Tasman River. Photo: Adriana Theobald

Project River Recovery Annual Report

1st July 2019 to 30th June 2020

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Department of Conservation
Te Papa Atawbai

New Zealand Government

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Summary

- This report summarises Project River Recovery's (PRR) progress towards its six key objectives as identified in its strategic plan for the period from the 1st of July 2019 to 30th of June 2020.
- PRR continues to give highest priority to preventing weed invasions of the near-pristine upper rivers above the hydro lakes of the upper Waitaki basin.
  - Over 4992 hours of targeted, ground-based control of weeds was carried out by PRR staff and contractors in eight riverbeds: Godley, Macaulay, Cass, Tasman, Ōhau, Ahuriri, Twizel and Pukaki Rivers, four streams: Coal, Mistake, Fraser and Fork Streams, three wetlands: Ruataniwha, Fraser Stream and Waterwheel, and three lake shore sites: Ōhau, Poaka and Ruataniwha.
  - Additionally PRR contributed $28,147 to the three way contract (with LINZ and ECan) for weed control in the upper Tekapō River, $10,000 as part of the LINZ, ECan and landowner project to control weeds in the Dobson River and spent $7285 on aerial control of Russell lupins in the upper Ahuriri
- This marked the fifteenth year of trapping results from the Tasman River Predator Control Project, a joint on-going programme between Te Manahuna Aoraki (TMA), PRR and the kakī management programme.
- The extensive Tasman trapping effort between 1st March 2019 – 29th Feb 2020 comprising 16317 trap checks resulted in a total of 1301 target species caught, including 113 cats, 21 ferrets, 466 hedgehogs, 44 Norway rats, 4 possums, 331 stoats and 45 weasels.
- Tasman outcome monitoring of tarapirohe/black-fronted tern (*Chlidonias albostriatus*, Nationally Endangered) and tarapuka/black-billed gull (*Larus bulleri*, Nationally Critical) colonies showed relatively low hatching success of known nests; 27% for black-fronted tern nests and 24% for black-billed gull nests. In previous years, tern nest hatching success has been 70%+. This years' low success was in part attributed to severe spring heavy rain events leading to flooding of nests.
- The Upper Ohau trapping network programme of intensive predator trapping around the black-fronted tern colony in the upper Ōhau River continued this year, resulting in the capture of 127 hedgehogs, 176 rabbits, 74 ferrets, 38 cats, 24 Norway rats, 14 possums, six stoats and eight weasels.
- Both the trapping and the application of pindone via bait stations is likely benefitting both the breeding black-fronted tern and the nearby Lakes skink *Oligosoma* aff. *chloronoton* "West Otago"; Nationally Vulnerable populations. A total of 104 black-fronted tern nests were monitored with outcomes ascertained for 66 nests. Hatching to 1 egg was only achieved by 6% of nests. As with the Tasman, hatching and breeding success was likely impacted by the large flooding event that occurred in early December 2019.
- Over the pitfall (live) trapping period of 7 days in February 2020, a total of 131 Lakes skink captures were made, consisting of 93 unique individuals and 38 recaptures, this is 19 more Lakes skinks than in the previous year. The data over the past 4 years suggests an upward trend in Lakes skinks numbers since trapping and monitoring was initiated in 2016.
- Walk-through braided river bird counts, and colony locations were completed on the Tasman, Ahuriri and Tekapō rivers, providing a nationally important dataset and giving an indication of the health of these three braided river systems.
- Southern crested grebe (*Podiceps cristatus australis* – Nationally Vulnerable) surveys were undertaken on Lake Ruataniwha, Wairepo Arm, Kellands Ponds, Lake Alexandrina and Lake McGregor, revealing similar numbers as the previous year.
- For the first time, PRR initiated the deployment of acoustic recording devices (ARDs) at historic location throughout the Mackenzie basin to inventory presence/absence of the cryptic and elusive bittern/

matuku hūrepo *(Botaurus poiciloptilus* - Nationally Critical) and marsh crake (*Porzana pusilla* - Declining).

- PRR initiated general lizard monitoring at sites across the Mackenzie basin using temporary artificial cover objects (ACOs). During three checks of the 80 artificial retreats between Oct 2019 and Jan 2020, 25 skinks were found; 18 McCanns skinks (*Oligosoma maccanni)*, two Grass skinks (*Oligosoma* aff. *Polychroma* Clade 5 - Declining) and 4 unknown escapees. The highest number of skinks (seven) was found at the Tekapo river true right site.
- Wetland management to sustain suitable habitat for both wading birds and threatened endemic flora included fence maintenance and water-level manipulation at Waterwheel and Ruataniwha wetlands.
- PRR spent $553,821 in the 2019-20 financial year.

1. Introduction

Project River Recovery (PRR) commenced operations in 1991 following the establishment of a compensatory funding agreement with the energy provider (ECNZ) in the upper Waitaki River which recognised the adverse impacts of hydroelectric power development on braided river and wetland ecosystems. A key focus of the programme over its 28 years of operation has been to maintain integrity of braided river ecosystems, particularly from the impacts of invasive plants. The programme has also invested considerable effort into assessing the impacts of mammalian predators on riverbed fauna and developing effective methods for their control in riverbed environments.

These and other goals are set out in the current seven-year strategic plan (2012-2019; Rebergen and Woolmore, 2015) which is still operative. Given that the funding agreement with Meridian Energy Limited and Genesis Energy Limited is in the early stages of renegotiation, both companies have agreed that the strategic plan will get a quick interim review until a new deal is reached.

This annual report summarises progress toward the six key objectives identified in the strategic plan, describes staffing and presents financial statements for the year from the 1st of July 2019 to 30th of June 2020.

2. Staff

Dean Nelson continues to manage the project as Senior Ranger for Biodiversity Assets and PRR.

Jemma Welch continued her role as PRR's biodiversity ranger until January 2020 (she has now taken a promotion within DOC in the Chatham islands). Jemma ensured the majority of PRR's biodiversity monitoring work was completed, including black-fronted tern monitoring in the upper Ōhau River and organising braided riverbed bird surveys.

Sam Gale joined the PRR team as a second ranger in October 2019 and has taken over completing PRRs core work and reporting whilst recruitment for Jemma's replacement is underway. Unfortunately, this was delayed by lockdown under COVID-19.

Our summer weed sprayer Michelle Kilgour took extended leave and then resigned during the year. Once again due to COVID-19 restrictions, there has been a delay in replacing her and PRR weed work has been undertaken by other DOC staff.

Jaimie Cooper was seconded into Jemma's role while she was initially working on the Chatham Islands (especially lizard monitoring during Jan – March 2020) and Marianne Marot has supported PRR's work both through Lakes skink monitoring and undertaking bittern call detection/ analysis.

Predator control work in the upper Ōhau River and much of the Tasman River continues to be serviced by Ecological Contracting Services Limited. Larger scale weed control over the year was again undertaken by contractor OK Vegetation Control.

PRR continues to work closely with the kakī management programme and Te Manahuna Aoraki in the Tasman River where we jointly fund a large-scale predator-control project to protect a range of riverbed fauna.

3. Strategic plan (2012-2019)

The strategic plan outlining the work objectives of PRR spans consecutive seven-year cycles, allowing regular review, reporting, and realignment. Following the completion of the 2005-2012 cycle (Woolmore and Sanders, 2005), the strategic objectives of PRR were reviewed, and the plan spanning the seven-year period from 2012

to 2019 is still in action (Rebergen and Woolmore, 2015). As noted above, this was due for review last year, however potential changes to the mitigation agreement as part of the Meridian and Genesis water re-consenting process means that the review will be completed in an interim form.

4. Progress toward objectives of the strategic plan

PRR's progress towards achieving the objectives of the current strategic plan is summarised below. Detailed reports of seasonal results and outcomes from trials and analyses of data are recorded through PRR's internal report series and are available on request.

4.1 Objective 1: Maintain indigenous biodiversity; protect and restore terrestrial and aquatic river and wetland habitat and the ecological communities within it by controlling and where possible, eradicating invasive weeds.

