



Two New Species of *Chondrostoma* Agassiz, 1832 (Teleostei: Cyprinidae) from the Ceyhan, Seyhan and Göksu Rivers in the East Mediterranean Region of Turkey

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Abstract

Chondrostoma toros sp.n. was described from the Göksu River. It was distinguished by a slightly arched lower jaw with a well-developed keratinized edge; a slightly developed keel in front of the dorsal-fin origin; lateral line with 56–64+1–3 scales; and 25–30 gill-rakers on outer side of first gill arch. *Chondrostoma ceyhanensis* sp.n. was described from Ceyhan, Seyhan and Berdan rivers. It was distinguished by its arched lower jaw with a slightly developed keratinized edge; a slightly developed keel between pelvic-fin and anus; lateral line with 59–66+1–3 scales; and 24–29 short gill-rakers on outer side of first gill arch.

Keywords: *Chondrostoma*, taxonomy, Turkey inland water fish, Turkey rivers.

Introduction

The genus *Chondrostoma* is reported throughout south and central Europe, from the Atlantic to the Caspian Sea, from the Mediterranean to the Baltic Sea (Durand *et al.*, 2003; Kottelat and Freyhof, 2007). The genus is also distributed in Asia Minor, the Caucasus, and Mesopotamia (Elvira, 1997; Durand *et al.*, 2003). Durand *et al.* (2003), in their studies of the origin and phylogenetic relationships of the genus *Chondrostoma*, have determined two main branches composed of the Danube (Susurluk, Aras, Tigris, the Euphrates, Orontes and Seyhan rivers) and Aegean-Macedo-Anatolian (Meriç, Gediz, Bakırçay, and Büyük Menderes rivers) in Turkey's inland waters. Çiftci *et al.* (2015) have also obtained similar results in their studies.

According to Elvira (1997), mainly allopatric speciation is observed in *Chondrostoma* Robalo *et al.* (2007), having fully resolved phylogeny based on Bayesian inference using five mitochondrial genes and one nuclear gene, suggests that traditional taxonomy is questionable. It relies on characteristics like those related to rasping mode of feeding, which seems to have evolved several times. Küçük *et al.* (2013) pointed out that the systematics of *Chondrostoma* are difficult to understand by traditional methods, and morphometric characters, as well as molecular and osteological (jaw bones that shape the mouth) characters may be key to finding a

solution.

The genus is composed of 27 species according to the same study based on osteological and morphological characters (Bogutskaya, 1997; Durand *et al.*, 2003; Elvira, 1997; Robalo *et al.*, 2007), and according to the most recent ichthyofaunal records, 10 of these species are distributed in Turkish inland waters (Krupp, 1985; Küçük *et al.*, 2007; Freyhof and Özuluğ, 2009; Küçük *et al.*, 2013; Kuru *et al.*, 2014): *Chondrostoma angorense* Elvira, 1987 (Kızıllırmak and Sakarya rivers), *Chondrostoma beysehırense*, Bogutskaya, 1997 (Beyşehir Lake), *Chondrostoma colchicum* Derjugin, 1899 (Yeşilırmak and Çoruh rivers), *Chondrostoma cyri* Kessler, 1877 (Kura and Aras rivers), *Chondrostoma fahirae* (Ladiges, 1960) (Dalaman Stream basin-Tefenni), *Chondrostoma holmwoodii* (Boulenger, 1896) (Gediz River and Bakırçay Stream), *Chondrostoma kinzelbachi* Krupp, 1985 (Orontes River), *Chondrostoma meandrense* Elvira, 1987 (Büyük Menderes River), *Chondrostoma regium* (Heckel, 1843) (Göksu, Seyhan, Ceyhan, Kuveik, Tigris and Euphrates rivers) and *Chondrostoma vardarense* Karaman, 1928 (Meriç River) (Figure 1). Çiçek *et al.* (2015), in addition to these species, added *Chondrostoma nasus*. However, it has been known for a long time that this species lives in the Black Sea basin and Europe, not in Turkey (Kottelat and Freyhof, 2007).

Geiger *et al.* (2014), in the molecular (COI gene) study of 498 freshwater fish species in 23 eco-regions

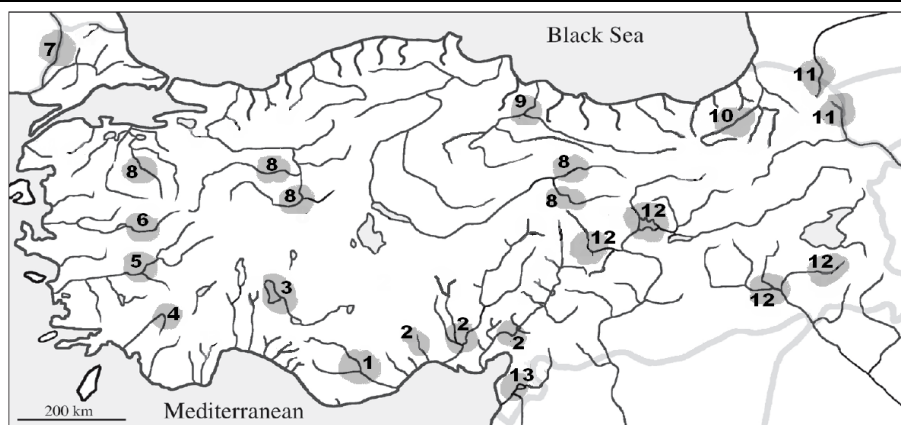


Figure 1. Distribution of *Chondrostoma* species in Turkey (1: *C. toros*, 2: *C. ceyhanensis*, 3: *C. beysehriense*, 4: *C. fahirae*, 5: *C. meandrense*, 6: *C. holmwoodii*, 7: *C. vardarensis*, 8: *C. angorensis*, 9: *C. cf. angorensis*, 10: *C. colchicum*, 11, *C. cyri*, 12, *C. regium*, 13: *C. kinzelbachi*).

