

Study of the biological cycles of paired species in Petromyzontiformes

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Figure 1: *Lampetra aepyptera*. North American Native Fishes Association (nanfa.org)

Introduction

Petromyzontiformes, also known as lampreys, are an order of vertebrates with a very distinctive funnel-like mouth with rasping teeth. They use it mainly to attack their preys, but it is absent in larvae. Some species don't feed as adults even though they have this kind of mouth.



Figure 2: *Lampetra planeri*. Encyclopedia of Life (eol.org)

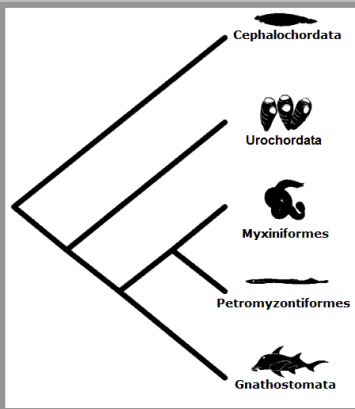


Figure 1: Phylogeny of Petromyzontiformes. Heimberg (2010)

Taxonomy

This class of vertebrates is classified as Agnatha, a superclass that also includes Myxiniiformes. Agnatha are Vertebrata, but they are different enough from the other species (Gnathostomata) of this subphylum, so they are in their own superclass.

Paired species

More than a half of the lamprey genera have paired (or satellite) species. This means that there's a group of 2 or more species: the adults of one of these species predate and migrate, while the adults of the other species only reproduce and die.

This phenomenon has only been observed in Petromyzontiformes, and it has caused a lot of speciation. The most accepted theory is that difference of size has a decisive importance in this speciation.

Genus	Species with adult feeding stage	Species without adult feeding stage
<i>Ichthyomyzon</i>	<i>I. unicuspis</i> <i>I. castaneus</i> <i>I. bdellium</i>	<i>I. fossor</i> <i>I. gagei</i> <i>I. greeleyi</i>
<i>Ertosphenus</i>	<i>E. tridentatus</i> <i>E. similis</i> <i>E. minimus</i> <i>E. macrostoma</i>	<i>E. lethrophagus</i> <i>E. folletti</i> <i>E. hubbsi</i>
<i>Eudontomyzon</i>	<i>E. danfordi</i> <i>E. moni</i>	<i>E. manae</i> <i>E. hellenicus</i>
<i>Lethenteron</i>	<i>L. camtschaticum</i>	<i>L. reissneri</i> <i>L. zanandreae</i> <i>L. kessleri</i>
<i>Lampetra</i> ¹	<i>L. fluviatilis</i>	<i>L. planeri</i> <i>L. lanceolata</i> ⁴
<i>Lampetra</i> ²	<i>L. ayresii</i>	<i>L. richardsoni</i> <i>L. pacifica</i> <i>L. aepyptera</i> <i>L. geminis</i>
<i>Lampetra</i> ³	<i>L. spadicus</i>	

¹ Species of *Lampetra* that live in Europe
² Species of *Lampetra* that live in USA and Canada
³ Species of *Lampetra* that live in Mexico
⁴ Some authors say that *L. lanceolata* is not a satellite species, but a species from another genus

Table 1: List of the genera of Petromyzontiformes with paired or satellite species. Salewski (2003)

	<i>Lampetra fluviatilis</i>	<i>Lampetra planeri</i>
Migration	Anadromous	Holobiotic
Feeding behaviour	Parasitizes	Doesn't feed
Adult size	Big (20-40 cm)	Small (12-20 cm)
Number of eggs	7.500-40.000	800-1.400
Larval stage duration	4'5 years	6'5 years
Adult stage duration	18-28 months	Weeks or months
Nest location	Lower part of the river	Upper part of the river

Table 2: Differences between two paired species. Kelly (2001)

