



2024 Amuri Salvage Field Report



North Canterbury Fish & Game

This report was prepared by staff at the North Canterbury region of New Zealand Fish & Game, for use in reports to regional council or other internal reports as needed. Segments of the report were originally prepared in conjunction with Nelmac-Kūmānu Environmental following the 2023 salvage.

INTRODUCTION

The Amuri Irrigation Company (Canterbury, New Zealand) requires annual de-watering of their irrigation races for removal of sediment, debris, and general maintenance. The two irrigation schemes are on the Hurunui River found at Balmoral Forest (42°47'47.58"S, 172°33'41.10"E), and on the Waiau Uwha River found at Leslie Hills Road (42°41'47.03"S, 172°48'4.06"E) (Figure 1). During the closedown period, fish become stranded in the lowered water levels of the irrigation races, holding ponds, and bypasses. North Canterbury Fish & Game are engaged annually by Amuri Irrigation Company for fish salvage operations following de-watering. Fish & Game engaged Marc Jary from Cawthron Institute in 2022, and subsequently Nelmac-Kūmānu Environmental in 2023 to assist in co-ordination, management, and implementation of the fish salvages. In 2024, Fish & Game did not engage any external agencies for assistance.

Fish species most commonly found in both the Hurunui and Waiau Uwha catchments include brown trout (*Salmo trutta*), rainbow trout (*Oncorhynchus mykiss*), chinook salmon (*Oncorhynchus tshawytscha*), common bully (*Gobiomorphus cotidianus*), upland bully (*Gobiomorphus breviceps*), torrentfish (*Cheimarrichthys fosteri*), longfin eel (*Anguilla dieffenbachia*), shortfin eel (*Anguilla australis*) and a variety of *Galaxias* species (Stoffels, 2022). This field report provides detail in relation to the fish salvage carried out on the Hurunui River and Waiau Uwha River schemes on the 23rd and 24th of May 2024, including some information from the 2022 and 2023 salvages.

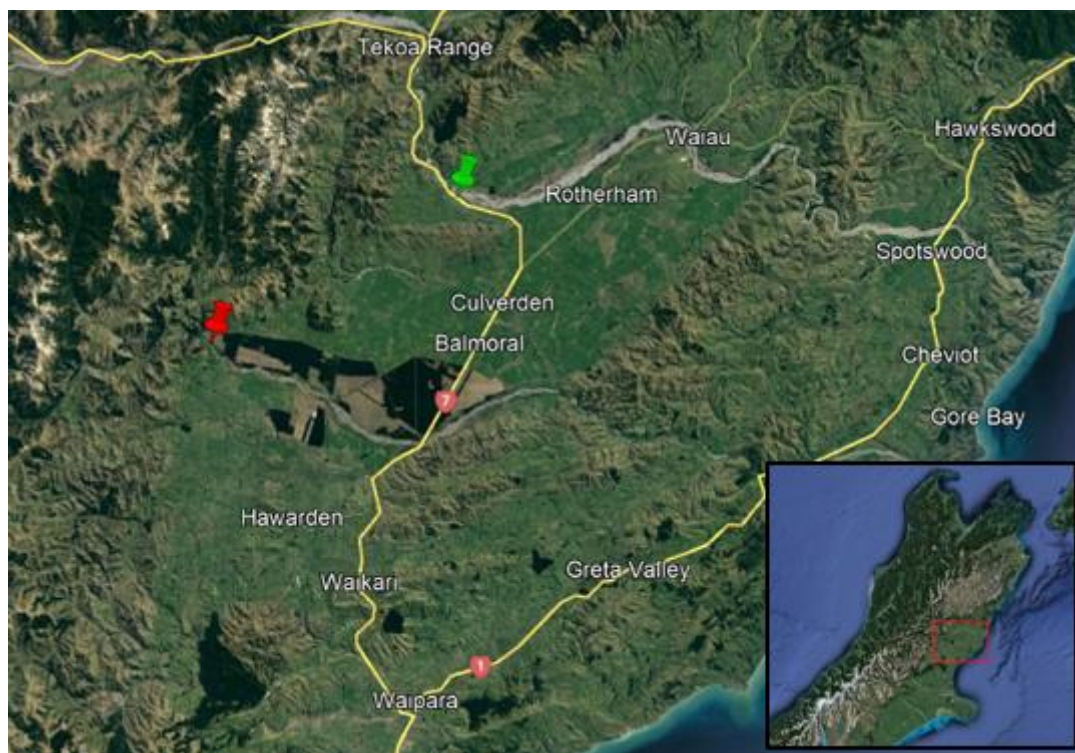


Figure 1. Location of the Balmoral scheme on the Hurunui River (red pin) and the Leslie Hills scheme on the Waiau Uwha River (green pin).

