Family Xenocyprididae

Chinese carps

The aggregation of non-native East Asian carps has been placed in several cyprinid subfamilies, depending on which molecular characters were studied. The genera *Squaliobarbus*, *Elopichthys*, *Ctenopharyngodon,* and *Mylopharyngodon* were previously classified within the Cyprinid subfamily Squaliobarbinae. *Hypophthalmichthys* has been placed in the family Leuciscidae. The results of recent, comprehensive molecular studies place these fishes in Xenocyprididae. Xenocyprididae is a diverse group that encompasses species native to Southeast Asia (e.g. *Macrochirichthys*, and *Parachela*) and East Asia (e.g., *Culter*, *Chanodichthys,* and *Ochetobius*). They represent an independent adaptive radiation within the order Cypriniformes and exhibit remarkable morphological and ecological diversity. In East Asia, they form similar ecological niches to those of Leuciscids in the West, and some are even superficially similar to *Alburnus*, *Leuciscus*, *Chondrostoma,* and others. Some species attain considerable size and exhibit rapid growth; four have been cultivated and widely introduced. Several other species are small pond dwellers, including *Aphyocypris*, *Hemigrammocypris,* and *Metzia*. Xenocypridis are particularly abundant in lowland freshwater ecosystems, with some species being ubiquitous. Some are also resistant to the majority of human impacts. One species, *Hemiculter leucisculus*, was introduced to the Aral basin and has become invasive along the southern and western coast of the Caspian Sea. Subsequently, it was introduced to the Euphrates and Tigris drainages, where it is expanding its range. *Ctenopharyngodon*, *Mylopharyngodon,* and *Hypophthalmichthys* have been stocked throughout West Asia and are typically sourced from European suppliers. However, these activities have declined due to the perceived inferiority of the flesh of these species and their subsequent low market value. There is no documented evidence of any established population of these species in West Asia. Nevertheless, their potential to become established in the future as a consequence of warming due to climate change cannot be discounted. **Further reading.** Howes 1981 (anatomy); Chen 1987 (phylogeny); Cunha et al. 2002 (genetics); Kottelat & Freyhof 2007 (summary of distribution and biology); DeVaney et al. 2009 (invasion potential).

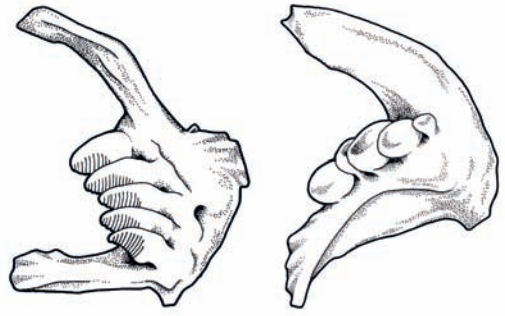

Figure 43. Frontal view of left pharyngeal arch of *Ctenopharyngodon idella* (the two small teeth on row 1 are not visible in frontal view) and left pharyngeal arch of *Mylopharyngodon piceus* (from Kottelat & Freyhof 2007, after Nico et al. 2005).

Ctenopharyngodon idella; aquaculture, Germany; ~600 mm SL. © A. Hartl.

Ctenopharyngodon idella

Common name. Grass carp.

Diagnosis. Distinguished from similar *Mylopharyngodon piceus* by: ● body olive to brassy green on back, silvery white to yellow on flank / ○ body cylindrical / ● pharyngeal teeth laterally compressed, serrated, with a groove along grinding surface (Figure 43), usually in two rows, 2,5–4,2. Size up to 1200 mm SL and 32 kg.

Distribution. Rarely introduced for weed control or escaped from aquaculture facilities. No established populations in West Asia. Native to East Asia, in most major Pacific drainages from Amur to Xi Jiang. Used in aquaculture in Asia, Europe, and North America; released in most major drainages. Established non-native populations in North America and in Aral Sea basin (Central Asia).

