NIWA
Taihoro Nukurangi

Te Wai Māori

MODERATE
VULNERABILITY

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

Kōura / kēwai (Freshwater crayfish)

Paranephrops planifrons

MODERATE VULNERABILITY

SENSITIVITY

Kōura complete their life cycle in freshwater. Females carry their young for 1 month. Adult kōura usually reach maturity at 2 years' age in streams and 3 years in lakes.

DISTRIBUTION	ABUNDANCE	PHENOLOGY
Sensitivity attributes related to taonga species' locations	Sensitivity attributes related to taonga species' productivity	Sensitivity attributes related to timing of events in taonga species' lifecycle
Dispersal	Prey specificity	
Adult mobility	Demographics	Spawning duration
Temperature sensitivity	Early life history, survival and recruitment	
Interspecific interactions	Reproduction complexity	Dependence on environmental triggers
Habitat specificity	Exposure to other pressures	

Sensitivity attributes vulnerability key: VERY HIGH | HIGH | MODERATE | LOW

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 kōura CCVA scores

Dispersal of early life stages

The dispersal of kōura early life stages is highly restricted which likely increases their vulnerability to climate change. Once kōura eggs hatch into juveniles, they are carried by the mother for up to three weeks and undergo two moults before they become independent. Genetic studies confirm that kōura dispersal is limited because there is strong genetic structuring among neighbouring catchments. The weak dispersal of kōura in freshwater means they likely cannot readily escape changes in their environment and colonise new habitats if climate changes impact their environments.

Adult mobility

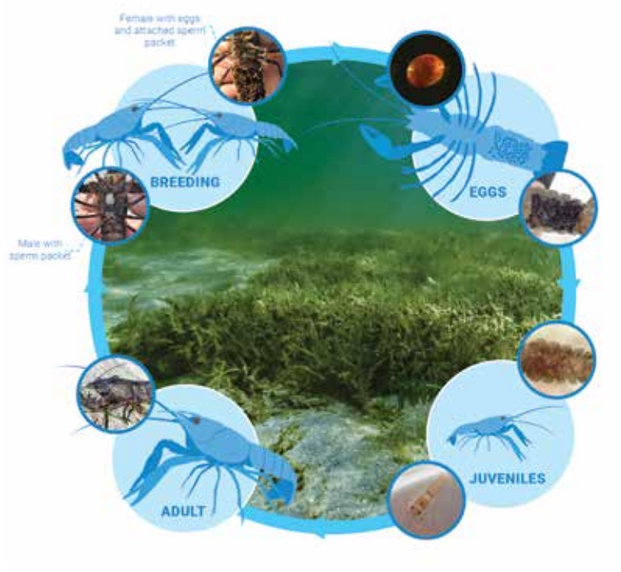
A species can survive changes in habitat if they can emigrate from unsuitable habitat and find new, suitable habitat. Kōura are considered a relatively mobile species but it is unlikely they can move substantial distances. Within lakes, kōura undertake daily movements between the shallow and deeper waters to feed and avoid predators. In rivers, there is little inter-catchment exchange of kōura, except where there are downstream freshwater connections. Translocation of populations is required to restore areas given their restricted adult movements.

Exposure to multiple pressures

Pressures on kōura populations include habitat loss (wetland drainage, deforestation), land management practises (drain clearance), water management practises (e.g., water abstraction, controlled flows), pollution and predation (particularly by introduced salmonids and pest fish species). In the most recent threat rankings by the Department of Conservation (2018), *P. planifrons* are ranked as least concern. The International Union for the Conservation of Nature indicates kōura populations are declining but globally, this species is also ranked as "least concern" although this assessment was done over a decade ago.

Complexity in reproduction

Kōura reproduction is relatively simple which likely decreases their vulnerability to climate change compared to other taonga species such as eels. Kōura can reproduce in their adult habitat and do not need to migrate for successful reproduction. Reproduction does not need to occur in large aggregations for it to be successful. Furthermore, the sex of kōura is not determined by a specific environmental variable and so sex ratios are less likely to be skewed towards males or females if a change in the environment occurs. They do not depend on another species to successfully complete their lifecycle.



EXPOSURE

The kōura species *P. planifrons* are only found in Aotearoa–New Zealand. They are widely distributed throughout the North Island and the West Coast region of the South Island.

