

FiSHPOR

The Pouched Lamprey (*Geotria australis* Gray, 1851) in Mediterranean streams of the Southern Hemisphere

David L. Morgan and Stephen J. Beatty

Centre for Sustainable Aquatic Ecosystems, Harry Butler Institute, Murdoch University, Murdoch, Western Australia. Correspondence to d.morgan@murdoch.edu.au

The lampreys (Petromyzontiformes) represent an ancient lineage of agnathan (jawless) fishes that are considered one of the oldest extant groups of vertebrates (Docker et al., 2015). There are ~45 lamprey species, of which only five species are known from the Southern Hemisphere, included in two monogeneric families (Mordaciidae and Geotriidae) (Maitland et al., 2015; Potter et al., 2015; Riva-Rossi et al., 2020). Until recently, the genus *Geotria* was monotypic, with its sole representative being the widespread Pouched Lamprey (*Geotria australis* Gray, 1851). It is found in Mediterranean climatic zones of Australia, Chile and Argentina as well as in New Zealand and several interspersing islands (Neira, 1984; Nardi et al., 2020). Recently, a second *Geotria* species (*G. macrostoma* (Burmeister, 1868)) was described from Patagonia and is referred to as either the Patagonian Lamprey or the Argentinian Pouched Lamprey (Nardi et al., 2020; Riva-Rossi et al., 2020). The males of these two species, along with the Chilean Lamprey (*Mordacia lapicida* (Gray, 1851)), are unique in that they develop a large, sac-like gular pouch during maturation. Other parasitic lamprey species may develop a similar, though much smaller structure (Hardisty and Potter, 1971; Monette and Renaud, 2011). There has long been speculation as to what purpose the pouch plays in the life history of this (or these) anadromous, semelparous species (Potter and Welsch, 1997). Believed to have a specialised role in either courtship or during the act of spawning, or for transporting stones during nest-building (Ivanova-Berg, 1968; Potter and Welsch, 1997), it was only very recently that courtship, mating, egg-laying and gular pouch function has been described (Baker et al. 2017; Paton et al., 2020). The gular pouch was found to massage and groom eggs until they hatch, potentially ventilating developing eggs (Baker et al., 2017).

In contrast to most Northern Hemisphere lamprey species, which die soon after spawning, *G. australis* has been shown to live for well-over a year (up to 511 days) post spawning in Mediterranean-climatic south-western Australian streams (Paton et al., 2020). This is remarkable considering that during their upstream migration phase, which in those Mediterranean-climate streams begins approximately 15 months prior to spawning, these fish don't feed, suggesting that they can survive for up to 30 months without eating (Paton et al., 2020). To contend with south-western Australia's hot dry Mediterranean summers, over-summering (upstream migrant) sub-adults and larvae (ammocoetes) occupy shady, often perennial, low salinity streams (Allen et al., 2017). While they have persisted for millions of years, their remaining habitats in south-western Australia are under serious threat from climate change, with a 50% reduction in stream flow observed in some parts since the 1970s. Many rivers have become secondarily salinized due to extensive land clearing in the last century, exposing non-halotolerant larval lampreys to lethal salinities (Allen et al., 2017). There is an urgent need to identify and safeguard the remaining habitats of *G. australis* during their freshwater phases throughout the region, and perhaps in other Mediterranean habitats within their Southern Hemisphere range.

Pouched lamprey in Mediterranean streams
DOI: 10.29094/FiSHMED.2023.004

CITATION

Morgan DL, Beatty SJ (2023). The Pouched Lamprey (*Geotria australis* Gray, 1851) in Mediterranean streams of the Southern Hemisphere. *Fishes in Mediterranean Environments* 2023.003: 5p. <https://doi.org/10.29094/FiSHMED.2023.004>



Picture 1. Rarely sighted during day-light hours, this adult male Pouched Lamprey (*Geotria australis*) seeks shelter in the cool, clear, perennial waters of Milyeannup Brook in south-western Australia's Blackwood River catchment. During the hot, dry Austral summers in this Mediterranean-climatic region of Australia, groundwater in Milyeannup Brook, expressed from the Yarragadee Aquifer, buffers adult, juvenile and larval (ammocoete) lampreys from higher temperatures that exist in most rivers of the region.