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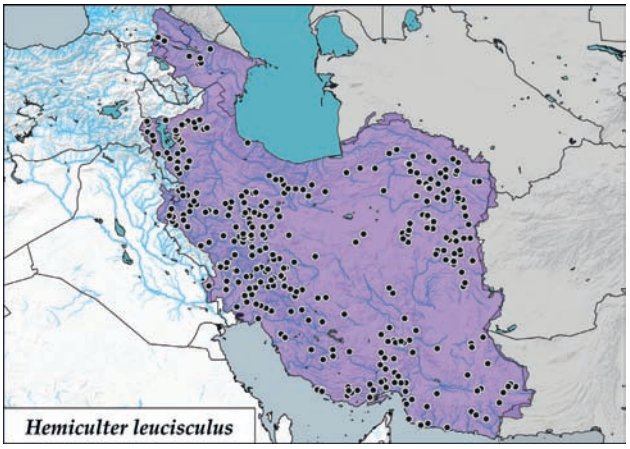
Habitat. Stocked in large rivers and almost all still waters such as lakes, reservoirs, and ponds. Often escapes from fish farms. In its native range, inhabits rivers with pronounced water level fluctuations caused by floods. Spawning and overwintering in middle and lower reaches of large rivers. In lakes, reservoirs, and backwaters during feeding season, preferably in warm, clear water with high oxygen concentrations.
Biology. In natural habitat, first spawns at 7–10 years and about 600–800 mm SL, females 1–2 years later than males. Spawns April–August. Migrates upstream and spawns during high water, in upper water layer, or on surface in sections with strong currents. Females lay one or more portions of eggs depending on length of flood. Average females lay about 1.5 million pelagic eggs, hatching while drifting downstream in 2–3 days; if river is blocked or available river reaches are too short, eggs cannot drift long enough and fail to develop. After spawning, adults leave river and migrate to flooded areas, lakes, or backwaters with dense vegetation. They return to river in autumn–winter and spend cold season in deep places in lower reaches. Larvae settle in flooded lakes and channels with little or no current after a downstream migration of about 1000 km. Larvae feed on phyto- and zooplankton and then, from about 25 to 50 mm SL, on aquatic macrophytes. Larger juveniles and adults feed mainly on macrophytes, including terrestrial macrophytes, during summer floods. Does not feed in winter. There are reliable data on natural spawning in rivers in southern Russia, but success of these reproductive events is not known.
Conservation status. Non-native; stocked for commercial fisheries. In West Asia very rarely stocked. Native stocks in eastern Russia and China are declining. Its introduction into Czech Republic was accompanied by introduction of tapeworm *Bothriocephalus gowkongensis*, which subsequently caused severe losses in *Cyprinus carpio* farmed stocks.
Further reading. Bíró 1999a (biology); Nico et al. 2001 (comparison with *Mylopharyngodon*); Kottelat & Freyhof 2007 (summary of distribution and biology).

Hemiculter leucisculus; Sirvan drainage, Iraq; ~90 mm SL.

Hemiculter leucisculus
Common name. Sharpbelly.
Diagnosis. Distinguished from superficially similar species of *Alburnus* by: ● sharp keel on ventral midline from chest to pelvic base / ● last unbranched dorsal ray unsegmented, stiff and spinous with flexible tip / ○ anal origin far behind vertical of last dorsal ray / ○ lateral line curves downward from its origin to end of pectoral fin. Size up to 200 mm SL.
Distribution. Non-native to southern Caspian basin in Iran, Azerbaijan, and southern Russia. Locally introduced in Tigris drainage. Native from Amur in Russia, south to China, North and South Korea, Japan, and northern Vietnam.
Habitat. Streams and rivers, reservoirs and lakes. Also in coastal lagoons in Caspian Sea.
Biology. Lives up to 6 years in Iran, begins spawning in second year. Spawns March–August, most likely fractional spawners. Feeds on algae, plant material, terrestrial and aquatic invertebrates, and small fish.
Conservation status. Non-native; introduced as a weed with stocked Common carp (*Cyprinus carpio*) or/and Chinese carps (*Ctenopharyngodon*, *Hyophthalmichthys*).
Remarks. An invasive species introduced with Chinese carp from Central Asia, invading the Caspian and Tigris basins. Could appear wherever carp are stocked as it is transported long distances with carp fingerlings. The current source of this species appears to be Caspian hatcheries in Azerbaijan

and Iran. Still, it is only a matter of time before it becomes established in hatcheries producing *Cyprinus carpio* elsewhere. This species will invade all of West Asia, Europe, and North Africa, following the path of *Pseudorasbora parva*. Several species are confused under this name. The identity of the species introduced in the Western Palaearctic has yet to be investigated.

