

Family Alosidae

True shads

Four genera are placed in this family: *Alosa*, *Brevoortia*, *Sardina*, and *Sardinops*. Only *Alosa* enters freshwaters in West Asia. *Sardina pilchardus* is a common species in the Mediterranean and Black Seas and is occasionally found in estuaries. It is not known to enter freshwater habitats regularly and is therefore excluded from the coverage of this book. *Alosa* are anadromous or form landlocked populations in the Atlantic, the Mediterranean, Caspian, and the Black Sea basins. Six species occur in North America. In the Caspian basin, three species, *A. braschnikowii*, *A. saposchnikowii*, and *A. sphaerocephala*, are fully marine and do not enter freshwater habitats. Caspian *A. caspia* and Black Sea *A. maeotica* regularly occur in coastal regions of Limans and river estuaries but only regionally and rarely enter freshwater regions to spawn. Only Caspian *A. kessleri* and *A. volgensis*, as well as Black Sea *A. immaculata*, are anadromous and migrate longer distances upriver. Black Sea *A. tanaica* and widespread *A. agone* regularly enter lower regions of rivers and freshened coastal lakes. *Alosa volgensis* from the northern Caspian basin may have occurred in the waters of the southern Caspian Sea. Still, this species was never identified from the region and went extinct in the 20th century.

Shads are very sensitive to environmental impacts such as impoundment, water pollution, and overfishing. Most anadromous species have sharply declined during the 20th century. Species undertaking long upriver migrations, such as *A. immaculata* and *A. kessleri*, are very vulnerable as most of their original spawning sites are no longer accessible, their spawning migrations being interrupted by dams and other alterations in river morphology. The status of species or populations spawning in the sea and lower stretches of rivers is better, as they can often find spawning habitats below dams.

The systematics of shads need critical review, and molecular data suggest that all Ponto-Caspian species are very closely related or frequently have been the victims of introgressive hybridisation. The Ponto-Caspian shads may form a recently evolved “species flock,” as it is known from cichlids in East Africa. Several subspecies and “forms” have been described from the Black and Caspian Seas, and their status needs to be revised based on the basis of adequate fresh material and molecular characters. **Further reading.** Berg 1949b (diversity, biology); Whitehead 1985 (diversity); Holčík 1986 (diversity, biology, distribution).

Keys to species of *Alosa* in freshwaters of West Asia

Caspian basin

- 1a - 59–92 gill rakers, shorter than branchial filaments.
.....*A. kessleri*
- 1b - 70–180 gill rakers, about as long as or longer than branchial filaments.
.....2
- 2a - Head length 23–26 % SL; 99–105 gill rakers, about as long as or longer than branchial filaments, with well-developed spines.
.....*A. volgensis*
- 2b - Head length 25–28 % SL; 70–180 gill rakers, long and close together; 1.5–2 times longer than branchial filaments in individuals larger than 150 mm SL, without spines.
.....*A. caspia*

Mediterranean and Black Sea basin

- 1a - Teeth on palatine and vomer absent or poorly developed.
.....2
- 1b - Teeth on palatine and vomer well developed.
.....3
- 2a - Teeth on palatine and vomer poorly developed; 66–96 gill rakers, longer than branchial filaments.
.....*A. tanaica*
- 2b - No teeth on palatine; 28–50 gill rakers (rarely up to 60) about as long as branchial filaments in individuals larger than 220 mm SL.
.....*A. agone*
- 3a - 36–69 gill rakers, longer than branchial filaments.
.....*A. immaculata*
- 3b - 29–39 gill rakers, about as long as branchial filaments.
.....*A. maeotica*



Alosa agone; lower Elbe, Germany; ~200 mm SL.

Alosa agone

Common name. Twaite shad.

Diagnosis. Distinguished from other species of *Alosa* entering freshwater in Black Sea and Mediterranean basins by:
 ○ 28–50 gill rakers, rarely up to 60 / ○ length of gill rakers equal to length of branchial filaments in individuals longer than 220 mm SL / ○ no teeth on palatine / ○ dorsal profile curved / ○ usually a series of 4–8 black blotches behind gill opening (sometimes a single blotch). Size up to 500 mm SL.

