

Family Mugilidae

Mulletts

A family of fishes primarily found in coastal waters, with approximately 25 genera and 75 species. They occur globally in various marine habitats, including temperate, subtropical, and tropical regions. Mulletts are distinguished by the presence of two separate dorsal fins, a small triangular mouth, and the absence of a lateral line on the flanks. Most species exhibit an unusually muscular stomach and a complex pharynx, which are believed to be an adaptation to grazing on plants, algae, and detritus. Some species inhabit freshwater habitats, while most are marine coastal species that occasionally enter lagoons, estuaries, or the lower reaches of rivers. They can be distinguished from superficially similar Atherinidae by several characteristics, including a dorso-ventrally flattened head (vs. laterally compressed), scales on the dorsal surface of the head (vs. absence of scales), and 11–14½ anal rays (vs. 10–20½). The taxonomy and nomenclature of the Mugilidae are not yet fully resolved, and several name changes have occurred recently. In the context of our region, the most significant alteration is the synonymisation of *Liza* with *Chelon* and the segregation of *Planiliza* from *Liza*.

Mulletts are pelagic fishes that live in schools and typically inhabit waters less than 200 m deep, with a preference for muddy bottoms. They spawn at sea. Eggs and early larvae are pelagic, while small juveniles move toward the shoreline and enter estuaries and lagoons, where they feed on zooplankton. Larger individuals return to the sea, where they feed on algae and vegetal detritus, often taking

a significant amount of sediment with them, which they filter through their branchial apparatus. All species exhibit a similar morphology, with a silvery appearance that renders them challenging to distinguish. Nine species have been documented from freshwaters in West Asia, with five representing non-native populations at least in part of their range. The sole true freshwater species is *Planiliza abu*, which also spawns in freshwater habitats. *Mugil cephalus*, *Chelon auratus*, and *C. ramada* frequently enter freshwaters in lower parts of rivers in the Black Sea and Mediterranean basins to forage, as do *C. auratus* and *C. saliens* that are also introduced to the Caspian Sea. East Asian *Planiliza haematocheilus* is rapidly expanding its range in the Black and Aegean Seas.

Ellochelon vaigiensis and *Planiliza carinata* are present in our region, although they have not yet been recorded from freshwater habitats in West Asia. Both species are included in the keys to allow their identification. *Ellochelon vaigiensis* is widely distributed in the Indo-Pacific region, occurring in the Red Sea, the Persian Gulf, and along the entire coast of Arabia. *Planiliza carinata* is found in the Red Sea and is invasive in the eastern Mediterranean, where it is recorded from Egypt (west to the Nile delta), Israel, Lebanon, and Türkiye. Identification literature for marine fish should be consulted to identify fish not found in pure freshwaters.

Further reading. Bograd 1961 (movements in freshwater); Thomson 1997 (systematics); Durand et al. 2012 (phylogeny, generic concept).



An encounter with an adult *Chelon labrosus*; Italy. © E. Motti.

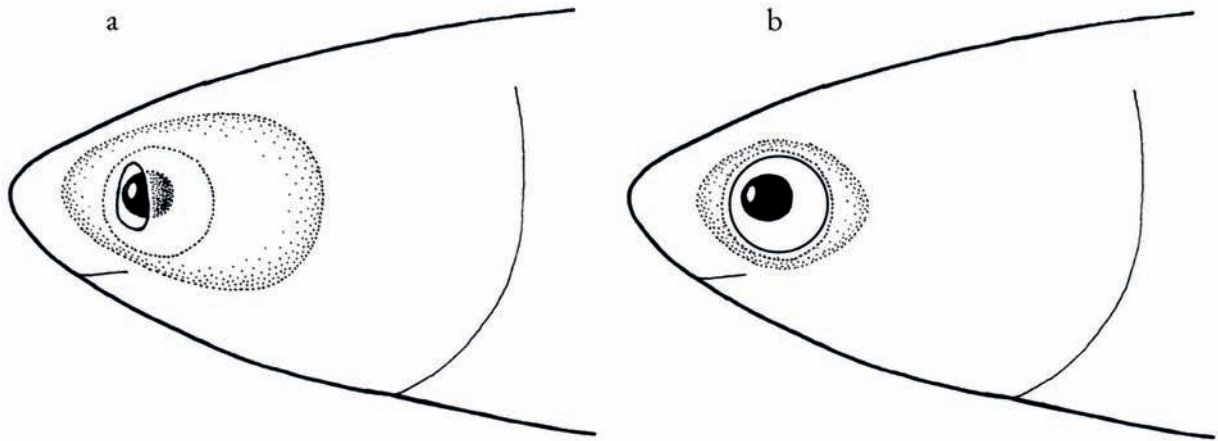


Figure 66. Adipose tissue around the eye in Mugilidae: **a**, *Mugil cephalus*; **b**, *Chelon* species.

