Department of Conservation
Te Papa Atawhai

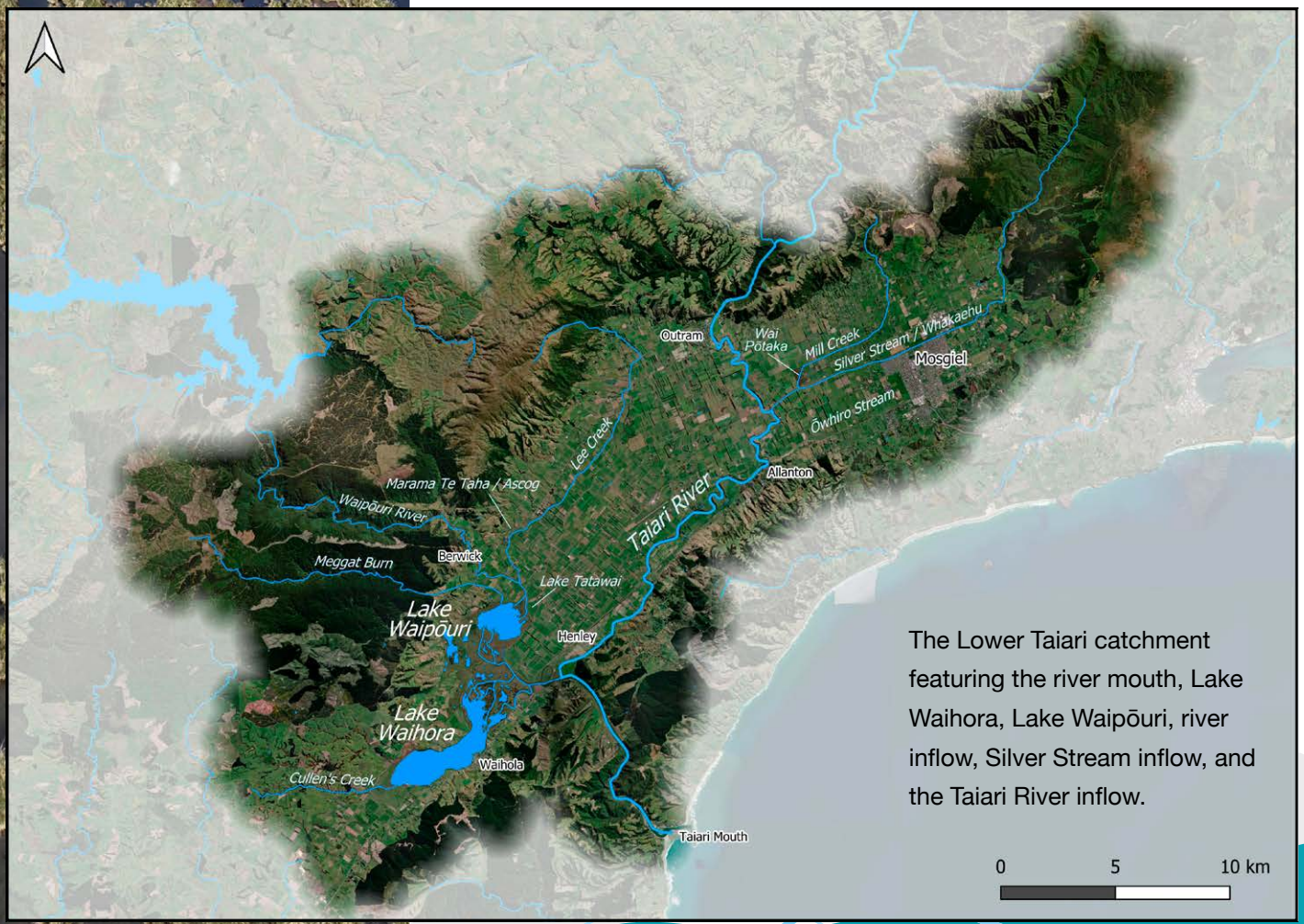
Lower Taiari

Climate change impacts on freshwater ecosystems & values, and management options

The Taiari is one of 14 rivers in DOC's Ngā Awa river restoration programme. DOC commissioned an assessment of the impacts of climate change on the Taiari catchment. This summary focuses on the Lower Taiari and highlights management opportunities to protect freshwater species and ecosystems likely to be impacted. For more in-depth analysis, please refer to the full report linked at the end of the document.

The Lower Taiari basin

We have defined the Lower Taiari as the area downstream from Outram, including all tributaries below an altitude of around 200 metres (excluding the upper Waipōuri River). There are several key freshwater values within this area which are likely to be impacted by climate change.



