

Family Acipenseridae

Sturgeons

Sturgeons are a small family restricted to the northern hemisphere, in Europe, northern Asia, and North America. Traditionally, all sturgeon species found in Western Asia and Europe were placed in two genera: *Acipenser* (nine species) and *Huso* (one species). Other genera in the family Acipenseridae include *Scaphirhynchus*, with three species in North America, and *Pseudoscaphirhynchus*, with 1-3 species in the Aral basin in Central Asia. The phylogeny of sturgeons has been well understood for many years, and it has long been evident that the genus *Acipenser* is paraphyletic. This has not been reflected into a generic classification, as species such as *Sterletus stellatus* have been found to occupy different positions in different analyses. Therefore, sturgeon phylogeny was considered preliminary. This was also intended to avoid renaming these highly threatened species, as it was feared that name changes would hinder sturgeon protection. Sturgeon phylogeny has recently been reanalysed and, for the first time, translated into a new generic structure. *Pseudoscaphirhynchus* and *Scaphirhynchus* remain valid genera, but *Acipenser* now comprises only *A. sturio*, *A. desotoi* and *A. oxyrinchus*. All other West Asian and European *Acipenser* species have been placed in the genus *Huso*, ignoring that *Huso* is a junior synonym of *Sterletus*. The type species of *Sterletus* is the American lake sturgeon (*S. fulvescens*). Consequently, all sturgeon species in the Pacific basin in Asia and America, including *Huso dauricus*, have been placed in the genus *Sinosturio*. Users of species names now have three options: 1) treat the knowledge of sturgeon phylogeny still as too incomplete to risk causing confusion by changing the names, 2) place all sturgeons in the family Acipenseridae in the genus *Acipenser* (requiring few name changes), or 3) accept the proposed generic concept, as we do in this book.

Sturgeons are a very isolated group of fishes resembling sharks with a heterocercal caudal, a largely cartilaginous skeleton, and an intestine with a spiral valve. The earliest fossil sturgeon is *Protopsephurus* from the Barremian (126.5–121.4 million years ago) in the Cretaceous of China. Sturgeons are large fish with five rows of hard bony plates, no scales, four barbels, a projecting snout, and an inferior mouth forming a protrusible tube. Bony plates or scutes are more prominent in small individuals, often partly hidden under the skin in adults. Most sturgeons are anadromous, foraging in marine waters or freshened parts of seas and undertaking long spawning migrations to large rivers. Upstream

migration generally starts in late summer and is less marked when temperatures fall below a threshold. Many individuals overwinter in freshwater. The main peak of upstream migration usually occurs in early spring. The individuals returning to rivers in late summer often move and spawn further upstream than those migrating in spring. All species spawn in freshwaters in spring and summer. Spawning generally takes place in fast-flowing water, on gravel bottom. Females return to foraging areas immediately after spawning, while males often remain at the spawning grounds for many weeks, waiting for other females. Females of most species do not spawn every year. Eggs and larvae are very sensitive to low oxygen concentrations. The juveniles of anadromous species usually migrate to the sea during their first summer. All sturgeons can complete their life cycles in pure freshwater, and non-anadromous, riverine individuals or populations existed in *S. nudiiventris* and *S. gueldenstaedtii*.



Sterletus huso; Caspian Sea, Russia: ~3000 mm TL. © G. Zauner.