METHODS

Prior to and including 2022, both irrigation races had been salvaged in the same day. In 2023 and 2024 the irrigation systems were salvaged on separate days. This allowed staff to conduct a more thorough salvage of each raceway and walk the current bypasses for assessment and further salvage if necessary.

Leslie Hills Scheme – Waiau Uwha River

Leslie Hills is the bigger of the two schemes and was salvaged first on Thursday 23rd May 2024. Shut-off of the Leslie Hills intake systems occurred in the preceding days before the salvage to allow water levels to drop enough for electric fishing to be practical, while still providing residual flow through the raceway.

Two fish tankers were filled up at the Mouse Point irrigation pond fed by the Leslie Hills scheme. Before the salvage, a brief visual check of the raceway was carried out to identify any hazards and key sections for salvage (e.g., where a large proportion of fish were present, or strandings in isolated pools). One Smith Root™ LR-24 Electric Fishing Machine (EFM) was used by an experienced Fish & Game operator in conjunction with hand netters, with further netting and bankside assistance provided by Fish & Game and Amuri Irrigation staff (two EFMs had been used in 2022 and 2023). The Leslie Hills scheme was fished from the top end of the stilling pond up to the intake (Figure 2). The raceway was systematically blocked into sections with large stop nets, which were cycled up the raceway following behind the salvage operators. This ensured efficient and effective salvage, while also preventing fish from moving back down the raceway to areas that had already been salvaged. One tanker followed the fishing team on the raceway access road. Multiple passes were carried out where necessary to ensure depletion of fish within the targeted areas, especially at the upper end where a majority of the trout were holding. Fishing was conducted as far up into both intake gates as possible where the water was deepest. However, the water level at the gates was too deep for electric fishing to be conducted safely, so the fish were instead corralled with hand nets and encouraged to move down the raceway into shallower water where they could be fished. A small number of trout could not be salvaged from the deepest sections as the fish would not move out from the deeper water down into the race to be safely fished.

Balmoral Scheme – Hurunui River

Balmoral was salvaged on Friday 24th May and the intake shut-off in the preceding days before the salvage to allow water levels to drop. Some residual flow was still coming in through the intake. The Balmoral scheme was separated into two parts for salvage: the intake section (Balmoral-1) and the bypass section (Balmoral-2) (Figure 3). The fish tanker was filled directly from the Hurunui River off the raceway access road.