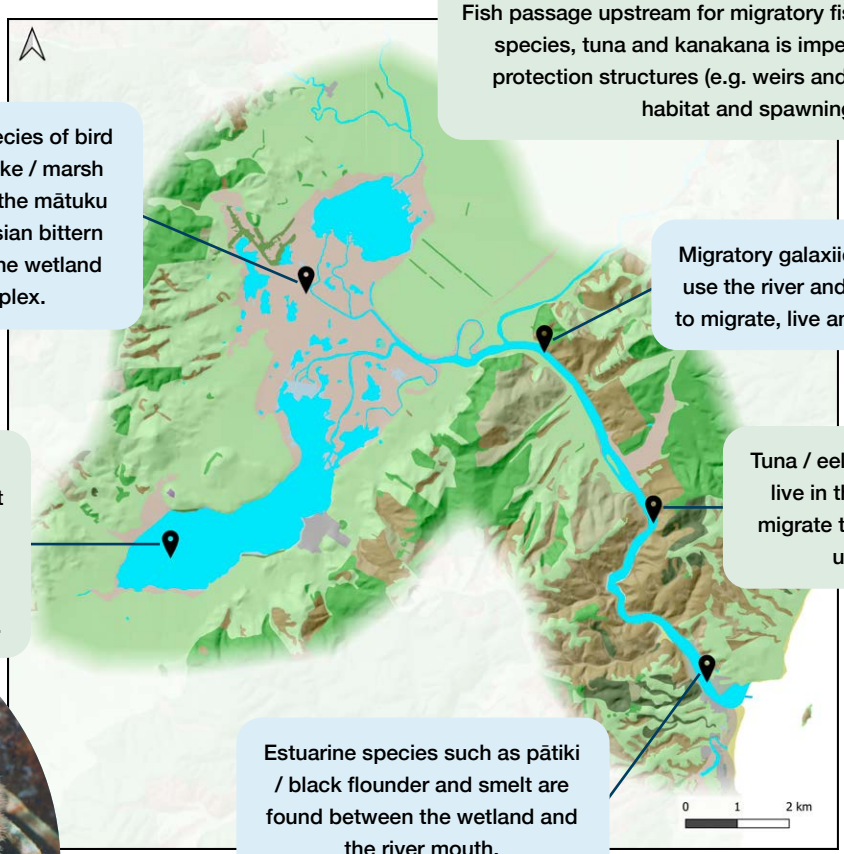
The Lower Taiari catchment featuring the river mouth, Lake Waihora, Lake Waipōuri, river inflow, Silver Stream inflow, and the Taiari River inflow.

Key freshwater values

Ten kilometres inland from Taiari Mouth, Lake Waihora, Lake Waipōuri and Te Nohoaka o Tukiauau (Sinclair Wetlands) are the remnants of a much larger lake-wetland complex that once covered the Taiari Plains.

In the past, a network of waterways and lakes connected the Taiari and Waipōuri systems, including Lakes Tatawai, Potaka and Marama Te Taha (Loch Ascog). Lakes in the area were estuarine, but as sea levels decreased over the last 4,000 years, they have become freshwater-dominated.

On big tides, the remaining lakes still receive an influx of salt water, which greatly affects their ecology. The Lower Taiari supports large and diverse bird, fish and invertebrate populations. Several of these species, like īnaka, whose juveniles form the bulk of the whitebait catch, must migrate between sea and freshwater to complete their life cycle.



Fish passage upstream for migratory fish including four whitebait species, tuna and kanakana is impeded upstream by flood protection structures (e.g. weirs and pumps), which reduce habitat and spawning ability.

Over 80 species of bird like kotoreke / marsh crake and the mātuku / Australasian bittern frequent the wetland complex.

Migratory galaxiid species use the river and network to migrate, live and spawn.

The wetland complex provides important habitat for invertebrates such as the long-lived kākahi / freshwater mussel and kōura/freshwater crayfish.

Tuna / eels and kanakana / lamprey live in the lower catchment and migrate through this area to reach upstream habitats.

Estuarine species such as pātiki / black flounder and smelt are found between the wetland and the river mouth.

Climate model predictions and risks for freshwater environs

Climate change is predicted to cause sea levels to rise and an increase in extreme weather events like floods and droughts. On the low-lying Taiari Plains, rising sea levels would see a change in the ecology of the wetlands as saltwater intrusions become more frequent and extend further into the lake system. Meanwhile, increased storms and flooding would stir up the water and increase the amount of sediment and nutrients flowing into the lakes, greatly affecting the plants and animals that live there. Careful management of freshwater inputs into the wetlands will be necessary to limit these effects.

