

Considering Pacific Lamprey When Implementing Instream Activities



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The purpose of this poster is to stimulate dialog and research in order to raise awareness of the need to consider lampreys and identify methods to address their needs when implementing instream projects.

Abstract
 Efforts to minimize negative effects during instream activities generally do not consider the life history characteristics of non-game fish species, specifically lamprey. While there is still much to be learned about Pacific lamprey distribution, abundance, and status, the need for conservation of lampreys is evident. Historically, Pacific lampreys were probably distributed wherever salmon and steelhead occurred. However, recent data indicate that distribution of the Pacific lamprey has been reduced or eliminated in many river drainages. Projects that alter passage, reduce flow hydraulics, alter stream substrates, and decrease habitat complexity can negatively affect lampreys. Of particular importance during construction activities are areas inhabited by ammocoetes. Methods to reduce effects to ammocoetes during construction need more research and testing. Measures that conserve lampreys will also benefit other fish species by providing for (1) diversity of habitats and stream structure, (2) complex velocity distributions, and (3) modifications to the duration and timing of instream actions.

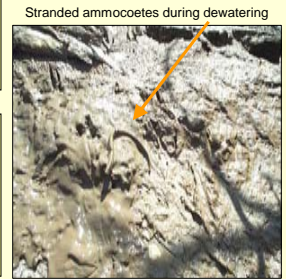
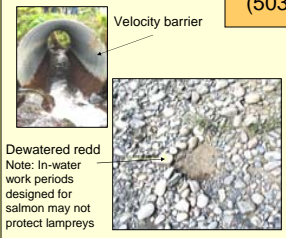
Overview of Pacific lamprey life history

Pacific lampreys play an important role in their native stream ecosystems. As adults in the marine environment, Pacific lampreys are parasitic and feed on a variety of marine and anadromous fish. After the adult feeding phase, Pacific lampreys migrate to freshwater, cease feeding, and hold over for almost a year before moving to spawning habitat. Most of their movement occurs at night. They spawn in gravel bottomed streams, typically above suitable young larvae (ammocoete) habitat from March – July. Both sexes construct the nests, often moving stones with their mouth. After the lampreys have spawned they die. Once the eggs hatch, the ammocoetes drift downstream to areas of low velocity and fine substrates where they burrow and live as filter feeders for 2 to 7 years. Several generations and age classes of ammocoetes congregate in high densities forming colonies where they are relatively immobile. Ammocoetes feed primarily on algae. Metamorphosis to macrophthalmia (juvenile phase) occurs gradually over several months as they develop eyes, teeth, and become free swimming. They drift and swim downstream as they emigrate to the ocean between late fall and spring where they mature into adults.

Considerations when implementing stream projects

Instream activities are generally a type of channel maintenance or stream restoration project that can include dredging, bank stabilization, structure maintenance, fish passage projects, and various types of habitat structures. Projects often modify streams to benefit or protect salmon by adjusting; the project work area, instream work periods, dewatering regimes, and modifications to structure designs to accommodate salmon swimming abilities. The unique life history of Pacific lamprey requires project modifications that consider long instream residency, use of substrates as ammocoetes, movements and migrations of adults, ammocoetes, and macrophthalmia, and poor swimming ability at all life stages. Moreover, Pacific lampreys have not been studied to the same degree as salmon, thus, our knowledge of specific requirements is lacking. On the other hand, many restoration projects that benefit salmon and aim at restoring natural channel functions will also benefit lamprey by providing diversity in habitats, substrates, off-channel habitats, cover, and good water quality.

Of particular importance during construction activities are areas utilized by ammocoetes where a single dewatering event, disturbance, or contamination may have a significant effect on a lamprey local population. We know little about movement and locations of ammocoetes within the substrates. Anecdotal information suggests that they may occur within the hyporheic zone and may move laterally through stream substrates.



Specific considerations to reduce effects to ammocoetes during construction

Note: methods are not well developed

Methods presently used include:

- Avoid dewatering
- Identify and protect areas that may function as ammocoete habitat

Protect natural surface and subsurface flows.

