



CENTRAL SOUTH ISLAND REGION

# Hydro Canal Fishery Management – Scoping Document

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## Executive Summary

This report identifies the current values of the canal fishery, possible threats causing loss or decline of the fishery and issues within CSIFGC statutory management. Importantly, gaps in our knowledge are identified and an extensive schedule of projects that address these has been produced. The schedule is a living document and should be updated at not more than 3-yearly intervals as existing projects are progressed or new projects are prioritised.

From this schedule the Top 5 projects have been subjectively prioritised by CSIFGC staff based on: CSIFGC Strategic Plan Outcomes addressed, each projects “high”, “moderate” or “low” ranking for achieving long-term management of the fishery’s sustainability, Staff time, funding, and the likelihood of the project’s ultimate success. Incorporation of “top 5” projects should be considered during the development of annual Operational Work Plans.

Project briefs are presented for the two highest priority projects for implementation under project 1.1.25 in the 2021/22 Operational Work Plan. These projects are to: produce a feasibility report on use of sonar by CSIFGC Staff to provide an annual count/index of fish population size; and identify options for statutory protection of canal habitat.

## Introduction

The immense productivity and popularity of the Mackenzie Basin hydro-canal fishery has established it as one of the foremost sports fishing assets of New Zealand. The sustainability of the canal fishery under such angling pressure and profile is the statutory responsibility of the Central South Island Fish and Game Council (CSIFGC). This scoping document reflects CSIFGC Council’s intent to progress long-term management of the hydro canal fishery by documenting its Operational Work Plan- (OWP) based project options and priorities from the 2021/22 year onwards.

### Value of fishery

The hydro canals of the Mackenzie Basin carry the waters of lakes Ohau, Pukaki and Tekapo for electricity generation. These canals sustain a sports fishery of national importance with an international profile. The canals attract immense patronage from Central South Island and North Canterbury based anglers and significant visitation by Otago and Southland anglers. The canals are an established destination fishery for anglers from further afield in New Zealand and internationally. The fisheries popularity is based on its ease of access, scenic setting, permissive regulations, variety of catch species and perhaps most importantly, the ever-present opportunity to catch trophy-sized trout. The 2014-15 National Anglers Survey states: *“Collectively, the canals are by far the most heavily used fishery under Fish & Game’s jurisdiction”*.

### Current knowledge

CSIFGC and their predecessors the South Canterbury and Waitaki Valley Acclimatisation Societies, have overseen the canal fisheries establishment and development. Canal fisheries management

knowledge has been gained through staff observation, CSIFGC projects and surveys and review of third-party practices and research, including:

- Observation of the canal fisheries establishment and growth, which began with the construction and commissioning of the canals and then introduction of the first of many salmon farms in 1992.
- Population and recruitment dynamics observed through the salvage of sports fish during the de-watering of canals and associated parts of the greater hydro scheme, drift dives, sonar surveys, spawning surveys, creel surveys, mark-recapture projects and observation of harvest of escaped farmed salmon.
- Observation of angling trends, catch and perceptions through ranging, stakeholder interactions and fishing community media including TV, print, and social media.
- Assessment of angler use through the National Angler Survey and creel surveys.

The sports fishery habitat of the canals is extremely stable and provides suitable water quantity and quality due to the control of flow through power stations and control gate structures. There are no floods in the canals as flood waters are first contained by the headwater lakes and then bypass the canals through spillways to rivers and lakes. However, the canals carry the turbid flood waters that can occur for many months after flood events. Only on rare occasions are parts of the canals fully dewatered for maintenance.

The fishery has historically been assessed to be self-sustaining and reliant on migration of juvenile and adult trout from the headwater lakes and the periodic escapement and releases of Chinook salmon from the salmon farms. Within-canal trout spawning has been assessed to be of limited value to the fishery's sustainability due to the limitations of its success. These limitations include suboptimal substrate, occurrence of redd dewatering, the known extent of redd creation and predation of juveniles by larger trout and salmon and other predators. Salmon stocks are practically all female and no self-sustainability is evident. The ability of the canals to consistently produce trout of trophy size and the occasional fish at world-record size is dependent on salmon farming operations supplementing diets with salmon food products.

Angler use of the canal fishery is nationally significant and has grown immensely since the canals first established sports fish populations after their commissioning. In recent years the popularity of wintertime fishing has increased and high angler use is now a year-round phenomenon. The fishery's dramatic rise in popularity and the continuation of high angler use levels has largely been driven by the recreational fishing industry, the many licence holders that have intensively promoted the extreme size of the trout, and the ability of the canal fishery to consistently offer the angler the chance to catch an extremely large trout or an escapee salmon.

### **Threats to the fishery**

The threats to the fishery are possible fundamental changes or events that would cause catastrophic loss or constant decline in the recruitment of fish, the availability of trophy-size fish or the availability of angling opportunities. These include:

- Decommissioning of canals.
- Cessation of salmon farming.
- Changes in salmon farming practices leading to:
  - reduced salmon availability
  - reduction in residual farm food for trout and escapee/released salmon.
- Disease outbreak of farmed fish affecting wild fish or vice versa.
- Loss of access.
- Fish screens on intakes reducing/eliminating migration from headwater lakes.
- Reduction in trout recruitment of headwater lake tributaries.

