

New Data on the Distribution and Conservation Status of the Two Endemic Scrapers in the Turkish Mediterranean Sea Drainages (Teleostei: Cyprinidae)

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Abstract

In the scope of this study, exact distribution of the two endemic *Capoeta* species in the Turkish Mediterranean Sea drainages was presented. Fishes were caught with pulsed DC electro-fishing equipment from 28 sampling sites throughout Turkish Mediterranean Sea drainages between Göksu River and stream Boğa. The findings of the study demonstrate that *Capoeta antalyensis* inhabits in Köprüçay and Aksu rivers, and streams Boğa and Gündoğdu, all around Antalya. *Capoeta caelestis* widely distributed in coastal stream and rivers between Stream Dim (Alanya) in the west and Göksu River (Silifke) in the east. Metric and meristic characters were collected from the fish samples which obtained in the field for *Capoeta caelestis* and *Capoeta antalyensis*, and museum material for *Capoeta damascina*. In this way, morphologic features of the species revealed and *Capoeta caelestis* compared with *Capoeta damascina* to remove the hesitations about the validity of the species. The conservation status of *Capoeta antalyensis* was recommended to uplist from Vulnerable to Endangered.

Keywords: Freshwater Fish Species; Anatolia; Pisces; *Capoeta antalyensis*; *C. caelestis*

Introduction

Capoeta is one of the most widespread genus in Anatolia. The diversity in the genus in Turkey has been studied intensively in the last 15 years by the both molecular and taxonomic studies [1-15]. Among these studies, Turan [5] examined mitochondrial 16S rDNA

gene sequences in order to reassess the taxonomic status of *Capoeta* species in Anatolia. According to his findings; *C. antalyensis*, *C. barroisi*, *C. damascina*, *C. pestai*, *C. tinca* and *C. trutta* are valid species, as well as there are four subspecies of *C. capoeta* (*C. c. angorae*, *C. c. bergamae*, *C. c. capoeta* and *C. c. sieboldii*). Turan [5] also suggested that Göksu River and Dalaman Stream populations are belong

to two new species that have not yet been named. Subsequently, Schöter, et al. [7] identified Göksu River populations as *C. caelestis*. Recently, Dalaman River populations have been identified as *C. aydinensis* with populations inhabit in Tersakan, Namnam and Büyük Menderes River [4]. Alwan [15] and Alwan, et al. [16] conclusively demonstrated that *C. angorae* from the Seyhan and Ceyhan is a synonym of *C. damascina*, this view also supported by following molecular and taxonomic studies [4,9,11-13,17].

Küçük & Güçlü [18] reported *C. antalyensis* between Peri Village (near Gündoğdu-Manavgat, Antalya) and stream Boğa (almost the westernmost side of the Antalya city).

According to the studies mentioned above, *Capoeta antalyensis* is known from stream and rivers around Antalya, and *C. caelestis* is known from Göksu River (near Silifke, Mersin) where it was described first and some coastal streams between Antalya and Göksu River. Here, we checked streams and rivers draining to Turkish Mediterranean Sea to determine the exact distribution range of the both species.

On the other hand, Özdemir [10] reported that *Capoeta caelestis* is taxonomically close to *C. damascina* and there is confusion in the taxonomic situation of this species. Her claim triggered us to evaluate the taxonomic validity of *C. caelestis* and compare it with *C. damascina*.

Material and Methods

Fishes were caught with pulsed DC electro-fishing equipment from 28 sampling sites throughout Turkish Mediterranean Sea drainages between Göksu River and stream Boğa (Figure 1 & Table 1). After anesthesia, fish samples were fixed in 4% formalin and transferred to the laboratory for classify at species level. Measurements were made using a dial calliper (0.1 mm). All measurements were made point-to-point, never by projections. Meristic counts and measurements follow Kottelat & Freyhof [19] and Kaya [14]. The map (Figure 1) was created using the Qgis v. 2.6.1-Brighton software available at <http://divagis.org>.