Distribution. Mediterranean basin and rarely in northern Black Sea, occasionally east to Crimea. Southern Baltic east to Nemunas in Lithuania, North Sea north to Bergen, Atlantic coasts from Scotland and Ireland to Morocco. Before dams migrated from Drin to Lake Ohrid.

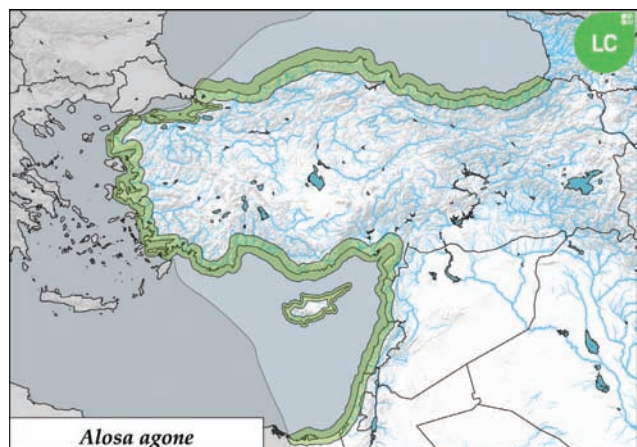
Habitat. At sea, pelagic. Juveniles stay close to shore and estuaries. Migrates from sea to rivers, spawning in main rivers often only a few kilometers above brackish water limit but used to ascend Rhône for 600 km and Nemunas for 400 km before construction of dams. In West Asia only known from lowermost rivers. Spawns in large rivers. Also reported in small rivers above gravel beds.

Biology. Anadromous. Males migrate upstream at 2–3 years, females at 3–4 years. Many individuals spawn for 3–4 seasons. Adults congregate near estuaries in April and enter rivers when temperatures reach 10–12°C, mainly in May–June. Spawning begins when temperatures reach about 15°C or higher in May–June. Spawns in large, very noisy schools near surface after midnight. Eggs sink to bottom or are pelagic. Spent fish migrate back to sea. Most juveniles migrate to estuary during their first summer and move to sea at end of second year, where most remain until maturity. Individual fish are thought to return to their natal spawning grounds. Northern distribution appears to be limited by water temperature. At sea, feeds mainly on crustaceans and small fish. Adults do not feed in freshwater. Juveniles feed on planktonic crustaceans.

Conservation status. LC; very locally distributed, a victim of pollution and damming of major rivers. Most populations declined in early 20th century but appeared to have stabilised at low levels since then.

Remarks. Up to seven subspecies of *A. fallax* have been recognised, several of which were treated as species until recently. Molecular studies using a variety of markers have identified two major groups of populations. One is widespread in northern Europe, the Atlantic, and the westernmost Mediterranean basin (*A. fallax*), and a second is found in the Ebro (Spain) across the northern Mediterranean basin to the east (*A. agone*). This is the one that is also found in West Asia. The molecular differences are very small, comparable to intraspecific differences in many other species. In addition, morphological differences are vague and focus on average gill raker numbers, which overlap widely between different “species”. We treat all populations of former *A. fallax* as *A. agone*, which has priority over *A. fallax*, which becomes a junior synonym.

Further reading. Quignard & Douchement 1991 (biology); Kottelat 1997 (systematics); Bianco 2002 (biology).





Alosa caspia; Caspian Sea, Iran; ~200 mm SL.

Alosa caspia

Common name. Caspian shad.

Diagnosis. Distinguished from other species of *Alosa* in Caspian basin by: ● head length 25–28 % SL / ○ eye diameter 19–24 % HL / ○ pectoral length 16–18 % SL / ○ teeth on palatine and vomer poorly developed / ○ 70–180 gill rakers, long, and close together, 1.5–2 times longer than branchial filaments in individuals longer than 150 mm SL. Size up to 280 mm SL.

Distribution. Caspian Sea, from where adults occasionally ascend the lowermost part of rivers and migrate a short distance upstream to spawn.