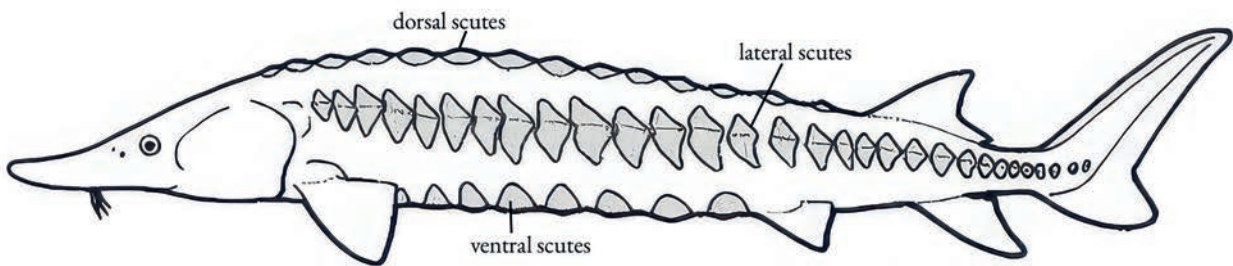
Among all Western Palaearctic fishes, sturgeons are the family most strongly impacted by human activities such as damming and overfishing. All anadromous sturgeons are now very rare in the Black Sea basin, following the impoundment of almost all spawning rivers. It is also evident that nearly all individuals found today descend from stocked juveniles produced in sturgeon farms. The last Black Sea tributaries that still support natural migrating populations are the Danube and the Rioni (Georgia). The Rioni is the key river in the Black Sea basin, home to the last populations of *S. nudiventris* (if still extant) and *S. persicus*. Despite their critical status these species are still overfished in the Rioni. The Caspian sturgeon populations are under immense pressure due to overfishing and the loss of spawning sites. It is clear that, except for *S. stellatus*, all anadromous sturgeons discussed in this book now completely depend on stocking. Overfishing at sea for meat and in rivers for caviar has resulted in their extinction. Indeed, sturgeons are a conservation success story, as most species would be completely extinct today without farming and stocking. Populations depend on stocking of juveniles from fish farms. This makes identification even more problematic as most sturgeon farms produce different hybrids. The most frequent hybrid is a cross between *S. huso* and *S. ruthenus* (called “bester”). Furthermore, non-native species such as *S. baerii* and different American species are widely produced and stocked. Fish farms in the Black and Caspian Seas used wild-caught genitors. As these are increasingly

difficult to find, farms gradually shift to in-farm spawners. It is common for *S. persicus* outside their main distribution range to be confused with *S. gueldenstaedtii* by sturgeon farmers, who often mix them with this species.

Further reading. Holčík et al. 1989a (biology, systematics); Birstein & Bemis 1997 (biology, conservation); Elvira 2000 (conservation); Pikitch et al. 2005 (conservation, fisheries); Krieger et al. 2008 (molecular phylogeny); Havelka et al. 2011 (cytogenetics); Near & Thacker 2024 (fossil); Brownstein & Near 2025 (generic concept); Kottelat & Freyhof 2025 (*Sterletus* vs. *Huso*).



Figure 28. Ventral view of head of: left, *S. persicus*, 550 mm TL; right, *S. gueldenstaedtii*, 450 mm TL.



Scute terminology in Acipenseridae. A series of scutes or bony plates partially cover the body of a sturgeon. The scutes are more prominent in juveniles and become embedded and reduced as they grow. Scutes are most deeply embedded and reduced in adult *S. huso*. Scutes are arranged in five longitudinal rows, one row along the dorsal midline between the head and the dorsal origin (dorsal scutes), one midlateral row from the head to the caudal (lateral scutes), and one row between the pectoral base and the anal origin (ventral scutes). Rhombic or star-shaped bony denticles may be present at least between the dorsal and lateral scute rows; some denticles are enlarged to form plates, especially in the posterior part of the body. These denticles are very prominent in juveniles of *S. stellatus*, *S. gueldenstaedtii*, and *S. persicus* but become relatively smaller and often deeply embedded in adults. In other species, denticles are often absent or very small. In *Acipenser sturio*, the denticles are more prominent, large, and clearly visible in adults. All scutes and denticles may be lacking in some individuals of all species.

Key to species of Acipenseridae in West Asia

1a - Gill membranes joined broadly to each other and free from isthmus; mouth very large, crescent-shaped.

.....*S. huso*

1b - Gill membranes attached to isthmus and not joined to each other and attached to isthmus; mouth small and straight.

.....2

2a - Lower lip continuous, not interrupted in middle; first dorsal scute larger than following ones, fused with head, forming an obtuse angle with head profile; barbels fimbriate.

.....*S. nudiventris*

2b - Lower lip interrupted in middle; first dorsal scute not larger than following ones; barbels fimbriate or not.

