in Figure 1 and Figure 2 respectively.

Discussion

From its first introduction date in 1980's (Baran and Ongan, 1988) *Carassius gibelio* seems to invade hundreds of water courses and reported from several freshwater basins of Turkey. There are no records from Ceyhan (Erk'akan and Özdemir, 2011; Kara et al., 2010), Göksu (Küçük et al., 2007), Eastern Black Sea (İlhan and Balık, 2008) and Western Black Sea basins. As discussed in other publications Prussian carp seem to invade primarily by human activities (translocation of native cyprinids, anglers etc.) (Aydın et al., 2011; Önsoy et al., 2011). Fishing efforts in Lake Van is concentrated on *Alburnus tarichi* and water quality of some big lakes (Van, Erçek and Arin) in basin may be unsuitable for *Carassius gibelio* due to saline/soda waters. And in Göksu, Eastern and Western Black Sea basins suitable habitats for *Carassius* establishment are scarce. For these reasons it can be expected that lesser translocation effort which may have prevented the invasion of *Carassius gibelio* in these basins.

Gynogenesis is an important trait for invasive fishes which makes them utilise male of other fish species. Natural gynogenesis involves the participation of normal sperm and eggs but embryogenesis occurs without the genetic contribution of sperm resulting with a more efficient way of progeny production (Luo et al., 2011). As a result of this process fish populations in different locations shows different genetic characteristics (Jia et al., 2008). Populations of gynogenetic females shows an abnormal male/female ratio and according to this gynogenetic females seem to be present in Bafra Fish Lake, Samsun (Bostancı et al., 2007b), Seyitler Reservoir, Afyon (Bulut et al., 2013); Uluabat Lake, Bursa (Emiroğlu et al., 2011); Ömerli Reservoir, İstanbul (Gaygusuz et al., 2007); Buldan Reservoir, Denizli (Sarı et al., 2008) and seem to dominate most of the populations in Marmara Region (Aydın et al., 2011).

Table 1. Distinctive characteristics of the species of the genus *Carassius* in Turkey (Özuluğ et al., 2004; Kottelat and Freyhof, 2007)

	<i>Carassius carassius</i>	<i>Carassius auratus</i>	<i>Carassius gibelio</i>
Free edge of dorsal fin	Convex	Concave-Straight	Concave-Straight
Last simple ray of anal & dorsal fin	Weakly serrated	Strongly serrated	Strongly serrated
Gill raker	23-33	38-47	37-52
Lateral line	31-36	26-31	29-33

Table 2. Distribution of *Carassius gibelio*

	Location	City	Date*	Reference
STREAM	Abdal Stream	Samsun	2002	Uğurlu and Polat, 2007
	Ağaçköy Stream	Kütahya	2004	İlhan and Balık, 2008
	Akarca Stream	Muğla	2010	Gaygusuz et al., 2013
	Akçay	Aydın	2003	Özcan, 2008; Yeğen et al., 2008
	Aksu Stream	Isparta	2001	Yeğen et al., 2006
	Ambar Stream	Diyarbakır	2011	This study
	Arnavut Stream	Kırklareli	1982	İlhan et al., 2005
	Asi River	Hatay		Özcan, 2013; This study
	Batman Stream	Batman	2010	Kaya, 2012
	Bulanık Stream	Kırklareli	1982	İlhan et al., 2005
	Büyükçay Stream	Konya	2012	This study
	Büyükköprü Stream	Konya	2012	This study
	Çamlıca Creek	Edirne		Özuluğ et al., 2004
	Çobanlar Stream	Samsun	2002	Uğurlu and Polat, 2007
	Eşme Stream	Uşak	2007	Yeğen et al., 2012
	Felek Stream	Kütahya	2004	İlhan and Balık, 2008
	İpsala Canal	Edirne	2010	Tarkan et al., 2012a
	Karasu Stream	Hatay	2011	Özcan, 2013
	Kavaklı Stream	Çanakkale		Özuluğ et al., 2004
	Kınıklı Stream	Tekirdağ		Özuluğ et al., 2004
	Kızılırmak River	Samsun		Innal, 2011
	Kocasu Stream	Kütahya	2008	Yeğen et al., 2012
	Köprüçay River	Antalya		Innal, 2011
	Meriç River	Edirne	2009	Aydın et al., 2011; Tarkan et al., 2012a; This study
	Mert River	Samsun	2002	Uğurlu and Polat, 2007
	Miliç (Kocaman) River	Samsun	2002	Uğurlu and Polat, 2007
	Porsuk Stream	Eskişehir	2010	Köse et al., 2012; Yeğen et al., 2012
	Sakarya River	Eskişehir	2005	Emiroğlu, 2011; Yeğen et al., 2012
	Salat Stream (Bismil)	Diyarbakır	2011	This study
	Sarıçay Stream	Muğla	2010	Gaygusuz et al., 2013
	Sarısu Stream	Eskişehir	2011	Yeğen et al., 2012
	Terme Stream	Samsun	2002	Uğurlu and Polat, 2007
	Tersakan Stream	Muğla	2011	Karakuş et al., 2013
	Tigris River (Bismil)	Diyarbakır	2005	Kaya, 2012; Çiçek, 2013; This study
Tigris River (Cizre)	Şırnak	2011	This study	
Tigris River (Diyarbakır)	Diyarbakır	2005	Ünlü, 2006; Kaya, 2012; Ünlü, 2013; This study	
Tigris River (Hasankeyf)	Batman	2011	Kaya, 2012; This study	
Tigris River (İlsu Vilage)	Mardin	2011	This study	
Tunca River	Edirne	1983	Özuluğ et al., 2004; İlhan et al., 2005	
Yeşilirmak (Lower Basin)	Samsun	2009	Akın, 2010	
Yurtluk Stream	Samsun	2002	Uğurlu and Polat, 2007	
	Location	City	Date*	Reference
LAKE	Aktaş Lake	Ardahan	2012	Zengin et al., 2012
	Bafra Fish Lakes	Samsun	2000	Bostancı et al., 2007b; Uğurlu and Polat, 2007; Yılmaz et al., 2007
	Eğrigöl	Antalya	1997	İlhan et al., 2005
	Lake Akgöl	Sakarya	2010	Emiroğlu et al., 2012a
	Lake Beyşehir	Konya	2001	Yeğen et al., 2006b; Çınar et al., 2007; Özparlak et al., 2012
	Lake Boztepe	Tokat	2003	Mendil and Uluözülü, 2007
	Lake Çıldır	Kars- Ardahan	2011	Zengin et al., 2012; This study
	Lake Çivril	Denizli		Kuru et al., 2001
	Lake Dutluca	Tokat	2003	Mendil et al., 2005
	Lake Eber	Afyon	2003	Yeğen et al., 2006a; This study
	Lake Eğirdir	Isparta	1996	Balık et al., 2004; İlhan et al., 2005; Yeğen et al., 2006b; Balık et al., 2007; Bostancı et al., 2007; Özkök et al., 2007
	Lake Gaga	Ordu	2013	This study
	Lake Gala	Edirne	1980s	Baran and Ongan, 1988; This study
	Lake Gölcük	Isparta	2001	Yeğen et al., 2006b
	Lake Gölcük	İzmir	2001	İlhan et al., 2005
	Lake Işıklı	Denizli	1998	İlhan et al., 2005; Yeğen et al., 2006a
	Lake İznik	Bursa	2003	Özuluğ et al., 2005; Acıpinar et al., 2006; Tarkan et al., 2006a; Tarkan et al., 2012a
	Lake Kolak	Denizli	2003	Yeğen et al., 2006a
	Lake Kovada	Isparta	2001	Yeğen et al., 2006a
Lake Ladik	Samsun	2013	This study	