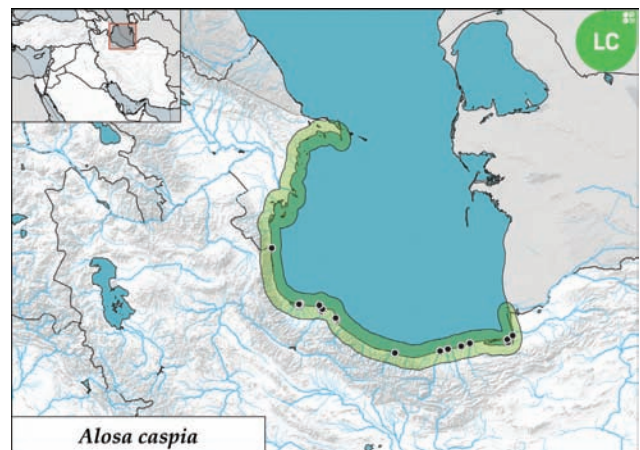
Habitat. At sea, pelagic, in coastal waters with steady currents, avoiding areas of stable salinity. Migrates from sea to mouths of large rivers, spawns in fresh or slightly brackish water in shallow areas washed by large river currents.

Biology. Anadromous. Males migrate upstream at 2–3 years, females at 4–5 years. Many individuals spawn in 2–4 seasons. Two migration peaks, one in late April (mostly males) and one in early May (mostly females), enter rivers when temperature rises above 10°C. Spawns when

temperature reaches 15°C or more, in May–June. Spawns usually in upper 3 m. Eggs semipelagic and demersal. Spent fish return to sea. Juveniles migrate to sea during their first summer and remain at sea until maturity. At sea feeds mainly on zooplankton such as copepods and mysids.

Conservation status. LC; widespread.

Further reading. Heckman 1991a (biology).





Alosa immaculata; South Bug, Ukraine; 217 mm SL.

Alosa immaculata

Common name. Large Black Sea shad.

Diagnosis. Distinguished from other species of *Alosa* entering freshwater in Black Sea basin by: ● 36–69 gill rakers, longer than branchial filaments / ○ teeth on palatine and vomer well developed. Size up to 350 mm SL.

Distribution. Black and Azov Seas, from where adults ascend rivers and migrate far upstream to spawn. Presence in Marmara basin questionable. Present in Rioni, but distribution in northern Anatolia poorly known. Used to ascend Danube for about 1600 km to Mohacs (Hungary), Don for 900 km to Oust-Medveditskaya, Dniepr to Kyiv, Dniester to Yampol, and South Bug to Voznessensk. Reported to spawn in Kuban below Krasnodar dam since 1983. A landlocked population occurs in Don.

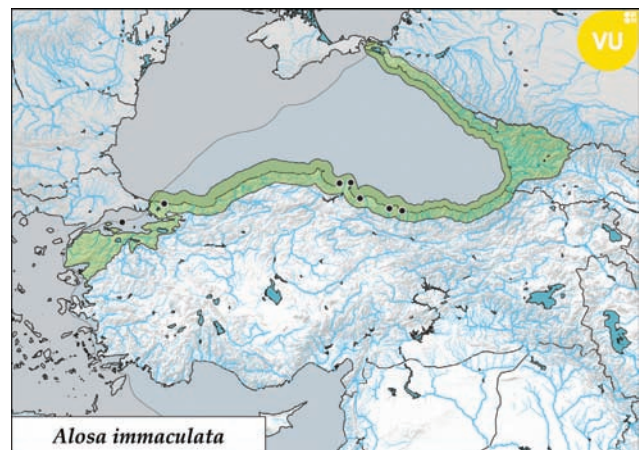
Habitat. At sea, pelagic, in deep water. Migrates to middle reaches of large rivers, spawning where current is strongest, near surface, usually at 2–3 m depth in main channel.

Biology. Anadromous, migrating upstream to spawn at three years, rarely earlier. Few individuals spawn two seasons. Appears along coast in March–April, enters rivers when temperatures reach about 6–9°C between late March and late April. Migration usually peaks in May. Spawning begins when temperatures rise above 15°C in April–August. Spawns usually in afternoon (1–8 pm), eggs pelagic. Spent

individuals return to sea to feed. Juveniles inhabit floodplain and shallow riverine habitats, migrating to sea or estuarine habitats during first summer; move to sea in autumn and remain there until maturity. At sea, it feeds on a wide variety of zooplankton (especially crustaceans) and small fish.

