

Family Cyprinidae

Barbels and carps

Cyprinids are the most speciose fish family, with about 1800 species recognised worldwide. In our region, 124 species have been identified. In West Asia, true cyprinids come in five evolutionary lineages and a variety of body shapes and ecological groups. True barbels of the genera *Barbus*, *Luciobarbus*, *Capoeta*, and *Cyprinion* are distinguished by having a serrated posterior margin of the last branched dorsal ray. True barbels are most diverse in West Asia and Europe. Labeonines of the genera *Garra*, *Tariqilabeo*, and *Bangana* have a horny sheath on the lower jaw, often a complicated, strongly modified mouth morphology, and a smooth posterior margin of the last branched dorsal ray. Labeonines are a diverse group of fishes, being widespread and speciose, especially in tropical Asia and Africa. Yellowfishes or Torini of the genera *Arabibarbus*, *Carasobarbus*, *Mesopotamichthys*, and most likely also unstudied *Caecocypris*, form a third independent evolutionary lineage. They have large, shield-shaped scales and a smooth posterior margin of the last branched dorsal ray. Along with the African genera *Acapoeta*, *Pterocapoeta*, *Labeobarbus* (including *Varicorhinus* and *Sanagia*) and several South Asian genera, Torini forms a well-supported monophyletic group. Carps of the genera *Carassius* and *Cyprinus* have an exceptionally long dorsal fin and a serrated posterior margin of the last branched dorsal ray. Carps are moderately diverse, especially in China, and all but two species found in West Asia are non-native to

the region. The last evolutionary lineage is represented by snow barbels, which are split into two phylogenetic groups that are not each other's closest relatives, both found in Iran. The Schizothoracines include the genus *Schizothorax* and several others in the high mountains of Asia, as well as the Schizopygopsines, which include *Schizopygopsis* and several other Asian mountain genera.

In Cyprinidae, the different structures around the mouth are essential for genus diagnosis. These include the rostral cap, the upper and lower lips, the upper and lower jaws, and the barbels. They vary in development or may be absent in different genera. The rostral cap is the fleshy tissue at the tip of the snout. The rostral groove separates the rostral cap from the upper lip. In several genera, the rostral cap develops into a pendulous fold that partly or completely covers the upper lip and the upper jaw. In such cases, the upper lip may be missing. The lower lip is separated from the skin of the throat by a postlabial groove. This groove is usually interrupted in the middle. In some species with fleshy lips, the median part may be hypertrophied and folded backward into a pendulous lobe. A cornified tissue with an anterior cutting edge may cover the lower jaw. In such cases, the lower jaw is often exposed, and the lower lip is restricted to the sides of the jaw. Most species of the genus *Garra* have a prominent gular disc posterior to the lower jaw. It is important to note that Labeonines have no lower lip. **Further reading.** Yang et al. 2015 (phylogeny).

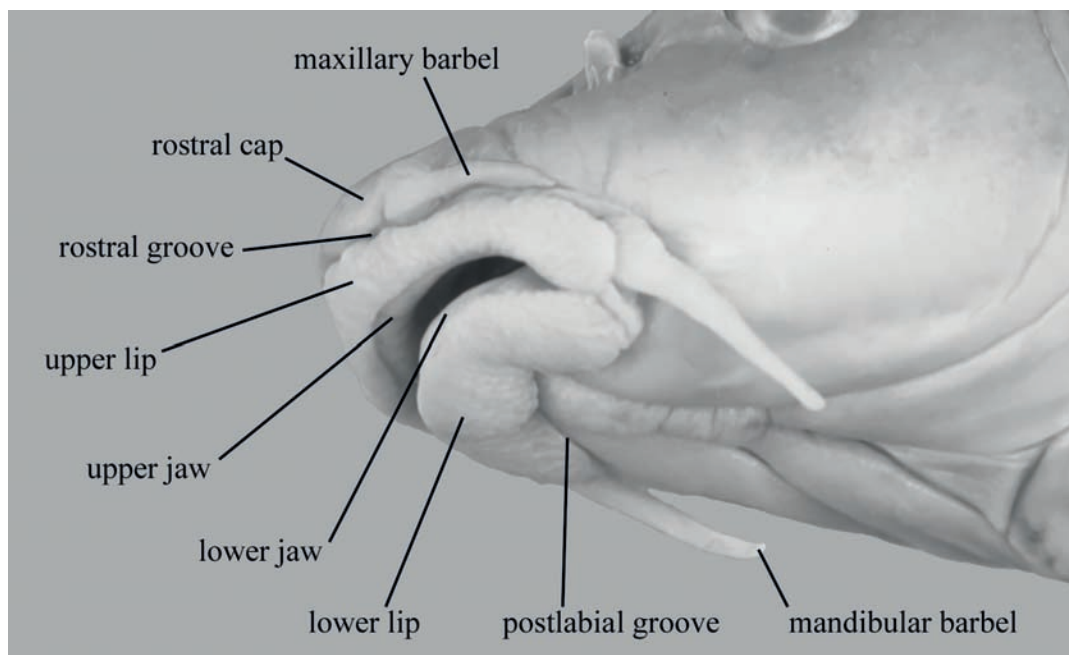


Figure 32. Mouth parts of Cyprinidae.



Figure 33. Mental structures and gular disk in *Garra*.



Figure 34. Lower lip with a sharp-edged horny sheath in *Capoeta*.

Key to genera of Cyprinidae in West Asia

1a - Last unbranched anal rays strongly ossified; serrated posteriorly.

.....2

1b - Last unbranched anal ray not strongly ossified, not serrated posteriorly.

.....3

2a - No barbels; pharyngeal teeth in one row.

.....*Carassius*

2b - Two pairs of barbels; pharyngeal teeth in three rows.

.....*Cyprinus*

3a - No barbels.

.....4

3b - One or two pairs of barbels.

.....8

4a - Scales restricted to lateral line, flank above pectoral, and few enlarged scales around anus and anal base.

.....*Schizopygopsis*

4b - Flank fully covered by scales.

.....5

5a - A distinctive row of enlarged, tiled scales along anal base.

.....*Schizocypris*

5b - No row of enlarged, tiled scales along anal base.

.....6

6a - An elevated gular disk behind lower jaw.

.....*Garra* (in part)

6b - Lower lip and lower jaw normally developed, without gular disk.

.....7

7a - Eyes absent or very small, often covered with skin; body whitish or pinkish without any colour patterns.

.....*Caecocypris*

7b - Eyes present and well developed; body silvery, golden or brown.

.....*Mesopotamichthys*

8a - A distinctive row of enlarged, tiled scales along anal base.

.....*Schizothorax*

8b - No row of enlarged, tiled scales along anal base.

.....9

9a - Last unbranched dorsal ray spinous, with serrae along its posterior edge.

.....10

9b - Last unbranched dorsal ray soft or spinous, without serrae along its posterior edge.

.....13

10a – 6–7½ branched anal rays; 12–17½ branched dorsal rays.

.....*Cyprinion*

10b - 5½ branched anal rays; 7–9½ branched dorsal rays.
.....11

11a - Lower lip absent or widely interrupted, lower jaw with a sharp-edged horny sheath.

.....*Capoeta*

11b - Lower lip with a fleshy lobe in middle, if interrupted, lower jaw without sharp-edged horny sheath.
.....12

12a - Body and fins covered with distinctive small black or dark-brown spots, many species with irregularly shaped brown blotches; nuptial tubercles very small, sand-like all over head.

.....*Barbus* and *Luciobarbus subquincunciatus*

12b - In adults larger than 150 mm SL, body uniform yellowish, brown or grey, without dark-brown or black blotches, sometimes with a faint lateral stripe; few, large nuptial tubercles on snout.

.....*Luciobarbus*

13a - Upper lip very narrow, almost completely reduced, hidden under rostral cap.

.....14

13b - Upper lip well developed, separated from skin of snout.

.....16

14a - A gular disc behind lower jaw, usually labrum with free margin, margins fused with skin of throat in *G. elegans*.

.....*Garra* (in part)

14b - No gular disc behind lower jaw.
.....15

15a - 29–34 total scales in lateral series, lower jaw round, without cutting edge; prominent lateral papillate pad on lower jaw.

.....*Garra* (in part)

15b - 34–38 total scales in lateral series; lower jaw almost straight, with a sharp cutting edge; no lateral papillate pad on lower jaw.

.....*Tariqilabeo*

16a - Rostral cap with a deep lateral groove (labial fold); lower lip absent.

.....*Bangana*

16b - Rostral cap without lateral groove; lower lip often with a fleshy lobe or interrupted in middle, but well developed at its margins.

.....17

17a - 6½ branched anal rays; 9–11½ branched dorsal rays; body depth usually 25–40 % SL.

.....*Carasobarbus*

17b - 5½ branched anal rays; usually 8½ branched dorsal rays; body depth usually 18–26 % SL.

.....*Arabibarbus*



Arabibarbus grypus; Tigris, Türkiye; 450 mm SL.



Arabibarbus arabicus; Wadi Maur, Yemen; 106 mm SL. © F. Krupp.

Arabibarbus

A genus of three very large (*A. grypus*) to medium-sized species endemic to West Asia. These are hexaploid barbels of the yellowfish (Torini) group, distinguished by large, shield-shaped scales with numerous parallel radii. The last unbranched dorsal ray is weakly to strongly ossified, without serrae. They have two pairs of barbels, $8\frac{1}{2}$ branched dorsal rays, and $5\frac{1}{2}$ branched anal rays. Their phylogenetic position has long been uncertain, but most authors categorised them in *Barbus*, as no alternative was available. One

species, *A. grypus*, occurs in the Persian Gulf basin. Some authors have placed it in the Asian genus *Tor*. However, it has only recently become clear that these three species belong together, and with *Carasobarbus*, *Mesopotamichthys*, and *Ptercapoeta* form the sister group of the large African genus *Labeobarbus*. Both Arabian species are superficially similar but allopatric, and the molecular characters studied suggest that they have a long, isolated evolutionary history. **Further reading.** Borkenhagen 2014 (description, phylogeny); Yang et al. 2015; Borkenhagen 2017 (phylogeny).

Key to species of *Arabibarbus*

1a - Body cylindrical; last unbranched dorsal ray weakly ossified; posterior barbel length 4–6 % SL; 29–36, usually 30–35, total lateral-line scales.

.....*A. grypus*

1b - Body laterally compressed; last unbranched dorsal ray strongly ossified; posterior barbel length 7–12 % SL; 32–44, usually 35–41, total lateral-line scales.

.....2

2a - 29–36, usually 32–35, total lateral-line scales; head depth 14–17 % SL; pectoral length 18–22 % SL; pelvic length 15–19 % SL; head length 24–31 % SL.

.....*A. arabicus*

2b - 29–32, usually 30–31, total lateral-line scales; head depth 16–18 % SL; pectoral length 20–24 % SL; pelvic length 17–20 % SL; head length 28–33 % SL.

.....*A. hadhrami*

Arabibarbus arabicus

Common name. Arabian Shabout.

Diagnosis. Distinguished from species of *Carasobarbus* in Arabian Peninsula by: ● $5\frac{1}{2}$ branched anal rays / ● $8\frac{1}{2}$ branched dorsal rays. Distinguished from *Arabibarbus hadhrami* by: ○ 29–36, usually 32–35 total lateral-line scales (mode 33) / ○ head depth 14–17 % SL / ○ pectoral length 18–22 % SL / ○ pelvic length 15–19 % SL / ○ head length 24–31 % SL. Size up to 351 mm SL.

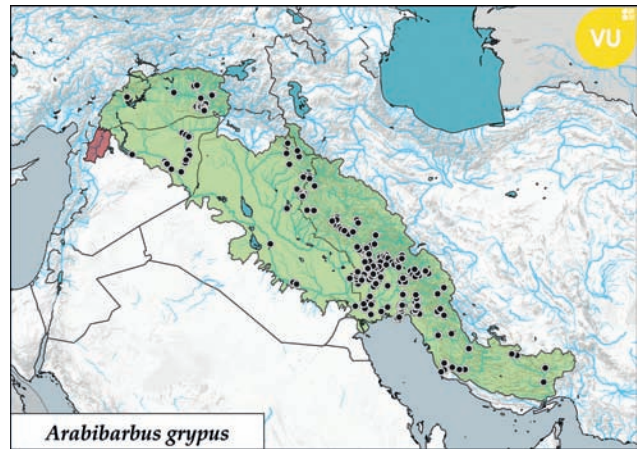
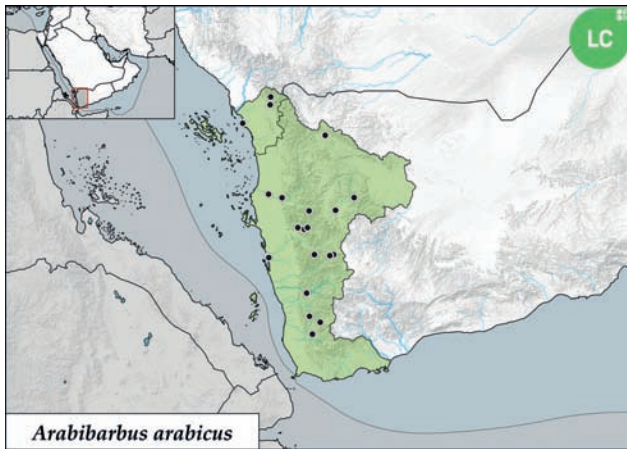
Distribution. Southern Red Sea and Gulf of Aden basins from southern Saudi Arabia to Yemen.

Habitat. Wadis with sections of deep pools.

Biology. No data.

Conservation status. LC; fishing might be a threat. Actual situation unknown.

Further reading. Trewavas 1941 (description); Banister & Clarke 1977 (distribution); Krupp 1983 (distribution); Borkenhagen 2014 (review).



Arabibarbus grypus; Lesser Zab, Iraq; 450 mm SL.



Arabibarbus grypus; Karun, Iran; 80 mm SL. © K. Borkenhagen.

Arabibarbus grypus

Common name. Shabout.

Diagnosis. Distinguished from species of *Luciobarbus*, *Barbus*, *Carasobarbus*, and *Mesopotamichthys* in West Asia by: ○ two pairs of barbels / ○ body cylindrical / ○ last unbranched dorsal ray weakly ossified, segmented, without serration at its posterior margin / ○ dorsal origin above or

in front of pelvic origin / ○ 29–36, usually 30–35, total lateral-line scales / ○ posterior barbel length 4–6 % SL / ○ median lobe on lower lip well developed, often hypertrophied. Size up to 1300 mm SL and 30 kg.

Distribution. Euphrates, Tigris, Karun, and Karkheh drainages, Qweiq (now extirpated), and rivers of Persian Gulf in Iran south to Minab.

Habitat. Large to medium-sized rivers with moderate currents. Often found in reservoirs. Spawns on sand, gravel, or submerged vegetation in fast-flowing waters.

Biology. Males mature at about 400 mm SL, females at about 450 mm SL, first spawning at 3–5 years. Lives up to 17 years, probably much longer. Spawns in Karun late April–early August and May–July in Atatürk reservoir, usually during floods when water is turbid. Migrations occur to fast-flowing stretches of rivers. Males congregate at spawning sites. Spawning migrations typically begin in April or May. Spawns only once a year. Appears in schools on spawning grounds just before dark and remains there until just before midnight, making loud noises by splashing, jumping, and chasing. Eggs are transparent and sticky and attached to stones or plants. In Iraq, reported to migrate upstream during hot, dry summers and then return downstream in September and October. Predominantly herbivorous, feeding on

algae and leaves, fruits, and seeds of higher plants, with small amounts of aquatic invertebrates and fish.

Conservation status. VU; threatened mainly by overfishing, to a lesser extent by pollution, water abstraction, and dams. Extirpated from Qweiq.

Remarks. Reported to weigh up to 100 kg, but such records probably refer to *Luciobarbus esocinus*. Often reported from the Orontes drainage, but there are only two records of two individuals each from Hamah in Syria in 1881, and the species has never been recorded from the Orontes since. Likely, these two fish were later mislabelled or transported from the Euphrates or Qweiq to Hamah as food fish. Often placed in Asian genus *Tor*.

Further reading. Karaman 1971 (description, as *Tor gryp*); Coad 2010a (distribution, biology); Borkenhagen 2014 (morphology, generic position); Coad 2021a (biology, morphology).



Tigris at Hasankeyf in 2009. Large rivers with diverse structures are a typical habitat of *Arabibarbus gryp*.



Arabibarbus hadhrami; Wadi Hadhramaut drainage, Yemen; 129 mm SL. © S. Tränkner/SGN.

Arabibarbus hadhrami

Common name. Hadhramaut Shabout.

Diagnosis. Distinguished from species of *Carasobarbus* in Arabian Peninsula by: ● 5½ branched anal rays / ● 8½ branched dorsal rays. Distinguished from *Arabibarbus arabicus* by: ○ 29–32 total lateral-line scales (mode 30) / ○ head depth 16–18 % SL / ○ pectoral length 20–24 % SL / ○ pelvic length 17–20 % SL / ○ head length 28–33 % SL. Size up to 205 mm SL.

Distribution. Yemen: Wadi Hadhramaut drainage.

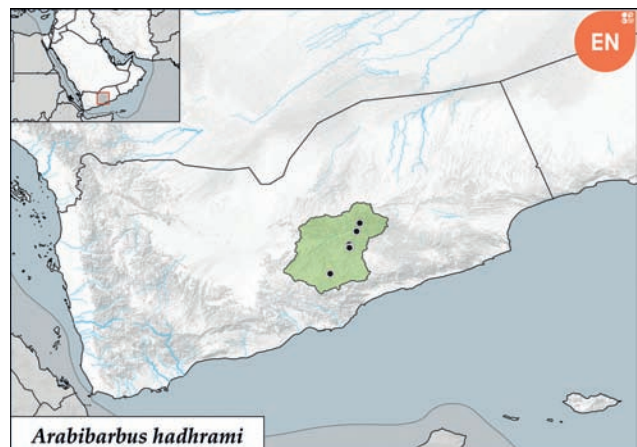
Habitat. Wadis with sections of deep pools.

Biology. No data.

Conservation status. EN; appears to be declining within its very small range.

Remarks. Poorly differentiated from *A. arabicus* by morphological characters but well differentiated by molecular characters.

Further reading. Borkenhagen 2014 (description).



Bangana dero; Mashkid drainage, Iran; ~130 mm SL. © H. Mousavi-Sabet.

Bangana

Bangana comprises approximately seven large or very large species distributed across South and Southeast Asia. It is closely related to *Labeo* that is found in tropical Asia and Africa. *Bangana* are rheophilic and feed on detritus and algae. Some are territorial and defend “gardens” on stones. They are regionally important food fish, but none is used in aquaculture. One species is known from Iran, where the genus reaches its westernmost distribution.

**Bangana dero**

Common name. Kalabans.

Diagnosis. Distinguished from other cyprinid species in southern Iran by: ● transversal groove along snout / ○ mouth inferior / ○ lips thick / ○ upper lip well developed, separated from skin of snout by a groove / ○ no gular disc / ○ one pair of barbels / ○ 38–44 total lateral-line scales / ○ 5½ branched anal rays. Size up to 500 mm SL.

Distribution. Iran: Mashkid drainage on border with Pakistan. Widespread east into Pakistan, Afghanistan, and along Himalayan foothills in India, Bhutan, Nepal, Bangladesh, Myanmar, and China. Introduced in Peninsular India and Sri Lanka.

Habitat. Iran: Small streams in desert areas. Usually in torrential mountain streams, rivers, and lakes at high altitudes. Spawns on gravel in fast or moderately fast-flowing water.

Biology. Lives up to 8 years. Matures after one year and 200–300 mm SL (NE India). Spawns on rocks or vegetation

in spring. Makes short spawning migrations to torrents. Spawns March–June (Garhwal Himalayas), June–July (NE India). May migrate to warmer regions of lakes and streams during winter. Herbivorous, feeding on detritus, diatoms, and algae, occasionally on invertebrates or small vertebrates. Highly valued as a food fish.

Conservation status. LC.

Remarks. *Bangana gedrosicus* is a related species reported from the Mashkid drainage in Pakistan. *Bangana dero* is distinguished from *B. gedrosicus* by having 5½ branched anal rays (vs. 6–7½) and 16–17 pectoral rays (vs. 14). *Tariqilabeo macmahoni* is another superficially similar species reported from the Mashkid basin. *Bangana dero* is distinguished from *Tariqilabeo macmahoni* in having 39–44 total lateral-line scales (vs. 35–36).

Further reading. Mohindra et al. 2005 (general information; as *Labeo dero*); Esmaeili et al. 2013a (Iran, morphology); Coad 2021a (biology, morphology).



Figure 35. *Bangana dero*; Mashkid drainage, Iran; ~130 mm SL.
© H. Mousavi-Sabet.

Barbus

Barbels are medium- to large-sized fishes that live near the bottom in a variety of habitats, from lakes and slow-flowing large rivers to hill streams. They are very speciose in Europe, especially in the rivers of the Mediterranean basin. Only 12 species are known from West Asia, where the genus is very widespread. The last unbranched dorsal ray may be spinous (flexible in its uppermost part only) and either rigid or not, with its posterior edge serrated on part or entire length. The extent and intensity of serration is changing

with growth. In many species, females have a longer and differently shaped anal than males, which is assumed to play a role in excavating the substrate for spawning. In all species, juveniles are covered with spots and blotches. Compared to adults, the last unbranched dorsal ray is shorter, less serrated, and less rigid. Some *Barbus* species have uniform brown to grey adults without blotches, while all species have small dark-brown or black spots on their scales. Diagnosis is based solely on adults.



Lower lip of barbels. The terminology used in the literature to describe the shape of the lower lip of *Barbus* and *Luciobarbus* species is often inconsistent or morphologically inaccurate. It has been uncritically compiled, adapted, or translated. Here, we use only the following terms and definitions. In several species, the lower lip is thick and fleshy. In some species, the median part of the lip is produced posteriorly into a lobe (often referred to in the literature as a tongue-like lobe or three-lobed lower lip). Posteriorly, the **lobe is not continuous with the skin of the throat**; laterally, it is separated from the rest of the lip by notches. The lobe may be long, protruding, and pendulous, or square-shaped, extending posteriorly only to the corner of the mouth. In other species, the median part of the lower lip is thickened but not produced into a lobe; it appears as a swollen pad, bounded posteriorly by a more or less deep groove; the posterior extremity of the **pad is not free but continuous with the skin of the throat** (often ambiguously described in the literature as a weakly developed lobe). The difference between a lobe and a pad may be slight; we make the distinction by gently passing a needle under the lobe, which results in one of two possibilities: if it is a lobe, the needle can be inserted under the lobe (left in the above image) and moved laterally under the entire width of the lobe; or, in the case of a pad, the needle can be inserted into the groove (if any) behind the pad (right in the above image), but cannot be moved under the pad. In some species, there may be a transition from a pad to a lobe during growth; sometimes, different individuals or populations show different conditions.

Key to species of *Barbus* in West Asia

1a - 39–44 total vertebrae; small-sized fish reaching about 200 mm SL.
.....2

1b - 44–49 total vertebrae; large-sized fish reaching usually 300–500 mm SL.
.....7

2a - Lower lip with a median lobe.
.....3

2b - Lower lip with a median swollen pad.
.....5

3a - 62–72 total lateral-line scales.
.....*B. niluferensis*

3b - 50–62 total lateral-line scales.
.....4

4a - Last unbranched dorsal ray 52–72 % ossified; posterior margin of dorsal slightly convex.
.....*B. pergamonensis*

4b - Last unbranched dorsal ray 33–50 % ossified; posterior margin of dorsal straight or slightly concave.
.....*B. xanthos*

5a - Dorsal origin slightly in front of vertical of pelvic origin.
.....*B. ida*

5b - Dorsal origin behind or above vertical of pelvic origin.
.....6

6a - 71–90 total lateral-line scales.
.....*B. miliaris*

6b - 52–77 total lateral-line scales.
.....*B. cyri/B. lacerta/B. karunensis*

7a - Lower lip with median swollen pad.
.....*B. tauricus*

7b - Lower lip with median lobe.
.....8

8a - Flank plain brown or with many minute dark-brown spots in adults.
.....*B. rionicus*

8b - Flank back and head with many irregularly shaped black or brown spots, often with large, dark-brown blotches in juveniles and adults.
.....9

9a - Lateral line with 53–58 scales; anal longer in female than in male.
.....*B. escherichii*

9b - Lateral line with 58–71 scales; anal of equal length in female and male.
.....*B. anatolicus*



Barbus anatolicus; Kızılırmak, Türkiye; 236 mm SL.

Barbus anatolicus

Common name. Anatolian barbel.

Diagnosis. Distinguished from other species of *Barbus* in West Asia by: ● anal of equal length in female and male / ○ 58–71 total lateral-line scales / ○ 9–11 gill rakers /

○ 45–49 total vertebrae / ○ lower lip with median lobe / ○ last simple dorsal ray moderately ossified, serrated along about 70–80 % of its posterior margin / ○ many small irregular shaped black or brown spots, smaller or as large as scales, often forming large, dark-brown blotches on head, back,

and flank in adults and juveniles / o posterior dorsal margin concave. Size up to 400 mm SL.

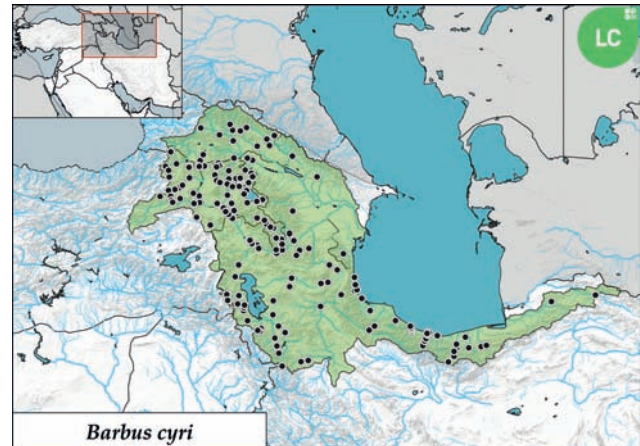
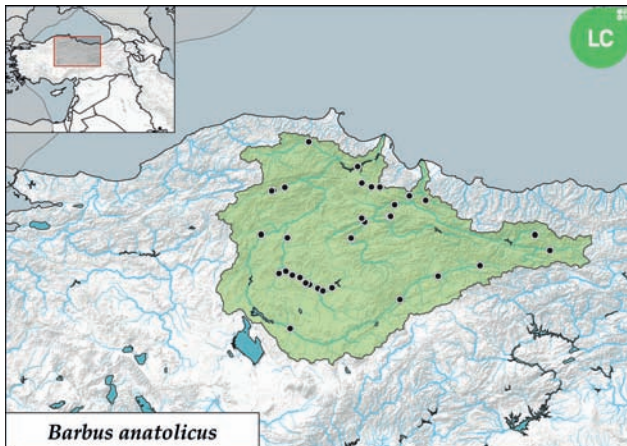
Distribution. Türkiye: Kızılırmak and Yeşilırmak drainages.

Habitat. Medium to large rivers. Wide variety of habitats with moderate to strong currents and rocky or gravelly substrate.

Biology. Matures at about 2–4 years, males one year earlier than females. Usually a fractional spawner, some females appear to spawn only once a year. Feeds mainly on aquatic invertebrates and algae.

Conservation status. LC.

Further reading. Kotlík et al. 2004 (molecular phylogeny; as clade IV); Turan et al. 2018c (description).



Barbus cyri; Urmia basin, Iran; female, ~120 mm SL.



Barbus cyri; Kura drainage, Türkiye; female, 130 mm SL. © M. Özuluğ.

Barbus cyri

Common name. Kura barbel.

Diagnosis. Distinguished from other species of *Barbus* in West Asia by: ○ 50–72+2–4 [52–76 total] lateral-line scales / ○ 39–44 total vertebrae / ○ postdorsal length 48–61 % SL / ○ dorsal base length 16–21 % SL / ○ anal length 6–10 % SL / ○ 28–33 scale around caudal peduncle / ○ 9–13 scales below lateral line / ○ lower lip with a median swollen pad / ○ dorsal origin at or behind vertical of pelvic origin / ○ numerous irregular dark-brown blotches on back, flanks and head / ○ anal longer in female than in male. Size up to 360 mm SL; usually smaller.

Distribution. Caspian basin: Kura and Aras west of Atrak. Also, in Lake Urmia basin.

Habitat. Mountain and foothill zones in streams and small rivers with fast, clear, well-oxygenated water and gravel substrate; also in large lakes; in steep rivers down to estuaries. In lowland areas often most common in small streams and rare in larger rivers. Spawns in streams on gravel beds.

Biology. Matures at about 2–3 years, males one year earlier than females. Usually lives 3–5 years. Spawns April–August,

depending on altitude, at water temperatures of 14–20°C. Fractional spawner, spawns 2–3 times a season, some females appear to spawn only once a year. Three life history forms have been described from Lake Sevan (Armenia), differing in size, distribution, migration patterns, and spawning habitats (lacustrine, river-lacustrine, and riverine). Feeds mainly on aquatic invertebrates and algae.

Conservation status. LC.

Remarks. *Barbus goktschaicus* from Lake Sevan basin (Armenia) and *B. urmianus* from Lake Urmia basin are synonyms. *Barbus cyri* can only be distinguished from *B. lacerta* and *B. karunensis* by molecular characters. While forming their own molecular clusters, these three species are very closely related and may be treated as one species with three population groups in the future.

Further reading. Bogutskaya 2003b, c (morphology, biology); Khaefi et al. 2017a (review); Eagderi et al. 2019d (description of *B. urmianus*); Kaya et al. 2020a (distribution); Coad 2021a (biology); Jouladeh-Roudbar et al. 2023d (*B. urmianus* as synonym of *B. cyri*); Gandlin et al. 2022 (phylogeography).



Barbus cyri; Tajan, Iran; male, 150 mm SL.

Barbels challenging species recognition. We usually use two completely independent datasets to determine whether two fish populations represent one or two species. These are molecular and morphological datasets. They may or may not agree. Suppose fish from two populations can be distinguished by non-overlapping or slightly overlapping morphological characters that are not expected to be phenotypically variable (based on the observer's experience). In that case, they can be recognised as two species. If fish from the two populations also form two "well-separated" groups in molecular analyses, all is well, and they are usually accepted as two species. But what happens when two morphologically indistinguishable populations are placed in two molecular groups? The conceptual framework for resolving such cases needs to be better discussed. Some authors use more or less arbitrary thresholds for molecular markers and call all populations beyond these thresholds "cryptic species." While we agree that some species are indistinguishable by external and internal characters, the term "cryptic species" has been applied to many very different cases and should be avoided as it is not clearly defined. In West Asia, the *Barbus lacerta* group represents such a case. Three poorly differentiated molecular lineages in the Caspian and Persian Gulf basins are found in allopatry. These lineages are usually recognised as *B. cyri*, *B. karunensis*, and *B. lacerta*, but they cannot be distinguished by

the morphological characters examined so far. Whether they should be treated as one species (*B. lacerta*) occurring in three distinct populations or as three poorly differentiated species is a matter of debate, as there is no clear conceptual background to resolve such situations. However, such cases are relatively rare, and few similar situations exist in *Garra* and *Oxynoemacheilus*. Thus far, nearly all species “well separated” by molecular characters can also be distinguished externally.



Barbus escherichii; Sakarya, Türkiye; 80 mm SL.



Barbus escherichii; Sakarya, Türkiye; 184 mm SL.

Barbus escherichii

Common name. Sakarya barbel.

Diagnosis. Distinguished from other species of *Barbus* in West Asia by: ● adults with numerous roundish, small, dark-brown dots, as large or larger than scales / ○ 53–58 total lateral-line scales / ○ last unbranched dorsal ray strongly ossified / ○ 7–10, usually 8–9, gill rakers / ○ head length 25–28 % SL / ○ lower lip with a median lobe / ○ juveniles with numerous irregular dark-brown blotches on back, flanks and head / ○ 45–48, usually 46–47, total vertebrae / ○ anal longer in female than in male. Size up to 300 mm SL.

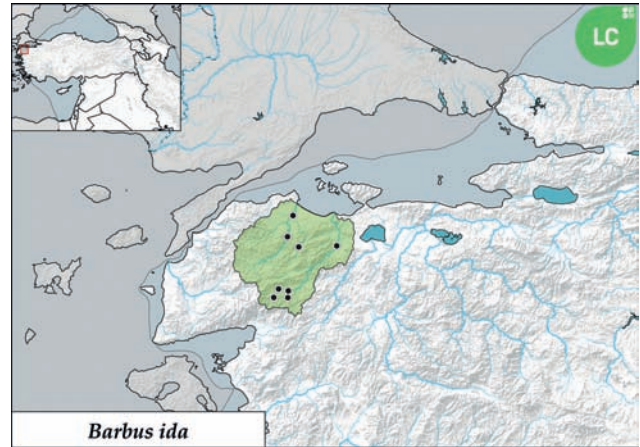
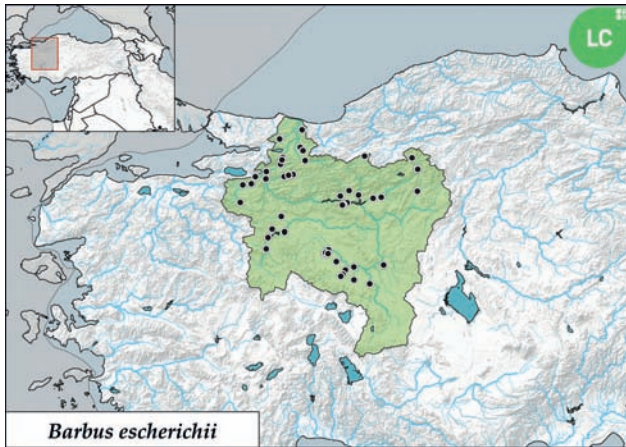
Distribution. Türkiye: Sakarya drainage.

Habitat. Large rivers to mid-sized streams with gravel bottoms. Spawns in riffles and rapids. Also, in reservoirs, from which it migrates into tributaries to spawn.

Biology. Matures at about 2–4 years, males one year earlier than females. A fractional spawner. Feeds mainly on aquatic invertebrates and algae.

Conservation status. LC.

Remarks. Previously, the name *B. escherichii* was often applied to *B. tauricus* in Anatolian Black Sea basin. *Barbus escherichii* cannot be distinguished from *B. tauricus* by



Barbus ida; Gönen, Türkiye; 150 mm SL.

its COI DNA sequences, and both species may be closely related, or *B. escherichii* may have been the victim of introgressive hybridisation. More research is needed on this species group to understand its diversity better.

Further reading. Steindachner 1897 (description); Turan et al. 2009b (comparison).

Barbus ida

Common name. Biga barbel.

Diagnosis. Distinguished from other species of *Barbus* in West Asia by: ○ 56–61 total lateral-line scales / ○ 9–10 gill rakers / ○ 39–40 total vertebrae / ○ head length 24–27 % SL / ○ lower lip with a median pad / ○ numerous irregular dark-brown blotches on back, flank, and head / ○ dorsal origin slightly in front of vertical of pelvic origin / ○ last

unbranched dorsal ray 41–55 % ossified / ○ posterior margin of dorsal straight or slightly convex / ○ anal longer in female than in male. Size up to 160 mm SL.

Distribution. Türkiye: Gönen and Biga drainages on Biga Peninsula.

Habitat. Headwaters of streams and small rivers with fast, clear, well-oxygenated water and gravel substrate.

Biology. No data.

Conservation status. LC; has a small range with stable populations.

Remarks. *Barbus ida* occurs locally sympatric with *B. tauricus*. It usually inhabits small headwater streams, whereas *B. tauricus* is found in larger, slow-flowing rivers.

Further reading. Güçlü et al. 2021 (description).



Streams like this tributary of the Murat in the Euphrates drainage, Türkiye, host a diverse fish fauna, including *Barbus lacerta* and many others.



Barbus karunensis; Karun, Iran; 120 mm SL.

Barbus karunensis

Common name. Karun barbel.

Diagnosis. Distinguished from other species of *Barbus* in West Asia by: ○ 59–66+2–4 [60–70 total] lateral-line scales / ○ 39–44 total vertebrae / ○ postdorsal length 50–53 % SL / ○ dorsal base length 17–22 % SL / ○ anal length 7–9 % SL / ○ 26–29 scale around caudal peduncle / ○ 9–11 scales below lateral line / ○ 33–42 predorsal scales / ○ lower lip with a median swollen pad / ○ dorsal origin at or behind vertical of pelvic origin / ○ anal longer in female than in male. Size up to 154 mm SL.

Distribution. Iran: Sezar, Bakhtiyari, Beshar, and Khersan in upper and rarely in lower Karun drainage.

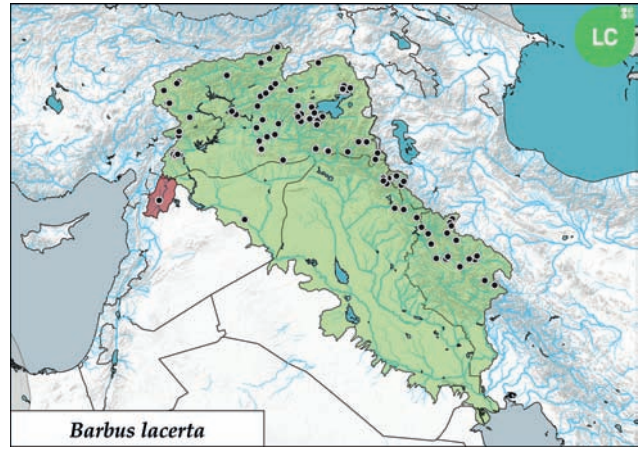
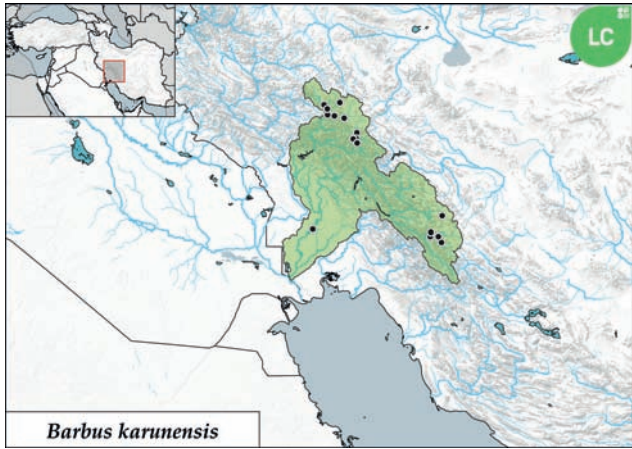
Habitat. Mountain and foothill zones, in streams and small rivers with fast, clear, well-oxygenated water and gravelly substrate.

Biology. Matures at about 2–4 years, males one year earlier than females. A fractional spawner. Feeds mainly on aquatic invertebrates and algae.

Conservation status. LC.

Remarks. *Barbus karunensis* can only be distinguished from *B. cyri* and *B. lacerta* by molecular characters.

Further reading. Khaefi et al. 2017a (description); Eagderi et al. 2019d (morphology).



Barbus lacerta; Euphrates, Türkiye; 112 mm SL.



Barbus lacerta; Lake Nemrut, Türkiye; 110 mm SL.

Barbus lacerta

Common name. Lizard barbel.

Diagnosis. Distinguished from other species of *Barbus* in West Asia by: ○ 52–73+2–4 [56–77 total] lateral-line scales / ○ 39–44 total vertebrae / ○ postdorsal length 46–59 % SL / ○ dorsal base length 16–22 % SL / ○ anal length 6.0–9 % SL / ○ 25–32 scale around caudal peduncle / ○ 35–48 predorsal scales / ○ lower lip with a median swollen pad / ○ dorsal origin at or slightly behind vertical of pelvic origin / ○ numerous irregular dark-brown blotches on back, flanks and head / ○ anal longer in female than in male. Size up to 186 mm SL.

Distribution. Qweiq, Euphrates, Tigris, and Karkheh drainages, also in Lake Van basin.

Habitat. Mountain and foothill areas, in streams and small rivers with fast, clear, well-oxygenated water and gravel

substrate. In lowlands usually most common in small streams and absent from large rivers.

Biology. Lives up to 7 years. Matures at about 2–4 years, males one year earlier than females. A fractional spawner. Feeds mainly on aquatic invertebrates and algae.

Conservation status. LC; one of the most common species in its range, extirpated from Qweiq.

Remarks. Rarely found syntopic with *Luciobarbus* species that occur in larger rivers and lowland habitats. *Barbus koss-wigi*, described from the upper Greater Zab drainage in Anatolian Hakkari province, and *B. ercisanus* from the Lake Van basin are synonyms. *Barbus lacerta* can only be distinguished from *B. cyri* and *B. karunensis* based on molecular characters.

Further reading. Khaefi et al. 2017a (review); Eagderi et al. 2019d (morphology); Coad 2021a (biology, morphology).



Barbus miiarlis; Jaj, Namak basin, Iran; ~110 mm SL.

Barbus miiarlis

Common name. Namak barbel.

Diagnosis. Distinguished from other species of *Barbus* in West Asia by: ○ 69–87+3–5, totally 71–90, lateral-line scales / ○ 39–44 total vertebrae / ○ postdorsal length 52–59 % SL / ○ dorsal base length 18–23 % SL / ○ anal length 7–9 % SL / ○ 28–35 scale around caudal peduncle / ○ 12–15 scales below lateral line / ○ 37–45 predorsal scales / ○ lower lip with a median swollen pad / ○ dorsal origin at or slightly behind vertical of pelvic origin / ○ numerous irregular dark-brown blotches on back, flanks and head / ○ anal longer in female than in male. Size up to 240 mm SL, usually smaller.

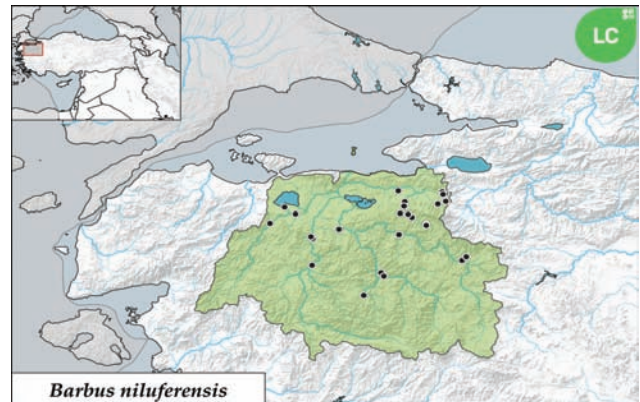
Distribution. Iran: Qom, Qareh Chai, and Jaj drainages in Lake Namak basin. Hable and Nam drainages and Cheshme Ali spring in Western Kavir basin.

Habitat. Slow to fast-flowing rivers with gravel and rocky bottoms.

Biology. Matures at about 2–4 years, males one year earlier than females. A fractional spawner. Feeds mainly on aquatic invertebrates and algae.

Conservation status. VU; possibly extirpated from Lake Namak basin and Cheshme Ali, now found only in small numbers in 5–10 independent, mostly declining populations in Nam and Hable in Western Kavir basin.

Further reading. De Filippi 1863 (description); Karaman 1971: (morphology; as *B. mursa miiarlis*); Jouladeh-Roudbar et al. 2015b (Kavir basin); Khaefi et al. 2017a (review); Eagderi et al. 2019d (morphology).



Barbus niluferensis; Susurluk drainage, Türkiye; 135 mm SL.

Barbus niluferensis

Common name. Susurluk barbel.

Diagnosis. Distinguished from other species of *Barbus* in West Asia by: ○ 62–72 total lateral-line scales / ○ last unbranched dorsal ray moderately ossified / ○ 6–8 gill rakers / ○ head length 23–26 % SL / ○ lower lip with a median lobe / ○ numerous irregular dark-brown blotches on back, flanks and head / ○ 43–44 total vertebrae / ○ anal longer in female than in male. Size up to 160 mm SL.

Distribution. Türkiye: Susurluk drainage.

Habitat. Headwater streams with fast to moderate flow, cobble, and gravel bottom.

Biology. Matures at about 2–4 years, males one year earlier than females. Usually a fractional spawner, some females appear to spawn only once a year. Feeds mainly on aquatic invertebrates and algae.

Conservation status. LC.

Remarks. *Barbus niluferensis* occurs locally sympatric with *B. tauricus*. It usually inhabits small headwater streams, whereas *B. tauricus* is found in larger, slow-flowing rivers.

Further reading. Turan et al. 2009b (description).

Barbus pergamonensis

Common name. Pergamon barbel.

Diagnosis. Distinguished from other species of *Barbus* in West Asia by: ○ 50–62 total lateral-line scales / ○ last unbranched dorsal ray ossified / ○ 8–11, usually 9, gill rakers / ○ 41–42 total vertebrae / ○ head length 24–26 % SL / ○ lower lip with a median lobe / ○ numerous irregular dark-brown blotches on back, flanks and head / ○ last unbranched dorsal ray 52–72 % ossified / ○ posterior margin of dorsal slightly convex / ○ anal longer in female than in male. Size up to 172 mm SL.

Distribution. Türkiye: Karamenderes south to Madra, Bakırçay and Gediz (Aegean basin). Also, on Lesbos Island (Greece).



Barbus pergamonensis; Bakırçay drainage, Türkiye; 120 mm SL.



Barbus cf. *pergamonensis*; Tahtalı drainage, Türkiye; 115 mm SL.

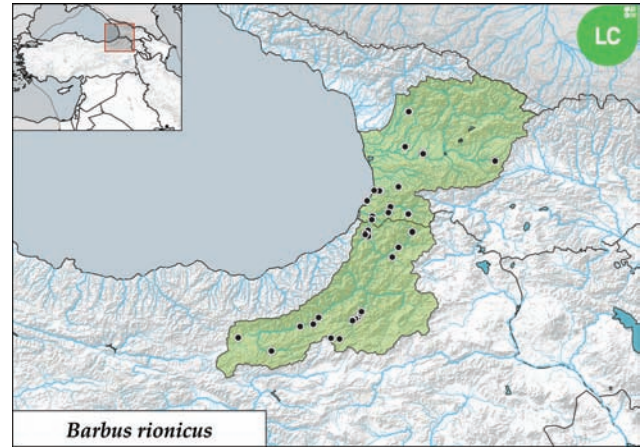
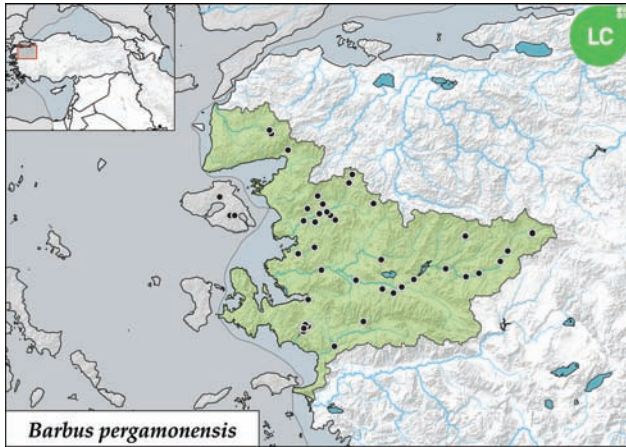
Habitat. A wide range of streams and rivers, usually in fast to moderately fast-flowing waters. Inhabit reservoirs where inflowing streams provide spawning habitat. Spawns in fast-flowing waters in riffles on gravelly substrate.

Biology. Matures at about 2–4 years, males one year earlier than females. A fractional spawner. Feeds mainly on aquatic invertebrates and algae.

Conservation status. LC; Still widespread, but range greatly reduced during 20th century due to massive pollution.

Remarks. Between the ranges of *B. pergamonensis* in north and *B. xanthos* in south, a third molecular cluster occurs in Tahtalı and Küçük Menderes drainages, which may represent an undescribed species. On the other hand, *B. pergamonensis* and *B. xanthos* are already very similar, and further studies may show that the characters distinguishing the two species are not confirmed. They may represent a case similar to the *B. lacerta* group (see above).

Further reading. Karaman 1971 (description); Güçlü et al. 2020 (morphology, distribution).



Barbus rionicus; Çoruh drainage, Türkiye; ~100 mm SL.

Barbus rionicus

Common name. Colchic barbel.

Diagnosis. Distinguished from other species of *Barbus* in West Asia by: ○ flank plain brown or grey with many minute, dark-brown spots, smaller than scales, in individuals over 100 mm SL / ○ lower lip with a median lobe / ○ 50–62, usually 54–58, total lateral-line scales / ○ last dorsal unbranched ray weakly to moderately ossified / ○ 8–12 gill rakers / ○ head length 24–28 % SL / ○ 44–47, usually 45–46, total vertebrae / ○ anal longer in female than in male. Size up to 500 mm SL, but expected to grow larger.

Distribution. Georgia and Türkiye: Eastern Black Sea basin from Kodori south to Rioni and Çoruh.

Habitat. Mountain to hill streams with gravel bottoms and moderate- to fast-flowing water. Prefers stretches with large rocks and rapids alternating with deep holes. Spawns in riffles and rapids.

Biology. Males mature at 2–3 years, 1–3 years earlier than females. Spawns May–September with a peak from May–July at water temperatures of 14–21°C. Spawns in large groups, fractional spawners. Migrates upstream to spawn. Feeds on benthic invertebrates and aquatic plants.

Conservation status. LC.

Further reading. Elanidze 1983 (morphology, biology; as *B. tauricus escherichii*); Yıldırım et al. 2001 (biology, Çoruh); Bogutskaya et al. 2003c (morphology, biology, as *B. tauricus escherichii*, partly); Kotlík et al. 2004 (molecular).



Barbus tauricus; Yenice drainage, Türkiye; ~130 mm SL.