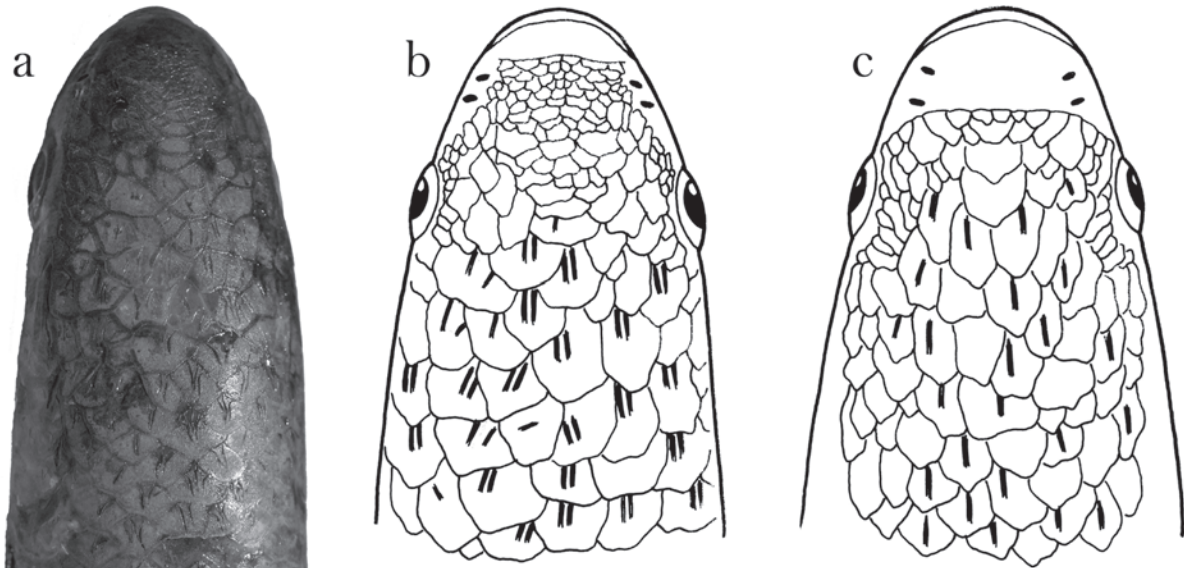


Figure 67. Longitudinal grooves on predorsal scales of *Chelon* species. **a+b**, *C. saliens*; **c**, other species (from Kottelat & Freyhof 2007, after Svetovidov 1964); first picture © E. Motti.

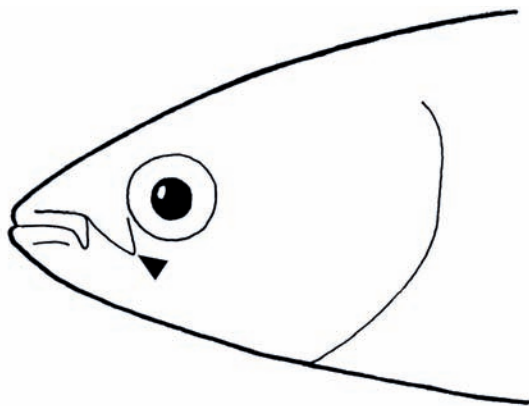


Figure 68. Head of *Chelon auratus* showing pointed posterior angle of preorbital bone (arrow) (from Kottelat & Freyhof 2007).



Figure 69. *Chelon labrosus*, Mesolongi, Greece; ~220 mm SL.

Keys to species of Mugilidae potentially entering freshwaters in West Asia**Persian Gulf basin and seas around Arabian Peninsula**

1a - Pectoral dark-grey or black.

.....*Ellochelon vaigiensis*

1b - Pectoral hyaline.

.....2

2a - Individuals larger than 70 mm SL with adipose tissue covering most of eye (Fig. 66), reaching or almost reaching pupil.

.....3

2b - Individuals larger than 70 mm SL without an adipose tissue rim around eye (Fig. 66).

.....5

3a - Anterior margin of preorbital bone straight, tip pointed; back rounded, not keeled in front of first dorsal.

.....*Mugil cephalus*

3b - Anterior margin of preorbital bone strongly concave, tip blunt; back in front of first dorsal keeled by thickened and ridged scales.

.....4

4a - Total gill rakers 69–82 in individuals between 67 and 96 mm SL, 83–93 in individuals between 106 and 124 mm SL; first pterygiophore of first dorsal ray set between 6th and 7th vertebrae.

