

Alaska's Lampreys

Lampreys (Family *Petromyzontidae*) belong to the group Agnatha, which, according to the fossil record, are thought to be the oldest fishlike animal.

There are about 40 species of lamprey that exist in the world, three of which can be found in Alaska, with some debate regarding taxonomy of some species that have different names according to their freshwater or anadromous forms. Lampreys have elongate, cylindrical bodies tapering to the tail. The dorsal fins begin at mid-body and are long and notched creating two sections of the fin, which connect with the caudal or tail fin. They have jawless, cylindrical to oval shaped mouths that are used for sucking, and they have seven gill openings on both sides of the head. Lampreys lack paired fins and vertebrae. Lamprey species are distinguished most easily by their teeth.



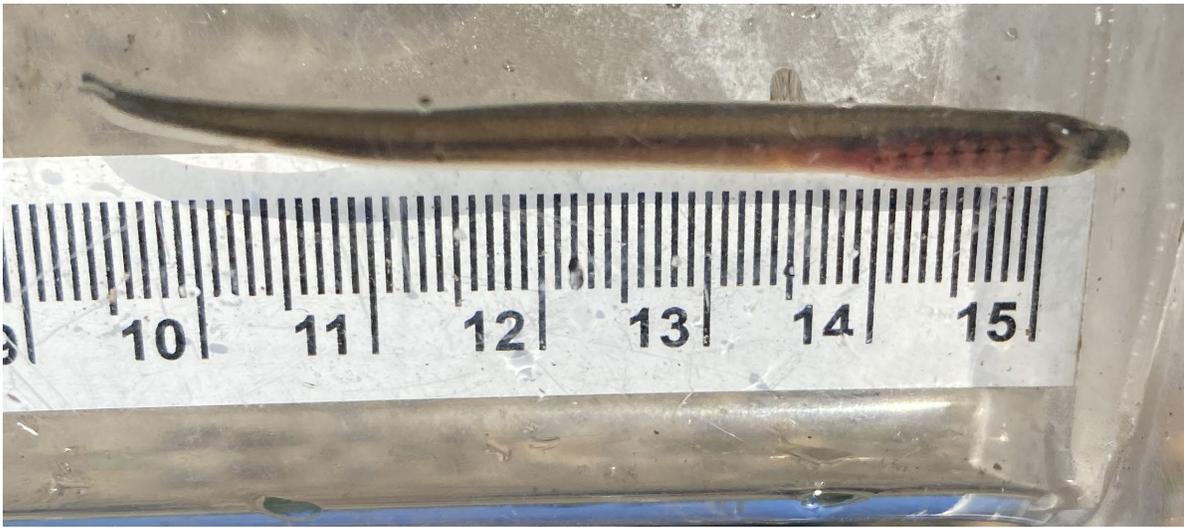
In Alaska, lamprey can exhibit two life histories, or ecotypes. Anadromous ecotype lampreys spend their juvenile lives in saltwater and, upon maturing, cease feeding and move to freshwater to spawn. The second ecotype is a freshwater species that completes its life cycle entirely in fresh water. It is thought that freshwater species evolved from anadromous forms. Regardless of ecotypes, the eyeless, filter-feeding, burrowing larval stage is universal among all extant lamprey species.

Life history: Some lampreys spawn in the spring after spending several months (if anadromous) moving to the cool, clear headwaters of streams to make their nests. Both males and females create these nest pits in stream riffles by removing small rocks with their mouths and fanning smaller particles with their tails. A male and female deposit sperm and eggs, simultaneously while intertwined, into the nest. A female (size dependent) can release several thousands of eggs, even up to 100,000 for some species. Shortly after the eggs are fertilized, the adults die.