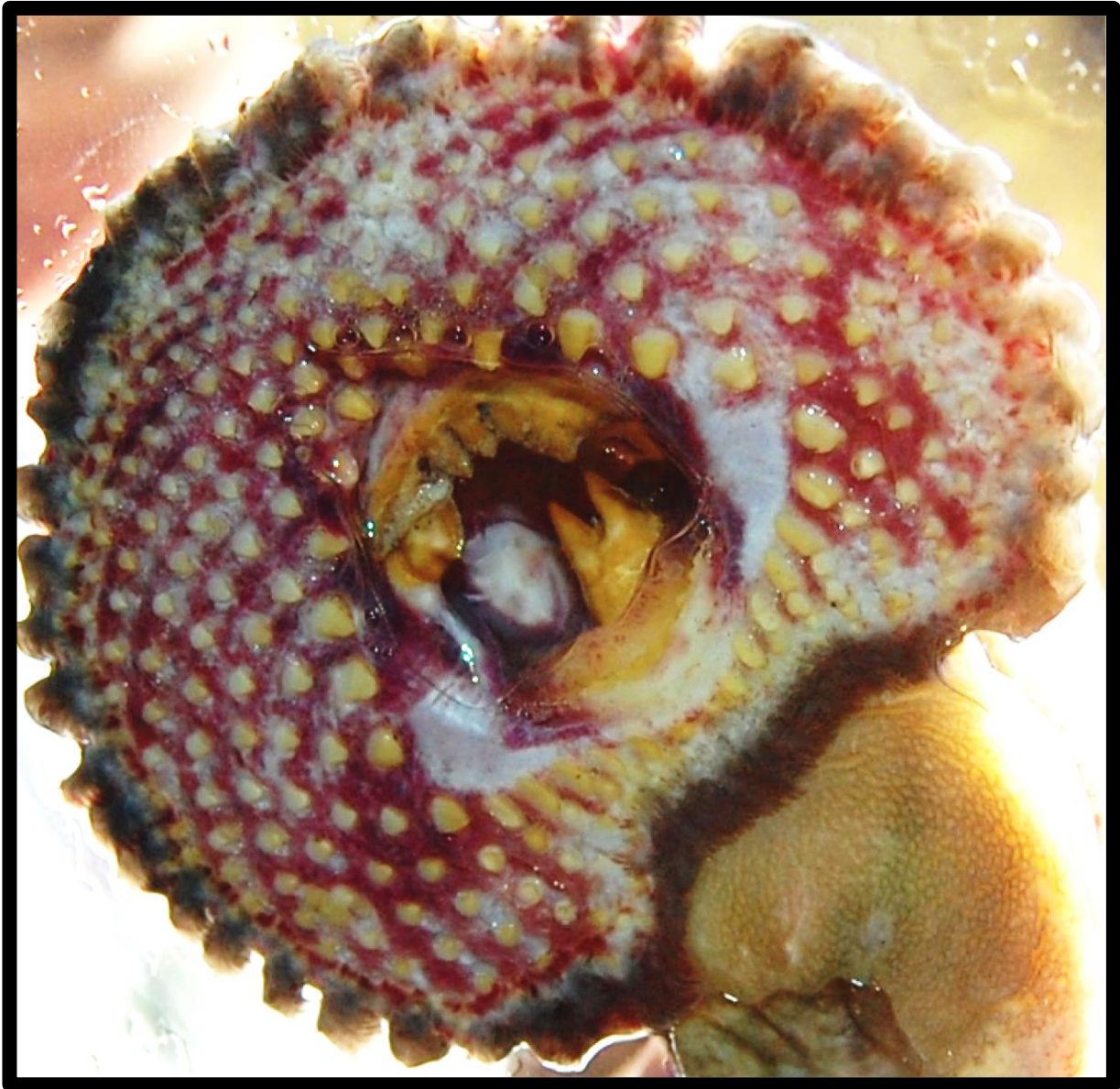
Pouched lamprey in Mediterranean streams
DOI: 10.29094/FiSHMED.2023.004



Picture 2. During maturation, the adult male Pouched Lamprey (*Geotria australis*) develops an enlarged gular pouch and oral disc. Following spawning, most lamprey species die fairly quickly (i.e., they are semelparous), however the Pouched Lamprey has been shown to survive for well over a year following spawning (Paton et al., 2020). This enhanced post-spawning survival compared to other lamprey species may be related to the need to use the gular pouch in the caring of the eggs (Baker et al., 2017).



