U.S. Fish & Wildlife Service

Pacific Lamprey

Entosphenus tridentata

June 2012

An adult Pacific lamprey Credit: Jeremy Monroe, Freshwaters Illustrated

Species Description

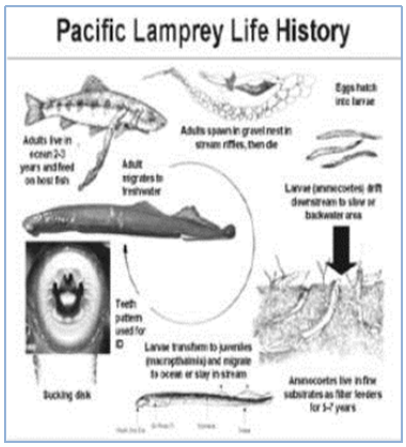
Lampreys belong to a primitive group of fishes that are eel-like in form but lack the jaws and paired fins of true fishes. These species have a round sucker-like mouth, no scales, and breathing holes instead of gills.

Identification of lampreys depends largely on the number, structure, and position of teeth found in adult lamprey; adult Pacific lampreys are characterized by the presence of 3 large teeth and posterior teeth on the oral disc. As larvae (ammocoetes), they are nearly indistinguishable from other lampreys.

Life History

Adult lamprey

As adults in the marine environment, Pacific lampreys are parasitic and feed on a variety of fish, including Pacific salmon, flatfish, rockfish, and pollock, and are preyed upon by sharks, sea lions, and other marine animals. They have been caught in depths ranging from 300 to 2,600 feet, and as far off the west coast as 62 miles in the ocean.



After spending 1 to 3 years in the marine environment, Pacific lampreys cease feeding and migrate to freshwater between February and June. They are thought to overwinter and remain in freshwater habitat for approximately one year before spawning where they may shrink in size up to 20 percent. Most upstream migration takes place at night. Adult size at the time of migration ranges from about 15 to 25 inches.

A Pacific lamprey digging a redd
Credit: Jeremy Monroe, Freshwaters Illustrated

Spawning

Pacific lampreys spawn in similar habitats to salmon; in gravel bottomed streams, at the upstream end of riffle habitat, typically above suitable young larvae (ammocoete) habitat.

Spawning occurs between March and July depending upon location within their range. The degree of homing is unknown, but adult lampreys cue in on ammocoete areas which release pheromones that are thought to aid adult migration and spawning location. Both sexes construct the nests, often moving stones with their mouth. After the eggs are deposited and fertilized, the adults typically die within 3 to 36 days after spawning.

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2600 S.E. 98th Avenue, Suite 100, Portland, OR 97266
503/231-6179; 503-231-6195 (fax)
http://www.fws.gov/pacific/Fisheries/sphabcon/Lamprey/index.cfm

Ammocoetes (larval lamprey)

Embryos hatch in approximately 19 days at 59° Fahrenheit (F) and the ammocoetes drift downstream to areas of low velocity and fine substrates where they burrow, grow and live as filter feeders for 2 to 7 years and feed primarily on algae. Several generations and age classes of ammocoetes congregate in high densities that form colonies.

Pacific lamprey ammocoetes
Credit: USFWS

Ammocoetes are relatively immobile in the stream substrates, though will move during high flow events. Larger ammocoetes drift primarily during higher flows in spring and smaller ammocoetes drift during the summer. Anecdotal information suggests that ammocoetes may occur within the hyporheic zone and may move laterally through stream substrates.

Macropthalmia (juvenile lamprey)

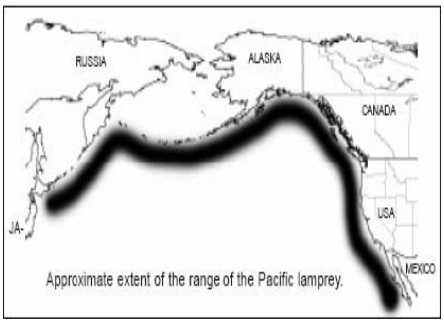
Pacific lamprey macropthalmia
Credit: USFWS

Metamorphosis to macropthalmia (juvenile phase) occurs gradually over several months as they develop eyes, teeth, and become free swimming.

Transformation from ammocoetes to macropthalmia typically begins in July to October. They drift and swim downstream as they emigrate to the ocean between late fall and spring where they mature into adults.

Range

Pacific lampreys are widely distributed. They have been found in streams from Hokkaido Island, Japan, and around the Pacific Rim including Alaska, Canada, Washington, Oregon, Idaho, and California to Punta Canoas, Baja California, Mexico. Their distribution includes major river systems such as the Fraser, Columbia, Klamath-Trinity, Eel, and Sacramento-San Joaquin Rivers. Historically, Pacific lampreys are thought to be distributed wherever salmon and steelhead have occurred.