The predicted effects of climate change on the Lower Taiari summarised below are projections from Goldsmith 2023 (link at end of document).

SEA LEVEL RISE

13.5cm from the last century.

13-30cm projected to 2040.

40-100cm to 2090.

PRECIPITATION

Increases in projected annual rainfall, and heavy rain days.

Decrease in annual dry days.

TEMPERATURE

Increases in projected annual temperature and projected +30˚C days.

Decrease in annual frost days.

WIND

Historical decreases in annual wind speed.

Decreases in projected extreme wind.

FLOWS

Increases in projected mean annual flows, and flood flows.

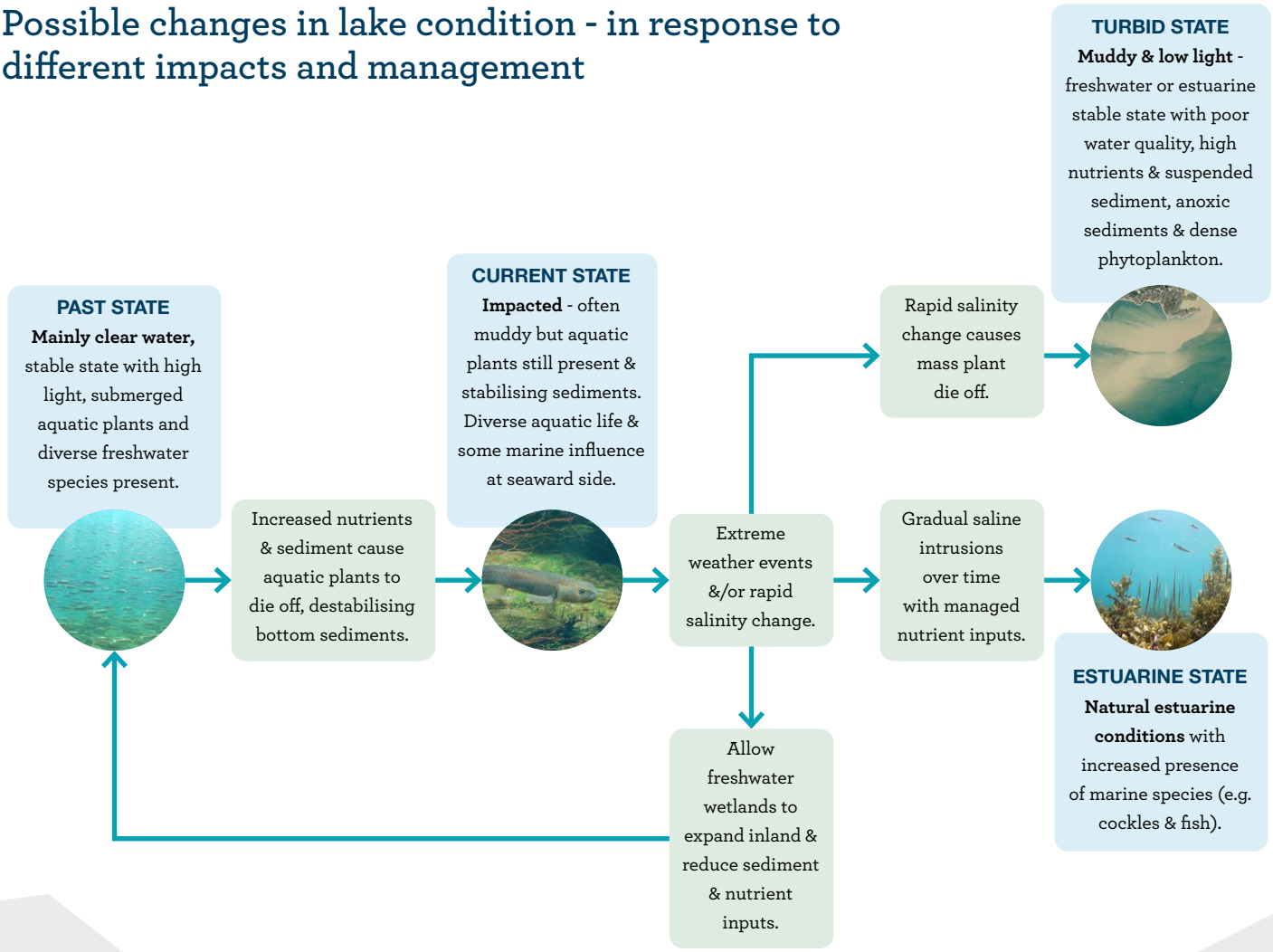
No change in annual low flows except for Silver Stream which increases.

