

Will These Fish Invade North America?

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Scientists at Buffalo State College translated Russian research on life requirements of 42 Ponto-Caspian fish and used this new information to predict the invasion (*risk*) potential of these fish species to North America.

Like invasive species already established in North America, many of the fish species examined in this study have invaded many parts of Europe via human activities such as canal construction, shipping, bait and the aquarium trade — often with serious impacts on native species. Species with broad salinity tolerances make them candidates for successful ballast transport to new areas.

Ten species, **Black Sea Kilka**, **Caspian Sea Sprat/Kilka**, **Eurasian Perch**, **Eurasian Minnow**, **Big Scale Sand Smelt (aka Black Sea Silversides)**, **Black Sea Shad**, **Black Striped Pipefish**, and three gobies: **Monkey Goby**, **Volga Dwarf Goby** and **Caspian Big-head Goby** — were identified by the research team with some potential to invade North America. These species have a proven track record for their ability to establish, spread and have negative impacts where they invaded in Europe. These species can tolerate a range of different salinities, suggesting they have potential to survive ballast water transport to North America, depending on the effectiveness of ship ballast exchange with sea water. The invasive potential of the 10 species is predicted to be **high** for four species, **moderate to high** for one species, **moderate to low** for three species and **very low** for two species based on their abilities to tolerate different salinity levels. Sea water has a salinity of about 34 ppt or parts per thousand. For comparison, the *maximum* salinity tolerances of the 10 species are in the chart below.

Invasion Risks* Based on Maximum Salinity Tolerances of the 10 Fish Species			
(*Risk = likelihood of surviving ballast water exchange)			
● High Risk	● Moderate to high	● Moderate to low	● Very low
> 28 ppt for all life stages	> 28 ppt for adults only > 14 to < 28 ppt for eggs/juveniles	> 14 to < 28 ppt for all life stages	12-14 ppt for all life stages



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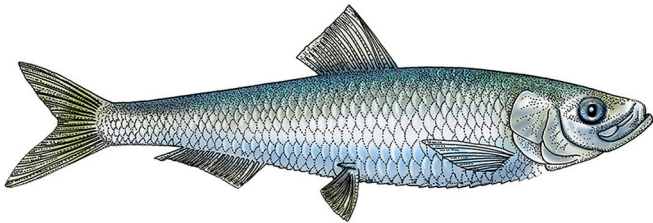
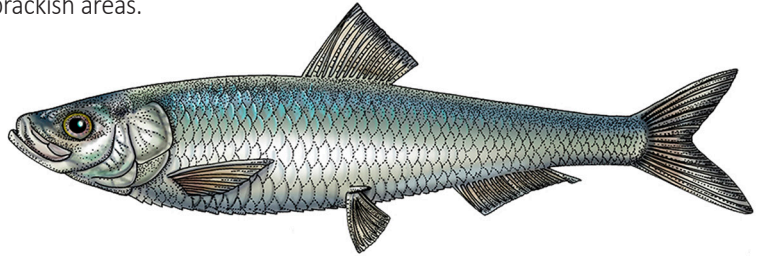
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What do we know about these 10 potentially invasive fish species?

Species names are color coded: **Red** for high, **orange** for moderate to high **green** for moderate to low and **blue** for very low invasion risk.

Black Sea Sprat/Kilka, *Clupeonella cultriventris*

- Like other “herrings”, school in open waters of rivers, lakes and brackish areas.
- Spawns in freshwater, can acclimate to freshwater existence.
- Food: zooplankton, freshwater shrimp and small fish.
- May compete with larval fish for food.
- Use canals/streams to invade lakes, rivers and reservoirs.
- “Crowd out” native fish, especially smelt and whitefish.
- Grow to 5-6”, live 3-6 years.
- Produce 30,000 to over 100,000 eggs per female.