Further reading. Coad 2010a (biology, distribution); Vasil'eva et al. 2022 (East Asian diversity).



Sharpbelly, the next generation invader to the Palaearctic. What differentiates an invasive species from a non-invasive one? Several studies have analysed the ecological traits associated with the invasive power of a species. A potent invader exhibits a high tolerance and adaptability to a wide range of temperatures, oxygen levels, and pollutants. It has no special requirements to achieve its high reproductive potential and no specialisation for feeding. It has a moderate size to enable it to exist in "normal"-sized fish communities but not to become the victim of fisheries. It requires a vector to spread, so humans should carry it around and, despite being illegal almost everywhere, transfer it from one drainage system to another. Being a weed in carp ponds seems to be the most effective way. Carps are stocked everywhere, traded internationally without strong limitations, and cultured in relaxed ways regarding biosafety. Several examples of weed species in carp ponds are quickly conquering large areas. In their native range, such potential invaders are typically found in pond areas, polluted canals, and various lake and river habitats. These characteristics indicate the most successful invasive fish species of the 20th century, including carps such as *Carassius,* mosquitofish *Gambusia holbrooki* and the topmouth gudgeon *Pseudorasbora parva*. Similarly, sharpbelly, *Hemiculter leucisculus*, is also spreading. It can be confidently predicted that this species will subsequently conquer all of West Asia, Europe, and North Africa. As it occurs north to the Amur in its native range, it is difficult to estimate how far north it might spread in Russia and Central Europe. It can be predicted that sharpbelly will become established in any location where carps are stocked. It will be an abundant and ecologically influential invader, competing with *Alburnus* species. The potential consequences of this phenomenon can be observed in Central Asia, where the fish communities of large rivers and artificial waterbodies are dominated by East Asian species, with native species being almost entirely restricted to small mountain rivers. **Further readings.** Alcaraz et al. 2005; Devin & Beisel 2007; Van Kleunen et al. 2010; Matzek 2012 (invasive species traits).

Hypophthalmichthys

Two of the three species of this genus have been introduced to Europe, from where they were subsequently spread to West Asia. Both have been hybridised in aquaculture, and fish found in West Asia and Europe do not represent pure species. As far as is currently known, they did not establish self-sustaining populations except (perhaps) in the Danube, Maritza (Europe), and Terek (western Caspian basin), where data at least allow us to suspect that *H. molitix* might have established. *Hypophthalmichthys* have also been introduced to Central Asia, particularly in the Aral basin. They were introduced from the Amur (Siberia) to European Russia and from the Yangtze (China) to Romania. From these two areas, fish were transported to various locations throughout North Africa, West Asia, and Europe for aquaculture purposes. It is estimated that most major rivers were stocked, particularly in reservoirs. Many fisheries biologists have postulated that these fish can transform algal blooms from pollution into edible fish protein. The first importation of these fish to Romania is a prime example of how careless fish introductions have often been handled. In 1961, unidentified fish larvae were caught in the Yangtze near the city of Wuhan and released in an aquaculture station near Bucharest. Upon draining the ponds in the autumn, 22 Chinese fish species were recorded, including *Hypophthalmichthys* and *Pseudorasbora*. While the other introduced species could be successfully eliminated, *Pseudorasbora* escaped from the ponds and is still expanding its range. *Hypophthalmichthys* and other introduced Chinese carps also hosted several parasites that conquered West Asia and Europe. The most spectacular of these is the glochidium of large freshwater mussel *Sinanodonta woodiana*.

Hypophthalmichthys molitrix; Volga delta, Russia; ~500 mm SL.

Hypophthalmichthys molitrix

Common name. Silver carp.