Status

Recent data indicate that distribution of the Pacific lamprey has been reduced in many river drainages. They are extirpated above dams and other impassable barriers in west coast streams, including many larger rivers throughout coastal Washington, Oregon, and California, and above dams in the upper Snake and Columbia Rivers. In addition to extirpations, Pacific lampreys have declined in abundance throughout the Columbia River basin and southern California.

In freshwater adult lamprey attach to rocks and large substrate while to hold in fast currents Credit: USFWS

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Threats

Pacific lampreys face a variety of threats to its various life history stages. Taking into account the potential for lamprey utilization of an area is essential to their conservation.

Even small dams may act as barriers to lamprey passage Credit: USFWS

Passage (dams, culverts, water diversions, tide gates, other barriers) both upstream & downstream: Artificial barriers can impede upstream migrations by adult lampreys and downstream movement of ammocoetes and macropthalmia. During downstream migrations juvenile lampreys may be entrained in water diversions or turbine intakes. In many cases, water diversions and hydroelectric projects have been screened to bypass juvenile salmonids.

However, due to their size and weak swimming ability, juvenile lampreys are frequently impinged on the screens resulting in injury or death. There is evidence that many dams with fish ladders designed to pass salmonids do not effectively pass lampreys. The excessive use of swimming energy required by Pacific lampreys to negotiate fish ladders or culverts combined with sharp angles and high water velocities, effectively block or restrict passage. Lampreys travel deeper in the water column (no air bladder) compared to salmonids, therefore, traditional spill gates may block passage. Pacific lampreys persist for only a few years above impassable barriers before dying out.

Macropthalmia entrained at a dam intake screen Credit: U.S. Army Corps of Engineers

Dewatering and flows (reservoir management, water diversions, construction projects): Alterations in reservoir levels may dewater areas where ammocoetes occur. Water diversions and instream construction projects (i.e., culvert replacements) may also dry up stream reaches where ammocoetes reside. Since several generations and age classes of ammocoetes congregate in areas forming colonies; one dewatering event can have a significant effect on a local lamprey population.

Dead juvenile lamprey in a de-watered stream. Credit: Ralph Lampman

Poisoning (accidental spills, chemical treatments): Because ammocoetes are relatively immobile in the stream substrates and often occur in high densities, they are prone to effects from chemical poisoning that may affect many age classes from a single action.

Poor water quality: Elevated water temperature has been documented as a mortality factor for eggs and early stage ammocoetes under laboratory conditions. Water temperatures of 72°F may cause significant death or deformation of eggs or ammocoetes. This may be a common occurrence in degraded streams during the early to mid-summer period of lamprey spawning and ammocoete development. Also, ammocoetes

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tend to concentrate in the lower portions of streams and rivers where gradients are low and toxins, if present, accumulate.

Dredging (channel maintenance and mining): Many age classes of ammocoetes in stream substrates can be impacted by mining or dredging activities because of their "colonial" nature. Dredging impacts have been documented and the effect of suction-dredge mining is thought to be one of the reasons for the loss of lamprey in the upper John Day River basin in Oregon.

Stream and floodplain degradation (i.e., channelization, loss of side channel habitat, scouring): Because lamprey ammocoetes colonize areas and are relatively immobile in the stream substrates, they are prone to effects from channel alterations. In addition, the loss of riffle and side channel habitats may reduce areas for spawning and for ammocoete rearing.

Channelized streams impact larval lamprey populations. Credit: USFWS

Ocean conditions (loss of prey, increase in predators): Changing ocean conditions could also be a possible threat to the Pacific lamprey adults. Pacific salmon, Pacific hake, and walleye pollock have declined in numbers; reductions in the availability of these host/food species may be affecting adult lamprey survival and growth.

Walleye prey on adult and juvenile lamprey Credit: Hook Up Guide Service

Predation by nonnative fish species: Nonnative fishes such as bass, sunfish, walleye, striped bass, and catfish, among others, have become established over the last century in some rivers in the western U.S. In addition, as Pacific lampreys migrate through reservoirs, they may be more susceptible to predation.

Overutilization of adult Pacific lampreys: Harvest was historically more widespread for lampreys than currently, though may still present a threat, particularly if concentrated on rivers with low numbers. Use of Pacific lampreys for bait has been discontinued by the states of Oregon and Washington. California allows unlimited harvest of lampreys and there is evidence that lampreys are regularly collected for bait.

Conservation Opportunities

Primary opportunities to protect and restore Pacific lamprey populations include:

- Provide lamprey passage
- Protect ammocoete habitat
- Restore stream channel complexity

Service biologists place large woody debris in a stream to restore aquatic habitat Credit: USFWS

For more information visit the following website:

http://www.fws.gov/pacific/Fisheries/sphabcon/Lamprey/index.cfm

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