- Environmental changes resulting in fish kills from high water temps and/or low dissolved oxygen levels.
- Reduction in water quality.

### **Angler management issues**

The canal fishery has a broad range of stakeholders, and each inherently poses individual and interdependent issues within the scope of CSIFGC's statutory management of the fishery. Issues can be as small as, one angler's frustration with another angler's fishing method, or as fundamental as the ongoing loss of access due to health and safety measures being imposed by power generators. Where possible and appropriate CSIFGC may respond and implement active management of such issues.

Canal angler management issues are summarised below under broad categories of angler concerns for fishery sustainability; angler compliance, satisfaction and interactions; and habitat, stakeholders and access.

Angler concerns for fishery sustainability:

- The canal fishery cannot sustain a continual increase in angling pressure.
- The dramatic recent increase in the targeting and harvest of the Tekapo Canal spawning run is affecting recruitment by removal of trophy-sized spawning trout.
- A lack of management in place to assess the fishery's long-term sustainability.
- The fishing experience and catch rate have diminished due to increased angler use and over-harvest.
- High catch and release occurrence when paired with poor fish handling techniques is contributing to a reduction in the trout population.
- Unnecessary management intervention to address angler concerns.
- A reduction in the availability of salmon due to Improvements in salmon farming practices.

Angler compliance, satisfaction and interactions:

- Overly complicated regulations leading to unintentional offending.
- Anglers unsatisfied with level of ranging and compliance activities.
- High offending rates around salmon escapement events.
- Concern that anglers fishing at night are offending at high rates, are going unchecked by rangers and are affecting daytime catch rates.
- Particular methods and fishing locations are conducive to high rates of foul hooking.
- Angler conflict caused by spatially incompatible methods.
- Angler opinion that bait fishing is not sporting or appropriate for catch and release.
- Angler opinion that the canals should be managed as a catch and release trophy fishery.
- Angler opinion that spawning-run fishing is immoral.
- Unrealistic expectations of catch created by widespread positive media of the fishery.
- Concern that anglers are exposing the fishery to unsustainable pressure through social media.

Habitat, stakeholders and access:

- Historical and ongoing loss of vehicle, walking and wheelchair access.
- Removal of Pukaki-Ohau A Canal salmon farm reducing productivity of fishery and shifting angling pressure to other canals.
- Concern that salmon farming is impacting water quality.
- Concern that fishing guides, social media influencers and others that benefit or profit from promoting the canals are causing increased angling pressure and a diminished angler experience.

## **CSIFGC's Strategic Plan**

In 2020, the CSIFGC adopted its Strategic Plan 2020-2024. The Plan sets seven strategic goals and their outcomes. Goal 4 relates specifically to canal fisheries. The Plan states:

4. *Manage, maintain and enhance the canal fisheries in the Central South Island Region to enable anglers to enjoy a sustainable and highly valued angling experience.*

4.1 *The current quality, population, and harvest of the canal fishery are understood and recorded.*

4.2 *Areas of the canal fishery, which are declining in quality, are identified and interventions are implemented to stem or reverse the decline.*

4.3 *Anglers' harvests are monitored and regulated to support the sustainability of the canal fishery.*

## **Aim**

The aim of this scoping document is to:

1. Identify project options for long-term management of sustainable hydro-canal trout and salmon populations in the recreational interests of anglers (Achieves 20/21 OWP project 1.1.25).
2. Identify the "Top 5" priority project options for the long-term management of the hydro-canal fishery in the recreational interests of anglers (Achieves 20/21 OWP project 1.1.25).
3. Recommend two of the "Top 5" priority project options for initiation in the 21/22 OWP (satisfies 21/22 OWP project 1.1.25).

## **Long-term management of sustainable hydro canals fisheries**

### **Management and knowledge gaps**

To ultimately achieve CSIFGC's strategic Goal 4, evidence-based and robust assessment of trends in key aspects of fisheries sustainability in the short- and long-term are required. Robust trend assessment requires the review of data sets of annual measurements. Currently there are no annual monitoring programmes in place on canal fisheries to assess trends, including any declining trends. The only cyclical monitoring programme in place is the National Angling Survey that measures angler use of all fisheries across New Zealand on a seven-year cycle. Many key aspects of the canal fishery remain unquantified, and their evidential assessment would assist to endorse or disprove long-held fundamental management principles and/or angler perceptions.

Key gaps in canal fisheries management and knowledge include:

- Annual estimates or indexes of sports fish populations.
- Annual estimates or indexes of sports fish catch, harvest and related angler use.
- Quantification of the relative contribution of the two recruitment pathways to sustaining the satisfactory catch of adult trout. Those pathways being within-canal spawning and downstream migration from headwater lakes.
- Distribution and quantity of spawning in Ohau C Canal and Pukaki Canal.
- Evaluation of anglers' canal-specific values needed to maximise angler satisfaction.
- Assessment of the diet of trout including the importance of salmon farm pellets, cannibalism, native prey fish, molluscs and invertebrates to maintaining a trophy fishery.