4.1.1 Ongoing riverbed and wetland weed-control programme

PRR continued its ongoing programme of weed control, using 4992 hours of targeted, ground-based spraying of weeds by staff and contractors in the main braided rivers, some of their tributaries, lake edges and in various natural and man-made wetlands of the upper Waitaki basin. The total area of braided river habitat in the large rivers of the upper Waitaki basin is approximately 32,000 hectares. PRR gives the highest priority to removing existing pockets of weeds, preventing new incursions of invasive weeds and removing newly established infestations at priority locations. Priority sites are generally still relatively 'clean' in terms of the number of weed species and the extent of their distribution. The rationale for selection of priority sites and their locations are set out in PRR's weed control plan (Woolmore, 2004).

PRR continues to maintain the excellent condition of rivers above Lakes Tekapō and Pūkakī, and the Ahuriri River above Longslip Creek. The Godley River is almost entirely free of Russell lupins (*Lupinus polyphyllus*) and introduced broom (*Cytisus scoparius*), while the Tasman River has had Russell lupin infestations reduced substantially. Just over $20,000 was spent on contractor control in the Tasman this season compared with up to $70,000 in the past. The contractor noted that much of their time was spent surveying for Russell lupin rather than physically spraying it.

The area of Russell lupin in the upper Ahuriri (mostly on a creek fan near Birchwood) has been found to be larger and more inaccessible than thought and $7285 was spent on aerial control. The December 2019 flood spread seed in under matagouri shrubland so ongoing groundwork with difficult access will be required in the future.

This year, Environment Canterbury (ECan) started a multi-year, landscape scale weed control project in the Dobson Valley. It aims to control elderberry, cotoneaster, buddleia (*Buddleia davidii*), willows and Russell lupin, as well as some miscellaneous garden escapees (raspberry, gooseberry, currant and flowering cherry). PRR has been doing some work in this area as weeds like buddleia have always been our priority weeds to keep out of the Mackenzie Basin. Also, the long-term aim is to remove Russell lupins from the mid part of the valley and progressively push them down valley toward Lake Ohau. Consequently, it made sense to support this project by contributing $10,000 in conjunction with other financial assistance from LINZ and the landowner of Glen Lyon Station. PRR will continue to help fund this project as it will concentrate on willows and Russell lupins in the Dobson riverbed and associated wetlands.

With assistance from ECan, there is increasing emphasis on willow control in wetland areas. This year PRR spent $10,000 on chainsawing and basal spraying willows in the Fraser Stream wetland and topped up the DOC budget for aerial spraying of willows in the Ben Omar wetland.

The rivers below the lakes, and the Ahuriri below Longslip Creek contain many more species of invasive plants, with infestations being much larger in size. Not all invasive weeds can be controlled at these sites, and PRR continues to work towards achieving sustainable and realistic weed control programmes at selected priority locations only or for specific weed species we want to prevent becoming established in the basin. However, as new techniques for controlling large scale weed infestations are developed, weed control at sites with much larger infestations may become a viable option. Gravel beach raking is one such technique, whereby a tractor is used to drag large ripping bars through gravel areas, mechanically disrupting the surface layers and roots of weed species (Clode and Beya, 2018). Gravel beach raking has been used as a channel modification tool on several North Island braided rivers and appears to also be effective in controlling large weed infestations. This technique is currently being trialled in the Ashley River and, depending on the outcome of that trial, could be used in some of the upper Waitaki Basin's more weed infested rivers.

Following the arrival of false tamarisk (*Myricaria germanica*) in early 2016, DOC staff and contractors have been controlling scattered plants on the Tasman, Cass, Godley and Pūkakī Rivers, returning to previously visited sites in the first instance. Not previously known to occur south of the Rangitata River, false tamarisk is a problem weed as it prefers braided riverbeds and, like many other weeds, it can alter or reduce the habitat in these areas for nesting birds. False tamarisk is highly invasive as it can tolerate flooding and may even thrive during these periods by spreading to new areas. It has fluffy, wind-borne seeds which can easily disperse and PRR will aim to prevent its spread in the upper Waitaki.

PRR, Environment Canterbury (ECan), and Land Information New Zealand (LINZ) contributed funding to an integrated weed-control programme in the upper Tekapō River targeting gorse (*Ulex europaeus*), broom, Russell lupin and willows (*Salix* spp.). LINZ and ECan contractors carry out this weed control work and this season, PRR's contribution amounted to $28,147.

In areas where control was undertaken by PRR staff and contractors, herbicides were applied using knapsack sprayers, hose and gun or cut and paste techniques. Target weeds included willow, broom, gorse, wilding pines (*Larix decidua*, *Pinus* spp., *Pseudotsuga menziesii*), yellow tree lupin (*Lupinus arboreus*), buddleia, Russell lupin and false tamarisk. A new vehicle-mounted spray unit was purchased for PRR weed staff this year to replace the aging unit that has seen many seasons' use. The new unit has twin hoses each measuring 200m in length which can be re-wound electrically. Compared to the old unit which had 80m twin hoses which could only be re-wound manually the new one is much more efficient, particularly for large weed infestations.

Contractor work practices were monitored by site visits and discussions with contractors. Contractors are committed to and continue to maintain high standards in their work. The effectiveness of weed control by PRR staff was monitored by site inspections before and after weed control, and the level of control achieved was very good.

Work to review and update PRR's weed control plan is still a priority, though with PRR currently still understaffed and the change in status of Russell lupin in ECan's Regional Pest Management Plan, the process has been delayed. It will remain a priority for the coming financial year. An operational plan will be completed for the coming season and will be followed by a reprioritisation of sites, priority weeds and methods of control as new techniques continue to evolve.

4.2 Objective 2: Test and where possible, improve the effectiveness of and implement experimental predator control for population recovery of braided river and wetland fauna.

4.2.1 Tasman River

Predator Control

PRR and the Kakī Management Programme continue to implement an extensive predator control project in the Tasman Valley supported by the Te Manahuna Aoraki (TMA) partnership who have extended trap lines throughout some of the area. The Tasman project's goal is to reduce predation of braided river birds to a level

where depleted populations are recovering, and large populations are in a stable state. The project takes a large-scale approach, using a wide variety of control methods that are applied continuously throughout the year. Success of the project is measured by achieving increasing fledging success and population growth for a range of river birds.

The 2019-20 season saw the fifteenth year of operation at this site, with a total of 700 DOC 150s, 311 DOC 250s, 310 Conibear traps, 77 Timms and 530 Victor leg-hold traps at the site. This extensive trapping effort between 1st March 2019 and 29th Feb 2020 comprising 16317 trap checks resulted in a total of 1301 catches target species caught, including 113 cats, 21 ferrets, 466 hedgehogs, 44 Norway rats, 4 possums, 331 stoats and 45 weasels.