Barbus tauricus; Biga drainage, Türkiye; 173 mm SL.

Barbus tauricus

Common name. Crimean barbel.

Diagnosis. Distinguished from other species of *Barbus* in West Asia by: ◦ flank plain brown or grey, with many minute dark-brown spots, smaller than scales, in individuals over 100 mm SL / ◦ lower lip with a median swollen pad / ◦ 51–64, usually 53–56, total lateral-line scales / ◦ last unbranched dorsal ray moderately ossified / ◦ 9–12 gill rakers / ◦ head length 26–30 % SL / ◦ 44–48, usually 45–46, total vertebrae / ◦ anal longer in female than in male. Size up to 700 mm SL.

Distribution. Southern tributaries of Marmara Sea from Lake İznik west to Karamenderes. Black Sea basin from Crimean Peninsula east along Caucasian Black Sea basin of Russia. All along Anatolian Black Sea coast, west to Thrace, and north to Kamchiya in Bulgaria. In Azov Sea basin in lower Kuban

drainage, possibly hybridised with *B. kubanicus*. Absent or restricted to lowermost Sakarya, Kızılırmak, and Yeşilırmak and eastern Black Sea basin in Georgia and Çoruh (Türkiye).

Habitat. Widespread, from mountain streams with strong currents to brackish estuaries. Inhabits river reaches from coastal areas to about 600 m above sea level.

Biology. Males spawn first time at 2 years, about 65 mm SL, females at 3 years, about 100 mm SL. Moves upstream to upper reaches or near rapids to spawn on gravel or rocky bottom. Spawns May–July when water temperature reaches 15–18°C, often in large groups. Females lay 1–3 portions of eggs. Eggs are not sticky and remain between or under pebbles until hatching. In early winter moves to deeper areas with less current and stops feeding. Feeds mainly on zoobenthos.



Lower Sakarya in Türkiye. Typical habitat of rheophilic fishes.

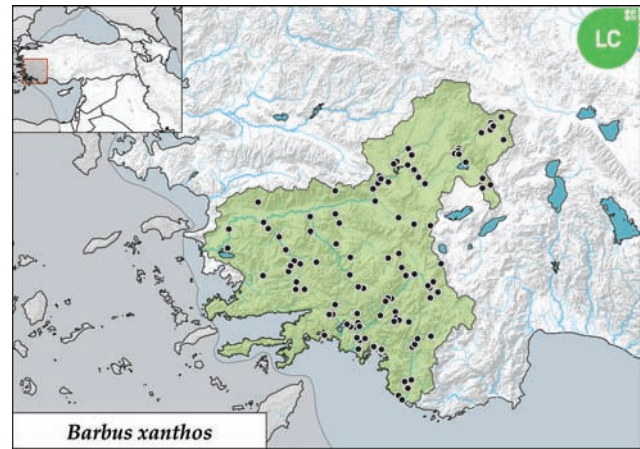
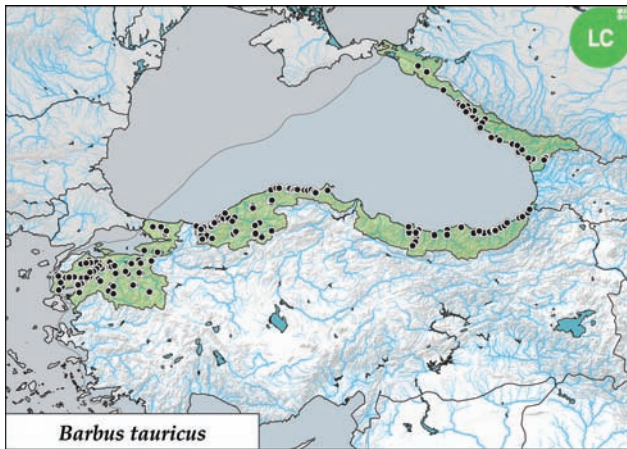
Life cycles of rheophilic fishes. Lampreys, most sturgeons, many cyprinids, leuciscids, nemacheilids, sisorid catfishes, and salmoniforms spend at least part of their lives in moderate- to fast-flowing waters, and their life cycles show many similarities. Adults spawn in fast-flowing waters on gravel or submerged vegetation. Most species lay their eggs in the gravel or spawn above the gravel, and the eggs sink into the interstices. Predators usually eat the eggs that remain on the surface of the gravel. Eggs develop in the gravel. Yolk sac larvae usually move away from the light (they are negatively phototactic) or try to move deeper into the gravel. Larvae have been observed several meters into the substrate, but only the first few centimeters are usually suitable for eggs and larvae. When the yolk sac reserves are exhausted, the larvae become positively phototactic and leave the gravel to find suitable habitats. Larval emergence usually peaks shortly after dawn, and the larvae drift downstream. Some sturgeon and cyprinid larvae drift for several days and may find their nursery habitat several kilometers downstream of the spawning sites. This can lead to strong longitudinal variation in habitat use and extensive migrations at different life stages. Larvae of most riverine species inhabit shallow banks and bays. As they grow, they move to deeper water with faster currents. Habitat use is strongly influenced by various abiotic (e.g. available habitats, climate) and biotic (e.g. food availability, predation risk) factors.

Conservation status. LC.

Remarks. *Barbus tauricus* was previously restricted to Crimea, but new data show that it is much more widespread. *Barbus kubanicus*, *B. rionicus*, *B. anatolicus*, and *B. escherichii* occur in rivers within the range of *B. tauricus*, and it is expected that hybrids of both species and introgressed individuals are common. *Barbus tauricus* seems to inhabit rivers close to the coast, while other species occur inland. *Barbus bergi* from European Türkiye

and Bulgaria and *B. oligolepis* from the Marmara basin are synonyms, as proposed differentiating characters could not be confirmed. *Barbus tauricus* locally occurs sympatric with *B. niluferensis* and *B. ida*, but it inhabits larger river sections.

Further reading. Bogutskaya et al. 2003c (morphology, biology, as *B. tauricus escherichii*, partly); Levin et al. 2015 (phylogeny); Turan et al. 2009b (description of *B. oligolepis*); Turan et al. 2018c (distribution).



Barbus xanthos; Büyük Menderes, Türkiye; 120 mm SL.

Barbus xanthos

Common name. Menderes barbel.

Diagnosis. Distinguished from other species of *Barbus* in West Asia by: ○ 53–60 total lateral-line scales / ○ last unbranched dorsal ray weakly ossified / ○ 7–10 gill rakers / ○ 41–43 total vertebrae / ○ head length 22–27 % SL / ○ lower lip with a median lobe / ○ numerous irregular dark-brown blotches on back, flanks, and head / ○ last unbranched dorsal ray 33–50 % ossified / ○ posterior margin of dorsal straight or slightly concave / ○ anal longer in female than in male. Size up to 190 mm SL.

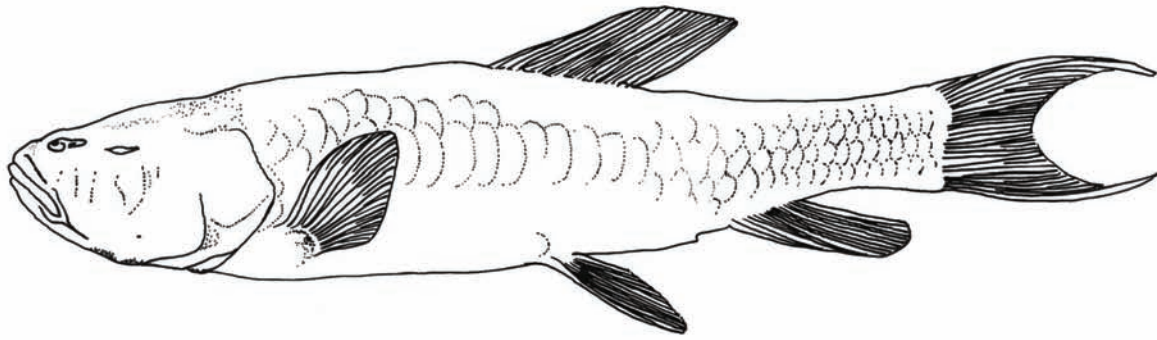
Distribution. Türkiye: Büyük Menderes south to Eşen (Aegean basin).

Habitat. A wide range of stream and river habitats, usually in fast to moderately fast-flowing waters. In reservoirs, where inflowing streams provide spawning habitat. Spawns in fast-flowing waters in riffles on gravel substrate.

Biology. No data. Expected to be similar to *B. pergamonensis*.

Conservation status. LC.

Further reading. Güçlü et al. 2013 (morphology, distribution); Güçlü et al. 2020 (description).



Caecocypris basimi; Haditha, Iraq, 49 mm SL. Modified from Coad 2010.

Caecocypris

This genus is represented by a single species: a small, whitish, eyeless, troglomorphic fish without barbels and with large scales. The orbit is filled with fatty tissue, and vestigial eyes are present only in juveniles. The species was only found once in 1979; virtually nothing is known about it. The large scales, body shape, and absence of barbels indicate a relationship to the geographically adjacent genus *Mesopotamichthys*.

Caecocypris basimi

Common name. Haditha cavefish.

Diagnosis. Distinguished from other subterranean fishes in West Asia by: ● barbels absent / ○ no gular disc. Size up to 49 mm SL.

Distribution. Iraq: aquifer near Haditha, accessible through a well about 3 m below Shaikh Hadeed.

Habitat. Underground waters.

Biology. No data.

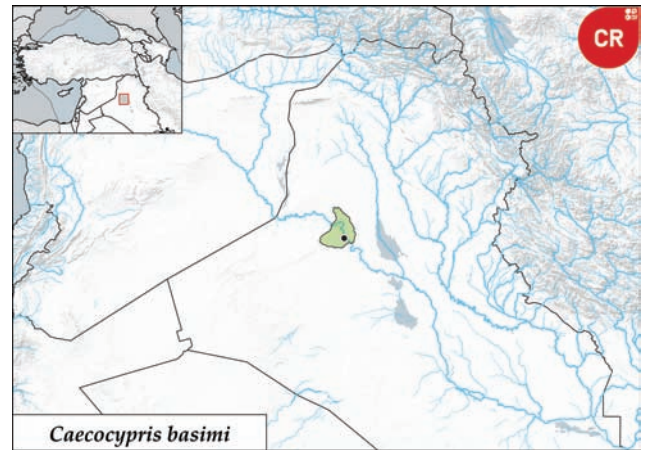
Conservation status. CR; possibly extinct. An attempt to locate this species in 2012 was unsuccessful.

Remarks. Coexists with *Garra widdowsoni*.

Further reading. Banister & Bunni 1980 (description).



Inside the pumping station in Shaikh Hadeed in Iraq, the only window to the habitat of *Caecocypris basimi* and *Garra widdowsoni*. © O. F. Al-Sheikhly.



Capoeta

Capoeta are medium-sized fishes found throughout West Asia. All 27 species of the genus are present in the region, with the distribution range of *C. heratensis* extending to the Amu Darya drainage in the Aral basin. *Capoeta* are unmistakable, with their 1–2 pairs of short barbels, straight or rounded lower jaw, horny cutting sheath, and strong, serrated last unbranched dorsal ray. Some *Capoeta* have two pairs of barbels, while most have one. There is some variation in this character, with occasional individuals having one, two, or even three barbels.

The molecular diversity of *Capoeta* was the focus of several detailed studies, resulting in the description of 12 new species since the year 2000. This makes *Capoeta* the second-largest genus of Cyprinids in West Asia (after *Garra*). These studies also resulted in the description of several “molecular” species that are hardly distinguishable by external characters. Several of the populations that were proposed as species could not be confirmed by subsequent studies and are treated as synonyms. *Capoeta* frequently forms hybrids with sympatric *Luciobarbus*. Many species of *Capoeta* show remarkable variation in the shape of the mouth, especially the lower jaw, which is often wide, straight in some individuals, narrow, and arched in others.

The hypothesis that these differences in mouth shape are attributed to gender was not supported when larger series were studied.

The genus *Paracapoeta* was proposed for *C. anamensis*, *C. barroisi*, *C. erhani*, *C. mandica*, and *C. trutta*. We reject this genus as valid. This species group forms a monophyletic group, very closely related to *Capoeta*, and morphological characters poorly distinguish it. *Capoeta anamensis* does not show any of the proposed diagnostic character states for *Paracapoeta*.

Capoeta forms an important component of many fish communities in West Asia, which are often dominated by these cyprinids by biomass. They are very abundant in many places and found in almost all kinds of water bodies, from cold mountain streams to large lowland lakes and small, brackish desert streams, as long as the fish have access to small patches of stony substrate and flowing waters. Spawning also takes place at the outflow of springs or wave-washed shores of lakes. Some *Capoeta* species are likely very powerful invasive species, but there have been few documented cases of translocations so far. **Further reading.** Levin et al. 2012 (phylogeny); Ghanavi et al. 2016 (phylogeny, Iran); Geiger et al. 2014 (phylogeny, Mediterranean); Bektaş et al. 2017 (phylogeny); Turan et al. 2022a (*Paracapoeta*).

Keys to species of *Capoeta*

Marmara and Mediterranean basins, including endorheic basins in Central Anatolia, the Damascus, and the Dead Sea basins

1a - Two pairs of barbels.

.....2

1b - One pair of barbels.

.....3

2a - Posterior edge of last unbranched dorsal ray smooth, without serrae; 49–57 total lateral-line scales.

.....*C. antalyensis*

2b - Posterior edge of last unbranched dorsal ray with serrae; 69–87 total lateral-line scales.

.....*C. tinca*

3a - Edge of lower jaw not cornified; lips fleshy; snout long and pointed.

.....*C. pestai*

3b - Edge of lower jaw cornified; lips narrow, not fleshy; snout short and blunt.

.....4

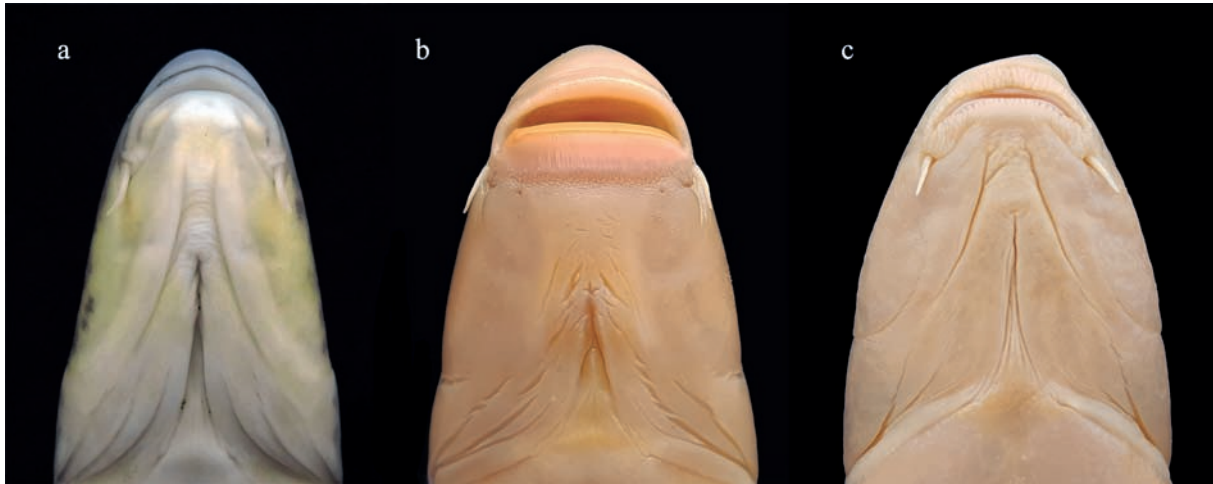


Figure 36. Shape of lower jaw: **a**, non-cornified in *C. pestai* from Lake Beyşehir; **b**, cornified in *C. damascina* from Nusaybin, Euphrates; **c**, lower lip pleated in *C. sieboldii* from Sakarya.

4a - Flank silvery or brown with many small black spots; last unbranched dorsal ray very strongly ossified, with strong serrae reaching almost to tip of ray.

.....5

4b - Flank beige or brown without small black spots; juveniles and some adults with large black blotches; last unbranched dorsal ray moderately ossified, without serrae or with small serrae, not or poorly ossified and without serrae on tip of ray.

.....6

5a - 76–83 total lateral-line scales; pelvic–hypural distance when carried forward, always falling in front of tip of snout; predorsal keel not or very slightly elevated; black spots on dorsal head smaller than on predorsal flank.

.....*C. barroisi*

5b - 63–79 total lateral-line scales; pelvic–hypural distance when carried forward, falling in between midpoint of nostril and tip of snout and center of eye; predorsal keel elevated; black spots on dorsal head about equally sized than on predorsal flank.

.....*C. erhani*

6a - Last unbranched dorsal ray weak, without serrae.

.....*C. caelestis*

6b - Last unbranched dorsal ray ossified, with serrae.

.....7

7a - Usually 68–82 total lateral-line scales; usually $9\frac{1}{2}$ branched dorsal rays.

.....*C. damascina*

7b - Usually 58–71 total lateral-line scales; usually $8\frac{1}{2}$ branched dorsal rays.

.....8

8a - Last unbranched dorsal ray with 21–27 small serrae; posterior margin of dorsal concave.

.....*C. bergamae*

8b - Last unbranched dorsal ray with 7–20 small serrae; posterior margin of dorsal straight.

.....*C. aydinensis*

Black Sea basin

1a - Two pairs of barbels.

.....2

1b - One pair of barbels.

.....4

2a - Last dorsal ray without serrae in individuals smaller than 100 mm SL, with 7–9 serrae in larger individuals.

.....*C. svanetica*

2b - Last dorsal ray with 12–28 serrae.

.....3

3a - 12–14 scale rows between lateral line and dorsal origin; 12–18 gill rakers; eye diameter smaller than cheek length; shape of lower jaw monomorphic, wide and straight in all individuals.

.....*C. banarescui*

3b - 14–17 scale rows between lateral line and dorsal origin; 16–22 gill rakers; eye diameter equal to or greater than cheek length; shape of lower jaw polymorphic, wide and straight or arched and narrow in some individuals.

.....*C. tinca*

4a - 7–10 gill rakers; 7½ branched dorsal rays; 68–82 total lateral-line scales; 0–8 serrae along posterior margin of last simple dorsal ray.

.....*C. oguzelii*

4b - 18–35 gill rakers; 8–9½ branched dorsal rays; 46–60 total lateral-line scales; many serrae along posterior margin of last simple dorsal ray.

.....5

5a - Lower and upper lips pleated, well developed and fleshy; edge of lower jaw not cornified; 28–35 gill rakers.

.....*C. sieboldii*

5b - Lower and upper lips smooth and narrow; edge of lower jaw cornified; 17–26 gill rakers.

.....*C. capoeta*

Caspian basin, Lake Urmia and Namak basins, Hari drainage, rivers flowing to the Persian Gulf south of Zohreh and Iranian endorheic basins

1a - Flank plain silvery or silvery with many small black spots, rarely brown with many black spots; last unbranched dorsal ray moderate to strongly ossified, with strong serrae.

.....2

1b - Flank beige, golden or brown without small black spots, juveniles and some adults with large black blotches; last unbranched dorsal ray soft or moderately ossified, with small serrae.

.....3

2a - Flank plain silvery or pale brown, often with grey stripe.

.....*C. anamisensis*

2b - Flank silvery or brown with many small black spots.

.....*C. mandica*

3a - Two pairs of barbels.

.....*C. heratensis*

3b - One pair of barbels.

.....4

4a - 63–95 total lateral-line scales.

.....5

4b - 32–63 total lateral-line scales.

.....7

5a - A deep groove in front of nares.

.....*C. coadi*

5b - No groove in front of nares.

.....6

6a - 23–28 circumpeduncular scales; 7–10 scales between lateral line and anal origin.

.....*C. saadii*

6b - 29–31 circumpeduncular scales; 10–11 scales between lateral line and anal origin.

.....*C. buhsei*

7a - Usually $7\frac{1}{2}$ branched dorsal rays; 12–15 gill rakers.

.....*C. fusca*

7b - Usually $8-9\frac{1}{2}$ branched dorsal rays; 15–25 gill rakers.

.....8

8a - Usually $9\frac{1}{2}$ branched dorsal rays.

.....*C. kaput*

8b - Usually $8\frac{1}{2}$ branched dorsal rays.

.....9

9a - 36–44 total lateral-line scales.

.....*C. aculeata*

9b - 46–59 total lateral-line scales.

.....10

10a - 44–47 total vertebrae.

.....*C. capoeta*

10b - Less than 44 total vertebrae.

.....*C. razii*

Euphrates and Tigris drainages, including Lake Van basin, excluding Karkheh, Karun, and Zohreh drainages in Iran

1a - Flank silvery with many small black spots, rarely brown with many black spots; last unbranched dorsal ray very strongly ossified, as long or longer than head, rarely shorter, with strong serrae.

.....*C. trutta*

1b - Flank beige, golden or brown without small black spots, juveniles and some adults with large black blotches; last unbranched dorsal ray soft or moderately ossified, shorter than head, with small serrae.

.....*C. damascina*

Karkheh, Karun, and Zohreh drainages in Iran

1a - Last unbranched dorsal ray as long as or longer than head, rarely shorter; adults larger than 150 mm SL, usually silvery with many small dark-brown or black blotches.

.....*C. trutta*

1b - Last unbranched dorsal ray shorter than head; adults larger 150 mm SL brown or silvery, without or with minute dark-brown or black spots.

.....2

2a - 32–44 total lateral-line scales.

.....*C. aculeata*

2b - 56–104 total lateral-line scales.

.....3

3a - A deep groove in front of nares.

.....4

3b - No groove in front of nares.

.....5

4a - 12–18 gill rakers on lower limb.

.....*C. damascina*

4b - 10–13 gill rakers on lower limb.

.....*C. coadi*

5a - Head depth at eye 90–102 % of postorbital length.

.....*C. ferdowsii*

5b - Head depth at eye 105–126 % of postorbital length.

.....*C. shajariani*



Capoeta aculeata; Lake Namak basin, Iran; ~200 mm SL.



Capoeta aculeata; Karun drainage, Iran; 183 mm SL.

Capoeta aculeata

Common name. Largescale scraper.

Diagnosis. Distinguished from other species of *Capoeta* in Iranian Tigris and endorheic basins by: ● 36–44 total lateral-line scales / ○ 14–15 predorsal scales / ○ one pair of barbels / ○ flank beige, golden or brown without small black spots, juveniles and some adults with large black blotches / ○ last unbranched dorsal ray soft or moderately ossified, with small serrae / ○ usually 8½ branched dorsal rays / ○ 16–17 circumpeduncular scale rows / ○ 6–8, usually 7 scale rows between dorsal origin and lateral line / ○ 5–8, usually 6 scales between anal origin and lateral line / ○ 4–7, usually 5–6 scales between pelvic origin and lateral line / ○ 17–22 gill rakers / ○ 38–39 total vertebrae. Size up to 370 mm SL.

Distribution. Iran: Tigris drainage, endorheic Kor and Esfahan basins. Qom, Qareh Chai, Jaj, Khar, Ab-e Kamar drainages in Lake Namak basin. Hable, Nam and Bidvaz drainages in Western Kavir basin.

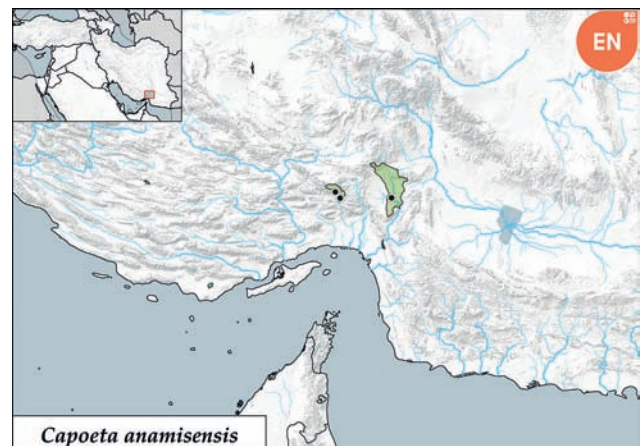
Habitat. Streams, rivers, and springs with moderately fast- to slow-flowing water. From reservoirs, they migrate to rivers to spawn.

Biology. Feeds on detritus, periphyton, and occasionally small invertebrates.

Conservation status. LC.

Remarks. *Capoeta aculeata* had been described from Iran without details of type locality. *Capoeta bergi*, described from the Lake Namak basin, was treated as a synonym. *Capoeta alborzensis* was described from the Lake Namak basin based on the assumption that the type locality of *C. aculeata* is in Kor basin and *C. bergi* is not an available name. No type material of *C. aculeata* was examined for that study. Later research identified the populations from the Lake Namak basin as *C. aculeata* and treated *C. gracilis* from the Esfahan basin and *C. macrolepis* from the Tigris and endorheic Kor as valid species. Again no type material was examined. We consider *C. aculeata*, *C. macrolepis*, *C. gracilis*, *C. bergi*, and *C. alborzensis* as conspecific as they are very closely related, with an COI distance < 1 %, and none of morphological characters proposed to distinguish them could be confirmed.

Further reading. Coad & Krupp 1994 (re-validation); Jouladeh-Roudbar et al. 2015b (distribution); Ghanavi et al. 2016 (phylogeny); Jouladeh-Roudbar et al. 2016a (description as *C. alborzensis*); Zareian et al. 2017 (phylogeny, morphology); Jouladeh-Roudbar et al. 2020 (distribution as *C. alborzensis*); Coad 2021a (biology, morphology).



Intrapopulation variation in mouth shape. In some, but not all, *Capoeta* species, there is a remarkable diversity of mouth shapes. In some individuals of the same size, the jaw is almost straight, while in others, it is horseshoe-shaped or strongly curved. These differences in mouth shape have been interpreted as sexual dimorphism. However, examination of a larger series has shown that mouth shape is unrelated to sex and that different mouth shapes occur at all ages and body sizes and reflect individual differences. The differences in mouth shape do not represent distinct morphs, and all intermediate mouth shapes are observed. Different mouth shapes may be related to ecological adaptations or feeding strategies that allow individuals within the same population to exploit a variety of food resources or habitats. However, this remains speculative and needs to be demonstrated by studying individual feeding behaviour, diet analysis and trophic signatures, such as stable isotopes.



Capoeta caelestis; Göksu drainage; Türkiye; wide- and narrow-mouth forms.



Capoeta anamisensis; Minhab drainage, Iran; 120 mm SL.

Capoeta anamisensis

Common name. Hormuz scraper.

Diagnosis. Distinguished from other species of *Capoeta* in Persian Gulf basin south of Zohreh and in Iranian endorheic basins by: ○ 56–67 total lateral-line scales / ○ flank plain silvery, often with an indistinct stripe / ○ last unbranched dorsal ray very strongly ossified, with strong serrae / ○ $8\frac{1}{2}$ – $9\frac{1}{2}$ branched dorsal rays / ○ 11–12 scale rows between dorsal origin and lateral line / ○ 6–8, usually six scales between anal origin and lateral line / ○ 10–13 scales between pelvic origin and lateral line /

○ one pair of barbels / ○ 21–25 gill rakers. Size up to 230 mm SL.

Distribution. Iran: Upper Minab, Hasan Langi, and Haji Abad drainages, which flow into Strait of Hormuz.

Habitat. Streams and rivers with moderate to fast-flowing water, sand, gravel or rock substrate.

Biology. Feeds on detritus, periphyton, and occasionally small invertebrates.

Conservation status. EN; appears to be declining within its very small range.

Further reading. Zareian et al. 2016 (description).



Capoeta antalyensis; Köprüçay drainage, Türkiye; 163 mm SL.

Capoeta antalyensis

Common name. Pamphylian scraper.

Diagnosis. Distinguished from other species of *Capoeta* in Mediterranean basin and endorheic basins in Central Anatolia by: ● two pairs of barbels / ● 49–57 total lateral-line scales / ○ posterior edge of last unbranched dorsal ray smooth, without serrae / ○ 15–17 gill rakers / ○ edge of lower jaw cornified. Size up to 240 mm SL.

Distribution. Türkiye: Aksu, Köprüçay drainages and coastal streams east to Manavgat.

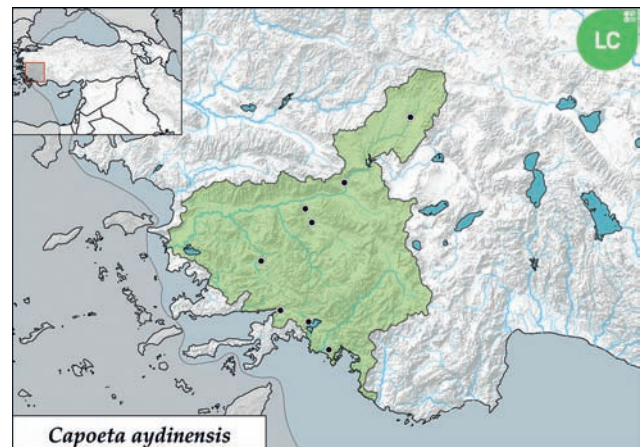
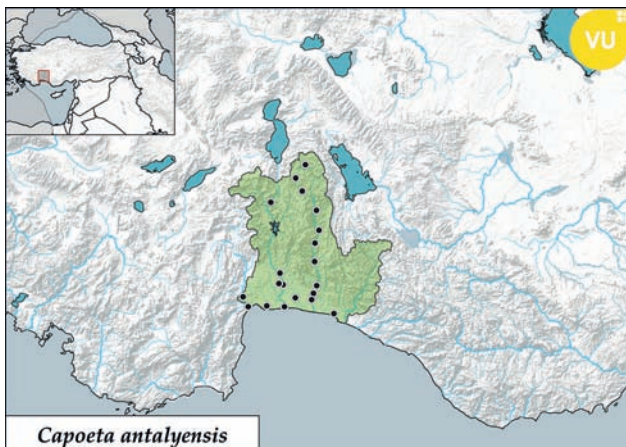
Habitat. Fast-flowing stretches of rivers and larger streams with gravel or rock substrate.

Biology. Feeds on detritus, periphyton, and occasionally small invertebrates.

Conservation status. VU; believed to be declining within its small range.

Remarks. In Ilıca and Manavgat, individuals with two, three and four barbels occur together. Hybrids of *C. antalyensis* and *C. caelestis* inhabit these streams. No hybrids were observed west of Gündoğdu (36.8502, 31.2900), where only *C. antalyensis* is found.

Further reading. Battalgil 1944 (description); Turan et al. 2006a (morphology); Bektaş et al. 2017 (phylogeny); Kaya et al. 2019 (hybrids).





Capoeta aydinensis; Büyük Menderes drainage, Türkiye; 153 mm SL.

Capoeta aydinensis

Common name. Carian scraper.

Diagnosis. Distinguished from other species of *Capoeta* in Marmara and Mediterranean basins and Central Anatolia by: ○ 58–71 total lateral-line scales / ○ $8\frac{1}{2}$ branched dorsal rays / ○ 18–24 gill rakers / ○ keel in front of dorsal origin well developed / ○ posterior dorsal margin straight / ○ flank plain brown, rarely silvery in individuals larger than 150 mm SL / ○ last simple dorsal ray weakly ossified, with 7–20 small serrae along its posterior edge origin / ○ 11–12 scale rows between dorsal origin and lateral line / ○ 7–9 scales between

anal origin and lateral line / ○ one pair of barbels / ○ edge of lower jaw cornified. Size up to 370 mm SL.

Distribution. Türkiye: Büyük Menderes south to Dalaman and streams Namnam and Tersakan. Recorded from Gökova Bay and Lake Köyceğiz.

Habitat. A wide range of streams and rivers with moderate to fast-flowing water and sand or gravel and rock substrate.

Biology. No data.

Conservation status. LC.

Further reading. Bektaş et al. 2017 (phylogeny); Turan et al. 2017c (description); Akyol et al. 2020 (record from Gökova Bay).



Capoeta banarescui; Çoruh drainage, Türkiye; 118 mm SL. © M. Özuluğ.

Capoeta banarescui**Common name.** Colchic scraper.

Diagnosis. Distinguished from other species of *Capoeta* in Black Sea basin by: ○ two pairs of barbels / ○ 64–77 total lateral-line scales / ○ 12–14 scale rows between lateral line and dorsal origin / ○ 8–9 scale rows between lateral line and anal origin / ○ 12–18 gill rakers / ○ 12–20 serrae on last unbranched dorsal ray / ○ eye diameter smaller than cheek length / ○ edge of lower jaw cornified / ○ lips narrow, not fleshy or pleated / ○ shape of lower jaw monomorphic, wide and straight in all individuals / ○ snout short and blunt. Size up to 350 mm SL.

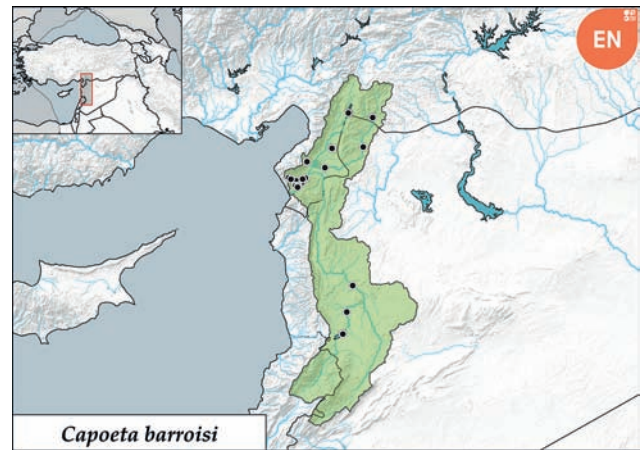
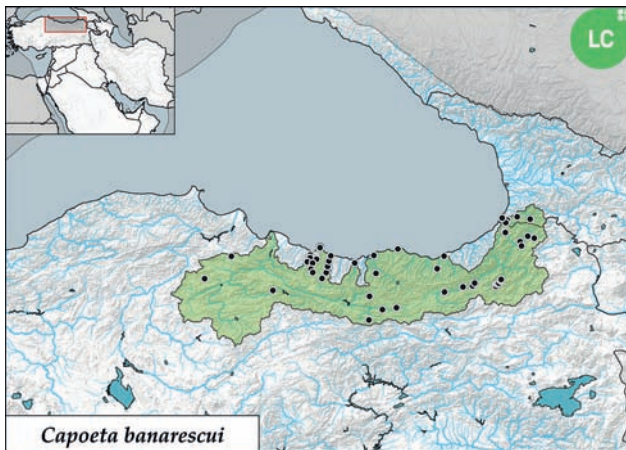
Distribution. Türkiye and Georgia: Yeşilırmak drainage east to Inguri.

Habitat. A wide range of moderately to rapidly flowing streams and rivers with sand, gravel, and rock substrate. Spawns on coarse sand or gravel in flowing water.

Biology. Lives up to 12 years. Matures at 2 (male) or 3 (female) years. Spawns May–July. Feeds on detritus, algae, and invertebrates.

Conservation status. LC.

Further reading. Yıldırım & Aras 2000 (biology); Turan et al. 2006a (description); Bektaş et al. 2017 (phylogeny).



Capoeta barroisi; Orontes drainage, Türkiye; individual with long dorsal ray, 155 mm SL.



Capoeta barroisi; Orontes drainage, Syria; 200 mm SL.

Capoeta barroisi

Common name. Orontes scraper.

Diagnosis. Distinguished from other species of *Capoeta* in Mediterranean and endorheic basins in Levant by:
 ○ one pair of barbels / ○ 76–83 total lateral-line scales /
 ○ flank silvery with many small black spots / ○ black spots on dorsal head smaller than on predorsal body / ○ pelvic-hypural distance when carried forward, always falling in front of tip of snout / ○ last unbranched dorsal ray very strongly ossified, strongly serrated / ○ 26–29 gill rakers /
 ○ predorsal keel not or very slightly elevated. Size up to 320 mm SL.

Distribution. Türkiye and Syria: Orontes drainage.

Habitat. Lakes, reservoirs, and larger lowland rivers. Likely to migrate to inflowing rivers or streams to spawn.

Biology. Feeds on detritus, periphyton, and occasionally small invertebrates.

Conservation status. EN; appears to be declining within its small range. Restricted to a few localities in Orontes drainage such as Tahtaköprü reservoir, lower Orontes, upper Afrin and Lake Gölbaşı (Kırkhan) in Türkiye and Qattinah reservoir in Syria. However, the exact distribution should be reviewed.

Remarks. Individuals of *C. barroisi* with the last unbranched dorsal ray as long as or longer than the head are often misidentified as *C. trutta*. *Capoeta trutta* does not occur in the Orontes.

Further reading. Turan et al. 2008b (distribution, morphology).



***Capoeta*, a genus of hybrid origin?** It has long been suspected that the relationship of *Capoeta* is with the Oriental algae scrapers of the genera *Onychostoma*, *Semiplotus*, and *Scaphiodonichthys*. Since, mitochondrial molecular markers have demonstrated that *Capoeta* is closely related to the genera *Aulopyge*, *Barbus* and *Luciobarbus*. All mitochondrial phylogenetic analyses indicate that *Capoeta* is nested within *Luciobarbus*. As is the case with the majority of Palearctic barbels, all *Luciobarbus* studied are tetraploid, with 100 chromosomes. Conversely, all *Capoeta* studied are hexaploid, with 150 chromosomes. The shift from tetraploidy to hexaploidy is a pivotal event in the evolution of *Capoeta*. Polyploidisation in fish is often associated with hybridisation, and it can be postulated that this was also the case in the origin of *Capoeta*. If a tetraploid mother (chromosomes in the egg: $n = 2$) and a diploid father (chromosome in the sperm cell: $n = 1$) (or vice versa) hybridise, the offspring is triploid ($n = 3$) and is likely to be sterile. It can be postulated that triploids cannot produce viable gametes.

It is plausible that these hybrids were sufficiently abundant in a certain situation to mate with each other and were occasionally able to produce mitotic gametes, i.e., gametes without meiotic division. These eggs and sperm should have been triploid ($n = 3$), and after fertilisation, a new fish with an even number of chromosomes, here six, would result. This hexaploid fish could then spawn normally with the other hexaploid hybrids, which might have constituted the initial step of the new lineage, the genus *Capoeta*. Support for this hybridisation event is further strengthened by nuclear DNA evidence from the RAG1 gene which, together with mitochondrial markers, suggests a biparental genomic contribution. While the mitochondrial data confirm *Luciobarbus* as the maternal source, the RAG1 tree indicates a mixed ancestry, consistent with an ancient Cyprinion-like paternal lineage, and reinforces the role of polyploidisation in the evolution of *Capoeta*. These hybridisation and polyploidisation events may have enabled the hybrids to occupy a different ecological niche than their parents, resulting in the evolution of reproductive isolation from their parents. **Further reading.** Yang et al. 2015 (hybrid origin).



Capoeta bergamae; Bakacak, Türkiye; 145 mm SL.

Capoeta bergamae

Common name. Aegean scraper.

Diagnosis. Distinguished from other species of *Capoeta* in Marmara and Mediterranean basins and Central Anatolia by: ○ 60–71 total lateral-line scales / ○ $8\frac{1}{2}$, rarely $7\frac{1}{2}$, branched dorsal rays / ○ 18–24 gill rakers / ○ keel in front of dorsal origin well developed / ○ posterior dorsal margin concave / ○ flank plain brown, rarely silvery in individuals larger than 150 mm SL / ○ last simple dorsal ray weakly ossified, with 21–27 small serrae along its posterior edge origin / ○ 11–14 scale rows between dorsal origin and lateral line / ○ 7–9 scales between anal origin and lateral line / ○ one pair of barbels / ○ edge of lower jaw cornified. Size up to 198 mm SL.

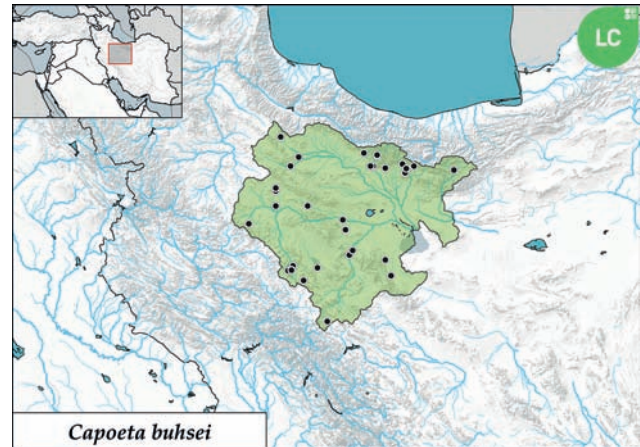
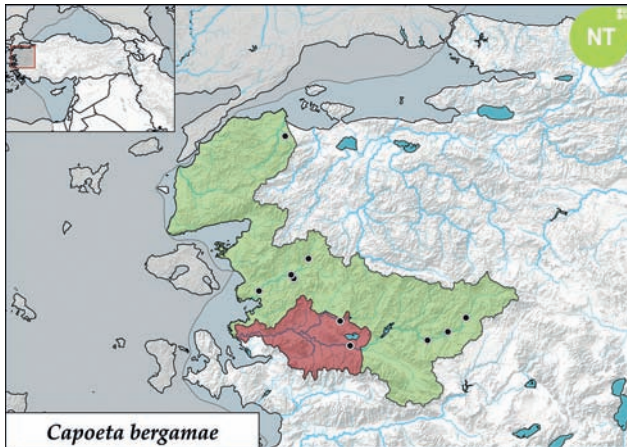
Distribution. Türkiye: Gediz north to Bakacak drainage (northern Biga Peninsula).

Habitat. Wide range of rivers and streams with clean and, at least seasonally, running water.

Biology. Feeds on detritus, periphyton, and occasionally small invertebrates.

Conservation status. NT; declined in recent years, but still too widespread and not declining fast enough to qualify for a threat category. Extirpated from Küçük Menderes.

Further reading. Karaman 1969 (description); Turan et al. 2017c (distribution, morphology); Bektaş et al. 2017 (phylogeny).



Capoeta buhsei; Lake Namak basin, Iran; ~200 mm SL.

Capoeta buhsei

Common name. Namak scraper.

Diagnosis. Distinguished from other species of *Capoeta* in Iranian endorheic basins by: ○ 82–95 total lateral-line scales / ○ usually $8\frac{1}{2}$ branched dorsal rays / ○ flank beige or brown without small black spots, juveniles and some adults individuals with large black blotches / ○ no groove in front of nares / ○ one pair of barbels / ○ last unbranched dorsal ray soft or moderately ossified, serrated / ○ 14–16 scales between lateral line and dorsal origin / ○ 29–31 circumpeduncular scales / ○ 12–14 gill rakers, 7–10 on lower limb / ○ 10–11 scales between lateral line and anal origin. Size up to 230 mm SL.

Distribution. Iran: Qom, Qareh chai, Jaj, Karaj, Khar, Kan and Mazlaghan drainages in Lake Namak basin. Hable, Nam, Qolrudbar and Boneh Koh in Western Kavir basin.

Habitat. Streams with sand, mud or gravel bottom.

Biology. Feeds on periphyton.

Conservation status. LC.

Further reading. Alwan 2010 (morphology, phylogeny); Alwan et al. 2016a (morphology, phylogeny); Jouladeh-Roudbar et al. 2017b (phylogeny, morphology); Zareian & Esmaeili 2017 (description); Jouladeh-Roudbar et al. 2020 (distribution); Coad 2021a (biology, morphology).



Capoeta caelestis; Göksu, Türkiye; 137 mm SL.

Capoeta caelestis

Common name. Taurus scraper.

Diagnosis. Distinguished from other species of *Capoeta* in Mediterranean basin by: ○ one pair of barbels / ○ 57–69 total lateral-line scales / ○ last unbranched dorsal ray weak, slender, without serrae / ○ 8½ or 9½ branched dorsal rays / ○ 16–21 gill rakers / ○ 10–13 scales rows between lateral line and dorsal origin / ○ 7–8 scales between anal origin and lateral line / ○ 23–24 circumpeduncular scales / ○ flank beige, golden or brown without small black spots, juveniles and some adults individuals with large black blotches. Size up to 340 mm SL.

Distribution. Türkiye: Ilıca and Manavgat east to Göksu drainage.

Habitat. Coastal streams to mountain rivers. Often sole species in a stream. Spawns in fast-flowing water in rapids and riffles.

Biology. No data.

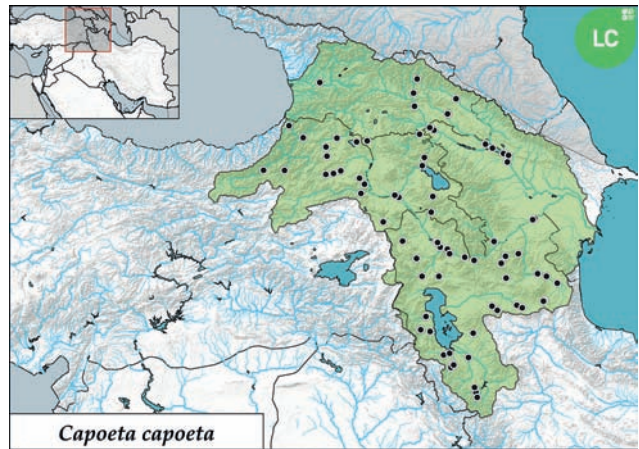
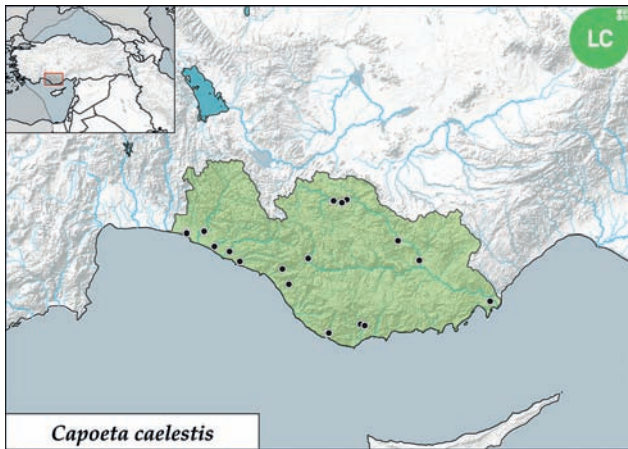
Conservation status. LC.

Remarks. In Ilıca and Manavgat, individuals with one pair, two pairs and three barbels occur together. These are hybrids between *C. antalyensis* and *C. caelestis*.

Further reading. Küçük 2007a (distribution); Schöter et al. 2009 (description); Alwan 2010 (morphology, phylogeny); Alwan et al. 2016b (morphology, phylogeny).



Figure 37. Gut coils in *Capoeta*, as visible in an x-ray picture, indicate the herbivory feeding behaviour of all species in this genus.



Capoeta capoeta; Urmia basin, Iran; ~140 mm SL.



Capoeta capoeta; Aras drainage, Türkiye; ~190 mm SL.

Capoeta capoeta

Common name. Caucasian scraper.

Diagnosis. Distinguished from other species of *Capoeta* in Black and Caspian Sea basins by: ○ one pair of barbels / ○ 46–59 total lateral-line scales / ○ usually 8½ branched dorsal rays / ○ last unbranched dorsal ray strong, with many serrae / ○ 18 or more predorsal scales / ○ back behind head and in front of dorsal origin strongly compressed / ○ 44–47 total vertebrae / ○ 17–26 gill rakers / ○ lower and upper lips smooth and narrow / ○ edge of lower jaw cornified. Size up to 380 mm SL.

Distribution. Caspian basin: Kura and Aras drainages (including Lake Sevan). Black Sea basin: Çoruh (Türkiye) northeast to Rioni (Georgia). Lake Urmia basin.

Habitat. Stream and river habitats from coastal to mountain streams with gravel substrates. Also in lakes and reservoirs. Spawns in fast-flowing waters in rapids and riffles on gravel or sand; also on wave-washed lake shores; migrates to lake tributaries to spawn.

Biology. Females live up to 10 years, males up to 6; usually 4–5 years. Spawns between March and September. Fractional spawner; individual females may spawn up to three times a year. Feeds mainly on detritus and periphyton.

Conservation status. LC.

Remarks. As with many barbels, the eggs are toxic and even inadequately cleaned fish can be dangerous to humans. *Capoeta ekmekciae* from the easternmost Black Sea basin (Çoruh in Türkiye northeast to Rioni in Georgia) and *C. sevangi* from Lake Sevan in Armenia are synonyms. The geographical boundaries between this species and *C. razii* south of Kura are unclear, and hybrids are expected to occur there and potentially in Aras.

Further reading. Berg 1949b (distribution, biology); Bănărescu 1999b (biology); Turan et al. 2006b (*Capoeta ekmekciae*); Zareian et al. 2017 (phylogeny, morphology); Kuljanishvili et al. 2020 (distribution, *C. ekmekciae* and *C. sevangi* as synonyms); Çiçek et al. 2022 (*C. ekmekciae* as a synonym).



Capoeta coadi; Karun drainage, Iran; 172 mm SL.

Capoeta coadi

Common name. Karun scraper.

Diagnosis: Distinguished from other species of *Capoeta* in Karkheh, Karun, Zohreh and endorheic Zayandeh drainages by: ○ usually 9½ branched dorsal rays / ○ one pair of barbels / ○ flank beige, golden or brown without small black spots, juveniles and some adults individuals with large black blotches / ○ last unbranched dorsal ray weakly ossified and serrated / ○ 14–18 gill rakers, 10–13 gill rakers on lower limb / ○ 65–84 total scales along lateral line / ○ 12–17 scales between lateral line and dorsal origin / ○ 9–11 scales between lateral line and pelvic origin / ○ 25–32 circumpeduncular scales / ○ a deep groove in front of nares. Size up to 280 mm SL.