.....*Planiliza carinata*

4b - Total gill rakers 79–96 in individuals between 66 and 91 mm SL, 94–109 in individuals between 110 and 139 mm SL; first pterygiophore of first dorsal ray set between 7th and 8th vertebrae.

.....*Planiliza klunzingeri*

5a - 27–32 total scales along lateral midline; preorbital bone does not fill space between lip and eye.

.....*Planiliza subviridis*

5b - 40–50 total scales along lateral midline; preorbital bone fills space between lip and eye.

.....6

6a - Pectoral long, reaching almost to vertical of first dorsal origin; no golden blotch on opercle; two dark-grey stripes on flank.

.....*Planiliza abu*

6b - Pectoral short, not reaching close to vertical of first dorsal origin; usually a golden or orange blotch on opercle; no stripes on flank.

.....*Chelon auratus*

Mediterranean, Caspian, and Black Seas

1a - Lower $\frac{1}{4}$ – $\frac{1}{3}$ of upper lip with 2–3 rows of papillae with horny ridges in individuals larger than 100 mm SL (Fig. 69).

.....*Chelon labrosus*

1b - Upper lip smooth.

.....2

2a - Individuals larger than 70 mm SL with adipose tissue covering most of eye, reaching or almost reaching pupil.

.....3

2b - Individuals larger than 70 mm SL without adipose tissue rim around eye.

.....4

3a - Anterior margin of preorbital bone straight, tip pointed; back rounded, not keeled in front of first dorsal.

.....*Mugil cephalus*

3b - Anterior margin of preorbital bone strongly concave, tip blunt; back in front of first dorsal keeled by thickened and ridged scales.

.....*Planiliza carinata*

4a - Pectoral long, reaching almost to vertical of first dorsal origin; two dark-grey stripes on flank (Orontes, Ceyhan, Seyhan drainages only).

.....*Planiliza abu*

4b - Pectoral short, not reaching close to vertical of first dorsal origin; flank plain grey silvery without stripes (coastal species).

.....5

5a - Posterior extremity of upper jaw reaching beyond anterior rim of eye.

.....*Planiliza haematocheilus*

5b - Posterior extremity of upper jaw not reaching anterior rim of eye.

.....6

6a - Predorsal scales with 2–5 longitudinal grooves (Fig. 67); 48–49 scales in lateral series (not including scales on caudal base).

.....*Chelon saliens*

6b - Predorsal scales with a single or no longitudinal groove (Fig. 67); 40–46 scales in lateral series (not including scales on caudal base).

.....7

7a - 20 circumpeduncular scale rows; when folded forward, pectoral reaching eye; posterior angle of preorbital bone pointed (Fig. 68); no black spot at pectoral base.

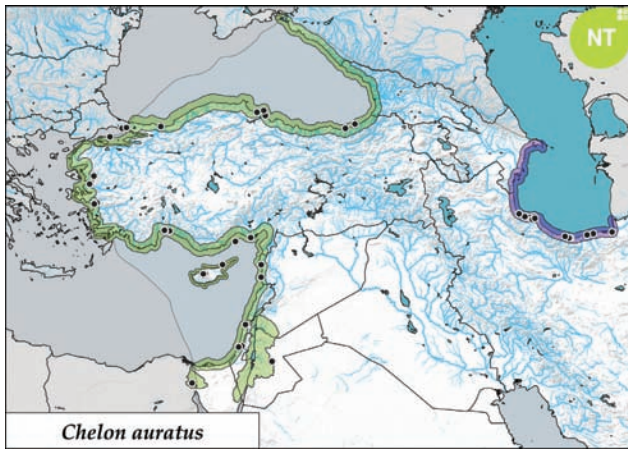
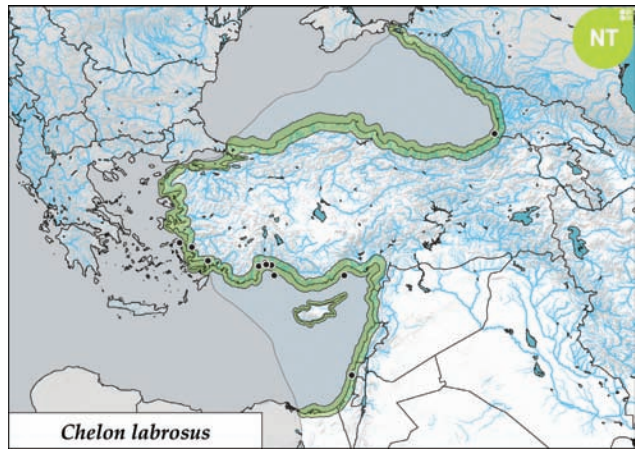
.....*Chelon auratus*

7b - 24 circumpeduncular scale rows; when folded forward, pectoral not reaching eye; posterior angle of preorbital bone rounded; a black spot at inner pectoral base.