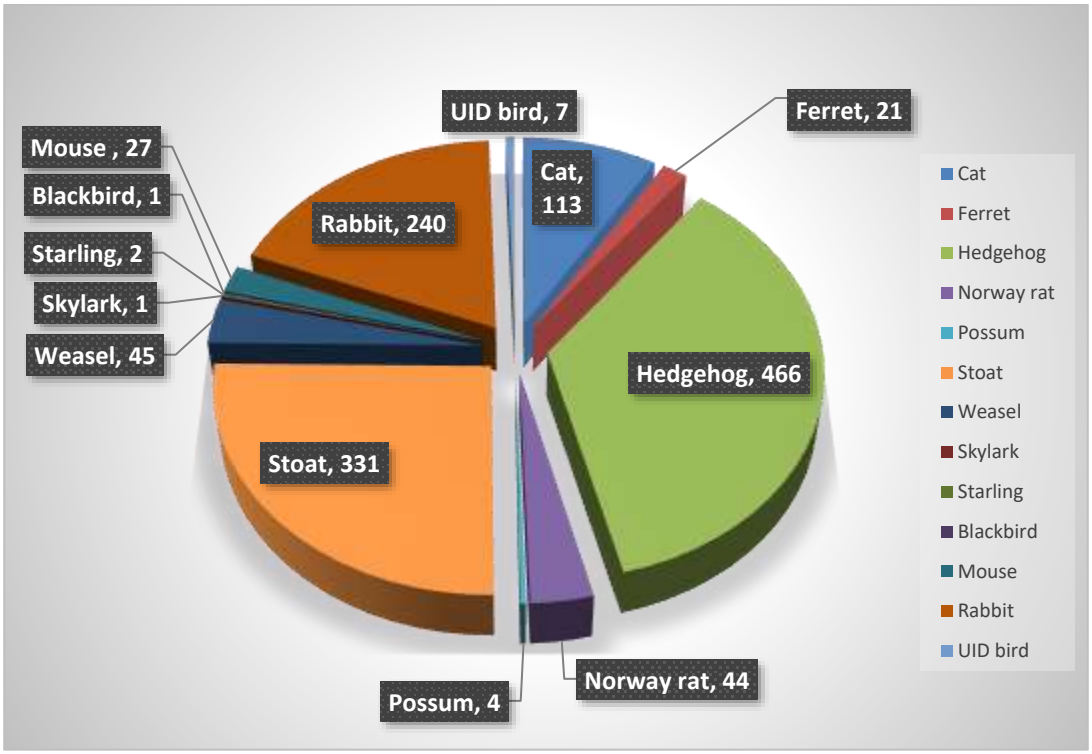


Figure 1: Tasman River Predator Control, species caught March 2019 – February 2020

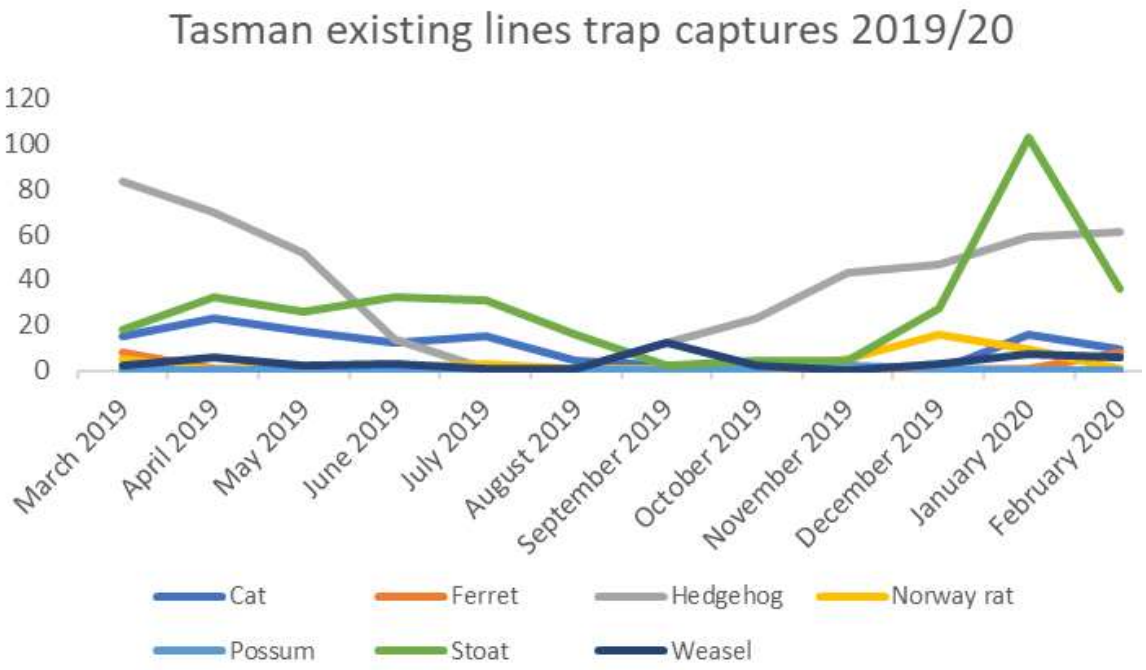


Figure 2: Tasman River Predator Control, species caught by month

Southern Black-back gull control

Nest camera footage collected from the Tasman over recent seasons and research conducted elsewhere in the Waitaki Valley has shown that southern black-backed gulls (SBBG) are a significant predator of both eggs and chicks of other braided river birds (Bell and Harborne, 2019). Since SBBG control was initiated in the 2013-14 season, the average hatching success of the black-fronted terns in the Tasman has increased from 20% to greater than 70%, except in major flooding years. (Figure 3).

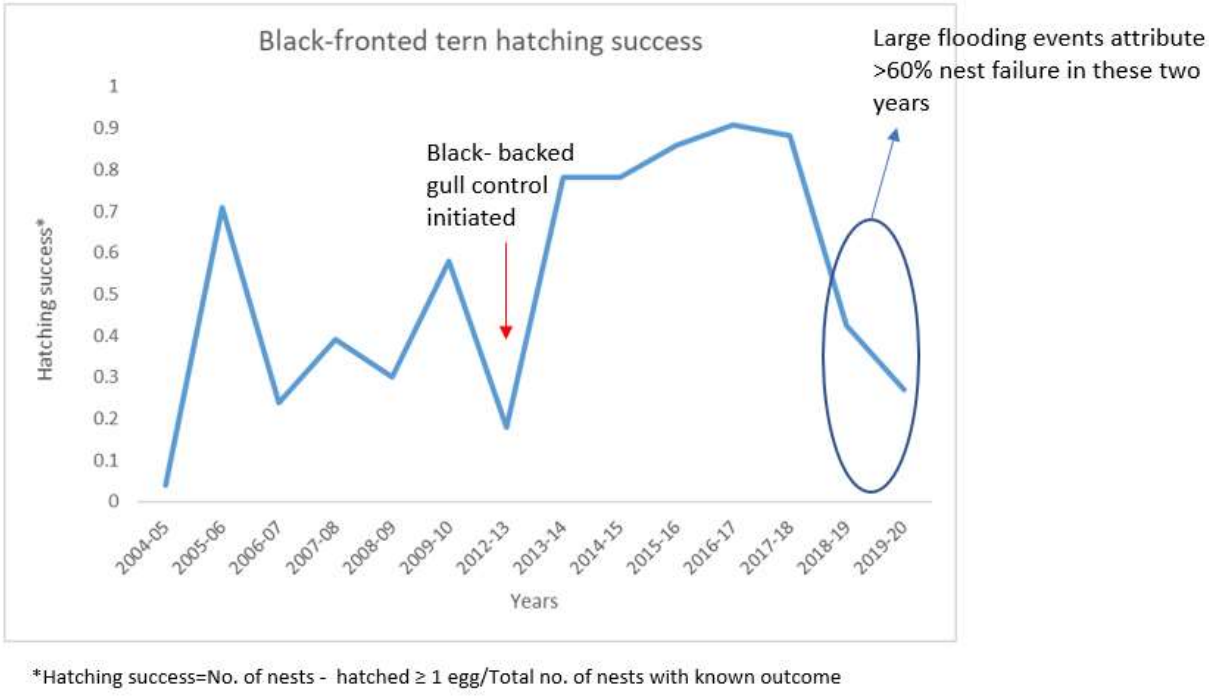


Figure 3: Hatching success of black-fronted terns Tasman River 2004- 2020

Various methods for control of SBBG have been trialled over the past six seasons with the aim of substantially reducing their unnaturally high populations to allow for the recovery of native braided river birds especially black-fronted terns and black-billed gulls. Due to the ongoing incursion of SBBG into the Tasman River between seasons, control is required on an annual basis. Ground shooting and aerial shooting (using a small Guimbal Cabri G2 helicopter with experienced pilot and a DOC staff member as shooter) has proven a successful, cost-effective combination over the past two seasons.

Aerial control work in the Tasman and Murchison was carried out in conjunction with Canada goose control and the effectiveness of the control over time is evident with numbers being significantly less than previous years totals. This season 74 SBBG were shot, mostly in the colony at the mouth of the Murchison River. Over the seven seasons of control in the Tasman, over 2360 gulls have been destroyed.