Species summary: Kōura / kēwai (Freshwater crayfish)

MODERATE VULNERABILITY

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

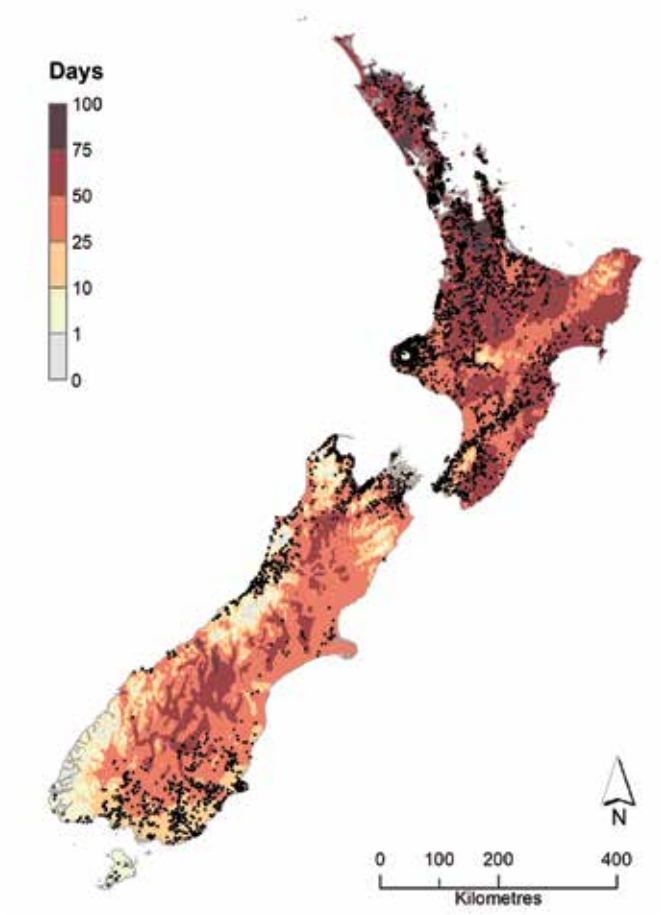
Annual and autumn air temperature

For the late century (2081–2100) time period and RCP 8.5, kōura will likely be very highly exposed to projected changes in mean autumn air temperatures and highly exposed to changes in annual air temperatures.

P. planifrons are considered a cool water species, and in the central North Island inhabits areas where water temperatures fluctuates seasonally from ~6-18°C in native forest habitat and ~5-25°C in pastoral habitats. Peak reproduction occurs in late autumn/early winter but can occur in spring and summer also. Populations spawning in autumn will therefore likely be the most exposed to changes in autumn temperatures. Autumn air temperatures are projected to increase up to 4°C with the greatest increases in the central North Island which is regarded as a population stronghold for this species. Temperature is considered the primary determinant of growth in *P. planifrons* and influences time to maturity and their mobility.

Temperature extremes

For the late century (2081–2100) time period and RCP 8.5, kōura will likely be highly exposed to projected changes in temperature extremes. *P. planifrons* can tolerate higher temperatures than the southern species (*P. zealandicus*), but optimum temperatures are likely to be less than 23°C. In an experiment to simulate exposure to high temperatures in pasture streams, 100% of crayfish exposed to 26.2°C survived after 24 hours compared to 5–10% at 28.9°C and 0% at 32.4°C. When hypoxia stress was added to five days of exposure to 26.2°C (to simulate deoxygenation in eutrophic lowland streams and as a multiple stressor) survival decreased to 40%, compared to 95% in crayfish held at 19°C. In habitats that are already degraded, kōura are therefore most likely to be negatively impacted by temperature increases. However, they can tolerate temperatures at 35°C but only for brief periods.



Current kōura distribution (dark circles) mapped with projected changes in annual number of hot days (for time period 2081–2100 under RCP 8.5).

Winter precipitation

For the two time periods (mid–century [2046–2065] and late century [2081–2100]) and RCP 8.5, kōura will likely be highly exposed to projected changes in mean winter rainfall. Kōura are thought to be sensitive to flood spates and any increases in severe weather events due to changes in climatic and weather patterns. Flood spates are considered an emerging threat to this species. In the central North Island, egg-bearing or "berried" kōura occur throughout the year but are most numerous in winter, meaning changes in winter rainfall may disproportionately affect reproductive individuals.

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**