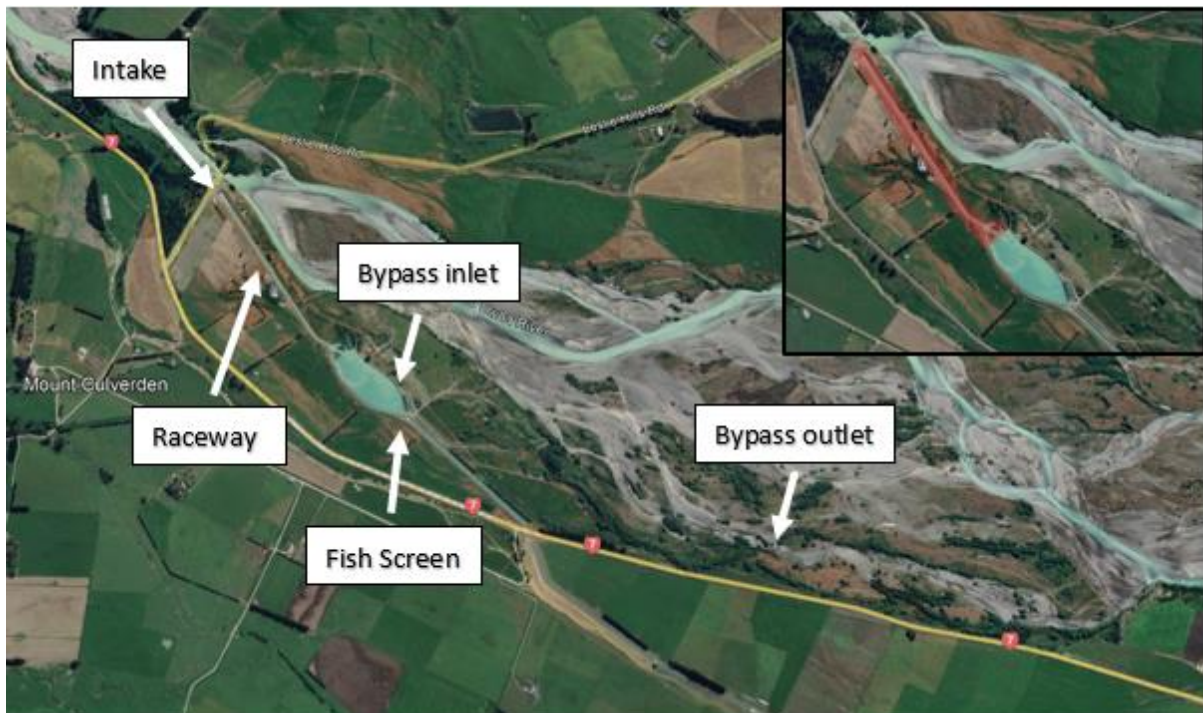


Figure 2. The Leslie Hills scheme on the Waiau Uwha River. Inset shows the focal salvage section highlighted in red.

The bypass section (Balmoral-2) was salvaged first as less fish were expected to be present. The scheme has two bypass channels; an upper channel flowing from the bottom of the intake raceway (above the stilling pond), and a lower channel flowing from near the fish screen at the bottom of the stilling pond. Fish were salvaged from the bypass inlets down to the bypass outlets. An EFM was taken for use on the lower channel, however fish in previous years were able to be netted from pools without an EFM. Most parts of the upper channel were not easily accessible with an EFM so hand nets were used instead.

The intake section (Balmoral-1) was salvaged from the raceway bridge up to the intake. The section below the raceway bridge down to the stilling pond was visually inspected before fishing the top section to ensure no salmonids were trapped in this section. The same fishing methods as outlined for the Leslie Hills salvage were used at the Balmoral site.