.....*Chelon ramada*



Chelon auratus, Mediterranean Sea, Spain; ~400 mm SL. © shutterstock_2366550807 Fernando M. Elkspera.

*Chelon auratus**Chelon labrosus****Chelon auratus***

Common name. Golden mullet.

Diagnosis. Distinguished from other species of mullets entering freshwaters in West Asia by: ○ usually a golden or orange blotch on opercle / ○ predorsal scales with a single or no longitudinal groove / ○ 20 circumpeduncular scale rows / ○ when folded forward, pectoral reaching eye / ○ no black spot at pectoral base / ○ posterior extremity of upper jaw not reaching anterior rim of eye / ○ posterior angle of pre-orbital bone pointed / ○ 40–46 total scales in lateral series / ○ without adipose tissue rim around eye / ○ pectoral short, not reaching close to vertical of first dorsal origin / ○ flank plain silvery grey / ○ upper lip smooth / ○ preorbital bone fills space between lip and eye / ○ caudal forked. Size up to 500 mm SL.

Distribution. Mediterranean, Black Sea, and eastern Atlantic from Cape Verde and Senegal to southern Norway and British Isles (not reaching southern Baltic); northern Red Sea. Introduced in Caspian Sea.

Habitat. Pelagic near shore, sometimes in lagoons and estuaries. Most freshwater-tolerant *Chelon* species recorded from West Asia. Spawns at sea.

Biology. Gregarious. Spawns September–November. Juveniles move to coastal lagoons and estuaries in winter and especially in spring. Juveniles feed on zooplankton and larger individuals on algae and plant detritus.

Conservation status. NT; like almost all *Chelon*, this species has declined considerably over the last 20 years.

Remarks. *Chelon auratus* has entered the northern Red Sea from the Mediterranean and has recently been reported from this area. It is unclear whether the species is expanding its range in the Red Sea.

Further reading. Ben-Tuvia, in Whitehead et al. 1986 (description); Gandolfi et al. 1991 (biology); Thomson 1997 (systematics).

*Chelon labrosus*; Iqem, Morocco, ~70 mm SL.

Chelon labrosus

Common name. Thick lip mullet.

Diagnosis. Distinguished from other species of mullets entering freshwaters in Mediterranean, Caspian, and Black Sea basins by: ● lower $\frac{1}{4}$ – $\frac{1}{3}$ of upper lip with 2–3 rows of papillae with horny ridges in individuals larger than 100 mm SL / ○ without adipose tissue rim around eye / ○ pectoral short, not reaching close to vertical of first dorsal origin. Size up to 600 mm SL.

Distribution. Coasts of Mediterranean, Black Sea, and eastern Atlantic from Cape Verde and Senegal to southern Norway, southern Iceland, and Faroe Islands.

Habitat. Pelagic near shore, sometimes in lagoons and estuaries. Spawns at sea in coastal surface waters.

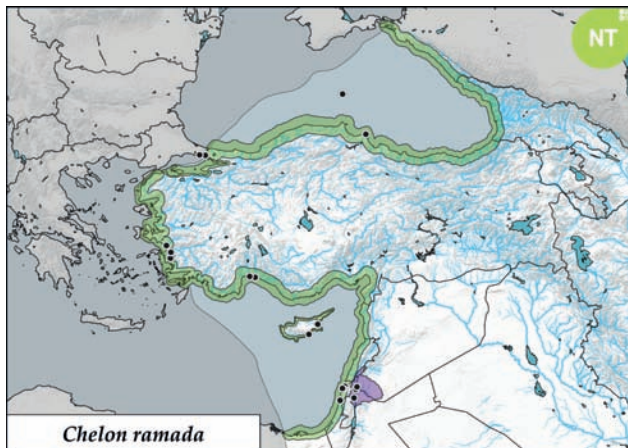
Biology. Gregarious along coasts, often entering lagoons and estuaries, juveniles readily adapt to freshwater. Lives up to 12 years. Males spawn for the first time at 2 years, females at 3, later in northern areas. Females larger than males. Spawns pelagic in February–April, eggs pelagic. Juveniles of about 20 mm SL move to coastal lagoons and estuaries in April–June, returning to sea in late summer. Juveniles feed on zooplankton; adults mainly on algae and plant detritus.