Table 2. Continued

	Location	City	Date*	Reference
LAKE	Aktaş Lake	Ardahan	2012	Zengin et al., 2012
	Bafra Fish Lakes	Samsun	2000	Bostancı et al., 2007b; Uğurlu and Polat, 2007; Yılmaz et al., 2007
	Eğrigöl	Antalya	1997	İlhan et al., 2005
	Lake Akgöl	Sakarya	2010	Emiroğlu et al., 2012a
	Lake Beyşehir	Konya	2001	Yeğen et al., 2006b; Çınar et al., 2007; Özparlak et al., 2012
	Lake Boztepe	Tokat	2003	Mendil and Uluöztlü, 2007
	Lake Çıldır	Kars- Ardahan	2011	Zengin et al., 2012; This study
	Lake Çivril	Denizli		Kuru et al., 2001
	Lake Dutluca	Tokat	2003	Mendil et al., 2005
	Lake Eber	Afyon	2003	Yeğen et al., 2006a; This study
	Lake Eğirdir	Isparta	1996	Balık et al., 2004; İlhan et al., 2005; Yeğen et al., 2006b; Balık et al., 2007; Bostancı et al., 2007; Özkök et al., 2007
	Lake Gaga	Ordu	2013	This study
	Lake Gala	Edirne	1980s	Baran and Ongan, 1988; This study
	Lake Gölcük	Isparta	2001	Yeğen et al., 2006b
	Lake Gölcük	İzmir	2001	İlhan et al., 2005
	Lake Işıklı	Denizli	1998	İlhan et al., 2005; Yeğen et al., 2006a
	Lake İznik	Bursa	2003	Özuluğ et al., 2005; Acıpmar et al., 2006; Tarkan et al., 2006a; Tarkan et al., 2012a
	Lake Kolak	Denizli	2003	Yeğen et al., 2006a
	Lake Kovada	Isparta	2001	Yeğen et al., 2006a
	Lake Ladik	Samsun	2013	This study
	Lake Manyas	Balıkesir	2009	Aydın et al., 2011
	Lake Marmara	Manisa	1990	İlhan et al., 2005; Özcan, 2007; Tarkan et al., 2012a
	Lake Nazik (Ahlat)	Bitlis	1998	This study
	Lake Saka	Kırklareli	1982	İlhan et al., 2005
	Lake Sapanca	Sakarya	2000	Okgerman et al., 2006
	Lake Sığırcı	Edirne	2009	Çolak, 2013
	Lake Taşkısığı	Sakarya	2009	Aydın et al., 2011
	Lake Tortum	Erzurum	2013	This study
	Lake Ula	Muğla	2008	Önsoy et al., 2011
	Lake Uluabat	Bursa	2004	Emiroğlu, 2008; Arslan and Emiroğlu 2011; Aydın et al., 2011; Emiroğlu et al., 2011; Emiroğlu et al., 2012b
	Lake Yayla	Denizli	2001	İlhan et al., 2005
	Lake Zinav	Tokat	2011	Buhan, 2013
Uzungöl	Samsun	1999	İlhan et al., 2005	
	Location	City	Date*	Reference
RESERVOIR	Adıgüzel Reservoir	Denizli	2003	Yeğen et al., 2006a
	Alahabalı Reservoir	Uşak	2008	Yeğen et al., 2012
	Altınapa Reservoir	Konya	2001	Yeğen et al., 2006b
	Apa Reservoir	Konya		Özparlak, 2013
	Atatürk Reservoir	Şanlıurfa	2008	Tarkan et al., 2012a; Oymak et al., 2013
	Avşar Reservoir	Manisa	1994	İlhan et al., 2005
	Baltalı Reservoir	Uşak	2007	Yeğen et al., 2012
	Batman Reservoir	Batman	2012	This study
	Bayraktar Reservoir	Kocaeli	2009	Aydın et al., 2011
	Buldan Reservoir	Denizli	1995	İlhan et al., 2005; Sarı et al., 2008
	Büyükçekmece Reservoir	İstanbul	1995	Özuluğ, 1999; Tarkan et al., 2012a
	Çağırğan Reservoir	Kocaeli	2009	Aydın et al., 2011
	Çakmak Reservoir	Samsun	2002	Uğurlu and Polat, 2007
	Çatören Reservoir	Eskişehir	2008	Yeğen et al., 2012; This study
	Çavdarhisar Reservoir	Kütahya	2010	Yeğen et al., 2012
	Çayırköy Reservoir	Kocaeli	2009	Aydın et al., 2011
	Davuldere Reservoir	Kocaeli	2009	Aydın et al., 2011
	Denizli Reservoir	Kocaeli	2009	Aydın et al., 2011
	Derbent Reservoir	Denizli	2003	Yeğen et al., 2006a
	Dodurga Reservoir	Bilecik	2010	Yeğen et al., 2012; This study
	Dümenler Reservoir	Uşak	2007	Yeğen et al., 2012
	Enne Reservoir	Kütahya	2007	Yeğen et al., 2012; This study
	Gelingüllü Reservoir	Yozgat	2005	Kırankaya and Ekmekçi, 2013
	Göğem Reservoir	Uşak	2007	Yeğen et al., 2012
	Gökçekaya Reservoir	Eskişehir		This study
	Göksu Reservoir (Çınar)	Diyarbakır	2012	This study
	Güneyköy Reservoir	Uşak	2008	Yeğen et al., 2012
İbriktepe Reservoir	Edirne		Özuluğ et al., 2004	
Karacaören I Reservoir	Burdur	2002	Yeğen et al., 2006a	