of the Mediterranean; *Chondrostoma fahirae* (Tefenni Burdur) has identified to separate branch. In the study; *Achondrostoma*, *Iberochondrostoma*, *Pseudochondrostoma*, *Parachondrostoma* and *Protochondrostoma* (Western Mediterranean Region) have been shown to be closely related to *Chondrostoma*. In addition to the *Chondrostoma* species present in the eastern Mediterranean region, which is also included in Turkey, three new *Chondrostoma* species have been recorded from Ceyhan and Seyhan, Göksu and B.Menderes rivers. In the conclusion of the study, although molecular markers and species will be more easily identified, it has been stated that morphological differences should not be neglected. In this paper we discussed taxonomic statue of *Chondrostoma regium* species group earlier known to be from Eastern Mediterranean (Ceyhan, Seyhan, Berdan and Göksu rivers) and Euphrates and Tigris rivers of Turkey (Figure 1). The type locality of *C. regium* is Tigris, Kuveik and Orontes rivers (Heckel, 1843). We morphologically compared *Chondrostoma regium* from Tigris and Euphrates rivers to ones from Ceyhan, Seyhan, Berdan and Göksu rivers as well as Orontes River and Lake Beyşehir, and concluded that they are two distinct, unnamed species as suggested by Geiger *et al.* (2014) and Küçük *et al.* (2013), that we describe here as *Chondrostoma ceyhanensis* sp.n. from Ceyhan, Seyhan and Berdan rivers, and *Chondrostoma toros* sp.n. from Göksu River.

Materials and Methods

Fish specimens were collected by pulsed DC electrofishing equipment, killed by over-anesthetization (0.5 ml/l phenoxyethanol) and fixed in 6-7% formalin. Material was deposited in: IFC-ESUF, Inland Fishes Collection, Eğirdir Fisheries Faculty of Süleyman Demirel University, Turkey. The Kottelat and Freyhof method (2007) was followed in counts and measurements. All measurements were point to point, made with a dial caliper and recorded at 0.1

mm precision. Other metrics include head width₁ (the width of the interorbital area), head width₂ (head width at the nape), head depth₁ (head depth through the eye), head depth₂ (head depth at the nape), and the snout width (measured at the level of the nostrils). Lateral line scales were counted until the posterior extremity of the hypural complex; scales in lateral series were counted along the mid-lateral line from the first one to touch the shoulder girdle to the last scale at the end of the hypural complex; scales on the caudal fin itself were indicated by "+"; the last two branched dorsal and anal fin rays articulating on a single pterygiophore were counted as 1½. Vertebral counts were obtained from radiographs and counted as total, pre-dorsal, abdominal and caudal vertebrae following Naseka (1996). Osteological preparations were made after clearing and based on the drawings by Bogutskaya (1996).

Results

Chondrostoma toros, a new species

(Figure 2-Figure 3)

Holotype: IFC-ESUF 03-1555, 142.76 mm SL; Turkey: Mersin (İçel) Prov.: Mut County, Hamamköy Village, Göksu River, 36°37'51.74"N-33°22'03.18" E, F. Küçük, S.S.Güçlü, & İ. Gülle, 04 July 2010.

Paratypes: IFC-ESUF 03-1547, 34, 54.95–163.77 mm SL; same locality as holotype; F. Küçük, S.S.Güçlü, & İ. Gülle, 04 July 2010. – IFC-ESUF 03-1554, 10, 142.37–189.92 mm SL; Turkey: Mersin Prov.: Silifke, Eustarin Zone, Göksu River drainage; F. Küçük & İ. Gülle, 21 June 2014.

Diagnosis: *Chondrostoma toros* sp.n. is distinguished from all the described species of *Chondrostoma* in Eastern Mediterranean and Central Anatolia region in Turkey by the combination of the following characters: head somewhat long (its length 20–23% SL); mouth slightly arched wide (its width of mouth gape 24–28% HL); lower jaw slightly arched, with a well-developed keratinized edge; snout with slightly pointed tip; isthmus lobe thin and straight;



Figure 2. *Chondrostoma toros*, IFC-ESUF 03-1555, 142.76 mm SL; Mersin Prov.: Mut County, Hamamköy Village, Göksu River (Holotype).



Figure 3. *Chondrostoma toros*, IFC-ESUF 03-1554, 161.71 mm SL; Mersin Prov.: Göksu River mouth- Silifke.

body slightly deep (its depth at dorsal-fin origin 23–27% SL); a slightly developed keel in front of the dorsal fin origin; dorsal-fin origin clearly vertical to pelvic-fin origin; lateral line with 56–64+1–3 scales; 10–11 scales rows between lateral line and dorsal-fin origin; 4–6 scale rows between lateral line and pelvic-fin origin; 25–30 gill rakers on outer side of first gill arch; total vertebrae 47, abdominal vertebrae 27 and caudal vertebrae 20.