- Growth and replacement rates of trophy fish.
- Statutory protection of habitat.

### **Ranking of priority projects**

The priority projects for the long-term management of sustainable hydro canals in the recreational interests of anglers can be ranked in a three-tier hierarchy, summarised as:

High priority projects for long-term management - projects include those that:

- Provide annual monitoring and evidential basis for long-term and short-term trend assessment of sports fish populations, catch, and related angler use and satisfaction.
- Quantify relative contribution to trout recruitment of headwater and within-canal spawning.
- Provide statutory protection of canal habitat.
- Maintain or improve and secure enduring access.

Moderate priority projects for long-term management - projects include those that:

- Evaluate, monitor, and enhance spawning where this will provide tangible benefit.
- Evaluate the canal-specific values of anglers.
- Provide a maximised and/or sustained increase in angling opportunity.
- Obtain evidence that supports or disproves key long-held management assumptions.
- Provide cyclical but not annual comparisons of sports fish populations, catch, and related angler use and satisfaction.
- Assess trends in the quality of the habitat.
- Provide major improvements to angler compliance rates through increased ranging and compliance activities.

Low priority projects for long-term management - projects include those that:

- Provide short-term opportunities to increase catch, participation, or interaction with stakeholders.
- Summarise pre-existing information.
- Investigate the occurrence of short-term or sporadic phenomena, for example the food competition caused by salmon farm escape events.
- Provide improved opportunity for a limited number of anglers.
- Provide only imperceptible or minor improvements to angler compliance rates.
- Provide information beyond ecosystem or habitat, for example, the economic valuation of the fishery.
- Support the social license of anglers, for example, by promoting litter clean-up events.

### **Schedule of projects**

An extensive schedule of historic, current and potential Operational Work Plan projects is appended. The Schedule includes a short description for each projects and for those with relevant existing information or that are incorporated in the 2021/22 OWP, the current status is provided.

The listing of any project is done without considering any limitations so that all reasonable project options can be considered. For example, projects with a potential cost of tens of thousands of dollars or the need to hire a new staff member are considered under the assumption that the project may be in the best interests of improving the management of the canal fishery. However, the resource limitations of any such project will become apparent through its feasibility reporting to decide if the project should be pursued.

The schedule is a living document and CSIFGC Staff recommend it should be updated at not more than 3-yearly intervals as existing projects are progressed or new projects are prioritised.

The projects have been assessed by CSIFGC Staff under five criteria in the Schedule to provide an overview of broad aspects of each project's relevance to CSIFGC's management and to enable prioritisation. Criteria includes: CSIFGC Strategic Plan Outcomes addressed, each projects "high", "moderate" or "low" ranking for achieving long-term management of the fishery's sustainability, Staff time, funding, and the likelihood of the project's ultimate success.

The action needed to progress a project towards its ultimate completion is identified as the Next Step. Next step "actions" are defined as:

- *Feasibility report* – means subject to Council approval through OWP process, to evaluate the fundamental aspects of the project before it is undertaken as a one-off or annual project. This could be either a desk-top analysis or a pilot study in the field or both. The feasibility report must include assessment of the project's ongoing practicality and the associated staff resourcing and funding requirements for CSIFGC's consideration.
- *Undertake* – means to implement the project with reporting requirements subject to Council approval through OWP process.
- *Repeat* – means to implement an historical project with reporting requirements subject to Council approval through OWP process.
- *Continue* – means it is a current OWP project with reporting requirements.
- *Completed* – means the project is completed and reported. Findings and recommendations will be considered in three-year review of project schedule.
- *Unfeasible* – means the project has been determined through experience and/or documented evidence that its likelihood of success is low and staff have concluded that it is not feasible to pursue.

## **Project prioritisation**

The Schedule identifies the Top 5 projects subjectively prioritised by CSIFGC staff to have their Next Step actioned. The Next Step projects would be approved under an Operational Work Plan. The 2021/22 OWP, project 1.1.25, provides for the investigation and evaluation (meaning Next Step) of at least one of the Top 5 priority project options identified in this report. The remaining Top 5 projects would be addressed in successive OWP's.

Recommended Top 5 Projects, in priority order:

1. Project 1.1 - Annual sonar survey to provide an index of sports fish population size – CSIFGC Staff. Recommended Next Step: Feasibility Report.
2. Project 6.1 – Identify options for statutory protections of habitat. Recommended Next Step: Undertake.
3. Project 3.2 - Annual canal fishery angler use and catch survey. Recommended Next Step: Feasibility Report.

4. Project 4.1 - Angler values of the canal fishery survey. Recommended next step: Undertake.
5. Project 4.3 - Catch and release best practice campaign. Recommended next step: Feasibility Report.

## **Project briefs**

The two highest priority Top 5 projects are accompanied by project briefs which provide the background and planned outcomes of the projects and their required Next Steps. These projects fulfil the requirements of 2021/22 OWP project 1.1.25.