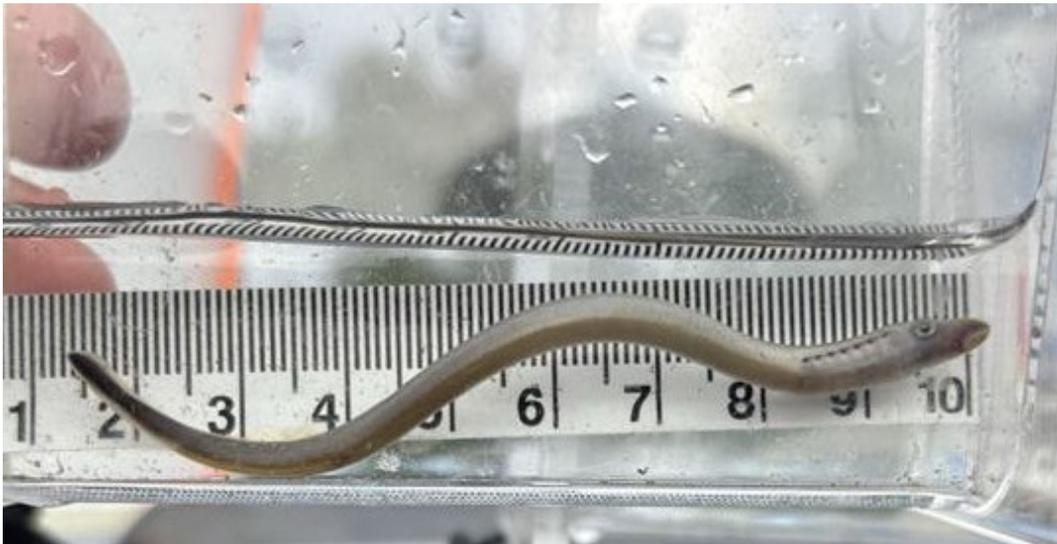
Pacific Lamprey building a nest on the Gulkana River. Photo credit: Nate Cathcart, ADF&G.

It takes one to two weeks for the eggs to hatch into larvae and another couple weeks before the larva emerge from the nest, drift downstream in the current, and eventually settle in low velocity, fine sediment habitats. Larval lampreys are eyeless, lack sucking mouthparts, and can grow to about eight inches. They burrow into the silt, sand or mud of shallow pools and eddies of clear streams and feed by filtering mostly detritus (and some algae or microorganisms) from the water. Anadromous lampreys may remain at this stage for two to seven years (or more!) and then during the fall they metamorphose into juveniles, which involve morphological and physiological changes, such as the development of a sucking mouth, sharp teeth, and eyes.



Larval Pacific Lamprey from the Gulkana River. Photo credit: Nate Cathcart, ADF&G.

Juvenile anadromous lampreys of Alaska can be parasitic or predatory. Parasitic lampreys, such as Pacific Lamprey, feed on fish and whales, using their sucking mouthparts to attach themselves to the body of their host. They use their teeth to cut through the scales and skin to get to the blood and body fluid and do not necessarily kill their host. Predatory lampreys, like the Arctic Lamprey, use their teeth to attach and shred smaller fishes, killing them and consuming them. Parasitic lampreys are usually anadromous and spend about one to seven years at sea before returning to fresh water to spawn. Some anadromous lampreys return to fresh water in the fall and over-winter until spring when they spawn. Once they begin their migration to streams, lampreys do not feed. Migrating lampreys tend to move in large groups. They sometimes rest on the way by attaching themselves with their sucking mouth to rocks and boulders along the stream bottom.



Juvenile Arctic Lamprey from the Little Susitna River. Photo credit: Nate Cathcart, ADF&G.

Nonparasitic lampreys, such as the freshwater resident forms of Arctic Lamprey (e.g., Alaska Brook Lamprey) or Western River Lamprey (formerly Western Brook Lamprey) do not enter a juvenile feeding stage and transform into adults to spawn and die. They live off the energy reserves acquired as larvae. Non-anadromous lampreys spawn in the spring following metamorphosis into the adult form.

Ecology: Lampreys are an important contributor to aquatic foodwebs. Besides the juveniles attaching itself to a host body to feed on its blood and body fluid, the larval and adult forms of lampreys are also important nutrient processors and sources. The larvae feed on particles that are too small for some organisms and process them into larger forms due to their reduced ability to digest these materials. Filter feeding organisms, such as invertebrates, can then utilize the nutrients.

Like salmon, lampreys also move marine-derived nutrients to freshwater systems after they die following migration and spawning. The decomposing body provides food to scavenging organisms and releases nutrients into the water.

Lampreys are prey for many animals. Larval lampreys are eaten by fish such as Sheefish, Northern Pike, and Burbot, and mammals, like otters, when they are disturbed from the silt or mud. When they are outmigrating to the ocean, juveniles are targeted by gulls and larger fish, including popular sport fish such as Rainbow Trout and Dolly Varden. Adults are eaten by marine mammals as they congregate at river mouths and once in rivers, larger fish, mammals such as mink, and birds (such as gulls) eat lamprey as they migrate upriver in large groups. In southcentral Alaska, the invasive population of Northern Pike has contributed to declines in Pacific salmon and is also consuming both Arctic and Pacific lampreys – from larvae to adults.



Mew Gull with lamprey from a stream on the Kenai Peninsula. Photo credit: George Kirsch.



Invasive Northern Pike with an adult Pacific Lamprey in its gut. Photo credit: Parker Bradley, ADF&G.