Distribution. Iran: Karun drainage and Esfahan basin.

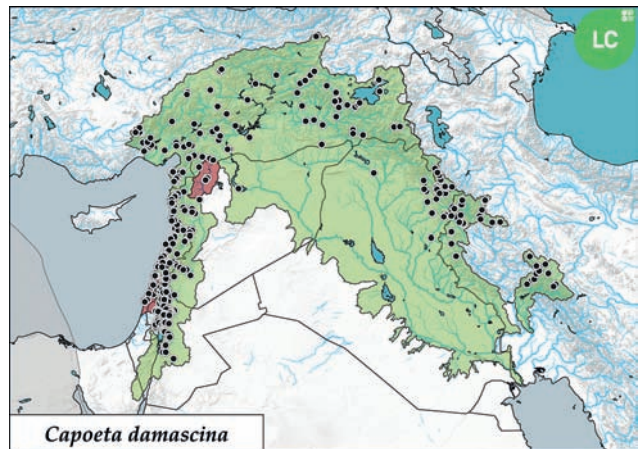
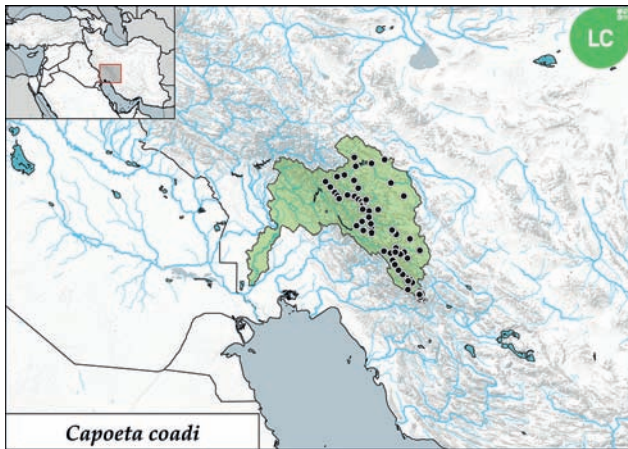
Habitat. Moderate or fast-flowing rivers, usually with gravel substrate and clear water.

Biology. Lives up to 10 years. Males mature at 2 years, females at 3–6 years. Spawns May–June. Feeds on periphyton.

Conservation status. LC.

Remarks. *Capoeta birunii* from the Zayandeh drainage is a synonym.

Further reading. Alwan 2010 (morphology, phylogeny); Alwan et al. 2016a (description); Jouladeh-Roudbar et al. 2016a (phylogeny); Jouladeh-Roudbar et al. 2017b (phylogeny, morphology); Zareian & Esmaeili 2017 (description of *C. birunii*); Jouladeh-Roudbar et al. 2020 (distribution, *C. birunii* as a synonym of *C. coadi*); Coad 2021a (biology, morphology); Jouladeh-Roudbar 2022 (*C. birunii* as a synonym of *C. coadi*).



Capoeta damascina; Barada spring, Damascus basin, Syria; 163 mm SL.



Capoeta damascina; Ceyhan drainage, Türkiye; 187 mm SL.



Capoeta damascina; Dez in Karun drainage, Iran; 194 mm SL.



Capoeta damascina (*Capoeta umbla* morphotype); Tigris, Türkiye; ~320 mm SL.

Capoeta damascina

Common name. Levantine scraper.

Diagnosis. Distinguished from other species of *Capoeta* in Mediterranean, Damascus, and Dead Sea basins, Lake Van basin, Euphrates, and Tigris (except Karkheh and Karun) by: ○ flank beige, golden, or brown without small black spots, juveniles and some adults individuals with large black blotches / ○ last unbranched dorsal ray weakly to moderately ossified and serrated / ○ $8\frac{1}{2}$ – $10\frac{1}{2}$, usually $9\frac{1}{2}$ branched dorsal rays / ○ usually 61–82 total lateral-line scales, many individuals have 80–104 total lateral-line scales in Tigris and Euphrates / ○ 11–20 scales between lateral line and dorsal origin / ○ 7.5–14.5 scales between lateral line and pelvic origin / ○ 23–34 circumpeduncular scales / ○ usually 18–23 gill rakers, 12–18 gill rakers on lower limb, 12–15 in Damascus basin / ○ one pair of barbels / ○ last unbranched dorsal ray shorter than head / ○ usually

18–25 scales above lateral line / ○ 11.5–15.5 scales below lateral line / ○ 31–39 circumpeduncular scales. Size up to 450 mm SL.

Distribution. Seyhan, Ceyhan, and Orontes southwards to Litani in Lebanon. Damascus and Qweiq endorheic basins, Jordan drainage, and major tributaries of Dead Sea (such as Moujib and Hasa). Euphrates and Tigris, including tributaries of Lake Van. Absent from Iranian rivers flowing into Persian Gulf south of Karun, except Dez, a tributary of Karun. Absent from other parts of Karun and Karkheh.

Habitat. A wide range of running waters, lakes, and reservoirs with (seasonally) inflowing rivers or streams. Occupies cold headwaters of mountain zones, medium-sized rivers, springs, and associated wetlands, down to small wadis and brackish desert streams. Spawns on gravel, wave-washed lake shores, and spring discharge horizons. Larvae and juveniles inhabit riparian habitats.

Biology. Lives up to 12 years. Spawns first time at 130–200 mm SL, usually matures at 2 (males) and 4 (females) years. Spawns May–June or late July (Lebanon), January–March or May (upper Jordan). Migrates regionally from lakes to rivers to spawn. In upper Jordan, migrates in December–February to spawning areas in upper reaches. Rainfall, flooding, and a drop in water temperature trigger migration. Several males usually follow a female to spawn. Eggs are sticky and are deposited in gravel excavated by female during spawning. Eggs poisonous. Adults migrate downstream after spawning. Juveniles have many dark brown blotches on a silvery or golden background. Feeds on detritus, periphyton, and invertebrates.

Conservation status. LC.

Remarks. Reported from an oasis on Sinai Peninsula, where it may have been introduced (but now extirpated). Despite its wide distribution, recent molecular studies involving fish across its range have not revealed a strong phylogeographic structure. *Capoeta kosswigi* from Lake Van basin and *C. angorae* from Seyhan and Ceyhan are synonyms. *Capoeta pyragyi*, described from the Dez, a tributary of Karun in Iran, is identical to *C. damascina* by its COI DNA sequences, and all morphological characters given in original description overlap with those of *C. damascina*. It is also treated as a synonym.

In the Tigris, high-scale count individuals (80–104, total lateral-line scales) occur in pure populations or syntopy with low-scale count individuals (61–82). In the Euphrates, no pure high-scale count populations have (yet) been reported, but low and high-scale count individuals often occur in syntopy, whereas in the Mediterranean, only low-scale count fish have been found. The high-scale count individuals are often recognised as a separate species,

C. umbla. High and low-scale-count fish are not distinguished by their COI DNA sequences (but few individuals differ slightly in their LSU sequences), all other meristic characters overlap, and high and low-scale-count individuals are superficially very similar in all other characters. Furthermore, the distribution of scale numbers in Van Lake basin bridges the gap between *C. damascina* and “*C. umbla*.” The background of this situation has yet to be understood. A first hypothesis is that they are two species often found in sympatry; intermediate individuals could be hybrids, and the lack of COI DNA sequences could be due to introgressive hybridisation. The overall high similarity of both “species” and their syntopic occurrence challenge this view. Such superficially similar and closely related species only rarely occur in syntopy, and it is difficult to imagine that this is the case for *Capoeta*, which is known to hybridise even with sympatric other *Capoeta* and *Luciobarbus* species. Alternatively, the often bimodal scale numbers in syntopic fishes may indicate that scale number inheritance may be associated with two alternative haplotypes leading to either high- or low-scale numbers rather than intermediate scale numbers, as expected in hybrids. This hypothesis suggests a species that occurs in individuals with high- or low-scale numbers, both in mixed and pure populations. Until this hypothesis is rejected, we treat *C. umbla* and *C. damascina* as conspecifics.

Further reading. Türkmen et al. 2002 (biology); Alwan 2010 (revision of *C. damascina* group); Alwan et al. 2016b (morphology, phylogeny); Esmaeili et al. 2016a (description, molecular phylogeny); Kaya et al. 2016 (distribution); Zareian & Esmaeili 2017 (description); Jouladeh-Roudbar et al. 2017c (description); Kaya 2019 (distribution); Coad 2021a (biology, morphology).



Capoeta erhani; Seyhan drainage, Türkiye; 129 mm SL.



Capoeta erhani; Seyhan drainage, Türkiye; 220 mm SL.

Capoeta erhani

Common name. Cilician scraper.

Diagnosis. Distinguished from other species of *Capoeta* in Mediterranean basin by: ○ one pair of barbels / ○ 63–79 total scales in lateral line / ○ flank silvery or brown with many small black spots / ○ black spots on dorsal head about equally sized than on predorsal body / ○ pelvic–hypural distance when carried forward, falling in-between midpoint of nostril–the tip of snout and center of eye / ○ last unbranched dorsal ray very strongly ossified, strongly serrated / ○ 25–30 gill rakers / ○ predorsal keel elevated. Size up to 320 mm SL.

Distribution. Türkiye: Seyhan and Ceyhan drainages.

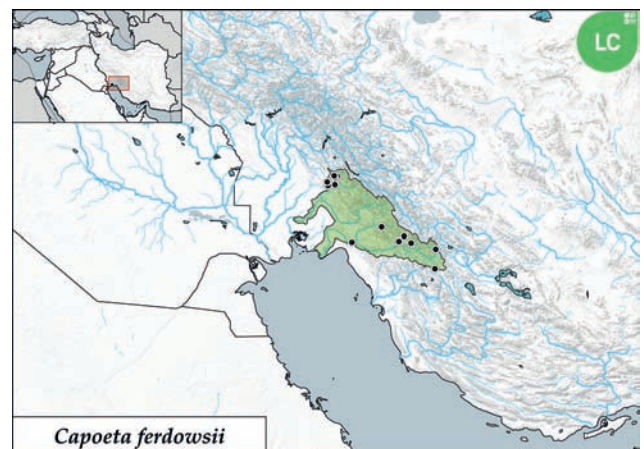
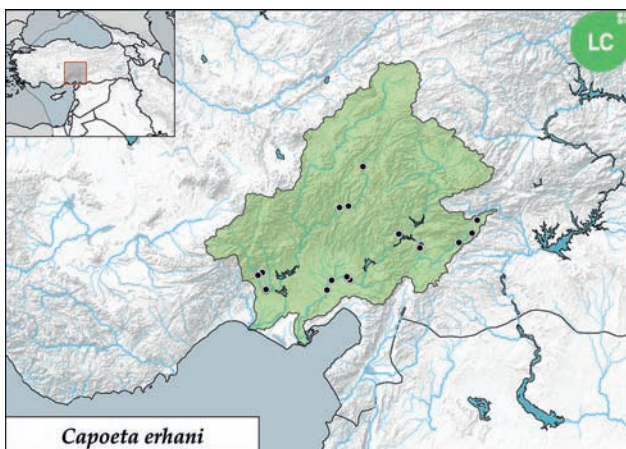
Habitat. Wide range of moderately to rapidly flowing streams and rivers with sandy, gravelly, or rocky bottoms. Common in reservoirs and large rivers.

Biology. Lives up to 5 years.

Conservation status. LC.

Remarks. *Capoeta turani* was described from Seyhan, but later studies found that the diagnostic characters overlap to a large extent. It is treated as a synonym of *C. erhani*.

Further reading. Turan et al. 2008b (description); Özuluğ & Freyhof 2008b (description as *C. turani*); Geiger et al. 2014; Bektaş et al. 2017 (phylogeny); Turan et al. 2022a (*C. turani* as a synonym of *C. erhani*).





Capoeta ferdowsii; Zohreh drainage, Iran; ~ 130 mm SL.

Capoeta ferdowsii

Common name. Zohreh scraper.

Diagnosis. Distinguished from other species of *Capoeta* in Karkheh, Karun and Zohreh drainages by: ○ flank beige, golden or brown without small black spots, juveniles and some adults individuals with large black blotches / ○ usually 9½ branched dorsal rays / ○ last unbranched dorsal ray shorter than head, weakly ossified and serrated / ○ 71–80 lateral-line scales / ○ 13–17 scales between dorsal origin and lateral line / ○ 8–11 scales between anal origin and lateral line / ○ 26–30 encircling least circumference of caudal

peduncle / ○ 13–15 gill rakers, 10–12 on lower limb / ○ no groove in front of nares / ○ head depth at eye 90–102 % of postorbital length. Size up to 170 mm SL, likely to grow much larger.

Distribution. Iran: Zohreh, Jarrahi, and Fahlian drainages.

Habitat. Medium to fast-flowing rivers with sand, gravel, or mud substrate.

Biology. No data.

Conservation status. LC.

Further reading. Jouladeh-Roudbar et al. 2017c (description); Zareian & Esmaeili 2017 (description).



Large, free-flowing rivers support a diverse fish fauna. The Aras at the border between Azerbaijan and Iran hosts *Capoeta capoeta* and *C. kaput*.



Capoeta fusca; Qanat-e Segonbadan, Iran; 124 mm SL.

Capoeta fusca

Common name. Qanat scraper.

Diagnosis. Distinguished from other species of *Capoeta* in Iranian endorheic basins by: ○ 7½ branched dorsal rays / ○ usually 42–50 total lateral-line scales / ○ usually 11–15 gill rakers / ○ one pair of barbels / ○ last unbranched dorsal ray soft with few fine serrae along proximal half / ○ flank beige, golden, or brown without small black spots, juveniles and some adult individuals with large black blotches. Size up to 180 mm SL, likely to grow larger.

Distribution. Sistan basin in Afghanistan. Atrak drainage, North and South Bejestan, Eastern Kavir, Gonabad, and Lut basins in Iran.

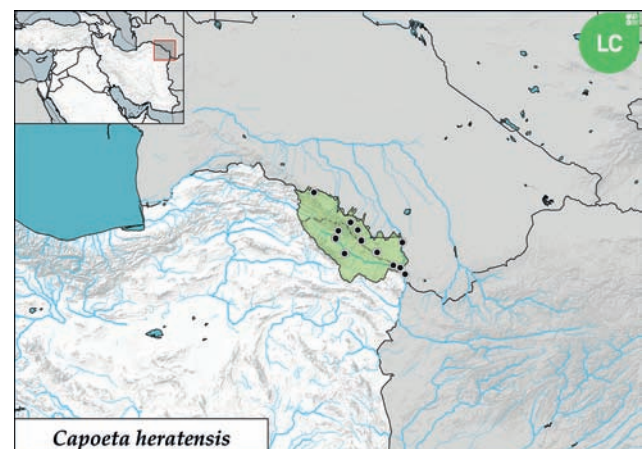
Habitat. A wide range of small to large desert streams, springs, qanats and canals. Habitats are often very small and isolated.

Biology. Lives up to 6 years. Spawns March–August, fractional spawning. Feeds on plants and filamentous algae, occasionally on invertebrates.

Conservation status. LC; although the species is widespread, its habitats are usually very small and under severe water stress.

Remarks. Scales on the belly and lower flank are deeply embedded in skin in some individuals or populations. This species is very closely related to *C. aculeata*.

Further reading. Johari et al. 2009 (biology); Patimar & Mohammadzadeh 2011 (biology); Jouladeh-Roudbar et al. 2020 (distribution); Coad 2021a (biology, morphology).





Capoeta heratensis; Kalat, Iran; about 150 mm SL. © H. Mousavi-Sabet.

Capoeta heratensis

Common name. Central Asian scraper.

Diagnosis. Distinguished from other species of *Capoeta* in Iranian endorheic basins by: ● usually two pairs of barbels / ○ 50–61 total lateral-line scales / ○ 17–22 gill rakers / ○ usually 8½ branched dorsal rays / ○ 8–11 scales between dorsal origin and lateral line / ○ 7–8 scales between anal origin and lateral line / ○ 7–10 scales between pelvic origin and lateral line / ○ back behind head and in front of dorsal origin not or very slightly compressed / ○ last unbranched dorsal ray strong, with many serrae. Size up to 292 mm SL.

Distribution. Hari drainage in Iran, Afghanistan, and Turkmenistan. In Morghab, Karakum Canal, and Kopetdag streams in Turkmenistan, Zeravshan, and Amu Darja in Central Asia.

Habitat. A wide range of streams and rivers, including reservoirs and lakes, from which it migrates into tributaries to spawn.

Biology. Lives for 8 years, probably longer, reported to mature at 2–4 years and 100 mm (probably TL). Small spawners appear to be all males. Spawns April–August at temperatures between 16 and 23°C (Uzbekistan) on gravel bottoms. Fractional spawners, females spawn more than once in a season.

Conservation status. LC.

Remarks. Individuals with three or two barbels are common in some populations. *Capoeta steindachneri* is a synonym.

Further reading. Berg 1949b (morphology, distribution); Jouladeh-Roudbar et al. 2017b (morphology); Zareian et al. 2017 (phylogeny, morphology).



Capoeta kaput; Aras, Iran; ~300 mm SL.

Capoeta kaput

Common name. Blue scraper.

Diagnosis. Distinguished from other species of *Capoeta* in Caspian basin by: ● usually 9½ branched dorsal rays / ● flank bluish or bluish-green without small black spots, juveniles with large black blotches / ○ 54–63 total lateral-line scales / ○ 24–25 gill rakers. Size up to 900 mm SL.

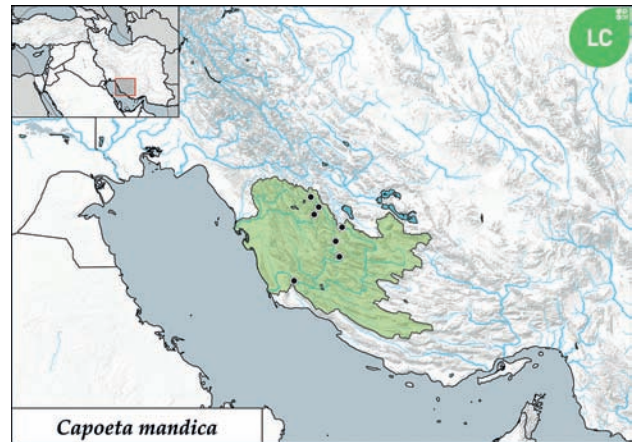
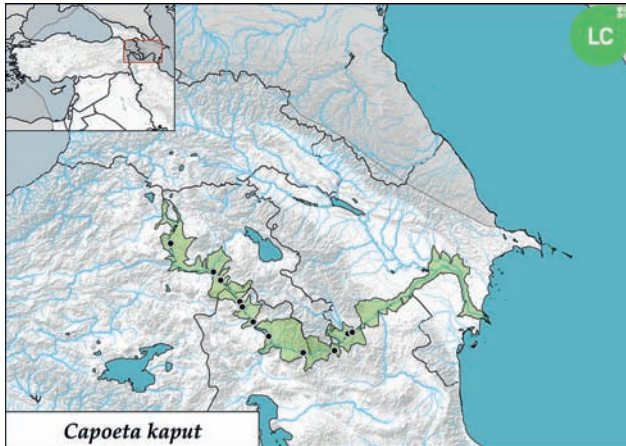
Distribution. Caspian basin: Aras drainage.

Habitat. Larger rivers with moderate or fast-flowing water.

Biology. Feeds on detritus, periphyton, and occasionally small invertebrates.

Conservation status. LC.

Further reading. Levin et al. 2019 (description); Kaya 2019 (distribution); Kuljanishvili et al. 2020 (distribution).



Finding fishes in West Asia is always connected with lots of driving in full cars on bad roads, as here in Iran.



Capoeta mandica; Mond drainage, Iran; 131 mm SL.

Capoeta mandica

Common name. Mond scraper.

Diagnosis. Distinguished from other species of *Capoeta* in Persian Gulf basin south of Zohreh and in Iranian endorheic basins by: ○ flank silvery or brown with many small black spots, especially on head and back / ○ last unbranched dorsal ray very strong, shorter than head, strongly serrated / ○ 58–68 total lateral-line scales / ○ 21–27 gill rakers / ○ 12–13 scales between dorsal and lateral line / ○ 8–10 scales between lateral line and anal / ○ usually 8½ branched dorsal rays. Size up to 300 mm SL.

Distribution. Iran: Helleh and Mond drainages.

Habitat. Small rivers and streams with sand or gravel bottoms. Usually in medium or fast-flowing clear or muddy waters.

Biology. Lives up to 6 years. Spawns in spring, most likely May–June.

Conservation status. LC.

Further reading. Bianco & Bănărescu 1982 (description); Zareian et al. 2018 (description).



Capoeta oguzelii; Ezine, Türkiye; ~100 mm SL.

Capoeta oguzelii

Common name. Ezine scraper.

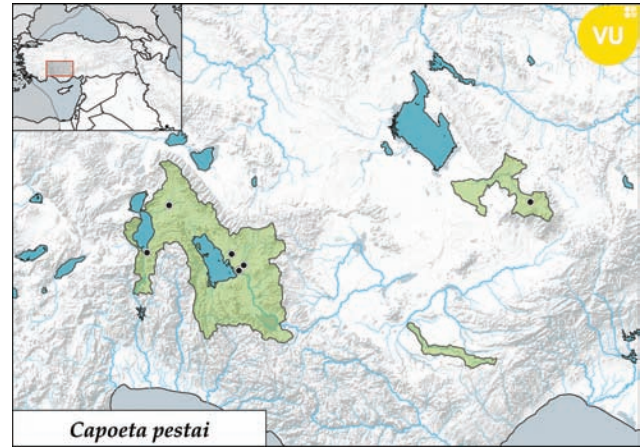
Diagnosis. Distinguished from other species of *Capoeta* in Black Sea basin by: ○ lower jaw strongly arched, without cornified edge / ○ 7–10 gill rakers / ○ 7½ branched anal rays / ○ one pair of barbels / ○ last unbranched dorsal ray weakly

ossified, its posterior edge of with 0–8 serrae / ○ 68–82 total lateral-line scales. Size up to 139 mm SL.

Distribution. Türkiye: Upper reaches of Ezine (Kastamonu).

Habitat. Streams with moderate, slow-flowing water and a gravel, sandy or muddy bottom.

Biology. No data.



Capoeta pestai; Lake Eğirdir basin, Türkiye; 210 mm SL.

Conservation status. CR; only a few small villages around type locality. Sudden pollution or desiccation may cause immediate extinction.

Further reading. Elp et al. 2018 (description); Kaya 2019 (distribution, conservation).

Capoeta pestai

Common name. Long-snout scraper.

Diagnosis. Distinguished from other species of *Capoeta* in Central Anatolia and Mediterranean basin by: ● edge of lower jaw arched, not cornified / ● lips fleshy / ● snout long, pointed / ○ one pair of barbels / ○ last unbranched dorsal ray strongly ossified, as long or longer than head in juveniles smaller than 80 mm, shorter in adults, its posterior edge of with many serrae / ○ 83–92 total lateral-line scales / ○ 16–18 gill rakers / ○ usually 8½ branched dorsal rays. Size up to 400 mm SL.

Distribution. Türkiye: Lake Eğirdir and Beyşehir basins, Melendiz (Ihlara Valley) and Yeşildere (Karaman) drainages in Central Anatolia.

Habitat. Streams with moderately fast-flowing or almost stagnant water. Regularly entering lakes.

Biology. No data.

Conservation status. VU; remaining populations mostly in streams. Formerly a predominantly lacustrine species, migrating to lake tributaries to spawn. Since the introduction of *Sander lucioperca*, few individuals migrate to the lakes, but the situation has improved due to overfishing of *Sander*.

Remarks. Eggs are toxic. According to one report, diarrhea, vomiting and diaphoresis were reported 4.5 h after ingestion of ovaries. *Capoeta pestai* and *C. mauricii* are indistinguishable by molecular characters (COI, cytochrome B) and morphological characters proposed to distinguish the two species could not be confirmed. *Capoeta mauricii* is treated as a synonym of *C. pestai*.

Further reading. Küçük et al. 2009a (morphology, distribution, description of *C. mauricii*); Küçük et al. 2009b (conservation); Geiger et al. 2014, Bektaş et al. 2017 (phylogeny); Özeren et al. 2019 (distribution, synonyms); Bayçelebi et al. 2020a (distribution).



Hybrid between *Capoeta damascina* and *Luciobarbus schejch*; Euphrates drainage, Türkiye; 135 mm SL.

***Capoeta* x *Luciobarbus* hybrids.** Hybrids between species of *Capoeta* and *Luciobarbus* have been recorded in areas where both species occur together. These hybrids were known to early ichthyologists exploring West Asia and have been named as *Barbus* species. Hybrids are often difficult to distinguish in the field, especially if they are young. In several *Capoeta* and *Luciobarbus*, the shape of the mouth is quite variable, and hybrids may bridge the gap between the mouth and head shapes of *Capoeta* and *Luciobarbus*. All *Luciobarbus*, for which data is available, are tetraploid with 100 chromosomes, while all *Capoeta* are hexaploid with 150 chromosomes. If a tetraploid ($n = 4$) parent and a hexaploid ($n = 6$) parent hybridise, the offspring is pentaploid ($n = 5$) and is likely to be sterile, as all odd-numbered hybrids are. The occasional findings of mitochondrial bodies of *Luciobarbus* in *Capoeta* species demonstrate that there must be a way of hybridogenous introgression via these pentaploid hybrids. This implies that at least some hybrids must be able to produce even-chromosome eggs or sperm ($n = 2$ or 4). These eggs can develop and produce a new, even-chromosome-numbered hybrid, which can reproduce with the pure species and transfer the mitochondrial body of one species into the other. However, this is merely speculative; the only certainty is that it must function somehow. Further research is required to elucidate the process of introgressive hybridisation in uneven chromosome cyprinids. In areas where two *Capoeta* species co-occur, hybrids are also observed, which exhibit morphological intermediary characteristics between the parental species. In *Capoeta*, it is frequently observed that in pure fish, the mitochondrial body of a syntopic species is present. For instance, in the Orontes drainage, *C. damascina* with the mitochondrial body of *C. barroisi* and vice versa are frequently observed, while morphologically intermediate fish are notably scarce.



Capoeta razii; Tajan, Iran; 189 mm SL.

Capoeta razii

Common name. Elbrus scraper.

Diagnosis. Distinguished from other species of *Capoeta* in Caspian basin by: ○ 46–54 total lateral-line scales / ○ 18 or more predorsal scales / ○ less than 44 total vertebrae / ○ usually 8½ branched dorsal rays / ○ last unbranched dorsal ray strong, with 15–25 serrae along its posterior edge / ○ 7–9 scales between dorsal origin and lateral line / ○ 6–7 scales between anal origin and lateral line. Size up to 300 mm SL.

Distribution. Azerbaijan and Iran: Atrak west to coastal rivers south of Kura estuary. Also, (possibly introduced) in upper Gamasiab (Karkheh drainage), Nam (Western Kavi basin), and Jaj in Lake Namak basin.

Habitat. A wide range of moderately to rapidly flowing streams and rivers with sand, gravel or rock bottoms.

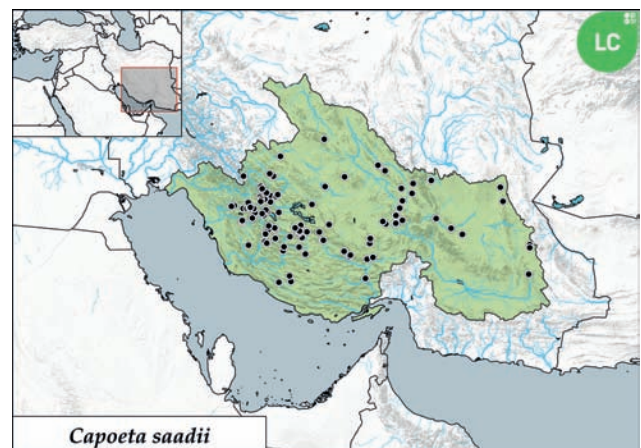
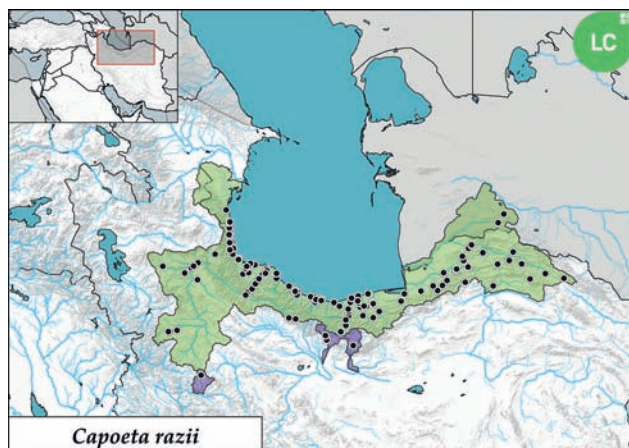
Biology. Lives up to 10 years. Spawns April–July. Males mature at 2 years, females at 2–3 years. Eggs are adhesive

and laid in gravel. Feeds on detritus, periphyton and invertebrates.

Conservation status. LC.

Remarks. This species is usually identified as *C. gracilis*, described from the Zayandeh drainage in Iran (a synonym of *C. aculeata*). Both species are well differentiated. *Capoeta razii* occurs geographically adjacent to *C. capoeta*, and both species are almost indistinguishable by published morphological characters. Only molecular characters allow these species to be differentiated. Fish identified as *C. razii* by mtDNA has been found in Aras drainage, where only *C. capoeta* and *C. kaput* should occur. Hybrids between different *Capoeta* species are expected to occur in that region.

Further reading. Jouladeh-Roudbar et al. 2017b (description); Zareian et al. 2017 (phylogeny, morphology); Jouladeh-Roudbar et al. 2020 (distribution); Koohestan Eskandari, 2003 (biology).



Capoeta saadii; Kol drainage, Iran; ~100 mm SL.



Capoeta saadii; Kor drainage, Iran; 192 mm SL.



Capoeta are dominant in biomass in many rivers in West Asia as here in the Kor in Iran, a habitat of *Capoeta saadii* and *C. aculeata*.

Capoeta saadii

Common name. Shiraz scraper.

Diagnosis. Distinguished from other species of *Capoeta* in Persian Gulf basin south of Zohreh and in Iranian endorheic basins by: ○ flank beige, golden or brown without small black spots, often with a lateral stripe, juveniles and some adults individuals with large black blotches / ○ 63–79 total lateral-line scales / ○ last unbranched dorsal ray soft or moderately ossified, shorter than head, with small serrae / ○ no groove in front of nares / ○ (7) 8–9½ branched dorsal rays / ○ 11–16 scales between lateral line and dorsal origin / ○ 7–10 scales between lateral line and pelvic origin / ○ 23–28 (29) circumpeduncular scales / ○ 11–17 gill rakers, usually 9–12 (15) on lower limb, 12–13 in Helleh drainage / ○ pectoral length 15–21 % SL. Size up to 384 mm SL.

Distribution. Iran: Coastal rivers from Helleh south to Kol. Also, found in endorheic basins of Kor, Esfahan and Sirjan, Jazmurian, Kerman, and Lut.

Habitat. A wide range of moderately to rapidly flowing streams and rivers with sand, gravel, and rock substrates.

Biology. No data.

Conservation status. LC.

Remarks. Analysis of COI DNA sequences places *C. raghazensis*, described from the Reghez Canyon in Kol drainage, within *C. saadii*. As morphological characters proposed to distinguish the two species could not be confirmed, *C. raghazensis* is treated as a synonym of *C. saadii*.

Further reading. Alwan 2010 (morphology, phylogeny); Alwan et al. 2016b (morphology, phylogeny); Zareian & Esmaeili 2017 (description); Jouladeh-Roudbar et al. 2020 (distribution); Coad 2021a (biology, morphology); Eagderi & Mousavi-Sabet 2021 (description of *C. raghazensis*).



Capoeta shajariani; Gamasiab, Karkheh drainage, Iran; 149 mm SL.

Capoeta shajariani

Common name. Karkheh scraper.

Diagnosis: Distinguished from other species of *Capoeta* in Karkheh, Karun and Zohreh drainages by: ○ flank beige, golden or brown without small black spots, juveniles and some adults individuals with large black blotches / ○ 70–80 scales in lateral-line series / ○ last unbranched dorsal ray moderately ossified, shorter than head, serrated / ○ no groove in front of nares / ○ usually 9½ branched dorsal rays / ○ 13–15 scales between lateral line and dorsal origin / ○ 9–11 scales between anal origin and lateral line /

○ 25–31 circumpeduncular scales / ○ 15–19 gill rakers, 11–14 on lower limb / ○ head depth at eye 105–126 % of postorbital length. Size up to 450 mm SL.

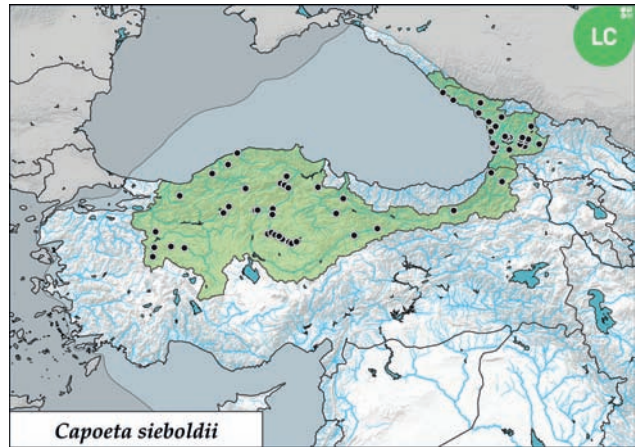
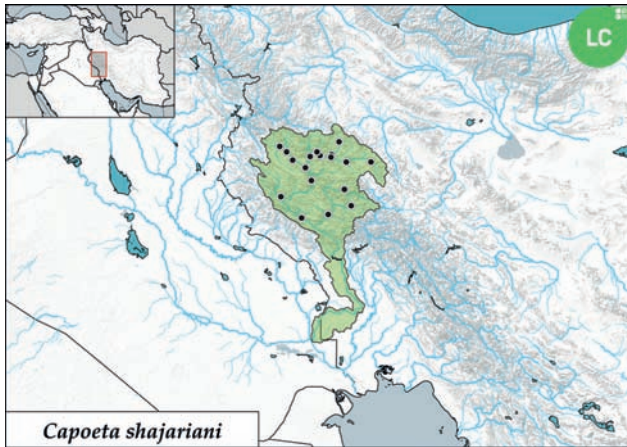
Distribution. Iran: Gamasiab, Dinevar, Razavar, Kashkan, Kahman, and Seymareh in Karkheh drainage.

Habitat. Slow to moderate flowing rivers with gravel beds.

Biology. Feeds on detritus, periphyton, and occasionally small invertebrates.

Conservation status. LC.

Further reading. Jouladeh-Roudbar et al. 2017c (description); Zareian & Esmaeili 2017 (description).



Capoeta sieboldii; Sakarya drainage, Türkiye; 221 mm SL.

Capoeta sieboldii

Common name. Nipple-lip scraper.

Diagnosis. Distinguished from other species of *Capoeta* in Black Sea basin by: ● lower and upper lips pleated, well developed and fleshy / ○ lower jaw without cornified edge / ○ one pair of barbels / ○ 52–60 total lateral-line scales / ● 28–35 gill rakers / ○ last unbranched dorsal ray ossified, its

posterior edge of with many serrae / ○ usually $8\frac{1}{2}$ branched dorsal rays / ○ 9–11 scales between lateral line and dorsal origin / ○ 8–10 scales between lateral line and pelvic origin. Size up to 400 mm SL.

Distribution. Türkiye and Georgia: Sakarya drainage east to northern coastal streams in Georgia.



Capoeta svanetica; Rioni, Georgia; ~100 mm SL. © G. Eptashvili.

Habitat. A wide range of streams and rivers with moderate to fast-flowing water and sand, gravel and rock substrate. In reservoirs, it migrates upstream to spawn.

Biology. Lives up to 8–10 years. Feeds on detritus, periphyton, and occasionally small invertebrates.

Conservation status. LC.

Further reading. Bektaş et al. 2017 (phylogeny).

Capoeta svanetica

Common name. Luchunis scraper.

Diagnosis. Distinguished from other species of *Capoeta* in Black Sea basin by: ● last unbranched dorsal ray not serrated or with 7–9 serrae / ○ two pairs of barbels / ○ 70–74 total lateral-line scales / ○ 10–12 scale rows between lateral line and dorsal origin / ○ 7–8 scale rows between lateral line and anal

origin / ○ 12–15 gill rakers / ○ edge of lower jaw cornified / ○ lips narrow, not fleshy or pleated / ○ lower jaw monomorphic, wide and straight / ○ snout short and blunt. Size up to 136 mm SL, likely to grow larger.

Distribution. Georgia: Rioni drainage.

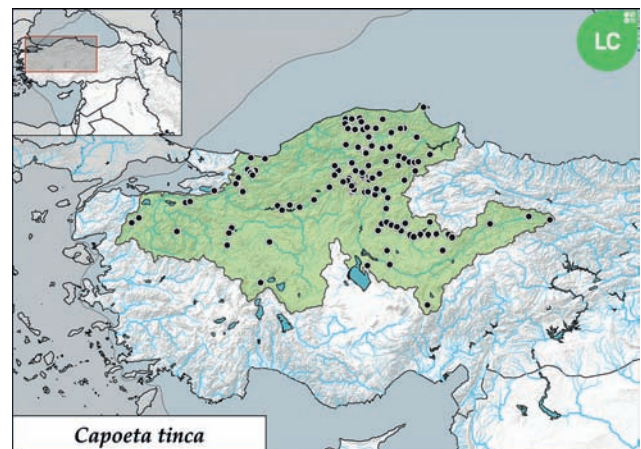
Habitat. A wide range of streams and rivers with moderate to fast-flowing water and sand, gravel and rock substrate. In reservoirs, it migrates upstream to spawn.

Biology. No data.

Conservation status. NE; due to very limited knowledge of this species.

Remarks. *Capoeta svanetica* is superficially very similar to the hybrid between *C. capoeta* and *Barbus rionicus*, and this possibility has not been rejected in its original description.

Further reading. Roman et al. 2022 (description).



Capoeta tinca; Sakarya drainage, Türkiye; 170 mm SL.



Capoeta tinca; Susurluk drainage, Türkiye; 108 mm SL.

Capoeta tinca

Common name. Fourbarbel scraper.

Diagnosis. Distinguished from other species of *Capoeta* in Marmara and Black Sea basin and Central Anatolia by:
 ○ two pairs of barbels / ○ 69–87 total lateral-line scales / ○ 14–17 scale rows between lateral line and dorsal origin / ○ 9–11 scale rows between lateral line and anal origin / ○ 16–22 gill rakers / ○ 17–28 serrae on last unbranched dorsal ray / ○ edge of lower jaw cornified / ○ lips narrow, not fleshy or pleated / ○ shape of lower jaw polymorphic, wide and straight or arched and narrow in parts of individuals / ○ snout short and blunt. Size up to 220 mm SL, likely to grow larger.

Distribution. Türkiye: Lake İznik, Eber and Akşehir basin and Sursuluk (Marmara basin) east to Kızılırmak drainage.

Habitat. Ubiquitous, inhabits a wide range of water bodies at least temporarily connected to running waters such as

springs, streams, rivers, and cold headwaters. Found in lakes, reservoirs, and large rivers.

Biology. Lives up to 10 years. Matures at 2 (male) or 3 years (female). Spawns May and June (Central Anatolia).

Conservation status. LC.

Remarks. Populations from the Black Sea basin were recognised as *C. baliki*, described from Sakarya. As more data became available, they were found to be conspecific with *C. tinca*. No characters could be found to distinguish the two species. Populations from Kızılırmak are very closely related to *C. tinca*, with only minor molecular differences.

Further reading. Ekmekçi 1996 (biology); Ekmekçi & Özeren 2003 (biology); Turan et al. 2006a (description as *C. baliki*); Bektaş et al. 2017 (phylogeny); Yoğurtçuoğlu et al. 2020a (distribution).



Capoeta trutta; Tigris, Türkiye; ~250 mm SL.



Capoeta trutta; Euphrates drainage, Türkiye; individual with long dorsal ray, 180 mm SL.



Capoeta trutta; Euphrates drainage, Türkiye; individual with short dorsal ray, 100 mm SL.

Capoeta trutta

Common name. Spotted scraper.

Diagnosis. Distinguished from other species of *Capoeta* in Qweiq, Euphrates, and Tigris drainages by: ● last unbranched dorsal ray very strong, longer than head, strongly serrated / ○ one pair of barbels / ○ flank silvery with many small black spots, spots often only on back in large individuals, rarely without spots / ○ 68–90 total lateral-line scales / ○ 15–17 scale rows between lateral line and dorsal origin / ○ 9–12 scale rows between lateral line and anal origin / ○ 24–29 gill rakers / ○ usually 8½ branched dorsal rays. Size up to 450 mm SL.

Distribution. Qweiq, Euphrates, Tigris, and Karun drainages.

Habitat. Moderately fast-flowing to standing waters, from mid-sized mountain streams to large lowland rivers. Often

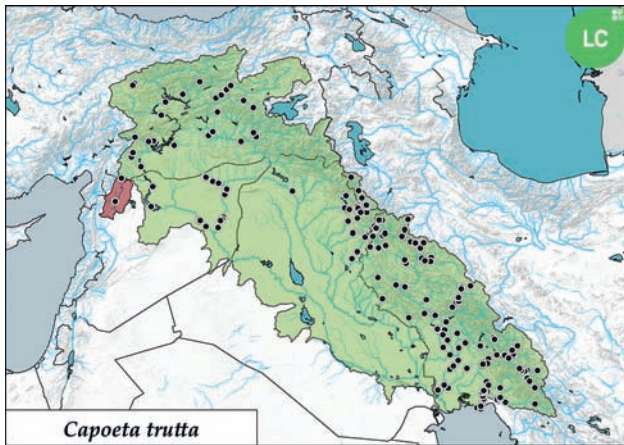
abundant in reservoirs and lakes, from where they migrate to inflowing streams and rivers to spawn.

Biology. Lives up to 10 years. First spawns at 2 (males) and 3 (females) years. Spawns March–July in Tigris in Iraq and May–June in Tigris in Türkiye. Feeds on epilithic algae and detritus. Often grazes top mud layers in reservoirs.

Conservation status. LC; extirpated from Qweiq.

Remarks. Fish with the last unbranched dorsal ray shorter than the head are often identified as *C. barroisi*, a species endemic to the Orontes drainage.

Further reading. Coad 2010a (description, biology); Kaya 2019 (distribution); Jouladeh-Roudbar et al. 2020 (distribution); Coad 2021a (biology, morphology).



Local fish markets are an important source of fishes for scientists also.



Capoeta trutta often establishes large populations in reservoirs, such as Atatürk reservoir in Türkiye.

How fishes moved between the Euphrates and the Levant. Fish movement between the Euphrates and the Levant is a subject of interest to those studying the region's biogeography. During most of the Miocene and Pliocene periods, the waters of the Levant flowed either west to the Mediterranean or east to the Euphrates. The first region to become isolated from the Euphrates was the Damascus drainage. Until the Upper Pliocene, the rivers of the present-day Damascus basin flowed through the current oasis of Palmyra to the Euphrates. Following the subsidence of the Damascene Plain and the upheaval of the southeastern Syrian highlands during the Upper Pliocene (approximately 3 million years ago), the rivers of the Damascene Plain became isolated from the Euphrates. At roughly the same time, these rivers began to flow to the upper Jordan drainage. The present endorheic basin of Damascus came into existence only after the basaltic eruptions of the Hauran and Gabal ad-Duruz during the late Pleistocene, which severed its connection with the Jordan. Furthermore, the present-day upper and middle parts of the Orontes flowed independently to the Euphrates. Up to the very early Pleistocene, a connection existed between the Orontes and Jordan–Litani system caused by the movement of the watershed. During that time, fishes could migrate from the Euphrates through the upper Orontes to the Litani and the Jordan. During the lower Pleistocene, the al-Ghab Valley subsided, resulting in the uplifting of Gabal az-Zawiyah Mountain. The uplifting of Gabal az-Zawiyah, which extended toward the Palmyra fold belt, severed the connections between the Proto-Orontes and the Euphrates. This subsequently led to a gradual separation. Currently, except *Capoeta damascina*, all fish species of the Damascus, Jordan, and Orontes basins are distinguishable from those of the Euphrates. However, the Jordan still shares several species with the Damascus basin (as *Oxynoemacheilus insignis*, *Garra nanus*, *Tristramella simonis* and the very closely related species pair *Pseudophoxinus syriacus* and *P. drusensis*).

Carasobarbus

Carasobarbus are a medium-sized group of barbels known from West Asia and Morocco. They are hexaploid and distinguished by large, shield-shaped scales with numerous parallel radii. The last unbranched dorsal ray is weakly to strongly ossified, without serrae. They have one or two pairs of barbels, 9–11½ branched dorsal rays, and 6½ branched anal rays. *Carasobarbus kosswigi* and *C. sublimus* were previously classified in a separate genus, *Kosswigobarbus*, which was recently synonymised with *Carasobarbus*. They are most species-rich in the Tigris, where six species are found. In the Arabian Peninsula, two species are known which have close relationships with

Mesopotamian *Carasobarbus*. *Carasobarbus* are inhabitants of slow-flowing or stagnant waters, often with much vegetation, while former *Kosswigobarbus* inhabit large, free-flowing, deep rivers. Some species are large fish that are commercially exploited in many areas. As in many other barbels, their eggs are poisonous. Some people have reported feeling dizzy, having abdominal pain, vomiting, diarrhea, dry mouth, and faintness after eating a kebab made with about ¼ of an ovary of *C. luteus*. **Further reading.** Karaman 1971 (description); Coad 2010a (toxic eggs); Borkenhagen & Krupp 2013 (description); Borkenhagen 2014 (phylogeny); Yang et al. 2015; Borkenhagen 2017 (phylogeny, in tribe Torini).

Keys to species of *Carasobarbus* in West Asia

Contributing author: Kai Borkenhagen (Büsum) contributed to the chapter on this genus.

Arabian Peninsula

1a - One pair of barbels; usually 10½ branched dorsal rays.

.....*C. apoensis*

1b - Two pairs of barbels; usually 9½ branched dorsal rays.

.....*C. exulatus*

Mediterranean and Persian Gulf basins

1a - Lower lip without median lobe.

.....2

1b - Lower lip with median lobe.

.....4

2a - Usually one pair of barbels; 25–30 total lateral-line scales.

.....*C. luteus*

2b - Usually two pairs of barbels; 29–38 total lateral-line scales.

.....3

3a - Usually 12 circumpeduncular scales; usually 7–9 gill rakers; head length 24–29 % SL; adults larger than 100 mm SL head grey and caudal peduncle and caudal yellow.

.....*C. canis*

3b - Usually 14–16 circumpeduncular scales; usually 9–12 gill rakers; head length 20–24 % SL; adults larger than 100 mm SL whole body golden or greenish grey.

.....*C. chantrei*

4a - 24–29 total lateral-line scales.

.....*C. sublimus*

4b - 32–44 total lateral-line scales.

.....5

5a - 32–37 total lateral-line scales.

.....6

5b - 38–44 total lateral-line scales.

.....7

6a - 32–37 (mode 36) total lateral-line scales; head length 25–27 % SL; posterior barbel 13–20 % HL; snout length 36–44 % HL.

.....*C. kosswigi*

6b - 32–34 (mode 33–34) total lateral-line scales; head length 20–24 % SL; posterior barbel 21–38 % HL; snout length 25–31 % HL.

.....*C. hajhosseini*

7a - A prominent black blotch on posterior caudal peduncle in individuals smaller than 85 mm SL; head length 22–25 % SL; dorsal fin height 19–26 % SL; distance between pelvic and anal fin origins 24–25 % SL.

.....*C. doadrioi*

7b - No black blotch on posterior caudal peduncle; head length 19–20 % SL; dorsal fin height 26–30 % SL; distance between pelvic and anal fin origins 26–28 % SL.

.....*C. saadatii*



Carasobarbus apoensis; Saudi Arabia; 212 mm SL. © J. Els.

Carasobarbus apoensis

Common name. Arabian himri.

Diagnosis. Distinguished from *Carasobarbus exulatus* and superficially similar *Arabibarbus arabicus* in Arabian Peninsula by: ● one pair of barbels / ● usually 10½ branched dorsal rays / ○ 6½ anal rays. Size up to 288 mm SL.

Distribution. Saudi Arabia: Hijaz mountain range, in wadis, draining both inland and toward Red Sea.

Habitat. Mainly upper reaches of wadis with large seasonal variations in flow.

Biology. Lives up to 19 years, possibly longer in captivity. Spawns in early spring. Feeds on both aquatic and terrestrial invertebrates and plants.

Conservation status. EN; appears to be declining within its very small range.

Remarks. Very closely related to the Mesopotamian *C. luteus*. The two species may only have diverged in post-glacial times when a river flowing from the mountains of western Saudi Arabia to the southernmost Shatt al-Arab dried up.