### **Project Brief 1: 1.1 Annual sonar surveys – CSIFGC Staff**

#### **Project description**

CSIFGC Staff prepare a feasibility report on the use of a sonar device to annually provide an index of the fish population to assess long-term population trends.

#### **Management issue or key gaps in fisheries management and knowledge project seeks to address**

Establishing an annual estimate or index of sports fish populations to enable short and long-term trends in the fishery to be assessed.

#### **Schedule Assessment Criteria**

Addresses Outcomes of CSIFGC Strategic Plan: 2.2, 4.1, 4.2, 4.3, 6.2, 6.3, 6.7.

Ranking of project for long-term management of sustainability: High.

Anticipated OWP staff time: Moderate.

Anticipated OWP budget funding: Moderate.

Likelihood of the project's ultimate success: Unknown.

#### **Recommended Next Step**

Feasibility report.

#### **Planned outcome**

By August 2022, provide a report to Council that evaluates the feasibility of use of any readily available sonar technology investigated and/or trialled by CSIFGC staff for its potential to provide an index of the fish population and be implemented as an annual work plan project. This would include an outlay of staff resourcing and costs of equipment etc of any future annual surveys. An independent review of the methodology would be sought and that is likely to require funding of between \$500-\$2,000. This may occur in successive OWP years.

#### **Current Status**

Initial field trials of some available sonar devices are underway in Winter of 2021. Recommended option to achieve project 1.1.25 of 21/22 OWP.

#### **Project background**

This project is assessed by CSIFGC Staff as the highest priority for actioning its Next Step. Importantly, it aims to provide an annual index of fish populations directly. The ability to assess the number of fish present could provide a consistent basis for assessment of sustainability as opposed to assessing an index of angler catch that may be influenced by many factors such as water clarity and flow rates.



An annual index of population size provides a basis for review of the short and long-term trends in sports fish populations and will assist greatly when considering the relevance of regulation change and the monitoring of any changes made. A count of fish also provides important information of natural variations of fish populations and could be helpful to share with any anglers that perceive fish populations are low and show concern for the state of the fishery.

DIDSON sonar was trialled for counting fish by the Cawthron Institute in the Tekapo Canal in 2011. The survey was assessed as providing a useful assessment of the distribution of fish across the canal. It was noted that there was no way of knowing how many fish were not detected, including those that were motionless on the bed of the canal, which demonstrates sonar is likely to provide an index of fish present in the area surveyed and not a population count.

This project aims to review the ability for accessible modern sonar technology to be utilised to provide an index of fish populations. Targeting spawning run congregations of fish in the upper parts of canals is predicted to provide the best quality data as other parts of the canal may not be entirely accessible with physical impediments like the wire cables around salmon farms. If this project fails to achieve its aim, then project 1.2 may be the next step by engaging a contractor to identify appropriate technology and survey design.

## **Project brief 2: 6.1 Statutory protection**

### **Project description**

Identify options and advocate for any potential statutory protections that maintain canal habitat and ecosystems.

**Management issue or key gaps in fisheries management and knowledge project seeks to address**  
statutory protection of habitat.

### **Schedule Assessment Criteria**

Addresses Outcomes of CSIFGC Strategic Plan: 1.1, 1.2, 1.3, 2.2, 4.1, 4.2, 6.2.

Ranking of project for long-term management of sustainability: High.

Anticipated OWP staff time: Moderate.

Anticipated OWP budget funding: Low.

Likelihood of the project's ultimate success: Unknown.

### **Recommended Next Step**

Undertake project.

### **Planned outcome**

By August 2022, provide a summary report to Council that reviews relevant Plans and consents that effect the habitat of the canal fishery highlighting investigations, outcomes and recommendations for achieving statutory protections. Actively review and advocate for protection afforded by resource consents during the scheduled 2025 reconsenting of the Waitaki Hydro Scheme.

### **Current Status**

Some habitat protection matters are being discussed between CSIFG, Meridian and Genesis through the 2025 reconsenting of upper Waitaki water rights consents.

### **Project background**

The hydro canals were constructed to support New Zealand demands for hydroelectricity. Although one of the country's most important sports fisheries has now developed in the canals they continue to be managed as a hydroelectric asset that New Zealand is dependent upon.

Currently, there is little, if any, statutory protection of the canals in their capacity to support sports fishery habitat. It is possible that extraordinary circumstances may occur in future that threaten to or cause a reduction of the quality of the habitat, temporarily or permanently, that could be addressed through statutory protections. This project seeks to investigate possible habitat protection through statutory mechanisms. It could be of benefit to the long-term sustainability for CSIFG to seek statutory protections through consent conditions and policy that proactively address any extraordinary events.