Diagnosis. Distinguished from *H. nobilis* by: ● sharp scaleless keel from pectoral region to anal origin / ● pectoral short, not reaching beyond pelvic origin / ● 650–820 long, slender gill rakers / ● head length 24–29 % SL / ● plain silvery colouration, greenish-grey above, whitish below. Size up to 1000 mm SL and 50 kg.

Distribution. Introduced in most drainages in West Asia. Established reproductive populations in North America, in Karakum Canal in Turkmenistan, Central Asia, potentially also in Danube (Europe). No established population in Aral Sea basin. Native to most major Pacific drainages in East Asia from Amur to Xi Jiang. Used in aquaculture almost worldwide outside of tropics.

Habitat. Stocked in large rivers and almost all still waters such as lakes, reservoirs, and ponds. Often escapes from fish farms. Aquaculture tolerates brackish water (up to 7 ‰) when stocked in estuaries and coastal lakes. In its native range, inhabits rivers with marked fluctuations in water level, overwintering in middle and lower reaches. During feeding season in shallow (0.5–1.0 m deep) and warm (above 21°C) backwaters, lakes, and flooded areas with slow currents. Spawns in rivers or tributaries above shallow rapids with gravel or sand bottoms, strong current (0.5–1.7 m/s), turbid water, temperatures above 15°C (usually 18–26°C), and high oxygen concentrations.

Biology. First spawns at 5–7 years. Juveniles and adults form large schools during spawning and overwintering. Migrates long distances upstream at onset of rapid floods and water level rise (April–August depending on location; late April–early June in Terek), able to jump over obstacles up to 1 m. Spawns during floods when water level rises 50–120 cm above normal, usually at 18–26°C. Stops spawning when conditions change (particularly sensitive to falling water levels, reduced turbidity and increased current velocity) and resumes spawning when water levels rise. Spawns in upper layer of water or even on surface. Females lay about 500,000 eggs in one or more portions, depending on duration of flood. Eggs float, are transparent, and hatch after about 2 days at about 25°C while drifting downstream. If river is blocked or if available river reaches are too short, eggs cannot drift long enough and fail to develop. After spawning, adults leave river and migrate to feeding areas. In autumn–winter they migrate to deeper places in mainstream, where they remain without feeding. Larvae drift downstream and settle in floodplain lakes, shallow banks, and backwaters with little or no current. Feeds from about 15 mm SL on phytoplankton only. Very sensitive to low temperature (below 5°C) and oxygen depletion. There is reliable data on natural spawning in rivers of southern Russia (Terek) and lower Danube. Still, it is not known whether eggs and larvae could complete development. There is no evidence that this species has become established in West Asia or North Africa.

Conservation status. Non-native; stocked for commercial fisheries. Survives in West Asia and Europe only through stocking. Potentially reproductive in Danube. Native wild stocks in Russia and China are declining.

Further reading. Holčík 1976 (introduction, Danube); Movchan & Smirnov 1983 (morphology, biology); Howes 1981 (anatomy); Kottelat & Freyhof 2007 (summary of distribution and biology).

Hypophthalmichthys nobilis; Shanghai Aquarium, ~350 mm SL. © Zhou Hang.

Hypophthalmichthys nobilis

Common name. Bighead carp.

Diagnosis. Distinguished from *H. molitrix* by: ● scaled keel from pelvic to anal / ● pectoral long reaching beyond pelvic origin / ● 240–300 long gill rakers / ● head length 27–35 % SL / ● dark-grey overall colouration, flank with dark, large, very irregularly shaped blotches. Size up to 1460 mm SL and 40 kg.

Distribution. Used in aquaculture in Europe, Asia, and North America. No reliable data on natural spawning in West Asia, spawning reported from Europe (Terek). This species is rarely used in aquaculture and may have already vanished from West Asia. Established reproductive populations in North America and Karakum Canal in Turkmenistan, Central Asia. No established population in Aral Sea basin. Native to Central and South China.