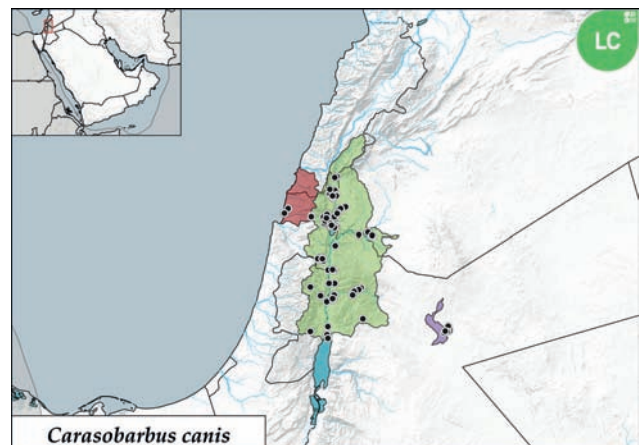
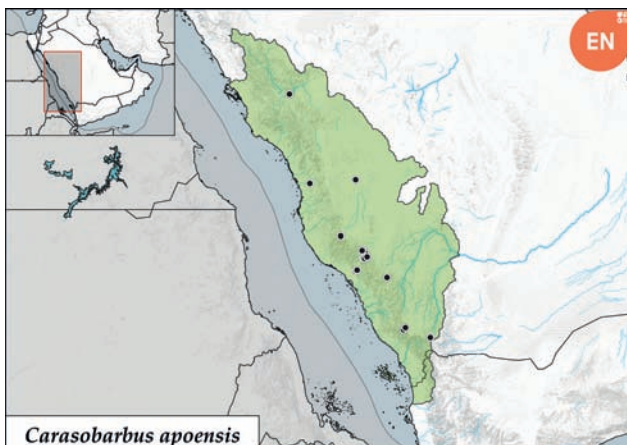
Further reading. Banister & Clarke 1977 (description); Krupp 1983 (morphology, distribution); Borkenhagen & Krupp 2013 (description, distribution).

Carasobarbus canis

Common name. Jordan himri.

Diagnosis. Distinguished from other species of *Carasobarbus* in Persian Gulf and Mediterranean basins by: ● head grey and caudal peduncle and caudal yellow in adults larger than 100 mm SL / ○ usually 12 circumpeduncular scales / ○ lower lip without median lobe / ○ last unbranched dorsal ray usually markedly shorter than head / ○ usually 7–9 gill rakers / ○ head length 24–29 % SL / ○ two pairs of barbels / ○ 29–35 total scales along lateral line. Size up to 550 mm SL.

Distribution. Jordan drainage. Introduced to Azraq Oasis in Jordan and coastal rivers Na'aman and Yarqon in Israel, now all extirpated.



Habitat. A wide range of rivers, lakes, and marshes. Spawns along banks, usually on hard bottoms.

Biology. Spawns December–January (Lake Tiberias). Eggs adhere to substrate. Diet consists of fish, invertebrates, algae, and detritus. Relative proportion of fish in diet increases with body length. *Mirogrex* are their main prey in Lake Tiberias.

Conservation status. LC.

Remarks. Records from Euphrates drainage are based on misidentifications.

Further reading. Ben-Tuvia 1978 (biology); Spataru & Gophen (1985b) (feeding); Fishelson et al. 1996 (reproduction); Tsigenopoulos et al. 2010 (phylogeny); Borkenhagen et al. 2011 (phylogeny); Borkenhagen & Krupp 2013 (description, distribution).



Carasobarbus canis; Jordan drainage, Syria; 180 mm SL.



Reservoir of Yarmuk in Jordan. *Carasobarbus* can establish large populations in artificial waterbodies.



Carasobarbus chantrei; Orontes drainage, Türkiye; 155 mm SL.

Carasobarbus chantrei

Common name. Orontes himri.

Diagnosis. Distinguished from other species of *Carasobarbus* in Persian Gulf and Mediterranean basins by: ○ head and flank golden or greenish grey in adults larger than 100 mm SL / ○ usually 14–16 circumpeduncular scales / ○ lower lip without median lobe / ○ last unbranched dorsal ray usually shorter or as long as head, moderately ossified / ○ usually 9–12 gill rakers / ○ head length 20–24 % SL / ○ two pairs of barbels / ○ 31–38 total lateral-line scales. Size up to 385 mm SL.

Distribution. Orontes drainage in Türkiye and Syria and Nahr Marqīyah, a coastal stream in Syria.

Habitat. Springs, lakes, reservoirs, and moderately fast-flowing rivers.

Biology. No data.

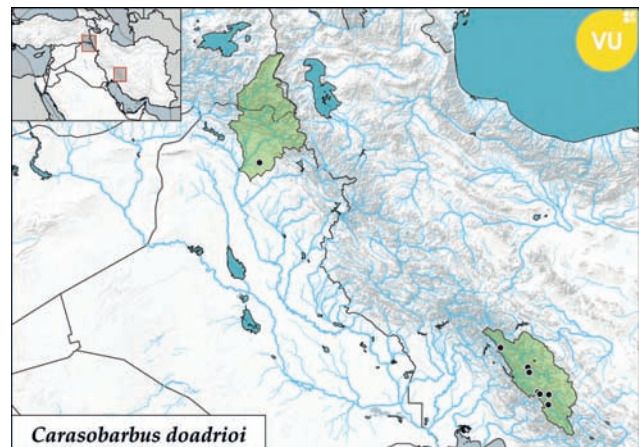
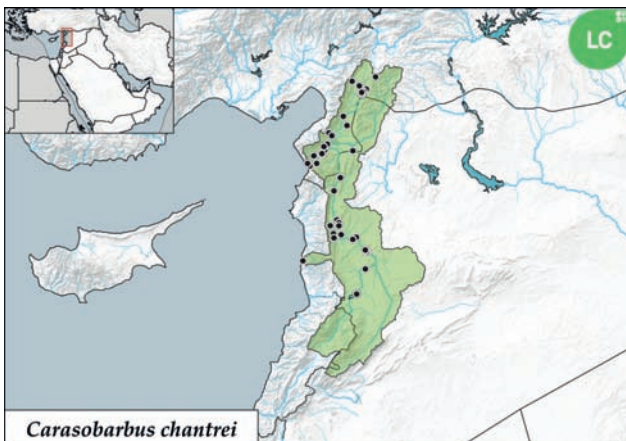
Conservation status. LC. Still present in lower Orontes in Türkiye and widespread in Syria. However, the situation in Syria needs some actual surveys.

Further reading. Krupp 1985b (description); Ekmekçi & Bănărescu 1989 (diversity); Tsigenopoulos et al. 2010 (phylogeny); Borkenhagen et al. 2011 (phylogeny); Borkenhagen & Krupp 2013 (description, distribution); Bayçelebi 2020 (distribution).

Carasobarbus doadrioi

Common name. Karun kiss-lip himri.

Diagnosis. Distinguished from other species of *Carasobarbus* in Persian Gulf and Mediterranean basins by: ● 40–44 total lateral-line scales / ○ well-developed median lobe on lower lip / ● prominent black blotch on posterior caudal peduncle in individuals smaller than 85 mm SL / ○ two pairs of barbels / ○ head length 22–25 % SL / ○ dorsal fin height 19–26 % SL / ○ distance between pelvic and anal fins 24–25 % SL. Size up to 200 mm SL.



Distribution. Iran and Iraq: Upper Tigris and Karun.

Habitat. Poorly known; seem to inhabit deep, summer-warm mountain river stretches with fast-flowing water and gravel bottoms.

Biology. No data.

Conservation status. VU.

Further reading. Jouladeh-Roudbar et al. 2024 (description).



Carasobarbus doadrioj; Karun, Iran; ~150 mm SL.



Carasobarbus exulatus; Wadi al Khun, Yemen; 69 mm SL. © F. Krupp.



Carasobarbus exulatus; Wadi Hadhramaut, Yemen; 212 mm SL. © F. Krupp.

Carasobarbus exulatus

Common name. Hadhramaut himri.

Diagnosis. Distinguished from *Carasobarbus apoensis* and sympatric *Arabibarbus hadhrami* in Arabian Peninsula by:

- two pairs of barbels / ○ usually $9\frac{1}{2}$ branched dorsal rays /
- $6\frac{1}{2}$ anal rays / ○ maximum body depth 26–36 % SL / ○ head shorter than maximum body depth. Size up to 290 mm SL, likely to grow larger.

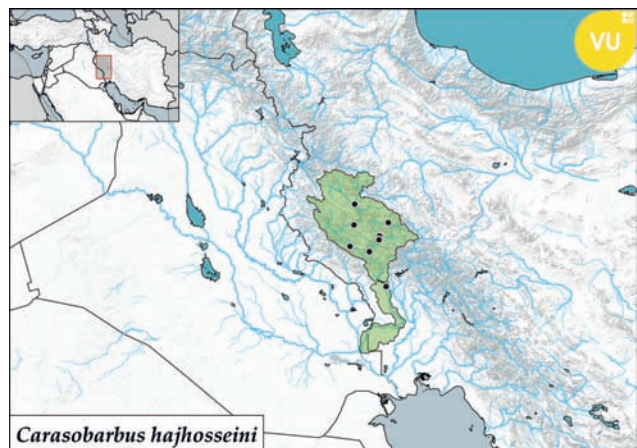
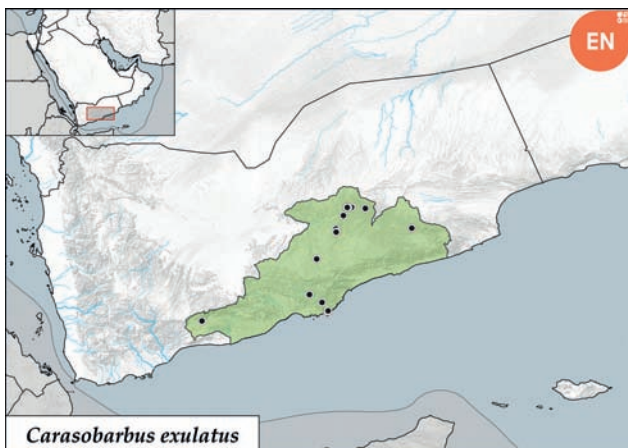
Distribution. Yemen: Wadi Hajr and upper Wadi Hadhramaut drainages.

Habitat. Wadis with high seasonal variation and sections of deep pools over gravel, bare rock or soft substrate. Large individuals usually in deep pools.

Biology. No data.

Conservation status. EN; appears to be declining within its very small range. Known from two drainage systems threatened by water abstraction, also fished for human consumption.

Further reading. Banister & Clarke 1977 (description); Krupp 1983 (description, distribution); Borkenhagen & Krupp 2013 (description, distribution).





Carasobarbus hajhosseini; Karkheh, Iran; 109 mm SL.



Carasobarbus hajhosseini; Karkheh drainage, Iran; ~65 mm SL. © K. Borkenhagen.

Carasobarbus hajhosseini

Common name. Karkheh kiss-lip himri.

Diagnosis. Distinguished from other species of *Carasobarbus* in Persian Gulf and Mediterranean basins by: ○ 32–34 total lateral-line scales / ○ poorly-developed median lobe on lower lip / ○ no black blotch on posterior caudal peduncle in adults / ○ two pairs of barbels / ○ head length 20–24 % SL / ○ posterior barbel 21–38 % HL / ○ snout length 25–31 % HL. Size up to 150 mm SL.

Distribution. Iran: Gamasiab, Kahman, Kashkan, and Seymareh, all in Karkheh drainage.

Habitat. Poorly known; seem to inhabit deep, summer-warm mountain river stretches with fast-flowing water and gravel bottoms.

Biology. No data.

Conservation status. VU.

Further reading. Jouladeh-Roudbar et al. 2024 (description).



Habitat of *Carasobarbus kosswigi*, free-flowing upper reaches of Lesser Zab in Iraq.



Carasobarbus kosswigi; Lesser Zab, Iraq; 137 mm SL.

Carasobarbus kosswigi

Common name. Kiss-lip himri.

Diagnosis. Distinguished from other species of *Carasobarbus* in Persian Gulf and Mediterranean basins by: ○ 32–37 total lateral-line scales / ○ well-developed median lobe on lower lip / ● last unbranched dorsal ray longer than head, strongly ossified / ○ head length 25–27 % SL / ○ posterior barbel 13–20 % HL / ○ snout length 36–44 % HL / ○ two pairs of barbels / ○ no black blotch on posterior caudal peduncle / ○ 14–16 circumpeduncular scales. Size up to 180 mm SL.

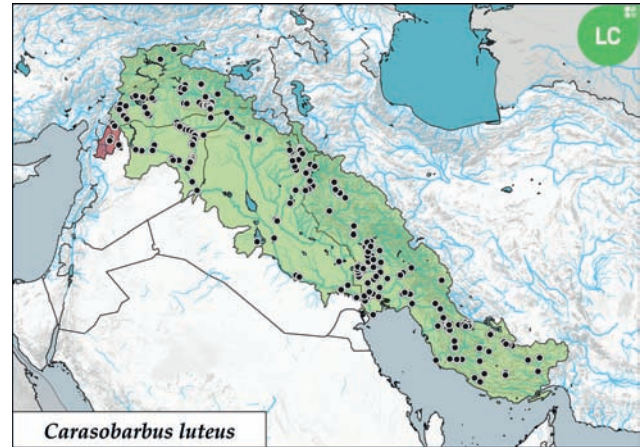
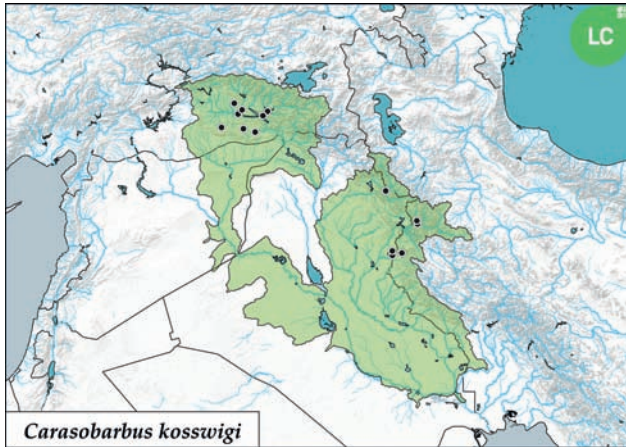
Distribution. Euphrates and Tigris drainages.

Habitat. Poorly known; seem to inhabit deep, summer-warm mountain river stretches with fast-flowing water and gravel bottoms.

Biology. Feeds on benthic invertebrates.

Conservation status. LC.

Further reading. Ladiges 1960 (description); Tsigenopoulos et al. 2010 (phylogeny); Borkenhagen et al. 2011 (phylogeny); Borkenhagen & Krupp 2013 (description, distribution); Jouladeh-Roudbar et al. 2024 (distribution).



Carasobarbus luteus; Golabi spring, Iran; 126 mm SL.

Carasobarbus luteus

Common name. Mesopotamian himri.

Diagnosis. Distinguished from other species of *Carasobarbus* in Persian Gulf and Mediterranean basins by: ● usually one pair of barbels / ○ fleshy lobe on lower lip absent / ○ 25–30 total lateral-line scales / ○ usually 12 circumpeduncular scales / ○ last unbranched dorsal ray about as long as head or slightly shorter, soft, and weakly ossified. Size up to 370 mm SL.

Distribution. Qweiq, Euphrates, Tigris, and Karun drainages. Persian Gulf south to Kol drainage. Also, in Kor endorheic basin (Iran).

Habitat. Lowland rivers, backwaters, lakes, reservoirs, springs, and ponds, rarely in fast-flowing waters. Tolerant of high salinity and reported from fully marine waters. Spawns on submerged vegetation.

Biology. Lives up to 8 years. Spawns first time at 1–2 years and about 90–140 mm SL; in Atatürk reservoir at 3 years. Spawns April–June (in Hammar Marsh) or May–July (in

Shatt al-Arab/Arvand). During spawning, male become reddish-brown on anterior part of body and greenish on caudal peduncle, while female is less colourful. Males can produce a series of sharp clicking sounds. Eggs are yellow to orange and sticky. Growth is reported to be slower in brackish water than in freshwater. Mainly herbivorous, taking detritus and small invertebrates, especially when young.

Conservation status. LC. Extirpated in Syrian reaches of Qweiq.

Remarks. Individuals with two pairs of barbels are very rare. In the Naband drainage in Iran, all individuals have two pairs of barbels, and this population may represent an undescribed species. Records from Orontes drainage and Damascus basin appear to have been mislabelled or taken from markets where fish from the Euphrates are sold. In some places, it is kept as a “sacred” fish in parks and holy places where it can be abundant. It adapts well to visitors, and people enjoy seeing it begging for food.

Further reading. Ahmed et al. 1984 (reproductive biology); Naama & Mushen 1986 (feeding); Mohamed et al. 1993 (occurrence in marine waters); Coad 2010a (biology); Tsigenopoulos

et al. 2010 (phylogeny); Borkenhagen et al. 2011 (phylogeny); Borkenhagen & Krupp 2013 (description, distribution); Kaya et al. 2016 (distribution); Coad 2021a (biology, morphology).



Carasobarbus luteus; Tigris, Türkiye; 130 mm SL.



Large rivers as the Botan are habitat of *Carasobarbus kosswigi*.



Balıklığöl: From ancient myths to saved fish. West Asia is a spiritual center for major religions and beliefs and one of the places where the world's earliest civilisations originated. As a result, a plethora of myths, legends, and folktales based on both pagan and Islamic beliefs exist, many of which continue to shape modern-day lives at the local level. Balıklığöl (or Halil-Ür Rahman Lake), a pool in the southwest of the city center of Şanlıurfa, is one of the most attractive places in this regard. It also provides an illustrative example of how verbal cultural heritages can potentially become a powerful tool in fish conservation. One of the myths associated with the lake dates back to approximately 8000 BC and is linked with Atargatis, the great goddess of northern Syria. The prevailing belief was that the fish in city ponds and canals associated with the goddess's reign were either a transformed form of herself or entities created by her activities, such as bathing in these waters. Another prominent and well-established belief is rooted in early Islam and is linked to the story of the conflict between Prophet Abraham and King Nimrod. In this narrative, Nimrod is angry with Abraham for rejecting his idols. Nimrod then throws Abraham into a raging fire with an arbalest, but God transforms the flames into water (the pool of Balıklığöl) and the logs into fish. While there have been a few other similar myths, as was believed by the older societies, the pool and the fishes inside are still considered sacred by all means, and catching or eating the fishes is strictly forbidden, which makes this a case of one of the oldest practises of fish conservation. The Balıklığöl pool is connected to the stream Karakoyun, a tributary of the upper Euphrates, which is fed by a large karstic aquifer. Four fish species occur in the pools: *Alburnus caeruleus*, *Carasobarbus luteus*, *Capoeta damascina*, and *Garra rufa*. In her pilgrimage account, written around 380 BC, Etheria already observed fountains full of fish of size, brightness, and flavor that she had never seen before.

Further reading. McClure & Feltoe 1919 (The pilgrimage of Etheria); Arslan 2015 (history); Ünlü 2021 (species).



Carasobarbus saadatii; Karun, Iran; 175 mm SL.

Carasobarbus saadatii

Common name. Zagros kiss-lip himri.

Diagnosis. Distinguished from other species of *Carasobarbus* in Persian Gulf and Mediterranean basins by: ○ 38–40 total lateral-line scales / ○ well-developed median lobe on lower lip / ○ no black blotch on posterior caudal peduncle in individuals larger than 85 mm SL / ○ two pairs of barbels / ○ head length 19–20 % SL / ○ dorsal fin height 26–30 % SL / ○ distance between pelvic and anal fins 26–28 % SL. Size up to 250 mm SL.

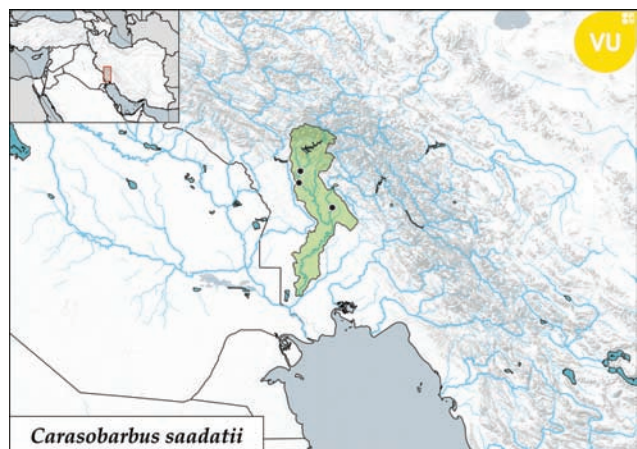
Distribution. Iran: lower Karun. Possibly more widespread.

Habitat. Poorly known; seem to inhabit deep, summer-warm mountain river stretches with fast-flowing water and gravel bottoms.

Biology. No data.

Conservation status. VU.

Further reading. Jouladeh-Roudbar et al. 2024 (description).



Carasobarbus sublimus; Zohreh, Iran; ~145 mm SL.

Carasobarbus sublimus

Common name. Persian kiss-lip himri.

Diagnosis. Distinguished from other species of *Carasobarbus* in Persian Gulf and Mediterranean basins by: ● 24–29 total lateral-line scales / ○ a fleshy median lobe on lower lip / ○ last unbranched dorsal ray about as long as head, strongly ossified / ○ two pairs of barbels / 12 circumpeduncular scales. Size up to 145 mm SL.

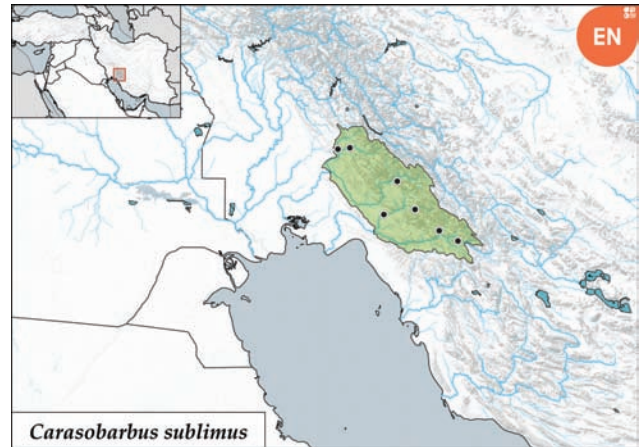
Distribution. Iran: Jarrahi and Zohreh drainages.

Habitat. Streams with medium to fast currents and hard substrate.

Biology. No data.

Conservation status. EN.

Further reading. Coad & Najafpour 1997 (description); Borkenhagen et al. 2011 (phylogeny); Borkenhagen & Krupp 2013 (description, distribution); Jouladeh-Roudbar et al. 2024 (distribution).

***Carassius***

Carp of the genus *Carassius* are immediately distinguishable from all other cyprinids in the region by having a long dorsal fin, a terminal mouth without barbels, and the last unbranched anal and dorsal rays strongly serrated. Crucian carp *C. carassius* is the only species native to the area. Three different species are known to be involved in the so-called *C. auratus* complex. These are (1) *C. auratus*, a widespread ornamental species that has become feral in many areas; (2) *C. gibelio*, an Asian species that may have been introduced with stocked fishes; (3) *C. langsdorfii* believed to be endemic to Japan and introduced as a pest with ornamental koi. An additional unnamed lineage potentially originating from Central Asia was introduced mostly within countries of the former Soviet Union and may be found in West Asia in the future.

All three mitochondrial lineages of non-native *Carassius* in West Asia are diploid and reproduce normally. This means that haploid male and female gametes join and produce a diploid offspring. In *C. auratus*, this is the only mode of reproduction. In the other lineages, triploid, all-female fish are common (but not found everywhere), and these reproduce by gynogenesis. Here, the sperm only triggers the triploid egg, and the offspring are clonal, triploid copies of the mother. If the sperm is included in the genome of the egg cell, then tetraploid individuals hatch. This might occasionally be the case in all populations with triploid fish. Triploid individuals are common, often even dominant, in many populations of the mitochondrial lineages called *C. gibelio* and *C. langsdorfii*. These lineages can switch between a recombinant and a clonal mode of reproduction.

The assignment of individual *Carassius* to *C. auratus*, *C. gibelio*, or *C. langsdorfii* by their mitochondrial DNA is not an

accurate reflection of their species identities. Mitochondrial DNA lacks recombination, which is not useful to identify hybrids. In particular, triploid individuals frequently possess genomes from two (or all three) different “species”. There is strong evidence that *C. auratus*, *C. gibelio*, and *C. langsdorfii* form large and highly diverse hybrid swarms in their non-native range. As all three “species” could reproduce by diploid sexual reproduction, they appear to have hybridised extensively, and their genomes are largely intermingled. We are confident that future nuclear DNA studies will not support three distinct, reproductively isolated non-native species in West Asia or Europe. However, some local populations may be pure *C. auratus*, *C. gibelio*, or *C. langsdorfii*. Identifying non-native *Carassius* to the species level is impossible because of the lack of morphological and molecular characters to identify pure species. We do not even know whether pure populations of non-native *Carassius* exist in West Asia, except for locally stocked *C. auratus*. We, therefore, refer to all populations as “*C. auratus* complex”, pending future studies.

It should not be forgotten that *Carassius* hybridise with *Cyprinus carpio*. Their hybrids are fertile and may form populations independent of their parental species. Such hybrid populations are known from Europe but have yet to be discovered in West Asia. *Carassius* x *Cyprinus* hybrids can be recognised by their short barbels. **Further reading.** Murakami et al. 2001 (polyploidy systems in Japan); Szczerbowski 2002 (biology); Hänfling et al. 2005 (genetics); Gao et al. 2012 (diversity in Asia); Kalous et al. 2013 (mtDNA records of *C. langsdorfii* in Europe); Rylková et al. 2013 (non-native *Carassius* in Europe); Halas et al. 2018 (diversity in North America); Khosravi et al. 2020 (Iran).



Individual with mtDNA of *C. auratus*; Sirvan drainage, Iraq; ~130 mm SL.

Carassius auratus

Common name. Goldfish.

Diagnosis. Distinguished from *C. carassius* in West Asia by: ● flank silvery, golden-green or reddish / ● last simple anal and dorsal rays strongly serrated / ● 38–52 gill rakers / ● 26–33 total lateral-line scales / ● free edge of dorsal concave or straight / ● usually 5½ branched anal rays / ● peritoneum black. Size up to 350 mm SL.

Distribution. Widespread in West Asia. Most non-native *Carassius* in West Asia have mitochondria belonging to this species. Reportedly native to East Asia, from Amur to Xi Jiang drainages in Russia, China, Korea, and Japan, several species appear to be confused under a single name, as evidenced by available data on Japanese populations. Domesticated in China more than 1000 years ago, introduced to Japan in 16th century and imported from Japan to Europe in 1611 (Portugal), 1691 (England), and 1755 (France) and subsequently introduced throughout West Asia, Europe, and most of the world.

Habitat. A wide variety of still waters and moderately slow-flowing rivers. Very tolerant of low oxygen and pollution. Usually associated with submerged vegetation or periodic flooding. Spawns on shallow, warm banks, on submerged vegetation or roots.

Biology. Only diploid populations known. Spawns first time at 1–2 years. Spawns June–July when temperatures reach 15–20°C. Juveniles need high temperatures to grow. Single females spawn with a few males in dense vegetation. Eggs are sticky and attached to water plants or other submerged objects. Usually lives for about 20 years in artificial conditions. Omnivorous, feeds mainly on plankton, benthic invertebrates, plant material, and detritus.

Conservation status. Non-native; introduced as a weed with stocked carp.

Further reading. Kottelat 1997 (systematics); Szczerbowski 2002 (biology); Kottelat & Freyhof 2007 (distribution, biology).

Carassius carassius

Common name. Crucian carp.

Diagnosis. Distinguished from non-native species of *Carassius* in West Asia by: ○ flank golden-green / ● last simple anal and dorsal rays weakly serrated / ● 23–33 gill rakers / ● 31–36 total lateral-line scales / ● free edge of dorsal convex / ● usually 6½ branched anal rays / ● peritoneum whitish. Size up to 550 mm SL.

Distribution. Locally in lower Sakarya (Akgöl), where it might be native, and in the upper Aras drainage (Lake Çıldır), where it may be non-native. Native to North, Baltic, White, Barents, northern Black, and Caspian Sea basins; Aegean Sea basin only in Maritza drainage; eastward to Kolyma drainage (Siberia); westward to Rhine and eastern drainages of England. Absent from North Sea basin in Sweden and Norway. In Baltic basin, north to about 66°N. Widely introduced to Italy, England, and France but possibly often confused with *C. auratus*.

Habitat. Usually restricted to densely vegetated backwaters and oxbows of lowland rivers. Also, in small, well-vegetated lakes and channels. Tolerates high summer temperatures and very low oxygen concentrations in summer and under ice cover. Able to survive in almost completely frozen water or almost-dry habitats by burying itself in mud. Spawns in dense submerged vegetation.



Carassius carassius; Danube delta, Romania; ~100 mm SL.



Individual with mtDNA of *Carassius gibelio*; Lower Danube, Romania; ~115 mm SL.

Biology. Lives about 10 years. Males reproduce for the first time at 3 years, females at 4 years in central and eastern Europe, at 2 years in southern Europe. Spawns in May–July at temperatures above 18°C. Individual females spawn with several males. Males follow ripe females, often with much splashing. Females spawn 3–5 times during a season. Eggs are sticky and are attached to water plants. Omnivorous, feeds all day but mostly at night on plankton, benthic invertebrates, plant material, and detritus. Seems to be a weak competitor, usually absent from waters with rich ichthyofauna and abundant predatory species. Very abundant in the absence of other fish species. High-bodied, fast-growing individuals in habitats with predatory fish more elongate in habitats without predatory fish.

Conservation status. LC.

Further reading. Szczerbowski & Szczerbowski, in Bănărescu & Paepke, 2002 (biology).

Carassius gibelio

Common name. Prussian carp.

Diagnosis. Distinguished from *C. carassius* in West Asia by: ● flank silvery / ● last simple anal and dorsal rays strongly serrated / ● 38–52 gill rakers / ○ 26–33 total lateral-line scales / ● free edge of dorsal concave or straight / ● usually 5½ branched anal rays / ● peritoneum black. Size up to 350 mm SL.

Distribution. Mitochondria of this species are found throughout West Asia. Often considered native from Central Europe to Siberia. As there are no historical records from Europe or West Asia, considered non-native to region. Native to Amur drainage in Russia and China and introduced in Europe with fish imported from Amur. Introduced from Europe to North Africa, West Asia, and elsewhere.

Habitat. Identical to *C. auratus*.

Biology. Usually, diploid and tetraploid individuals of both sexes, often together with triploid females. Also, all-female

populations where all individuals are triploids. Triploids reproduce by gynogenesis as sperm parasites of other species, such as *Cyprinus carpio* and various leuciscids. Lives about 10 years. Spawns first time at 3–4 years in central and eastern Europe, at 1–2 years in West Asia. Spawns May–July at temperatures above 14°C, with spawning most intensive in early morning. Older individuals spawn earlier in season than younger ones. Males move to spawning sites before females. Single female spawns with several males. Males follow mature female, often with much splashing. Female spawn up to three times per season. Sticky eggs are attached

to water plants or other submerged objects. Feeding larvae and juveniles inhabit highly complex habitats such as reed beds. Omnivorous, feeding on plankton, benthic invertebrates, plant material, and detritus.

Conservation status. Non-native; introduced as a weed with stocked carp.

Further reading. Kottelat 1997 (systematics); Vasil'ev & Vasil'eva 2000 (genetics); Szczerbowski 2002 (biology; as *C. auratus*, in part); Hänfling et al. 2005 (genetics); Kottelat & Freyhof 2007 (distribution, biology); Yerli et al. 2014 (distribution).



Many thousands of small reservoirs in West Asia, as in upper Euphrates drainage, have been stocked with *Carassius*, making them the most widespread freshwater fish in the region.



Individual with mtDNA of *Carassius langsdorfii*; Biskra, Algeria; ~160 mm SL.

Carassius langsdorfii

Common name. Ginbuna.

Diagnosis. Distinguished from *C. carassius* in West Asia by:
 ● flank silvery / ● last simple anal and dorsal rays strongly serrated / ● 38–52 gill rakers / ○ 26–33 total lateral-line scales / ● free edge of dorsal concave or straight / ● usually 5½ branched anal rays / ● peritoneum black. Size up to 350 mm SL.

Distribution. Native to Japan. Mitochondria of this species are reported from Lar National Park (Iran) but are considered widespread in West Asia. Already found in Czech Republic, Greece, Germany, Ukraine, Italy and Bosnia-Herzegovina (Europe), from Lake Tahoe (USA), and British Columbia (Canada).

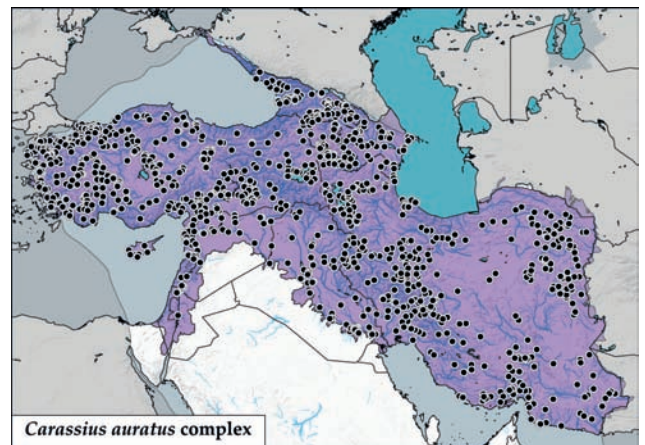
Habitat. Identical to *C. auratus*.

Biology. In its native range, it occurs as a diploid with normal sexual reproduction, as a triploid with gynogenetic reproduction, and rarely as a tetraploid. Only triploids have been recorded in Europe. Species may shift ploidy levels, diploids and tetraploids are expected to occur. Triploid Ginbuna has their evolutionary origin in hybridisation of diploid *C. langsdorfii*, *C. gibelio*, and *C. auratus*, as these maternal lineages have been detected in Japanese triploid *C. langsdorfii*.

Conservation status. Non-native.

Remarks. Likely introduced as a weed with ornamental koi from Japan but expected to spread as a weed in carp farms from where it escapes into the wild.

Further reading. Murakami et al. 2001 (polyploidy systems in Japan); Kalous et al. 2013; Rylková et al. 2013 (Europe); Halas et al. 2018 (North America); Khosravi et al. 2020 (Iran).



Cyprinion

Lotaks are a small genus known from Arabia, the Persian Gulf basin, adjacent Iran and Pakistan, east to the Indus drainage. They are medium-sized fish that inhabit a wide range of running waters, from fast-flowing mountain torrents to brackish desert and coastal streams. Lotaks can be identified by their usually $7\frac{1}{2}$, rarely $6\frac{1}{2}$, branched anal rays (compared with $5-6\frac{1}{2}$ in other barbels), laterally compressed body, the sharp edge on the lower jaw (except in *C. milesi*), one pair of barbels, the serrated posterior margin of the last unbranched dorsal ray, and the $12\frac{1}{2}-17\frac{1}{2}$ branched dorsal rays. They are related to South and Southeast Asian genera, such as *Semiplotus* and *Scaphiodontichthys*, but the relationships in this group of fishes are poorly understood.

To the extent that they have been studied, lotaks are diploid, with $2n = 50$ chromosomes. Molecular data suggest that

Cyprinion hybridised with the ancestors of *Capoeta* and *Labeobarbus* and was thus involved in the allo-polyplodisation event that led to the formation of these genera. All but one of the lotaks occur in West Asia. Only *C. watsoni* is described from outside the region, from the rivers of the Sind Hills and the Salt Range in the Indus drainage of Pakistan.

While *Cyprinion* is relatively tolerant of water pollution and salinisation, it is sensitive to low temperatures and absent from the mountainous headwaters of the Euphrates in Eastern Anatolia. They feed on a wide variety of food, usually periphyton, but will take whatever is available. They spawn in flowing water, laying their eggs between gravel and rocks. Nuptial male lotaks can be territorial and aggressively defend spawning sites against other males. **Further reading.** Banister & Clarke 1977; Krupp 1983 (Arabian species, identification); Yang et al. 2015 (phylogenetic position).

Keys to *Cyprinion* in West Asia**Arabian Peninsula**

1a - Last unbranched dorsal ray short, thin, serrated along proximal third of ray in large individuals; 14–16 circumpectuncular scales.

.....*C. muscatense*

1b - Last unbranched dorsal ray long, thick, serrated along almost entire length in large individuals; 16–22 circumpectuncular scales.

.....2

2a - 19–22 circumpectuncular scales; 8–9 scales between lateral line and dorsal origin.

.....*C. mhalense*

2b - 16–18 circumpectuncular scales; 6–7 scales between lateral line and dorsal origin.

.....*C. acinaces*

Persian Gulf and Iranian endorheic basin

1a - Mouth subterminal, oblique in lateral view, clearly U-shaped.

.....*C. milesi*

1b - Mouth inferior, variably arched to transverse.

.....2

2a - Mouth semi-circular; lower jaw finger-like with papillous median pad on lower lip in adults larger than 100 mm SL.

.....*C. kais*

2b - Mouth straight, with sharp cutting edge on lower jaw, without papillous central pad on lower lip; no large lateral lobes on lower lip.

.....3

3a - $9-12\frac{1}{2}$, usually $10-11\frac{1}{2}$, branched dorsal rays; orange spots along lateral line.

.....*C. microphthalmum*

3b - $11-17\frac{1}{2}$, usually $12-15\frac{1}{2}$, branched dorsal rays; no orange spots along lateral line.

.....4

4a - Posterior dorsal margin moderately to markedly concave; 39–45, usually 40–44, total lateral-line scales.

.....*C. macrostomum*

4b - Posterior dorsal margin about straight or slightly concave; 32–39, usually 34–38, total lateral-line scales.

.....*C. tenuiradius*



Cyprinion acinaces; Wadi Dauan, Yemen; 88 mm SL. © F. Krupp

Cyprinion acinaces

Common name. Arabian lotak.

Diagnosis. Distinguished from other species of *Cyprinion* in Arabian Peninsula by: ● 16–18 circumpeduncular scales / ○ last unbranched dorsal ray long, thick, serrated along almost entire length in large individuals / ○ 37–41, usually 38–40, total lateral-line scales / ○ 6–7 scales between lateral line and dorsal origin. Size up to 110 mm SL.

Distribution. Yemen: Wadi Hadhramaut drainage. Saudi Arabia: Coastal wadis of Hijaz mountains such as Hadiyah, Sulayma, and wadis near Jeddah.

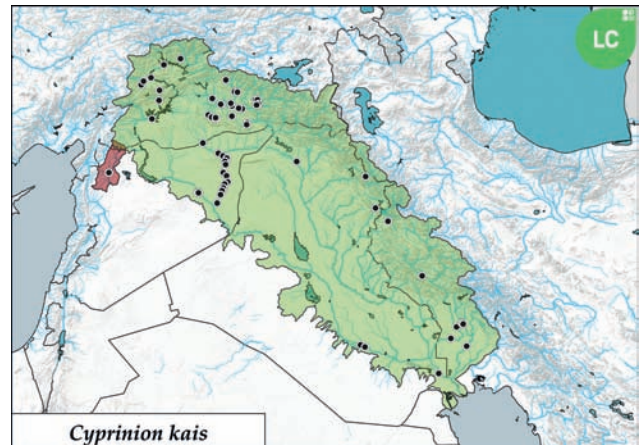
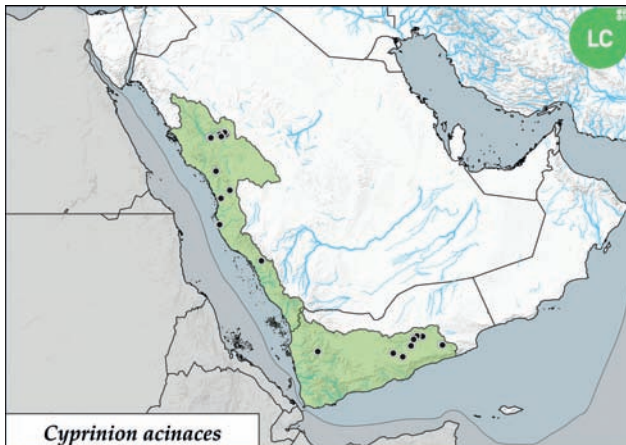
Habitat. Wadis with high seasonal fluctuations in discharge, usually over bare rock or gravel, rarely over soft substrate.

Biology. Feeds on periphyton.

Conservation status. LC.

Remarks. *Cyprinion acinaces hijazi* from northern Saudi Arabia is treated as a synonym, but further study is encouraged to determine whether it may be a separate species.

Further reading. Banister & Clarke 1977 (description); Krupp 1983 (subspecies); Freyhof et al. 2020 (distribution, identification).





Cyprinion kais; Lesser Zab drainage, Iraq; male, ~100 mm SL.



Cyprinion kais; Tigris, Türkiye; male, ~110 mm SL.

Cyprinion kais

Common name. Smallmouth lotak.

Diagnosis. Distinguished from other species of *Cyprinion* in Persian Gulf and Iranian endorheic basins by: ● mouth semi-circular with two large lateral lobes on lower lip / ○ pelvic origin below or in front of dorsal origin / ● finger-like lower jaw with a papillous central pad / ○ 10–15 gill rakers on lower branch of first arch / ○ pelvic origin below dorsal origin / ○ no black spots or speckles on gill cover. Size up to 210 mm SL.

Distribution. Qweiq, Euphrates, Tigris, and Karun drainages.

Habitat. Usually rheophilic in fast-flowing waters in rapids and riffles. Less common in slow-flowing rivers and reservoirs. Rare in small streams and absent from cold headwaters.

Biology. No data.

Conservation status. LC; extirpated from Qweiq.

Remarks. Usually syntopic with *C. macrostomum*. Juveniles of both species are quite similar. Mitochondrial data suggest that *C. kais* is completely introgressed by *C. macrostomum*, having lost its own mitochondrial bodies. It has even been interpreted as a trophic, neotenic morphotype of *C. macrostomum*. However, the position of fins, the nuptial tubercles, and the colour pattern are so different that there is no doubt that they are two separate species.

Further reading. Kafuku 1969 (morphology); Bănărescu & Herzig-Straschil 1995 (morphology, distribution); Coad 2010a (overlap with *C. macrostomum*); Daştan et al. 2012 (genetic diversity); Kaya et al. 2016 (distribution); Keivany et al. 2016 (distribution); Nasri et al. 2018 (morphology); Coad 2021a (biology, morphology).



Cyprinion macrostomum; Tigris drainage, Türkiye; ~100 mm SL.



Cyprinion macrostomum; Lesser Zab drainage, Iraq; 150 mm SL.

Cyprinion macrostomum

Common name. Largemouth lotak.

Diagnosis. Distinguished from other species of *Cyprinion* in Persian Gulf and Iranian endorheic basins by: ○ mouth wide, with sharp cutting edge on lower jaw, without papilious central pad on lower lip / ○ pelvic origin behind dorsal origin / ○ no large lateral lobes on lower lip / ○ no orange spots along lateral line / ○ 13–21 gill rakers / ○ 39–45, usually 40–44, total lateral-line scales / ○ last unbranched dorsal ray long, thick, flexible only on very tip, usually serrated along almost entire length / ○ posterior dorsal margin moderately to markedly concave / ○ 13–16½, rarely 17½, branched dorsal rays. Size up to 300 mm SL.

Distribution. Qweiq, Euphrates, Tigris and Karun drainages. Also, in Gulf basin south to Zohreh.

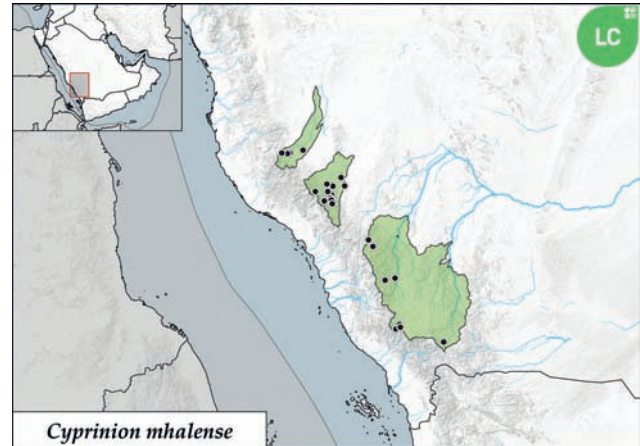
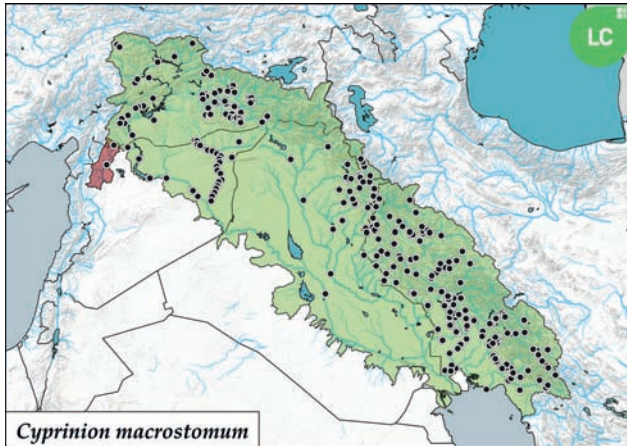
Habitat. Ubiquitous species found in almost all types of habitats, from very small streams to large rivers, including backwaters and reservoirs, from where it migrates into tributaries to spawn in rapids and riffles. Often very abundant in small streams, especially if moderately polluted.

Biology. Lives up to 7 years, spawns first time at second or third year at about 100 mm SL. Spawns May–June, some into July. Eggs are laid in gravel in riffles. Feeds on epilithic algae, detritus, and plant material scraped from hard surfaces such as stones, wood, or plants.

Conservation status. LC; extirpated from Qweiq.

Remarks. Record from Orontes based on one individual reportedly collected from Lake Amik in 1881. With no further records of this hardy and ubiquitous species, it is very likely that this individual was either mislabelled or the fish was transported from the Euphrates to a fish market at Lake Amik.

Further reading. Kafuku 1969 (morphology); Bănărescu & Herzig-Straschil 1995 (morphology, distribution); Daştan et al. 2012 (genetic diversity); Kaya et al. 2016 (distribution); Keivany et al. 2016 (distribution); Nasri et al. 2018 (morphology); Coad 2021a (biology, morphology).



Cyprinion mhalense; Wadi Turabah, Saudi Arabia; 49 mm SL. © F. Krupp.

Cyprinion mhalense

Common name. Dawasir lotak.

Diagnosis. Distinguished from other species of *Cyprinion* in Arabian Peninsula by: ● usually 40–44 total lateral-line scales / ● 19–22 circumpeduncular scales / ● 8–9 scales between lateral line and dorsal origin / ○ last unbranched dorsal ray long, thick, serrated along almost entire length in large individuals. Size up to 160 mm SL.

Distribution. Saudi Arabia: Pleistocene and extant tributaries of Wadi ad-Dawasir, which flows to interior of Peninsula,

including wadis Turabah, Afrak, Shuqub, Buwah, Shumrukh, Noaman, and Habayaba, between 1390 and 1830 m above sea level.

Habitat. Wadis with large seasonal variations in flow.

Biology. No data.

Conservation status. LC.

Further reading. Alkahem & Behnke 1983 (description); Krupp 1983 (description); Freyhof et al. 2020 (distribution, identification).



Cyprinion microphthalmum; Makran, Iran; 140 mm SL.



Cyprinion microphthalmum; Minhab, Iran, about 100 mm SL.

Cyprinion microphthalmum

Common name. Orange stripe lotak.

Diagnosis. Distinguished from other species of *Cyprinion* in Persian Gulf and Iranian endorheic basins by:

- mouth wide, variably arched to almost straight with cutting edge in adults /
- orange spots along lateral line /
- no lateral lobes or papillous central pad on lower lip /
- 8–18 gill rakers /
- 31–43, usually 35–40, total lateral-line scales /
- last unbranched dorsal ray thin, flexible along at least upper third, usually serrated from half to two-thirds of length /
- dorsal margin usually from slightly concave to slightly convex /
- 9–12½, usually 10–11½, branched dorsal rays /
- back in front of dorsal with naked median area of variable length and about one scale wide /
- scales on belly and upper anterior flank variably imbricated and often embedded in skin or absent. Size up to 200 mm SL.

Distribution. Shur (Iran) east to Makran region of Pakistan, where it occurs east of Bahukalat. Also, in endorheic basins of Jazmurian and Mashkid (Iran and Pakistan), Gonabad, and Lut (Iran and Pakistan).

Habitat. Ubiquitous. Inhabits a wide range of streams and rivers. Can be found in almost any freshwater habitat within its range. Spawns on gravel, usually in riffles.

Biology. Fractional spawner; individual females spawn several times during spring and summer. Males defend territories and have a dark-grey nuptial colour. Feeds on epilithic algae, detritus, and plant material scraped from hard surfaces such as stones, wood, or plants.

Conservation status. LC.

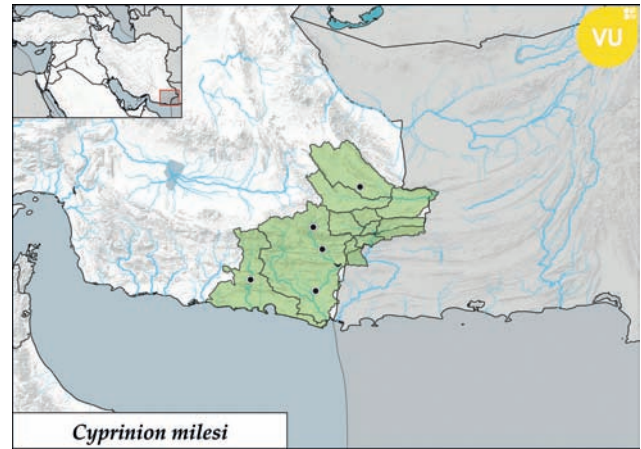
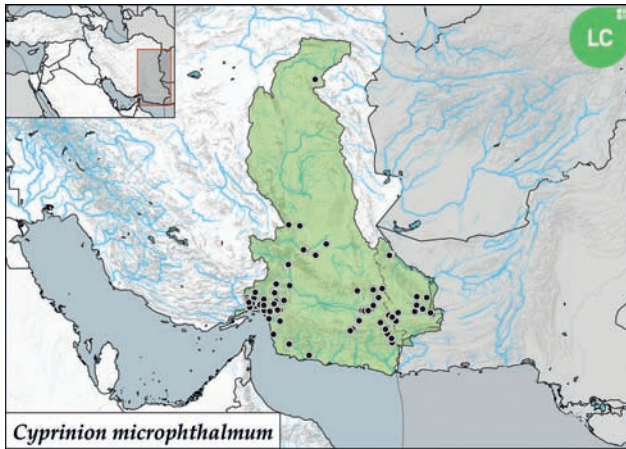
Remarks. The shape of mouth varies from almost terminal and moderately oblique in lateral view (similar to *C. milesi*) to inferior and transverse, with no real gap visible in lateral view. The thickness and degree of serration of the

last unbranched dorsal ray also appear variable. *Cyprinion kirmanense*, from southeastern Iran, is usually treated as a synonym of *C. microphthalmum* but may be a valid species. *Cyprinion microphthalmum* has often been considered a synonym of *C. watsoni* from Pakistan.