### **Recommendations:**

- 1. THAT COUNCIL RECEIVE THIS REPORT.**
- 2. THAT DURING THE 2021/22 OPERATION YEAR STAFF PRODUCE A FEASIBILITY REPORT FOR PROJECT 1.1 AND UNDERTAKE PROJECT 6.1 AS PROVIDED FOR AS OBJECTIVE 1.1.25 IN THE 2021/2022 OWP.**
- 3. THAT COUNCIL NOTES PROJECTS 1.1, 6.1, 3.2, 4.1, 4.3 AS "TOP 5" PRIORTIES TOWARDS IMPROVING THE LONG-TERM MANAGEMENT OF THE CANAL FISHERY FOR CONSIDERATION IN FUTURE OWP'S.**
- 4. THAT A THREE-YEAR REVIEW OF THE PROJECT SCHEDULE AND "TOP 5" PRIORITIES BE UNDERTAKEN IN THE 2024/25 OWP.**

Note: Should Council decide to add or amend projects under recommendation 2, It is recommended that these be informed by a Project Brief prior to resolution.

## Schedule of historic, current, and potential canal fishery Operation Work Plan projects – September 2021

Code	Project options *some existing information in this area	Project description	Addresses Outcomes of CSIFGC Strategic Plan	Ranking of long-term management of fishery sustainability	Staff time	Funding	Likelihood of the project's ultimate success	Current status	Next Step	Staff recommended priority for Next Step - Top 5 (1=highest - 5=lowest)
<b>1 - Sports fish population monitoring</b>										
1.1	Annual sonar surveys - Fish & Game Staff	CSI Staff to use sonar device to annually provide an index of the fish population to assess long term population trends	2.2, 4.1, 4.2, 4.3, 6.2, 6.3, 6.7	High	Moderate	Moderate	unknown	Recommended option to achieve project 1.1.25 of 21/22 OWP	Feasibility report	1
1.2	*Annual sonar surveys - contracted	Use sonar device to annually count an index of the fish population to assess long term population trends	2.2, 4.1, 4.2, 4.3, 6.2, 6.3, 6.7	High	Low	high	unknown	NIWA and Cawthron have some experience and equipment	Feasibility report	1* subject to outcome of feasibility report of Top 5 priority project 1.1
1.3	*Annual Drift Dive surveys	Annual survey of sports fish population index to assess long term population trends.	2.2, 4.1, 4.2, 4.3, 6.2, 6.3, 6.7	n/a	Moderate	Moderate	Low	Some historical data but water clarity inconsistent.	Unfeasible	Unfeasible
1.4	Triennial period Mark-recapture stocking and angler diary scheme/ creel survey	Stock significant numbers of tagged or fin clipped wild or hatchery sourced trout and assess their prevalence in angler catch through a angler diary scheme for population size assessment	2.3, 4.1, 4.2, 4.3, 6.4, 6.5	High	Moderate	Moderate	Low		Feasibility report	>5
1.5	*Sports fish stocks survey at Lake Ruataniwha	Repeat historical netting survey of Lake Ruataniwha undertaken to assess the establishment of the fishery in relation to the construction of the hydro scheme.	1.1, 2.2, 4.1	Moderate	Moderate	Moderate	High	1982/84 and 1992 surveys completed and reported.	Repeat	>5
<b>2 - Trout recruitment evaluation</b>										
2.1	*Natal origin assessment using trace element and isotope analysis	Investigate the proportion of canal trout identifiable as from headwater lakes origin to provide assessment of the relative importance within-canal and headwater recruitment pathways	1.3, 2.2	High	Moderate	high	Low	NIWA advice suggests high risk and high-cost pilot study initially required	Feasibility report	>5
2.2	*Annual spawning survey at upper Ohau River (Ohau B Canal)	Annual redd and live fish counts as an index of spawning activity and distribution and the utilisation of spawning enhancement.	1.1, 1.3, 2.2, 4.1	High	Low	Moderate	High	Incorporated in project 1.1.17 in 21/22 OWP	Continue	Currently in place