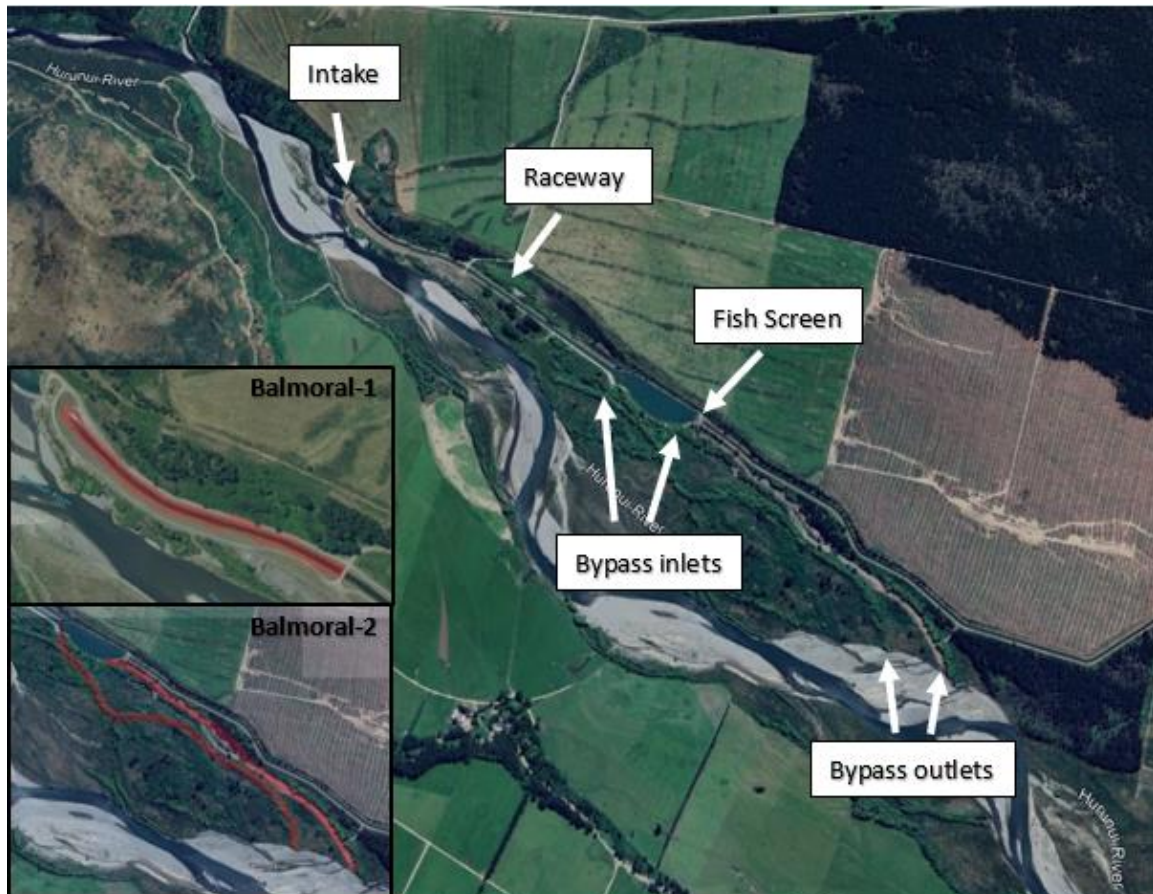


Figure 3. The Balmoral scheme on the Hurunui River. Insets show the upper and lower (bypass) focal sections highlighted in red.

Measurement & transport

At both sites, all fish captured were carried by bucket or net up to a vehicle towing a live fish tanker. Each fish was identified, measured, and recorded using the Fish Collection Form – Electrofishing and Spotlighting (Joy, David & Lake, 2013). Salmonids and adult eels were measured on the flat measuring board, while smaller native species and elvers were measured in the smaller V-shaped board for best handling practice. Where a species count exceeded 50 fish, only measurements from the first 50 individuals were recorded. The remainder of individuals were measured and recorded in size bags (small, medium, large) specific to each species. Individuals that could not be identified due to their size (e.g., elvers, small bullies) were noted as unidentified in their respective genus. Regular checks of temperature and dissolved oxygen in the tanker were taken and recorded to ensure good fish health. Any galaxiids caught were to be kept separate from the tanker to avoid predation and returned to the river separately. Where necessary, multiple tankers were used; at Leslie Hills required three tanker loads, consequently one tanker had to be taken to release the fish and be filled up again to be used for the remainder of the salvage. Conversely, only one tanker was required at Balmoral.

Fish were released in predefined locations within the same catchment in areas conducive to migration activities during May. Leslie Hills fish were released into the main stem of the Waiau Uwha River at an access point approximately 7km downstream of the intake (42°41'55.91"S 172°53'13.44"E). Balmoral fish were released into the main stem of the Hurunui River below the intake, at the same location where the tankers were filled (42°47'53.47"S 172°33'46.75"E).



Figure 4. A brown trout from the top of the Leslie Hills raceway being measured before being placed in the fish tanker.

RESULTS

Leslie Hills Scheme – Waiau Uwha River

Leslie Hills scheme continues to have large numbers of salmonids salvaged, and this year had a remarkably higher number of brown trout salvaged than in previous years (Table 1). Conversely, no rainbow trout and only four chinook salmon were salvaged, a reduction on previous years. At least one rainbow trout was observed in the raceway amongst the large number of brown trout, however this fish was not captured and was one of the few that could not be salvaged from the deeper water at the gates. The reduced number of native fish salvaged this year appears to be due mostly to the lack of *Gobiomorphus* species, which is also the main cause of the overall decline in fish numbers compared to the 2023 salvage. It is unclear whether the reduction in bullies in 2024 is due to characteristics of the scheme itself or differing competencies in electric fishing operators/hand netters between years. Overall, the proportion of salmonids salvaged in 2024 (90% of all fish caught) was much higher than the previous two years (Figure 5).