Conservation status. NT; like almost all *Chelons*, this species has declined considerably over the last 20 years.

Further reading. Ben Tuvia, in Whitehead et al. 1986 (description); Gandolfi et al. 1991 (biology); Thomson 1997 (systematics); Harrison 2003b (biology).

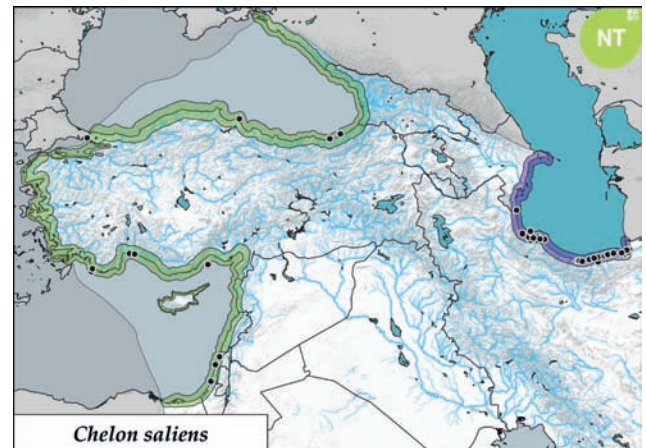


Chelon ramada; İlica drainage, Antalya, Türkiye; ~120 mm SL.

***Chelon ramada***

Common name. Thinlip mullet.

Diagnosis. Distinguished from other species of mullets entering freshwaters in Mediterranean, Caspian, and Black Sea basins by: ○ predorsal scales with a single or no longitudinal groove / ○ 24 circumpeduncular scale rows / ● when folded forward, pectoral not reaching eye / ○ posterior angle of preorbital bone rounded / ○ posterior



extremity of upper jaw not reaching anterior rim of eye / ● a black spot at pectoral base / ○ 41–46 scales in lateral series (not including scales on caudal base) / ○ upper lip smooth / ○ without adipose tissue rim around eye / ○ pectoral short, not reaching close to vertical of first dorsal origin. Size up to 545 mm SL.

Distribution. Mediterranean, Black Sea, Azov Sea, and eastern Atlantic from Cape Verde and Senegal to southern Baltic and

British Isles (not reaching northern Scotland). Migrates north during summer. Introduced in Lake Kinneret (Israel).

Habitat. Pelagic inshore, entering lagoons and lower reaches of rivers, often found in polluted waters. Spawns offshore at sea.

Biology. Usually in schools. Males spawn first time at 2–3 years, females at 4 or later. Females slightly larger than males. Spawns several million pelagic eggs in September–December in Mediterranean, April–July along British coast.

Juveniles about 20 mm SL move into coastal lagoons and estuaries in autumn, especially in winter. Juveniles feed on zooplankton until about 30 mm SL, then on benthic animals and plants. Adults filter algae and plant detritus.

Conservation status. NT; like almost all *Chelon*, this species has declined considerably over the last 20 years.

Further reading. Ben Tuvia, in Whitehead et al. 1986 (description); Gandolfi et al. 1991 (biology); Costa Pereira 1995; Thomson 1997 (systematics); Harrison 2003c (biology).



Chelon saliens; Mediterranean Sea, Spain; ~200 mm SL. © shutterstock_2141170165 Ion Mes.

Chelon saliens

Common name. Sharpnose mullet.

Diagnosis. Distinguished from other species of mullets entering freshwaters in Mediterranean, Caspian, and Black Sea basins by: ● predorsal scales with 2–5 longitudinal grooves / ● 48–49 scales in lateral series (not including scales on caudal base) / ○ 20 circumpeduncular scale rows / ○ when folded forward, pectoral reaching eye / ○ posterior extremity of upper jaw not reaching anterior rim of eye / ○ upper lip smooth / ○ without adipose tissue rim around eye / ○ pectoral short, not reaching close to vertical of first dorsal origin. Size up to 350 mm SL.

Distribution. Mediterranean, Black Sea, and eastern Atlantic from Angola to Bay of Biscay. Introduced in Caspian Sea.

Habitat. Pelagic near shore, sometimes in lagoons and estuaries. Spawns at sea.

Biology. Usually in schools. Males spawn for first time at 2, females at 3 years. Females larger than males. Spawns pelagic eggs in May–August, rarely until early October. Juveniles about 20 mm SL move to coastal lagoons and estuaries in summer and autumn. Juveniles feed on zooplankton to about 30 mm SL, then benthic organisms to 50 mm SL; adults feed on algae and plant detritus.