Further reading. Bianco & Bănărescu 1982 (morphology, Kol drainage, as *C. watsoni*); Howes 1982 (anatomy; revalidation of *C. microphthalmum*); Nasri et al. 2013 (morphometrics, as *C. watsoni*); Nasri et al. 2018 (morphology).



Cyprinion microphthalmum inhabits a wide range of waters, including qanats.



Cyprinion milesi; Sarbaz drainage, Iran; ~100 mm SL. © H. Mousavi-Sabet.

Cyprinion milesi

Common name. Bighead lotak.

Diagnosis. Distinguished from other species of *Cyprinion* in Persian Gulf and Iranian endorheic basins by: ● mouth subterminal, oblique in lateral view, clearly U-shaped / ○ no lateral lobes or pad on lower lip / ○ 11–12 gill rakers / ○ 34–39 total lateral-line scales / ○ last unbranched dorsal ray variably thick, weakly to strongly ossified and variably serrated / ○ dorsal margin straight / ○ 10–13½ branched dorsal rays / ○ back in front of dorsal usually without naked median area / ○ scales present on belly. Size up to 190 mm SL.

Distribution. Iran: Tang-e Sarhe toward Sarbaz and Mashkid, reported from Akar Kaur (Gwadar/Pakistan), both adjacent in Makran region. Also, in endorheic basins in Pakistan such as Kalat and Quetta, in Bampur

and near Guadjik in Baschakird mountains, and in Panjgur basin.

Habitat. Streams and pools with fresh or brackish waters.

Biology. No data.

Conservation status. VU; thought to be declining in its small range, mainly due to desiccation of streams.

Remarks. A subterminal and moderately oblique mouth (in lateral view) is also found in individuals identical to *C. microphthalmum* in their mitochondrial DNA. The taxonomic status of *C. milesi*-like fishes in Iran requires further study. *Cyprinion milesi* is very similar to *C. watsoni* from the Indus, and it needs to be clarified if both are distinct.

Further reading. Mirza 1972 (distribution); Howes 1982 (anatomy); Nasri et al. 2013 (morphometrics); Nasri et al. 2016 (morphology); Coad 2021a (biology, morphology).



Cyprinion cf. *microphthalmum*; Minhab, Iran; long head form, ~110 mm SL.

***Cyprinion milesi* in Iran.** *Cyprinion milesi* is readily distinguishable from other *Cyprinion* species in West Asia by its subterminal, clearly U-shaped mouth, which lacks the sharp cutting-edge characteristic of most *Cyprinion*. There are numerous records of *C. milesi* from the southern Persian Gulf basin in Iran, all based on *Cyprinion* with a subterminal, clearly U-shaped mouth, without a cutting edge on the lower jaw. These *C. milesi* are often found at the same localities as *C. microphthalmum*. It has been proposed that *C. milesi* is merely a morph of the latter species, retaining juvenile features in the mouth's structure. During the fieldwork for this book, we examined such individuals. Except for the head and mouth shape, these fish are indistinguishable from the syntopic *C. microphthalmum*. Mitochondrial molecular data support the view that these are aberrant individuals of *C. microphthalmum*. However, it cannot be ruled out that these are *C. milesi* carrying mtDNA of *C. microphthalmum* due to past introgressive hybridisation. *Cyprinion milesi* carrying its own mtDNA has been found in a few rivers, e.g., Bahukalat, Tang-e Sarhe, and Iranian Sarbarz. However, it is expected to be more common in adjacent Pakistan. In the future, it would be beneficial to conduct further research into the evolutionary and ontogenetic background of “aberrant” individuals of *C. microphthalmum*.



Cyprinion muscatense; Wadi Bani Khalid, Oman; ~90 mm SL.

Cyprinion muscatense

Common name. Hajar lotak.

Diagnosis. Distinguished from other species of *Cyprinion* in Arabian Peninsula by: ● last unbranched dorsal ray short, thin, and serrated along only proximal third of ray in large individuals / ● 14–16 circumpeduncular scales / ○ 37–41 total lateral-line scales / ○ 6–7 scales between lateral line and dorsal origin. Size up to 134 mm SL.

Distribution. Oman and United Arab Emirates: Wadis of Hajar mountains.

Habitat. Wadis with large seasonal variations in flow. Adults occupy larger pools than juveniles. Spawns in flowing water on gravel beds.

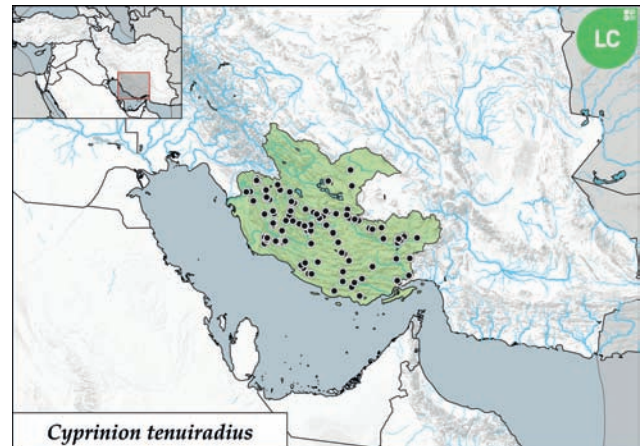
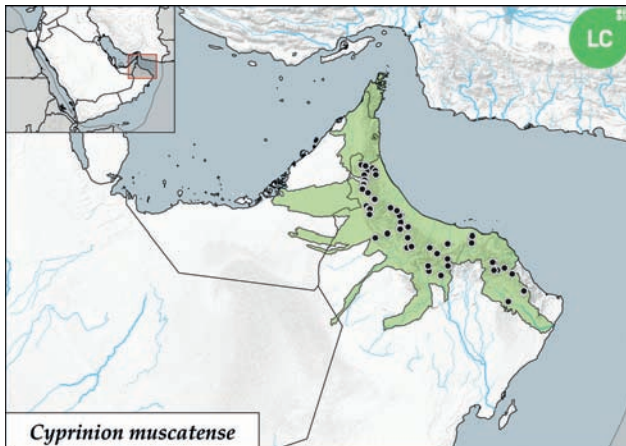
Biology. First spawns at 8–13 months. Fractional spawner, individual females spawn several times in a season. Survives more than 20 years in captivity; no data available from wild, but life expectancy in wild is likely to be much shorter.

Fast-moving, active, mid-water dweller; usually found in small schools. In isolated pools, adults are generally very wary of human presence and initially remain hidden or in deeper areas close to hiding places; this may be an adaptation to predation by piscivorous birds. During spawning season, adults develop a distinctive pale blue colouration on anterior part of body, particularly lips and pectoral fins. Colour changes from mottled golden juveniles to silvery-grey adults. Juveniles are also proportionally thinner, i.e., body is less deep. Feeds on periphyton, opportunistically on aquatic and terrestrial invertebrates, and occasionally on plant material.

Conservation status. LC.

Remarks. This species is widespread in Hajar mountains. While the sympatric *Garra* are separated into different species, all populations of *C. muscatense* are very closely related.

Further reading. Alkahem & Behnke 1983; Krupp 1983 (description); Freyhof et al. 2020 (distribution, identification).



Cyprinion tenuiradius; Mond, Iran; ~90 mm SL. © H.R. Esmaeili.



Cyprinion tenuiradius; Golabi spring, Iran; ~100 mm SL.

Cyprinion tenuiradius

Common name. Persian lotak.

Diagnosis. Distinguished from other species of *Cyprinion* in Persian Gulf and Iranian endorheic basins by: ○ mouth wide, variably arched to straight / ○ no lateral lobes or pad on lower lip or small lateral lobes present / ○ 10–21 gill rakers / ○ 32–39, usually 34–38, total lateral-line scales / ○ last unbranched dorsal ray thin, flexible along at least upper third, usually serrated from half to two-thirds of length / ○ posterior dorsal margin about straight or slightly concave / ○ with or without orange spots along lateral line / ○ 11–15½, usually 12–14½, branched dorsal rays / ○ back in front of dorsal with naked median strip of variable length and about one scale wide / ○ scales on belly and upper anterior flank variably imbricated and often small and embedded in skin or absent. Size up to 130 mm SL.

Distribution. Iran: Persian Gulf basin from Helleh to Kol drainages, and Kor endorheic basin.

Habitat. A wide range of streams and rivers.

Biology. No data.

Conservation status. LC.

Remarks. *Cyprinion tenuiradius* occurs between the range of *C. macrostomum* in the north and *C. microphthalmum* in the south. It is also morphologically intermediate between these two species, with populations more or less resembling *C. macrostomum* or *C. microphthalmum*, often making identification difficult. Furthermore, *C. tenuiradius* shares its mtDNA with *C. macrostomum* or *C. microphthalmum*, and no species-specific mtDNA characters have been found so far. It is expected that *C. tenuiradius* has its evolutionary origin in hybridisation of *C. macrostomum* and *C. microphthalmum*, and the species' distribution area is a wide hybrid zone between two parental species. We accept it as a species of hybrid origin, a problematic position that needs to be studied in more detail.

Further reading. Bănărescu & Herzig-Straschil 1995 (description); Teimori et al. 2010 (distribution); Nasri et al. 2018 (morphology).

Cyprinus

A genus of about 24 species distributed mainly in southern China and northern Vietnam. Several species were endemic to lakes and may have formed adaptive radiations and species flocks. All these radiations are extinct, and only a few of the species involved remain. A few locally and regionally endemic carps are known from East Asia, all potentially under massive pressure from introduced non-native carps. In West Asia, only *Cyprinus carpio* is native. In Europe, carp appears to have been domesticated since the Middle Ages, and cultivated stocks are domesticated from the Danube wild population. Wild stocks occur naturally only in rivers draining the Black, Caspian, and Aral Seas. Carps are now found almost everywhere in West Asia. Since the 1960s, they have spread massively into all reservoirs and other large bodies of water. Interestingly, carp are relatively rare in most natural bodies of water and seem to have established populations primarily in large rivers and reservoirs. Japanese ornamental varieties (koi) are thought to be derived from *C. rubrofasciatus* or to be hybrids with *C. carpio*. However, molecular data do not support this hypothesis, suggesting instead that the native range of *C. carpio* extends deep into China, with many native Chinese populations belonging to this species. The situation may be complicated by the widespread introduction of European carp into the native range of *C. rubrofasciatus*.

Cyprinus carpio is widely cultivated around the world and is one of the most important species for aquaculture and inland fisheries in temperate regions. Although it

is considered a pest in some countries, such as the USA, it is generally regarded as a valuable addition to fishing opportunities. In West Asia, where it is non-native to most catchment areas, it has been and still is stocked widely. The presence of carp outside of its native range is perceived as normal. If you ask someone at a reservoir which fish live there, the answer is almost always carp. Carp are especially recognised and appreciated because they grow big. Humans are fascinated by big fish, whether for food, recreational fishing or just to see them. Catching big fish is an ancient, deeply ingrained human fascination, and the person who catches a big fish is highly regarded by their social circle. Carp is one of the few large species that is ecologically well-suited to being stocked in artificial water bodies. *Silurus glanis* is another. The production of carp is big business, with all kinds of equipment available, ranging from bait and fishing tackle to fish finders, tents, video games, films and clothing. It is just another multi-million-pound industry. Carp angling is also a social event with international competitions and tourist travels. The internet is full of offers of what one needs and can do to catch 'the big carp'. As with all businesses, the aim is to expand and create new markets. West Asian countries are a new market for all carp fishing products. All that is needed is enough advertising to convince people to buy them. Reservoirs and carp already exist everywhere and are perceived as normal and native, even though they are only native to a very small part of the area.



Cyprinus carpio; Regreg drainage, Morocco; ~200 mm SL.

Cyprinus carpio

Common name. Common carp.

Diagnosis. Distinguished from other species of Cyprinidae in West Asia by: ○ two pairs of barbels / ○ 15–20½ branched dorsal rays / ○ last unbranched anal ray strongly ossified and serrated at its posterior margin / ○ caudal deeply emarginate. Size up to 1100 mm SL and 50 kg, usually less than 400 mm SL.

Distribution. Black, Caspian, and Aral basins. Introduced worldwide, including almost all drainages in West Asia.

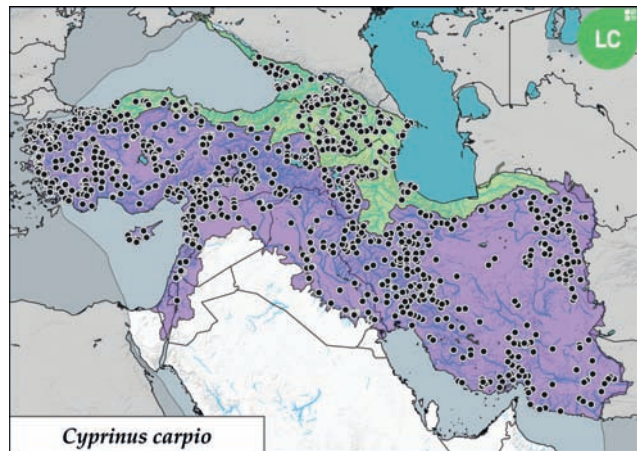
Habitat. Warm, deep, slow-flowing, still waters like lowland rivers and large, well-vegetated lakes. Often semi-anadromous in Azov and Caspian basins. Introduced in all types of waters, especially reservoirs. Tolerates permanent salinities up to 8 ‰, temporarily up to 18.6 ‰. Spawns along banks or in backwaters. Successful survival of larvae only in warm water, under shallow submerged vegetation. Eggs hatch in water up to 10 ‰, with good results down to 6.6 ‰.

Biology. Males first spawn at 1–5 years, females at 1–6 years. Usually mature at 1–2 years in warm waters such as southern Iraq. Lives to 50 years and usually spawns annually. Age of maturity varies with latitude and altitude. Spawns late February–late April in Iraq and May–June in northern part of range when temperatures are above 18°C. Reported to spawn again in October–November in southern Iraq. Adults often undertake extensive spawning migrations to suitable backwaters and flooded meadows. Individual female spawn with few males in dense vegetation. Sticky eggs are attached to aquatic plants or other submerged objects. Larvae and juveniles inhabit warm and shallow flooded river margins or backwaters, feeding mainly on very small zooplankton (rotifers). Juveniles and

adults feed on various benthic organisms and plant material. Most active at dusk and dawn. Very tolerant of low oxygen levels.

Conservation status. LC in native range. Wild populations have declined sharply since the 18th century due to river regulation and wetland draining. Cultivated in large quantities for human consumption and stocked for recreational fishing. Wild populations are slowly but steadily declining due to hybridisation with domesticated stocks. Probably very few populations remain “genetically unpolluted” due to this long process. The largest “wild” populations in West Asia appear to exist in lowland wetlands of the southern Caspian basin.

Further reading. Steffens 1958 (biology); Balon 1974, 1995 (domestication); Kottelat 1997 (systematics); Kottelat 2001a (Asian carps); Chu & Chen 1989 (Asian carps); Baruš et al. 2002 (biology); Coad 2010a (biology in Iraq, salinity tolerance).



Cyprinus carpio; aquaculture variety, mirror carp, Germany; 450 mm SL. © A. Hartl.

Garra

The genus *Garra* comprises small fishes widely distributed in West South and Southeast Asia, and tropical Africa. The genus is highly diverse, with approximately 190 species currently recognised, while many others await formal description. It is the most speciose genus of Cyprinids in West Asia, with 42 species. The diversity of *Garra* in West Asia has long been significantly underestimated, as several species exhibit highly similar meristic character states and even the complex gular discs behind the mouth exhibit minimal consistent interspecific variation. Recent molecular studies have greatly contributed to the understanding of the diversity of this genus.

Most *Garra* species can be readily distinguished from other cyprinids by a prominent, uniquely shaped gular disc on the skin behind the lower jaw. This gular disc is structured into an anteromedian fold and a central callus. *Garra* species are often adapted to swift-flowing mountain streams, where they are aided in maintaining their position in the current by the gular disc and the lateral position of their large, paired fins. Furthermore, the air bladder is often reduced to reduce buoyancy. Rheophilic, current-loving species usually have a very large gular disc, but the gular disc can be reduced or even absent in some species that do not reside in fast currents.

The presence of a gular disc has long been regarded as the most important diagnostic character for *Garra*. Recent phylogenetic studies suggested that its presence is a plesiomorphic condition (an ancestral character state) in a range of labeonine cyprinids. This is evidenced by the fact that several labeonine lineages that lack the gular disc are nested within lineages that have a gular disc. Historically, species without a gular disc have been excluded from *Garra*. In West Asia, such species were previously placed in *Hemigrammocapoeta* and *Iranocypris*, but looking more closely, all of these still have remnants of some elements of the gular disc. It has long been suggested that they are closely related to *Garra*, and the “absence” of the gular disc is a secondary, adaptive character state in these fishes. This was recently supported by molecular data, which indicated that *Hemigrammocapoeta* species do not form a monophyletic lineage, but the species are related to three different groups of *Garra* species. All former *Hemigrammocapoeta*, *Iranocypris*, *Tylognathus*, and *Typhlogarra* from West Asia are included here within the genus *Garra*.

All *Garra* species feed on periphyton, plants, and detritus but are opportunistic feeders when other food sources are readily available. In streams where *Garra* are common, they have a substantial effect on the stream ecosystem by permanently grazing almost all surfaces. In West Asia, most species of *Garra* are ubiquitous inhabitants of streams and rivers. Still, they also occur in springs, lakes with stony shores, and even in marshes with dense vegetation. In southern Iran and the Arabian Peninsula, *Garra* are typically found in isolated pools in wadis that are otherwise dry, except when rain floods the river courses. They also occur in subterranean habitats.

Many species of *Garra* display prominent tubercles on the snout. The function of these tubercles has been discussed extensively, and it is generally believed that they function in territoriality and social interaction. In several species of *Garra*, the outer tubercles on the snout are enlarged and serve a social function. In most species, only some individuals develop prominent tubercles, and this character state is not associated with the sex of individuals. It has been proposed that individuals holding a territory develop tubercles, and those without territory do not. It has also been suggested that the snout tubercles may reduce the impact of rushing waters. However, these hypotheses remain untested. **Further reading.** Menon 1964 (diversity and biogeography); Krupp 1985d (phylogenetic position of *Hemigrammocapoeta*); Stiassny & Getahun 2007 (diversity in Africa); Yang et al. 2012 (phylogeny of Labeonines); Hamidan et al. 2014 (*Iranocypris*); Behrens-Chapuis et al. 2015 (molecular phylogeny); Esmaeili et al. 2016c; Zamani-Faradonbe et al. 2021b (Iran); Hashemzadeh Segherloo et al. 2016a (convergent reduction of gular disc; phylogeny).



Garra mamshuqa; Wadi al-Khun, Yemen; 52 mm SL. © F. Krupp.



Figure 38. Head of *Garra jordanica* showing the generalised shape and structures of the gular disc and head in *Garra*.

Keys to species *Garra* in West Asia

Please note that the gular disc is present in all species; it is only incompletely developed in some.

Central Anatolia, Mediterranean, and Dead Sea basins

1a - Gular disc incompletely developed.
.....2

1b - Gular disc fully developed.
.....7

2a - No barbels; a papillate and elevated mental pad behind lower jaw.
.....3

2b - One or two pairs of barbels; no mental pad behind lower jaw.
.....4

3a - 9–15 gill rakers; few papillae on mental pad.
.....*G. kemali*

3b - 15–17 gill rakers; many papillae on mental pad.
.....*G. klatti*

4a - $8\frac{1}{2}$ branched dorsal rays; two pairs of barbels; lateral line complete.
.....*G. nanus*

4b - $7\frac{1}{2}$ branched dorsal rays; one pair of barbels; lateral line incomplete.
.....5

5a - Skin behind lower jaw continuous, with a shallow depression in middle; chin behind lateral lobes rounded anteriorly, not reaching between lateral lobes.
.....*G. festai*

5b - Skin behind lower jaw with a wide lateral lobe, very narrow, almost split in middle; chin between lateral lobes strongly pointed anteriorly, reaching deeply between lateral lobes.
.....6

6a - Skin behind lower jaw with lateral lobe strongly papillate on entire surface; scale in rows 2–3 above and below lateral line densely pigmented in middle, forming indistinct stripes; wide orange or reddish lateral stripe from eye to caudal base in live nuptial male.
.....*G. culiciphaga*

6b - Skin behind lower jaw with lateral lobe smooth or with indistinct furrows, papillate in middle in some individuals; scale in rows 2–3 above and below lateral line not more densely pigmented in middle, without stripes; live nuptial male with plain golden flank.
.....*G. caudomaculata*

7a - One pair of barbels.

.....*G. variabilis*

7b - Two pairs of barbels.

.....8

8a - 7½ branched dorsal rays; a small field of tubercles behind upper, posterior eye margin; 31-32+1-2 lateral-line scales; no black blotch on flank at middle of posterior caudal peduncle.

.....*G. ghorensis*

8b - 8½ branched dorsal rays; no tubercles behind upper, posterior eye margin; 33-36+1-2 lateral-line scales; a black blotch on flank at middle of posterior caudal peduncle at least visible in juveniles.

.....9

Persian Gulf basin and endorheic basins in Iran, including Hari drainage

1a - Subterranean, body whitish, orange or pink; eye reduced and invisible externally.

.....2

1b - Epigean, body brown or grey, usually mottled; eye fully developed.

.....5

2a - Gular disc incompletely developed.

.....*G. typhlops*

2b - Gular disc completely developed.

.....3

3a - Lateral line complete or almost complete, with 28-35 scales.

.....*G. widdowsoni*

3b - Body completely naked or few scales present at pelvic base and on flank.

.....4

4a - Scales present at pelvic base, often isolated scales on flank; lateral line reduced, no visible pores.

.....*G. tashanensis*

4b - Body completely naked; lateral line on body well developed with 28-35 pores.

.....*G. lorestanensis*

5a - Lateral and distal margin of labrum of gular disc fused with skin of chin.

.....*G. elegans*

9a - Snout blunt; body depth at dorsal origin 18-21 % SL.

.....*G. turcica*

9b - Snout slightly pointed; body depth at dorsal origin 21-26 % SL.

.....10

10a - 12-17 gill rakers on lower limb of first gill arch; 5-6, rarely 4 scales between tip of pectoral and pelvic origin; maximum head width 64-72 % HL.

.....*G. jordanica*

10b - 17-21 gill rakers on lower limb of first gill arch; 2-3, rarely 4 scales between tip of pectoral and pelvic origin; maximum head width 73-82 % HL.

.....*G. orontesi*

5b - Lateral and distal margin of labrum of gular disc free from skin of chin.

.....6

6a - Barbels absent.

.....*G. roseae*

6b - One or two pairs of barbels present.

.....7

7a - One pair of barbels; if two pairs, rostral barbel very small, sometimes just a tubercle.

.....8

7b - Two pairs of normally developed barbels.

.....10

8a - 20-26 gill rakers.

.....*G. variabilis*

8b - 10-16 gill rakers.

.....9

9a - Predorsal midline, chest, and belly almost without scales.

.....*G. nudiventris*

9b - Predorsal midline, chest, and belly fully covered by scales.

.....*G. rossica*

10a - 8+8 branched caudal rays.

.....*G. persica*

10b - 9+8 branched caudal rays.

.....11

11a - Usually 8½ branched dorsal rays.
.....12

11b - Usually 7½ branched dorsal rays.
.....13

12a - 32–38 total lateral-line scales.
.....*G. gymnothorax/G. rufa*

12b - 30–33 total lateral-line scales.
.....*G. tiam*

13a - 11–16 total gill rakers.
.....*G. rezai*

13b - 16–24 total gill rakers.
.....14

Hajar Mountains of United Arab Emirates and northern Oman

1a - Subterranean, whitish or pink, eye reduced and invisible externally.
.....*G. cavernicola*

1b - Epigean, brown or grey eye fully developed.
.....2

2a - Tip of dorsal white.
.....3

2b - Tip of dorsal similar to middle and proximal part of fin.
.....4

3a - A pale- or deeply orange spot at upper opercle; middle caudal rays bold black, membranes white; 15–18 gill rakers on lower limb of first gill arch.
.....*G. barreimiae*

Saudi Arabia, Yemen and Dhofar (Oman)

1a - Subterranean, whitish or pink; eye small.
.....*G. dunsirei*

1b - Epigean, brown, grey, often mottled; eye fully developed.
.....2

2a - A deep groove between tip of snout and nostrils; 12 circumpeduncular scales.
.....*G. mamshuqa*

2b - A shallow groove between tip of snout and nostrils or groove absent; 12–20 circumpeduncular scales.
.....3

14a - Usually two scales between anus and anal origin.
.....*G. amirhosseini*

14b - Usually three scales between anus and anal origin.
.....15

15a - Posterior margin of scales on chest not embedded in skin.

.....*G. hormuzensis*

15b - Posterior margin of scales on chest embedded in skin.

.....*G. meymehensis*

3b - No orange spot at upper opercle; middle caudal rays and membranes same colour as other caudal rays and membranes or slightly darker; 10–14 gill rakers on lower limb of first gill arch.
.....*G. shamal*

4a - Flank strongly mottled, with individual or series of orange scales.
.....*G. sharq*

4b - Flank usually plain greenish, brown, black, rarely with a midlateral stripe or faint mottling, never with orange midlateral scales.
.....5

5a - Flank scales with bold, dark-brown or grey margins.
.....*G. longipinnis*

5b - Flank scales same colour as centers of scales or with very indistinct dark-brown or grey margins.
.....*G. gallagheri*

3a - 36–39 total lateral-line scales; 20, very rarely 18, circumpeduncular scales.
.....*G. buettikeri*

3b - 30–36 total lateral-line scales; 12–18 circumpeduncular scales.
.....4

4a - Dorsal dark-grey or black; 8½ branched dorsal rays.
.....*G. sahilia*

4b - Dorsal hyaline or pale-brown with black spots at bases of branched rays; 7½ branched dorsal rays.
.....5

5a - Chest and belly naked.

.....*G. lautior*

5b - Chest and belly covered by scales at least to level of pectoral base.

.....6

6a - Usually 16–18 circumpeduncular scales; tubercles on snout usually present.

.....*G. tibanica*

6b - Usually 14–16 circumpeduncular scales; tubercles on snout absent.

.....7

7a - 8–13 gill rakers on lower limb of first gill arch; gular disc wider than long; prominent hump on back in some individuals.

.....*G. sindhae*

7b - 12–15 gill rakers on lower limb of first gill arch (10–13 in Laggashaylon); gular disc longer than wide; without hump on back.

.....*G. smartae*



Garra amirhosseini; Sartang-e-Bijar hot spring, Iran; 49 mm SL.

Garra amirhosseini

Common name. Ilam garra.

Diagnosis. Distinguished from other species of *Garra* in Persian Gulf and Iranian endorheic basins by: ○ chest and belly with very small, deeply embedded scales / ○ 17–19 scales on predorsal midline, often deeply embedded / ○ usually 7½ branched dorsal rays / ○ 9+8 branched caudal rays / ○ usually 2 scales between anus and anal origin / ○ 16–20 total gill rakers on first branchial arch / ○ 33–36 total scales along lateral line / ○ two pairs of normally developed barbels / ○ gular disc present / ○ lateral and distal margin of labrum of gular disc free from skin of chin / ○ body brown or grey, usually mottled / ○ eye fully developed. Size up to 105 mm SL.

Distribution. Iran: Sartang-e-Bijar sulfuric spring at Mehran, Meymeh, Godar khosh, Konjan cham, Zeynegan, and Kangir in Tigris drainage.

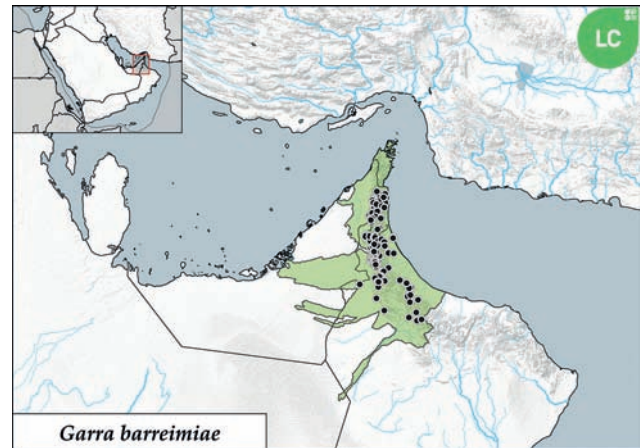
Habitat. Springs and spring-fed streams.

Biology. No data.

Conservation status. VU; known from less than 10 populations, and habitats are declining due to multiple threats, including water abstraction and climate change.

Remarks. Occurs in sympatry with *G. rufa*. *Garra amirhosseini* has COI DNA sequences very similar to *G. elegans*, while both species are clearly separated by morphological characters.

Further reading. Esmaeili et al. 2016c (description, molecular phylogeny).



Garra barreimiae; Al-Juwayf, Oman; 49 mm SL.

Garra barreimiae

Common name. Orange-ear garra.

Diagnosis. Distinguished from other species of *Garra* in Hajar Mountains by: ● 15–18 gill rakers on lower limb of first gill arch / ● a pale- or deeply orange spot at upper opercle / ○ strongly mottled flank pattern with individual or series of orange midlateral scales / ○ middle caudal rays bold black, membranes white / ○ dorsal tip white / ○ anal and paired fins usually orange. Size up to 70 mm SL.

Distribution. United Arab Emirates and Oman: Wadis on both flanks of northern Hajar Mountains, extending south from southern edge of Ru'us al-Jibal range (Musandam Peninsula) to at least Wadi Hawasina on coast of Gulf of Oman and Wadi al-Kabir and its tributaries on inner flank.

Habitat. Streams, falaj systems, and springs with fresh or brackish water and gravel or rock bottoms. Typically found in small rock or gravel pools, shallow sections of larger slow-flowing pools, springs, and fast-flowing perennial sections of wadis. In small pools, juveniles occupy shallow

sections, while larger adults are usually found at greater depths near hiding places.

Biology. Believed to spawn in anticipation of wadi flooding, but exact triggers remain unknown. Often explores upstream against current, dispersing when wadis flow. Can travel short distances out of water, including climbing steep, damp rock surfaces (e.g., near waterfalls or during rain). Can survive almost complete disappearance of surface water from their habitat; it has been speculated that juveniles may be able to survive in fossorial aquatic environments within wadi gravels. Accumulations of dead garra have been found in gravel under boulders at low points in wadis, apparently retreated as water levels have dropped below surface. In shallow pools, movements may be frantic on first encounter. Adults swim and feed close to substrate. Feeds mainly on periphyton but opportunistically on other food if available, e.g., dead insects floating on surface or decaying fruit or plant material. Seen to defend small feeding territories and “gardening” of algae fields might occur.



Garra buettikeri; Wadi Shumruk, Saudi Arabia; 170 mm SL. © N.A. Hamidan.

Conservation status. LC.

Further reading. Fowler & Steinitz 1956 (description); Banister & Clarke 1977 (subspecies); Krupp 1983 (morphology); Feulner 1998 (distribution, biology); Khalaf 2009 (*G. b. wurayahi*); Kruckenhauser et al. 2011 (molecular data; as *G. barreimiae* clade 1); Hamidan et al. 2014 (molecular data); Lyon et al. 2016 (phylogeny); Kirchner et al. 2020 (distribution, identification).

Garra buettikeri

Common name. Asir garra.

Diagnosis. Distinguished from other species of *Garra* in Saudi Arabia, Yemen, and Dhofar (Oman) by: ● 36–39 total lateral-line scales / ● 20, very rarely 18 circumpeduncular scales / ○ 7½ branched dorsal rays / ○ 10–14 gill rakers on lower limb of first gill arch / ○ dorsal hyaline or pale-brown with black spots at bases of branched rays / ○ groove between tip of snout and nostrils shallow or absent. Size up to 180 mm SL, likely to grow larger.

Distribution. Saudi Arabia: Wadis of Asir Mountains that drain inland toward Wadi ad-Dawasir, such as Wadi Turabah, between 1400–2400 m above sea level.

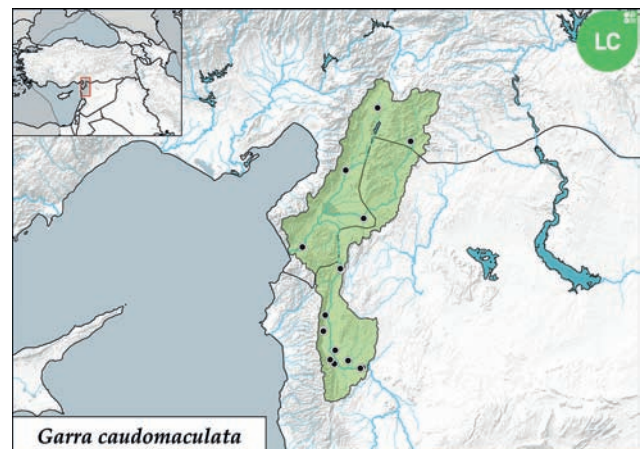
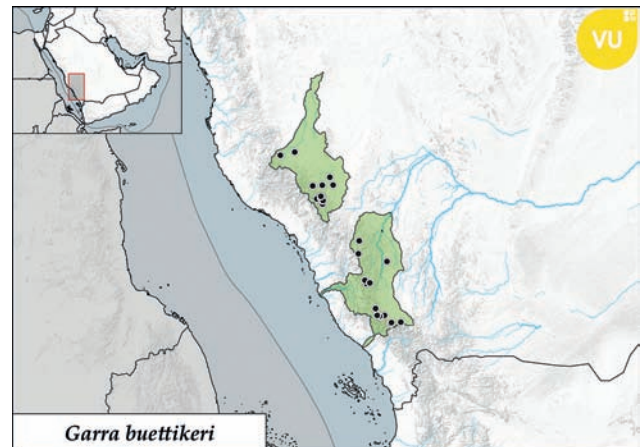
Habitat. Wide variety of habitats, in fast-flowing to almost stagnant water over bare rock or soft sediment with gravel.

Biology. Feeds mainly on periphyton but opportunistically also on other food items.

Conservation status. VU; known from fewer than 10 populations, and habitat is declining due to multiple threats, including water abstraction and climate change.

Remarks. In Abala (2390 m), fish have 6–8 rakers on the lower limb of first gill arch and may represent an own species. *Garra buettikeri* is closely related to *G. tibanica* from western Arabia and *G. dunsirei*, *G. smartae*, and *G. sindhae* from Oman.

Further reading. Krupp 1983 (description); Hamidan et al. 2014 (phylogeny); Lyon et al. 2016 (phylogeny); Freyhof et al. 2020 (distribution, identification).





Garra caudomaculata; Orontes drainage, Syria; female, 47 mm SL.



Garra caudomaculata; Orontes drainage, Syria; male, 42 mm SL.

Garra caudomaculata

Common name. Orontes golden barb.

Diagnosis. Distinguished from other species of *Garra* in Central Anatolia, Mediterranean, and Dead Sea basins by:
 ○ gular disc incomplete / ○ skin behind lower jaw with a wide lateral lobe, very narrow, almost split in middle / ○ lateral lobe on skin behind lower jaw smooth or with indistinct furrows, papillate in middle in some individuals / ○ chin between lateral lobes strongly pointed anteriorly, reaching deeply between lateral lobes / ○ a black spot at posteriormost caudal peduncle in juveniles / ○ $7\frac{1}{2}$ branched dorsal rays /

○ 31–34 scales in total lateral series / ○ lateral line incomplete, with 8–11 pored scales / ○ one pair of very small barbels / ○ scale in rows 2–3 above and below lateral line not more densely pigmented in middle, without stripes / ○ live nuptial male with plain golden flank. Size up to 60 mm SL.

Distribution. Türkiye and Syria: Orontes drainage and Nahr al-Kabir at border between Syria and Lebanon.

Habitat. Slow-flowing rivers and streams, densely vegetated springs, and wetlands.

Biology. Spawns after first winter. Fractional spawner.

Conservation status. LC.

Remarks. Earlier placed in *Hemigrammocapoeta* and often considered as a synonym of *G. culiciphaga*. *Garra caudomaculata*, *G. culiciphaga*, and *G. nanus* form a monophyletic lineage.

Further reading. Battalgil 1942 (description); Geiger et al. 2014 (molecular phylogeny, placement in *Garra*); Hamidan et al. 2014 (revalidation); Behrens-Chapuis et al. 2015 (molecular phylogeny); Bayçelebi 2020 (distribution).



Garra cavernicola; Al-Hoota cave, Oman; ~50 mm SL.



Orontes in Syria, just south of border with Türkiye. Habitat of a rich fish fauna including *Garra caudomaculata* and *G. orontesi*.

Garra cavernicola

Common name: Al-Hoota garra.

Diagnosis. Distinguished from other species of *Garra* in Hajar Mountains by: ○ eye reduced and invisible externally / ○ whitish or pink, without colour pattern. Size up to 80 mm SL.

Distribution. Oman: Al-Hoota cave system.

Habitat. Subterranean waters.

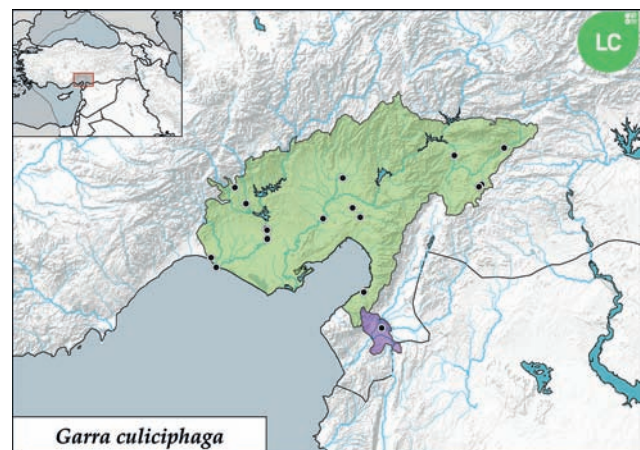
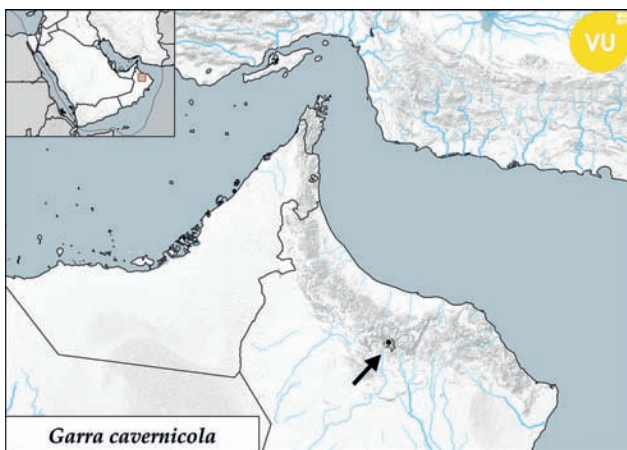
Biology. No data.

Conservation status. VU; known from a very small area. The population is affected by climate change.

Remarks. This species is genetically very closely related to neighboring surface-dwelling populations

of *G. longipinnis* and has been treated as a ‘form’ of *G. longipinnis*. Despite being very young, this evolutionary lineage shows strong and distinct evolutionary trajectories and represents a different species under the Evolutionary Species Concept. A second subterranean population may occur near the town of Al Hamra and may represent an undescribed species.

Further reading. Banister 1984 (finding of cave *Garra*); Kruckenhauser et al. 2011; Kirchner et al. 2020 (Omani cave *Garra*); Hamidan et al. 2014 (phylogeny; as *G. cf. longipinnis*); Freyhof et al. 2020 (distribution, identification); Freyhof 2025 (description).



Garra culiciphaga; Ceyhan drainage, Türkiye; female, 48 mm SL.



Garra culiciphaga; Seyhan drainage, Türkiye; male, 50 mm SL.

Garra culiciphaga

Common name. Red stripe barb.

Diagnosis. Distinguished from other species of *Garra* in Central Anatolia, Mediterranean, and Dead Sea basins by:
 ● wide, orange or reddish lateral stripe from eye to caudal base in nuptial male / ○ gular disc incomplete / ○ skin behind lower jaw with a wide lateral lobe, very narrow, almost split in middle / ○ lateral lobe on skin behind lower jaw strongly papillate on entire surface / ○ chin between lateral lobes strongly pointed anteriorly, reaching deeply between lateral lobes / ○ a black spot at posteriormost caudal peduncle in juveniles / ○ 7½ branched dorsal rays / ○ 29–34 scales in total lateral series / ○ lateral line incomplete, with 7–11 pored scales / ○ one pair of very small barbels / ○ scale in rows 2–3 above and below lateral line densely pigmented in middle, forming indistinct stripes. Size up to 70 mm SL.

Distribution. Türkiye: Lower Tarsus, Seyhan and Ceyhan drainages, also in a coastal stream at İskenderun. Likely introduced to Lake Balık (Gölbaşı-Hatay).

Habitat. Slow-flowing rivers and streams, densely vegetated springs, and wetlands. Spawns in dense vegetation of submerged plants, roots, or algae.

Biology. Usually solitary. Lives 3–4 years. Spawns first time after first winter. Spawns April–September, fractional spawner. Several males follow female into dense vegetation and spread small, transparent, and sticky eggs widely in vegetation. First-time spawners spawn later in spring than older spawners. Larvae solitary, inhabit dense vegetation, feed on plankton and detritus.

Conservation status. LC.

Remarks. Earlier placed in *Hemigrammocapoeta*.

Further reading. Pellegrin, 1927 (description); Geiger et al. 2014 (molecular phylogeny, placement in *Garra*); Hamidan et al. 2014, Behrens-Chapuis et al. 2015 (molecular phylogeny); Bayçelebi 2020 (distribution).

***Garra culiciphaga*: a misnamed fish?** The field of etymology is replete with misconceptions, and at times, consulting the original descriptions or older literature can reveal errors even in well-known names that have been in use for decades. For instance, the name “*culiciphaga*,” ascribed by Jacques Pellegrin to the species, is understood to refer to its efficacy in the destruction of mosquito larvae (*Culex*, mosquito; *phaga*, to eat). Pellegrin had received the type specimens from D.E. Tok, the head doctor of the antimalarial service in the Adana region. In his own words, Pellegrin stated that “according to the experiments of the latter (D.E. Tok), these fish are excellent destroyers of mosquito larvae, hence the name given to the species.” In the original description, he stated that he had received the material with a postscript attached, denoting the fish’s mosquito-eating behaviour, which D.E. Tok had sent. However, in the batch of samples he had received, there was another species, which he noted as “*Aphanius fasciatus*,” known as an “excellent mosquito destroyer.” D.E. Tok had likely referred to *A. fasciatus* as “d’excellents destructeurs,” a case that was misinterpreted by Pellegrin. According to the rules of zoological nomenclature, the name *culiciphaga* cannot be changed, even if based on misinformation. **Further reading.** Pellegrin 1927 (description).



The Sinkhole at Tawi Attair in Oman is the only habitat of *Garra dunsirei*. © J. Els.



Garra dunsirei; Tawi Attair, Oman, 60 mm SL.

Garra dunsirei

Common name. Tawi Attair garra.

Diagnosis. Distinguished from other species of *Garra* in Saudi Arabia, Yemen, and Dhofar (Oman) by: ● neural spines very short and not penetrating between dorsal pterygiophores / ○ subterranean, body whitish or pink / ○ eye small / ○ scales on chest and belly reduced or absent. Size up to 81 mm SL.

Distribution. Oman: Sinkhole at Tawi Attair in Jabal Qara Mountains in Dhofar region.

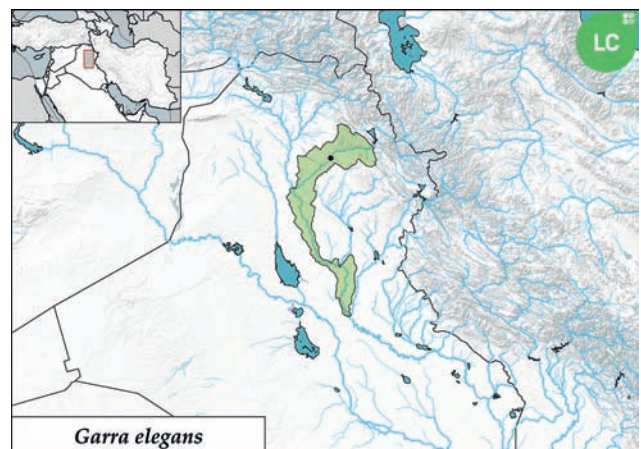
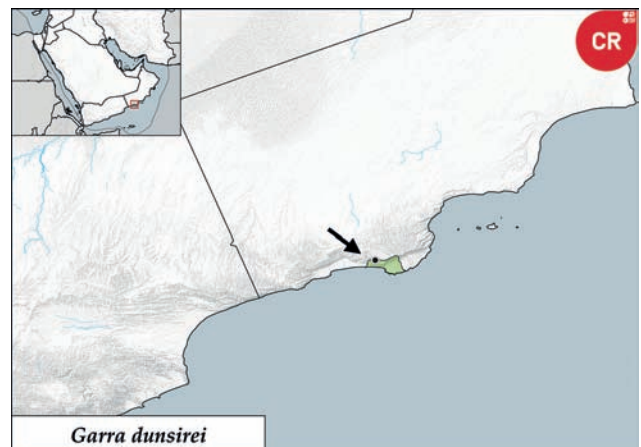
Habitat. Subterranean species. Found in a large side passage about 200 m below surface, which may be a window into a much larger underground cave system.

Biology. No data. Captive individuals have been reported to live up to 16 years; no data are available from wild, but life expectancy in wild is likely to be much shorter.

Conservation status. CR; restricted to a single known locality where it has not been found in recent years. Fewer than 250 mature individuals are believed to exist, although this may be underestimated due to the difficulty of thoroughly exploring the sinkhole.

Remarks. Its closest relatives are *G. smartae* and *G. sindhae*. Despite being a young species, it shows very strong and distinct evolutionary trajectories and represents a different species under the Evolutionary Species Concept.

Further reading. Banister 1987 (description); Hamidan et al. 2014 (phylogeny); Freyhof et al. 2020 (distribution, identification); Sayyadzadeh et al. 2023 (phylogeny).





Garra elegans; Lesser Zab, Iraq; 54 mm SL.

Garra elegans

Common name. Mesopotamian garra.

Diagnosis. Distinguished from *Garra* in Persian Gulf and endorheic basins in Iran by: ● lateral and distal margin of labrum fused with chin skin / ○ chest and anterior belly without scales / ○ mid-dorsal area in front of dorsal origin covered by scales / ○ 9+8 branched caudal rays / ○ 17–20 gill rakers / ○ two pairs of normally developed barbels / ○ body brown or grey, usually mottled / ○ eye fully developed. Size up to 87 mm SL.

Distribution. Iraq: Lower Lesser Zab and main stem of Tigris.

Habitat. Large lowland rivers.

Biology. No data.

Conservation status. LC; very poorly known.

Remarks. Distribution very poorly known but thought to occur mainly in lower parts of large rivers. Previously placed in *Tylognathus*, *Hemigarra*, or *Hemigrammocapoeta*. Molecular markers place it close to *G. amirhosseini*. *Garra elegans* is usually described as lacking a gular disc, but the disc is fully attached to the chin.

Further reading. Behrens-Chapuis et al. 2015 (molecular phylogeny); Freyhof 2016b (description).



Unlike other *Garra* species in West Asia, *G. elegans* seems specialised to large lowland rivers. It was found here, in the middle of Lesser Zab in Iraq.



Garra festai; Ammiq marsh, Lebanon; 45 mm SL.

Garra festai

Common name. Ammiq barb.

Diagnosis. Distinguished from other species *Garra* in Central Anatolia, Mediterranean, and Dead Sea basins by:

- gular disc incomplete / ○ $7\frac{1}{2}$ branched dorsal rays / ○ one pair of barbels / ○ lateral line incomplete / ○ skin behind lower jaw continuous, with a shallow depression in middle / ○ chin behind lateral lobes rounded anteriorly, not reaching between lateral lobes. Size up to 90 mm SL.

Distribution. Lebanon: Ammiq marshes in upper Litani drainage.