Table 2. Continued

	Location	City	Date*	Reference
RESERVOIR	Karakaya Reservoir	Elazığ	2011	This study
	Karamanlı Reservoir	Burdur	2002	Yeğen et al., 2006a
	Karpuzlu Reservoir	Edirne	2009	Aydın et al., 2011
	Kayaboğazı Reservoir	Kütahya	2007	Yeğen et al., 2012; This study
	Kayalıköy Reservoir	Kırklareli	2002	Kalous et al., 2004
	Kazan Reservoir	Muğla	2009	Tarkan et al., 2012a
	Keban Reservoir	Elazığ	2008	This study
	Kemer Reservoir	Aydın	2006	Özcan, 2008; Şaşı and Berber, 2013; Tarkan et al., 2012a
	Ketenciler Reservoir	Kocaeli	2009	Aydın et al., 2011
	Kızıldamlar Reservoir	Bilecik	2010	Yeğen et al., 2012
	Kızılhisar Reservoir	Uşak	2007	Yeğen et al., 2012
	Kızılsu Reservoir	Burdur	2005	Yeğen et al., 2006a
	Kirazoğlu Reservoir	Kocaeli	2009	Aydın et al., 2011
	Kunduzlar Reservoir	Eskişehir	2008	Yeğen et al., 2012; This study
	Kuşdemir Reservoir	Uşak	2007	Yeğen et al., 2012
	May Reservoir	Konya	2004	Yeğen et al., 2006a
	Mesudiye Reservoir	Uşak	2007	Yeğen et al., 2012
	Ömerli Reservoir	İstanbul	2002	Tarkan et al., 2006b; Gaygusuz et al., 2007; Tarkan et al., 2007; Tarkan et al., 2012a,b
	Porsuk Reservoir	Eskişehir	2007	Emiroğlu et al., 2010; Köse et al., 2012; Tarkan et al., 2012a; Yeğen et al., 2012;
	Sarıcaali Reservoir	Kırklareli		Özuluğ et al., 2004
	Sarıyar Reservoir	Ankara		This study
	Selevir Reservoir	Afyon	2003	Yeğen et al., 2006a
	Seyhan Reservoir	Adana	2004	Öztürk, 2010; Ergüden and Göksu, 2012
	Seyitler Reservoir	Afyon	2003	Yeğen et al., 2006a; Bulut et al., 2013
	Sille Reservoir	Konya	2004	Yeğen et al., 2006a
	Sipahiler Reservoir	Kocaeli	2010	Gaygusuz et al., 2013
	Suat Uğurlu Reservoir	Samsun	2003	Uğurlu and Polat, 2005
	Süçüllü Reservoir	Isparta	2001	Yeğen et al., 2006a
	Tahtalı Reservoir	Kocaeli	2009	Aydın et al., 2011
	Takmak I-II Reservoir	Uşak	2008	Yeğen et al., 2012
Topaçlı Reservoir	İstanbul	2010	Tarkan et al., 2012a	
Topçam Reservoir	Aydın	1999	Şaşı and Balık, 2003; Özcan, 2008; Bostancı, 2011; Şaşı and Berber, 2013; Tarkan et al., 2012a	
Ula Reservoir	Muğla	2008	Tarkan et al., 2012a	
Üçpınar Reservoir	Uşak		Yeğen et al., 2006a	
Yenice Reservoir	Eskişehir		This study	
Yenice Reservoir	Uşak	2007	Yeğen et al., 2012	
Yeşilkavak Reservoir	Uşak	2008	Yeğen et al., 2012	
Yuvacık Reservoir	Kocaeli	2009	Aydın et al., 2011	
POND	Ahırköy Pond	Eskişehir	2009	Yeğen et al., 2012
	Akviran Pond	Konya	2004	Yeğen et al., 2006a
	Arif's Pond	Aydın	2008	Tarkan et al., 2012a
	Atabey Pond	Isparta	2001	Yeğen et al., 2006a
	Aydoğdu Pond	Denizli	2003	Yeğen et al., 2006a
	Balcı Pond	Isparta	2001	Yeğen et al., 2006a
	Bayat Pond	Afyon	2003	Yeğen et al., 2006a
	Bülbüldere Pond	Edirne		Özuluğ et al., 2004
	Cevizlik (Hurdaz) Pond	Samsun	2002	Polat and Uğurlu, 2011
	Çalköy Pond	Kütahya	2007	Yeğen et al., 2012
	Çerte Pond	Kütahya	2007	Yeğen et al., 2012
	Çöpköy Pond	Edirne		Özuluğ et al., 2004
	Çukurhisar Pond	Eskişehir	2008	Yeğen et al., 2012
	Dağcı Pond	Eskişehir	2009	Yeğen et al., 2012
	Dereyalak Pond	Eskişehir	2008	Yeğen et al., 2012
	Divanbaşı Pond	Samsun	2002	Uğurlu and Polat, 2007
	Doğuşah Pond	Kütahya	2007	Yeğen et al., 2012
	Dutluca Pond	Eskişehir	2008	Yeğen et al., 2012
	Düger Pond	Afyon	2003	Yeğen et al., 2006a
	Erenköy Pond	Eskişehir	2008	Yeğen et al., 2012
	Erkmen Pond	Afyon	2003	Yeğen et al., 2006a
	Esere Pond	Bilecik	2010	Yeğen et al., 2012
	Gencek Pond	Konya	2005	Yeğen et al., 2006a
	Günyüzü Pond	Eskişehir	2009	Yeğen et al., 2012
	Hadım Pond	Konya	2004	Yeğen et al., 2006a
	Hatunsaray Pond	Konya	2004	Yeğen et al., 2006a