Habitat. Stocked in large rivers and almost all still waters such as lakes and ponds. Often escape from fish farms. In aquaculture, adults tolerate brackish water (up to 7 ‰) when stocked in estuaries and coastal lakes. In native range, in rivers with marked water level fluctuations, overwintering in middle and lower reaches. Foraging in shallow (0.5–1.5 m deep) and warm (above 24°C) backwaters, lakes, and flooded areas with slow currents. Spawns in deep, turbid, and warm water above 18°C (usually 22–30°C), with strong currents (1.1–1.9 m/s) and high oxygen concentrations.

Biology. Lives up to 20 years. Spawns first time at 5–6 years, 550–700 mm SL, and 5–10 kg (Russian Pacific basin), or even at 2–4 years (males) and 3–5 years (females) in Turkmenistan. Migrates long distances upstream at onset of rapid flooding and water level rise (April–July, depending on location). Spawning migration begins in mid–May at temperatures of 18–19°C and lasts until end of June (Terek). Spawns during floods. Stops spawning when conditions change and resumes when water level rises. Spawns in upper water layer or even on surface in June (Terek). Females lay up to 1.1 million eggs in 1–3 portions, depending on flood duration. Eggs are yellowish, transparent, and hatch after about 2 days at around 25°C while drifting downstream in a deep open water layer. If river is blocked or available river reaches are too short, eggs cannot drift long enough and fail to develop. After spawning, adults leave river and migrate to feeding areas. Larvae drift downstream and settle in floodplain lakes, shallow banks, and backwaters with little or no current. In autumn/winter, when temperatures drop to 10°C, juveniles and adults form separate large schools and move downstream to deeper areas in main river to overwinter. Feeds mainly on zooplankton and also on algae.

Conservation status. Non-native; stocked for commercial fisheries. There are reliable data on natural spawning in rivers of southern Russia (Terek), but whether eggs and larvae could complete development is unknown. Native wild stocks in Russia and China are declining.

Further reading. Holčík 1976 (introduction, Danube); Movchan & Smirnov 1983 (morphology, biology); Kottelat & Freyhof 2007 (summary of distribution and biology).

Mylopharyngodon piceus; Shanghai Aquarium; China; ~800 mm SL. © Zhou Hang.

Mylopharyngodon piceus

Common name. Black carp.

Diagnosis. Distinguished from similar *Ctenopharyngodon idella* by: ● body black, blue-grey or dark-brown / ○ body slightly compressed / ● pharyngeal teeth molar-like, massive, smooth, very strong (Figure 43). Size up to 1800 mm SL and more than 60 kg.

Distribution. Used in aquaculture; stocked in Rioni (Georgia), Danube, Dniestr, Dniepr, Don, Kuban, and Volga drainages. Reproductive populations established only in Amu Darya (Central Asia) and possibly in Tone drainages (Japan), not in West Asia. Native to most major Pacific drainages, from Amur to Xi Jiang.

Habitat. Stocked to reservoirs. In native range, large lowland rivers and lakes usually with clear water and high oxygen concentrations.

Biology. Spawns first time at 6–11 years, females later than males, at about 1000 mm SL and 15 kg, males at 900 mm and 11 kg. Migrates upstream and spawns in open waters from March to July. Spawns when water level rises, at 19–30°C. Eggs pelagic or semi-pelagic, hatching while drifting downstream. If river is blocked or available river reaches are too short, eggs cannot drift long enough to develop. Larvae settle in floodplain lakes and channels with little or no current. Larvae feed on zooplankton, then ostracods and aquatic insects. At about 120 mm SL, juveniles begin to feed on small snails and clams; larger juveniles and adults feed almost exclusively on molluscs.

Conservation status. Non-native; stocked to control bivalves. In West Asia, persists only in Rioni (Georgia) through stocking. Native stocks in Russia and China have declined sharply. Expected to disappear if stocking is stopped.

Remarks. Introduced to control of populations of molluscan vectors of fish and human parasites. Commonly used to remove *Dreissena* mussels that clog hydroelectric plants.

Further reading. Evtushenko et al. 1994 (biology); Bíró 1999b (biology); Nico et al. 2001 (biology, introductions); Nico et al. 2005 (synopsis).

Çöçelli spring is the habitat of *Pseudophoxinus zekayi*, *Paraphanius alexandri,* and *Garra culiciphaga*.