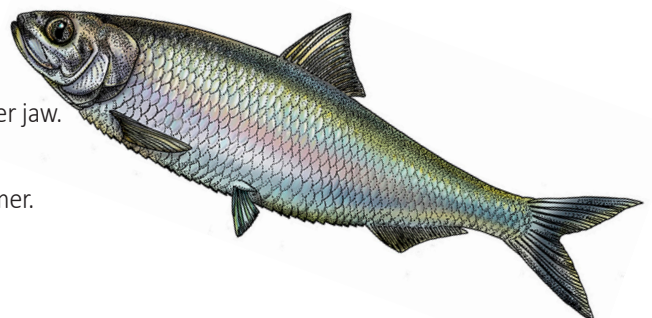


Caspian Sea Kilka, *Clupeonella cultriventris caspia* or *Clupeonella caspia*

- More common in the Caspian Sea area.
- Prefers higher salinities than Black Sea Kilka.
- Very similar to the Black Sea Kilka in form and habits.
- Slightly shorter (3%) pectoral and pelvic fins than Black Sea Kilka.
- Either a subspecies of the Black Sea Kilka or a separate species.
- Found as much as 40 miles upstream in rivers that flow into the Caspian Sea.
- Produce 120,000 - 130,000 eggs.

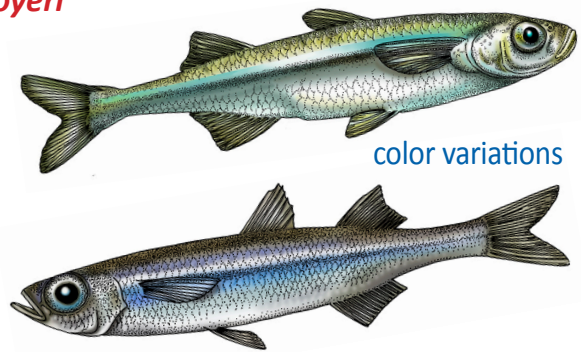
Black Sea Shad, *Alosa maeotica*

- Native to open waters of the Black Sea, highest salinity tolerances **only** as adults.
- Alewife relative, but schools in cooler, deeper water.
- Teeth well-developed.
- Similar to the two Kilka species, but has a notch in upper jaw.
- Food: small fish, freshwater shrimp.
- Spawns in freshwater during the spring and early summer.
- Generally 6-8” in length.
- Produce 20,000 - 300,000 eggs.



Black Sea Silverside or Big Scale sand smelt, *Atherina boyeri*

- Not a true smelt; related to native silversides in the Great Lakes.
- Broad salinity range from freshwater to full strength sea water.
- Tolerates a wide range of temperatures from 32° to high of 80° F.
- Forms dense schools in still or slow flowing water over vegetation.
- Food: worms, mollusks, fish larvae, larval insects, small zooplankton.
- Reduce zooplankton density to low levels.
- Matures early, batch spawner; March to October; 700 - 1800 “hairy” eggs.
- Max size 3”.



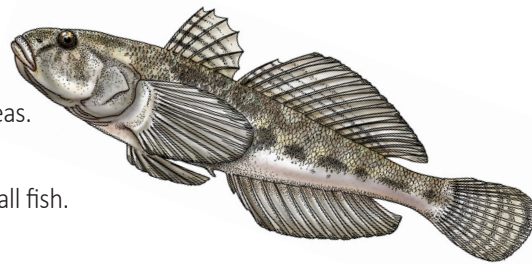
Black-striped pipefish, *Syngnathus abaster*

- Seahorse relatives; long, slender body encased by bony rings.
- Inhabits Caspian, Black and Mediterranean Sea Basin, fresh to salt water.
- History of invading many inland reservoirs.
- Males incubate eggs in external brood pouch under the tail.
- Anchors to submerged vegetation using tail to ambush prey.
- Food (suction tube mouth): larval fish, bottom dwelling invertebrates.
- Can produce several broods of young over the year (spring to fall).
- Lives up to 4 years, reaching 8”.



Monkey Goby, *Neogobius fluviatilis*

- Lives in rivers, estuaries, nearshore in lakes in sandy bottom areas.
- Tolerates fresh and brackish water.
- Food: snails, clams, worms, aquatic insect larvae, tadpoles, small fish.
- Forms dense schools; populations can double within one year.
- Can invade new areas via canals and upstream of rivers and streams.
- Batch spawners, producing 3000 to 12,000 adhesive eggs.
- May interbreed with round gobies, faster growing (up to 8”).