*The 'projections' use the mid to high range RCP and a 2090-time frame. Projections vary depending on the scenario and timeframe modelled and thus impacts could differ depending on emissions. There is also likely to be seasonal and inter-annual variability (e.g. El Niño / La Niña years). See the Taiari Climate Change Risks & Impacts report and its source material for further detail (link at end).

Potential impacts of climate change (extreme events and sea level rise) on the coastal wetland / lake complex

The biggest threat to the health of shallow lakes like Waihora, is the loss of the submerged aquatic plant community (macrophytes) that holds bottom sediments in place. Extreme weather events such as storms and floods could increase sedimentation & nutrient enrichment causing plankton blooms and increased turbidity (muddy, low light conditions). The low light conditions cause plants to 'die off' releasing the bottom sediments resulting in a change to a predominantly turbid/muddy system (see below). Rapid salinisation from low flows and sea level rise could exacerbate this issue, but if managed well, the aquatic plant community could adapt to higher salinity. At present these lakes are considered impacted and are at risk of 'flipping' into a predominantly turbid state. Ongoing management to reduce sediment and nutrient inputs is recommended.

Possible changes in lake condition - in response to different impacts and management



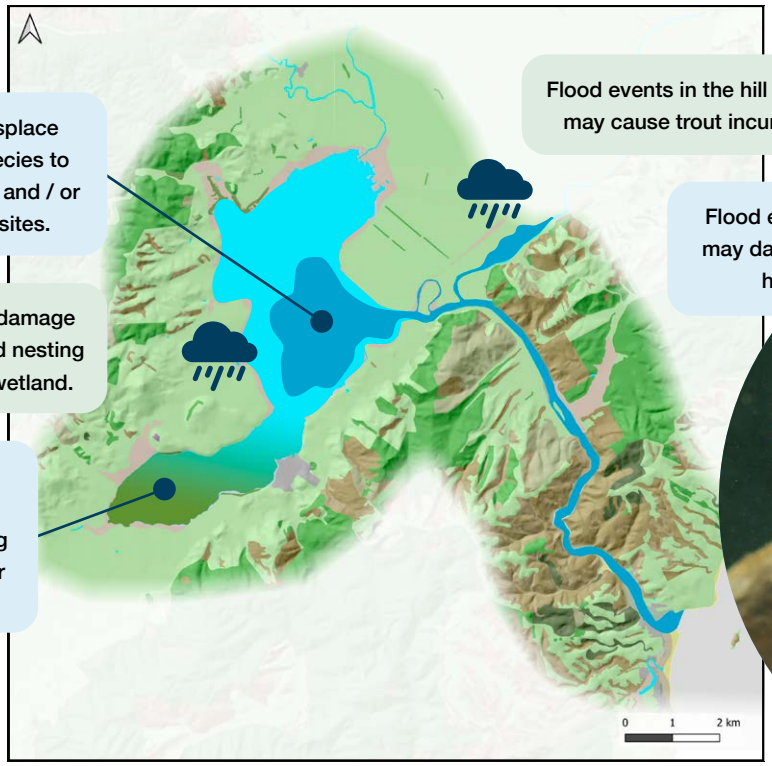
Potential interactions with the Taiari flood protection scheme and Waipōuri hydro scheme

The Taiari flood protection scheme and the upstream Waipōuri hydro-electricity scheme impacts how the lower catchment functions.

