Assessing the vulnerability of taonga freshwater species to climate change – species summary:

Piharau / Kanakana (Pouched lamprey)

Geotria australis

VERY HIGH VULNERABILITY

SENSITIVITY

Lamprey/kanakana use marine, estuarine and freshwater habitats to complete their life cycle. Lamprey migrate from the sea into freshwaters to spawn. Adult lamprey are attracted to pheromones (chemicals) released by juveniles. Length of the marine stage is not known but it is suggested to range between two and four years.

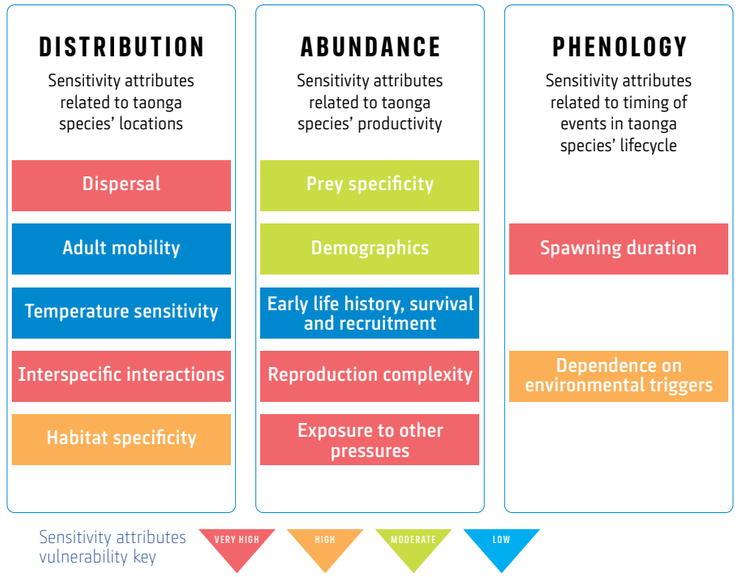
What is a CCVA?

Climate Change Vulnerability Assessments (CCVAs) are used to assess species' vulnerability to climate change. They identify which species may be most vulnerable to climate change in the future based on:

(1) their exposure to predicted changes in the environment (e.g., warming oceans or more frequent droughts)

(2) their sensitivity or ability to cope with changes in their environment based on their unique characteristics (e.g., food, habitats, reproduction).

Together, exposure and sensitivity form a species' climate change vulnerability score.



Subset of the sensitivity attributes that contributed to lamprey/kanakana CCVA scores

Dispersal of early life stages

In general, greater larval dispersal corresponds with a better ability to respond to climate change. The dispersal of larval lamprey is limited. Lamprey lay their eggs under boulders in freshwater and so are benthic spawners. Once the eggs hatch, larval lamprey remain in the nest for at least 2 weeks. After this period, they are then believed to disperse away from the nest, but the extent of this dispersal is limited. The weak dispersal of larval lamprey in freshwater means they cannot readily escape changes in their environment and colonise new habitats.

Dependence on interspecific interactions

Species are likely to be particularly sensitive to climate change if, for example, they are highly dependent on beneficial interaction(s) with one or few particular species. During the marine life stage, lamprey feed parasitically on other fish (and potentially marine mammals) meaning they rely on another species to complete their life cycle. The marine migration routes of lamprey are likely determined by those of their unknown host species. This means that if climate change affects the marine migration route of their host, then lamprey will be indirectly affected.

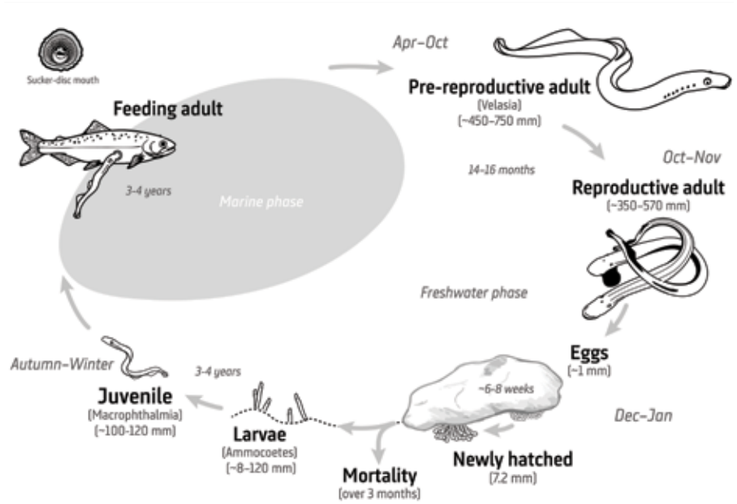
Exposure to multiple pressures

Lamprey were ranked as 'Nationally Vulnerable' by the Department of Conservation in 2017 and 'data deficient' by the International Union for Conservation of Nature in 2019. River regulation and construction of instream barriers have affected the abundance and distribution of lamprey. Hydropower development is a specific threat in Aotearoa–New Zealand, and poorly designed instream barriers like culverts, weirs and fords can impact the upstream migration of adult fish. Changes to river flow regimes have likely altered migratory cues (presence of juvenile pheromones) and the quality of juvenile nursery habitats. As a result of land use change, adults now likely have to travel greater distances to find suitable spawning habitat which may impact adult condition, whilst the overall area of suitable spawning habitat has likely decreased. Lamprey Reddening Syndrome was observed in 2011 resulting in mass mortalities of pre-reproductive adults.

Complexity in reproduction

Lamprey have several reproductive characteristics that likely increase their vulnerability to climate change. Lamprey likely use the same spawning sites in fresh water within and between years. However, considering their spawning sites are only known from a handful of sites throughout the country, their fidelity for a specific spawning area is not well known. Adult lamprey are attracted to pheromones released by juveniles and it is believed that this helps adults locate suitable spawning and rearing habitats.