Code	Project options *some existing information in this area	Project description	Addresses Outcomes of CSIFGC Strategic Plan	Ranking of long-term management of fishery sustainability	Staff time	Funding	Likelihood of the project's ultimate success	Current status	Next Step	Staff recommended priority for Next Step - Top 5 (1=highest - 5=lowest)
2.3	Impact of dewatering on redd success at upper Tekapo Canal	Assessment of the occurrence of redd dewatering and its effects on redd success	1.1, 1.2, 1.3, 2.2, 4.1, 4.2, 6.6	Moderate	High	Moderate	Low		Feasibility report	>5
2.4	Tekapo spillway to canal migration timing and success - Radio tracking	Use radio tags to monitor the migration of trout within the Tekapo Spillway and the occurrence of reaching the canal successfully	4.1, 4.2, 6.6	Moderate	High	High	High		Undertake	>5
2.5	*Tekapo spillway to canal migration timing and success - floy tag	Undertake further floy tagging of trout stranded in Tekapo Spillway to monitor the migration of trout and the occurrence of reaching the canal successfully	4.1, 4.2, 6.6	Moderate	Moderate	Low	Moderate	Completed and reported 2021. Some questions of migration outcomes remain.	Repeat	>5
2.6	Power Station migration survivability	Review relevant literature of survivability of sports fish migrating through power station turbines and control structures.	4.1, 6.6	Low	Low	Low	High		Undertake	>5
2.7	*Determine distribution of visible edge spawning redds	Assess the geographical distribution of redds visible on the edges of all canals.	1.1, 1.2, 1.3, 2.2, 4.1, 4.2, 6.6	Moderate	Low	Low	High	Incorporated in project 1.1.1 in 21/22 OWP	Continue	Currently in place
2.8	Drift diving/scuba diving for redd counts	Assessment of distribution of redds during period of high water clarity	1.1, 1.3, 4.1	Moderate	Moderate	Moderate	Low		Feasibility report	>5
2.9	Closure of spawning areas	Assessment of the relevance of spawning area closures to protect recruitment	1.1, 1.3, 4.2, 6.8	Moderate	Low	Low	Unknown	Dependant of spawning surveys and natal origin research	Feasibility report	>5
2.10	Juvenile trout survival and contribute to angler catch	Assessment of juvenile survival from predation and other factors to reach a size that contributes to angler catch and harvest	1.1, 2.1, 4.3	Moderate	Unknown	Unknown	Unknown		Feasibility report	>5
2.11	Annual spawning redds index surveys Tekapo Canal	Annual counts of redds visible on the banks of the Tekapo Canal as an index of annual spawning activity	1.1, 1.2, 1.3, 2.2, 4.1, 4.2, 6.6	Moderate	Low	Low	Moderate		Feasibility report	>5
2.12	Triennial period headwater rainbow trout recruitment assessment	Electric fishing surveys for rainbow trout juveniles in headwater lake tributaries of the canal system	1.3, 2.2, 4.1, 6.2	Moderate	Low	Low	Moderate	Project 1.1.26 in 21/22 OWP	Undertake	Currently in place

3 - Angler use and catch surveys										
Code	Project options *some existing information in this area	Project description	Addresses Outcomes of CSIFGC Strategic Plan	Ranking of long-term management of fishery sustainability	Staff time	Funding	Likelihood of the project's ultimate success	Current status	Next Step	Staff recommended priority for Next Step - Top 5 (1=highest - 5=lowest)
3.1	*Annual angler use and catch survey of upper Tekapo Canal during spawning run	Continue existing survey but implement as an annual survey to provide long-term assessment. Requires re-opening of winter season closure.	1.3, 2.2, 4.1 4.2, 4.3, 6.1, 6.5	High	High	Moderate	High	Completed in 2019 and 2020 and reported.	Repeat	3* Will be considered subject to Next Step of project 3.2 as recommended in Top 5 priority
3.2	*Annual canal fishery angler use and catch survey	Annual survey of angler use and catch at the canals to provide long-term assessment	1.2, 2.2, 4.1, 4.2, 4.3, 6.1, 6.5	High	High	Moderate	High	Recommended that consideration be given to incorporating project in the 2022/23 OWP	Feasibility report	3
3.3	*Monitor catch of upper Ohau River Spring Season	Monitor the catch of Spring Season anglers as an index of the Ohau B Canal fishery	1.1, 1.2, 1.3, 2.1, 2.2, 2.3, 4.3, 6.1, 6.4, 6.5	High	High	Low	High	Incorporated in project 1.1.17 in 21/22 OWP	Continue	Currently in place
3.4	Hydro canal angler use and catch survey	One-off Repeat of the 2015-16 survey to provide comparison	1.2, 4.1, 4.2, 4.3, 6.1, 6.5	Moderate	High	Moderate	High	Completed 2015-16 and reported	Repeat	>5
3.5	Annual Angler Diary scheme	Distribute diaries to active canal anglers to provide index of catch rate and fish size	1.2, 2.2, 4.1, 4.2, 4.3, 6.1, 6.5	Moderate	Moderate	Low	Low		Feasibility report	>5
3.6	*Annual angler use and catch survey of upper Tekapo Canal during spawning run closure shoulder months	Continue existing survey but implement as an annual survey to provide long-term assessment. Requires continuation of winter season closure.	1.2, 2.2, 4.1, 4.2, 4.3, 6.1, 6.4, 6.5	Moderate	Moderate	Moderate	High	Project 1.2.7 in 21/22 OWP	Continue	Currently in place
3.7	*Effects of salmon farm changes on angler use, catch and fish size at Pukaki-Ohau-A & Ohau C canals	Repeat parts of 2015-16 angler use and catch survey to provided comparisons of angler use and catch at canals that have experience substantial changes in salmon farming practises	1.1, 1.2, 2.2, 4.1, 4.2, 4.3, 6.2, 6.6, 6.8	Moderate	High	Moderate	Moderate		Feasibility report	>5
4 - Angler dynamics										
4.0	Maintain or improve and secure enduring access	Maintain or improve outcomes for access management with power companies and third-parties	4.2, 6.1, 6.2, 6.3, 6.6, 6.8	High	Low	Low	Low	Project 3.1.2 and 2.1.6 in 21/22 OWP	Continue	currently in place