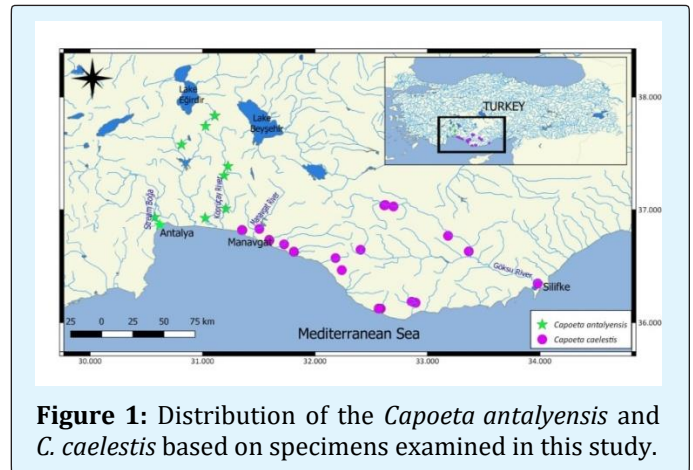


Figure 1: Distribution of the *Capoeta antalyensis* and *C. caelestis* based on specimens examined in this study.

Catalog number	Sampling sites	Coordinates	N	Sampling date	
<i>Capoeta caelestis</i>					
IFC-ESUF	03-0018	Göksu River at Yelmez	37.039444, 32.616111	4	10.10.2004
	03-0084	Göksu River at Hamamköy-	36.631389, 33.367778	12	26.06.2012
	03-0020	Göksu River at near Dülgerler	37.029167, 32.697778	57	10.10.2004
	03-0046	Stream Gevne at Çayarası	36.645833, 32.405000	5	18.10.2009
	03-0003	Manavgat River at 7 km northeast Manavgat	36.830556, 31.504167	N	14.10.1995
	03-0006	Stream Karpuz at Hacıobası	36.728889, 31.593333	9	25.05.1995
	03-0028	Stream Alara at Çakallar	36.693611, 31.724444	4	13.10.1995
	03-0047	Stream Ilıca -at Ilıca	36.818611, 31.353056	2	02.05.2009
	03-0044	Stream Dragon (Anamur)-at Alaköprü	36.175833, 32.895000	13	17.06.2008
	03-0045	Stream Karpuz at Hacıobası	36.728889, 31.593333	2	18.10.2009
	03-0048	Stream Kaledran at Anıtlı	36.123333, 32.584444	4	17.06.2008
	03-0114	Stream Kargı at northern Türkler	36.624940, 31.813196	5	18.06.2008
	03-0120	Stream Kargı at northern Türkler	36.624940, 31.813196	4	15.10.1995
FFR	1962	Stream Güneybahşiş at Güneybahşiş	36.185000, 32.859000	27	24.03.2019
	1964	Stream Sapadere at north of Beyreli	36.465007, 32.237990	7	25.03.2019
	1965	Kaledran Çayı western Anıtlı	36.122000, 32.570000	6	26.03.2019
	1966	Göksu River at 5 km southeast Silifke	36.346611, 33.980613	10	24.03.2019

	1967	Stream Dim at west of Üzümlü	36.572002, 32.182004	8	25.03.2019
	1922	Göksu River at Yağcı	37.042117, 32.625608	8	10.10.2004
	1943	Göksu River at Göksu	36.769517, 33.183086	14	10.11.2016
<i>Capoeta antalyensis</i>					
IFC-ESUF	03-0007	Köprüçay River	37.741944, 31.025556	13	15.10.2003
	03-0008	Köprüçay at west of Sağırin	37.010278, 31.205556	6	18.05.1996
	03-0009	Köprüçay, at Başpınar	37.833056, 31.108889	6	15.05.1996
	03-0010	Kayaburnu bridge at Kayaburnu	36.926881, 31.022211	2	31.05.1998
	03-0011	Köprüçay River at Çaltepe,	37.302222, 31.190833	4	15.09.1996
	03-0029	Köprüçay River at Başpınar	37.833056, 31.108889	9	15.10.2003
	03-0030	Stream Boğa at Antalya	36.865556, 30.618611	1	09.05.2004
	03-0031	Stream Kovada (Aksu) at southwest of Aşağıgökdere	37.576785, 30.812212	23	20.08.2014
	03-0040	Köprüçay River at Değirmenözü	37.385556, 31.225278	1	19.06.2008
	03-0113	Stream Karaman at northwest of Antalya	36.933889, 30.574167	4	22.05.2010

Table 1: Sampling sites in the studied area.