.....3

3a - 20–49 fan-shaped gill rakers terminated by several tubercles; 32–62 lateral scutes.

.....*S. baerii*

3b - 15–35 rod-shaped gill rakers; 23–50 lateral scutes.

.....4

4a - Rhombic or elongated denticles between dorsal and lateral scutes; a series of plates along posterior part of anal base; 2–4 plates along lower edge of caudal peduncle.

.....*A. sturio*

4b - Star-shaped or roundish denticles between dorsal and lateral scutes; no plates along posterior part of anal base; 0–1 plate along lower edge of caudal peduncle.

.....5

5a - Base of barbels closer to mouth than to tip of snout; snout very long (59–65 % HL), narrow, depressed.

.....*S. stellatus*

5b - Base of barbels closer to tip of snout than to mouth; snout short (22–36 % HL) and blunt.

.....6

6a - Head triangular, if seen from below (Figure 28); dorsal profiles of head and body forming an obtuse angle; belly yellowish-white; dorsum golden brown; snout short, blunt and somewhat rounded, its depth at eye about equal to or smaller than its length.

.....*S. gueldenstaedtii*

6b - Head squarish, if seen from below (Figure 28); dorsal profiles of head and body continuous; belly white; dorsum greyish-blue to black; snout elongate massive and curved downward, its depth at eye smaller than its length.

.....*S. persicus*

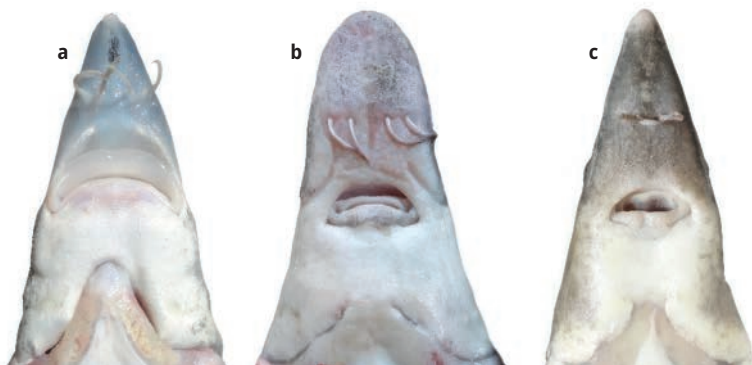


Figure 29. Ventral view of the head of **a**, *S. huso*; **b**, *S. nudiventris*; **c**, *S. ruthenus*.



Acipenser sturio; Gironde, France; ~1000 mm TL. © A. Hartl.

Acipenser sturio

Common name. Atlantic sturgeon

Diagnosis. Distinguished from species of *Sterletus* in West Asia by: ○ many rhombic or elongated denticles between dorsal and lateral scutes / ○ a series of plates along posterior part of anal base / ○ 2–4 plates along lower edge of caudal peduncle / ○ first dorsal scute fused with head / ○ 24–40 lateral scutes / ○ base of barbels midway between mouth and tip of snout or closer to mouth / ○ barbels not fimbriate / ○ 15–29 gill rakers / ○ lower lip interrupted in middle / ○ diploid. Largest documented size 6000 mm TL and 1000 kg, but today rarely exceeds 2000 mm TL.

Distribution. Only spawning river in West Asia was Rioni (Georgia). Found along all coasts of Mediterranean and Black Sea. Also, North and White Seas, and European coasts of Atlantic. Occasionally recorded from Iceland. Anadromous, in most large rivers, but not recorded from Danube upstream of delta. Currently confined to Garonne (France).

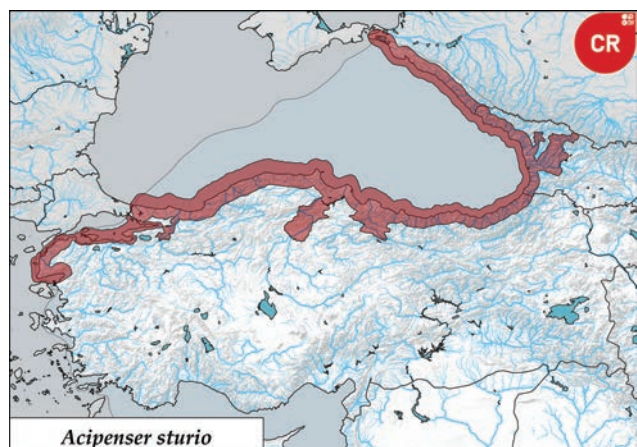
Habitat. At sea, coastal and estuarine areas on soft ground. In freshwaters, estuaries, and large rivers.