Table 2. Continued

	Location	City	Date*	Reference
POND	İğdeli Pond	Burdur	2002	Yeğen et al., 2006a
	İlmen Pond	Konya	2005	Yeğen et al., 2006a
	İnlince Pond	Konya	2005	Yeğen et al., 2006a
	Kanlıpınar Pond	Eskişehir	2008	Yeğen et al., 2012; This study
	Karacadağ Ponds (Ovabağ)	Diyarbakır	2010	This study
	Karaören Pond	Eskişehir	2008	Yeğen et al., 2012
	Kayabelen Pond	Afyon	2003	Yeğen et al., 2006a
	Kayasu Pond	Konya	2004	Yeğen et al., 2006a
	Kayı Pond	Kütahya	2007	Yeğen et al., 2012
	Keskin Pond	Eskişehir	2008	Yeğen et al., 2012; This study
	Köprücek Pond	Kütahya	2007	Yeğen et al., 2012
	Kuruçay Pond	Kütahya	2007	Yeğen et al., 2012
	Kuzfındık Pond	Eskişehir		This study
	Küçükelmali Pond	Bilecik	2010	Yeğen et al., 2012
	Musaözü Pond	Eskişehir		This study
	Pazarlar Pond	Kütahya	2007	Yeğen et al., 2012
	Sarısungur Pond	Eskişehir	2008	Yeğen et al., 2012; This study
	Sazak I Pond	Eskişehir	2009	Yeğen et al., 2012; This study
	Taşoluk Pond	Afyon	2003	Yeğen et al., 2006a
	Tınaztepe Pond	Afyon	2003	Yeğen et al., 2006
	University Pond I	Samsun	2002	Uğurlu and Polat, 2007
	University Pond II	Samsun	2002	Polat and Uğurlu, 2011
	Üççam Pond	Eskişehir	2008	Yeğen et al., 2012
	Üççam Pond	Uşak	2008	Yeğen et al., 2012
	Yapıldak Pond	Eskişehir	2008	Yeğen et al., 2012
	Yazlıca Pond	Konya	2004	Yeğen et al., 2006a
	Yedigöller	Kütahya	2010	This study
	Yukarısöğüt Pond	Eskişehir	2008	Yeğen et al., 2012
	Zemzemiye Pond	Bilecik	2010	Yeğen et al., 2012

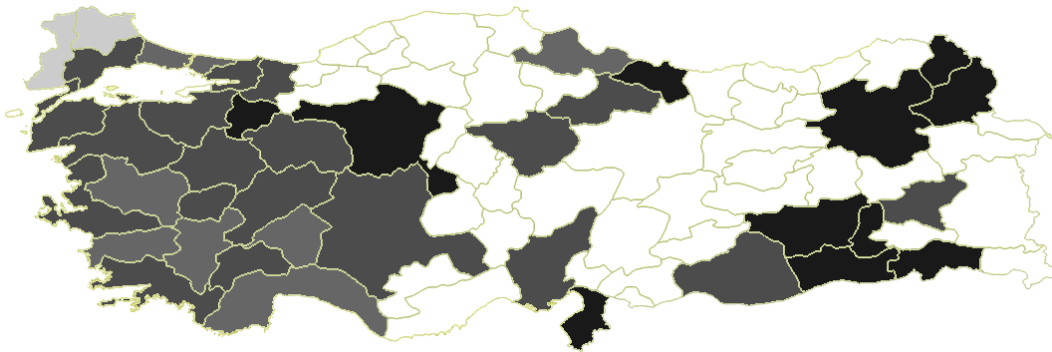


Figure 1. First record date of *Carassius gibelio* in region. (From lighter to darker: 1980-1989; 1990-1999; 2000-2010; 2010-2014).

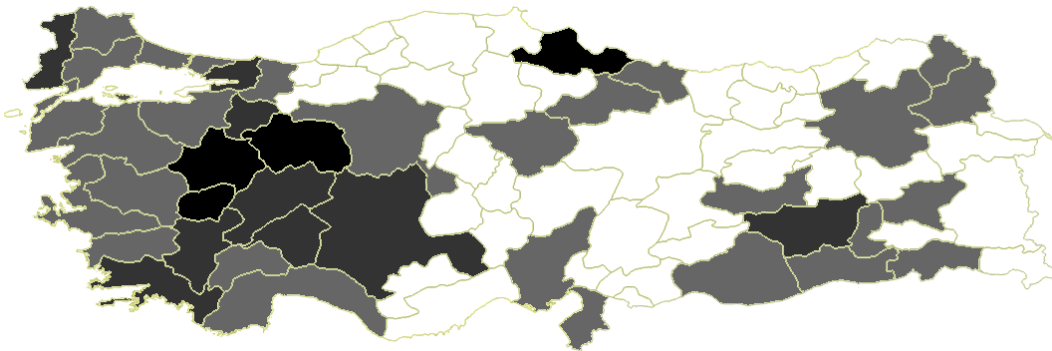


Figure 2. Number of localities *Carassius gibelio* reported (From lighter to darker: 1-5; 5-10; 10+).

Systematic problems of the genus has not been resolved yet. Ongoing introductions of *Carassius* sp., ploidy level, loss of type specimens and existence of *Carassius carassius* X *Carassius auratus* hybrid are some of the problems faced in determination of the origin and validation of *Carassius gibelio*. Due to loss of type specimens (Paepke, 1999), many authors offer neotypes for building a stepping stone (from Kazakhstan, Sakai et al., 2009; from Czech Republic, Kalous et al., 2012). According to Takada et al., 2010; there seems to be a clade (Clade V) showing a wide distribution in Eurasian continent with a monophyletic lineage of cytochrome-b sequences referring to nativeness of the species (referred as *Carassius auratus*-complex but sequences forming this lineage was taken from Kalous et al., 2007; Li and Gui, 2007 and species were given as *Carassius gibelio* and *Carassius auratus gibelio* respectively by the authors). In addition to that certain European haplotypes were originated from Japan with artificial introductions (Takada et al., 2010). But recent studies showed Amurian origin of the cluster from Czech Republic which was called native to Europe (Sakai et al., 2011). Genetic studies about *Carassius* genus still can not definitely answer all questions (Takada et al., 2010; Sakai et al., 2011; Kalous et al., 2012; Podlesnykh et al., 2012). Determination of Bloch's species, phylogenetic approaches with multiple loci and intensive sampling from Eurasian continent seems to help in resolution of this conflict.

Localities given in this work should be treated carefully as determination of the species seems to be problematic. Due to this identification problem of the species, literature selection has been narrowed yet misidentifications still exists in this represented data. For future work; validation of these populations are needed to be made and status (population density, hybridization, ploidy level etc.) of these populations needed to be determined. For management of the non-native species a standardized sampling and reporting procedures need to be determined rather than single occurrence records.