This season TMA took over responsibility for SBBG control in the Godley and Cass rivers and PRR was able to extend SBBG control into three large colonies in the Tekapo and lower Pukaki Rivers. SBBG can forage over large distances so the birds from these colonies are likely to feed in the Tasman. A total of 628 birds were destroyed from these three colonies.

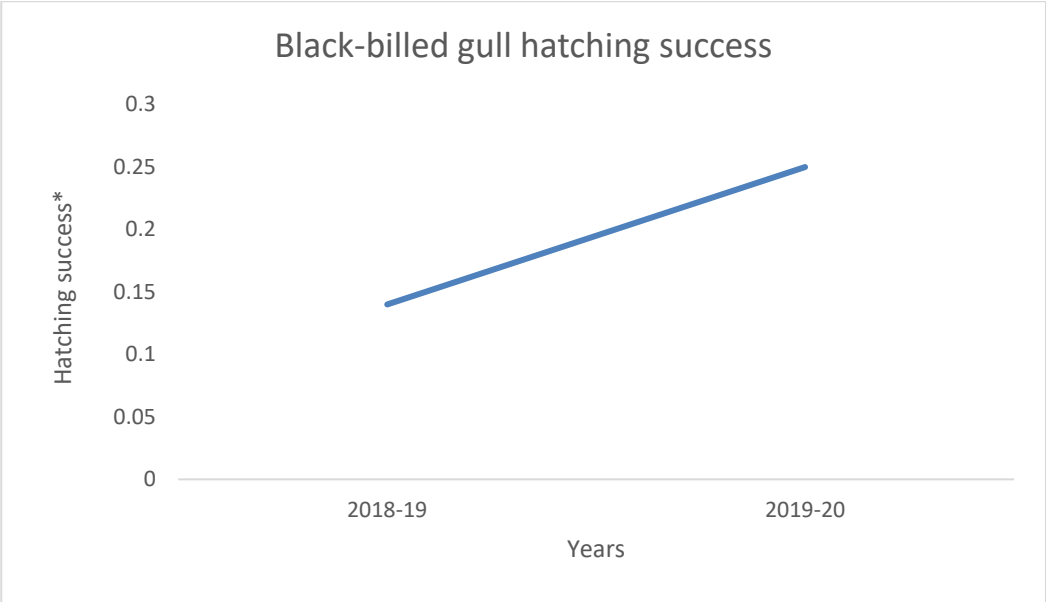
Tasman River Outcome Monitoring

Detailed studies of the breeding success of some species of braided river bird colonies over the entire season (from nest building to hatching and fledgling success) provide specific information on the impacts of natural events such as flooding and threats from predators, and provide a metric of predator control success

Black-fronted terns and black-billed gulls continued to be monitored in the 2019-2020 season. Wrybill monitoring was discontinued several seasons ago due to their consistently high hatching success over the course of the outcome monitoring study (average for years 2004-2018: 79.5%) and the difficult and time-consuming nature of finding and following chicks through to fledging.

Staff funded both by TMA and PRR undertook location and monitoring of nests in accordance with established methodology (Leseberg et al. 2005b). Nest checks were carried out and outcomes classified into the following categories: successful, predation, predation then desertion, desertion, flooding, damaged in nest, died during incubation/infertile and unknown. Colonies were monitored up to fledging age to determine how many hatched chicks fledged and calculate breeding success.

Figures 3 and 4 show the hatching success of black-fronted terns and black-billed gulls across the respective seasons when monitored. Hatching success is $\leq$ 0.4 for both species in 2018-18 and 2019-2020, falling from $\geq$0.7 in 2013 – 2017 in the case of black fronted terns. As previously mentioned, the heavy rain events, and subsequent flooding in the Tasman, resulted in many nests failing in these years. Indeed, for both species, in all years monitored, the most frequent known cause of nest failure was either flooding and/or predation (Table 1).



* Hatching success= No. of nests - hatched ≥ 1 egg/ Total no. of nests with known outcome

Figure 4: Black-billed gull hatching success, Tasman River 2018/19 and 2019/20

Table 1 – Tasman River (a) back-fronted terns and (b) black-billed gull colonies nest outcomes during monitored years

(a) Black-fronted tern	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Total no. of nests	28	60	76	29	31	26	219	51	39	65	98	166	380	215
Total no. of nests with known outcome	23	52	76	28	30	26	201	51	37	65	77	160	247	159
No. of nests - hatched ≥ 1 egg	1	37	18	11	9	15	36	40	29	56	70	141	105	43
Total no. of nests that failed	22	15	58	17	22	11	165	11	8	9	7	19	142	116
Nest failure due to:														
Predation	5	2	39	14	13	10	124	9	0	0	0	0	47	34
Predation then desertion	0	0	0	0	0	0	2	0	0	0	1	3	0	1
Desertion	2	7	0	0	3	0	7	0	8	6	5	9	5	6
Flooding	0	0	11	1	5	1	31	2	0	3	0	2	87	75
Died during incubation/infertile	0	1	4	2	0	0	0	0	0	0	1	3	1	0
Failed, cause unknown	15	5	4	0	1	0	1	0	0	0	0	1	1	0
Damaged in nest	0	0	0	0	0	0	0	0	0	0	0	1	1	0

(b)Black-billed gull	2018-19	2019-20
Total no. of nests	43	200
Total no. of nests with known outcome	36	150
No. of nests - hatched ≥ 1 egg	5	37
Total no. of nests that failed	31	113
Nest failure due to:		
Predation	0	28
Predation then desertion	0	0
Desertion	0	26
Flooding	28	57
Died during incubation/infertile	3	0
Failed, cause unknown	0	2
Damaged in nest	0	0

4.2.2 Upper Ōhau River/Tern Island

Tarapirohe/black-fronted tern is a small, nationally endangered tern species endemic to New Zealand (Robertson et al., 2016). A braided river specialist, black-fronted terns breed only in the eastern and southern South Island, with recent population estimates of only 10,000 birds. The upper Ōhau predator control programme commenced in 2009 and aims to improve the breeding success of a large black-fronted tern colony that nests each year on an island in the upper Ōhau River (known locally as "Tern Island").