Biology. Anadromous. Males first spawn at 9–13 years, females at 11–18 years. Females spawn every other year and males every year in March–August when temperatures rise above 20°C, later in northern populations and in populations spawning further upstream. Spawning migrations peak in spring, with a secondary weak peak in late summer and autumn. Individuals migrating in late summer overwinter in rivers and spawn in spring. Spawns in strong-current habitats, in large and deep rivers, on stone to gravel bottoms. Spent individuals return directly to sea. Some juveniles migrate to sea during first summer, but most leave freshwater habitats after 2–4 years and remain at sea until

maturity. At sea, feeds on a variety of molluscs, worms, crustaceans, and small fish. Atlantic populations feed benthically, while Black Sea populations feed in pelagic zone, mainly on anchovies.

Conservation status. CR; survival appears to depend only on stocking. Decline began in 19th century or possibly earlier due to massive overfishing, damming, river regulation and pollution. Last natural spawning in 1994. Last remaining population (in France) still declining. Population in Rioni (Georgia) disappeared in late 20th century. Bycatch and accidental kills are still a major problem in France. Reintroduction programmes are underway in France and Germany.

Further reading. Holčík et al. 1989b (biology); Holčík 2000 (conservation); Elvira 2000 (biology); Bacalbasa-Dobrovici & Holčík 2000 (Black Sea population); Rochard, in Keith & Allardi 2001 (status in France); Ludwig et al. 2002 (genetics).





Sterletus baerii; aquaculture, Russia; ~700 mm TL. © A. Hartl.

Sterletus baerii

Common name. Siberian sturgeon

Diagnosis. Distinguished from other species of *Acipenser* and *Sterletus* in West Asia by: ● 20–49 fan-shaped gill rakers terminated by several tubercles / ○ lower lip interrupted in middle / ○ 10–20 dorsal scutes / ○ 32–62 lateral scutes / ○ 7–16 ventral scutes / ○ barbels not fimbriate / ○ tetraploid. Size usually up to 2000 mm TL and 210 kg.

Distribution. Siberia (from Ob to Kolyma drainages, Lake Baikal). Aquaculture has resulted in deliberate and accidental releases, especially in Caucasus. No known established populations in West Asia.

Habitat. Deep parts of large rivers with moderate to rapid currents. Spawns in main channel over stone-gravel or gravel-sand bottom in strong current.

Biology. Non-anadromous. Males first spawn at 11–24 years, females at 20–28 years (9–10 and 11–12 years, respectively, in Lena). Females spawn every 3–5 years and males every 2–3 years in May–June at 9–18°C. In Siberian part of range, there are both sedentary and migratory parts of populations. Migratory individuals feed in estuaries and migrate upstream to spawn. Before construction of dams on Ob, they migrated about 3000 km upstream. Spawning migration begins in autumn. Sedentary individuals inhabit middle and upper reaches of rivers and do not undertake long migrations. Feeds on a variety of benthic organisms, including crustaceans and chironomid larvae.

Conservation status. Non-native and not established; released for commercial fisheries or escaped from fish farms. CR in native range.

Further reading. Sokolov & Vasil'ev 1989b (biology).



Sterletus gueldenstaedtii; Volga, Russia; ~900 mm TL. © A. Hartl.