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References

- Acipinar, H., Gaygusuz, Ö., Tarkan, A. S., Gürsoy, Ç. and Al, Z. 2006. Presence of an invasive fish species, *Carassius gibelio* (Bloch, 1782) in the diet of the Dice Snake, *Natrix tessellata* (Laurenti, 1768). Journal of Fisheries and Aquatic Science, Vol: 1, Issue: 2, 213-217.
- Akın, Ş. (Project Leader), 2010. Barajların nehir besin ağı ve balıkların beslenme alışkanlıkları üzerine duyarlı karbon, azot ve mide analiz yöntemleriyle belirlenmesi. TÜBİTAK-107 O 519.
- Antonova, E.I. 2010. Short-term thermal compensatory-adaptive reaction mechanisms of the liver in *C. auratus gibelio*. Contemp Probl Ecol, 3:57-62
- Arslan, N. and Emiroğlu, Ö. 2011. First record of parasitic Annelida-Hirudinea (*Piscicola geometra* Linnaeus, 1761) on *Carassius gibelio* (Bloch, 1782) in Lake Uluabat (Turkey). Kafkas Univ Vet Fak Derg, 17 (1): 131-133.
- Aydın, H., Gaygusuz, Ö., Tarkan, A.S., Top, N., Emiroğlu, Ö. and Gaygusuz, Ç.G. 2011. Invasion of freshwater bodies in the Marmara Region (Northwestern Turkey) by nonnative Gibel Carp, *Carassius gibelio* (Bloch, 1782). Turkish Journal of Zoology, 35(6): 829-836. doi: 10.3906/zoo-1007-31
- Balık, İ., Çubuk, H. and Özkök, R. 2007. Eğirdir Gölü'nde ekonomik balık popülasyonlarının göl sahasındaki dağılımları. Journal of Fisheries Sciences.com, 1(2): 88-96. doi:10.3153/jfsc.com.2007011
- Balık, I., Özkök, R., Çubuk, H. and Uysal, R. 2004. Investigation of some biological characteristics of the Silver Crucian Carp, *Carassius gibelio* (Bloch 1782) population in Lake Eğirdir. Turkish Journal of Zoology, 28:19-28.
- Baran, I. and Ongan, T. 1988. Gala Gölü'nün limnolojik özellikleri, balıkçılık sorunları ve öneriler. Gala Gölü ve Sorunları Sempozyumu, Doğal Hayatı Koruma Derneği Bilimsel Yayınlar Serisi, İstanbul, 46-54.
- Bostancı, D., Polat, N. and Akyürek M. 2007a. Some biological aspects of the Crucian Carp, *Carassius gibelio* Bloch, 1782 inhabiting in Eğirdir Lake. International Journal of Natural and Engineering Sciences, 1 (3): 55-58.
- Bostancı, D., Polat, N., Kandemir, Ş. and Yılmaz S. 2007b. Determination of condition factor and length-weight relationship of the Crucian Carp, *Carassius gibelio* (Bloch, 1782) inhabiting Bafra Fish Lake. SDÜ Fen Edebiyat Fakültesi Fen Dergisi (E-Dergi), 2(2): 117-125.
- Bostancı, D. 2011. Otolith biometry-body length relationships in four fish species (Chub, Pikeperch, Crucian carp, and Common Carp). Journal of Freshwater Ecology, 24(4): 619-624.
- Buhan, E. (Project Leader), 2013. Zinav Gölü Havzası'nda balık toplulukları ve su kalitesinin zamansal ve alansal dağılımı. TÜBİTAK-110 Y 117.
- Bulut, S., Mert, R., Algan, B., Özbek, M., Ünal, B. and Konuk, M. 2013. Several growth characteristics of an invasive cyprinid fish (*Carassius gibelio* Bloch, 1782). Not Sci Biol, 5(2):133-138.
- Çınar, Ş., Çubuk, H., Özkök, R., Tümgelir, L., Çetinkaya, S., Erol, K. G. and Ceylan, M. 2007. Growth features of Silver Crucian Carp (*Carassius gibelio* Bloch, 1782) population in Lake Beyşehir. Turkish Journal of Aquatic Life, 3-5,5-8, 401-409.
- Çiçek, 2013. Dicle Nehri'nde yaşayan *Carassius gibelio*, *Acanthobrama marmid* ve *Alburnus mossulensis* türlerinin biyolojisi üzerine araştırmalar. PhD thesis. Diyarbakır: Dicle University.
- Çolak, H. S. 2013. Metazoan parasites of fish species from Lake Sığırcı (Edirne, Turkey). Turk J Vet Anim