- Salvage lampreys using standard techniques such as electro-shocking or seining

If dewatering is necessary:

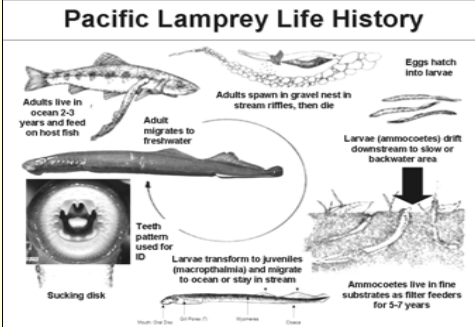
- Dewater slowly over several days or at a minimum overnight.
- Identify areas adjacent to ammocoete habitat outside of the disturbance area but within the channel and dig holes where ammocoetes may take refuge. Anecdotal information suggests that ammocoetes will move into areas that retain water. Cover these "refuge holes" to protect them from predators.
- A technique yet untried but worth further research is to place straw bales in or near ammocoete habitat as dewatering occurs and overnight. Based on techniques used by fishermen on the Fraser River to catch ammocoetes for bait, the lampreys purportedly will move into the straw.

Basic steps to minimize impacts:

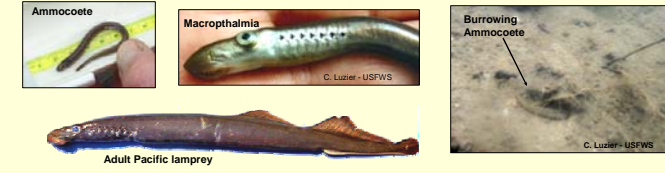
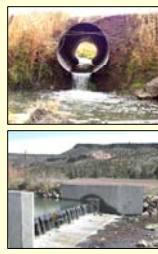
1. Raise awareness of the need to consider lampreys.
2. Identify locations within streams where activities have the greatest potential to affect lampreys.
3. Modify project design and implementation to accommodate Pacific lampreys.
4. Monitor and report success and failure for items 2 and 3.

Acknowledgments: Recommendations are based on literature, information from biologists conducting research and implementing projects on lampreys or other aquatic species throughout the west. Some of the information was gathered from various experts using a survey. Special thanks to the following below and many others not identified:

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The two photos below show typical lamprey passage barriers.



Project type	Potential short-term (ST) and long-term (LT) adverse effects of action of various life stages		
	Ammocoete	Macrophthalmia	Adult
Temporary dewatering of channel - typically conducted for projects such as those listed below	ST – desiccation LT – loss of several age classes and generations	ST – desiccation, delay in outmigration LT - unknown	ST- desiccation of redd, disruption in migration LT – loss of year class
Channel / ditch dredging	ST – entrainment with dredge material, excess sediment LT – loss of substrate / habitat	ST – entrainment with dredge material LT - Unknown	ST – loss of redds, disruption in migration LT - loss of spawning habitat, loss of cues for migration
Road crossing modifications such as culvert replacements	ST - direct loss with removal / disturbance to substrate LT – passage barrier	ST – unknown LT - passage barrier	ST - disruption in migration LT - passage barrier
Instream structures for habitat restoration or grade control	ST – direct loss with disturbance to substrate removal / disturbance LT - passage barrier	ST – delay in outmigration LT - passage barrier	ST – Loss of redds, disruption in migration LT - passage barrier, loss of spawning habitat
Bank stabilization	ST - direct loss with disturbance LT – loss of habitat	Unknown	ST – sedimentation of redds LT - unknown
Irrigation diversion modifications	ST – direct loss with disturbance, desiccation LT – mortality due to high water temperature, impingement / entrainment, desiccation, passage barrier	ST – desiccation, delay in outmigration LT - mortality due to high water temperature, impingement / entrainment, desiccation, passage barrier	ST - desiccation of redd, disruption in migration LT - mortality due to high water temperature, entrainment, passage barrier
Projects in side channels	ST – direct loss with disturbance LT - loss of habitat	ST/LT - Loss of refugia	ST/LT - Loss of refugia during high flows
Estuarine projects	No effect	ST – effect on outmigration LT – depends on the project, e.g., tidegates block passage	ST – disruption in migration LT – depends on the project, e.g., tidegates block passage