Sterletus gueldenstaedtii

Common name. Russian sturgeon

Diagnosis. Distinguished from other species of *Acipenser* and *Sterletus* in West Asia by: ○ head triangular, if seen from below / ○ base of barbels closer to tip of snout than to mouth / ○ barbels not fimbriate / ○ lower lip interrupted in middle / ○ 15–31 gill rakers / ○ 8–19 dorsal scutes / ○ 24–50 lateral scutes / ○ 6–13 ventral scutes / ○ snout short (22–36 % HL) and blunt / ○ head length 17–19 % TL / ○ many star-shaped bony denticles of various sizes between dorsal

and lateral scutes / ○ dorsum golden brown, belly yellowish white / ○ dorsal profiles of head and body forming an obtuse angle / ○ no plates along posterior part of anal base / ○ 0–1 plate along lower edge of caudal peduncle / ○ tetraploid. Size up to 2360 mm TL and 115 kg. Evidence does not support records of size up to 4000 mm TL. Subfossil specimens about 3000 mm TL.

Distribution. Caspian, Black, and Azov Sea basins.

Habitat. At sea, shallow coastal and estuarine areas. In freshwaters, deep parts of large rivers with moderate to

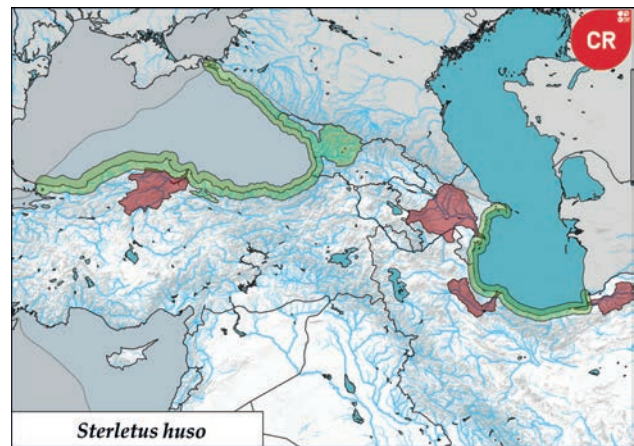
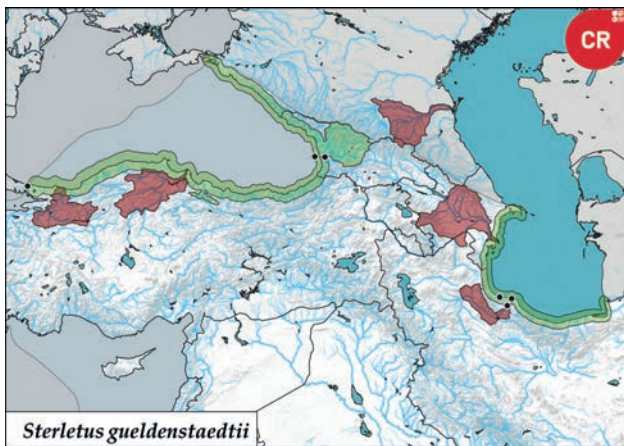
fast currents. Spawns in strong currents (1.0–1.5 m/s) in large and deep rivers on stony or gravelly bottoms.

Biology. Anadromous and freshwater populations. A complex pattern of spawning migrations includes spring and autumn runs. Individuals migrating in spring enter freshwater just before spawning, tend to spawn in lower reaches of rivers (320–650 km in unregulated Ural). Individuals migrating in autumn overwinter in rivers and spawn further upstream in spring (900–1200 km in Ural). Males first spawn at 8–13 years, females at 10–16 years. Females spawn every 4–6 years and males every 2–3 years in April–June when temperatures rise

above 10°C. Larvae drift on currents; juveniles then move to shallower habitats before migrating to sea during their first summer. Remain at sea until maturity. Feeds on a wide variety of benthic molluscs, crustaceans and small fish.

Conservation status. CR; survival appears to depend only on stocking. Very rare in Black Sea basin. Almost all spawning grounds lost due to dam construction. Heavily overfished. Caspian populations are under massive pressure from overfishing and loss of spawning habitat. Almost all migrating spawners are poached below Volgograd dam.

Further reading. Vlasenko et al. 1989a (biology).



Sterletus huso; Volga, Russia; ~1000 mm TL. © A. Hartl.