Description: General appearance is shown in Figure 2–Figure 3; morphometric and meristic data are given in Table 1, Table 3 and Table 4. The head is somewhat long, its dorsal profile concave in interorbital area and slightly concave at level of nostrils. The snout somewhat long and its length 29–34% HL, mean 32.1, with slightly rounded tip. The mouth inferior and slightly arched; the posterior extremity of upper jaw clearly in front of anterior eye margin. The lower jaw relatively long, and the lower jaw-quadrate junction on vertical through focus of pupil. The isthmus lobe thin and straight (Figure 4a). The body slightly deep and somewhat compressed laterally. The dorsal profile of body slightly convex or straight, and the ventral profile more convex than the dorsal profile. Presence of a slightly developed keel in front of the dorsal-fin origin. The caudal-peduncle slender, and its depth about 0.5–0.6 times in its length. The dorsal-fin origin vertical to pelvic-fin origin.

The lateral line with 56 (2), 57 (2), 58 (2), 59 (3), 60 (1), 61 (4), 62 (3) and 64 (1) scales; 10 (16) and 11 (6) scale rows between lateral line and dorsal-fin origin; 4 (8), 5 (5) and 6 (9) scale rows are between lateral line and pelvic-fin origin. 25–30 gill rakers on outer side of first gill arch (Table 4). The

dorsal fin with 3–4 simple, 8½ (1), 9½ (16) and 10½ (1) branched rays and the outer margin slightly concave. The anal fin with 3 simple, 9½ (5), 10½ (12) and 11½ (1) branched rays and the outer margin concave. The caudal fin deeply forked, the upper lobe pointed and the lower lobe somewhat rounded. There is a dorsal crest on the caudal peduncle. The outer margin of pectoral fin is straight. The outer margin of pelvic fin clearly rounded. The nucleus of the scales between the lateral line and the dorsal fin closer to the anterior edge, posterior radii well-developed, and a narrow angle between the anterior edge and nucleus (Figure 5a). The pharyngeal teeth formula 6–6, markedly large-tipped and knife shaped.

The premaxilla deep, the anterior process short and the posterior process slender. The maxilla short and large, and its lower front is serrated. The dentary elongated, in front of arch by 90 degrees and the outer margin cavity, caronoid process inclined forward. The hyomandibular bone short and wide, the outer margin of quadrate rounded (Figure 6a).

Sexual dimorphism: There are tubercles on head and pectoral girdle in males during the reproductive period, which is between April and June.

Coloration: In live individuals: the color silvery on back and flank, yellowish on belly. In formalin-preserved specimens: the color light greenish on back and flank, belly silvery. All fins are yellowish. Hyaline and membranes of dorsal, anal, pelvic and pectoral fins are unpigmented. The outer margin of caudal fin with a thin black band. The peritoneal membrane is black.

Distribution: *Chondrostoma toros* is presently known only to be from the Göksu River. This river is located in the Central Taurus Mountains and is about

Table 1. Morphometry of *Chondrostoma toros* (Holotype IFC-ESUF 03-1555, paratypes IFC-ESUF 03-1547, n=22) and *Chondrostoma ceyhanensis* (Holotype IFC-ESUF 03-1556, paratypes IFC-ESUF 03-1545, n=25)

	<i>C.toros</i>		<i>C.ceyhanensis</i>		
	Göksu River		Ceyhan River		Seyhan River
	Holotype	Paratypes (n=22)	Holotype	Paratypes (n=14)	Paratypes (n=11)
SL (mm)	142.76	54.9-163.8	208.49	191.8-264.8	161.17-202.77
In percent of standard length					
Head length	21.73	22.1 (19.9-23.2)	19.91	20.3 (19.7-21.4)	20.2 (19.0-21.0)
Body depth	25.27	24.5 (23.3-26.7)	23.57	23.2 (21.3-24.5)	22.3 (20.9-24.2)
Predorsal distance	51.71	51.8 (49.9-53.1)	50.40	50.4 (48.5-52.0)	50.9 (49.2-52.9)
Prepelvic distance	52.36	53.5 (52.3-55.0)	50.83	51.3 (50.5-52.6)	51.4 (50.6-52.7)
Prenal distance	71.99	73.3 (71.9-75.2)	73.46	72.7 (69.9-75.3)	71.8 (70.5-72.5)
Pectoral-fin origin to anal fin	51.44	51.5 (49.4-53.1)	53.86	52.8 (48.9-54.7)	51.9 (50.6-53.7)
Pectoral-fin origin to pelvic fin	31.01	30.8 (28.2-32.7)	30.99	30.5 (28.6-31.7)	30.4 (28.8-32.2)
Pelvic-fin origin to anal fin	20.75	21.1 (20.1-22.4)	22.96	22.8 (19.7-24.9)	21.9 (20.0-22.8)
Dorsal fin depth	17.01	17.6 (16.3-18.7)	15.97	16.2 (14.8-17.8)	16.4 (15.4-17.1)
Dorsal fin length	11.84	11.7 (10.7-12.0)	10.72	11.0 (10.0-12.0)	11.3 (10.4-12.0)
Anal fin depth	13.27	13.7 (12.8-14.7)	12.69	13.4 (12.4-14.4)	13.2 (12.7-13.7)
Anal fin length	10.42	10.5 (10.0-11.2)	10.38	10.6 (9.6-12.2)	11.5 (10.7-12.3)
Pectoral fin length	17.01	17.5 (15.5-18.6)	15.50	16.4 (15.0-18.1)	16.7 (15.7-17.9)
Pelvic fin length	14.41	14.7 (13.2-15.8)	12.85	14.0 (12.7-15.6)	14.1 (12.9-14.8)
Caudal peduncle length	17.42	17.4 (16.4-18.8)	17.40	18.0 (16.4-19.4)	17.4 (16.1-18.1)
Caudal peduncle depth	9.98	9.9 (9.4-10.3)	9.24	9.6 (9.2-10.1)	9.7 (8.9-10.3)
In percent of head length					
Snout length	32.94	32.1 (29.4-34.2)	30.86	31.4 (30.1-33.7)	30.8 (28.8-33.0)
Eye diameter	21.79	22.7 (19.5-24.9)	20.63	20.2 (18.9-23.1)	22.4 (21.0-23.9)
Interorbital distance	36.75	35.9 (33.8-39.2)	37.56	37.9 (35.2-40.9)	35.1 (31.6-39.0)
Head width ₁	54.44	53.5 (48.4-56.2)	55.22	55.6 (53.0-57.8)	53.8 (49.7-58.2)
Head width ₂	43.90	44.6 (41.1-49.6)	42.03	43.9 (39.8-46.9)	40.6 (36.9-43.9)
Head depth ₁	49.14	50.1 (46.2-56.8)	48.40	49.2 (46.6-51.5)	47.1 (44.0-49.6)
Head depth ₂	70.63	72.6 (69.6-75.1)	76.36	75.6 (67.5-80.9)	71.1 (67.8-74.1)
Interostril distance	20.16	19.7 (18.0-20.6)	21.54	21.2 (19.8-22.3)	19.8 (18.0-22.3)
Mouth width	25.04	25.1 (23.7-27.6)	24.05	24.4 (23.4-25.6)	24.6 (21.9-27.0)