Comparative Material

Capoeta damascina: FFR 01887, 15, 102-230 mm SL; Gaziantep, Islahiye; Orontes River, stream Karasu, 07.06.2014, 36.853, 36.687. FFR 01881, 25, 74-187 mm SL; Hatay, Serinyol; Orontes River, stream Serinyol,

07.06.2014, 36.365, 36.214.

Results

Metric and meristic characters of *Capoeta antalyensis*, *C. caelestis* and *C. damascina* were given in Tables 2&3.

	<i>C. antalyensis</i> , n=18			<i>C. caelestis</i> , n=20			<i>C. damascina</i> , n=10		
	range	mean	SD	range	mean	SD	range	mean	SD
Standard length (mm)	115-199	146.1	28.8	113-177	130.7	15.4	148-208	171.8	22
%Standard length									
Head length	23.5-24.8	24.1	0.5	23.5-26.2	24.9	0.7	21.8-24.0	23.1	0.7
Body depth at dorsal-fin origin	23.0-25.4	24.1	0.6	23.3-27.1	24.9	1	23.8-26.7	25.2	0.9
Body depth at anal-fin origin	17.0-18.7	17.7	0.6	16.8-18.2	17.5	0.4	16.1-17.3	16.6	0.4
Depth of caudal peduncle	11.1-12.2	11.5	0.3	10.4-12.2	11.2	0.5	10.7-11.7	11.2	0.4
Length of caudal peduncle	17.0-19.0	18	0.6	16.0-19.2	17.9	0.9	17.5-19.1	18.5	0.6
Head width at interorbital region	11.9-13.1	12.6	0.4	11.8-13.8	13.2	0.5	11.3-13.3	12.5	0.7
Head width at nape	14.7-16.1	15.3	0.5	13.7-17.0	15.9	0.7	13.9-16.	15.3	0.7
Head depth at interorbital region	12.4-13.7	13.1	0.4	12.6-14.0	13.2	0.4	10.9-13.0	12.3	0.7
Head depth at nape	16.3-17.8	17.1	0.4	16.7-18.6	17.5	0.5	15.1-17.0	16.5	0.6
Snout width	9.4-10.6	10	0.4	9.7-11.2	10.5	0.4	8.3-10.2	9.7	0.7
Snout depth	8.4-9.7	9.2	0.4	8.9-10.2	9.5	0.4	8.1-9.5	9	0.5
Eye diameter	3.7-5.2	4.5	0.4	3.7-5.6	5	0.5	3.4-4.4	4	0.4
Snout length	9.0-9.8	9.4	0.3	9.4-10.2	9.8	0.2	8.6-9.5	9	0.3
Postorbital distance	10.8-12.1	11.3	0.4	10.4-12.4	11.2	0.5	10.5-11.7	11.1	0.5
Interorbital width	8.6-9.9	9.2	0.4	8.8-10.1	9.5	0.4	9.1-10.5	9.8	0.5
Width of mouth gape	6.7-9.0	7.9	0.7	7.3-9.7	8.6	0.7	5.5-8.1	7	1
Length of maxillary barbel	2.4-4.4	3.6	0.5	4.0-5.7	4.9	0.5	2.9-3.7	3.3	0.3
Predorsal length	49.7-52.4	51.4	0.9	51.4-54.8	53	1	48.9-51.	50.2	0.8
Prepelvic length	54.0-57.0	55.2	0.8	52.2-56.3	54.4	1.2	51.0-54.1	52.7	0.9
Postdorsal length	35.4-39.8	37.5	1.3	34.0-40.2	37	1.9	37.8-41.5	39.7	1.3
Preanal length	75.7-80.1	77.7	1.4	74.4-78.4	76.5	1.2	74.7-76.	75.8	0.7
Distance between pectoral and anal fins	54.4-59.2	56.8	1.6	51.8-58.0	54.5	1.4	52.2-57.8	55.5	1.9