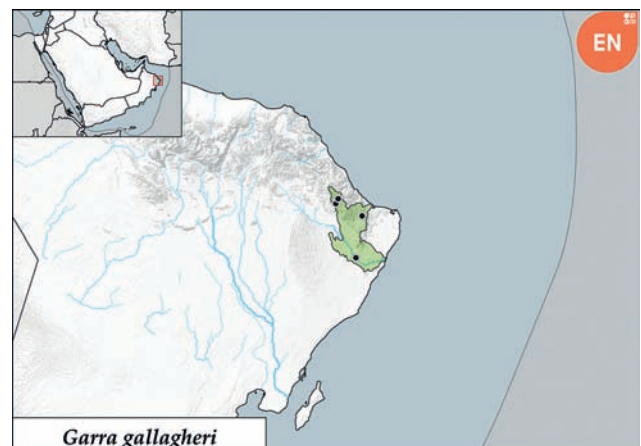
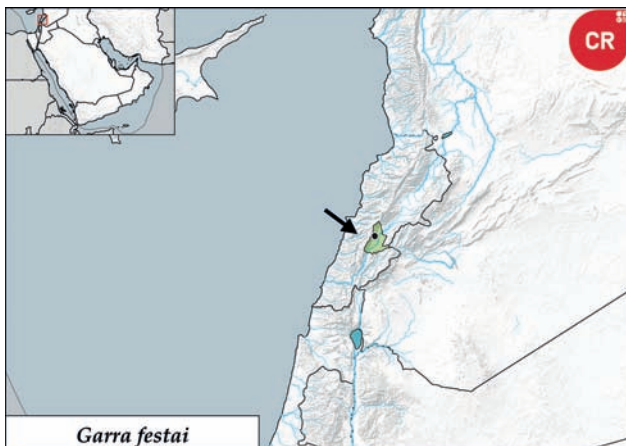
Habitat. A small wetland with dense reeds and springs. Spawns in dense vegetation.

Biology. Lives for 5 years and spawns first time after first winter. Fractional spawner.

Conservation status. CR; limited to a small wetland that partially dries out in summer. Ammiq marshes (253 ha) are remnants of much more extensive marshes and lakes that once existed in Bekaa Valley, and since 1970, 90 % of Ammiq marshes have been drained. It is an Important Bird Area, listed in Directory of Wetlands, a Ramsar site; part of it is a UNESCO Biosphere Reserve.

Remarks. Earlier placed in *Hemigrammocapoeta*. *Garra festai* seems not to be closely related to *G. caudomaculata*, *G. culiciphaga*, and *G. nanus*.

Further reading. Tortonese 1938 (description); Krupp 1985d (distribution); Geiger et al. 2014 (molecular phylogeny, placement in *Garra*); Behrens-Chapuis et al. 2015 (molecular phylogeny); Hashemzadeh Segherloo et al. 2016a (molecular phylogeny, reduction of gular disc).





Garra gallagheri; Wadi Bani Khalid, Oman; 55 mm SL.

Garra gallagheri

Common name. Black garra.

Diagnosis. Distinguished from other species of *Garra* in Hajar Mountains by: ○ scales without bold dark-brown or grey margins or scale pockets / ○ flank plain or almost plain, golden-greenish, brown, grey, or black without or with little mottling, a faint dark-green lateral stripe present in some individuals / ○ no orange midlateral scales on flank / ○ no orange spot at upper opercle / ○ tip of dorsal not white / ○ 12–14 gill rakers on lower limb of first gill arch. Size up to 75 mm SL.

Distribution. Oman: Wadi Bani Khalid and downstream falaj systems, as in towns of Bani Bu Ali and Al Mudayrib.

Habitat. Ponds, falaj systems, and springs with fresh or brackish water and rocky bottoms. Usually in stagnant or slow-flowing water. In small pools, juveniles occupy shallow areas, while larger adults are typically found at greater depths near hiding places.

Biology. Feeds on periphyton and detritus but can take other food if readily available.

Conservation status. EN; appears to be declining within its very small range. Known from only three populations, two of which are very small and vulnerable to renovation of falaj systems. The main population in Wadi Bani Khalid has experienced a large decline due to restriction of wadi,



Ein Al-Haditha in Jordan is a habitat of *Garra ghorensis*.

but is thought to be relatively secure now. Climate change could have a significant impact on this population.

Remarks. Closely related to *G. longipinnis*, from which molecular characters well separate it, but differences in colour shades are vague and may not always be sufficient to distinguish the two species. Quite variable in colour within Wadi Bani Khalid, but all colour patterns represent the same population.

Further reading. Krupp 1988 (description); Kruckenhauser et al. 2011 (molecular data; as *G. barreimiae* clade 2); Lyon et al. 2016 (phylogeny); Kirchner et al. 2020 (distribution, identification).

Garra ghorensis

Common name. Dead Sea garra.

Diagnosis. Distinguished from other species of *Garra* in Mediterranean and Dead Sea basins by: ● tubercles present on upper posterior eye margin / ○ gular disc fully developed / ○ two pairs of normally developed barbels / ○ 31–32+1–2 lateral-line scales / ○ 12–16, usually 14 circumpeduncular scales / ○ slender body / ○ 7½ branched dorsal rays / ○ 9–11 gill rakers on lower limb of first gill

arch / ○ mid-dorsal area in front of dorsal origin scaled / ○ chest naked or one to several scales forming one row between pectoral bases / ○ black blotch at posterior caudal peduncle absent. Size up to 101 mm SL.

Distribution. Jordan and Israel: Southern tributaries of Dead Sea: Lower part of Wadi Ibn Hammad, Ein Al-Haditha, Wadi Al-Hassa (including Wadi al-Burbaitah), Wadi Fifa, and Wadi Khneizerah.

Habitat. Fresh and brackish streams and springs with gravel bottoms. Usually in moderate currents.

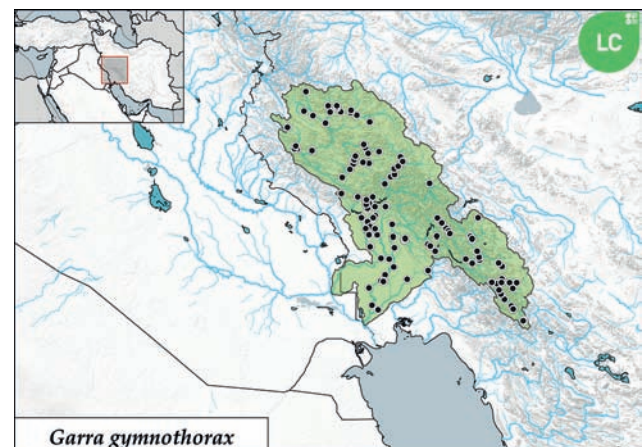
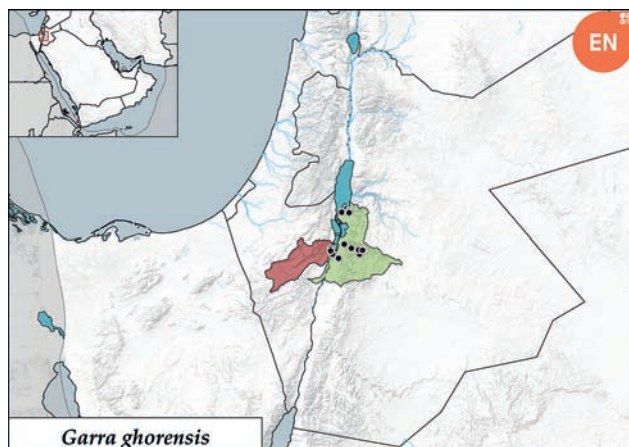
Biology. Feeds almost exclusively on algae. Tolerates high water temperatures. Spawns in groups in late spring and early summer.

Conservation status. EN; extirpated from Israel. Population in Ain al-Haditha is now restricted to a very short stream, perhaps 300 m long, which is affected by non-native *Oreochromis aureus*. Downstream, spring water is entirely used for irrigation.

Further reading. Krupp 1982 (description); Krupp & Schneider 1989 (description); Geiger et al. 2014 (molecular phylogeny); Hamidan et al. 2014 (molecular phylogeny, morphological comparisons).



Garra ghorensis; spring at Ghor al Hadithah, Jordan; 101 mm SL.





Garra gymnothorax; Gamasiab in Karkheh drainage, Iran; 120 mm SL.

Garra gymnothorax

Common name. Karun garra.

Diagnosis. Distinguished from other species of *Garra* in Persian Gulf and endorheic basins in Iran by: ○ chest without or with normally sized, often embedded scales / ○ mid-dorsal area in front of dorsal origin covered by embedded scales / ○ usually 8½ branched dorsal rays / ○ 9+8 branched caudal rays / ○ 17–23 gill rakers / ○ 32–37 total scales along lateral line / 13–17 circumpeduncular scale rows / ○ two pairs of normally developed barbels / ○ gular disc fully developed / ○ lateral and distal margin of labrum of gular disc free from skin of chin / ○ body brown or grey, usually mottled / ○ eye fully developed. Size up to 151 mm SL.

Distribution. Iran: Karun and Karkheh drainages. Most populations in Karun are hybrids with *G. rufa*.

Habitat. Streams and rivers of all kinds, as long as there are at least small areas of rock or gravel.

Biology. Lives up to 4 years. Spawns March–September with a peak in May–June. Usually total spawners. Benthic grazer feeding on algae, cyanobacteria, and small invertebrates scraped from hard surfaces such as stones, roots, and plants.

Conservation status. LC.

Remarks. *Garra gymnothorax* was described based on fish from the Karun having a naked chest, whereas most *Garra* from the Euphrates, Tigris, Karun (and Karkheh) have a scaled chest. In the Karun and Karkheh, there is an endemic mtDNA lineage of *Garra* that is well differentiated from *G. rufa*. This endemic mtDNA lineage is found in fish with naked as well as with scaled chests. Fish containing mitochondria with this endemic sequence have been identified as *G. gymnothorax*. No known morphological characters distinguish fish with mtDNA of “*G. gymnothorax*” from those with mtDNA of *G. rufa*. While all fish in Karun and Karkheh have *G. gymnothorax* mtDNA, genome-wide SNP data show that many populations in Karun (including fish at the type locality of *G. gymnothorax*) are hybrids between “*G. gymnothorax*” and *G. rufa*. Both *G. gymnothorax* and *G. rufa* mtDNA are found in Karun, suggesting extensive hybridisation between the two species.

Further reading. Berg 1949a (description); Abedi et al. 2011 (biology, as *G. rufa*); Hamidan et al. 2014, Behrens-Chapuis et al. 2015 (molecular data); Keivany et al. 2015 (morphological diversity; similarity with *G. rufa*); Sayyadzadeh et al. 2015b (discussion on taxonomic status); Esmaeili et al. 2016c (molecular phylogeny, description, revalidation); Hashemzadeh Segherloo et al. 2016a (molecular phylogeny, gular disc morphology).



Garra hormuzensis; Golabii spring, Iran; 70 mm SL.

Garra hormuzensis

Common name. Kol garra.

Diagnosis. Distinguished from other species of *Garra* in Persian Gulf and endorheic basins in Iran by: ○ mid-dorsal area in front of dorsal origin covered by scales / ○ posterior scale-margin on chest not embedded in skin / ○ chest and belly covered by scales / ○ usually $7\frac{1}{2}$ branched dorsal rays / ○ 9+8 branched caudal rays / ○ usually 3 scales between anus and anal origin / ○ 16–21 gill rakers / ○ two pairs of normally developed barbels / ○ gular disc fully developed / ○ lateral and distal margin of labrum of gular disc free from skin of chin / ○ body brown or grey, usually mottled / ○ eye fully developed. Size up to 70 mm SL, likely to grow larger.

Distribution. Iran: Golabii spring, Haji Abad, Roudbal, and Fadami in Kol drainage.

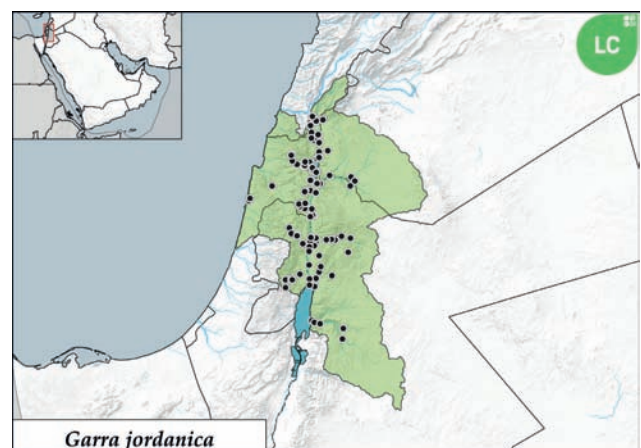
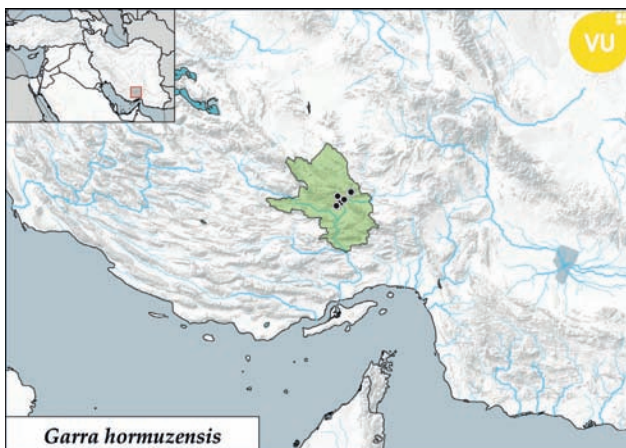
Habitat. Moderately warm to very warm springs and muddy streams to moderately fast-flowing cold waters.

Biology. No data.

Conservation status. VU; known from fewer than 10 populations and declining habitat due to water abstraction and climate change.

Remarks. The mtDNA of this species is very similar to the mtDNA of “*G. mondica*.” Also, occurs in sympatry, but not syntopy, with *G. persica*.

Further reading. Zamani-Faradonbe et al. 2021a (description).





Garra jordanica; Jordan drainage, Syria; 96 mm SL.

Garra jordanica

Common name. Jordan garra.

Diagnosis. Distinguished from other species of *Garra* in Mediterranean and Dead Sea basins by: ◦ gular disc fully developed / ◦ tubercles absent on upper posterior eye margin / ◦ two pairs of normally developed barbels / ◦ 8½ branched dorsal rays / ◦ 35–37 total lateral-line scales / ◦ 16 circumpeduncular scales / ◦ 12–17, usually, 16, gill rakers on lower limb of first gill arch / ◦ 5–6, rarely 4 scales between tip of pectoral and pelvic origin / ◦ maximum head width 64–72 % HL / ◦ body depth at dorsal origin 20–25 % SL / ◦ snout slightly pointed / ◦ chest and belly scaled, 4–7 rows of deeply embedded scales

on chest between pectoral bases / ◦ mid-dorsal area in front of dorsal origin covered by scales / ◦ dark-brown or grey blotch at posterior caudal peduncle present. Size up to 137 mm SL.

Distribution. Jordan drainage and lower Wadi Moujib, at east side of northern Dead Sea in Jordan.

Habitat. Springs, rivers, and streams with moderate to fast-flowing waters. Also in reservoirs and lakes.

Biology. No data.

Conservation status. LC.

Further reading. Goren 1974 (morphology, distribution; as *Garra rufa*); Geiger et al. 2014 (phylogeny, as *G. cf. ghorensis*); Hamidan et al. 2014 (description, molecular phylogeny).



Meyil Lake in Türkiye is a sinkhole in the Pleistocene Lake Tuz basin and one of the few habitats of *Garra kemali*.



Garra kemali; Lake Beyşehir basin, Türkiye; female, 74 mm SL.



Garra kemali; Lake Meyil, Türkiye; male, 50 mm SL.

Garra kemali

Common name. Tuz golden barb.

Diagnosis. Distinguished from other species of *Garra* in Central Anatolia, Mediterranean, and Dead Sea basins by:
 ○ no barbels / ○ gular disc incomplete / ○ 9–15 gill rakers / ○ few papillae on mental pad / ○ 36–45+1–2 scales in lateral series /
 ○ lateral line incomplete, with 5–14 pored scales. Size up to 74 mm SL.

Distribution. Türkiye: Ereğli marshes and Lake Meyil in Lake Tuz basin. Lakes Beyşehir and Seydişehir basins, including Çarşamba Canal. Also, in Hirfanlı reservoir (Kızılırmak).

Habitat. Densely vegetated springs, lakes, reservoirs, and slow-flowing streams.

Biology. Matures within a year. Males with bright golden nuptial colouration. Spawns on vegetation. Comes close to

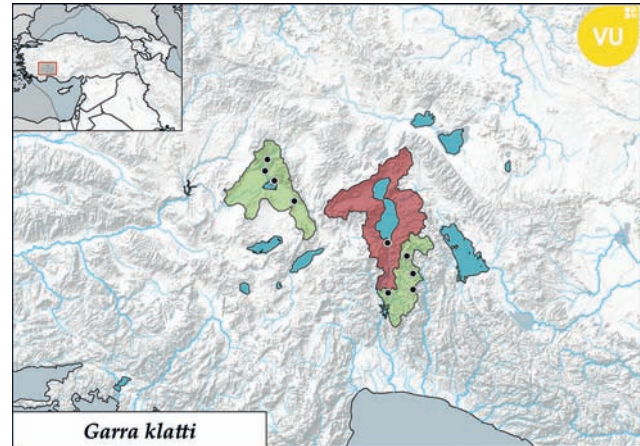
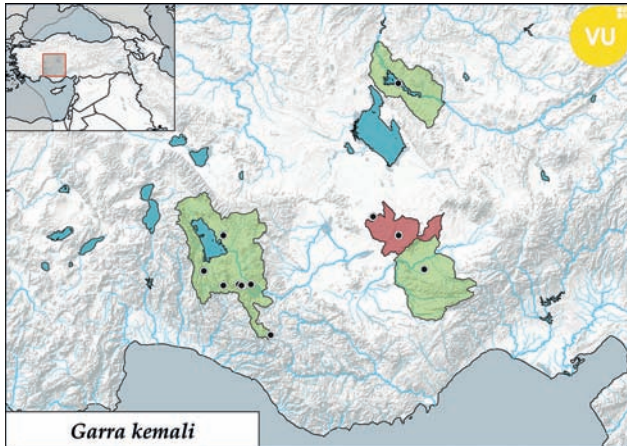
shore in spring but stays deep and far from shore in Hirfanlı reservoir in late summer and winter.

Conservation status. VU; occurs in less than 10 populations. Extirpated from Ereğli marshes due to draining of wetland. Other populations in decline.

Remarks. Very abundant when discovered in Hirfanlı reservoir in 2017. Despite regular monitoring efforts, not

seen again until 2024, when it was found again. Previously placed in *Hemigrammocapoeta*.

Further reading. Hankó 1925 (description); Geiger et al. 2014 (molecular phylogeny, placement in *Garra*); Behrens-Chapuis et al. 2015 (molecular phylogeny); Küçük et al. 2015 (morphology, in *Hemigrammocapoeta*); Yoğurtçuoğlu et al. 2018a (distribution).



Garra klatti; Köprüçay drainage, Türkiye; female, ~70 mm SL.



Garra klatti; Lake Işıklı basin, Türkiye; male, 49 mm SL.

Garra klatti

Common name. Anatolian golden barb.

Diagnosis. Distinguished from other species of *Garra* in Central Anatolia, Mediterranean, and Dead Sea basins by:
 ○ no barbels / ○ gular disc incomplete / ○ 15–17 gill rakers /
 ○ many papillae on mental pad / ○ 36–41+1–2 scales in lateral series / ○ lateral line incomplete, with 6–32 pored scales. Size up to 75 mm SL.

Distribution. Türkiye: Lake Eğirdir basin, Lake Işıklı basin in upper Büyük Menderes drainage, Lake Gölçük (Isparta), and upper Köprüçay drainage.

Habitat. Springs, lakes, and slow-flowing streams.

Biology. Lives up to 4 years. Spawns in second year.

Conservation status. VU; extirpated from Gölçük and Eğirdir basins due to invasion of non-native species. Other populations in decline.

Remarks. Earlier placed in *Hemigrammocapoeta* or *Crossocheilus* and considered as a synonym of *G. kemali* by some authors. *Hemigrammocapoeta menderesensis* is a synonym.

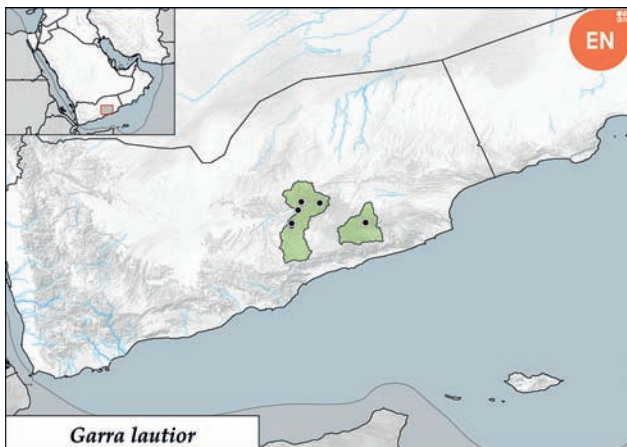
Further reading. Kosswig 1950 (description); Karaman 1971 (morphology); Sarı et al. 2008 (biology); Küçük et al. 2009b (conservation); Geiger et al. 2014 (molecular phylogeny, placement in *Garra*); Hamidan et al. 2014 (molecular phylogeny); Behrens-Chapuis et al. 2015 (molecular phylogeny); Küçük et al. 2015 (morphology, in *Hemigrammocapoeta*).

The Levantine Rift System. The Levantine Rift System represents the northernmost part of the East African Rift System. This vast geological formation is currently undergoing a process of rifting, whereby the African plate is splitting apart to create a new ocean. Simply put, a rift is a fracture in the Earth's surface that widens over time. In the East African Rift System, the Somali Plate is pulling apart from the African plate. The African Plate moves to the north, while the Somali Plate moves to the east. The African and the Arabian Plates move in a north-northeast direction, but the Arabian Plate moves faster, which leads to the rifting process. Between the Sinai and East Anatolia, the rift is subdivided into several elements, which have formed the complex geological situation observed today. The Dead Sea basin and most of the Litani and Orontes drainages are situated in the rift structures of the northern part of this rift system, the Levantine Rift Valley. Notably, the rifting and associated uplifting of the lateral mountains are relatively recent processes. In the Pliocene epoch (~3–2 million years ago), tectonic uplifting of the current-day land between the Mediterranean and the rift finally disconnected the rift valley from the Mediterranean, which flooded the area at high water levels. The last connection, through the Jezreel Valley, was disconnected only ~2 million years ago. The uplifting of the mountains of the Levant, which are also a consequence of the rifting

process, resulted in the interruption of the majority of rivers in this region, which previously flowed into the Mediterranean Sea. Furthermore, it severed the westernmost tributaries of the Euphrates from this drainage system, redirecting their watercourse to the Levant. This has resulted in a complex river history for the region, with several biogeographic puzzles that help explain the Levant's fish communities, which comprise both Mesopotamian and Mediterranean elements. **Further reading.** Alwan 2013 (biogeography).



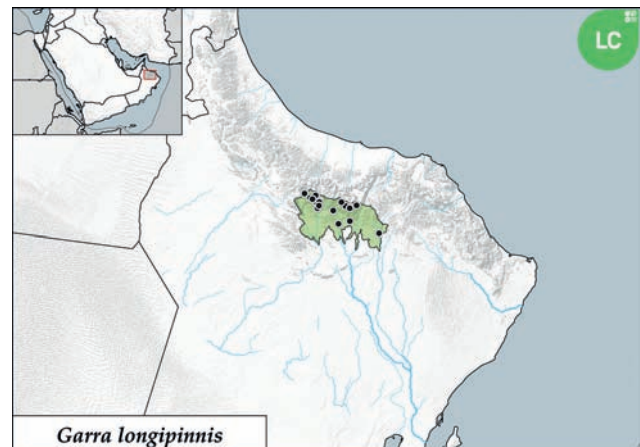
Garra lautior; Wadi Sah, Yemen; 110 mm SL. © S. Tränkner/SGN.



Garra lautior

Common name. Smooth Hadhramaut garra.

Diagnosis. Distinguished from other species of *Garra* in Saudi Arabia, Yemen, and Dhofar (Oman) by: ○ 34–36 total lateral-line scales / ○ 14–16 circumpeduncular scales / ○ $7\frac{1}{2}$ branched dorsal rays / ○ 11–17 gill rakers on lower limb of first gill arch / ○ chest and belly naked / ○ no tubercles on snout / ○ dorsal hyaline or pale-brown with black spots at bases of branched rays / ○ groove between tip of snout and nostrils shallow or absent. Size up to 120 mm SL.



Distribution. Yemen: Wadi Hadhramaut drainage.

Habitat. Wadis with large seasonal variations in flow.

Biology. No data.

Conservation status. EN; appears to be declining within its very small range. Threatened by water abstraction, but threats and distribution poorly known.

Further reading. Krupp 1983 (morphology, as *Garra incertae sedis*); Banister 1987 (description); Freyhof et al. 2020 (distribution, identification).



Garra longipinnis; Saiq, Oman; 57 mm SL.

Garra longipinnis

Common name: Jabal Akhdar garra.

Diagnosis. Distinguished from other species of *Garra* in Hajar Mountains by: ○ scales with dark-brown or grey, bold scale pockets on back and dark-brown or grey scale margins on flank / ○ flank plain greenish, brown, or grey with little or no mottling, a faint dark-green lateral stripe in some individuals / ○ no orange midlateral scales on flank / ○ no orange spot at upper opercle / ○ tip of dorsal not white / ○ 12–14 gill rakers on lower limb of first gill arch. Size up to 80 mm SL.

Distribution. Oman: Mountain wadis and associated falaj systems draining southwards from Jebel Akhdar range and Semail Gap, from Jebel Kawr and Jebel Shams eastwards to about Lizq and nearby tributaries of Wadi ‘Andam.

Habitat. Springs, streams, and falaj systems with gravel or rocky bottoms. Usually in stagnant or slow-flowing water.

Biology. Feeds on periphyton and detritus.

Conservation status. LC.

Further reading. Banister & Clarke 1977 (description); Krupp 1983 (description); Hamidan et al. 2014 (phylogeny; as *G. cf. longipinnis*); Kirchner et al. 2020 (distribution, identification).

Garra lorestanensis

Common name. Lorestan cave garra.

Diagnosis. Distinguished from other species of *Garra* in Persian Gulf and endorheic basins in Iran by: ○ eye reduced and invisible externally / ○ whitish or pink, without colour pattern / ○ body without scales / ○ lateral line on body well developed, with 6–31 pores / ○ 9+8 branched caudal rays / ○ 7–8½ branched dorsal rays / ○ 10–12 gill rakers / ○ rostral cap poorly developed, partly covering upper lip / ○ gular disc fully developed longer than wide / ○ two pairs of normally developed barbels. Size up to 74 mm SL.

Distribution. Iran: Loven spring in Ab-e Sirum (or Ab-e Serum) valley near Tang-e Haft, and springs around Tuveh in Dez system of Tigris drainage. Probably more widespread.

Habitat. Underground waters.

Biology. No data.

Conservation status. LC; as with all subterranean species, distribution and threats are difficult to understand.

Remarks. Coexists with *Garra typhlops* and the cave loach *Eidinemacheilus smithi*.

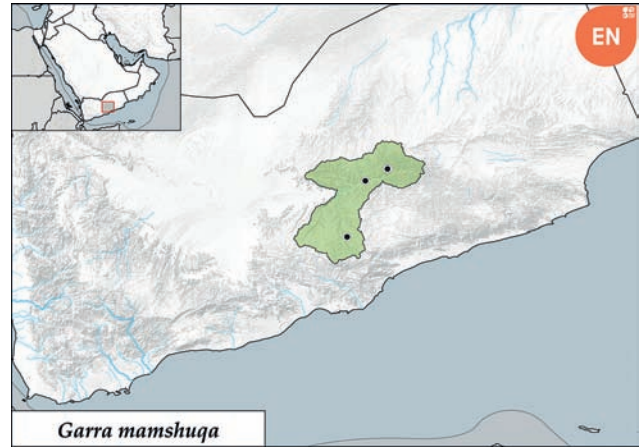
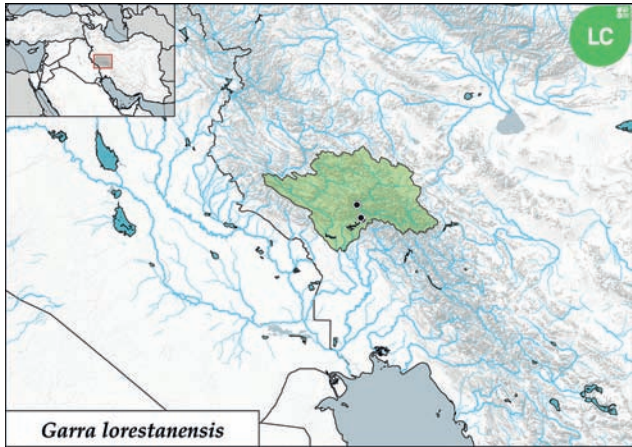
Further reading. Hashemzadeh Segherloo et al. 2012 (genetic difference of sympatric *Garra*); Mousavi-Sabet & Eagderi 2016b (description).



Garra lorestanensis; Tuveh, Iran; 56 mm SL.



Loven spring in Iran is the outflow of an aquifer inhabited by *Garra lorestanensis*, *G. typhlops*, and *Eidinemacheilus smithi*.



Garra mamshuqa; Wadi al-Khun, Yemen; 52 mm SL. © F. Krupp.

Garra mamshuqa

Common name. Hadhramaut garra.

Diagnosis. Distinguished from other species of *Garra* in Saudi Arabia, Yemen, and Dhofar (Oman) by: ● groove between tip of snout and nostrils deep / ○ usually $8\frac{1}{2}$, rarely $7\frac{1}{2}$, branched dorsal rays / ○ 34–36 total lateral-line scales / ○ usually 12 circumpeduncular scales / ○ 15–17 gill rakers on lower limb of first gill arch / ○ tubercles on snout present / ○ gular disc as long as wide or longer than wide / ○ dorsal hyaline or pale-brown with black spots at bases of branched rays. Size up to 74 mm SL, likely to grow larger.

Distribution. Yemen: Wadi Hadhramaut–Wadi Masila drainage.

Habitat. Wadis with high seasonal fluctuations in discharge over soft substrate, gravel, or bare rock.

Biology. Feeds mainly on periphyton.

Conservation status. EN; appears to be declining within its very small range due to water abstraction and climate change.

Further reading. Krupp 1983 (description); Banister 1987 (comparison with *G. lautior*); Freyhof et al. 2020 (distribution, identification).



Garra meymehensis; Meymeh, Iran; ~60 mm SL.

Garra meymehensis

Common name. Meymeh garra.

Diagnosis. Distinguished from other species of *Garra* in Persian Gulf and endorheic basins in Iran by: ○ chest with normal-sized, posterior margin of scales embedded in skin / ○ mid-dorsal area in front of dorsal origin covered by embedded scales / ○ usually 3 scales between anus and anal origin / ○ usually 7½ branched dorsal rays / ○ 9+8 branched caudal rays / ○ 16–20 gill rakers / ○ 33–37 total scales along lateral line / ○ 13–16 circumpeduncular scale rows / ○ lateral and distal margin of labrum of gular disc free from skin of chin / ○ two pairs of normally developed barbels / ○ gular

disc present / ○ body brown or grey, usually mottled / ○ eye fully developed. Size up to 73 mm SL, likely to grow larger.

Distribution. Iran: Meymeh, Doiraj, and Changoleh (Tigris drainage). Iraq: Nahre Al-Tayeb.

Habitat. Springs and spring-fed streams.

Biology. Feeds mainly on periphyton.

Conservation status. VU; with small, declining populations.

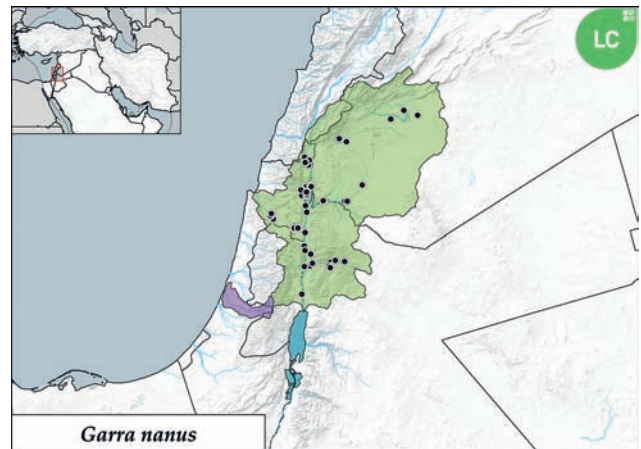
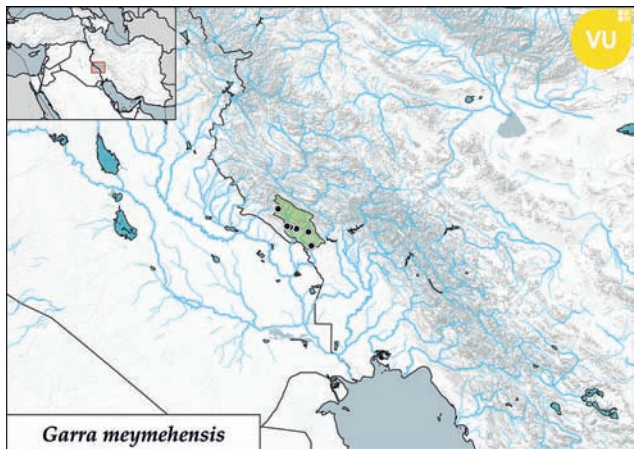
Remarks. Occurs in sympatry with *G. rufa* and *G. amirhosseini*.

Further reading. Zamani-Faradonbe et al. 2021b (description); Jouladeh-Roudbar et al. 2020 (distribution).



Garra "mondica"; Konar Siyah spring, Iran; 73 mm SL.

“*Garra mondica*,” a ghost of evolutionary past. Iranian “*G. mondica*” was considered endemic to the springs of Tang-e-Mohr, Konar Siyah, and Firozabad in the Mond drainage. In fact, “*G. mondica*” is a long-extinct species, and only its mitochondrial genome has survived in a few populations of *G. rufa* as a remnant of its evolutionary past. “*Garra mondica*” was described as a separate species based on mtDNA alone; none of the morphological characters proposed as diagnostic could be confirmed. Genome-wide SNP data examined for “*G. mondica*” show that its nuclear DNA, which codes for all its morphology, ecology, and behaviour, is identical to that of *G. rufa*. Only the mitochondrial genome of *G. mondica* survived the intense introgression of *G. rufa* after it invaded the Mond drainage. As “*G. mondica*” was described based on *G. rufa* individuals containing mitochondrial DNA of the extinct “*G. mondica*,” it is treated as a synonym of *G. rufa*. Similar discordances between nuclear DNA and mtDNA have been found in *G. gymnothorax*, and the situation should be carefully investigated in *G. amirhosseini*, *G. hormuzensis*, *G. meymehensis*, and *G. tiam*. All these species occur in sympatry or proximity to *G. rufa*. **Further reading.** Sayyadzadeh et al. 2015b (description); Zamani-Faradonbe et al. 2021b (characters, distribution).



Garra nanus; Al Tammasiyyar, Syria; 61 mm SL.



Garra nanus; Jordan drainage, Syria; 58 mm SL.

Garra nanus

Common name. Damascus barb.

Diagnosis. Distinguished from other species of *Garra* in Central Anatolia, Mediterranean, and Dead Sea basins by: ○ gular disc absent / ○ two pairs of barbels / ○ 8½ branched dorsal rays / ○ a complete total lateral-line with 31–37 scales / ○ 9–15 gill rakers. Size up to 100 mm SL.

Distribution. Syria: al-Awaj in Damascus basin. Qishon in northern Israel and Jordan drainage including Lake Tiberias. Introduced to a coastal stream in southwest Israel.

Habitat. Slow-flowing or stagnant waters of streams, lakes, and springs. Usually in warm, muddy, and even slightly polluted waters.

Biology. Spawns in winter. Feeds mainly on plants, periphyton, and detritus.

Conservation status. LC.

Remarks. Earlier placed in *Hemigrammocapoeta*. *Garra nanus*, *G. caudomaculata*, and *G. culiciphaga*, form a monophyletic lineage. *Garra sauvagei* is a synonym, but molecular differences between populations are considerable, and the species needs revision.

Further reading. Goren 1974 (distribution, habitat; as *Tylognathus steinitziorum*); Krupp & Schneider 1989 (morphology); Geiger et al. 2014 (molecular phylogeny, placement in *Garra*); Behrens-Chapuis et al. 2015 (molecular phylogeny); Hashemzadeh Segherloo et al. 2016a (molecular phylogeny, reduction of gular disc).



Garra nudiventris; Birjand, Iran; ~55 mm SL.

Garra nudiventris

Common name. Lut garra.

Diagnosis. Distinguished from other species of *Garra* in Persian Gulf and endorheic basins in Iran by: ○ one or two pairs of barbels; if two pairs, rostral barbel very small sometimes just a tubercle / ○ gular disc small / ○ chest, belly, and predorsal midline naked / ○ $5\frac{1}{2}$ – $6\frac{1}{2}$ transverse scale rows between lateral line and dorsal origin / ○ $4\frac{1}{2}$ – $5\frac{1}{2}$ transverse scale rows between lateral line and pelvic origin / ○ 10–11 total gill rakers / ○ $7\frac{1}{2}$ branched dorsal rays / ○ lateral and distal margin of labrum of gular disc free from skin of

chin / ○ body brown or grey, usually mottled / ○ eye fully developed. Size up to 81 mm SL.

Distribution. Iran: Qanats and streams in Lut and Bejestan basins.

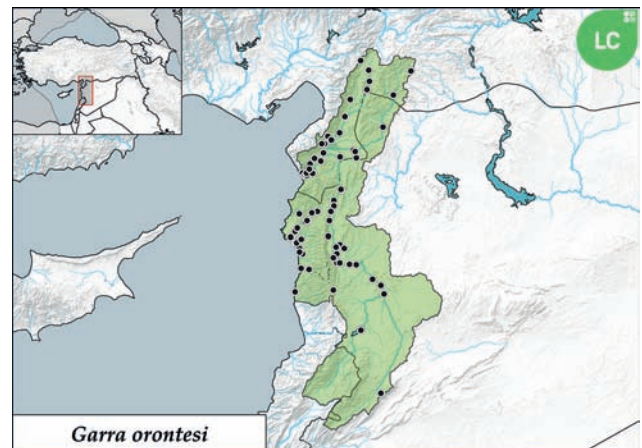
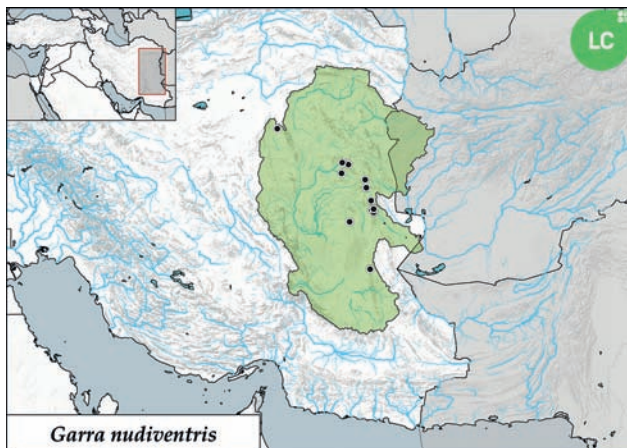
Habitat. Springs, canals, and slow-flowing streams.

Biology. No data

Conservation status. LC.

Remarks *Garra nudiventris* and *G. rossica* are very closely related and may be recognised as conspecifics in future.

Further reading. Esmaili et al. 2016c (discussion on *G. nudiventris*); Mousavi-Sabet et al. 2019a (distribution).



Garra orontesi; Orontes drainage, Türkiye; 117 mm SL.



Garra orontesi; Orontes drainage, Türkiye; ~90 mm SL.

Garra orontesi

Common name. Orontes garra.

Diagnosis. Distinguished from other species of *Garra* in Central Anatolia, Mediterranean, and Dead Sea basins by: ○ two pairs of normally developed barbels / ○ gular disc fully developed / ○ usually $8\frac{1}{2}$ branched dorsal / ○ 35–38 total lateral-line scales / ○ 17–21 gill rakers on lower limb of first gill arch / ○ no tubercles on upper posterior eye margin / ○ maximum head width 73–82 % HL / ○ 2–3, rarely 4 scales between tip of pectoral and pelvic origin / ○ a slightly pointed snout / ○ body depth at dorsal origin 22–25 % SL / ○ caudal peduncle 13–14 % SL. Size up to 130 mm SL.

Distribution. Orontes and Nahr al-Kabir North drainages in Türkiye and Syria.

Habitat. A wide range of lakes, reservoirs, canals, streams, and rivers with at least small rock or gravel areas. Springs without much current, but usually in moderate to fast-flowing waters. Resistant to moderate pollution and can reach very high abundance in shallow, polluted streams.

Biology. Feeds on periphyton.

Conservation status. LC.

Further reading. Yalçın-Özdilek & Ekmekçi 2006 (food); Hamidan et al. 2014 (molecular phylogeny); Hashemzadeh Segherloo et al. 2016a (molecular phylogeny); Bayçelebi et al. 2021a (description).



Garra persica; Rudan drainage, Iran; 50 mm SL.

Garra persica

Common name. Persian garra.

Diagnosis. Distinguished from other species of *Garra* in Persian Gulf and endorheic basins in Iran by: ● 8+8 branched caudal rays / ○ chest and belly covered by normally developed scales, absent at isthmus in some individuals / ○ mid-dorsal area in front of dorsal origin covered by scales / ○ usually 7½ branched dorsal rays / ○ 15–21 gill rakers / ○ lateral and distal margin of labrum of gular disc free from skin of chin / ○ gular disc usually present / ○ two pairs of normally developed barbels / ○ body brown or grey, usually mottled / ○ eye fully developed. Size up to 85 mm SL.

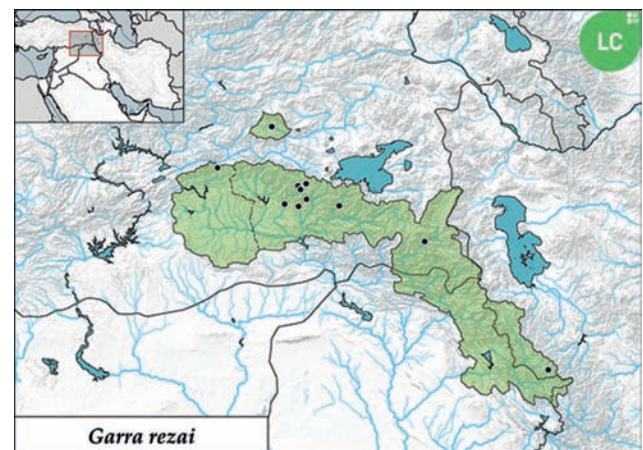
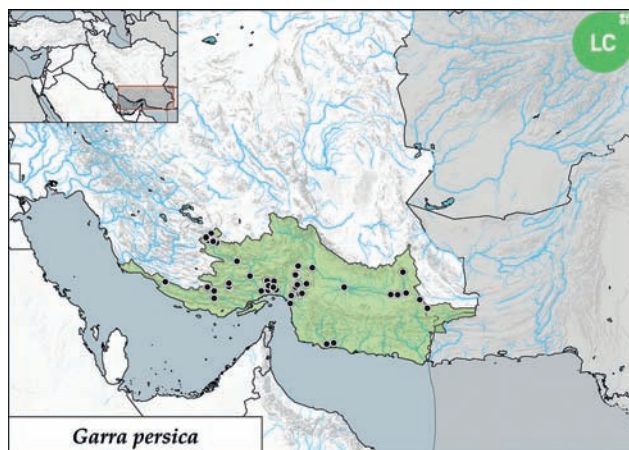
Distribution. Iran: Mehran drainage east to Makran region in northern Gulf of Oman. Also, in Jazmurian basin.

Habitat. A wide range of rivers and streams with gravel bottoms and running water.

Biology. No data.

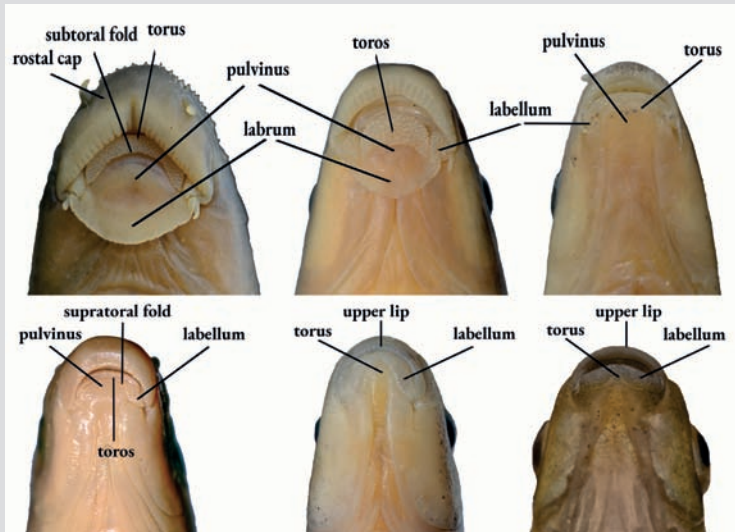
Conservation status. LC.

Further reading. Berg 1914 (description); Coad 1982a (description, revalidation); Esmaeili et al. 2016c (molecular phylogeny, description); Hashemzadeh Segherloo et al. 2016a (molecular phylogeny); Coad 2021a (biology, morphology).



Dollo's law and the lower lip in *Garra*. In evolution, “Dollo's Law” states that once a complex trait has been lost, it cannot evolve again in the same way. Although the law has fallen into disrepute, it is still one of the most important rules in evolution. This is interesting because species in the former genus *Hemigrammocapoeta* (*G. culiciphaga*, *G. caudomaculata*, *G. festai*, *G. nanus*) have a well-developed “lower lip”. Molecular characters place these in *Garra* and treat *Hemigrammocapoeta* as a synonym. This hypothesis has been rejected because garras have only a very short remnant of the lower lip in the corner of the mouth, usually called the labellum. If *Hemigrammocapoeta* were part of *Garra*, the lower lip would have re-evolved in these species, breaking Dollo's law. The gular disc on the ventral side of the head of garras has often been regarded as a modified lower lip. But the gular disc is a structure completely independent of the lips or mouth. It develops from tissues of the gular region, an area behind the mouth, between the lower jaws, often extending to the end of the ventral head. In *Garra*, as in many other algae-eaters (*Capoeta*, *Chondrostoma*), the lower jaw is covered by a keratinous sheath. In contrast to *Capoeta* or *Chondrostoma*, there is a skin fold behind the lower jaw, separated from it by a groove, which some authors have called the lower lip. This skin fold is not homologous to the lower lip and is called the subtoral fold. Species in the former genus *Hemigrammocapoeta* also have a complete subtotal fold behind the lower jaw, so their “lower lip” cannot be homologous to the subtotal fold. *Hemigrammocapoeta* has a well-developed “lower lip” separated in the middle by a short, pointed papillate structure. This structure has a small transverse split in the middle and may represent the reduced torus and labrum of the gular disc. As the structures of the gular disc in *Garra* are not split in the middle, the “lower lip” of *Hemigrammocapoeta* is most likely not homologous with any of them. Their “lower lip” is probably homologous to the labellum, which is usually restricted to the corner of the mouth in *Garra*. Like other Cyprinidae, the enlarged labellum/lower lip is continuous with the upper lip. As the labellum in *Garra* is the remnant of the lower lip, the “lower lip” of *Hemigrammocapoeta* represents a true lower lip. Do these species violate Dollo's law by re-evolving

the lower lip? Not in our opinion, because Dollo's law is about the loss of complex characters, and (1) the lower lip was not completely lost, and (2) a shorter or longer lower lip is a simple change of a character state, not a complex one. **Further reading.** Kottelat 2020 (gular disc).



From left: *G. rufa*, *G. variabilis*, *G. elegans*, lower row: *G. klatti*, *G. festai*, *G. culiciphaga*.



Garra rezai; Yanarsu in Tigris drainage, Türkiye; ~100 mm SL.

Garra rezai

Common name. Tigris garra.

Diagnosis. Distinguished from other species of *Garra* in Persian Gulf and endorheic basins in Iran by: ○ two pairs of barbels / ○ chest with embedded scales / ○ belly and predorsal midline covered by scales, 15–19 scales along predorsal midline / ○ gular disc short and wide / ○ 35–40 total lateral-line scales / ○ $5\frac{1}{2}$ (rarely $4\frac{1}{2}$ and $6\frac{1}{2}$) transverse scale rows between lateral line and dorsal origin / ○ $3\frac{1}{2}$ – $4\frac{1}{2}$ transverse scale rows between lateral line and pelvic origin / ○ 15–18 circumpeduncular scales / ○ 9+8 branched caudal rays / ○ axillary scale at pelvic origin large / ○ 11–16 total gill rakers / ○ lateral and distal margin of labrum of gular disc free from skin of chin / ○ usually $7\frac{1}{2}$ branched dorsal rays /

○ body brown, usually mottled / ○ eye fully developed. Size up to 127 mm SL.

Distribution. Türkiye: Kaynarca (Murat drainage) in Euphrates and Yanarsu, Botan, Menfez, Hezil and Batman drainages, as well as from Aktoprak in Tigris. Iran: Boein-e Olia in Choman drainage, a tributary of Lesser Zab.

Habitat. Springs and slow-flowing streams.

Biology. No data

Conservation status. LC.

Remarks. The known distribution of this species is highly disjunct, and it is expected that it will be found in other streams in the region.

Further reading. Mousavi-Sabet et al. 2022 (description); Kaya et al. 2024a (distribution in Türkiye).



Garra roseae; stream Tang-e-Sarhe, Iran; 45 mm SL.