Table 2. Morphometry of *Chondrostoma regium* (IFC-ESUF 03-1527), *Chondrostoma kinzelbachi* (IFC-ESUF 03-1518) and *Chondrostoma beysehirense* (IFC-ESUF 03-1505)

	<i>C.regium</i> Tigris R.	<i>C.kinzelbachi</i> Gölbaşı Lake	<i>C.beysehirense</i> Beşşehir Lake
	(n=15)	(n=19)	(n=16)
SL (mm)	151.4-263.1	173.6-220.6	155.7-250.8
In percent of standard length			
Head length	19.8 (18.8-21.6)	19.9 (19.0-20.8)	20.8 (20.2-22.1)
Body depth	21.2 (19.8-22.3)	20.7 (19.7-22.2)	23.1 (21.7-25.2)
Predorsal distance	49.0 (47.1-50.7)	50.0 (48.7-53.3)	49.7 (48.6-50.9)
Prepelvic distance	50.5 (49.7-51.7)	49.7 (48.4-51.2)	50.0 (48.9-51.0)
Prenal distance	71.3 (68.8-73.1)	70.2 (67.8-74.8)	72.7 (71.2-74.3)
Pectoral-fin origin to anal fin	51.1 (48.8-52.7)	50.5 (48.3-53.6)	52.6 (49.7-53.8)
Pectoral-fin origin to pelvic fin	29.7 (27.2-30.9)	28.8 (27.8-30.7)	29.2 (28.7-30.3)
Pelvic-fin origin to anal fin	21.9 (19.3-23.1)	22.1 (20.0-23.6)	24.1 (21.3-24.6)
Dorsal fin depth	17.3 (16.3-18.3)	16.2 (15.5-17.6)	17.3 (16.1-18.5)
Dorsal fin length	11.6 (10.5-12.1)	12.2 (11.3-13.3)	11.4 (11.0-12.2)
Anal fin depth	13.5 (12.7-14.5)	13.0 (12.3-13.9)	13.1 (11.6-14.5)
Anal fin length	11.9 (10.8-12.5)	11.5 (9.9-13.0)	10.7 (10.3-11.7)
Pectoral fin length	15.7 (14.8-16.6)	16.0 (14.9-18.1)	15.8 (14.4-16.6)
Pelvic fin length	13.9 (13.1-14.8)	13.4 (12.7-14.3)	13.2 (12.1-14.0)
Caudal peduncle length	17.9 (16.9-20.0)	19.2 (18.0-20.3)	18.6 (17.1-19.5)
Caudal peduncle depth	9.2 (8.8-9.6)	8.6 (8.1-9.3)	9.7 (9.4-10.0)
In percent of head length			
Snout length	30.1 (28.3-32.3)	29.3 (27.3-31.1)	30.9 (27.6-33.0)
Eye diameter	21.0 (19.6-23.5)	20.0 (18.4-22.2)	19.3 (18.3-20.5)
Interorbital distance	34.9 (32.3-38.2)	37.3 (34.6-39.2)	34.3 (32.8-36.0)
Head width ₁	42.9 (39.5-47.1)	44.9 (39.5-47.2)	37.4 (35.1-39.7)
Head width ₂	55.1 (51.9-60.0)	55.5 (53.2-57.8)	52.5 (51.1-53.3)
Head depth ₁	48.1 (46.0-54.2)	48.5 (46.0-50.6)	44.2 (41.3-45.9)
Head depth ₂	70.3 (67.1-77.0)	72.2 (68.43-75.5)	68.0 (64.3-69.3)
Interostril distance	20.3 (19.1-22.6)	20.54 (18.7-22.3)	18.5 (17.0-20.2)
Mouth width	24.5 (23.3-27.7)	23.1 (21.9-25.3)	22.1 (21.1-22.9)

250 km in length. Fish species found at the same localities include: *A. anguilla*, *Salmo* cf. *opimus*, *Sardinella aurita*, *Cyprinus carpio*, *Capoeta caelestis*, *Gobio* cf. *hettitorum*, *Luciobarbus pectoralis*, *Seminemacheilus* cf. *ispartensis*, *Mugil cephalus*, *Liza ramada* and *Liza saliens*.