Volga dwarf goby, *Hyrcanogobius bergi*

- Like other gobies, tolerant to both fresh and brackish waters.
- Lives in open waters nearshore of lakes and river mouths.
- Food: small invertebrates in muddy and sandy areas.
- Usually live only one year, grow to 1.5”.
- Females produce up to 1400 eggs in 2-3 batches.
- Spawns in muddy bottomed areas with clam and mussel shell beds.
- Semitransparent with brownish dots on upper body and head.

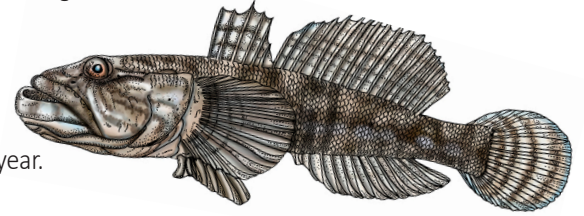


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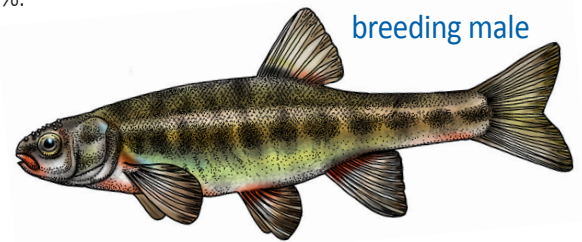
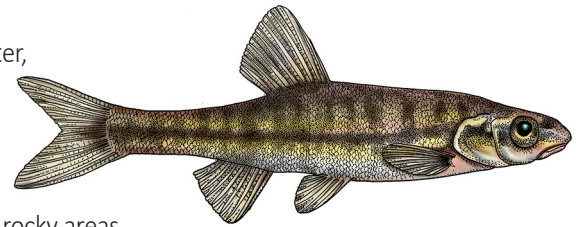
Caspian Big-head goby, *Ponticola (Neogobius) gorlap*

- Lives in rivers, estuaries, inshore areas of lakes with rocky, sand or vegetated bottoms.
- Can also migrate upstream in currents of around 12 ft/sec.
- Food: scuds, worms, small fish including young gobies.
- 2-3 years lifespan, reaching 3-6" in length.
- Females mature at age 1 and can produce over 3000 eggs per year.
- Spawning occurs in the spring over rocky bottomed areas.
- Broad head, protruding bottom jaw.



Eurasian Minnow, *Phoxinus phoxinus*

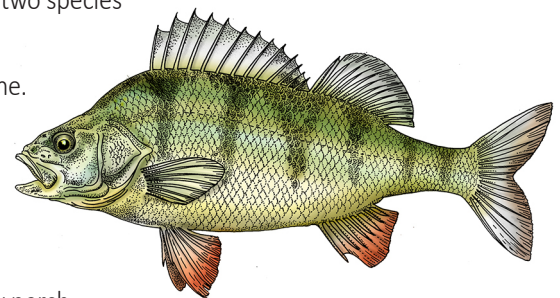
- Despite predicted (very low) survival in exchanged ballast water, still a potential from other invasion pathways (i.e. bait or aquarium trade).
- Used as bait species, forage fish, sold in the aquarium trade.
- Prefers cold, well oxygenated streams, rivers, lakes in shallow rocky areas.
- Compete with young trout; can reduce trout abundance by 35%.
- Food: algae, plant debris, aquatic insects, and mollusks.
- Variable living strategy from one population to another.
- Can adjust by changing population life spans, growth rates, egg production.



breeding male

Eurasian or European Perch, *Perca fluviatilis*

- Despite predicted (very low) survival in exchanged ballast water, still a potential from other invasion pathways (i.e. aquarium trade).
- Very similar to native yellow perch in body form and habitats; the two species may interbreed.
- Only noticeable difference: arrangement of small bones along spine.
- Both species reproduce in freshwater.
- Lives in lakes and some mildly brackish areas (up to 10-12 ppt salinity).
- Food: invertebrates and fish.
- More tolerant to productive, nutrient enriched waters than yellow perch.



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