Table 1. Species counts on the Waiau Uwha River irrigation scheme (Leslie Hills) above the stilling pond in 2022 and 2023.

Species	Common name	2022	2023	2024
<i>Oncorhynchus mykiss</i>	Rainbow Trout	53	12	0
<i>Salmo trutta</i>	Brown Trout	78	93	261
<i>Oncorhynchus tshawytscha</i>	Chinook Salmon	3	16	4
<i>Gobiomorphus cotidianus</i>	Common Bully	0	24	3
<i>Gobiomorphus breviceps</i>	Upland bully	55	211	3
<i>Gobiomorphus sp.</i>	Unidentified bully	0	80	0
<i>Anguilla dieffenchii</i>	Longfin eel	0	44	23
<i>Anguilla australis</i>	Shortfin eel	0	11	0
<i>Anguilla sp.</i>	Unidentified eel	65	3	0
<i>Galaxias brevipinnis</i>	Koaro	0	1	0
<i>Cheimarrichthys fosteri</i>	Torrentfish	2	0	2
<i>Geotria australis</i>	Lamprey	0	0	1
Total count		256	495	297

Brown trout salvaged from the Leslie Hills scheme ranged from 67-650mm (mean 371mm±15), with the majority classed as “medium” sized fish (150-450mm). Only a small proportion were “large” fish (450+mm), and an even smaller proportion “small” (0-150mm).

Chinook salmon ranged from 93-700mm (mean 260mm±146). One salmon was an adult, and the remaining three juveniles; these fish were likely entrained into the Leslie Hills system while making their upstream and downstream migrations respectively.

The majority of longfin eels were smaller ($\leq 600\text{mm}$), however one longfin was almost 1 metre in length. Bullies were fairly similar in size, as were the torrentfish. The single lamprey was a juvenile (116mm).