Etymology: The species is named after the Taurus Mountains in Turkish. An adjective.

Chondrostoma ceyhanensis, a new species (Figure 7-Figure 8)

Holotype: IFC-ESUF 03-1556, 208.49 mm SL; Turkey: Kahramanmaraş Prov.: Sır Dam Lake, Ceyhan River, 37°34' 30.09"N-36° 45' 43.60" E, F. Küçük, D.Turan, S.S.Güçlü, 03 November 2012.

Paratypes: IFC-ESUF 03-1545, 22, 191.76–264.77 mm SL; same locality as holotype; F. Küçük,

D. Turan, S.S. Güçlü, 03 November 2012. – IFC-ESUF 03-1546, 26, 77.76–143.15 mm SL; Turkey: Osmaniye Prov.: Tecirli Bridge, Ceyhan River drainage; F. Küçük, D. Turan & S.S. Güçlü, 27 June 2012. – IFC-ESUF 03-1539, 14, 140.85–205.36 mm SL; Turkey: Adana Prov.: Seyhan Dam Lake; F. Küçük, D. Turan & S.S. Güçlü, 27 June 2012. – IFC-ESUF 03-1540, 3, 59.54–97.73 mm SL; Turkey: Adana Prov.: Çakıt Stream, Seyhan River drainage; F. Küçük, D. Turan & S.S. Güçlü, 27 June 2012. – IFC-ESUF 03-1541, 16, 71.42–81.88 mm SL; Turkey: Adana Prov.: Eğlence Stream, Seyhan River drainage; F. Küçük, D. Turan & S.S. Güçlü, 27 June 2012.

Diagnosis: *Chondrostoma ceyhanensis* sp.n. is distinguished from all the described species of *Chondrostoma* in the Eastern Mediterranean region of Turkey by the combination of the following characteristics: head small (its length 20–21% SL); mouth arched, wide (its width of mouth gape 22–27% SL); lower jaw arched, with a slightly developed keratinized edge; snout with slightly pointed tip; isthmus lobe markedly large and round; body slightly deep and thick (its depth at dorsal-fin origin 21–25% SL); presence a slight developed keel between pelvic fin and anus; dorsal-fin origin clearly in front of pelvic-fin origin; lateral line with 59-68 scales; 9-11 scale rows between lateral line and dorsal-fin origin; 4–5, rarely 6 scale rows between lateral line and pelvic-fin origin; pharyngeal teeth formula 6–6; 24-29 gill rakers on outer side of first gill arch; total vertebrae 46–48, abdominal vertebrae 26–27 and caudal vertebrae 19–21.

Description: General appearance is shown in Figure 7–Figure 8; morphometric and meristic data are given in Tables 1, 3 and 4. The head short, its dorsal profile concave in interorbital area, markedly concave on snout. The snout somewhat long, its length 29–34% HL, with slightly pointed tip. The isthmus lobe markedly large and round (Figure 4b). The mouth clearly inferior and arched. The posterior extremity of upper jaw clearly in front of anterior eye margin. The lower jaw relatively long, lower jaw-quadrangle junction located on vertical through anterior margin of pupil. The body slightly deep and thick, somewhat compressed laterally, its dorsal and ventral profiles slightly convex. The caudal-peduncle slender; its depth about 0.5 (0.5–0.6) times its length. The dorsal-fin origin clearly in front of the pelvic-fin origin. Presence a slightly distinct scaled ventral keel between pelvic and anal fins.

The lateral line with 59 (3), 60 (6), 61 (2), 62 (3), 63 (2), 64 (1), 65 (2), 66 (3), 67 (1) and 68 (1) scales; 9 (8), 10 (27) and 11 (7) scale rows between lateral line and dorsal-fin origin; 4 (6), 5 (33) and 6 (3) scale rows between lateral line and pelvic-fin origin. 24–29 gill rakers on the outer side of first gill arch (Table 4). The dorsal fin with 3 simple, 8½ (8) and 9½ (17) branched rays and outer margin slightly concave. The anal fin with 3 simple and 9½ (3), 10½ (19) and 11½ (2) branched rays, outer margin slightly

concave. The outer margin of pectoral fin concave. The outer margin of pelvic fins straight or slightly concave. The caudal fin deeply forked, with slightly pointed lobes. The nucleus of the scales between the lateral line and the dorsal fin closer to the anterior edge, posterior radii well-developed, and a narrow angle between the anterior edge and nucleus (Figure 5c). The pharyngeal teeth formula 6–6, markedly large-tipped and knife shaped. The premaxilla deep, its posterior margin slender. The maxilla short and deep, and its lower front serrated. The dentary relatively short and thick, in front of arch with 90 degrees, with wide outer margin cavity, and the coronoid process somewhat vertical. The hyomandibular bone somewhat long and narrow, the outer margin of quadrate slightly pointed (Figure 6b).

Sexual dimorphism: There are small tubercles on the head in males during the reproductive period in April and June.

Coloration: In live individuals, the back greyish, and the flank and belly silvery. In formalin-preserved specimens, the back dark brownish, and the flank and belly light brownish. All fins are yellowish. There is a narrow blackish band on the free margin of the caudal fin. The peritoneal membrane is black.