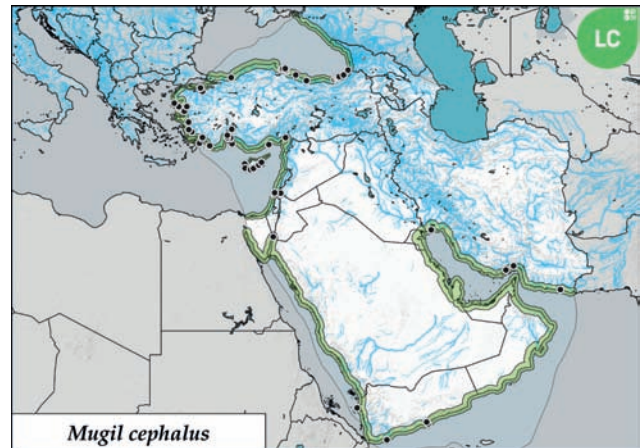
Conservation status. NT; like almost all *Chelon*, this species has declined considerably over the last 20 years.

Remarks. Seems rarely to enter freshwaters and might be excluded from freshwater fish in future. Only known from sea in Caspian.

Further reading. Ben Tuvia, in Whitehead et al. 1986 (description); Gandolfi et al. 1991 (biology); Thomson 1997 (systematics); Harrison 2003d (biology).



Mugil cephalus; Mesolongi, Greece; ~300 mm SL.





Mugil cephalus; Köprüçay drainage, Türkiye; ~160 mm SL.

Mugil cephalus

Common name. Flathead mullet.

Diagnosis. Distinguished from other species of mullets entering freshwaters in West Asia by: ○ adipose tissue covering most of eye, reaching pupil in adults / ○ back rounded, not keeled in front of first dorsal / ○ anterior margin of preorbital bone straight, tip pointed / ○ upper lip smooth / ○ pectoral short, not reaching close to vertical of first dorsal origin / ○ caudal forked. Size up to 800 mm SL.

Distribution. All tropical and subtropical seas, Mediterranean, Black Sea, and Atlantic, reaching northward to England and the Netherlands.

Habitat. Pelagic near shore, often foraging in lagoons, estuaries, and lower reaches of rivers. Spawns at sea in coastal surface waters.

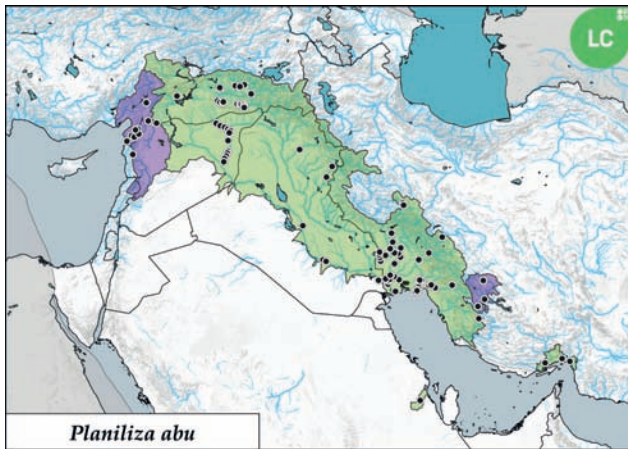
Biology. Usually in schools. Males spawn first time at 2 years, females at 3 years. Females larger than males. Spawns at sea in coastal surface waters, producing several million pelagic eggs from July to October (Mediterranean). Eggs develop optimally in full marine salinity. Juveniles of about 20 mm SL migrate to coastal lagoons and estuaries in autumn. Juveniles feed on zooplankton until about 30 mm SL and larger individuals filter algae, plant detritus, and small invertebrates.

Conservation status. LC.

Further reading. Ben Tuvia, in Whitehead et al. 1986 (description); Gandolfi et al. 1991 (biology); Thomson 1997 (systematics); Harrison 2003a (biology); Attaala & Rubaia 2005 (record from Yemen); Kottelat & Freyhof 2007 (distribution, biology).



Planiliza abu; Lesser Zab drainage, Iraq; 91 mm SL.



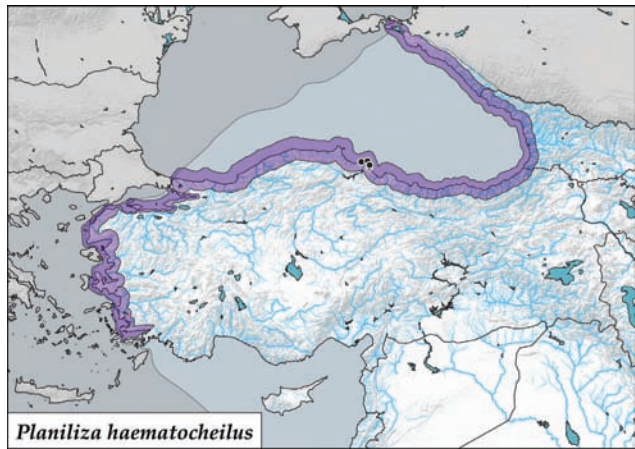
Planiliza abu

Common name. Abu mullet.