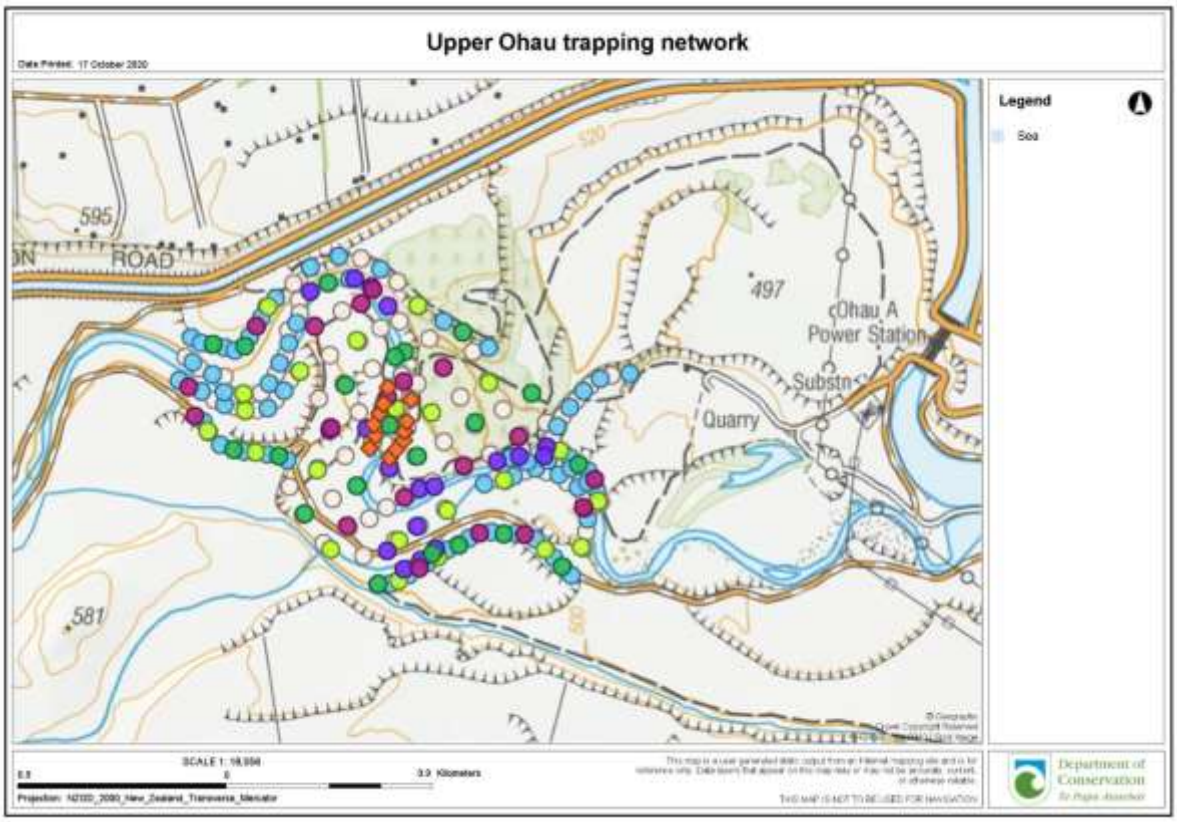
Predator Control

Predation of adults, eggs and chicks by introduced mammals is believed to be one of the primary threats to black-fronted terns in the upper Waitaki basin (Keedwell, 2002, 2005). Efforts to supress predator numbers follow standard practice consisting of a combination of year-round of kill traps (feral cats, ferrets, stoats, weasels, possums, hedgehogs and rats) and poison targeting (rats throughout the breeding season).

This year, for the tenth season, predator control was undertaken utilizing a kill trap grid spanning a 500m radius from the tern colony (Figure 5) and targeted rat control using poison (0.5g/kg pindone) (Figure 6).

The trapping network comprised of 353 DOC 150's, DOC 250's, Twizel cat traps, Belisle Super X 220 traps and modified Timms traps serviced between once and four times a month, resulted in the capture of 127 hedgehogs, 176 rabbits, 74 ferrets, 38 cats, 24 Norway rats, 14 possums, six stoats and eight weasels (Figure 6). Six tracking cards placed on the island did not show signs of rats but Norway rats were seen predating chicks and eggs on all of the six trail cameras deployed on tern nests, and this may be a significant factor in the resulting tern colony abandonment in mid-November. Six SBBGs were culled this year but due to capability constraints this did not occur until early December when terns had already abandoned the island.

Biannual rabbit night counts showed 110 rabbits in the untreated area, a number that suggest that rabbit control would be beneficial.