Sterletus huso

Common name. Beluga

Diagnosis. Distinguished from other species of *Acipenser* and *Sterletus* in West Asia by: ● gill membranes joined and free from isthmus / ● mouth very large, crescent-shaped / ● barbels laterally flattened / ○ 9–17 dorsal scutes / ○ 37–53 lateral scutes / ○ 7–14 ventral scutes / ○ 17–36 gill rakers. Largest documented size 8000 mm TL and 3200 kg, but generally below 5000 mm TL and 1000 kg.

Distribution. Caspian, Black, Marmara, Azov, and Adriatic Sea basins. Extirpated and actually reintroduced in Adriatic basin.

Habitat. At sea, pelagic, following food organisms. Migrates further upstream to spawn than any other sturgeon (in Danube to Germany). Spawns in strong-current habitats in main channel of large and deep rivers on rocky or gravelly bottoms. Juveniles spend first summer in shallow river habitats.

Biology. Anadromous. Males first spawn at 10–16 years, females at 14–20 years. Spawns every 3–4 years in April–June. A complicated pattern of spawning migrations includes a peak in late winter and spring and a peak in late summer and autumn. In spring, individuals migrate from sea prior to spawning. Individuals

migrating in autumn remain in river until following spring. Yolk sac larvae pelagic for 7–8 days, drifting with current. Juveniles migrate to sea during their first summer and remain there until maturity. At sea, feeds on a wide variety of fish; seals and birds have also been reported as prey.

Conservation status. CR; survival appears to depend only on stocking. Extirpated from Adriatic (1970s) and Sea

of Azov. Last populations in Black Sea basin migrate to Danube and Rioni (Georgia). All other populations almost extirpated due to overfishing and damming of spawning rivers. Occasional individuals are still recorded from Azov and Black Seas. No natural spawning in Iranian or Turkish waters. Most females recorded are in their first year of maturity.

Further reading. Pirogovskii et al. 1989 (biology).



Sterletus huso sold illegally at a roadside market close to Batumi in Georgia in 2014.



Sterletus nudiventris; aquaculture, Iran; ~750 mm TL. © K. Abbasi.

Sterletus nudiventris

Common name. Ship sturgeon

Diagnosis. Distinguished from other species of *Acipenser* and *Sterletus* in West Asia by: ● lower lip continuous, not interrupted in middle / ● first dorsal scute larger than following ones, fused with head, forming an obtuse angle with head profile / ○ barbels fimbriate / ○ 24–45 gill rakers / ○ 11–17 dorsal scutes / ○ 49–74 lateral scutes / ○ diploid. Size up to 2200 mm TL.

Distribution. Black, Azov, Caspian, and Aral Sea basins. Danube up to Bratislava, Volga up to Kazan, Ural up to Chkalov, unknown or very rare in others. Introduced in Lake Balkhash (Kazakhstan) from Syr-Darya (Aral basin) in 1960s.

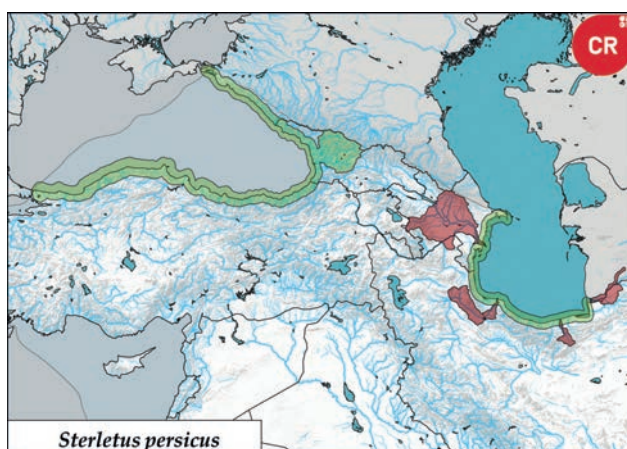
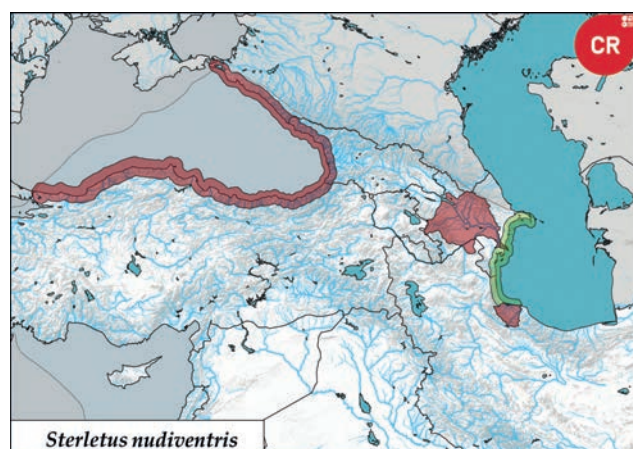
Habitat. At sea, near coasts and estuaries. In freshwater, deep sections of large rivers. Juveniles in shallow river habitats. Spawns in strong-current habitats in mainstem of large and deep rivers on stony or gravelly bottoms.