Conservation status. VU; damming of major rivers significantly reduced available spawning habitat and migration routes in 20th century. Decline appears to be continuing due to severe overfishing. Largest population in Danube.

Further reading. Kolarov 1991b (biology; as *A. pontica*); Kottelat 1997 (systematics).



Alosa kessleri

Common name. Black-back shad.

Diagnosis. Distinguished from other species of *Alosa* in Caspian basin by: ● dorsum black in spring / ● teeth on palatine and vomer well developed / ○ 59–92 thick gill rakers, shorter than gill filaments, with conspicuous lateral spines in juveniles but lost in adults / ○ head length 22–25 % SL / ○ eye diameter 15–20 % HL / ○ pectoral length 14–16 % SL. Size up to 400 mm SL.

Distribution. Caspian Sea from where adults ascend Kura and Aras (Azerbaijan) and Sefid (Iran). Possibly also in other rivers. In European Caspian basin, in Volga, few enter Ural and Terek. Previously migrated Volga upstream to Kama and Oka systems. Migration now blocked by Volgograd Dam. There is evidence that it has formed landlocked populations in Volga reservoirs.



Alosa kessleri; Volga delta, Russia; ~300 mm SL.

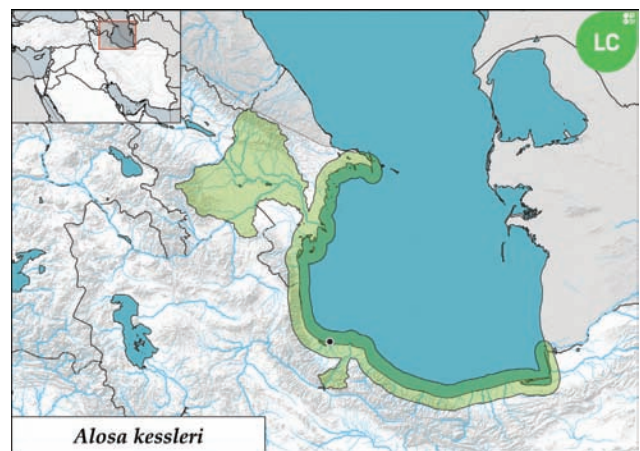
Habitat. At sea, pelagic, in a wide variety of habitats. Migrates to middle reaches of large rivers, spawning near banks in main channel and in almost still waters such as river bays, eddies, and floodplains.

Biology. Anadromous. Migrates upstream to spawn at 4–5 years. Enters rivers with immature gonads. Some spawn for 2–4 seasons, but most females die after spawning. Spawners appear along coast in March–April and enter rivers in April–May when temperatures reach about 9°C, peaking at 12–15°C. Spawning run originally lasted 30–50 days. Spawning begins in May–August when temperatures rise above 15°C and continue as long as temperatures remain at 15–23°C. Spawning is most intense between 4 and 10 pm. Eggs are bathypelagic. Spent fish return to sea to feed. In autumn, move to southern part of sea to overwinter. Juveniles migrate to sea or estuaries during their first summer until maturity. At sea, feeds on a wide variety of zooplankton, crustaceans, and small fish.

Conservation status. LC; damming of major rivers in 20th century has significantly reduced available spawning

habitat and migration routes and heavily fished, especially on Volga, where largest population exists. Populations in West Asia small, most abundant in Kura and Sefid.

Further reading. Heckman 1991b (biology).



Alosa maeotica; Black Sea, Romania; ~250 mm SL.

Alosa maeotica

Common name. Azov shad.

Diagnosis. Distinguished from other species of *Alosa* entering freshwater in Black Sea basin by: ● 29–39 gill rakers, about as long as branchial filaments / ○ teeth on palatine and vomer well developed. Size up to 280 mm SL.