- Sci, 37, 200-205.
- Elger M. and Hentschel. 1981. The glomerulus of a stenohaline fresh-water teleost, *Carassius auratus gibelio*, adapted to saline water. A scanning and transmission electron-microscopic study. Cell Tissue Res., 220(1): 73-85.
- Emiroğlu, Ö. 2008. Investigation of bio-ecological features of *Esox lucius* (Linnaeus, 1758), *Carassius gibelio* (Bloch, 1782) and *Scardinius erythrophthalmus* (Linnaeus, 1758) in Lake Uluabat (Bursa). PhD thesis. Eskişehir: University of Osmangazi.
- Emiroğlu, Ö., Uyanoğlu, M., Canbek M. and Başkurt S. 2010. Erythrocyte sizes of *Carassius gibelio* species in Porsuk Dam Lake (Eskişehir/Turkey). Journal of Animal and Veterinary Advances, 9(24): 3077-3082.
- Emiroğlu, Ö. 2011. Alien fish species in upper Sakarya River and their distribution. African Journal of Biotechnology, 10(73):16674-16681.
- Emiroğlu, Ö., Bayramoğlu, G., Öztürk, D., and Yaylacı, Ö.K. 2011. Determination of the gynogenetic reproduction character of *Carassius gibelio* in Uluabat Lake. Asian Journal of Animal and Veterinary Advances 6(6): 648-653. doi: 10.3923/ajava.2011.648.653
- Emiroğlu, Ö., Uyanoğlu, M. and Başkurt, S. 2012a. Comparison of the erythrocyte sizes of *Carassius gibelio* and *Carassius carassius* species living together in Akgöl (Adapazari/Turkey). Asian Journal of Animal and Veterinary Advances, 7(9): 876-883.
- Emiroğlu, Ö., Tarkan, A. S., Top, N., Başkurt, S. and Sülün, Ş. 2012b. Growth and life history traits of a highly exploited population of non- native Gibel Carp, *Carassius gibelio* from a large eutrophic lake (Lake Uluabat, NW Turkey): is reproduction the key factor for establishment success?. Turk. J. Fish. Aquat. Sci., 12: 925-936.
- Ergüden, S.A. and Göksu, M. Z. L. 2012. The fish fauna of the Seyhan Dam Lake (Adana). Journal of Fisheries Sciences, 6(1): 39-52.
- Erk'akan, F. and Özdemir, F. 2011. Revision of the fish fauna of the Seyhan and Ceyhan River basins in Turkey. Research Journal of Biological Sciences, 6(1):1-8.
- Gaygusuz, Ö., Emiroğlu, Ö., Tarkan, A.S., Aydın, H., Top, N., Dorak, Z., Karakuş, U. and Başkurt, S. 2013. Assessing the potential impact of nonnative fish on native fish by relative condition. Turkish Journal of Zoology, 37: 84-91. doi: 10.3906/zoo-1203-15
- Gaygusuz, Ö., Tarkan, A.S. and Gaygusuz, Ç.G. 2007. Changes in the fish community of the Ömerli Reservoir (Turkey) following the introduction of non-native Gibel Carp *Carassius gibelio* (Bloch, 1782) and other human impacts. Aquatic Invasions, 2(2): 117-120.
- Gozlan, R. E., Britton, J. R., Cowx, I. and Copp, G. H. 2010. Current knowledge on non-native freshwater fish introductions. Journal of Fish Biology, 76:751-786. doi: 10.1111/j.1095-8649.2010.02566.x
- Holcik, J. 1991. Fish introductions in Europe with particular reference to its central and eastern part. Can. J. Fish. Aquat. Sci., 48(Suppl. 1): 13-23
- İlhan, A. and Balık, S. 2008. Batı Karadeniz Bölgesi içsularının balık faunası. E.Ü. Su Ürünleri Dergisi, 25(1): 75-82.
- İlhan, A., Balık, S., Sarı, H.M. and Ustaoglu, M.R. 2005. Batı ve Orta Anadolu, Güney Marmara, Trakya ve Batı Karadeniz Bölgeleri içsularındaki *Carassius* (Cyprinidae, Pisces) türleri ve dağılımları. E.U. Su Ürünleri Dergisi, 22(3-4): 343-346.
- İnnal, D. 2011. Distribution and impacts of *Carassius* species (Cyprinidae) in Turkey: a review. Management of Biological Invasions, 2: 57-68.
- İnnal, D. and Erk'akan, F. 2006. Effects of exotic and translocated fish species in the inland waters of Turkey. Rev Fish Biol Fisheries, 16:39-50. doi: 10.1007/s11160-006-9005-y
- Jia, Z. Y., Shi, L. Y., Sun, X. W. and Lei, Q. Q. 2008. Inheritance of microsatellite DNA in bisexual gynogenesis complex of Fangzheng silver crucian carp, *Carassius auratus gibelio* (Bloch). J. Fish Biol., 73: 1161-1169.
- Kalous, L., Bohlen, J., Rylkova, K. and Petryl, M. 2012. Hidden diversity within the Prussian carp and designation of a neotype for *Carassius gibelio* (Teleostei: Cyprinidae). Ichthyol. Explor. Freshwaters, 23(1):11-18.
- Kalous, L., Memiş, D. and Bohlen, J. 2004. Finding of triploid *Carassius gibelio* (Bloch, 1780) (Cypriniformes, Cyprinidae) in Turkey. Cybium, 28:77-79.
- Kalous, L., Slechtova, Jr. V., Bohlen, J., Petryl, M. and Svatora, M. 2007. First European record of the *Carassius langsdorfii* from the Elbe Basin. Journal of Fish Biology, 70 (Suppl A): 132-138. doi: 0.1111/j.1095-8649.2006.01290.x
- Kara, C., Alp, A. and Şimşekli, M. 2010. Distribution of fish fauna on the upper and middle basin of Ceyhan River, Turkey. Turkish Journal of Fisheries and Aquatic Sciences, 10: 111-122. doi: 10.4194/trjfas.2010.0116
- Karakuş, U., Ağdamar, S., Tarkan, A. S. and Özdemir, N. 2013. Range extension of the invasive freshwater fish species, gibel carp *Carassius gibelio* (Bloch, 1782) in western Turkey. BioInvasions Records, 2, (2):153-157.
- Kaya, C. 2012. Dicle Nehri'nin yukarı havzasının balık faunası. MSc thesis. Rize: Recep Tayyip Erdoğan University.
- Kırankaya, Ş.G. and Ekmekçi, F.G. 2013. Life-History traits of the invasive population of Prussian Carp, *Carassius gibelio* (Actinopterygi: Cypriniformes: Cyprinidae), from Gelingüllü Reservoir, Yozgat, Turkey, Acta Ichthyologica et Piscatoria, 43(1):31-40. doi: 10.3750/AIP2013.43.1.05
- Kottelat, M. 1997. European freshwater fishes. Biologia, 52 (Suppl 5):1-271.
- Kottelat M. and Freyhof J. 2007. Handbook of European Freshwater Fishes. Kottelat and Freyhof, Cornol and Berlin, 646 p.
- Köse, E., Uysal, K., Tokatli, C., Çiçek, A., Emiroğlu, Ö. and Arslan N. 2012. Assessment of boron in water, sediment and fish tissues of Porsuk Stream, Turkey. Pakistan J. Zool., 44(5): 1446-1449.
- Kuru, M., Balık, S., Ustaoglu, M.R., Ünlü, E., Taşkavak, E., Gül, A., Yılmaz, M., Sarı, H.M., Küçük, F., Kutrup, B., and Hamalosmanoğlu, M. 2001. Türkiye'de bulunan sulak alanların Ramsar Sözleşmesi Balık Kriterlerine göre değerlendirilmesi projesi. T.C. Çevre Bakanlığı