Legend Trap types

A24trappoints

DOC250
TCT
Warrior
SuperX
Timms
DOC150

Figure 5: Layout of Upper Ōhau predator control trapping network

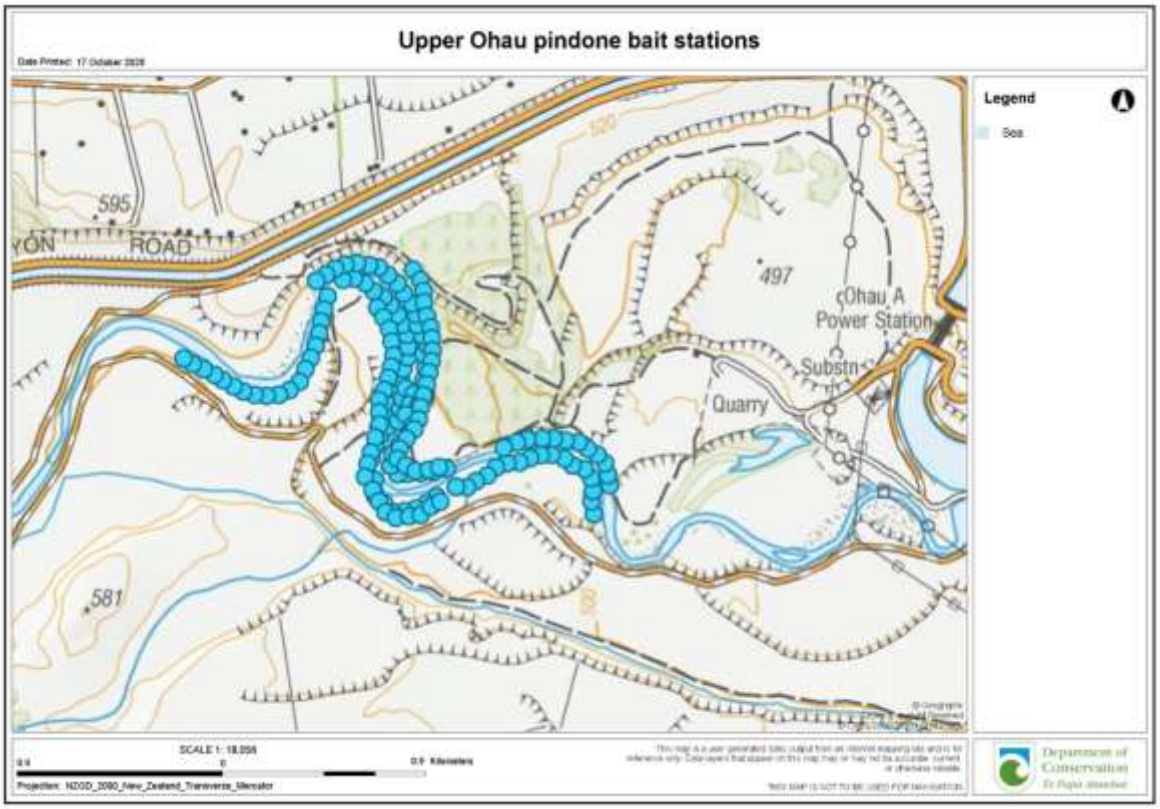


Figure 6: Layout of Upper Ōhau predator control pindone bait station network

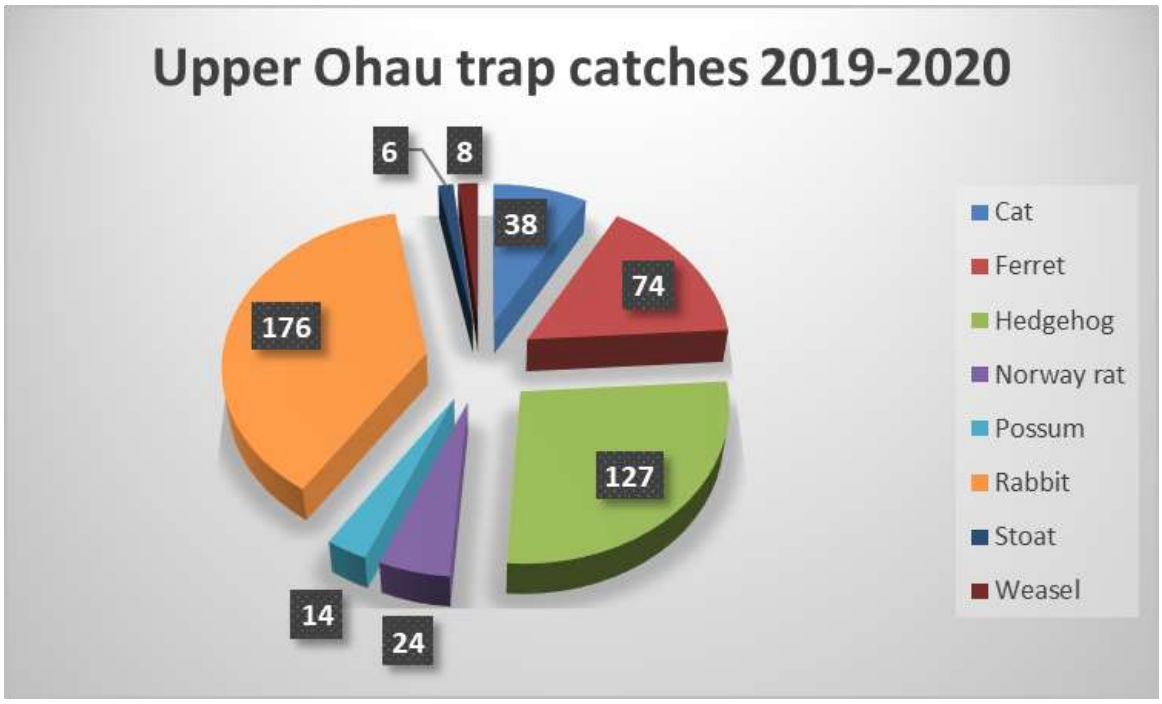
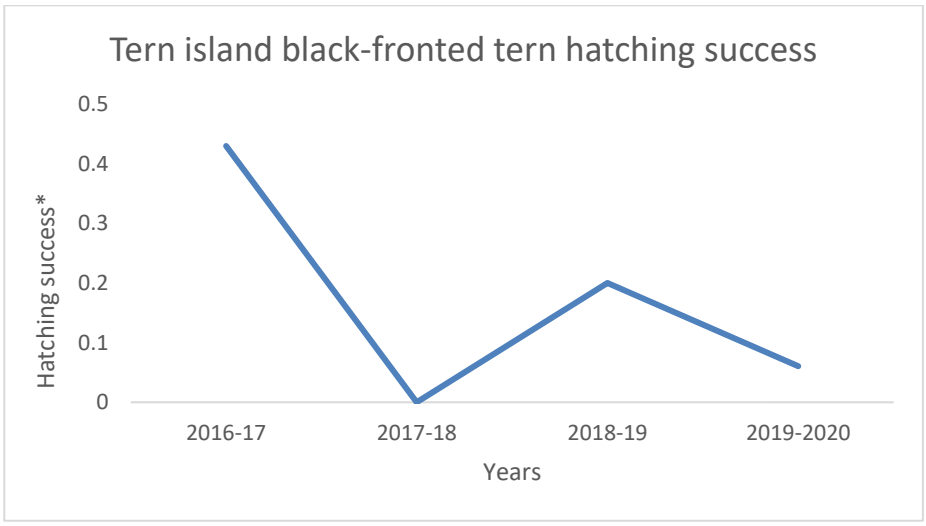


Figure 7: Upper Ōhau River Predator Control, species caught 2019/20

Black-fronted tern outcome monitoring

At Tern Island, total number of adults, nest, egg hatching and fledgling success are key parameters that are recorded following methods described in previous operational reports (Welch 2018).

Outcomes this year included: 1) monitoring 104 black-fronted tern nests with the fate of 66 nests accurately ascertained (insufficient data and flooding prevented island access in early Dec) with 6% nest to have hatched successfully (Table 2) and 2) the estimated adult colony numbers peaked 16th Sep to 1st Oct 2019 (100+) with several fluctuations (but that could be due to the time of day) and a gradual decline by-mid December 2019 (Figure 10). Hatching success has been <0.4 for the past three seasons mostly due to predation and desertion of eggs by the parents (Figure 8 and Table 2)



* Hatching success = No. of nests hatched ≥ 1 egg/ Total no. of nests with known outcome

Figure 8: Tern island black-fronted tern hatching success 2016/17 – 2019/20

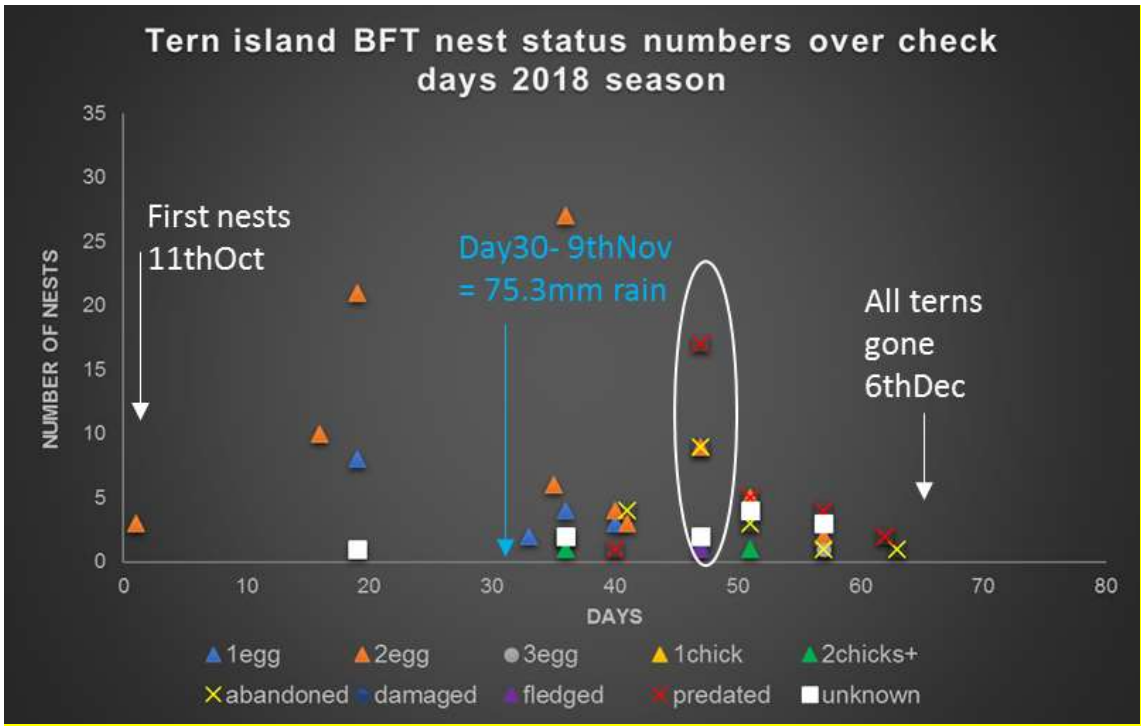
Table 2: Tern island black-fronted tern nest summary table

Black-fronted tern	2016-17	2017-18	2018-19	2019-2020
Total no. of monitored nests (nesting attempt in same nest counted as multiple nests)	25	2	57	104
Total no. of monitored nests with known outcome (A)	23	2	55	66
Total no. of nests that failed	_	_	45	103
Nest failure due to:	_	_		
Predation	_	_	4-29	50
Predation then desertion	_	_	3	?*
Desertion	_	_	12-37	18
Flooding	_	_	0	?*
Died during incubation/infertile	_	_	1	?**
Failed, cause unknown	_	_	0	35
Damaged in nest	_	_	0	0
* Could not access island during or immediately after flooding				
**The eggs were abandoned by incubating adults - it is not clear if this was because of infertile eggs or because of other reasons-embryos were not checked				

Multiple days of rain and flooding over the Lake Ohau weir made access to the island from 3rd to 19th Dec and water is likely to have inundated several active nests. An apparent mass predation / loss of eggs outcome occurred (see Figure 10) despite a predator control network comprising of 353 traps and pindone (0.5 g/kg) in 158 baits stations all within a 500m radius of the island. Trail cameras showed a rat(s) eating tern eggs (Figure 9) so methods to ensure better rat control will need to be investigated.

Whatever predator control actions are taken, the benefits of the Tern island predator control network to other species in the area such as the Lakes skinks (Haultain, 2017b; Welch et al., 2018b) need to be considered.