Distribution: *Chondrostoma ceyhanensis* is presently known to be only from the Ceyhan, Seyhan and Berdan rivers (Tarsus). This species is commercially fished in the rivers.

Etymology: The species is named after the Ceyhan River. An adjective.

Comparison: In conclusion, our two groups of *Chondrostoma* populations from streams and rivers entering the Mediterranean Sea along its north-eastern coast are morphologically distinct, diagnosable. They are unambiguously different species under most species concepts and especially the Evolutionary Species Concept (ESC) (see, e. g., Kottelat, 1997; Mayden, 2002; Kottelat and Freyhof, 2007).

Chondrostoma toros sp.n. is easily distinguished from *C. ceyhanensis* sp.n. by the absence of a keel between the anus and the pelvic-fin base (vs. slightly developed keel between the anus and the pelvic-fin base) and the lower jaw with a well-developed keratinized edge (vs. slightly developed). *Chondrostoma toros* is further distinguished from *C. ceyhanensis* by a somewhat longer head (head length 20–23% SL, mean 22.1 vs. 20–21, mean 20.3) and a greater pre-pelvic distance (52–55% SL, mean 53.5 vs. 51–53, mean 51.4). *Chondrostoma toros* has a wide and straight isthmus lobe (vs. wide and rounded lobe) (Figure 4a, Figure 4b). Besides the differences given above, *Chondrostoma toros* differs from *C. ceyhanensis* by the morphology of its jaws, hyomandibular and quadrate bones (posterior process of premaxilla long, hyomandibular short and wide, outer margin of quadrate rounded, vs. short, long and narrow, and slightly pointed, respectively) (Figure 6a, Figure 6b).

Chondrostoma toros is distinguished from *C.*

Table 3. Frequency distribution of some meristic features of East Mediterranean Anatolia *Chondrostoma* species

	N	lateral line scales																mean	
		56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71		72
<i>C.ceyhanensis</i> (Ceyhan R.)	13	-	-	-	3	3	2	2	-	-	1	-	-	-	-	-	-	-	61.1
<i>C.ceyhanensis</i> (Seyhan R.)	11	-	-	-	-	3	-	1	-	1	2	2	1	1	-	-	-	-	63.9
<i>C.toros</i> (Göksu R.)	18	2	2	2	3	1	4	3	-	1	-	-	-	-	-	-	-	59.6	
<i>C.regium</i> (Tigris R.)	12	-	-	-	-	-	-	-	2	5	1	1	-	2	1	-	-	65.1	
<i>C.regium</i> (Euphrates R.)	10	-	-	-	-	-	-	1	-	1	1	-	1	3	2	-	-	67.3	
<i>C.kinzelbachi</i> (Gölbaşı L.)	13	-	-	-	1	-	-	-	1	-	2	-	-	1	2	1	1	68.5	
<i>C.beyshehirense</i> (Beyshehir L.)	11	-	-	-	-	1	-	1	1	-	2	2	3	-	-	1	-	65.3	

	N	rows of scales between lateral line and dorsal-fin origin					rows of scales between lateral line and pelvic -fin origin				
		8	9	10	11	mean	4	5	6	7	mean
<i>C.ceyhanensis</i> (Ceyhan R.)	21	-	-	17	4	10.1	2	18	1	-	4.9
<i>C.ceyhanensis</i> (Seyhan R.)	21	-	8	10	3	9.7	4	15	2	-	4.9
<i>C.toros</i> (Göksu R.)	22	-	-	16	6	10.2	8	5	9	-	5.0
<i>C.regium</i> (Tigris R.)	21	-	3	16	2	9.9	1	15	5	-	5.1
<i>C.regium</i> (Euphrates R.)	12	-	-	8	4	10.3	7	3	2	-	4.5
<i>C.kinzelbachi</i> (Gölbaşı L.)	19	-	-	5	14	10.7	-	17	2	-	5.1
<i>C.beyshehirense</i> (Beyshehir L.)	11	-	-	10	1	10.0	-	8	3	-	5.2

Table 4. Frequency distribution of gill rakers of East Mediterranean Anatolia *Chondrostoma* species

	N	Gill rakers																			
		20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
<i>C.ceyhanensis</i> (Ceyhan R.)	13	-	-	-	-	2	3	4	1	3	-	-	-	-	-	-	-	-	-	-	-
<i>C.ceyhanensis</i> (Seyhan R.)	11	-	-	-	-	-	2	2	2	3	-	-	-	-	-	-	-	-	-	-	-
<i>C.toros</i> (Göksu R.)	14	-	-	-	-	-	1	1	3	4	3	2	-	-	-	-	-	-	-	-	-
<i>C.regium</i> (Tigris R.)	12	-	-	-	-	-	1	3	1	3	2	1	-	1	-	-	-	-	-	-	-
<i>C.regium</i> (Euphrates R.)	5	-	-	-	-	-	-	-	1	1	1	2	-	-	-	-	-	-	-	-	-
<i>C.kinzelbachi</i> (Gölbaşı L.)	13	-	-	-	-	-	-	-	-	-	-	-	5	5	2	1	-	-	-	-	-
<i>C.beyshehirense</i> (Beyshehir L.)	11	-	-	-	-	-	-	-	-	-	-	-	-	2	3	-	3	1	1	1	1

**Figure 4.** Ventral view of head of (a: *Chondrostoma toros*, b: *Chondrostoma ceyhanensis*, c: *Chondrostoma regium*, d: *Chondrostoma kinzelbachi*, e: *Chondrostoma beyshehirense*).