Diagnosis. Distinguished from other species of mullets entering freshwaters in West Asia by: ● 44–50 total scales in lateral series / ● pectoral long, reaching almost to vertical of first dorsal origin / ○ no golden blotch on opercle / ● two irregular dark-grey lateral stripes / ○ caudal deeply emarginate / ○ upper lip smooth / ○ without adipose tissue rim around eye. Size up to 220 mm SL.

Distribution. Persian Gulf basin from Euphrates and Tigris south to Indus. A relict population in Al-Ahsa oasis in Saudi Arabia. Introduced in Orontes, Ceyhan and Seyhan drainages (Türkiye), and Kor basin (Iran).

Habitat. Medium-sized streams to large rivers, lakes, and reservoirs. Also, in densely vegetated springs and canals. A wide range of still to moderately fast-flowing waters. Absent from very fast-flowing rivers and streams. Usually in salinities below 2 ‰ but can tolerate up to 30 ‰. Usually a warm-water species, absent from cold headwaters of Anatolia.



Biology. Freshwater species usually live in large schools under water's surface. Lives up to 7 years, usually 4–5 years. Spawns first time at one year and about 100 mm TL in late February–March (southern Iraq), March–May (Baghdad), and March–July (southern Türkiye). Spawns once or twice a year. Eggs attached to submerged vegetation. Feeds mainly on detritus, phytoplankton, and aquatic plants. Small amounts of planktonic invertebrates are taken.

Remarks. This species is a very powerful invader and would be able to colonise large parts of the Mediterranean basin if introduced.

Conservation status. LC; relatively resistant to pollution. Despite its small size, commercially caught in large quantities, particularly in Iran and Iraq and accidentally introduced in Mediterranean coastal areas in Türkiye and Syria, where it is considered a pest.

Further reading. Talwar & Jhingran 1992 (distribution, identification); Coad 2010a (biology); Kaya et al. 2016 (distribution); Bayçelebi 2020 (distribution).



Planiliza haematocheilus; aquarium Moscow, Russia; ~300 mm SL. © J. Pfleiderer.

Planiliza haematocheilus

Common name. Soiuy mullet.

Diagnosis. Distinguished from other species of mullets entering freshwaters in Black Sea and Mediterranean basins by: ● posterior extremity of upper jaw reaching beyond anterior rim of eye / ○ predorsal scales with a single longitudinal groove / ○ 41–42 scales in lateral series (not including scales on caudal base) / ○ 24 circumpeduncular scale rows / ○ upper lip smooth / ○ without adipose tissue rim around eye / ○ pectoral short, not reaching close to vertical of first dorsal origin. Size up to 530 mm SL.

Distribution. Coast of East Asia from Vladivostok to Hainan Island. Introduced in Sea of Azov in late 1960s, reached Aegean in 1995. Southernmost record in Aegean from Homa lagoon (İzmir) more widespread.

Habitat. At sea, pelagic near shore. Juveniles enter brackish and fresh waters of lagoons and lower reaches of rivers.

Spawns at sea and in brackish waters. Often enters freshwater to overwinter.

Biology. Euryhaline, live six years, likely much longer. Feeds on detritus, diatoms and blue-green algae. Eggs and larvae planktonic.