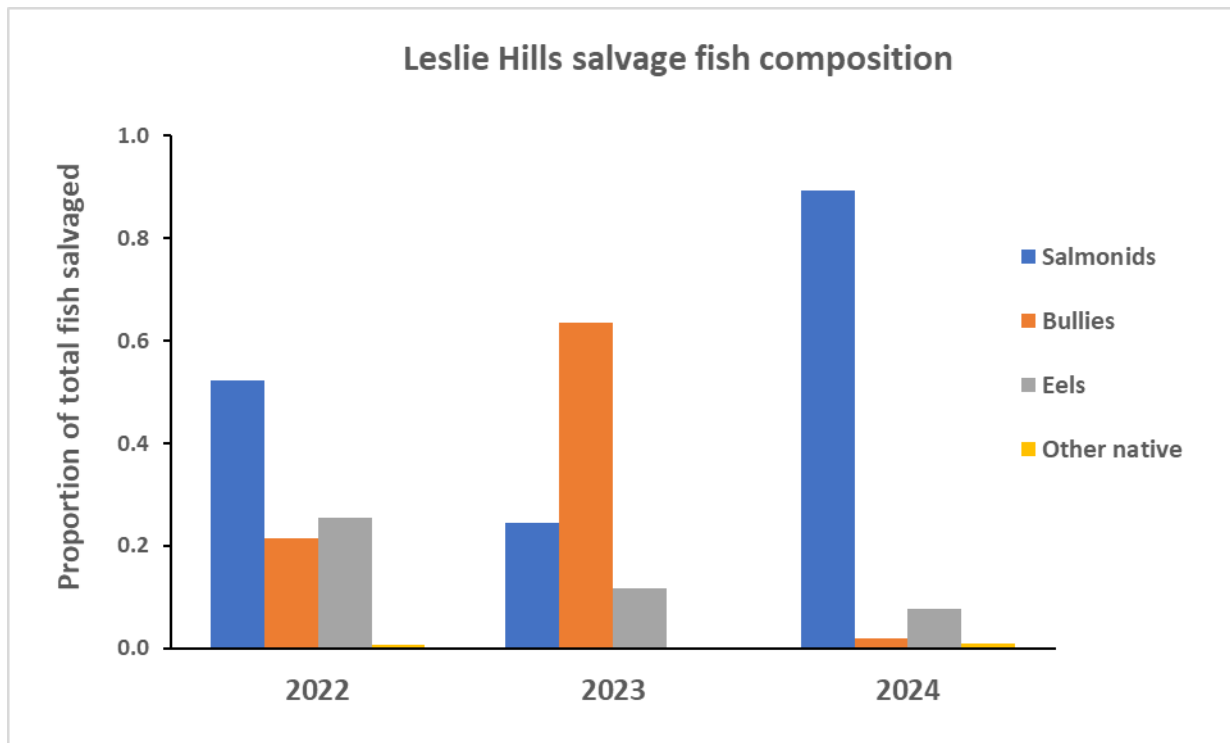


Figure 5. Proportions of different fish groups salvaged from the Leslie Hills scheme 2022-2024. Other native fish includes galaxiids, torrentfish and lamprey.

Balmoral Scheme – Hurunui River

There were considerably fewer fish of all species across both upper and lower sections of the Balmoral scheme in 2024 (Table 2). Amuri Irrigation Company staff suggested the 2024 salvage resulted in the smallest number of fish to date. Of the salmonids, only brown trout were found this year: five at the intake, and three at the top of the lower bypass section. Brown trout ranged from 85-540mm (mean $269\text{mm} \pm 70$); the fish were also more evenly distributed across the size classes (four “small”, two “medium, and two “large”). With the low number of salmonids, bullies made up the majority composition of fish in the Balmoral scheme (Figure 6).

In contrast to 2022, in 2023 and 2024 the mainstem of the Hurunui River upstream at the intake and bypass outlets was flowing along it’s true-right bank and this potentially would have reduced the chance of fish entering the scheme via the intake or the two bypass channels. The removal of debris and straightening of the lower bypass channel along with its fish passage barrier in recent years has been a further contributor to less fish present. The lower bypass was perched at the confluence with the river, preventing fish passage

upstream (Figure 7). The drop height of this barrier may however discourage fish swimming downstream from re-entering the river.

Table 2. Species counts on the Hurunui River irrigation scheme (Balmoral) in the upper intake) and lower (bypass) sections in 2022 and 2023.

Species	Common name	2022		2023		2024	
		Upper	Lower	Upper	Lower	Upper	Lower
<i>Oncorhynchus mykiss</i>	Rainbow Trout	0	0	0	0	0	0
<i>Salmo trutta</i>	Brown Trout	65	26	19	14	5	3
<i>Oncorhynchus tshawytscha</i>	Chinook Salmon	1	6	0	0	0	0
<i>Gobiomorphus cotidianus</i>	Common Bully	0	0	6	1	0	0
<i>Gobiomorphus breviceps</i>	Upland bully	60	0	203	51	89	0
<i>Gobiomorphus sp.</i>	Unidentified	0	0	0	0	0	0
<i>Anguilla dieffenchii</i>	Longfin eel	1	0	7	3	0	0
<i>Anguilla australis</i>	Shortfin eel	0	0	2	0	0	0
<i>Anguilla sp.</i>	Unidentified eel	45	0	0	3	1	0
<i>Galaxias brevipinnis</i>	Kōaro	0	0	2	1	0	0
<i>Cheimarrichthys fosteri</i>	Torrentfish	0	0	0	0	0	0
Total count		172	32	239	73	95	3
Grand total upper + lower		205		312		98	