Garra roseae

Common name. Tang-e Sarhe garra.

Diagnosis. Distinguished from other species of *Garra* in Persian Gulf and endorheic basins in Iran by: ● barbels absent / ○ chest without scales / ○ belly and predorsal midline covered by scales / ○ gular disc small / ○ $7\frac{1}{2}$ – $8\frac{1}{2}$ transverse scale rows between lateral line and dorsal origin / ○ $6\frac{1}{2}$ transverse scale rows between lateral line and pelvic origin / ○ no axillary scale at pelvic origin / ○ 11–13 total gill rakers / ○ $7\frac{1}{2}$ branched dorsal rays / ○ lateral and distal

margin of labrum of gular disc free from skin of chin / ○ body brown or grey usually mottled / ○ eye fully developed. Size up to 51 mm SL.

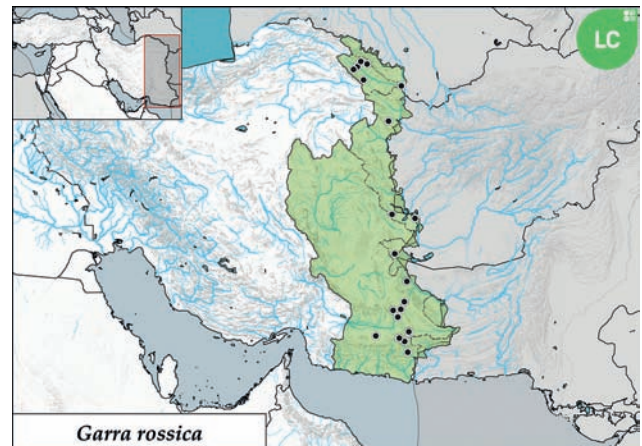
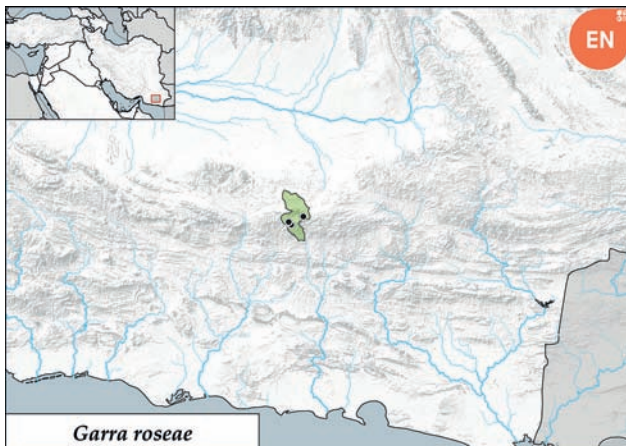
Distribution. Iran: Tang-e Sarhe in Makran region.

Habitat. Springs and slow-flowing streams.

Biology. No data

Conservation status. EN; appears to be declining within its very small range.

Further reading. Mousavi-Sabet et al. 2019a (description).





Garra rossica; Nobahar, Hari drainage, Iran; 65 mm SL.

Garra rossica

Common name. Afghan garra.

Diagnosis. Distinguished from other species of *Garra* in Persian Gulf and endorheic basins in Iran by: ○ one or two pairs of barbels; if two pairs, rostral barbel very small, sometimes just tubercle / ○ gular disc small / ○ chest, belly, and predorsal midline fully covered by scales / ○ $5\frac{1}{2}$ – $6\frac{1}{2}$ transverse scale rows between lateral line and dorsal origin / ○ $4\frac{1}{2}$ – $5\frac{1}{2}$ transverse scale rows between lateral line and pelvic origin / ○ an axillary scale at pelvic origin / ○ 13–16 gill rakers / ○ $7\frac{1}{2}$ branched dorsal rays / ○ lateral and distal margin of labrum of gular disc free from skin of chin / ○ body brown or grey, usually mottled / ○ eye fully developed. Size up to 95 mm SL.

Distribution. Hari, Morghab, Bejestan, Sistan, Mashkid, and Jazmurian basins and Makran region in Iran, Turkmenistan, and Afghanistan. North-western Baluchistan west of Central Brahui, Mashkid basin, and Kharan-Makran areas in Pakistan.

Habitat. Springs, slow-flowing streams, canals, and various artificial habitats.

Biology. Mature at 2–3 years. Feeds on algae and detritus.

Conservation status. LC.

Remarks. *Garra phryne* from Sistan in Iran is a synonym. *Garra rossica* and *G. nudiventris* are very closely related and may be accepted as conspecifics in future.

Further reading. Nikolskii 1900 (description); Esmaeili et al. 2016c (discussion on *G. nudiventris*); Mousavi-Sabet et al. 2019a (distribution); Coad 2021a (biology, morphology).



Kashaf in Hari drainage, a habitat of *Garra rossica*.



Garra rufa; Sirvan drainage, Iraq; ~100 mm SL.



Garra rufa; Great Zab drainage, Iraq; ~110 mm SL.

Garra rufa

Common name. Red garra.

Diagnosis. Distinguished from other species of *Garra* in Persian Gulf and endorheic basins in Iran by: ○ chest and belly covered by scales, scales embedded in skin, rarely absent / ○ mid-dorsal area in front of dorsal origin covered by scales / ○ usually 8½ branched dorsal rays / ○ 20–24 gill rakers / ○ 32–38 total scales along lateral line / ○ 11–13 circumpeduncular scale rows / ○ 9+8 branched caudal rays / ○ gular disc fully developed / ○ two pairs of normally developed barbels / ○ lateral and distal margin of labrum of gular disc free from skin of chin / ○ body brown or grey, usually mottled / ○ eye fully developed. Size up to 200 mm SL.

Distribution. Qweiq, Euphrates, and Tigris drainages. Also, in Iranian Persian Gulf basin from Zohreh south to Mond, including endorheic Kor basin. Absent from Karkheh drainage. In Karun, most *Garra* are hybrids of this species and *G. gymnothorax*.

Habitat. Moderately warm to very warm streams, rivers, lakes, reservoirs, and artificial habitats of all types, provided there are at least small rock or gravel areas. Usually in moderately to rapidly flowing waters. Resistant to moderate pollution and may reach very high abundance in shallow, polluted streams.

Biology. Lives up to 7 years. Usually spawns after one or two years, depending on water temperature, hatching month,

and food availability. Spawns in spring and summer, March–July, depending on altitude and latitude. Fractional spawner. Spawns in groups over gravel substrate in open water column. Eggs are not sticky and fall into crevices. Larvae pelagic and increasingly lithophilic as they grow. Benthic grazer feeding on detritus, algae, cyanobacteria, and small invertebrates scraped from hard surfaces such as stones, roots, and plants.

Conservation status. LC; extirpated from Qweiq.

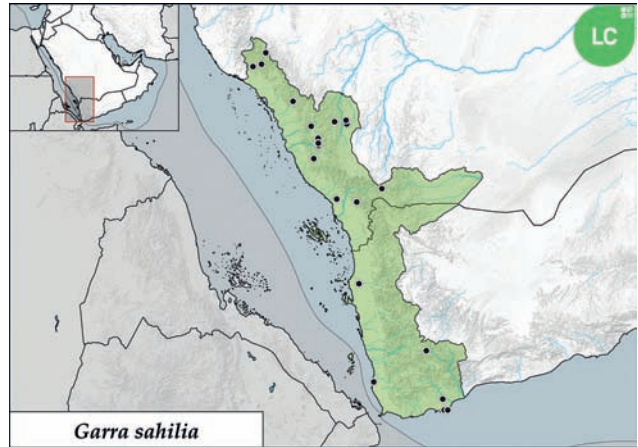
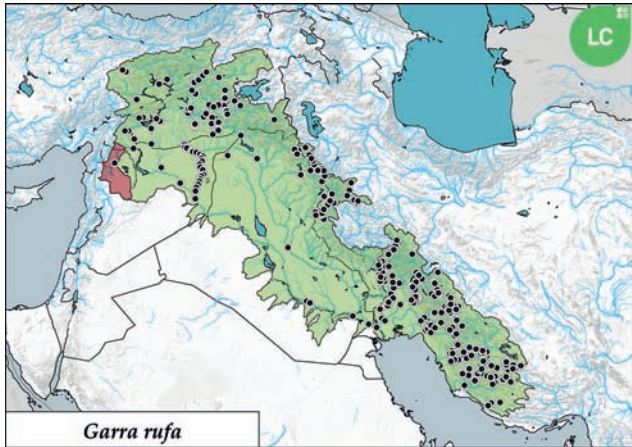
Remarks. This is the original Kangal doctor fish. Replaced by *G. gymnothorax* in Iranian Karkheh drainage. Both

species are indistinguishable by external characters, although they belong to different phylogenetic clades.

Further reading. Patimar et al. 2010b (biology); Hamidan et al. 2014 (molecular data, restriction to Persian Gulf basin); Keivany et al. 2015 (morphological diversity); Esmaeili et al. 2016c (molecular phylogeny, description); Hashemzadeh Segherloo et al. 2016a (molecular phylogeny, gular disc morphology); Coad 2021a (biology, morphology); Kaya et al. 2024 (distribution in Türkiye).

Balıkli Kaplica: from a remote spring to a city spa. The Anatolian village of Kangal in the upper Euphrates drainage is well known internationally, not for fish, but for the famous Kangal dogs, a large breed originally used to protect herds from wolves in the Anatolian plains. Less well known is the Balıkli Kaplica bath and the Kangal fish, also known as the doctor fish, which became famous in the late 1990s. The Balıkli Kaplica hot springs have been a popular bathing site for centuries. Additionally, the fish found in the springs are renowned for gently nibbling on and removing dead skin from bathers. These fish are believed to be beneficial for people who have psoriasis. There are two species of fish known for their scraping behaviour in Kangal: *Garra rufa* and *Cyprinion macrostomum*. Both are active in the spring. The therapeutic properties are attributed to the elevated levels of selenium in the water, which has been demonstrated to be beneficial in treating certain skin conditions. The fish facilitate the action of selenium by softening and cleaning the psoriatic plaque and scales, thereby exposing the lesions to the water. The treatment of psoriasis by *G. rufa* from Kangal has developed into a global health industry. In the 1950s, accommodation in Balıkli Kaplica was provided in earthen buildings, with natural pools surrounded by timbers. The first concrete buildings, with summer opening hours, were constructed in the 1960s. Balıkli Kaplica commenced operation under the modern system in the 1980s. Indoor pools serve the health industry both in winter and summer. Existing buildings were renovated, and the total bed capacity was increased to 270 after a new hotel with a 100-bed capacity was built. Today, it is a large and highly developed spa complex. *Garra rufa* from Kangal was taken illegally, most likely in the 1990s, and the species was eventually bred in Europe in large quantities. While initially perceived as a mere novelty, bathing with Kangal fish has become commercially profitable. Fish spas have increased globally, with numerous establishments operating in multiple cities, particularly holiday resorts. These spas offer a range of fish species, including *G. rufa* and other *Garra* species, and *Oreochromis* cichlids, which are frequently used. Recent molecular studies have shown that many hotels in southwest Türkiye are actually using *Garra turcica* instead of *G. rufa*. Concurrently, wild *Garra* species are distributed throughout their range and may be locally abundant. They come and nibble on you if you stand quietly in a stream.





Garra sahilia; Wadi Maur, Yemen; 129 mm SL. © F. Krupp.

Garra sahilia

Common name. Coastal garra.

Diagnosis. Distinguished from other species of *Garra* in Saudi Arabia, Yemen, and Dhofar (Oman) by: ● dorsal membranes dark-grey or black / ○ 32–36 total lateral-line scales / ○ 16–17, rarely 15 or 18, circumpeduncular scales / ○ usually 8½ branched dorsal rays / ○ 11–16 gill rakers on lower limb of first gill arch, 6–10 in Saudi Arabian populations / ○ groove between tip of snout and nostrils shallow or absent / ○ eye fully developed. Size up to 129 mm SL.

Distribution. Yemen and Saudi Arabia: streams flowing to Gulf of Aden and southern Red Sea coast. Yemen: Wadis Bana, al Kabir, Lahej, Tiban, Murlwani, Maur, and others. Found up to 1130 m above sea level. Saudi Arabia: Wadis

Minshah, Daga, Gaanah, north of Jizan, Sharfa, from 100–300 m above sea level.

Habitat. Wadis with high seasonal fluctuations in discharge.

Biology. No data.

Conservation status. LC.

Remarks. Molecular data suggest that this species is more closely related to the Anatolian and Mesopotamian *Garra* than to other species from the western Arabian Peninsula. The Saudi Arabian populations are described as *Garra sahilia gharbia*. They may represent a separate species, distinguished by having 6–10 gill rakers on the lower limb of first gill arch, whereas *Garra s. sahilia* has 11–16 gill rakers.

Further reading. Krupp 1983 (description); Hamidan et al. 2014 (phylogeny); Freyhof et al. 2020 (distribution, identification).



Garra shamal; Wadi Bani Kharus, Oman; 70 mm SL.

Garra shamal

Common name. Muscat garra.

Diagnosis. Distinguished from other species of *Garra* in Hajar Mountains by: ● middle caudal rays' with same colour as other rays or slightly darker, not bold black / ● membranes between these rays brown or hyaline / ○ strongly mottled flank pattern usually lacking orange scales on flank / ○ white dorsal tip / ○ no orange spot at upper opercle / ○ 10–14 gill rakers on lower limb of first gill arch / ○ eye fully developed. Size up to 75 mm SL.

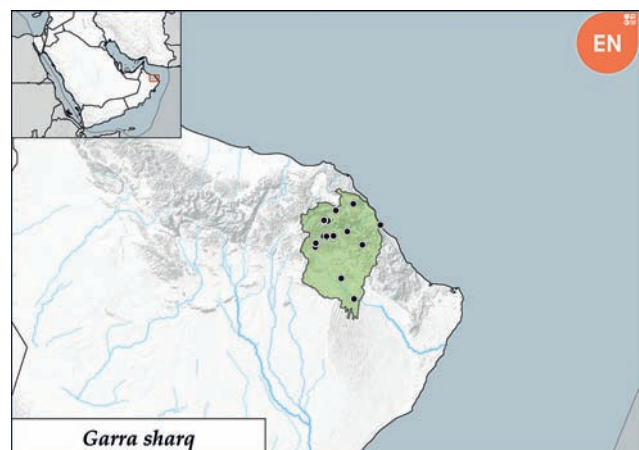
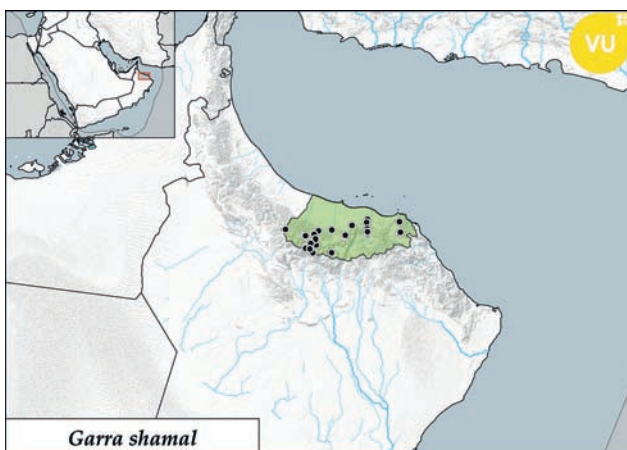
Distribution. Oman: Wadis draining from Hajar Mountains to coast of Gulf of Oman, east and west of Muscat, including northern flank of Jebel Akhdar, extending from Wadi Hoqain (near Rustaq) in west to Wadi Mayh (Wadi Yiti), east of Muscat.

Habitat. Headwater streams and falaj systems draining mountain front, springs, streams, and falaj systems with fresh or brackish water, gravel, or bedrock bottoms. Usually in stagnant or slow-flowing water.

Biology. Feeds on periphyton and detritus.

Conservation status. VU; relatively small area with fewer than 10 independent populations. Has experienced loss of several populations, and many are vulnerable to overuse of water, pollution, and climate change.

Further reading. Kruckenhauser et al. 2011 (molecular phylogeny); Pichler et al. 2018 (morphology, as north clade); Kirchner et al. 2020 (description); Kirchner et al. 2020 (distribution, identification).





Garra sharq; Wadi Khabbah, Oman; 49 mm SL.

Garra sharq

Common name. Dayqah garra.

Diagnosis. Distinguished from other species of *Garra* in Hajar Mountains by: ○ strongly mottled flank pattern with individual or series of orange midlateral scales / ○ no orange spot at upper opercle / ○ tip of dorsal not white / ○ membranes between central caudal rays black, not silvery / ○ 10–14 gill rakers on lower limb of first gill arch / ○ eye fully developed. Size up to 50 mm SL, likely to grow larger.

Distribution. Oman: Wadi Dayqah drainage, including wadis Tayyin, Deema, and Khabbah, flowing to coast entering sea at Daghmar. Also, in isolated falaj systems and springs in endorheic basin north of Wahiba Sands.

Habitat. Mountain wadis, streams, falaj systems, and springs with freshwater, gravel, or bedrock bottoms. Usually in slow-flowing water.

Biology. Feeds on periphyton and detritus.

Conservation status. EN; significant decline due to water abstraction and expected further decline due to climate change.

Remarks. The distribution of this species in Wadi Dayqah drainage and adjacent endorheic basins suggests recent connections between two watersheds, allowing the invasion of *G. sharq*. While *G. sharq* occurs in upper Wadi Dayn and in falaj systems of town of Al-Mintirib, other falaj systems in area are occupied by *G. gallagheri*. As the *Garra* from Wadi Dayn and Al-Mintirib have only been examined for molecular characters, we cannot exclude the possibility that both species are sympatric or that these are hybrid populations between the two species.

Further reading. Pichler et al. 2018 (morphology); Kirchner et al. 2020 (description); Freyhof et al. 2020 (distribution, identification).



Habitat of *Garra sharq* in Oman.



Wadis in Hajar Mountains are usually small and have little water except few days when all stream bed is flushed.



Garra sindhae; Wadi Andhur, Oman; ~45 mm SL. © G. Lyon.

Garra sindhae

Common name. Andhur garra.

Diagnosis. Distinguished from other species of *Garra* in Saudi Arabia, Yemen, and Dhofar (Oman) by: ● prominent hump on back in some individuals / ○ 33–36 total lateral-line scales / ○ 14(–16) circumpeduncular scales / ○ 7½ branched dorsal rays / ○ 8–13 gill rakers on lower limb of first gill arch / ○ chest and belly behind pectoral origin fully covered by deeply embedded scales / ○ gular disc usually wider than long / ○ tubercles on snout absent / ○ dorsal hyaline or pale-brown with black spots at bases of branched rays / ○ groove between tip of snout and nostrils shallow or absent / ○ eye fully developed. Size up to 82 mm SL.

Distribution. Oman: Wadi Andhur in Dhofar region.

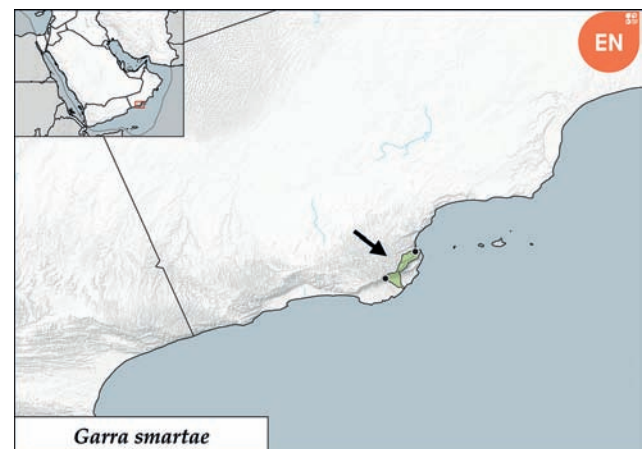
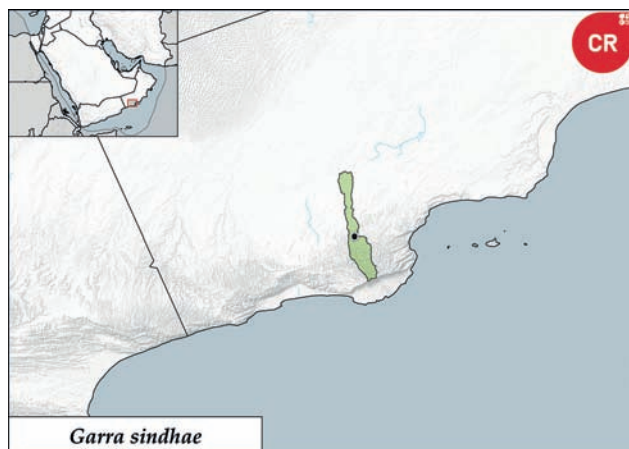
Habitat. Wadis with high seasonal fluctuations in discharge.

Biology. No data.

Conservation status. CR; restricted to a short stretch of Wadi Andhur. There appears to be no direct threat from human activity, but reduced rainfall due to climate change could threaten this species.

Remarks. Mistakenly treated as a synonym of *G. dunsirei*, which is quite distinct and, as a subterranean species, has its own distinct evolutionary history compared to *G. sindhae*. Described as *G. sindhi*, but the species name is dedicated to a female and must, therefore, be declinate to *G. sindhae*.

Further reading. Lyon et al. 2016 (description, phylogeny); Freyhof et al. 2020 (distribution, identification); Sayyadza-deh et al. 2023 (phylogeny).



Garra smartae; Wadi Hasik, Oman; 58 mm SL. © J. Els.

Garra smartae

Common name. Hasik garra.

Diagnosis. Distinguished from other species of *Garra* in Saudi Arabia, Yemen, and Dhofar (Oman) by: ● no prominent hump on back / ○ 33–35 total lateral-line scales / ○ 14(–16) circumpeduncular scales / ○ $7\frac{1}{2}$ branched dorsal rays / ○ 12–15 gill rakers on lower limb of first gill arch, 10–13 in Laggashaylon / ○ chest and belly behind pectoral origin fully covered by scales but scales on ventral midline and in front of pectoral base deeply embedded and small or absent / ○ gular disc usually longer than wide / ○ tubercles on snout absent / ○ dorsal hyaline or pale-brown with black spots at bases of branched rays / ○ groove between tip of snout and nostrils shallow or absent / ○ eye fully developed. Size up to 76 mm SL.

Distribution. Oman: Wadis Hasik and Laggashaylon in Dhofar region.

Habitat. Wadis with high seasonal fluctuations in discharge.

Biology. Feeds on periphyton and detritus. In captivity, individuals reach sexual maturity at five to six months.

Conservation status. EN; appears to be declining within its very small range.

Remarks. The Laggashaylon population appears to bridge the morphological gap between *G. smartae* and *G. sindhae*, and published molecular data suggest that this population may represent an undescribed species. *Garra smartae* has been erroneously treated as a synonym of *G. dunsirei*, which is well differentiated and, as a subterranean species, has its own distinct evolutionary trajectory when compared to *G. smartae*. Described as *Garra smarti*, but the species name is dedicated to a female and must, therefore, be declinate to *G. smartae*.

Further reading. Krupp & Budd 2009 (description); Lyon et al. 2016 (phylogeny); Freyhof et al. 2020 (distribution, identification); Sayyadzadeh et al. 2023 (phylogeny).



Garra tashanensis; Tashan Cave, Iran; 27 mm SL.

Garra tashanensis

Common name. Tashan cave garra.

Diagnosis. Distinguished from other species of *Garra* in Persian Gulf and endorheic basins in Iran by: ● lateral line on body reduced, visible pores absent / ○ eye reduced and invisible externally / ○ whitish or pink, without colour pattern / ○ body almost naked, few scales at pelvic base only / ○ 9+8 branched caudal rays / ○ $7\frac{1}{2}$ branched dorsal rays / ○ rostral cap well developed, completely covering upper lip / ○ gular disc fully developed as long as wide / ○ two pairs of normally developed barbels. Size up to 35 mm SL.

Distribution. Iran: Tashan Cave at Sarjusher and Tang-e Ban spring in Jarahi drainage.

Habitat. Underground waters.

Biology. No data.

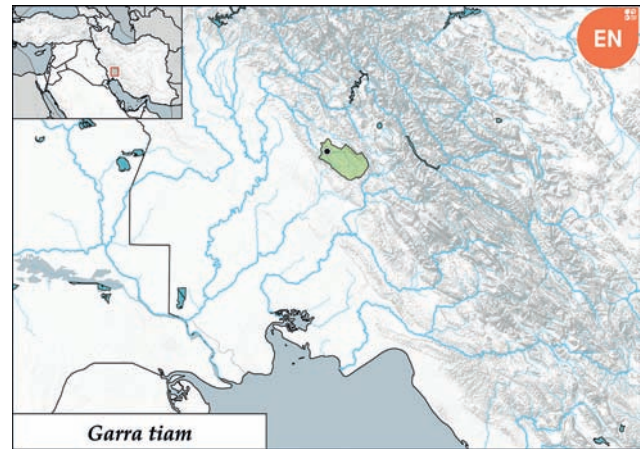
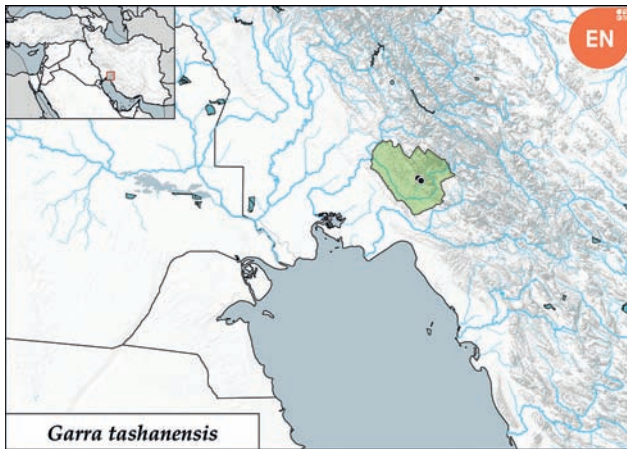
Conservation status. EN; appears to be declining within its very small range. Only two locations are known: Tashan cave and Tang-e Ban spring. Tashan cave spans approximately 900 m in length and reaches a depth of about 50 m. Tang-e Ban is a seasonal karstic spring that only flows during winter and spring, during which fish are washed from the cave to the surface.

Further reading. Mousavi-Sabet et al. 2016c (description).



Did freshwater fishes cross the Bab-al-Mandeb? Numerous studies concern species movements between Africa and Eurasia, including the migrations of early humans ‘out of Africa’. A frequently cited dispersal route is across a land bridge in the southern Red Sea, which is suggested to have emerged during glacial sea-level low stands. The existence of a land bridge between Africa and the Arabian Peninsula is supported by numerous biogeographical similarities between the two regions, as evidenced by the distribution of different animal groups. This is the land bridge over the Bab-al-Mandeb Strait between Yemen and Djibouti. However, the precise timing of the final opening of the Red Sea to the Gulf of Aden remains a matter of contention, and the exact manner and timing of the entry of Asian freshwater fishes into Africa remain unclear. Geological data prove that Africa and Arabia were the last to be connected at the Bab-al-Mandeb-strait during the Miocene (10–5 million years ago). Postulated land bridge periods in younger, post-Miocene times are not supported. This indicates that no early humans or other biota, such as freshwater fishes, have walked on dry land or swam in freshwater from Djibouti to Yemen or vice versa. Following the Miocene, freshwater fishes could no longer cross the Bab-al-Mandeb Strait. However, they could still reach Africa from Asia via the Levant and the northern Arabian Peninsula and possibly through the Nile. It is evident that most freshwater fishes migrated from Arabia to Africa before the end of the Miocene, yet the specific dispersal routes remain uncertain.

Today, all native Arabian freshwater fish species are closely related to species in the Persian Gulf basin and not to African fishes. The only group of Arabian freshwater fishes that are not closely related to other West Asian species are the *Garra* of the *G. tibanica* group (*G. tibanica*, *G. buettikeri*, *G. dunsirei*, *G. smartae*, and *G. sindhae*). Indeed, Ethiopian *G. makiensis* is also related to the *G. tibanica* group. This supports the hypotheses of dispersal events and vicariance around the southern Red Sea area. However, *G. makiensis* is not very closely related to the species of the *G. tibanica* group, indicating that the last common ancestor lived much earlier than the late Miocene. The last common ancestor of all the other African *Garra* species is related to the last common ancestor of the many species of the *G. rufa* group. It has invaded Africa independently, probably through the Levant and the Nile. **Further reading.** Bosworth et al. 2005, Fernandes et al. 2006, Autin et al. 2010 (Bab-al-Mandeb-strait); Stewart & Murray 2017 (fossils of Awash); Englmaier et al. 2020 (relationship of Arabian and Ethiopian *Garra*).



Garra tiam; Abshur drainage, Iran; ~60 mm SL.

Garra tiam

Common name. Abshur garra.

Diagnosis. Distinguished from other species of *Garra* in Persian Gulf and endorheic basins in Iran by: ◦ chest with normal-sized, often embedded scales / ◦ mid-dorsal area in front of dorsal origin with 9–11 scales / ◦ usually 8½ branched dorsal rays / ◦ 9+8 branched caudal rays / ◦ 18–22 gill rakers / ◦ 30–33 total scales along lateral line / ◦ 30–33 total lateral-line scales / ◦ 12–13 circumpeduncular scales / ◦ two pairs of normally developed barbels / ◦ lateral and distal margin of

labrum of gular disc free from skin of chin / ◦ gular disc fully developed / ◦ body brown or grey usually mottled / ◦ eye fully developed. Size up to 63 mm SL, likely to grow larger.

Distribution. Iran: Abshur drainage, a tributary of Karun.

Habitat. Streams and springs with rocks or gravel bottom.

Biology. Feeds mainly on periphyton.

Conservation status. EN; found in a very small area where climate change and desiccation of streams is ongoing.

Further reading. Zamani-Faradonbe et al. 2021b (description).



Garra tibanica; Wadi Dhila, Saudi Arabia; 65 mm SL. © F. Krupp.

Garra tibanica

Common name. Hijaz garra.

Diagnosis. Distinguished from other species of *Garra* in Saudi Arabia, Yemen, and Dhofar (Oman) by: $\circ$ 34–36, very rarely 32, 33 or 37, 38 total lateral-line scales / $\circ$ 16–18, very rarely 14, 15 or 20 circumpeduncular scales / $\circ$ 6–8½, usually 7½, branched dorsal rays / $\circ$ 6–17, usually 9–15, gill rakers on lower limb of first gill arch / $\circ$ gular disc of considerably variable shape and size, usually wider than long / $\circ$ chest and belly usually covered by scales, scales may be embedded and barely overlapping or partly absent leaving some naked areas / $\circ$ tubercles on snout usually present / $\circ$ dorsal membrane hyaline or pale-brown with black spots at bases of branched rays / $\circ$ groove between tip of snout and nostrils shallow or absent / $\circ$ eye fully developed. Size up to 131 mm SL.

Distribution. Wadi Hajr in Yemen to Khaibar area in Saudi Arabia.

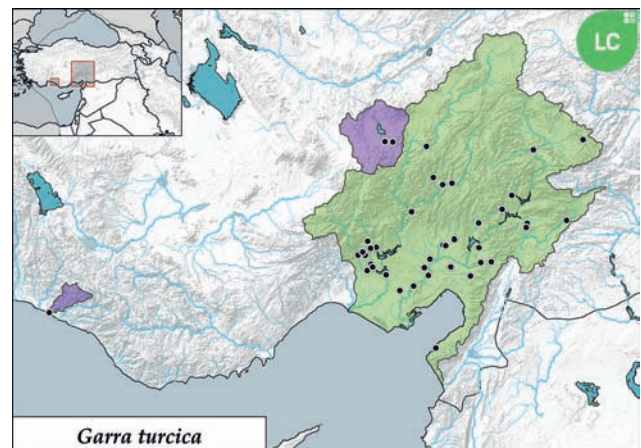
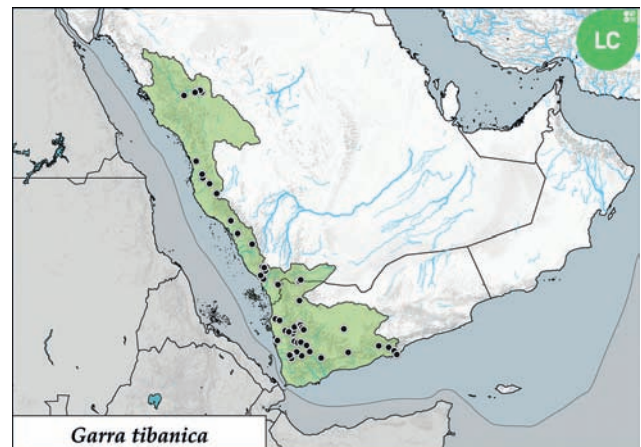
Habitat. Wadis with high seasonal fluctuations in discharge.

Biology. Observed moving over short distances on land, climbing steep, moist rocky surfaces, especially near waterfalls, to reach higher pools.

Conservation status. LC.

Remarks. *Garra tibanica* was synonymised with *G. quadrimaculata* from Ethiopia, a view not supported by later studies. *Garra brittoni*, *Garra tibanica dhamarica*, *Garra tibanica elbahrica*, *Garra tibanica kasaba*, *Garra tibanica multaka*, *Garra tibanica nakalani*, *Garra tibanica scortecii*, and *Garra tibanica yemenica*, which are all from Yemen, are treated as synonyms of *Garra tibanica*. New fieldworks should test this hypothesis.

Further reading. Trewavas 1941 (description); Krupp 1983 (revised diagnosis); Balletto & Spanò 1977 (description, sub-species); Hamidan et al. 2014 (phylogeny); Freyhof et al. 2020 (distribution, identification).





Garra turcica; Seyhan drainage, Türkiye; 90 mm SL.



Garra turcica; Ceyhan drainage, Türkiye; 103 mm SL.

Garra turcica

Common name. Cilician garra.

Diagnosis. Distinguished from other species of *Garra* in Central Anatolia, Mediterranean, and Dead Sea basins by: ○ two pairs of normally developed barbels / ○ gular disc fully developed / ○ tubercles absent on upper posterior eye margin / ○ 33–37 total lateral-line scales / ○ 8½ branched dorsal rays / ○ snout blunt / ○ body depth at dorsal origin 18–21 % SL / ○ chest and belly scaled / ○ mid-dorsal area in front of dorsal origin covered by scales / ○ dark-grey blotch at posterior caudal peduncle present. Size up to 115 mm SL.

Distribution. Türkiye: Seyhan and Ceyhan drainages and small rivers south to Arsuz. Introduced to Ilıca in Manavgat, also to the Sultan Marshes via Zamantı Tunnel.

Habitat. Streams and rivers with rocks or gravel bottoms.

Biology. No data.

Conservation status. LC.

Remarks. Molecular studies demonstrate that the majority of producers claiming to supply *G. rufa* to fish spas in Antalya (Türkiye) are in fact supplying *G. turcica*.

Further reading. Karaman 1971 (description); Kara et al. 2010: (morphology, distribution); Hashemzadeh Segherloo et al. 2016a (molecular phylogeny).



Garra typhlops; Tuveh, Iran, ~40 mm SL. © S. Vatandoust.



Garra typhlops; Tuveh, Iran, ~45 mm SL. © S. Vatandoust.

Garra typhlops

Common name. Zagros cave garra.

Diagnosis. Distinguished from other species of *Garra* in Persian Gulf and endorheic basins in Iran by: ○ eye reduced and invisible externally / ○ whitish, pink, orange, without colour pattern / ○ body without scales / ○ 9+8 branched caudal rays / ○ 8½ branched dorsal rays / ○ 10–13 gill rakers / ○ gular disc incomplete / ○ two pairs of normally developed barbels. Size up to 64 mm SL.

Distribution. Iran: Loven spring in Ab-e Sirum (or Ab-e Serum) valley near Tang-e Haft, and springs around Tuveh in Dez system of Karun drainage. Also, in a tunnel of Simareh Dam (now encased). Probably more widespread.

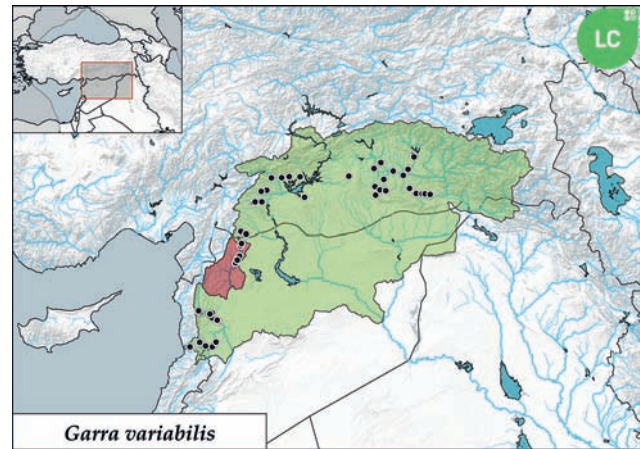
Habitat. Underground waters.

Biology. No data.

Conservation status. LC; as with all subterranean species, its distribution is difficult to understand, and threat levels may be low.

Remarks. A record from Simareh Dam is likely to belong to an undescribed species. Previously placed in a separate genus, *Iranocypris*. Coexists with the *Garra lorestanensis* and the cave loach *Eidinemacheilus smithi*.

Further reading. Bruun & Kaiser 1944 (description); Sargeran et al. 2008 (morphology); Hashemzadeh Segherloo et al. 2012 (molecular data); Farashi et al. 2014 (placement in *Garra*); Hamidan et al. 2014; Mousavi-Sabet & Eagderi 2016b (taxonomy); Coad 2021a (biology, morphology).



Garra variabilis, Tigris drainage, Türkiye; ~120 mm SL.

Garra variabilis

Common name. Small mouth garra.

Diagnosis. Distinguished from other species of *Garra* in Mediterranean and Gulf basins by: ○ one pair of barbels / ○ 20–26 gill rakers / ● gular disc small and narrow / ○ usually $7\frac{1}{2}$ branched dorsal rays / ○ tubercles absent on upper posterior eye margin / ○ body brown or grey, usually mottled / ○ lateral and distal margin of labrum of gular disc free from skin of chin / ○ eye fully developed / ○ 32–38 lateral-line scales. Size up to 140 mm SL.

Distribution. Orontes in Syria and Lebanon and Syrian Nahr al-Kabir (South) in the Mediterranean basin. Also, Upper Euphrates and Tigris in Türkiye, Syria, and Iraq.

Habitat. Streams, springs, and rivers with slow-flowing or stagnant water, often with dense vegetation or submerged wood.

Biology. No data.

Conservation status. LC; extirpated from Qweiq.

Remarks. Not recorded from the Iranian part of Tigris drainage. While there are records from the Tigris in Iraq, it could not be found in Greater and Lesser Zab and the Sirvan, three tributaries of Tigris in Iraq.

Further reading. Geiger et al. 2014 (molecular phylogeny, placement in *Garra*); Hamidan et al. 2014 (molecular phylogeny); Behrens-Chapuis et al. 2015 (molecular phylogeny); Esmaeili et al. 2016c (molecular phylogeny); Kaya et al. 2016 (distribution).



Garra widdowsoni; Haditha, Iraq; ~50 mm SL.

Garra widdowsoni

Common name. Haditha garra.

Diagnosis. Distinguished from other species of *Garra* in Persian Gulf and endorheic basins in Iran by: ● scales restricted to lateral midline, rarely fully scaled / ○ lateral line complete, with 28–35 scales in lateral series / ○ eye reduced and invisible externally / ○ cream white or pink, without colour pattern / ○ usually 8½ branched dorsal rays / ○ gular disc fully developed / ○ two pairs of normally developed barbels. Size up to 61 mm SL.

Distribution. Iraq: groundwater table near Haditha, from three wells; one about 3 m below Shaikh Hadeed, a second 9 m deep, 135 m south-west of Shaikh Hadeed, and a third called “Pigeon Hole,” 12 km south of Sheik Hadid shrine, all in Euphrates drainage.

Habitat. Underground waters.

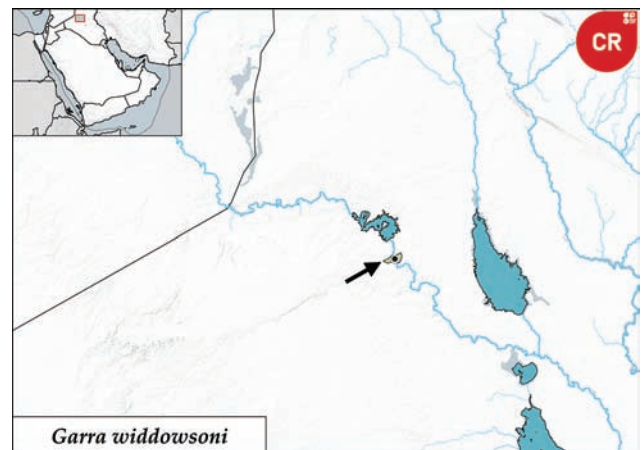
Biology. Appears to spawn all year round as all sizes of fish are present. Grazes epilithic layers of bacteria and ciliates from rock surfaces. Also, takes food from water surface by upside-down grazing.

Conservation status. CR; three sites indicate a wider distribution in Haditha Karst. Water table in karst is now much lower than in past, and fish can only be found at Shaikh Hadeed. All other springs are dry. While this species was once very abundant, and hundreds were sold as ornamental fish in Baghdad, it is now rare in accessible parts

of groundwater. Water is abstracted from wells, and the construction of a reservoir on the Euphrates upstream of Haditha has lowered the water table. The species may be on the verge of extinction. However, it is impossible to study which part of population lives in inaccessible parts of karst and which part lives in inaccessible parts.

Remarks. Often placed in a separate genus *Typhlogarra* but closely related to *Garra rufa*. Coexists with *Caecocypris basimi*.

Further reading. Trewavas 1955 (description); Hamidan et al. 2014 (molecular phylogeny, placement in *Garra*).





Springs at the edge of mountain slopes in the Orontes drainage, such as this one south of Qala'at in Syria, are the habitat of *Garra variabilis*.

Cave Garras in West Asia. Since their discovery, the troglomorphic animals, adapted to live in subterranean habitats, have fascinated humans. The most striking features of many troglobionts (cave-dwelling species) are the reduction of eyes and pigmentation. The discussion about the forces driving convergent evolution of reduced eyes and loss of pigmentation in typical cave-living animals was initiated very early in the history of evolutionary theory. It is usually attributed to subterranean animals' access to very limited resources and their need to save energy. The loss of pigmentation and eyes provides an advantage by conserving energy. In West Asia, six species of *Garra* have entered cave and underground waters, while only three other fish species did so (the cyprinid *Caecocypris basimi* and the loaches *Eidinemacheilus smithi* and *E. proudlovi*). It can be hypothesised that species of *Garra* are preadapted to subterranean life. A study on the eye morphology of *G. rufa* suggests that it has limited eyesight. Furthermore, *Garra* species are already adapted to grazing algae and other biofilms from surfaces and possess a long and coiled gut, which allows them to digest food effectively. In underground habitats, food resources are likely to be very restricted, and fishes that can graze bacteria- and ciliate-dominated biofilms from surfaces might not encounter the same challenges as other fish species may face regarding food scarcity. In light of this advantage, cave *Garra* may have adapted relatively quickly to the new environment by reducing their eye, colour, and scales, which are not as necessary in such a predator-free environment. **Further reading.** Romero & Paulson 2001 (subterranean fishes); Kruckenhauser et al. 2011; Kirchner et al. 2017 (molecular studies on Omani cave *Garra*).

Luciobarbus

Luciobarbus are medium to large fishes that often co-occur with superficially similar *Barbus* and *Capoeta* species. *Luciobarbus* are less rheophilic and prefer more stagnant habitats than sympatric *Barbus*. In West Asia, all but one *Luciobarbus* species can be readily distinguished from *Barbus* species by their uniform yellowish, brown, or grey colouration, sometimes with an indistinct lateral stripe (vs. body and fins covered with distinctive, irregularly shaped spots and blotches), and by the presence of large nuptial tubercles on the snout (vs. very small nuptial tubercles throughout the head). Juveniles of both genera show a pattern of dark-brown blotches on the body and are difficult to distinguish at first sight. *Luciobarbus* can also be immediately distinguished from *Capoeta* by the absence of a keratinised lower jaw (vs. present in most species), a long, pointed head (vs. short and roundish), and the presence of two pairs of barbels (vs. usually one pair). *Luciobarbus* and *Capoeta* often hybridise. Some *Luciobarbus*, such as *L. pectoralis* and *L. schejch*, show a polymorphic lower lip, with a pendulous central lobe and fleshy lips in some individuals, and an interrupted lower lip with a hard and exposed lower jaw in other individuals, including all intermediate lip shapes. This polymorphism has been misinterpreted as species diagnostic, and individuals with a fleshy lobe on the lower lip have often been identified as *L. barbatus* (= *L. schejch*) throughout West Asia. In contrast, individuals without such a lobe have been identified as *L. pectoralis*. Both species are strictly allopatric, and both lip forms are found in both species. The lip shape is not variable in other *Luciobarbus*, such as *L. esocinus* and *L. subquincunciatus*. Furthermore, *Luciobarbus* species exhibit significant allometric growth in body shape and the length and strength of the last unbranched dorsal ray. This has led to some taxonomic confusion, particularly in the Persian Gulf basin.

The identification of *Luciobarbus* species in the large rivers of the Euphrates and Tigris drainages has only recently been resolved. *Luciobarbus esocinus* and *L. subquincunciatus* are two well-differentiated species, *L. schejch* often hybridises with *L. esocinus*. Individuals cannot be identified by their COI DNA sequence alone, as they may have their own or the mtDNA of *L. esocinus*. Fish commonly identified as *L. barbatus* or *L. xanthopterus* all belong to *L. schejch*. The syntypes of *L. xanthopterus* have been identified as hybrids of *L. esocinus* and *L. schejch*, and this name is not available for any of the species. **Further reading.** Freyhof et al. 2025 (revision).



Luciobarbus esocinus; Tigris, Türkiye; ~1300 mm SL.



Potential hybrid between *Luciobarbus esocinus* and *L. schejch*; Iraq: Shatt-al Arab at Basra. © A. Ali.



Potential hybrid between *Luciobarbus esocinus* and *L. schejch*; Iraq: Baghdad. © O. F. Al-Sheikhly.

Keys to species of *Luciobarbus* in West Asia

Caspian basin and Hari drainage

Differences between *L. capito* (Caspian basin) and *L. conocephalus* (Hari & Aral basin) need to be better understood, and future research will require more effort. Molecular data support both as distinct species.

1a - Predorsal length shorter than postdorsal length; 7½ branched dorsal rays; 16–25 gill rakers.

.....*L. brachycephalus*

1b - Predorsal length equal to or longer than postdorsal length; 8½ branched dorsal rays; 10–19 gill rakers.

.....2

2a - Lips very thick, lower lip with a median lobe or pad; 83–103 total lateral-line scales; back not or slightly compressed in front of dorsal origin; colouration of back and belly not sharply contrasted.

.....*L. mursa*

2b - Lower lip very thin, interrupted in middle, without fleshy middle lobe; 52–72 total lateral-line scales; back between head and dorsal origin laterally compressed, forming a keel; sharp contrast between dark-brown or yellowish back and whitish or yellow belly in large individuals.

.....*L. capito* / *L. conocephalus*

Mediterranean basin

1a - 43–48 total lateral-line scales.

.....*L. graecus*

1b - 48–63 total lateral-line scales.

.....2

2a - 48–58 total lateral-line scales.

.....*L. pectoralis*

2b - 55–63 total lateral-line scales.

.....*L. longiceps*

Persian Gulf basin

1a - Numerous large, roundish, dark-brown, or black blotches on head, body, and fins arranged in an almost quincunx pattern; 75–88 total lateral-line scales.

.....*L. subquincunciatus*

1b - Body plain yellow, grey; or silvery or back and upper part of body brown and lower body yellow or silvery; irregularly shaped, small pale-brown spots and blotches present in juveniles 45–73 (78) total lateral-line scales.

.....2

2a - Head pike-like, strongly pointed, depressed; mouth almost terminal or terminal; snout length 2.0–2.9 times in postorbital length in individuals larger than 150 mm SL; 8–11 total gill rakes; 60–73(–78) total lateral-line scales; juveniles often with many, small dark-brown spots on upper flank.

.....*L. esocinus*

2b - Head barbel-like, not strongly pointed or depressed; mouth inferior in small individuals, inferior or subterminal in large individuals; snout length 1.1–1.9 times in postorbital length; 11–24 total gill rakes; 50–62 total lateral-line scales; juveniles without small dark-brown spots on upper flank.

.....*L. schejch*



Luciobarbus are the target of local fisheries all over their range as here in the upper Tigris in Türkiye.



Luciobarbus brachycephalus; Caspian Sea, Iran; ~250 mm SL.

Luciobarbus brachycephalus

Common name. Shorthead barbel.

Diagnosis. Distinguished from other species of *Luciobarbus* in Caspian basin and Hari drainage by: ● predorsal length shorter than postdorsal length / ● usually $7\frac{1}{2}$ branched dorsal rays / ○ 16–25 gill rakers / ● back between head and dorsal origin laterally compressed, forming a keel / ○ 62–90 (usually 65–77) total lateral-line scales / ○ lower lip thin, without median lobe or pad. Size up to about 1000 mm SL and 21 kg.

Distribution. Southern and western Caspian basin. Land-locked population in Mingachevir reservoir (Azerbaijan). Migrates up larger tributaries of western and southern coasts to spawn: Terek, Samur, Kura, and lower Aras. Rarely in lower Volga (to Volgograd) and Ural. Recorded from Karakum Canal and Kopetdag reservoir in Turkmenistan. Widespread in Aral basin (Central Asia).