Biology. Anadromous, with some non-migratory freshwater populations. Males first spawn at 6–15 years, females at 12–22 years. Recorded life span of 36 years, but probably

much longer. Spring and autumn migrations occur in most drainages. Individuals migrating in autumn remain in river until following spring to spawn. Females spawn every 2–3 years and males every 1–2 years in March–May and at temperatures above 10°C. Most juveniles migrate to sea in their first summer and remain there until maturity. Recorded migrating 1500 km upstream in Amu Darya. Some individuals stay in freshwater for longer periods. Feeds on a wide variety of benthic fish, molluscs and crustaceans.

Conservation status. CR; survival appears to depend on stocking. Extirpated from Aral and Black Sea basins. Only occasional records from Danube, Rioni, and lower Volga. Only a very small population may remain in Ural (Russia, Kazakhstan). No natural spawning in Iran. Established in Lake Balkhash, where it forms a small population, but details are not known. Caspian *S. stellatus* introduced in Aral basin were infected by parasitic monogenean flatworm *Nitzschia sturionis*, which caused collapse of Aral population of *S. nudiventris*.

Further reading. Sokolov & Vasil'ev 1989a (biology).



Sterletus persicus; aquaculture, Iran; ~550 mm TL.

Sterletus persicus

Common name. Persian sturgeon

Diagnosis. Distinguished from other species of *Acipenser* and *Sterletus* in West Asia by: ○ head squarish, if seen from below / ○ dorsum greyish-blue to black, belly white / ○ base of barbels closer to tip of snout than to mouth / ○ barbels not fimbriate / ○ lower lip interrupted in middle / ○ snout elongate, massive and curved downward / ○ dorsal profiles of head and body continuous / ○ no plate along posterior part of anal base / ○ no plate along posterior part of anal base / ○ 0–1 plate along lower edge of caudal peduncle / ○ 15–31 gill rakers / ○ 7–19 dorsal scutes / ○ 23–41 lateral scutes / ○ 7–13 ventral scutes. Size up to 2280 mm TL and 70 kg.

Distribution. Caspian basin, most abundant in southern part. Also, in south-eastern Black Sea basin along Georgian and Anatolian coasts where it enters Rioni and previously lower Danube.

Habitat. At sea, coastal and estuarine zones. Spawns in strong-current habitats in main channel of large and deep rivers on stony or gravel bottoms. Juveniles spend their first summer in riverine habitats.

Biology. Anadromous. Males first spawn at 8–15 years, females at 12–18 years. Does not spawn every year. Spawns June–August when temperature rises above 16°C. In southern Caspian basin, spawns April–September, but

reproduction is interrupted from June to August when temperatures rise above 25°C. Most individuals migrate upstream in April–May, but some may enter rivers at other times of the year. In southern Caspian basin, there is a second run in September–October. Juveniles migrate to sea during their first summer and remain there until maturity. At sea, it feeds on a wide variety of benthic molluscs, crustaceans, and small fish.

Conservation status. CR; survival appears to depend only on stocking. Presence generally ignored; individuals often confused with *S. gueldenstaedtii*. Last spawning population migrates to Rioni in Georgia. Probably no natural reproduction anymore in Caspian basin. Has been massively stocked from artificial propagation in Iran. Recently, Iranian stocking programmes for this species have been discontinued.