Figure 9: Rat captured on trail camera eating tern eggs



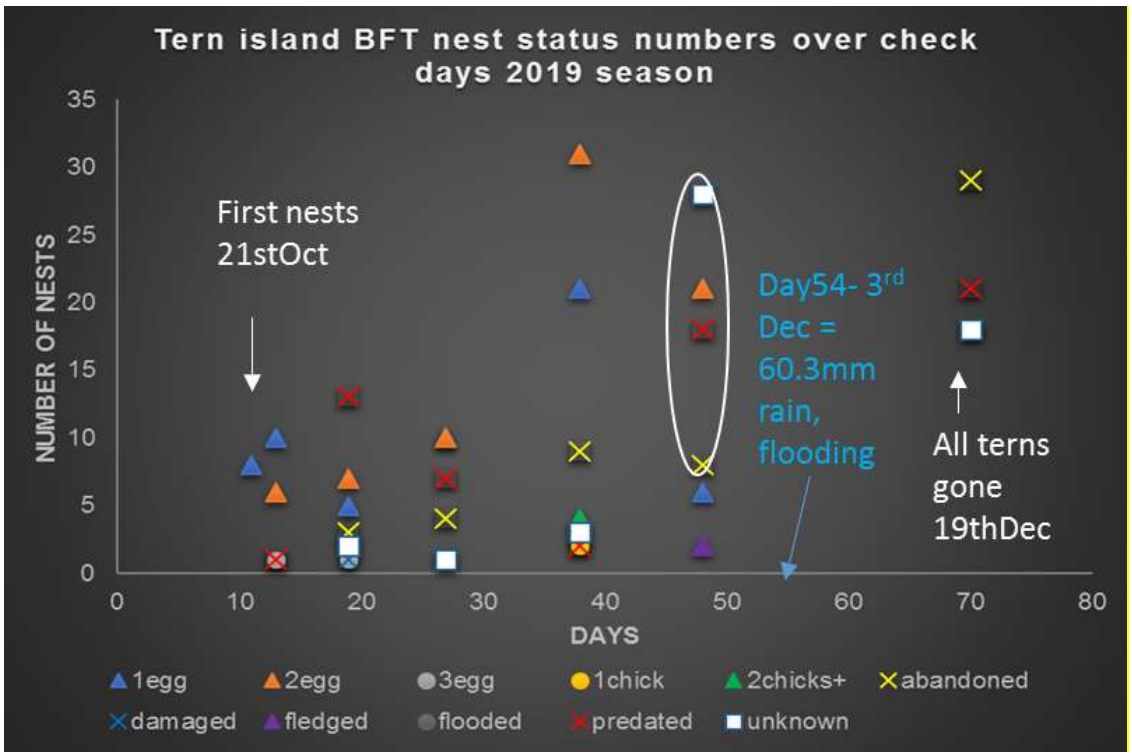


Figure 10: Comparing status (eggs, chicks, fledged, predated, abandoned, etc) of BFT tern nests over 70 days in 2018 and 2019 seasons highlighting events such as flooding and peak predation (white ellipses).

Lakes Skink Monitoring

Lakes skinks (*Oligosoma* aff. *chloronoton* "West Otago"; Nationally Vulnerable; see Figure 11) are a taxonomically indeterminate, large-bodied lizard that inhabit the area from the Eyre Mountains in the south to the Pūkakī River in the north.

Figure 11: Lakes skinks in pitfall trap. (Photo: Jemma Welch)

Lakes skink monitoring has been undertaken within the upper Ōhau predator control area since 2017, with the premise that predator control may also positively benefit species other than black-fronted terns (Haultain, 2017b). This is backed up by the fact that in 2017, other good habitat sites were searched outside of the predator control area to use as experimental control sites however no other Lakes skinks were found.

In a section of scree slope bordering the Upper Ohau predator control area, forty-one pitfall traps placed at 5m intervals were left open for seven consecutive days of surveying in early February- March 2020. Traps were baited with pieces of pear (canned in syrup), contained a handful of wet moss gathered from the surrounding area to reduce thermal stress to captured animals, and were covered with wooden lids (20cm x 20cm square) leaving an opening of approximately 2-3cm between the lid and top of the trap at ground level. All skinks captured were temporarily marked with a non-toxic permanent marker (allowing recaptures within the survey period to be easily detected), had their morphological measurements recorded, and were photographed to assess the potential of using natural markings for identification of individuals among seasons.

Over the trapping period of 7 days in February 2020 a total of 131 Lakes skink captures were made, consisting of 93 unique individuals and 38 recaptures (Table 3.). A range of size classes were captured, indicating a healthy population structure and regular births. Captures of not only Lakes skinks but also McCann's skinks (*Oligosoma maccanni*; Not Threatened) and Southern grass skink (*O.* aff. *polychroma* Clade 5; At Risk, declining) were much higher than in previous years.

High catch rates in all years are hopefully an indication that the trapping is having a positive effect on the population however the higher catch rates observed this year could be explained by the warmer temperatures experienced over the surveying period. As ectotherms, lizards are generally more active at warmer temperatures and consequently need to eat more to support increased energy requirements and be more attracted by the bait inside traps. It is for this reason that temperature is often considered to be one of the most significant factors in the number of skinks caught in pitfalls (pers. comm Jo Monks- DOC herpetologist; Lettink and Monks 2016).

With natural unique body markings between Lakes skinks individuals, we are investigating the plausibility of using a series of photographs of each individual (left, right and posterior sides of the head) to identify recaptures among seasons (Haultain, 2017b). If natural markings remain stable among seasons and recaptures are sufficiently high, then an estimate of the size of the upper Ōhau population could be made, presenting a more accurate annual comparison. Whilst automated image recognition software is being trialled for other lizard species it has not been developed for Lakes skinks and as such manually matching photos between years is required. This process requires some time and with reduced PRR staff capacity has not yet been undertaken for the 2020 images. The Upper Ohau skinks are the only population of Lakes skinks currently being studied in New Zealand and one of the few studies of lizard populations in New Zealand being monitored to such detail.

Table 3: Summary of Upper Ōhau skink pitfall traps seasons 2017-2020

	2017	*2018*	*2019*	*2020*
Total monitoring days	8	7	7	7
Maximum temperature (˚C)	17.3	22.7	36.5	37.7
Minimum temperature (˚C)	6.9	8.9	10.2	3.6
Species captured	Lakes skink, McCann's skink	Lakes skink, McCann's skink, Southern Alps Gecko	Lakes skink, McCann's skink, Southern Alps Gecko, Southern Grass Skink	Lakes skink, McCann's and Southern grass skink
Total captures (all lizard types and recaptures)	64	114	145	167
Total unique captures (all lizard types)	63	93	121	127
Total unique Lakes skink captures	42	63	74	93
Average unique Lakes skink captures per day	5.25	9	10.57	13.28
Lakes skink recaptures	1	20	17	38

4.3 Objective 3: Increase public awareness of braided rivers and associated wetlands within a changing environment.

Copies of the book *Rivers Rare*, written by Neville Peat in 2016 to celebrate the first 25 years of operation for PRR, are on sale in the Twizel bookstore, the Aoraki/Mt Cook Visitor's Centre and small numbers of the book are being sold online by Wheelers and the University Book Shops in Dunedin and Auckland have stocked it. The book is given to prominent visitors and DOC staff as a means of promoting the work of PRR and braided rivers.

The ongoing work by PRR on weed and predator control in the Tasman River was recognised by winning the River Story award at the New Zealand River Awards (Figure 12). The process for this involved having author Andrew Gawith write a short piece about the Tasman River which saw us shortlisted into the final eight, followed by the making of a short video by Nick Tansley which was judged against the other two finalists. There was significant media coverage of this win and extensive social media coverage using the video which has been hugely beneficial in raising public awareness of braided rivers.

Meridian made a video promoting PRR's work and this involved coverage of staff involved in the Tasman project, kaki management, lizard monitoring and freshwater fish surveys. According to Meridian communications staff, Meridian have used this video extensively on social media.

Unfortunately, due to Lockdown, the annual University of Otago Wildlife Management student visit was cancelled. This was to be the 20th visit so this cancellation was a disappointment for students and staff alike however it is hoped that it may take place later in the year.