regium by having fewer lateral line scales (56 [2], 57 [2], 58 [2], 59 [3], 60 [1], 61 [4], 62 [3], 64 [1] vs. 62 [1], 63 [2], 64 [6], 65 [2], 66 [1], 67 [1], 68 [5], 69 [3] 73 [1]), a deeper body (body depth at dorsal fin origin 23–27% SL, mean 24.5 vs. 20–22, mean 21.2), and a greater pre-pelvic distance (52–55% SL, mean 53.5 vs. 50–52, mean 50.5). The new species further differs from *C. regium* by its slightly convex free margin of lower jaw (vs. straight) and its caudal-fin

margin with narrow black stripe (vs. wide black stripe). The new species differs from *C. regium* by the morphology of jaws and hyomandibular and quadrate bones (dentary coronoid process inclined forward, hyomandibulare short and wide, outer margin of quadrate rounded, vs. vertically, long and narrow, and slightly pointed, respectively) (Figure 6a, Figure 6b). Besides the differences given above, *Chondrostoma toros* differs from *C. regium* by the scale morphology.

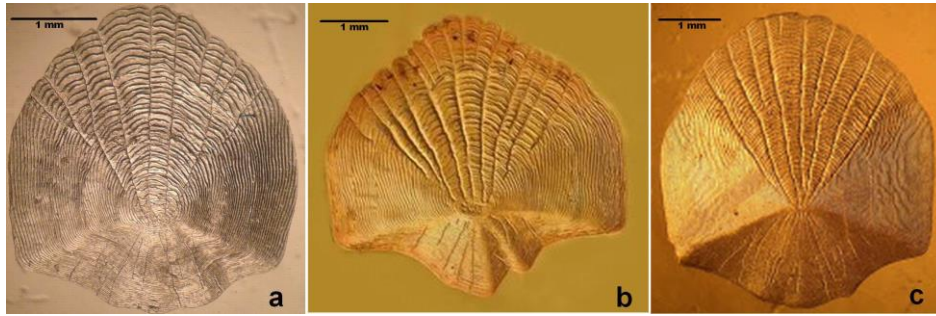


Figure 5. Some *Chondrostoma* species of scale between dorsal-fin and lateral line (a: *C. toros*, b: *C. regium* c: *C. ceyhanensis*).

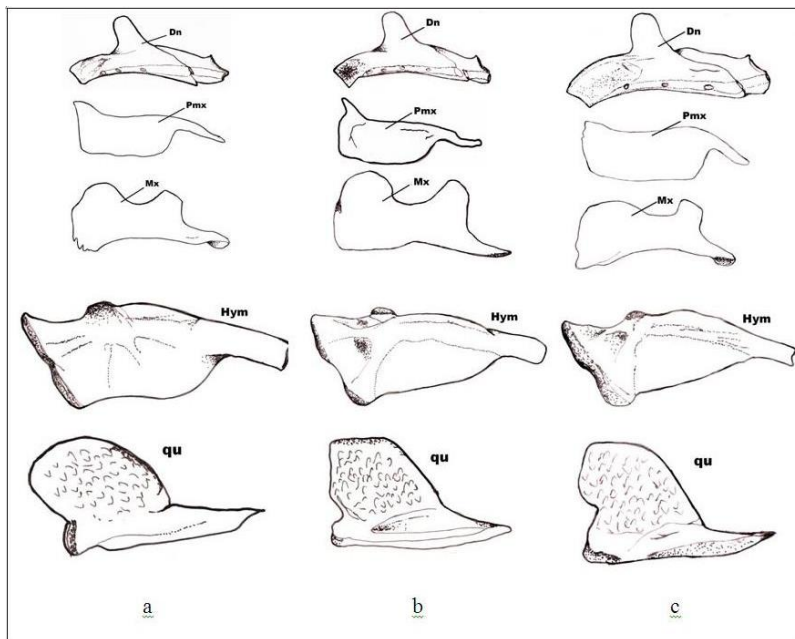


Figure 6. Jaws, hyomandibular and quadrata bone of *C. toros* (a), *C. ceyhanensis* (b) and *C. regium* (c) (Dn: dentary, Pmx: premaxilla, Mx: maxilla, Hym: hyomandibulare, qu: quadrata)



Figure 7. *Chondrostoma ceyhanensis*, IFC-ESUF 03-1556, 208.49 mm SL; Turkey: Kahramanmaraş Prov.: Sır Dam Lake, Ceyhan River (Holotype).



Figure 8. *Chondrostoma ceyhanensis*, IFC-ESUF 03-1556, 199.4 mm SL; Turkey: Kahramanmaraş Prov.: Sır Dam Lake, Ceyhan River (Paratype).

The nucleus is far from the anterior edge (vs. very close to), and the angle between the nucleus and the anterior edge is narrow (vs. wide) (Figure 4a, Figure 4b).

Chondrostoma toros is immediately distinguished from *C. beysehirense* by having fewer gill rakers on the first gill arch (25–30 vs. 33–39) and slightly fewer lateral line scales (56 [2], 57 [2], 58 [2], 59 [3], 60 [1], 61 [4], 62 [3], 64 [1] vs. 60 [1], 62 [1], 63 [1], 65 [2], 66 [2], 67 [3] and 70 [1]). *Chondrostoma toros* further differs from *C. beysehirense* by the mouth shape (mouth wide and slightly arched [width of mouth gape 24–28% HL, mean 25.1] vs. mouth narrow and markedly arched [width of mouth gape 21–23 % HL, mean 22.1]), and the lower jaw with a well-developed keratinized edge (vs. slightly developed). *Chondrostoma toros* has a wider and deeper head than *C. beysehirense* (head depth through eye 46–57% HL, mean 50.1 vs. 41–46, mean 44.2; head width through eye 49–56% HL, mean 53.5 vs. 35–40, mean 37.4) (Table 2).