- Çevre Koruma Genel Müdürlüğü, 289 pp.
- Küçük, F., Gümüş, E., Gülle, İ. and Güçlü, S. S. 2007. The fish fauna of the Göksu River (Türkiye): taxonomic and zoogeographic features. Turkish Journal of Fisheries and Aquatic Sciences, 7:53-63.
- Li, F. B. and Gui, J. F. 2007. Clonal diversity and genealogical relationships of Gibel Carp in four hatcheries, Anim Genet, 39:28-33.
- Luo, K., Xiao, J., Liu, S., Wang, J., He, W., Hu, J., Qin, Q., Zhang, C., Tao, M. and Liu, Y. 2011. Massive production of all-female diploids and triploids in the crucian carp, Int J Biol Sci, 7(4):487-495.
- Luskova, V., Lusk, S., Halacka, K. and Vetesnik, L. 2010. *Carassius auratus gibelio*-The most successful invasive fish in waters of the Czech Republic. Russian Journal of Biological Invasions, 1(3): 176-180.
- Lushchak, V.I., Luschchak, L.P., Mota, A.A. and Hermes-Lima, M. 2001. Oxidative stress and antioxidant defenses in goldfish *C. auratus* during anoxia and reoxygenation. Am J Physiol Reg, 1 280:R100-R107.
- Mendil, D., Uluözlü, Ö.D., Hasdemir, E., Tüzen, M., Sari, H. and Suiçmez, M. 2005. Determination of trace metal levels in seven fish species in lakes in Tokat, Turkey. Food Chemistry, 90:175-179. doi: 10.1016/j.foodchem.2004.03.039
- Mendil, D., and Uluözlü, Ö.D. 2007. Determination of trace metal levels in sediment and five fish species from lakes in Tokat, Turkey. Food Chemistry, 101:739-745. doi: 10.1016/j.foodchem.2006.01.050
- Nathanailides, C., Perdikaris, C., Gouva, E. and Paschos, I. 2003. Gibel Carp (*Carassius gibelio*) growth under increased ammonia concentration. In: Proceedings of the 11th Panhellenic Conference of Ichthyologists, Chania, pp 178-181 (in Greek with English abstract)
- Okgerman, H., Elp, M., Dorak, Z., Yardımcı, H.C., Yılmaz, N. and Yiğit, S. 2006. Sapanca Gölü'nün balık faunasındaki değişimler. II. Ulusal Limnoloji Çalıştayı, Sinop.
- Oymak, S.A., Ünlü, E., Parmaksız, A. and Doğan, N. 2013. Some reproductive characteristics of an invasive species *Carassius auratus* Bloch, 1782 in Atatürk Dam Lake (Turkey). 4th Aquatic Biodiversity International Conference, 2013 Sibiu / Transylvania / Romania.
- Önsoy, B., Filiz, H., Tarkan, A. S., Bilge, G. and Tarkan, A. N. 2011. Occurrence of non-native fishes in a small man-made Lake (Lake Ula, Muğla): Past, present, future perspectives. Turkish Journal of Fisheries and Aquatic Sciences, 11: 209-215.
- Özcan, G. 2008. Büyük Menderes Nehir Havzası'ndaki egzotik balık türleri ve etkileri. Türk Bilimsel Derlemeler Dergisi, 1(2):23-25.
- Özcan, G. 2013. The first occurrence of *Carassius gibelio* (Bloch, 1782) and *Carassius auratus auratus* (Linnaeus, 1758) in the Orontes River Basin (Hatay, Turkey). Water Research and Management, 3(3): 33-35.
- Özkök, R., Çubuk, H., Tümgelir, L., Uysal, R., Çınar, Ş., Küçükkara, R., Erol, K.G. and Ceylan, M. 2007. Growth features of Silver Crucian Carp (*Carassius gibelio* Bloch, 1782) population in Lake Eğirdir. Turkish Journal of Aquatic Life, 3-5,5-8, 313-322
- Özparlak, H., Arslan, G. and Arslan E. 2012. Determination of some metal levels in muscle tissue of nine fish species from Beyşehir Lake, Turkey. Turkish Journal of Fisheries and Aquatic Sciences, 12: 761-770.
- Özparlak, H. 2013. Effect of seasons on fatty acid composition and n-3/n-6 ratios of muscle lipids of some fish species in Apa Dam Lake, Turkey. Pakistan J. Zool., 45(4):1027-1033.
- Öztürk, M. O. 2010. A research on plathelminth parasites of *Carassius gibelio* (Bloch, 1782) in Lake Dam Seyitler, Afyonkarahisar. AKÜ Fen Bilimleri Dergisi, 02, 91-97.
- Özuluğ, M. 1999. A taxonomic study on the fish in the basin of Büyükçekmece Dam Lake. Turkish Journal of Zoology, 23:439-45.
- Özuluğ, M., Meriç, N. and Freyhof, J. 2004. The distribution of *Carassius gibelio* (Bloch, 1782) (Teleostei: Cyprinidae) in Thrace (Turkey). Zool. Middle East, 31: 63-66.
- Özuluğ, M., Altun, Ö. and Meriç, N. 2005. On the fish fauna of Lake İznik (Turkey). Turkish Journal of Zoology, 29:371-375.
- Paepke H.J. 1999. Bloch's Fish Collection in the Museum für Naturkunde der Humboldt Universität zu Berlin: an illustrated catalog and historical account. A.R.G. Gantner Verlag KG, Ruggel/Liechtenstein, 216 p., 32 pls.
- Perdikaris, C., Ergolavou, A., Gouva, E., Nathanailides, C., Chantzaropoulos, C. and Paschos, I. 2012. *Carassius gibelio* in Greece: the dominant naturalised invader of freshwaters. Rev Fish Biol Fisheries, 22: 17-27. doi: 10.1007/s11160-011-9216-8.
- Podlesnykh, A. V., Apalikova, O. V. and Brykov, V. A. 2012. Phylogenetic relationships of Silver Crucian Carp in *Carassius auratus* complex based on mtDNA analysis. Russian Journal of Genetics, 48(12):1207-1217.
- Polat, N. and Uğurlu, S. 2011. Samsun İli Tatlı Su Balık Faunası. Ceylan Ofset, Samsun, 272 pp.
- Rylkova, K., Kalous, L., Bohlen, J., Lamatsch, D. K and Petryl, M. 2013. Phylogeny and biogeographic history of the cyprinid fish genus *Carassius* (Teleostei: Cyprinidae) with focus on natural and anthropogenic arrivals in Europe. Aquaculture, 380-383: 13-20. doi: 10.1016/j.aquaculture.2012.11.027
- Sakai, H., Iguchi K., Yamazaki Y., Sideleva V.G. and Goto A. 2009. Morphological and mtDNA sequence studies on three crucian carps (*Carassius*: Cyprinidae) including a new stock from the Ob River system, Kazakhstan. Journal of Fish Biology, 74: 1756-1773.
- Sakai, H., Yamazaki, Y., Nazarkin, M. V., Sideleva, V. G., Chmylevsky, D. A., Iguchi, K. and Goto, A. 2011. Morphological and mtDNA sequence studies searching for the roots of Silver Crucian Carp *Carassius gibelio* (Cyprinidae) from the ponds of Sergievka Park, Saint Petersburg, Russia. Proceedings of the Zoological Institute RAS, 315(3):352-364.
- Sarı, H.M., Balık, S., Ustaoglu, M.R. and İlhan, A. 2008. Population structure, growth and mortality of *Carassius gibelio* (Bloch, 1782) in Buldan Dam Lake. Turkish Journal of Fisheries and Aquatic