Code	Project options *some existing information in this area	Project description	Addresses Outcomes of CSIFGC Strategic Plan	Ranking of long-term management of fishery sustainability	Staff time	Funding	Likelihood of the project's ultimate success	Current status	Next Step	Staff recommended priority for Next Step - Top 5 (1=highest - 5=lowest)
4.1	Angler values of the canal fishery survey	Survey of anglers to quantify their values of various aspects of the canal fishery	1.1, 1.2, 2.2, 4.1, 4.2, 4.3, 6.1, 6.2, 6.5, 6.8	Moderate	Moderate	Low	High	Recommended that consideration be given to incorporating project in the 2022/23 OWP	Undertake	4
4.2	Survey of angler satisfaction	An add-on survey to any existing canal-based surveying like ranging and creel surveys	1.1, 1.2, 2.2, 4.1, 4.2, 4.3, 6.1, 6.2, 6.5, 6.8	Moderate	Moderate	Low	High	Incorporated in 21/22 OWP projects 1.1.17 and 1.2.7	Continue	Currently in place
4.3	Catch and release best practice campaign	A coordinated, multi-media approach to advocating best practice catch and release	4.1, 4.3, 6.4, 6.5, 7.3	Moderate	Moderate	Moderate	High	Recommended that consideration be given to incorporating project in the 2022/23 OWP	Feasibility report	5
4.4	Survey of night angling use and compliance rate	Paired-staff night-time ranging of canals throughout the year to assess angle use levels and compliance rates of angler fishing the canals during darkness.	4.1, 4.3, 6.4, 7.3	Moderate	High	Moderate	High	Incorporated in project 5.1.1 in 21/22 OWP	Continue	Currently in place
4.5	Review of regulations	Review appropriateness and efficacy of regulations to provide a sustainable fishery with maximised opportunity	2.2, 4.1, 4.2, 4.3, 6.3, 6.4, 6.8, 7.3	Moderate	Moderate	low	Unknown		Undertake	>5
4.6	*National Angler Survey	NIWA contracted survey of sports fishing angler effort across New Zealand, undertaken on 7-year cycle.	1.1, 1.2, 2.2, 4.1, 4.2, 6.2, 6.5, 6.8	Moderate	Low	High	High	Project 1.2.6 in 21/22 OWP	Continue	currently in place
4.8	Trophy fishery management	The application of regulations or other management options designed to increase the size of catch and frequency of catching trophy-sized trout.	1.1, 1.2, 2.2, 4.1, 4.3, 7.3	Low	Low	Low	Moderate		Feasibility report	>5
4.9	Economic valuation of the canal fishery	Economic valuation of the canal fishery to the local and national economy	2.2, 4.1, 4.3, 6.2	Low	Low	High	High		Undertake	>5
4.10	External funding of canal-based ranger(s)	Assess alternate sources of funding to hire canal-based ranger(s)	4.3, 7.3	Low	Low	Low	Unknown		Feasibility report	>5
4.11	Increase staff ranger presence	reallocate staff hours to provide an appreciable increase in canal ranging by staff to provide further deterrence to offending	4.3, 7.3	Low	High	High	High		Feasibility report	>5
4.12	Closure of sanctuary areas with no fishing pressure	The closure of areas, other than for spawning protection, to prohibit localised catch in areas where fish congregate.	2.2, 4.2, 4.3, 7.3	Low	Moderate	Moderate	Low		Feasibility report	>5

Code	Project options *some existing information in this area	Project description	Addresses Outcomes of CSIFGC Strategic Plan	Ranking of long-term management of fishery sustainability	Staff time	Funding	Likelihood of the project's ultimate success	Current status	Next Step	Staff recommended priority for Next Step - Top 5 (1=highest - 5=lowest)
4.13	*Canal litter clean-up event	Ensure canal litter clean-up event occurs on a regular or as-needed basis	1.2, 4.2, 6.2, 6.4, 6.5	Low	Low	Low	High	Currently managed by third party club with some support by CSIFG, Incorporated in project 4.5.2 of 21/22 OWP	Continue	Currently in place
4.14	Controlled fishery management	Limiting angler use geographically or temporarily so that catch and angling experience can be managed.	2.2, 4.1, 4.3, 6.1, 6.3, 6.5, 7.3	Low	Moderate	Low	Moderate		Feasibility report	>5
<b>5 - Fishery enhancement</b>										
5.1	Assessment of carrying capacity of Ohau C Canal.	Subject to a stocking programme, assess the maximum number of fish the Ohau C Canal can sustain to an acceptable size and condition	2.2, 4.1, 4.3, 6.3	Moderate	Moderate	High	Moderate		Feasibility report	>5
5.2	Within-canal spawning enhancement	Improve habitat to assist the success of within-canal spawning	1.3, 2.2, 4.1, 6.3	Moderate	high	High	Low		Feasibility report	>5
5.3	Upper Ohau River spawning enhancement	Introduce spawning gravels to expand spawning areas and improve substrate type with support of Meridian Energy	1.1, 1.3, 2.1, 2.2	Moderate	Moderate	High	Moderate	Incorporated in project 2.1.6 in 21/22 OWP	Continue	Currently in place
5.4	*Put 'n' take salmon stocking programme	Secure funding and stocks required to provide annual put 'n' take salmon stocking programme	4.1, 4.2, 4.3, 6.1, 6.3	Moderate	Low	High	Moderate	Catch rates proven viable during previous stocking investigation.	Feasibility report	>5
5.5	Put 'n' take trout stocking of Ohau C Canal with catchment sourced wild juvenile trout and/or hatchery stock	Undertake and monitor stocking Ohau C Canal with catchment sourced wild juvenile trout caught by electric fishing and/or stock supplies from hatcheries	2.2, 4.1, 4.3, 6.3,	Moderate	Moderate	low	Low		Feasibility report	>5
5.6	*Install fish feeders in Pukaki-Ohau A Canal	Increase food supply for wild sports fish to increase their size and condition	2.2, 4.1, 4.2, 4.3, 6.3	Moderate	High	High	High		Feasibility report	>5
5.7	Stocking "novelty" fish -e.g. triploid trout or sterile options	Source sterile hatchery sports fish stocks to provide novelty catches and fish that grown at exceptionally fast rates.	4.1, 4.3, 6.3, 6.4	Low	Low	Moderate	low		Feasibility report	>5
5.8	Fishing events - tagged fish with prize rewards	Hold event to promote participation with the benefit of increasing the profile and awareness of fish tagging research	4.1, 4.3, 6.1, 6.3, 6.8	Low	Low	Low	High		Feasibility report	>5
5.9	Fish & Game fishing competition	Add-on to other projects where fish data or samples required and collected through fishing competition with weigh-in.	4.1, 4.3, 6.1, 6.3, 6.8	Low	high	Moderate	High		Feasibility report	>5