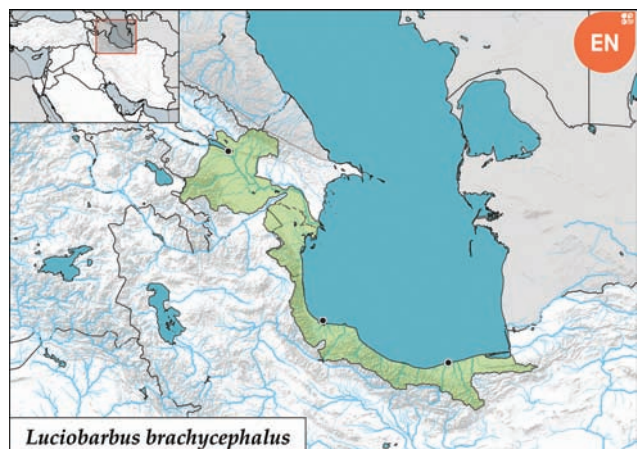
Habitat. At sea, to 25 m depth. In rivers, in deep stretches with gravel or stone bottoms. Spawns in fast-flowing water in hard bottom areas, 1–2 m deep.

Biology. Mostly semi-anadromous, rarely land-locked in Caspian basin, riverine in Aral basin. Lives up to 10 years (males) and 13 years (females). Spawns first time at about 500–700 mm SL, 5–7 years, females later than males. Spawns April to August, peaking at 23–27°C. Some individuals begin spawning migration in August–September and spawn next spring after overwintering in river. Some enter rivers in early spring (March) and spawn in same year. Spring run begins at water temperatures between 7–11°C and is most intense in early summer at 25–27°C. Females lay 100,000–1,250,000 bright yellow eggs in 2–3 portions during a single season. Eggs are semi-pelagic and hatch after at least 2 days at 25°C while drifting downstream. Larvae settle in areas of slow

current; after 2–12 months, juveniles drift downstream to sea (or reservoir if river is dammed). In the low-salinity zones of the sea, it feeds mainly on benthic crustaceans. Does not feed during upstream migration. Starts feeding again at spawning grounds, mainly on insects, juveniles of other fish, and rarely on algae, seeds, and other plant material.

Conservation status. EN; stocks in Caspian basin declined sharply due to massive habitat alteration, particularly overfishing and dam construction. Currently very rare in Caspian basin, but still reported from coastal rivers in Azerbaijan, the Iranian Lenkoran and Terek in Dagestan. It is regularly found in middle Amu Darya drainage, where it is expected to decline sharply due to increased hydroelectric development, overfishing, and water diversion from rivers for irrigation, especially in Turkmenistan and Afghanistan (Qosh Tepa Canal).

Further reading. Abdurakhmanov 1962 (biology); Mago-medov 1981 (biology); Mitrofanov et al. 1988 (description, biology); Bogutskaya 2003a (biology).





Luciobarbus capito; Aras, Armenia; ~300 mm SL. © S. Pipoyan.

Luciobarbus capito

Common name. Bulatmai barbel.

Diagnosis. Distinguished from other species of *Luciobarbus* in Caspian basin and Hari drainage by: ○ 52–72 (usually 60–66) total lateral-line scales / ○ 13–15 gill rakers / ○ upper part of body dark-brown, lower part yellow in life in large individuals / ○ lower lip thin, without median lobe or pad / ○ 8½ branched dorsal rays / ○ back between head and dorsal origin laterally compressed, forming a keel / ○ predorsal length longer than postdorsal length / ○ dorsal moderately long, 13–14 % of body depth in individuals of about 400 mm SL. Size up to about 920 mm SL and 16 kg.

Distribution. Caspian basin: tributaries of western and southern coasts, from Volga south to Atrak (Iran). Always very rare in Volga. Introduced in Jaj reservoir in Namak Lake basin (Iran).

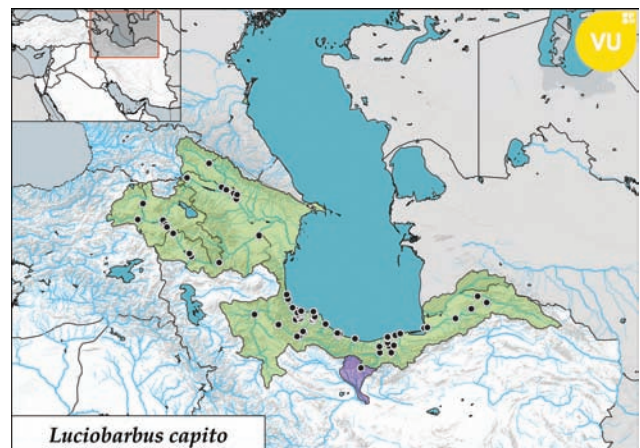
Habitat. Resident populations mostly in large to medium-sized rivers, often also in reservoirs. At sea, usually near coast. Forages in estuaries. Spawns in lowland streams and rivers on sand-gravel bottoms, usually in strong currents.

Biology. Semi-anadromous and resident individuals and populations. Spawns first time at 3–7 years, females later than males, above 200 mm SL. Spawns April–August. Males spawn every year, some females annually, others apparently every 2–3 years. Semi-anadromous populations begin migration in late summer-autumn and spawn in next spring, but some enter rivers in early spring and spawn in same year. Migrates to uppermost tributaries of rivers. Non-anadromous populations migrate to upper reaches of tributaries just

before spawning or spawn in lakes and reservoirs on sandy to muddy bottoms. Larvae feed on zooplankton and small benthic invertebrates. Juveniles and adults feed on invertebrates, algae, detritus, plant material, and small fish.

Conservation status. VU; resident populations still widespread, but abundance greatly reduced due to overfishing. Semi-anadromous populations are now very rare due to dam constructions. Terek and Kura were major spawning rivers for anadromous fish. Very rare in Terek today. Decline expected to continue due to increasing hydropower development, overfishing in estuaries, and many strong ecological impacts on the Caspian basin.

Further reading. Kazancheyev 1981 (biology); Bogutskaya et al. 2003a (description, biology); Kaya et al. 2020a (distribution); Coad 2021a (biology, morphology).





Luciobarbus conocephalus; Hari, Iran; ~250 mm SL.

Luciobarbus conocephalus

Common name. Conehead barbel.

Diagnosis. Distinguished from other species of *Luciobarbus* in Caspian basin and Hari drainage by: ○ 58–70 (usually 61–68) total lateral-line scales / ○ 13–15 gill rakers / ○ upper part of body dark-brown, lower part yellow in life in large individuals / ○ lower lip thin, without median lobe or pad / ○ 8½ branched dorsal rays / ○ back between head and dorsal origin laterally compressed, forming a keel / ○ predorsal length longer than postdorsal length / ○ dorsal long, 15–16 % of body depth in individuals of about 400 mm SL. Size up to about 664 mm SL.

Distribution. Iran: Hari drainage. Morghab, Aral basins, and Chu drainage in Central Asia. In Karakum Canal, Kopetdag, and Uzboi lakes in Turkmenistan.

Habitat. Large rivers and reservoirs, from which fish migrate into tributaries to spawn.

Biology. Poorly known, mostly a freshwater species that does not undertake long migrations.

Conservation status. LC.

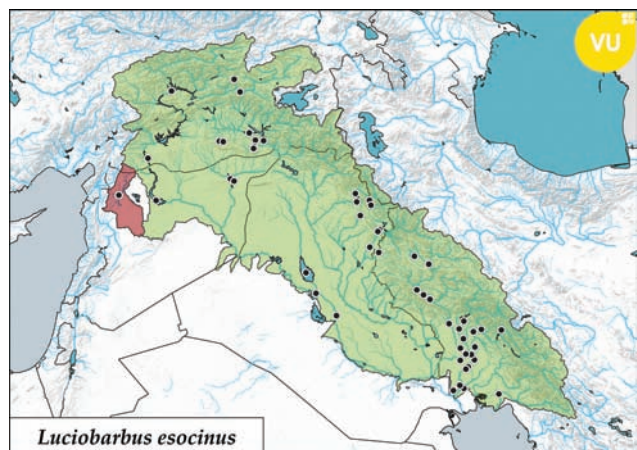
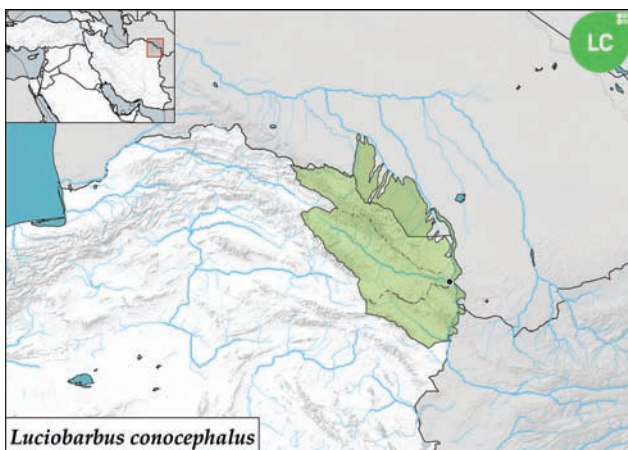
Remarks. This species is distinguished from *L. capito* by molecular characters, but no material was available to test whether morphological characters can also distinguish the two. It might be an old species and by this a synonym of *L. capito*.

Further reading. Berg 1949b (diagnosis, distribution); Bogutskaya et al., in Bănărescu & Bogutskaya 2003a (distribution).

Luciobarbus esocinus

Common name. Pike barbel.

Diagnosis. Distinguished from other species of *Luciobarbus* in Persian Gulf basin by: ● mouth subterminal in small, almost terminal or terminal in large individuals / ● head pike-like, strongly pointed, depressed / ● snout length 2.0–2.9 times in postorbital length in individuals larger than 150 mm SL / ● dorsal head profile straight or concave / ○ 8–11 gill rakers / ○ 60–73(–78) total lateral-line scales /





Luciobarbus esocinus; Lesser Zab, Iraq; ~230 mm SL.

● juveniles often with many, small dark-brown spots on upper flank. Size up to 2000 mm SL and 198 kg, regularly larger than 50 kg.

Distribution. Euphrates, Tigris, Karun and Jarahi drainages. Extirpated in Qweiq.

Habitat. Large rivers and reservoirs, from which fish migrate into tributaries to spawn.

Biology. Biology of this enigmatic species virtually unknown. Lives up to 17 years, probably longer. Spawns first time at a size greater than 1000 mm SL, probably at an age of about 10 years, in March–April. Predatory, feeding mainly on fish.

Conservation status. VU; builds up large populations in reservoirs, from where it migrate into tributaries to spawn. An important commercial species that has declined due to overfishing. Affected by pollution, draining of marshes, damming, and water abstraction.

Remarks. Growth hormones from this species have been cloned and used to increase growth in *Cyprinus carpio*. Often hybridises with sympatric *L. schejch*, and most hybrids seem to have had *L. esocinus* as their mother. Type material of *L. xanthopterus* has been identified as such hybrids.

Further reading. Coad 2010a (biology, distribution); Coad 2021a (biology, morphology); Freyhof et al. 2025 (revision).

Luciobarbus graecus

Common name. Greek barbel.

Diagnosis. Distinguished from other species of *Luciobarbus* in Mediterranean basin by: ● 43–48 total lateral line scales. Size up to 400 mm SL.

Distribution. Türkiye: Bakacak on Biga Peninsula west to Çanakkale and south to Büyük Menderes. Also, lakes Yliki and Paralimni plus Sperchios drainage in southwestern Greece. Introduced to Beletsi and Marathon reservoirs and Kifissos drainage.

Habitat. Large to medium-sized streams and rivers with moderate currents. Also, in reservoirs.

Biology. Spawns April–July.

Conservation status. LC.

Remarks. *Luciobarbus kottelati*, and *L. lydianus* are synonyms. The biogeography of *L. graecus* is a mystery, and it is possible that *L. graecus* was introduced to Greece before the time of ichthyological exploration.



Luciobarbus graecus; Büyük Menderes, Türkiye; 170 mm SL.



Luciobarbus graecus; Biga Peninsula, Türkiye; 195 mm SL.

Further reading. Turan et al. 2008a (description as *L. kottelati*); Güçlü et al. 2013, İlhan et al. 2020, 2021 (distribution in Anatolia); Freyhof & Yoğurtçuoğlu 2024 (synonymy of *L. kottelati* and *L. lydianus*)

Luciobarbus longiceps

Common name. Jordan barbel.

Diagnosis. Distinguished from other species of *Luciobarbus* in Mediterranean basin by: ● 55–63 total lateral-line scales / ○ 10–13 gill rakers on lower arch / ○ pelvic origin behind or below dorsal origin. Size up to 700 mm SL.

Distribution. Jordan drainage, as well as Naaman at coast of Israel.

Habitat. Large to medium-sized streams and rivers with moderate currents. Also in reservoirs and lakes.

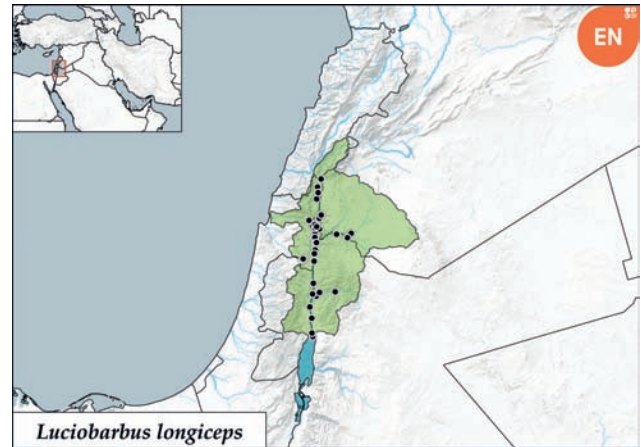
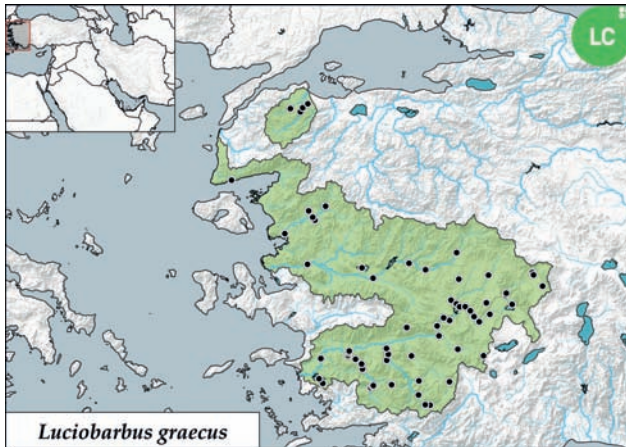
Biology. Matures at about 200 mm SL (males) and 250 mm SL (females). Migrates upstream in winter to spawn in small streams in January–March. Feeds on invertebrates, especially molluscs.

Conservation status. EN; declined sharply due to overfishing and desiccation of rivers and streams.

Further reading. Krupp & Schneider 1989 (diagnosis, distribution).



Luciobarbus longiceps; Jordan drainage, Syria; 150 mm SL.



Luciobarbus mursa; Tajan, Iran; 198 mm SL.

Luciobarbus mursa

Common name. Mursa.

Diagnosis. Distinguished from other species of *Luciobarbus* in Caspian basin and Hari drainage by: ● lower lip thick and fleshy, with median lobe or pad / ● 83–103 total lateral-line scales / ○ 8½ branched dorsal rays / ● back between head and dorsal origin not or slightly compressed / ○ colouration of back and belly not sharply contrasted / ○ predorsal length equal or longer than postdorsal length / ○ body plain brown in life. Size up to about 400 mm SL.

Distribution. Kura and Aras drainages east to Gorgan.

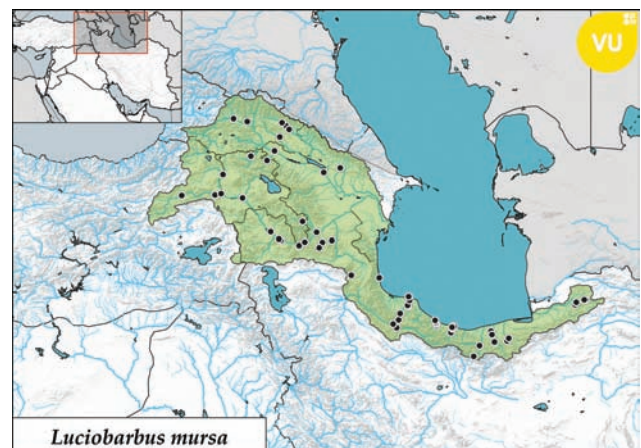
Habitat. Wide range of streams and rivers with fast to moderately fast-flowing water. Also, in lakes and reservoirs, from where fish migrate to rivers and streams to spawn.

Biology. Spawns first time at 2–3 years, females later than males, between April and August. Migrates to uppermost tributaries of rivers to spawn in fast-flowing water on gravel. Feeds on invertebrates, algae, detritus, plant material, and small fish.

Conservation status. VU; important commercial species, particularly prized in Georgia and severely overfished, especially in Kura and Aras.

Remarks. Reports from Urmia basin (Iran) have yet to be confirmed and are probably mistaken.

Further reading. Berg 1949b (identification, distribution); Bogutskaya et al. 2003b (biology); Kaya et al. 2020a (distribution); Coad 2021a (biology, morphology).





Luciobarbus pectoralis; Orontes drainage, Syria; 190 mm SL.

Luciobarbus pectoralis

Common name. Levantine barbel.

Diagnosis. Distinguished from other species of *Luciobarbus* in Mediterranean basin by: ○ 48–58 total lateral-line scales / ○ 8–13 gill rakers on lower arch / ○ 10–11 scale rows between dorsal origin and lateral line / ○ 7–8 scale row between anal origin and lateral line. Size up to 470 mm SL.

Distribution. Türkiye and Syria: Göksu east to Orontes drainage. Absent in between Göksu and Seyhan drainages.

Habitat. Medium to large streams and rivers. Also, in reservoirs from which it migrates to rivers or streams to spawn. Absent from cold mountain streams and springs. Often abundant at edge of rapids or riffles.

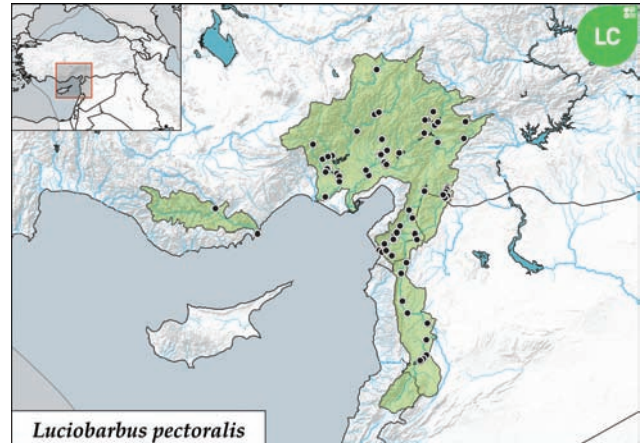
Biology. No data.

Conservation status. LC.

Remarks. Often reported to occur in Euphrates and Tigris drainages, but none of these reports have been confirmed. Most likely, all records are based on misidentified specimens of *L. schejch*. *Luciobarbus lorteti*, described from Lake Amik in Orontes drainage, is treated as a synonym of *L. pectoralis*. *Luciobarbus lorteti* was distinguished from *L. pectoralis* by the presence of a molariform (vs. normally developed) 4th pharyngeal

tooth. Such individuals are still found in the wild. Fish with a molariform 4th pharyngeal tooth have no other distinguishing characters, and molecular data do not allow them to be distinguished from *L. pectoralis*. The shape of the 4th pharyngeal tooth may be related to the size of individual and likely to the availability and use of hard-shelled prey such as molluscs.

Further reading. Krupp 1985c (*B. lorteti*); Krupp 1985d (distribution, description); Bayçelebi 2020 (distribution).



Luciobarbus schejch; Tigris, Türkiye; 195 mm SL.



Luciobarbus schejch; Lesser Zab, Iraq; 143 mm SL.



Luciobarbus schejch; Sosangerd, Iran; 331 mm SL; 229 mm SL.



Luciobarbus schejch; Tigris, Iraq; 259 mm SL.

Luciobarbus schejch**Common name.** Gattan.

Diagnosis. Distinguished from other species of *Luciobarbus* in Persian Gulf basin by: ● back and upper flank yellowish or brown, lower flank yellowish or cream white in life, blackish or grey in large individuals / ○ head not strongly pointed, not depressed, barbel-like / ○ dorsal head profile convex / ○ mouth inferior or subterminal in very large individuals / ○ snout length 1.1–1.9 times in postorbital length / ○ 50–62 total lateral-line scales / ○ 11–24 gill rakers / ○ lips fleshy, usually with median pad, lips hypertrophied in some individuals / ○ juveniles without small dark-brown spots on upper flank. Size up to 800 mm SL and 30 kg (such large individuals might be hybrids with *L. esocinus*).

Distribution. Euphrates, Tigris, Karun drainages, and coastal rivers of Persian Gulf south to Kol.

Habitat. Large streams, mountain and lowland rivers, lakes, reservoirs, and marshes, from which it migrates into tributaries to spawn. Spawns on gravel substrate in shallow areas of large rivers in 30–150 cm water depths.

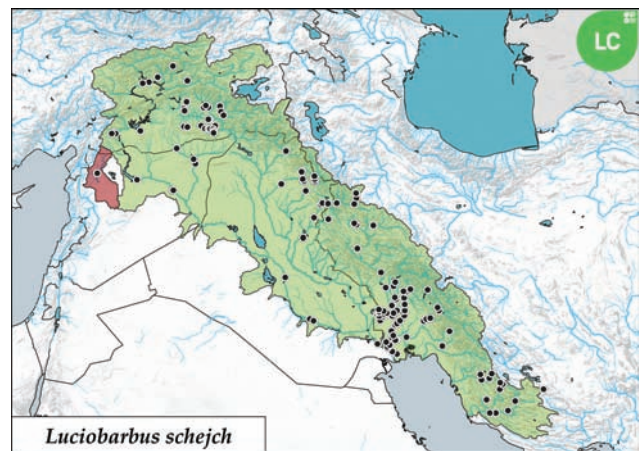
Biology. Lives up to 11 years, probably longer. Maturity of males at 3 years and about 330 mm SL, females at 6 years and about 600 mm SL. Spawns June–August (Mosul), at dusk until just before midnight, with loud splashing, jumping, and chasing. Exclaims large areas of gravel to spawn in “nests.” Spawns once a year. Tolerant of low oxygen and moderate salinity. Feeds on a wide variety of aquatic invertebrates, small fish, detritus, and plants. Locally, molluscs are an important prey item.

Conservation status. LC; extirpated from Qweiq. Establishes large populations in reservoirs. Highly overexploited in large rivers.

Remarks. Many, but not all, individuals of *L. schejch* carry mitochondria from *L. esocinus*, as hybridisation between

the two species is common. Usually, male *L. schejch* spawns with female *L. esocinus*. *Luciobarbus schejch* with mitochondria of *L. schejch* (not *L. esocinus*) have been identified as *L. kersin*. *Luciobarbus schejch* with its own mitochondria and those with mitochondria of *L. esocinus* are widespread, occur in sympatry, and are indistinguishable by morphological characters. *Luciobarbus kersin* is a synonym of *L. schejch*. *Luciobarbus schejch* is often known as *L. barbulus* or, in parts of its range, as *L. mystaceus*. *Luciobarbus barbulus* is a junior synonym of *L. schejch*. *Luciobarbus mystaceus* has been described from the Kura in Georgia, and this species is a synonym of *L. capito*. *Barbus rajanorum*, described from Aleppo, is a hybrid of *L. schejch* and *Capoeta damascina*.

Further reading. Khaefi et al. 2017b (as *L. barbulus*); Coad 2010a (biology, distribution as *L. pectoralis*, *L. barbulus*, and *L. xanthopterus*); Coad 2021a (biology, morphology, as *L. barbulus*); Freyhof et al. 2025a (taxonomic revision).



Luciobarbus subquincunciatus; Tigris, Türkiye; 500 mm SL. © M. Oral

Luciobarbus subquincunciatus

Common name. Leopard barbel.

Diagnosis. Distinguished from other species of *Luciobarbus* in West Asia by: ● numerous large roundish dark-brown or black blotches on head, body, and fins arranged in an almost quincunx pattern / ● 3rd inner pharyngeal tooth enlarged, molariform / ○ 75–88 lateral-line scales on body / ○ no median lobe in lower lip. Size up to 600 mm SL, but likely to grow much larger.

Distribution. Euphrates and Tigris drainages from southern Anatolia to Shatt-al Arab/Arvand and Hammar marshes, including Karun.

Habitat. Large lowland rivers. Rarely reported from reservoirs and marshes.

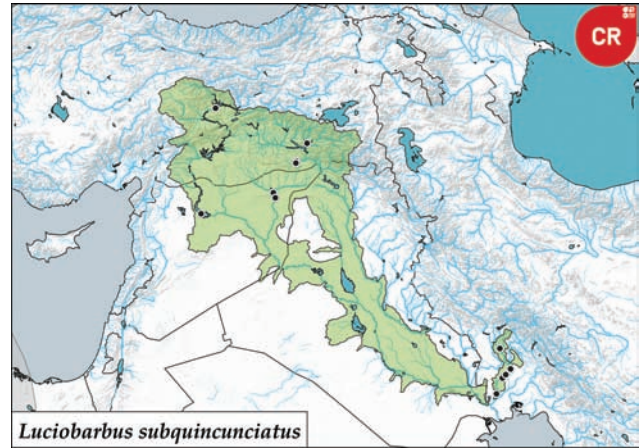
Biology. Feeds mainly on molluscs but also takes considerable amounts of algae and detritus.

Conservation status. CR; very rare throughout its range. Still in very small numbers in Tigris around Cizre, Botan, a tributary of Tigris, Murat, a major tributary of Euphrates, and Karun in Iran. Very rare in Tigris below Diyarbakır and adjacent waters in Iraq. Probably almost extinct in Khabur,

a tributary of Euphrates, but situation in main stem of Tigris is unknown.

Remarks. Placed in *Bertinius* by some authors, a genus based on enlarged, molariform pharyngeal teeth, a character state found in several unrelated *Luciobarbus* species.

Further reading. Coad 2010a (biology, distribution); Coad 2021a (biology, morphology).



Luciobarbus and *Mesopotamichthys* are of major commercial importance in the marshes in Mesopotamia.



Mesopotamichthys sharpeyi; Shatt al-Arab drainage, Iraq; ~250 mm SL.

Mesopotamichthys

A monospecific cyprinid genus with large scales and no barbels. The only species within the genus, *Mesopotamichthys sharpeyi* forms a well-distinct clade with *Carasobarbus*, *Arabibarbus*, Moroccan *Ptercapoeta*, and *Atlantor reinii* and is most likely related to the unstudied subterranean *Caecocypris basimi* from Iraq. They all belong to the Torini group, which is also widespread in tropical Asia and Africa. **Further reading.** Borkenhagen 2014 (comparison; phylogeny).

Mesopotamichthys sharpeyi

Common name. Binni.

Diagnosis. Distinguished from superficially similar *Carasobarbus* and *Arabibarbus* by: ● no barbels / ○ 7–9½, usually 8½, branched dorsal rays / ○ 5½ branched anal rays / ○ lower lip without median lobe or pad / ○ body depth 28–35 % SL. Size up to 470 mm SL and 4 kg.

Distribution. Southern part of Euphrates and Tigris drainage. Iran: Hor Al Azim and Shadegan marshes and lower parts of Zohreh, Karkheh, and Karun. Syria: Asad reservoir and other large reservoirs (probably introduced). Iraq: Shatt-al Arab/Arvand and lower part of Euphrates, Tigris, Sirvan, including Al-Hammar Marsh and Huwazah Marsh, Lakes Saniyah, Habbaniyah, Tharthar, and Razzazah, and reservoirs Al Qadisiyah and Dukan (some probably introduced).

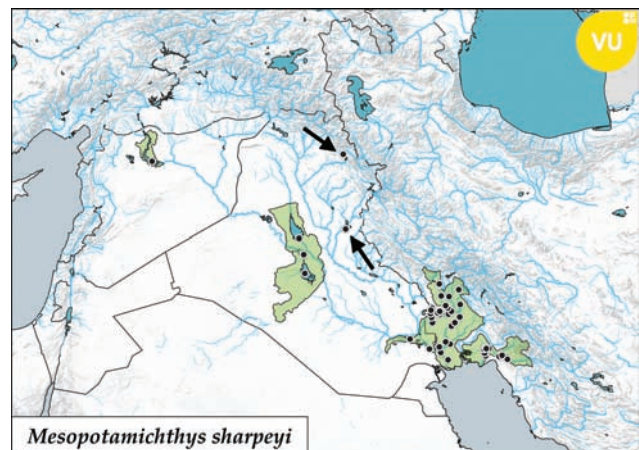
Habitat. Large rivers, lakes, and marshes, usually in stagnant water with dense vegetation in salinities up to 19 ‰. Spawns in stagnant water, usually on vegetation.

Biology. Lives up to 9 years. Usually spawns first at 2–4 years and 210–300 mm SL, on plants in February–April. Comes to spawning sites at dusk and dawn. Eggs are yellow and sticky. Mostly herbivorous, feeding on algae and plants.

Conservation status. VU; declined in recent years in all Iraqi and Iranian marshes and now virtually absent from rivers. Large populations restricted to Huwazah Marsh in Iraq and Shadegan Marsh in Iran. Few populations introduced in reservoirs in Syria.

Remarks. Next to *Tenuulosa ilisha*, it is considered the tastiest fish from the Iraqi marshes.

Further reading. Karaman 1971 (generic description); Ekmekçi & Bănărescu 1998 (description); Coad 2010a (biology); Borkenhagen 2014 (phylogeny); Yang et al. 2015 (phylogeny); Coad 2021a (biology, morphology).



Schizocypris*, *Schizopygopsis* & *Schizothorax

Snow barbel or snow trouts are common names for two large, monophyletic radiations of Asian high-altitude cyprinids. All but one genus this book covers belong to Schizothoracinae, which includes four genera. Only *Schizopygopsis* is placed in the subfamily Schizopygopsinae, consisting of nine snow barbels genera. Phylogenetic hypotheses derived from several studies suggest that these groups may have originated repeatedly and ambiguously through hybridisation and polyploidisation within the Cyprinidae family. This may be responsible for the controversial classification among subfamilies. The history of polyploidisation in Cyprinidae remains uncertain, presenting significant challenges for phylogenetic systematics. Preliminary results indicate that Schizothoracinae and Schizopygopsinae are the maternal siblings of Cyprininae and paternal siblings of Torinae.

This hypothesis suggests that hybridisation between early carps and yellowfish may have played a pivotal role in the evolution of snow barbels.

Snow barbels are speciose and abundant in the mountains east of the Zagros and Elbrus. They are often the most common fish in these regions, dominating the fish communities by biomass. Snow barbels are highly specialised and represent the ecological pendants of barbels and scrapers. Several species show high individual variation in head and mouth shape and the development of lips. Snow barbels are a large group of fishes (more than 150 species) but only occur marginally in the area covered by this book. Their taxonomy and species diversity have never been comprehensively studied, and much remains to be done. Two species of *Schizothorax* and one species of *Schizocypris* occur in Eastern Iran. *Schizopygopsis stoliczkai* is occasionally reported from the fauna of Iran (Sistan basin), and *Schizothorax intermedius* is listed for

the Hari. These records are based on misidentifications, and our area has no documented records of these species. *Schizothorax intermedius* is likely restricted to the upper Indus drainage, while *S. stoliczkai* is widely distributed in mountain areas of Afghanistan, Pakistan, India, and western China.

As is the case with barbel eggs, the eggs of these fish are poisonous to humans. Deaths have been reported as a result of eating the eggs of *Schizothorax*. Severe cases present with muscular cramps, paralysis, convulsions, and coma. Victims typically recover within 3–5 days after stomach evacuation, although this may take longer. It is advisable to exercise caution when consuming fish during its breeding season, as it is important to ensure that all traces of the eggs are removed to avoid contamination of the flesh. It should be noted that cooking does not destroy the toxin. **Further reading.** Yang et al. 2015 (phylogeny of Cyprinidae); Tan & Armbruster 2018 (subfamilies in Cyprinidae).



Schizocypris altidorsalis; Sistan, Iran; ~100 mm SL. © H. Mousavi-Sabet.

Schizocypris altidorsalis

Common name. Gorgak.

Diagnosis. Distinguished from other species of snow barbels in Iran by: ● barbels absent / ○ body fully covered by scales, 81–96 scales along lateral line / ○ last unbranched dorsal ray longer than head, spinous, strongly serrated. Size up to 351 mm SL.

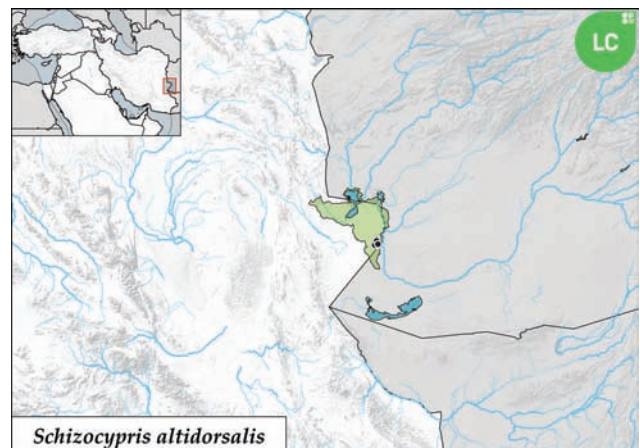
Distribution. Afghanistan and Iran: Sistan basin, including Helmand drainage, Chahnime reservoirs, and Hamun Lakes.

Habitat. All kinds of permanent waterbodies, migrate to seasonal rivers and streams at high water levels to spawn.

Biology. Feed mostly on aufwuchs and detritus.

Conservation status. LC; situation in Helmand is unknown.

Further reading. Bianco & Bănărescu 1982 (description); Coad & Keyzer-de Ville 2005 (identification); Coad 2021a (identification, distribution).



Key to species of snow barbels in Iran.

1a - Barbels absent.

.....*Schizocypris altidorsalis*

1b - Two pairs of barbels.

.....2

2a - 9–18 gill rakers.

.....*Schizothorax pelzami*

2b - 21–41 gill rakers.

.....*Schizothorax zarudnyi*

Schizothorax pelzami; Cheshmeh Ali Spring, Western Kavir basin, Iran; ~170 mm SL. © H. Mousavi-Sabet.



Schizothorax pelzami; Hari drainage, Iran; ~170 mm SL. © Mousavi-Sabet.

Schizothorax pelzami

Common name. Kavir snow barbel.

Diagnosis. Distinguished from other species of snow barbels in Iran by: ○ two pairs of barbels / ○ 9–18 gill rakers. Size up to 480 mm SL and 3 kg.

Distribution. Iran: Jam, Sharak, Akhlamad, Kashaf, and small water bodies in Khorasan, upper Kal Shur, Jajarm, and Jovein in Eastern and Western Kavir basins. Also, in Cheshmeh Ali (Iran) and Hari drainage in Afghanistan, Iran, and Turkmenistan, as well as in Morghab drainage in Afghanistan and Turkmenistan.

Habitat. All types of permanent waterbodies such as springs, streams, rivers, and qanats. Migrates to seasonal rivers and streams at high water to spawn.

Biology. Lives more than 7 years. Feeds on invertebrates, larger individuals mainly on small fish.

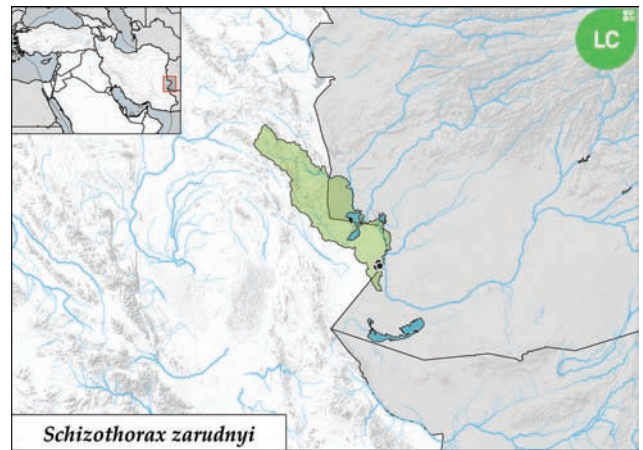
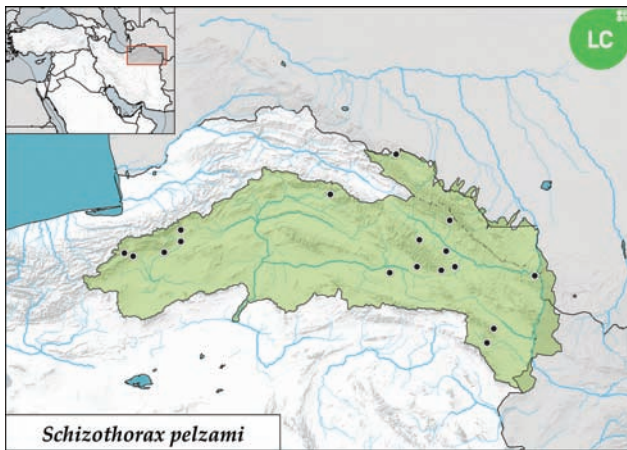
Conservation status. LC; situation outside Iran unknown.

Remarks. Occasionally hybridised with *Capoeta heratensis*. This is the westernmost species of snow barbel, and the Cheshmeh Ali spring is its westernmost record. *Schizothorax iranicus* may be a separate species based on molecular data, but no morphological diagnosis has been made.

Further reading. Aliev et al. 1988 (distribution); Abdoli et al. 2007 (ecology); Jouladeh-Roudbar et al. 2020 (distribution); Coad 2021a (biology, morphology).



Schizothorax zarudnyi; Sistan basin, Iran; ~250 mm SL.



Schizothorax zarudnyi

Common name. Hamoun snow barbel.

Diagnosis. Distinguished from other species of snow barbels in Iran by: ○ two pairs of barbels / ○ 21–41 gill rakers. Size up to 530 mm SL, but maybe much larger. Up to 12 kg.

Distribution. Afghanistan and Iran: Sistan basin, including Helmand drainage. Iran: Zahak, Chahnime reservoirs, and Hamun Lakes.

Habitat. Pelagic in lakes, reed beds, and reservoirs. Appears to spawn in running waters. Expected to occur also in large rivers.

Biology. Mature after 4 years and at about 290–310 mm (male) and 380–400 mm (female, probably TL). Spawns March–April at water temperatures above 18°C. Reported to feed mainly on fish.

Conservation status. LC; situation in Helmand is unknown. A commercial species artificially propagated and stocked in Iran. Once widespread in Sistan but now reportedly restricted to the Chahnime reservoir near Zahak as other major wetlands have dried up and severely affected by invasion of non-native species such as *Cyprinus carpio*, *Carassius auratus*, *Ctenopharyngodon idella*, and *Hypophthalmichthys molitrix*.

Remarks. Placed in *Oreinus* by some authors, making the genus *Schizothorax* polyphyletic. We retain *S. zarudnyi* in *Schizothorax* until the case is better resolved.

Further reading. Gharaei 2012 (distribution); Coad 2014 (identification, distribution); Coad 2021a (biology, distribution).

Polyloid evolution in Cyprinidae. The achievement of evolutionary novelty is challenging due to the multitude of evolutionary pressures and the lengthy process of mutation and selection. On rare occasions, species hybridisation may result in fertile hybrids that exhibit an ecological benefit from the novel combination of genes and the subsequent morphological, physiological, and behavioural characteristics. However, hybrids of very different species may encounter difficulties due to the distinctiveness of their genomes, which may prevent the normal meiotic process essential for the formation of gametes (egg and sperm). Such hybrids are often sterile and unable to transmit their novel character combination to the next generation. Numerous hybrids between different species in Cyprinidae and Leuciscidae are known, and it is assumed that hybridisation, even between distantly related fish species, has occurred frequently for millions of years.

In exceptional cases, a hybrid may exhibit a doubling of chromosomes inherited from each parent, restoring meiotic pairing and fertility. This process, known as polyploidisation, results in a transition from a diploid, sterile hybrid to a tetraploid, fertile hybrid. Additionally, fish can duplicate their genome during their ontogenetic development, resulting in a doubling of the number of chromosomes inherited from the same parental species. This phenomenon, known as **auto-polyploidisation**, occurs independently of hybridisation. In a further pathway, a hybrid between species produces clonal, full-genomic gametes with two sets of chromosomes, as in all other body cells. This is an accidental occurrence in the gamete-tissue. In such a diploid, the clonal egg is fertilised by a haploid sperm, resulting in triploid offspring. Triploid individuals, which are usually females, experience difficulties in producing gametes via meiosis and are once again sterile. Except in the case in which the female may again produce clonal eggs, now with three sets of chromosomes (as in many *Carassius*), the offspring will be tetraploid (with four copies of each chromosome) if a haploid sperm of the parental species fertilise these. These hybrids are viable and fertile and may have a double-size genome, with four sets of chromosomes from each parental species. This represents one pathway in the process of **allo-polyploidisation**. Other pathways include F1 hybrids producing clonal, diploid eggs and sperm. In all cases, the fish overcomes the sterility associated with hybrids as soon as an even ($4n$, $6n$) chromosome number has been re-established with even numbers of chromosomes from each parental species.

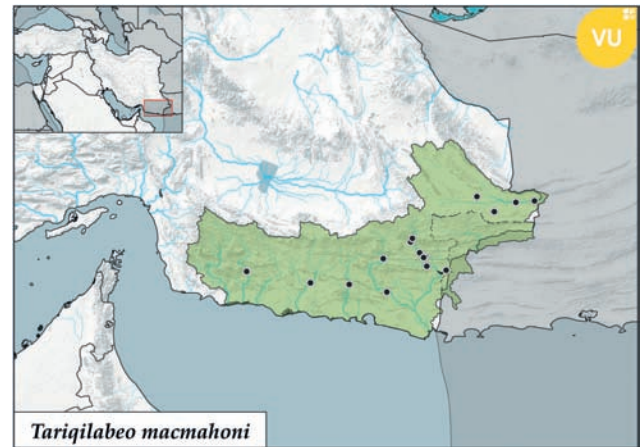
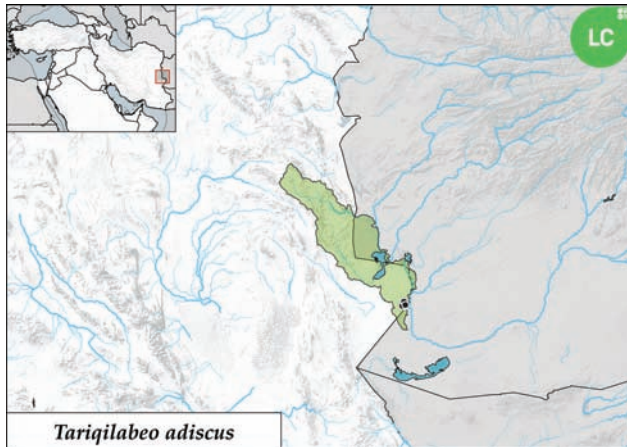
In evolutionary terms, polyploidisation is rare in vertebrates, occurring only in a few fish groups, including sturgeons and some cypriniforms. Many of the polyploidisation events in Cyprinidae are ancient, having happened at the base of large radiations that are recognised at the generic or subfamily level today. One example is an allo-tetraploidisation event at the root of all barbels (Barbini), which are all tetraploid. The allo-tetraploidisation event at the root of Cyprinini (carps and goldfish) is believed to have occurred approximately 12 million years ago, at the end of the middle Miocene. The hybridisation event leading to the hexaploid genus *Capoeta* occurred more recently, during the late Miocene. As previously discussed in the context of *Capoeta*, identifying the parental species associated with allo-polyploidisation events is of interest. In the case of Cyprinini, one species of Barbini or Acrossocheilini was potentially the maternal contributor. In contrast, a species closely related to or included within Labeonini was potentially the paternal source. These can be identified as each polyploid fish possesses each gene four times (if tetraploid), with two copies originating from the mother and two from the father. As both parental species may have been only distantly related, the phylogeny of the polyploid fish has two roots. It does not follow the “tree-like” evolutionary pathway often seen in textbooks. This phenomenon makes it difficult to reconstruct the phylogeny of cyprinid fishes, which is why we still have a poor understanding of the relationships of different groups of Cyprinids. It is noteworthy that maternal subgenomes frequently predominate in the genomes, a phenomenon that introduces an additional layer of complexity.

One might inquire why polyploidy is so uncommon in fishes compared to plants. Polyploid animals appear to encounter significant challenges in coping with genomic and developmental chaos from merging two genomes. A fish cannot organise its functions from its new genome, as conflicting recipes exist for the same transcriptional challenges. Fish employ diverse strategies to balance dynamic subgenomic diversification during continuous re-diploidisation. They regain functional diploidy over time by eliminating certain parts of their genome, potentially those that disrupt transcription. Originally, polyploid fishes became functional diploids again through this process. This phenomenon is observed in numerous species within the Cyprinidae family. **Further reading.** Otto & Whitton 2000 (evolution); Mable 2013 (ecological benefits of polyploids and hybrids); Yang et al. 2015 (phylogeny of Cyprinidae); Ma et al. 2014 (timing of polyploidisations in Cyprinini); Luo et al. 2020 (diploidisation); Xu et al. 2023 (subgenomic differentiation).

Tariqilabeo

Tariqilabeo comprises small labeonines related to *Garra*. They share several characteristics with the latter, including a rounded snout, a mouth usually inferior and crescent-shaped, a horny edge on the lower jaw, a rostral cap usually fringed, and non-thickened unbranched dorsal rays. *Tariqilabeo* can be readily distinguished from superficially similar species of *Garra* lacking a gular disc, and the lower jaw and area behind it are heavily tuberculated with

glandular openings and irregularly arranged hard ridges. Eight species are known. Their systematics and diversity have not been well studied, and numerous changes in taxonomy are expected in the future. Previously, species were included in the Southeast Asian genus *Crossocheilus* and *Gonorhynchus*. *Crossocheilus* is now restricted to a few species related to *C. siamensis* and is only found from Myanmar to the east. **Further reading.** Kottelat 2016 (generic name).



Tariqilabeo adiscus; Chahnime reservoirs, Sistan basin, Iran; ~70 mm SL.

Tariqilabeo adiscus

Common name. Sistan latia.

Diagnosis. Distinguished from *T. macmahoni* by: ● two pairs of relatively long barbels / ● 3–5, usually 4, scales between anus and anal origin / ● 19–22 total gill rakers / ● maximum body depth 17–22 % SL. Size up to 93 mm SL.

Distribution. Afghanistan and Iran: Sistan basin, including Helmand drainage. Iran: Zehak, Chahnime reservoirs, and Hamun Lakes.

Habitat. Wide range of slow-flowing and stagnant-water habitats. Common in small streams with rocky or muddy bottoms, irrigation ditches, reedbed channels, and pools.

Biology. Bottom feeders, feeding on detritus and algae.

Conservation status. LC; situation in Helmand unknown.

Remarks. Despite conflicting opinions, we maintain this species as valid and that fish from the Helmand drainage reportedly have 20–26 gill rakers. More material needs to be examined better to understand the diversity of *Tariqilabeo*



Tariqilabeo macmahoni; Sarbaz, Iran; ~75 mm SL.

in West Asia. Often identified as *Crossocheilus latius*, a species of *Tariqilabeo* from India from which it differs in having 19–22 gill rakers (vs. 37–39 in *T. latius*) and 34–38 total lateral-line scales (vs. 39–41).

Further reading. Annandale 1919 (description); Sayyadzadeh et al. 2015a (description, as *Gonorhynchus adiscus*); Behrens-Chapuis et al. 2015 (molecular phylogeny, as *Gonorhynchus adiscus*); Coad 2021a (biology, distribution).

Tariqilabeo macmahoni

Common name. Mashkid latia.

Diagnosis. Distinguished from *T. adiscus* by: ● usually one pair of rostral barbels; if present, maxillary barbels very short / ● 2–3 scales between anus and anal origin / ● 22–25 total gill rakers / ● maximum body depth 22–30 % SL. Size up to 95 mm SL.

Distribution. Iran: Bahukalat and Sarbaz in Makran region, Mashkid basin in Iran and Pakistan and Makran region in Pakistan.

Habitat. Wide range of running water habitats, including qanats and small coastal streams.

Biology. No data.

Conservation status. VU; The 2020 Red List assessment classified *Tariqilabeo macmahoni* as VU in Pakistan; however, the species' occurrence in Iran was overlooked, and including this range would likely result in a LC status.

Remarks. Often identified as *T. diplochilus*, a species that has been described from the Indus drainage. Mashkid latia differs from *T. diplochilus* by having a very short or absent maxillary barb (vs. very long), a long rostral barb (vs. short), and 3–5 scales between anus and anal origin (vs. 2–3). *Tariqilabeo iranicus* has been recently described from the Makran region of Iran, based on literature, which erroneously states that *T. macmahoni* lacks fringes on the rostral fold. This is clearly not the case and therefore *T. iranicus* is a synonym of *T. macmahoni*.

Further reading. Behrens-Chapuis et al. 2015 (molecular phylogeny); Sayyadzadeh et al. 2015a (description); Cicotto & Page 2016 (Indus and Iran); Coad 2021a (biology, distribution). Esmaeili et al. 2025 (*T. iranicus*).



In the Helmand river in Iran, the flow of water downstream is only permitted after significant rainfall. This environment is home to a diverse community of fish species, including *Tariqilabeo adiscus* and snow barbels.