Lamprey reproduce in pairs unlike other fish species that spawn in large mixed groups of males and females. Male lamprey care for the eggs and help with hatching of the larvae. This is one of few examples of paternal care for New Zealand's freshwater fish species. Lamprey only reproduce once in their lifetime and they die about three months after reproduction.



EXPOSURE

Lamprey are found throughout the Southern Hemisphere's temperate waters. In Aotearoa–New Zealand they are relatively common in Taranaki, Wellington, Banks Peninsula, and the south–eastern corner of the South Island. They can travel substantial distances inland (up to 200 km and can climb over 300 m in elevation).

VERY HIGH VULNERABILITY

Subset of the exposure variables that will likely increase the vulnerability of lamprey to climate change

Rainfall (annual, autumn and winter)

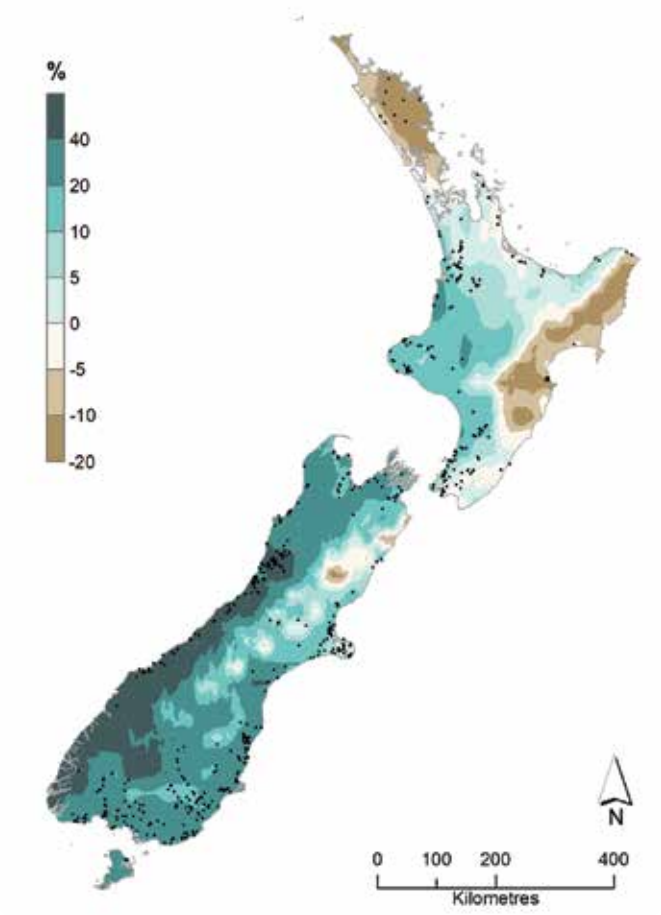
Lamprey will likely to be highly or very highly exposed to changes in mean annual and seasonal (autumn and winter) rainfall for the two time periods (mid–century [2046–2065] and late century [2081–2100]) and RCPs [4.5 and 8.5]. Winter rainfall projections show clear differences throughout Aotearoa-New Zealand: precipitation increases by >=20% for many parts of the South Island while the North Island and part of the north-east coast of the South Island will see negligible changes or even decreases.

Adult lamprey return to freshwaters during late autumn, throughout winter and into early spring. Their upstream migrations are stimulated by large flow events. This may benefit the upstream migrations of lamprey. Conversely, large flood events can delay upstream movement and may displace some lamprey downstream.

Autumn air temperatures

By 2081–2100 under RCP 8.5 conditions, lamprey will likely be highly exposed to autumn mean air temperature changes. Juvenile lamprey typically migrate downstream in autumn. Therefore, increased autumn air temperatures could potentially increase lamprey metabolic rates and their swimming speeds so that downstream migration to the marine environment occurs at a faster rate. Migrations of lamprey from the marine environment into freshwater occur in autumn and are usually the most intense between 12°C and 14.5°C. If mean autumn air temperatures increase beyond this range, then migration to spawning sites may be reduced and/or inhibited.

In Australia, projected temperature increases could result in a 30% reduction in pouched lamprey distributions. Furthermore, lamprey are predicted to lose between 50% and 70% of their current population size in Australia, as a result of temperature increases. Data does not exist for Aotearoa–New Zealand populations, however, the CCVA suggests a better understanding the effects of changes in autumn air temperature on lamprey populations is needed.



Current lamprey distribution (dark circles) mapped with projected changes in winter precipitation (for time period 2081–2100 under RCP 8.5).

Western Pacific Ocean circulation changes

Lamprey will likely be highly exposed to projected changes in Western Boundary Currents by late century (2081–2100) for RCP 8.5 which makes lamprey highly vulnerable to climate change. Although the marine migratory routes of lamprey are poorly known, recent research suggests this species uses tropical waters during its marine life. There is significant uncertainty about the likelihood of lamprey exposure to changes in oceanic conditions. Until a better understanding of the marine life of lamprey is attained, we cannot predict what the consequences of a changing marine environment may have on this taonga species.

This document summarises some of the key findings from the report: Egan, E., Woolley, J.M., Williams, E. (2020) Climate change vulnerability assessment of selected taonga freshwater species: Technical report. NIWA Client Report: 2020073CH. April 2020. 85 p.

For more on the methodology of CCVAs and the assessment of 10 freshwater taonga species (eight fish and two invertebrates) visit: **niwa.co.nz/te-kuwaha/CCVA**