Picture 3. Prior to spawning, which occurs ~15 months after sub-adult lampreys re-enter the rivers as part of an upstream migrant phase, the adult male Pouched Lamprey (*Geotria australis*) develops an enlarged sac-like gular pouch and oral disc. It is remarkable that the purpose of the gular pouch has only recently been elucidated (Baker et al., 2017), and that this semelparous species, which ceases feeding following their re-entry to freshwater habitats from the marine environment, can survive for almost three years without feeding.



Picture 4. The enlarged suckorial disc of a male *Geotria australis* that develops prior to spawning starkly contrasts that of an early upstream migrant (see Potter et al., 2015, Fig. 2.2b; Allen et al., 2017, Fig. 2b). Lampreys can be parasitic or non-parasitic, with parasitic species being either blood-suckers or flesh-eaters. The dentition of *G. australis* is characteristic of a flesh-eating lamprey, which use piston-like tongue teeth to rasp away flesh from the host (Renaud et al., 2009).

Pouched lamprey in Mediterranean streams
DOI: 10.29094/FiSHMED.2023.004

CITED REFERENCES

- Allen MG, Beatty SJ, Morgan DL (2017) Aquatic fauna refuges in Margaret River and the Cape to Cape region of Australia's Mediterranean-climatic Southwestern Province. *FISHMED: Fishes in Mediterranean Environments* 2017.002: 1–26.
- Baker CF, Jellyman DJ, Reeve K, Crow S, Stewart M, Buchinger T (2017) First observations of spawning nests in the pouched lamprey (*Geotria australis*). *Canadian Journal of Fisheries and Aquatic Sciences* 74: 1603–1611.
- Docker MF, Hume JB, Clemens BJ (2015) Introduction: A surfeit of lampreys. In *Lampreys: biology, conservation and control* (Ed Docker MF) Volume 1, pp. 1–34. (Springer: Dordrecht.)
- Hardisty MW, Potter IC (1971) The general biology of adult lampreys. In *The biology of lampreys*. (Eds Hardisty MW, Potter IC) Volume 1, pp. 127–206. Academic Press, London.
- Ivanova-Berg MM (1968) Discovery of the southern lamprey (*Geotria australis* Gray) in the Scotia Sea near Georgia Island. *Problems of Ichthyology* 8: 138–141.
- Maitland P, Renaud C, Quintella B, Close D, Docker M (2015) Conservation of native lampreys. In *Lampreys: biology, conservation and control* (Ed Docker MF) Volume 1, pp. 375–428. (Springer: Dordrecht.)
- Monette SN, Renaud CB (2005) The gular pouch in northern hemisphere parasitic lampreys (Petromyzontidae). *Canadian Journal of Zoology* 83: 527–535.
- Nardi CF, Sánchez J, Fernández DA, Casalnuovo MA, Rojo JH, Chalde T (2020) Detection of lamprey in Southernmost South America by environmental DNA (eDNA) and molecular evidence for a new species. *Polar Biology* 43: 369–383.
- Neira FJ (1984) Biomorfología de las lampreas parásitas Chilenas *Geotria australis* Gray 1851 y *Mordacia lapicida* (Gray, 1851) (Petromyzontiformes). *Gayana Zoología* 48: 3–40
- Paton KR, Cake MH, Bird DJ, Potter IC (2020) Descriptions of spawning of the pouched lamprey (*Geotria australis*) in tanks and of morphological changes leading up to and following spawning. *Pacific Conservation Biology* 26: 301–307.
- Potter IC, Gill HS, Renaud CB, Haoucher D (2015) The taxonomy, phylogeny, and distribution of lampreys. In *Lampreys: biology, conservation and control* (Ed Docker MF) Volume 1, pp. 35–73. (Springer: Dordrecht.)
- Potter IC, Welsch U (1997) The structure of the gular pouch of mature males of the lamprey *Geotria australis*. *Acta Zoologica* 78: 97–106.
- Renaud CB, Gill HS, Potter IC (2009) Relationships between the diets and characteristics of the dentition, buccal glands and velar tentacles of the adults of the parasitic species of lamprey. *Journal of Zoology* 278: 231–242.
- Riva-Rossi C, Barrasso DA, Baker C, Quiroga AP, Baigún C, Basso NG (2020) Revalidation of the Argentinian pouched lamprey *Geotria macrostoma* (Burmeister, 1868) with molecular and morphological evidence. *PLOS ONE* 0233792.