

# Summary: The Implications of Climate Change for New Zealand's Freshwater Fish

## Key Objectives:

- Assess how climate change severity may affect end-of-century distributions of New Zealand's native and nonnative freshwater fish
- Examine potential overlap between trout (introduced species) and vulnerable native fish species in future scenarios

## Methodology:

- Analysed 45 fish species (35 native, 10 nonnative) using data from NZ Freshwater Fish Database
- Used random forest modelling to predict end-of-century distributions based on:
  - Six climate models
  - Four climate scenarios (RCPs 2.6, 4.5, 6.0, and 8.5)
  - Environmental variables including temperature, hydrology, and habitat characteristics

## Key Findings:

### 1. Native Species Impact

- Nine native species at risk of extinction/near-extinction under severe climate change
- Eight additional native species likely to experience substantial population declines
- Four species predicted to show >30% increased range (including some whitebait species)

### 2. Nonnative Species Impact

- Seven nonnative species predicted to decline substantially
- Trout populations expected to decrease:
  - \* Brown trout: 30-40
  - \* Rainbow trout: 17-24% reduction in range
- Some invasive species like koi carp may expand their range

### 3. Geographic Changes

- Most significant changes expected in:
  - \* North Island: Southward and inland range reductions
  - \* South Island: Minimal changes observed
  - \* Lowland areas: Potential increases in warm-water species

## **Management Implications:**

### **1. Conservation Priorities**

- Focus on protecting and restoring habitats in predicted future ranges
- Consider assisted migration for some species
- Implement intervention-forward adaptive management approaches

### **2. Recommended Actions**

- Reduce climate change severity through emissions reduction
- Improve land use practices affecting freshwater ecosystems
- Monitor and manage overlap between trout and vulnerable native species
- Develop coordinated conservation strategies considering both native and valued sports fish

## **Limitations and Considerations:**

- Model predictions assume current habitat conditions remain unchanged
- Does not account for potential changes in water quality
- Interactions between species may vary in novel environments
- Limited experimental data on species' temperature and hydrological tolerances

The study emphasizes the urgent need for both climate change mitigation and improved freshwater habitat management to prevent potential extinctions and maintain New Zealand's unique freshwater biodiversity.