Chondrostoma toros is significantly different from *C. kinzelbachi* (Gölbaşı Lake, Orontes River Basin) by having fewer gill rakers on outer side of the first gill arch (25–30 vs. 32–35) (Table 4). *Chondrostoma toros* is distinguished from *C. kinzelbachi* further by a longer head (head length 20–23% HL, mean 22.1 vs. 19–21, mean 19.9), a deeper body (body depth at dorsal fin origin 23–27% SL, mean 24.5 vs. 20–22, mean 20.7), a somewhat shorter caudal peduncle (length 16–19% SL, mean 17.4 vs. 18–20, mean 19.2), a greater eye diameter (20–25% HL, mean 22.7 vs. 18–22, mean 20.0) and a longer snout (length 29–34% HL, mean 32.1 vs. 27–31, mean 29.3 respectively). *Chondrostoma toros* has a wider mouth than *C. kinzelbachi* (width of mouth gape 24–28 % HL, mean 25.1 vs. 22–25, mean 23.1).

Chondrostoma ceyhanensis is easily distinguished from *C. regium* by the lower jaw with a slightly developed keratinized edge (vs. well-developed), the shape of the mouth (arched vs. straight or slightly arched) and the caudal fin with a narrow black stripe on the outer margin of lobes (vs. wide). The new species is further distinguished from *C. regium* by having slightly fewer lateral line scales (59 [3], 60 [6], 61 [2], 62 [3], 63 [2], 64 [1], 65 [2], 66 [3], 67 [1] and 68 [1]) vs. 62 [1], 63 [2], 64 [6], 65 [2], 66 [1], 67 [1], 68 [5], 69 [3], 73 [1]). Besides the differences given above, *Chondrostoma ceyhanensis* differs from *C. regium* by the morphology of scales. The nucleus is far from the anterior edge (vs. close to), and the angle between the nucleus and the anterior edge is narrow (vs. wide) (Figure 4b, Figure 4c).

Chondrostoma ceyhanensis is distinguished from *C. kinzelbachi* by having fewer gill rakers on the outer side of the first gill arch (24–29 vs. 32–35) (Table 4). The new species is distinguished from *C. kinzelbachi* further by having deeper body depth (body depth at dorsal fin origin 21–25% SL, mean

23.2 vs. 20–22, mean 20.7% SL), and a deeper caudal peduncle (length 9–10% SL, mean 9.6 vs. 8–9, mean 8.6).

Chondrostoma ceyhanensis differs from *C. beysehirense* by having fewer gill rakers on the first gill arch (24–29 vs. 33–39), a slightly arched lower jaw (vs. arched) and wide and rounded isthmus lobe (vs. wide and straight lobe) (Figure 4b, Figure 4e).

The most important threats for the new species *Chondrostoma toros* and *C. ceyhanensis* are construction and building activities on water bodies, irresponsible fishing and illegal fishing tools (trivırı; domestic term for a method, etc.) and agricultural pollution. Hence, it is appropriate to propose this species' conservation status as "vulnerable".

Comparison Material

Chondrostoma regium: IFC-ESUF 03-1527, 21, 177.96–263.07 mm SL; Turkey: Siirt Prov.: Botan Stream, Tigris River drainage; C. Kaya, 29 June 2012. – IFC-ESUF 03-1528, 20, 151.97–196.37 mm SL; Turkey: Batman Prov.: Botan Stream, Tigris River drainage; C. Kaya, 25 September 2012. – IFC-ESUF 03-1529, 15, 151.43–228.79 mm SL; Turkey: Batman Prov.: Botan Stream, Tigris River drainage; C. Kaya, 25 September 2012. – IFC-ESUF 03-1530, 9, 181.67–204.74 mm SL; Turkey: Diyarbakır Prov.: Ongözlü Bridge, Tigris River drainage; C. Kaya, 11 August 2012. – IFC-ESUF 03-1531, 9, 157.68–202.35 mm SL; Turkey: Ilısu Village, Kaplıcalar, Tigris River drainage; C. Kaya, 17 February 2012. – IFC-ESUF 03-1533, 20, 137.06–235.95 mm SL; Turkey: Sivas Prov.: Kangal, Delihacı Village, Euphrates River drainage; D. Turan & C. Kaya, 19 September 2012. – IFC-ESUF 03-1552, 1, 70.82 mm SL; Turkey: Kilis Prov.: Sinnep (Kuveik) Stream; F. Küçük, D. Turan & S.S. Güçlü, 26 June 2012.

Chondrostoma beysehirense: IFC-ESUF 03-1505, 16, 155.70–250.79 mm SL; Turkey: Konya Prov.: Beyşehir, Beyşehir Lake; F. Küçük & S.S. Güçlü, 26 June 2012.

Chondrostoma kinzelbachi: IFC-ESUF 03-1518, 19, 173.6–220.58 mm SL, Turkey: Hatay Prov.: Gölbaşı Lake, F. Küçük, D. Turan & S.S. Güçlü, 30 June 2012.

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