Human Use: People have been utilizing lampreys for food and bait for a long time. The larvae are used for burbot bait and are harvested by digging in the silt and mud of streams during summer. Native Americans from Washington and Oregon have subsisted on lampreys. There are also some accounts of Alaskan natives around the Yukon River basin catching lampreys for food. Lampreys have rich, fatty flesh like salmon (but have a higher percentage of fat content than salmon) that is usually dried, smoked, or canned. Some people along the Yukon River have harvested Arctic Lampreys in commercial fishing seasons. Along with selling the lampreys to a small market in Asia or for bait, the fishers agreed to provide information and specimens to help further understand the distribution, abundance and general biology of lampreys.

Arctic Lamprey: Arctic Lampreys (*Lethenteron camtschaticum*) are the most common lamprey in Alaska. They range from the Arctic coast to the Kenai Peninsula, up the Yukon River into the Yukon Territory in Canada, in the Kuskokwim and Tanana river drainages. They are most commonly anadromous and predatory, but it is hypothesized that the Alaskan Brook Lamprey is the nonparasitic, freshwater resident ecotype of the Arctic Lamprey. They remain as larvae for one to four years (less if anadromous, more if freshwater resident) before they metamorphose into the juveniles if anadromous or adults if freshwater. The adult's upper body appears blue-black to dark brown, their lower body yellow to light brown, and have light tan to gray fins. A dark blotch is also found on the posterior dorsal fin (the lobe closest to the tail) and the tail. Adult Arctic lampreys are typically five to 15 inches long.

With genetic knowledge and a better understanding of different life histories of the same species, it is generally thought that the Alaskan Brook Lamprey (*L. alaskense*) is a derivative of the Arctic Lamprey in the same way a Rainbow Trout can have a freshwater form as well as an anadromous form called steelhead. The freshwater form is located in a few areas of Alaska, including on the Alaska and Kenai peninsulas and in the Chatanika and Chena rivers. They are a nonparasitic, freshwater species that are gray-brown on the back and white underneath with a dark blotch on the second dorsal fin and a dark tail. They have blunt teeth and measure five to seven inches as adults. They spawn in spring and summer in shallow areas of streams and sometimes lakes. After spending four years as larvae,

these lampreys metamorphose to adults in the fall and spawn the following spring.



Juvenile Arctic Lamprey from a stream in the Porcupine River drainage. Photo credit: Nate Cathcart, ADF&G.

Pacific Lamprey: Pacific Lampreys (*Entosphenus tridentatus*) are found in freshwaters from the Kuskokwim River south to California (historically in Mexico). They are an anadromous, parasitic species that are blue-black to dark brown on the upper body and a pale or silver lower body, while the fins are a dusky color. During spawning, they can appear to be reddish brown. Pacific Lampreys regularly reach 15 to 28 inches long as adults, which are much larger than the other species of lamprey in Alaska. They remain as larvae for three to eight years, though some places have recorded larval ages reaching 15 years, at which time they metamorphose into juveniles and move to the sea. They feed at sea for about a year and half (though upwards of seven!), then may return to fresh water in the fall before spawning in the spring or they may spawn immediately after their migration that summer and die.



Pacific Lamprey from the Kuskokwim River. Photo credit: Jay Baumer and Chad Bear, ADF&G.

Western River Lamprey: Western River Lamprey (*Occidentis ayresii*, formerly *Lampetra ayresii*) are rare in Alaska. All sightings of this species have been in the southeastern portions of the state near Juneau south to California. They are anadromous and parasitic with dark yellow-brown to silver gray or blue-black upper bodies and silver to white lower bodies. They have yellow fins and the tail has a dark gray blotch. They are typically five to 12 inches long as adults.

Similar to the Arctic Lamprey species complex that contains the freshwater ecotype called the Alaskan Brook Lamprey (for now), Western River Lamprey has a freshwater ecotype previously referred to as Western Brook Lamprey (formerly *Lampetra richardsoni*) are brown, olive or black on the back and pale or silver underneath with olive green translucent fins with a dark patch on the tail. They are a freshwater, nonparasitic species and are typically four to seven inches long. These lampreys are found sparingly around southeast Alaska and south to areas in California. Recent genetic data has elucidated the two ecotypes represent one species: *Occidentis ayresii*.



Freshwater form of the Western River Lamprey sampled while electrofishing in southeast Alaska. Photo credit: Dylan Krull, ADF&G.

Text: Kelly Mansfield and Nate Cathcart (updated November 2025)

Illustration: Kelly Mansfield

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