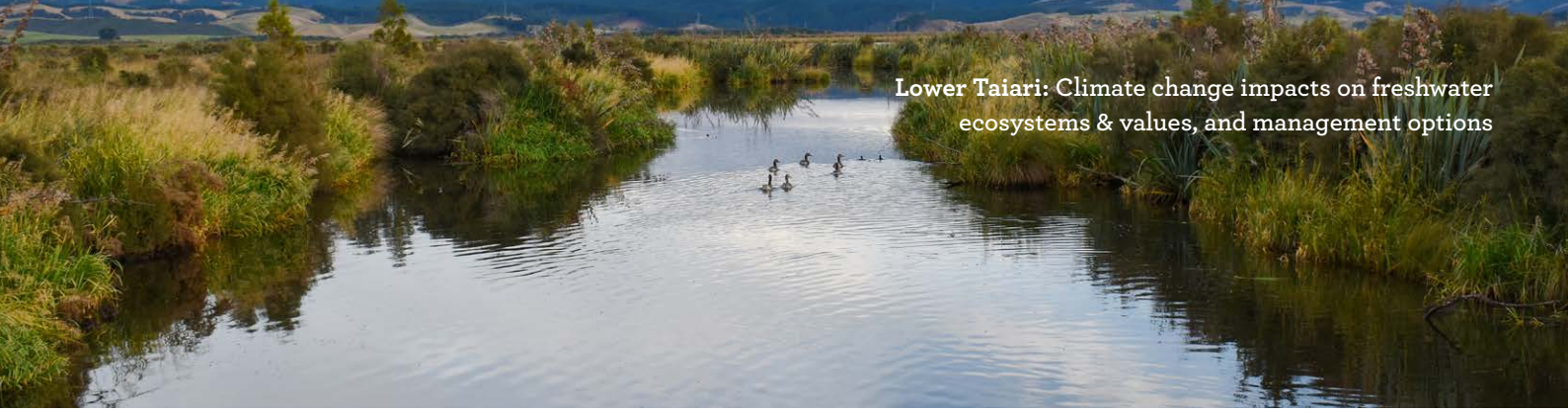
From a biodiversity perspective, the stop banks of the scheme, while protecting against flooding, constrain the wetland complex from expansion to historical sizes. If the wetland complex were allowed to expand beyond the constraints of the existing flood management scheme through strategic, managed changes, then freshwater habitats could shift towards higher areas of the basin, allowing freshwater species to adapt to rising sea levels. If the flood management scheme is bolstered against rising water levels, including increased pumping out of drains, this could limit/delay marine intrusions but eventually the productive freshwater and brackish lakes and wetlands of the Lower Taiari Plain will be replaced by an estuarine environment. Bolstering of flood protection could also result in further barriers to fish passage – it also means historical wetlands won't contribute to flood mitigation, water quality improvement and habitat provision for freshwater species. Investment in the flood management scheme also requires complex consideration of costs and risks to the community and economy under different climate scenarios (including sudden scheme failure under extreme events) – and is beyond the scope of our assessment.

Releasing more fresh water into the lakes from upstream at key times could slow the effects of saline intrusions, and support a transition to a healthy estuarine system with positive biodiversity values. The projected increase in droughts will put pressure on the Taiari River for irrigation water, making it difficult to provide more freshwater inflows into the lake-wetland complex in summer.
Flows of the Waipōuri River from Lake Mahinerangi are managed for hydro-electric generation. There might be an opportunity to retain water in Lake Mahinerangi in winter and release it downstream to the lake-wetland complex during summer/autumn, when Taiari River inflows are likely to decline, and when saline intrusions are likely to occur with greater frequency and magnitude.

Potential impacts of climate on the fauna of the Lower Taiari basin



Giant kokopu © Angus McIntosh



Management options

Mitigating extreme events, salinisation and sea level rise

- Assist a gradual transition to an estuarine state by supporting consistent freshwater inflows into the lake-wetland complex during summer low-flow periods, i.e. investigate feasibility of hydro schemes supporting management of freshwater inflows to avoid sudden increased saline intrusion.
- Restore existing and historical wetlands (including the sites of historic lakes) in a controlled manner, to improve resilience to climate impacts. Wetlands markedly improve water quality and can capture carbon, which helps to mitigate further climate change, increase aquatic biodiversity, and increase resilience to floods and drought.

Restoration to increase resilience to hydrological changes and extreme events

- Habitat restoration - landowners, rural advisors and catchment groups can seek recent survey information for important freshwater species (e.g. giant kōkopu, kanakana, īnaka) in their area (e.g. from Otago Regional Council, Department of Conservation). This will help identify important populations and spawning sites for habitat restoration opportunities.
- Restore riparian and wetland habitat and increase instream cover and refuge habitat in tributaries. Examples are riparian plantings that provide overhanging vegetation, root mats and undercuts as well as restoring fish passage. Diversifying habitat will increase resilience of fish and bird species to the potential impacts of climate change such as drought and floods.
- Restore the upstream limits of estuarine spawning areas (e.g. for īnaka and smelt) to allow inland migration of this habitat with coastal salinisation.
- Restore fish passage upstream so that inland migration with freshwater/saline limit can occur but ensure trout interactions with upstream rare non-migratory galaxiid populations are managed appropriately.

Download full reports: Closs et al. (2024) Climate change vulnerability assessment of freshwater ecosystems and values of the Taiari River catchment, and management options.

Goldsmith (2023) Climate change impacts and risks – Taiari River catchment. A compilation of current research to support local decision-making.