Distance between pectoral and pelvic fins	32.3-36.4	33.7	1.2	30.3-34.9	32	1.2	29.8-34.4	31.8	1.7
Distance between pelvic and anal fins	21.9-26.8	23.9	1.4	21.4-24.5	23	0.7	23.0-26.0	24.9	1.1
Height of dorsal-fin	17.4-20.3	18.7	0.8	17.9-22.9	20.3	1.2	19.1-23.4	20.9	1.4
Length of dorsal-fin base	12.4-13.5	13	0.4	12.5-14.4	13.6	0.6	13.4-15.6	14.6	0.8
Length of pectoral-fin	17.6-19.6	18.6	0.7	19.0-22.8	21.3	1.1	18.6-20.9	19.5	0.7
Length of pelvic-fin	15.3-17.3	16.3	0.6	15.3-20.1	17.8	1.1	15.9-18.6	17.1	0.9
Height of anal-fin	15.1-19.8	17.7	1.3	15.5-21.7	19	1.7	17.5-19.8	18.6	0.8
Length of anal-fin base	6.6-8.7	7.5	0.6	6.7-8.9	7.8	0.5	6.4-8.2	7.3	0.5
Length of upper caudal-fin lobe	23.3-28.4	26.1	1.5	26.2-32.6	29.1	1.3	24.6-28.7	26.4	1.2
Length of median caudal-fin rays	11.4-14.3	13.1	0.5	11.2-12.9	12.1	0.4	12.1-13.8	12.8	0.6

Table 2: Morphometry of *Capoeta antalyensis*, *C. caelestis* and *C. damascina*.

Capoeta antalyensis (Battalgil, 1944) - Pamphylian scraper

Capoeta antalyensis was described by Battalgil [20] as *Varicorhinus antalyensis* from Antalya. Karaman [21] examined the specimens belonging to this species and claimed that it is synonym of *Hemigrammocapoeta kemali*. In order to eliminate this uncertainty, Erkanan & Kuru [22] compared the samples from streams Aksu and Köprüçay with *H. kemali* and named them as *Capoeta antalyensis* [20].

The species characterized by having two pairs barbel, comparatively large scales (51-57 lateral line scales), less gill rakers on the first gill arch (14-17), a very weak last unbranched dorsal-fin ray (ossified 8-18%) and the absence of serrae along the posterior margin of the last unbranched dorsal-fin ray (Figure 2).



Figure 2: *Capoeta antalyensis*, Antalya, stream Karaman.

• Distribution

The species found from Köprüçay and Aksu rivers and streams Boğa and Gündoğdu, all around Antalya (Table 1 & Figure 1).

• Habitat

The species prefer fast flowing rivers and larger streams with gravel or rocky substrates. However, it is also known in dam lakes on Aksu River.

Capoeta caelestis Schöter, Özuluğ & Freyhof, 2009 - Taurus scraper

The species characterized by having 57-67 lateral line scales, one pair of barbel, 17-21 gill rakers on the first gill arch, a weak last unbranched dorsal-fin ray (ossified % 32-50) and the absence of serrae along the posterior margin of the last unbranched dorsal-fin ray (Figure 3).



Figure 3: *Capoeta caelestis*, Mersin, Silifke; Göksu River.

• Distribution

Capoeta caelestis inhabits coastal stream and rivers between Alanya (Mersin) in west and Silifke (Mersin) in east (Table 1 & Figure 1).

• Habitat

The species is generally preferring gravel substrate and often being the only fish species in its habitat.

Discussion and Suggestion

The findings of this study demonstrate that *Capoeta antalyensis* and *Capoeta caelestis* inhabits very close geographically. *Capoeta caelestis* is distinguished from *Capoeta antalyensis* by having one pair barbels (vs. two pairs), more lateral line scales (57-67, vs. 51-57) and more gill rakers on the first gill arch (17-21, vs. 14-17) (Table 3). Additionally, it was reported that there are 4.14%

differences in cyt b gene sequences between *C. caelestis* and *C. antalyensis* [11].