	Male	Female	Male/Female ratio	Hatched eggs
Control	Medium <i>L. ayresii</i> (19'9 cm)	Medium <i>L. ayresii</i> (18'1 cm)	1'1/1	45%
Small difference	Large <i>L. richardsoni</i> (15'1 cm)	Small <i>L. ayresii</i> (18 cm)	0'84/1	33%
Small difference	Small <i>L. ayresii</i> (19 cm)	Large <i>L. richardsoni</i> (15'7 cm)	1'21/1	33%
Great difference	Small <i>L. richardsoni</i> (13'6 cm)	Large <i>L. ayresii</i> (20'6 cm)	0'66/1	18%
Great difference	Large <i>L. ayresii</i> (20'1 cm)	Small <i>L. richardsoni</i> (12'2 cm)	1'65/1	20%

Table 3: Egg hatching rate related to size difference. Beamish (1992)

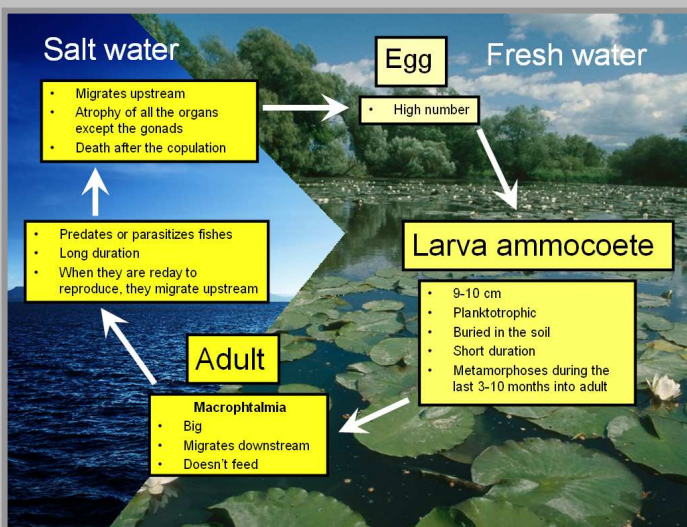


Figure 3: Biological cycles of species with adult feeding stage

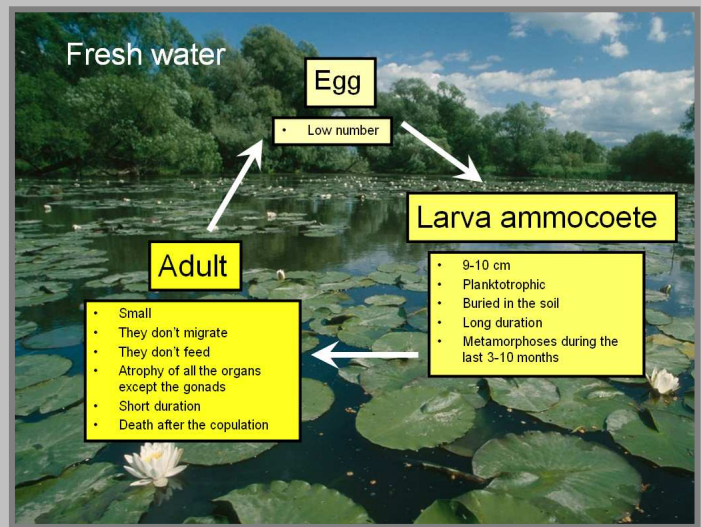


Figure 4: Biological cycle of species with adult non feeding stage

Common ancestor and controversial studies

The common ancestor of paired (or satellite) species is considered to be parasitic or parasitoid by most of the authors. That's because non feeding adults develop their mouth with rasping teeth even though they don't attack any prey; and we usually find several non feeding species which have a restricted distribution that only overlaps with the distribution of a feeding species (the "parent" species).

A molecular study about the *Lethenteron* species suggested that, by parsimonious reconstruction, the most probable phylogeny was that non feeding species were the ancestors. But those studies, which analysed different genes, had contradictory data, and the most widespread theory is still that the common ancestor was a species with feeding adult stage.