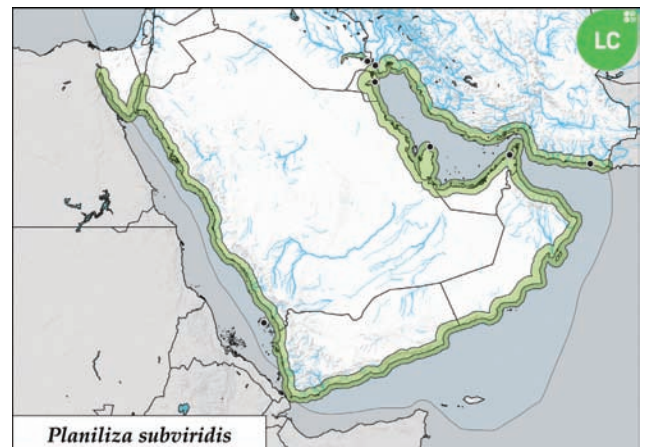
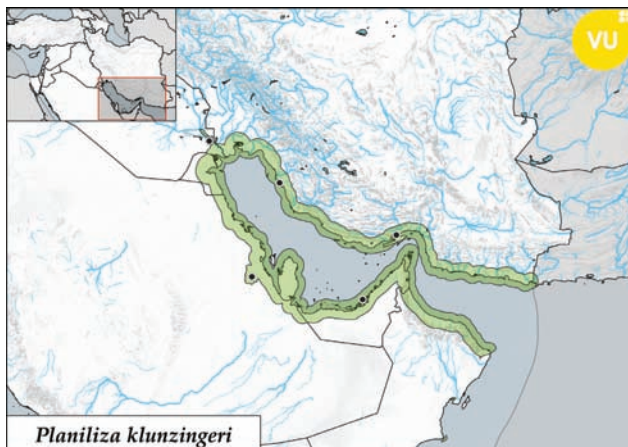
Conservation status. Non-native; situation poorly known. Most abundant Mugilid in Azov Sea. Along shores of Black Sea and possibly Aegean, its expansion corresponds to a sharp decline in native species of Mugilidae, which it appears to be replacing.

Remarks. Surprisingly, there are very few records of this species from the Anatolian, but none from the Georgian Black Sea basin, whereas it is common along the coasts of Russian Caucasus.

Further reading. Starushenko & Kazansky 1996 (introduction); Thomson 1997 (systematics; as *L. lauvergnii*); Koutrakis & Economidis 2000 (biology).



Planiliza klunzingeri; Shatt al Arab, Iraq; 137 mm SL. © A. Ali.



Planiliza klunzingeri

Common name. Eastern keeled mullet.

Diagnosis. Distinguished from other species of mullets in Persian Gulf basin and coasts of Arabian Peninsula by:
 ○ back in front of first dorsal keeled by thickened and ridged stripes on scales / ○ with adipose tissue rim around eye reaching or almost reaching pupil / ○ total gill rakers 79–96 in individuals between 66 and 91 mm SL, 94–109 in individuals between 110 and 139 mm SL / ○ first pterygiophore of first dorsal ray set between 7th and 8th vertebrae / ○ caudal forked / ○ pectoral short, not reaching close to vertical of first dorsal origin / ○ anterior margin of preorbital bone strongly concave, tip blunt. Size up to 175 mm SL.

Distribution. Coasts of Persian Gulf, including lower Shatt al Arab/Arvand and Hammar marshes, east to Pakistan and west coast of India. Mostly in estuaries of larger rivers.

Habitat. Large estuarine areas, lagoons, marshes, and lower reaches of rivers, often found in polluted waters.

Biology. Gregarious. Lives up to five years. Spawns first time at 1 year and about 100 mm SL. Spawns at sea at 14–18°C in December–April (Kuwait Bay). Juveniles enter estuaries and freshwaters to feed. Highest growth rate and food conversion efficiency at 15 ‰ salinity under experimental conditions. Feeds mainly on detritus, algae, phytoplankton, and zooplankton.

Conservation status. VU; appears to be in steady decline due to overfishing.

Remarks. Often identified as *Liza carinata*.

Further reading. Senou et al. 1987 (identification, distribution); Thomson 1997 (description, biology, distribution).



Planiliza subviridis; Hong Kong; ~ 160 mm SL. © Tse Chung Yi.

Planiliza subviridis

Common name. Greenback mullet.

Diagnosis. Distinguished from other species of mullets in Persian Gulf basin and coasts of Arabian Peninsula by:
 ● preorbital bone not filling space between lip and eye /
 ○ back rounded, not keeled in front of first dorsal / ○ 27–32 total scales along lateral midline / ○ caudal emarginate or truncate / ○ without adipose tissue rim around eye /
 ○ pectoral short, not reaching close to vertical of first dorsal origin / ○ anterior margin of preorbital bone strongly concave, tip blunt. Size up to 260 mm SL.

Distribution. Persian Gulf east to India, China, northern Australia, and Polynesia. Recorded from lower Shatt al Arab/Arvand and Hammar marshes.

Habitat. Coastal waters, lagoons, marshes, estuaries, and lower reaches of rivers. Spawns at sea.

Biology. Gregarious. Lives up to 6 years. Spawns first time at about 120 mm SL. Spawns February–April in Shatt al Arab/Arvand, March–April, often June, offshore in Persian Gulf. After spawning, adults and juveniles migrate to brackish and fresh waters. Feeds mainly on algae, detritus, plants, and plankton.

Conservation status. LC.

Remarks. Sometimes identified as *Liza dussumieri* in Persian Gulf basin.

Further reading. Thomson 1997 (description, biology, distribution).