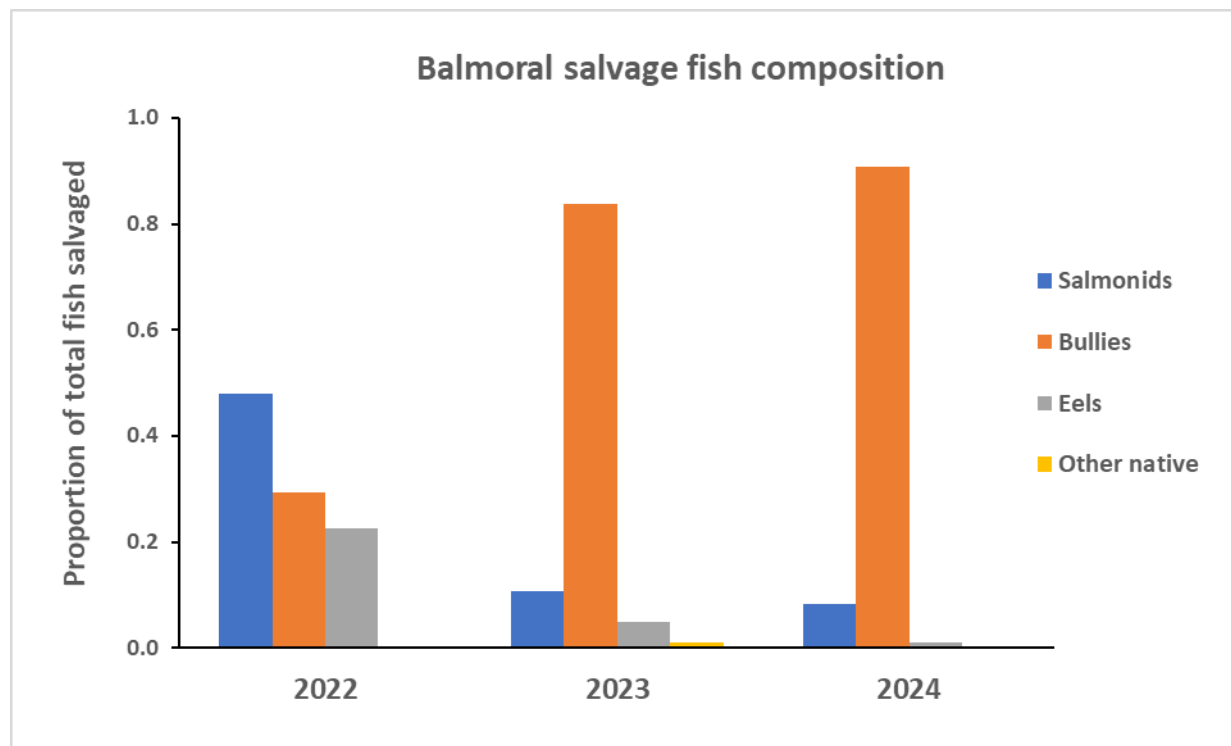


Figure 6. Proportions of different fish groups salvaged from both upper and lower sections of the Balmoral scheme 2022-2024. Other native fish includes galaxiids and torrentfish.



Figure 6. Outlet of lower bypass channel of Balmoral irrigation scheme where it meets the Hurunui River riverbed .

RECOMMENDATIONS

In future salvages a larger area should be investigated for the presence of fish; at both schemes, the stilling ponds were not salvaged but may hold fish. Salvaging larger areas would however require more time spent at each scheme. More thorough investigations of the return flow channels, and the overflow channels should also be undertaken; as each overflow channel flows into either the Hurunui or Waiau river, these areas can be attractive habitats for both salmonid and native fish species. As there were large areas of already de-watered overflow channels/streams associated with each irrigation scheme, we recommend an earlier inspection and potential salvage of any stranded fish prior to salvaging the main channel.

Fish passage barriers should be constructed (where not existing already), and both new and existing barriers maintained at each overflow channel confluence. These barriers could be simply an overhang or similar that will inhibit fish passage upstream. Whilst the current ~1m height drop at the outlet / lower end of the Balmoral return flow channel effectively prevents passage of fish into the channel at low river flows recent years fish salvage operations has demonstrated that during rain events both upstream migrating adult salmon and trout do easily get attracted and make it into this channel. Once adult fish becomes

trapped in the return flow channel it appears they are likely hesitant to move back downstream over the barrier to return to the mainstem river. This may also be the case for smaller or juvenile salmonids during lower baseflow conditions. Taken together observations from our recent fish salvage operations at both Balmoral and Leslie Hills water intake schemes have consistently shown poorly functioning return flow and fish outmigration channels. Improvements to both their design, specific locations and potentially the amount of water allocated to help assist fish returning to the main river are needed. Options to achieve improvements both in short and longer-term should be investigated urgently.

REFERENCES

Joy, M., David, B. O., & Lake, M. D. (2013). *New Zealand freshwater fish sampling protocols: Part 1. Wadeable river & streams: Field guide*. Ecology Group, Institute of Natural Resources, Massey University.

Stoffels R (2022). New Zealand Freshwater Fish Database (extended). The National Institute of Water and Atmospheric Research (NIWA). <https://nzffdms.niwa.co.nz/download> accessed 12th August 2024.