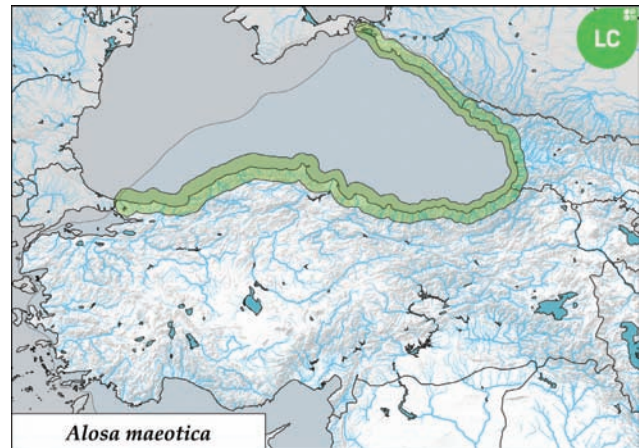
Distribution. Black Sea and Sea of Azov, from where adults enter coastal lagoons to spawn.

Habitat. At sea, pelagic in deep waters, entering brackish lagoons to spawn.

Biology. Spawns first time at 2 years. Many individuals spawn in 2–4 seasons. In Romania, spawners enter Lake Razelm at about 7°C in March. Spawning begins at about 15°C in late April–June. Eggs sink to bottom. Spent fish return to sea to feed. In autumn, migrates to southern Black Sea to overwinter. Juveniles migrate to sea or remain in estuaries during first summer. Feeds mainly on small fish and crustaceans.

Conservation status. LC; still common in coastal lagoons.

Further reading. Kolarov 1991a (biology).



Alosa tanaica; Lake Razelm, Romania; ~160 mm SL.

Alosa tanaica

Common name. Little Black Sea shad.

Diagnosis. Distinguished from other species of *Alosa* entering freshwater in Black Sea basin by: ● 66–96 gill rakers, longer than branchial filaments / ● teeth on palatine and vomer poorly developed. Size up to 200 mm SL.

Distribution. Black and Azov Seas, from where adults ascend rivers and migrate a short distance upstream to spawn. Inland populations in Anatolian lakes of Sapanca, Apolyont, and Manyas.

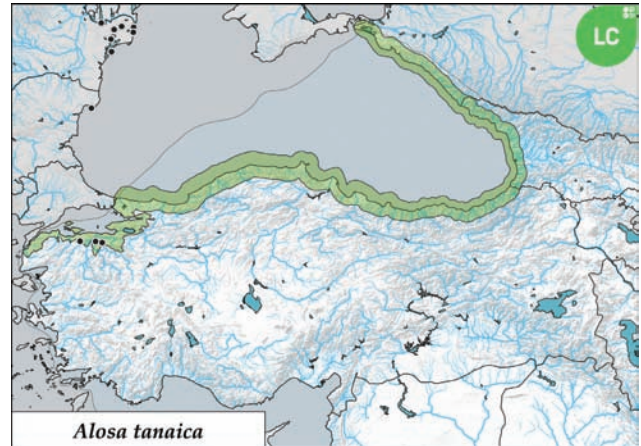
Habitat. At sea, pelagic, in deeper layers (50–70 m) of coastal waters. Migrates from sea to estuaries and lower reaches of large rivers, spawns in fresh or slightly brackish water, usually close to shore, in upper 2–4 m, in almost still waters such as floodplains or lakes.

Biology. Anadromous. Migrates upstream at 1–2 years. Many individuals spawn in 2–4 seasons. Spawners appear along coast in late January–March, enter rivers when temperature reaches about 10°C, late April–May. Spawning begins when temperature reaches about 15°C or higher in May–June. Eggs are bathypelagic or sink to bottom. Fry migrate to estuaries and coastal lagoons or to sea near estuaries to feed. In autumn, move to sea to overwinter. Juveniles migrate to sea or estuaries during first summer until they reach maturity. At sea, feed on a wide variety of zooplankton (crustaceans) and small fish.

Conservation status. LC; most populations declined in early decades of 20th century due to pollution. Seems to have stabilised at moderate levels since then. Situation in West Asia needs to be better known.

Remarks. Landlocked populations in Türkiye have not been studied for many years and might have vanished. They need a critical review.

Further reading. Mogil'chenko 1991 (biology); Kottelat 1997 (systematics).



Clupeiform fishes support small scale fisheries all over their range.