- Sciences, 8:25-29.
- Şaşı, H. and Balık, S. 2003. The distribution of three exotic fishes in Anatolia, Turkish Journal of Zoology, 27: 319-322.
- Şaşı, H. and Berber S. 2013. The indigenous and invasion fishes in two main reservoirs in the Southwestern Anatolia (Aydın). Cuadernos de Investigación UNED, 5(1), Junio.
- Szczerbowski, J. A. 2001. *Carassius auratus*. In: Banarescu, P. and Paepke, H. J. (Eds.), The Freshwater Fishes of Europe, Vol. 5. Cyprinidae-2, Part III Carassius to Cyprinus: Gasterosteidae. Germany, p 5-41.
- Takada M., Tachihara K., Kon T., Yamamoto G., Iguchi K., Miya M. and Nishida M. 2010. Biogeography and evolution of the *Carassius auratus*-complex in East Asia. BMC Evolutionary Biology, 10: 7.
- Tarkan, A. S., Gaygusuz, Ö., Acıpinar, H., Gürsoy, Ç. and Özuluğ, M. 2006a. Length–weight relationship of fishes from the Marmara Region (NW-Turkey). J. Appl. Ichthyol. 22, 271–273.
- Tarkan, A. S., Gaygusuz, Ö., Gürsoy, Ç., Acıpinar, H. and Bilge G. 2006b. A new predator species *Carassius gibelio* (Bloch, 1782) in Marmara Region: succesful or not. 1. Balıklandırma ve Rezervuar Yönetimi Sempozyumu, Antalya, 195-204.
- Tarkan, A. N., Gaygusuz, Ö., Tarkan, A. S., Gürsoy, Ç. and Acıpinar, H. 2007. Interannual variability of fecundity and egg size of an invasive cyprinid, *Carassius gibelio*: effects of density-dependent and density-independent factors. Journal of Freshwater Ecology, 22(1): 11-17.
- Tarkan, A.S., Copp, G.H., Top, N., Özdemir, N., Önsoy, B., Bilge, G., Filiz H., et al. 2012a. Are introduced Gibel Carp *Carassius gibelio* in Turkey more invasive in artificial than in natural waters?. Fisheries Management and Ecology, 19(2):178-187.
- Tarkan, A. S., Gaygusuz, Ö., Gürsoy, Gaygusuz, Ç., Saç, G. and Copp, G. H. 2012b. Circumstantial evidence of Gibel Carp, *Carassius gibelio*, reproductive competition exerted on native fish species in a mesotrophic reservoir. Fisheries Management and Ecology, 19, 167–177.
- Uğurlu, S. and Polat, N. 2005. Suat Uğurlu Baraj Gölü ile Terice ve Göksu Deresi balıkları, Süleyman Demirel Üniversitesi Eğirdir Su Ürünleri Fakültesi Dergisi, 1 (2): 27-37.
- Uğurlu, S. and Polat, N. 2007. Samsun İli tatlı su kaynaklarında yaşayan egzotik balık türleri, Journal of FisheriesSciences.com, 1(3): 139-151.
- Ünlü, E. 2006. Tigris River Ichthyological Studies in Turkey. A review with regard to the Ilisu Hydroelectric Project. IlisuconsortiumIlisu Damand hepp environmental impactanswers to the ECA's matrix “ Questions / Comments/ Open Issues : UEIAR and EAP ”.
- Ünlü, E. 2013. Çevresel etkilerin Dicle Nehri balık türleri üzerine etkileri. In: Haspolat et al. (Ed.), Diyarbakır Yerüstü Kaynakları 1, Diyarbakır, p 318-332.
- Yeğen, V., Balık, S., Bostan, H., Uysal, R. and Bilçen, E. 2006b. Göller Bölgesi'ndeki bazı göl ve baraj göllerinin balık faunalarının son durumu, I. Ulusal Balıklandırma ve Rezervuar Yönetimi Sempozyumu, Antalya, 129-139.
- Yeğen, V., Balık, S., Ustaoglu, M.R., Sarı, H.M., İlhan, A., Uysal, R., Bostan, H., Bilçen, E. and Yağcı, A. 2006a. Göller Bölgesi balık faunasının tespiti projesi sonuç raporu, Eğirdir Su Ürünleri Araştırma Enstitüsü Müdürlüğü, Project No: Tagem/Haysüd/2001/09/02/01.
- Yeğen, V., Balık, S., Bilçen, E., Sarı, H. M., Uysal, R. and Yağcı, A. 2008. Denizli İli akarsularında yayılım gösteren balık türleri ve bölgedeki dağılımları, Journal of FisheriesSciences.com, 2(3): 301-311.
- Yeğen, V., Uysal, R., Bostan, H., Cesur, M., Çetinkaya, S., Yağcı, A., Yağcı (Apaydın), M., Bilgin, F. and Dölcü, B. 2012. Bilecik, Eskişehir, Kütahya ve Uşak illeri balık faunasının tespiti projesi sonuç raporu. G.T.H.B. Akdeniz Su Ürünleri Araştırma Üretme ve Eğitim Enstitüsü Müdürlüğü.
- Yılmaz, M., Yılmaz, S., Bostancı, D. and Polat, N. 2007. Bafra Balık Gölleri'nde yaşayan havuz balığı (*Carassius gibelio*, Bloch 1782)'nın beslenme rejimi. Journal of FisheriesSciences.com, 1(2):48-57.
- Zengin, M., Yerli S.V., Dağtekin, M. and Akpınar Özcan, İ. 2012. Son yirmi yılda Çıldır Gölü balıkçılığında meydana gelen değişimler. SDÜ Eğirdir Su Ürünleri Fakültesi Dergisi, Sempozyum Özel Sayısı, 8(2):10-24.
- Zhu, X., Xie, S., Zou, Z., Lei, W., Cui, Y., Yang, Y. and Wootton, R. J. 2004. Compensatory growth and food consumption in gibel carp, *Carassius auratus gibelio*, and Chinese longsnout catfish *Leiocassis longirostris*, experiencing cycles of feed deprivation and re-feeding. Aquaculture, 241: 235-247. doi:10.1016/j.aquaculture.2004.07.027