		Lateral-line scales																										
	n	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	mean
<i>C. antalyensis</i>	20	1	3	6	2	5	2	1																				53.9
<i>C. caelestis</i>	20							1	1	1	4	2	4	3	3	1												61.5
<i>C. damascina</i>	16																1		1	1	2	2	3	1	1	3	1	71.8
		Transversal scales																										
	n	Between dorsal-fin and lateral line							Between anal-fin and lateral line					Number of gill rakers														
	n	10	11	12	13	14	15	mean	7	8	9	10	mean	14	15	16	17	18	19	20	21	22	23	24	25	mean		
<i>C. antalyensis</i>	20	2	13	5				11.2	20				7	2	6	10	2									15.6		
<i>C. caelestis</i>	20		10	7	3			11.7	13	7			7.4				2	6	5	4	3				19			
<i>C. damascina</i>	16			2	9	4	1	13.3		2	13	1	8.9							1	4	5	3	1	2	22.3		

Table 3: Frequency distribution of meristic features of the species of *Capoeta antalyensis*, *C. caelestis* and *C. damascina*.

There are two main habitats of *Capoeta antalyensis*. The first one is Aksu River which is massively polluted by household waste of Isparta city. In addition to these reservoirs there is also a regulator. Reservoirs seriously affect fish species, because they are lentic water systems. The regulator leaves the water of the river bed completely to agricultural areas. In this case, the *Capoeta antalyensis* population on the Aksu River is quite critical. There are two huge reservoirs in the middle section of the river which causing significant changes on the water level and habitat. Besides, these reservoirs affect the fish species seriously, because they hold water in irrigation. In this case, we can say that *Capoeta antalyensis* populations in the Aksu River are in quite critical.

The second river is Köprüçay which is faced with environmental pollution in upper part. However, the situation seems to be slightly better than Aksu River. In recent years, because of the activities of marble and quarry cement-derived substances are mixed with the river. These activities have led to mass fish deaths in the river several times. The habitat between the Köprülü canyon and the DSİ Aspendos regulator remains a suitable habitat for *Capoeta antalyensis*.

Freyhof [23] emphasized the situation of the both Aksu and Köprüçay. Accordingly, he assessed the conservation status of the species as Vulnerable. However, our recent observation in the field shows that the situation is worse and -at least for now- there is not any solution to protect the species. Therefore, we are

recommending moving conservation status of the species from Vulnerable to Endangered.

Freyhof [23] mentioned that several populations of *C. antalyensis* seem to be impacted by (natural) hybridization with *Capoeta caelestis*. Geiger, et al. [17] supported this opinion with molecular data. This opinion triggered us to compare the specimens accordingly. Our comparisons show that all of populations located west of stream Gündoğdu (36.850182, 31.290019) belong to *Capoeta antalyensis*. It has been observed that there are some variations in terms of meristic features (such as lateral line scales and number of barbels which are diagnostically important for the both species in the region) among the specimens which are distributed in the region between Ilica and Kargı streams. In order to solve this problem exactly, detailed morphological and molecular studies are needed.

Freyhof [24] emphasized that *Capoeta caelestis* is relatively resistant against most threats despite it has a relatively small distribution range. Besides, he remarked that the species has more than 10 independent populations and it is not believed to has declined fast enough to qualify for a threat category or "Near Threatened". Therefore, he assessed the conservation status of the species as "Least Concern". In this study, we found the species from 18 different locations and at least 12 independent water sources. Our findings very similar to the result of Freyhof [24]. Therefore, we agree about the conservation status of the species as "Least Concern" by following Freyhof [24].



Figure 4: *Capoeta damascina*, Gaziantep, Orontes River, stream Karasu.

Özdemir [10] claimed that *Capoeta caelestis* is taxonomically close to *C. damascina* (Figure 4) and there is confusion in the taxonomic situation of this species. According to our comparison, *Capoeta caelestis* is distinguished from *C. damascina* by having weaker last unbranched dorsal-fin ray (ossified 32-50%, vs. 50-75%) and the absence of serrae along the posterior margin of it (vs. presence). Besides, *C. caelestis* has less lateral line scales than *C. damascina* (57-67, vs. 66-76), less scale rows between lateral line and anal fin origin (7-8, vs. 8-12) and fewer gill rakers on the first gill arch (17-21, vs. 20-25) (Table 3). Additionally, it was reported that there are 2% differences in cyt b gene sequences between *C. caelestis* and *C. damascina* [11].

These results show that the both species are well separated from each other by both molecular and morphological data. Therefore, there is not any confusion about the validity of *C. caelestis* as Özdemir [10] mentioned.

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