Remarks. *Acipenser colchicus* has been proposed as a valid species for the Black Sea population. Molecular or other data have not supported this hypothesis, and we treat *S. colchicus* as a synonym of *S. persicus*. Similar datasets also do not support *S. persicus* as distinct from *S. gueldenstaedtii*, while these two species are always recognised as morphologically distinct, especially in the Caspian basin. Further research is needed to resolve this taxonomic issue.

Further reading. Vlasenko et al. 1989b (biology).



Sterletus stellatus; Danube, Hungary; ~1200 mm TL. © Z. Sallai.

Sterletus stellatus

Common name. Stellate sturgeon

Diagnosis. Distinguished from other species of *Acipenser* and *Sterletus* in West Asia by: ● snout very long (59–65 % HL), narrow, dorsoventrally compressed / ○ star-shaped bony denticles between rows of scutes / ○ no plate along posterior part of anal base / ○ 0–1 plate along lower edge of caudal peduncle / ○ 9–16 dorsal scutes / ○ 26–43 lateral scutes / ○ 9–14 ventral scutes / ○ base of barbels closer to mouth than to tip of snout / ○ lower lip interrupted in middle / ○ 24–29 gill rakers / ○ diploid. Size up to 2180 mm TL and 54 kg.

Distribution. Caspian, Black, Azov, and Aegean basins, ascending rivers to spawn. Introduced in Aral basin.

Habitat. At sea, in coastal and estuarine areas. Feed on bottom, usually on clayey sand, and intensively in middle and upper water layers. Spawns in strong currents in main channel of large and deep rivers, on stone or gravel bottoms. Also, spawns on flooded riverbanks; if gravel bottom is unavailable spawns on sand or sandy clay. Juveniles occupy shallow river habitats during first summer.

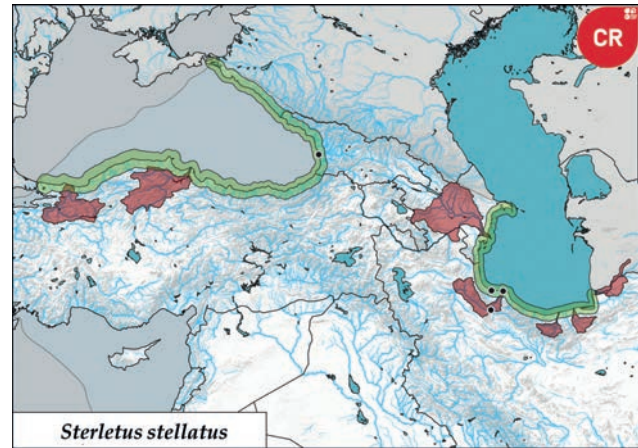
Biology. Anadromous. Males first spawn at 6–12 years, females at 8–14 years. Females spawn every 3–4 years and

males every 2–3 years in April–September. Spawns only under relatively constant hydrological conditions. Fluctuating hydrological conditions result in high egg mortality. Upstream migration with two peaks in spring and autumn. Migrates at higher temperatures and therefore later than other sturgeons. Males spend no more than 6 weeks at spawning sites, and females only 10–12 days. Spent individuals return directly to sea. Yolk sac larvae pelagic for 2–3 days, drifting with current. Juveniles migrate to sea during their first summer and remain there until maturity. At sea, feeds on a wide variety of crustaceans, molluscs and benthic and pelagic fish.

Conservation status. CR; survival appears to depend on stocking. Extirpated from Aegean Sea. In Black Sea basin, last natural populations still migrate to Danube and Rioni (Georgia), where it is heavily overfished. Very few spawners remain in rest of Black Sea basin. Large numbers were stocked from Caspian to Azov basins in 1961–1986. Caspian populations under massive pressure from overfishing and

loss of spawning grounds. Stocks are rapidly declining. Almost all migrating spawners poached below Volgograd dam.

Further reading. Shubina et al. 1989 (biology); Economidis et al. 2000 (Aegean Sea).



Rioni in Georgia. One of the last spawning sites of sturgeons left in West Asia.