6 - Canal ecosystem and habitat										
Code	Project options *some existing information in this area	Project description	Addresses Outcomes of CSIFGC Strategic Plan	Ranking of long-term management of fishery sustainability	Staff time	Funding	Likelihood of the project's ultimate success	Current status	Next Step	Staff recommended for Next Step - Top 5 (1=highest - 5=lowest)
6.1	Statutory protection	Identify options and advocate for any potential statutory protections that maintain canal habitat and ecosystems	1.1, 1.2, 1.3, 2.2, 4.1, 4.2, 6.2	High	Moderate	Low	unknown	Recommended option to achieve project 1.1.25 of 21/22 OWP, and partially included in 2.1.6 and 2.1.11 of the 21/22 OWP	Undertake	2
6.2	Trout diet analysis - gut samples	Collect gut samples from canal trout for visual assessment of contents	1.1, 2.2, 4.1,	Moderate	Moderate	high	Moderate		Feasibility report	>5
6.3	*Trout diet analysis - stable isotope	Analysis of trout tissue samples to detect various food types in diet	1.1, 2.2, 4.1,	Moderate	Moderate	high	High	Similar research in place in New Zealand	Feasibility report	>5
6.4	*Stocking of Tekapo Canal with tagged salvaged trout	To record and monitor angler catch rate and trout growth by mark recapture of stocked trout in the Tekapo Canal as opportunities arise through fish salvage and angler returns.	1.1, 2.2, 4.1, 4.3	Moderate	Moderate	Low	High	Project 1.1.21 in 21/22 OWP	Continue	Currently in place
6.5	*Trout growth rate and age structure - otolith	Use aging of angler caught trout otoliths to assess the age and growth rates of angler caught trout.	1.1, 4.1, 4.3, 6.4, 6.5	Moderate	Moderate	Moderate	Moderate	Project 1.1.20 in 21/22 OWP	Continue	Currently in place
6.6	Trends in water quality, habitat and ecosystem health	Assessment of available data on water quality and habitat to identify risks of decline.	1.1, 1.2, 1.3, 2.2, 4.1, 4.2, 6.2	Moderate	High	low	Moderate	Responsibility of ECan and resource users with discharge consents	Undertake	>5
6.7	Establish fish and habitat information during canal dewatering and fish salvage	Assist power companies with fish salvage and the collection of relevant habitat, ecosystem and sports fish data subject to any canal dewatering operations.	1.1, 1.2, 2.2	Moderate	Moderate	Low	High	Incorporated in project 1.3.1 in 21/22 OWP	Continue	Currently in place
6.8	*Trout movement analysis radio tracking of Pukaki-Ohau A and Ohau C canals trout	Assess the movements of trout during the spawning season	1.3, 4.3	n/a	High	High	High	Completed 2020 - Awaiting final report by NIWA	Completed	n/a
6.9	*Trout movement analysis radio tracking of Tekapo and Ohau B Canal trout	Assess the temporal movements of trout in the Tekapo and Ohau B Canals	1.3, 4.1, 4.3, 6.3, 6.8	Low	High	High	High	Project has been completed on the other canals	Undertake	>5
6.10	Influence of salmon farm escapees on trout food competition	Assess the diet of escaped of released salmon in regard to their direct competition for food sources with trout.	1.1, 2.2, 4.1	Low	High	High	Low		Feasibility report	>5
6.11	Literature review of canal research	Literature review to provide compiled summary of key findings of existing canal fisheries research	1.1, 1.2, 4.1	Low	Moderate	Low	High		Undertake	>5