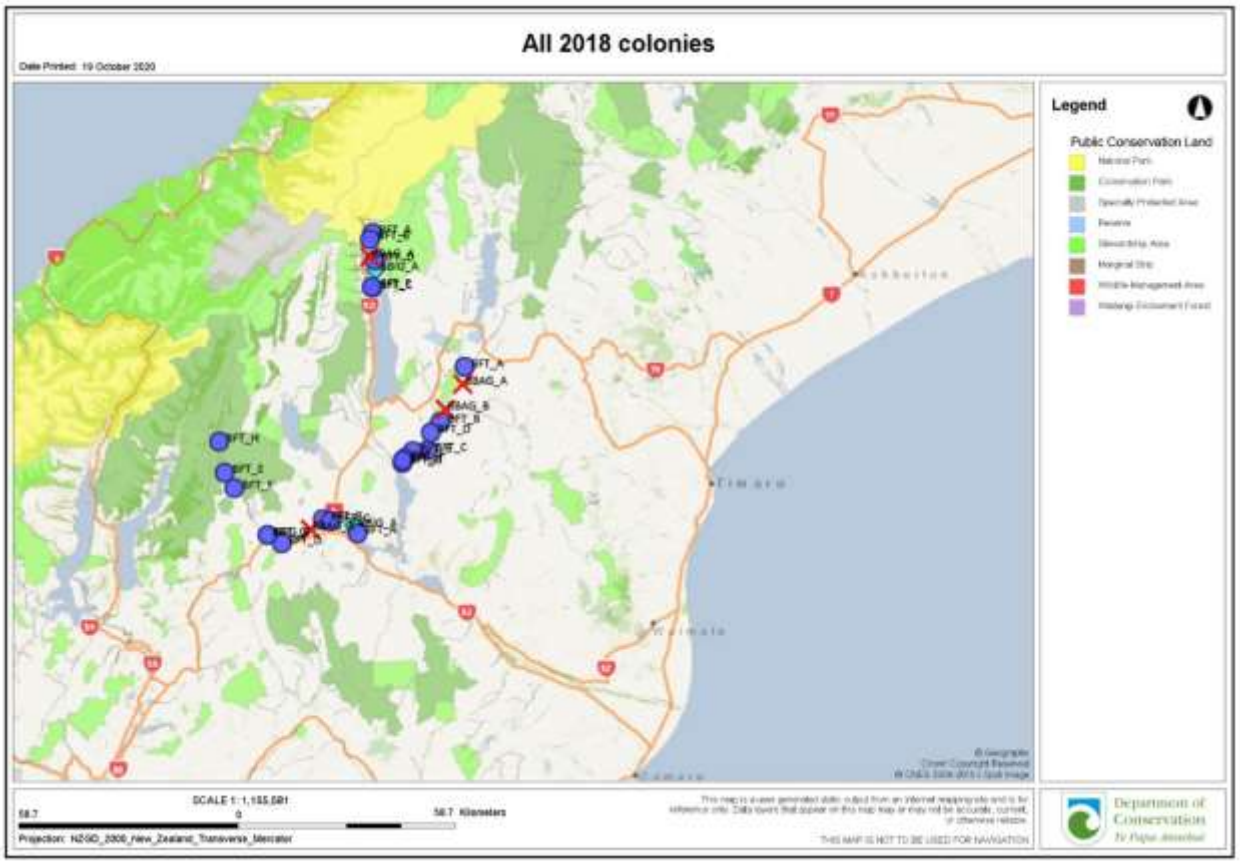
Figure 12: Director General Lou Sanson and Jemma Welch with the NZ River Awards trophy

Objective 4: Gain ecosystem knowledge in upper Waitaki rivers and wetlands through research and monitoring

4.4.1 Braided River Bird Surveys

PRR has continued its programme of braided river bird counts. This is as part of a regular cycle of repeated surveys aimed at long term monitoring of population trends in threatened, as well as more common braided river birds. In the early 1990s, PRR completed surveys of all the upper Waitaki rivers over three years, and while the resources to continue re-surveying all of the rivers in this way are not currently available, rivers are being sequentially re-surveyed over three consecutive years on a rotational basis.

PRR surveys of braided river birds use standardised walk-through methodology, allowing the data collected to be compared directly with other braided river bird surveys around the country. This allows PRR to improve the understanding of bird population changes over time in upper Waitaki rivers, as well contributing to information on species-wide dynamics at a national scale.



Species legend

Figure 13 a: All black-fronted terns (BFT), Black-billed gulls (BBIG) and Black-backed gulls (BBAG) colonies on Ahuriri, Tasman and Tekapo Rivers surveys 2018

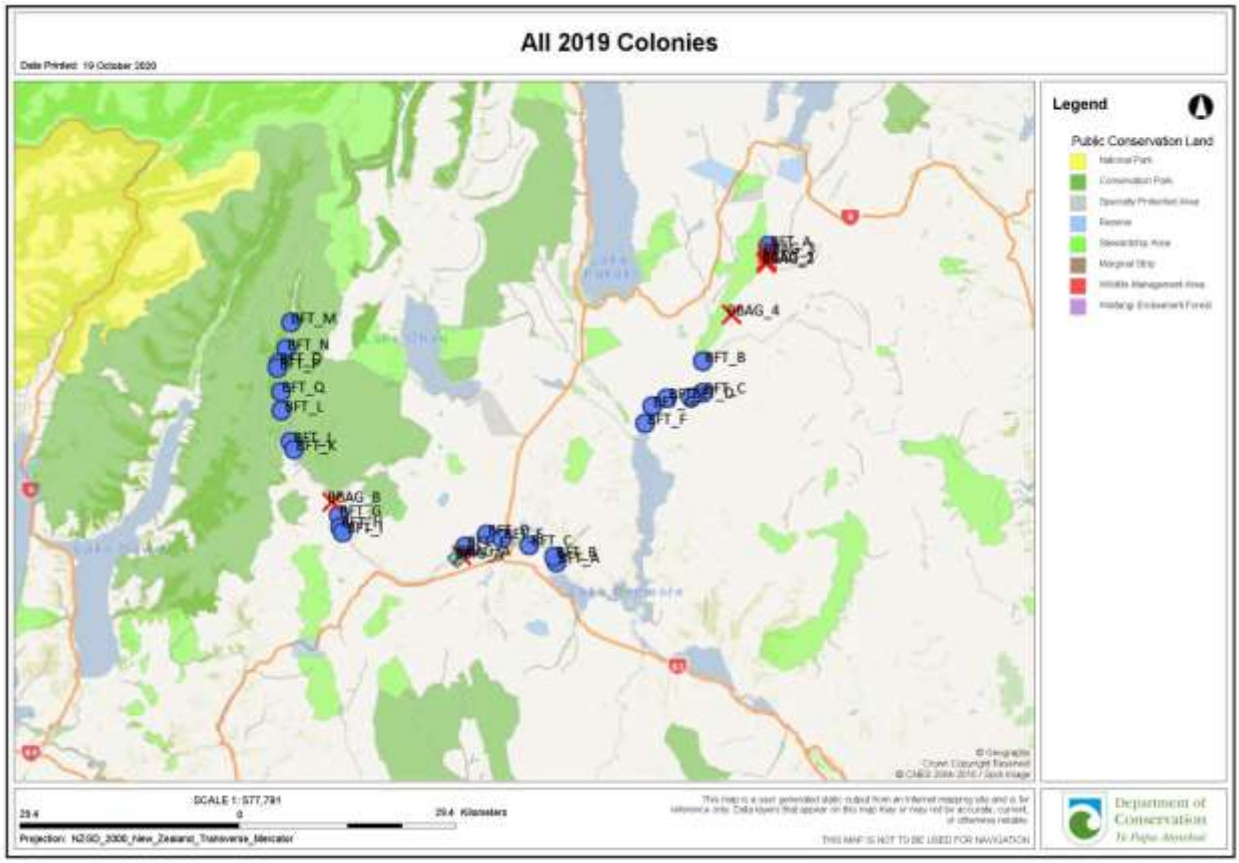


Figure 13 b: All black-fronted terns (BFT), Black-billed gulls (BBIG) and Black-backed gulls (BBAG) colonies on Ahuriri and Tekapo Rivers surveys 2019

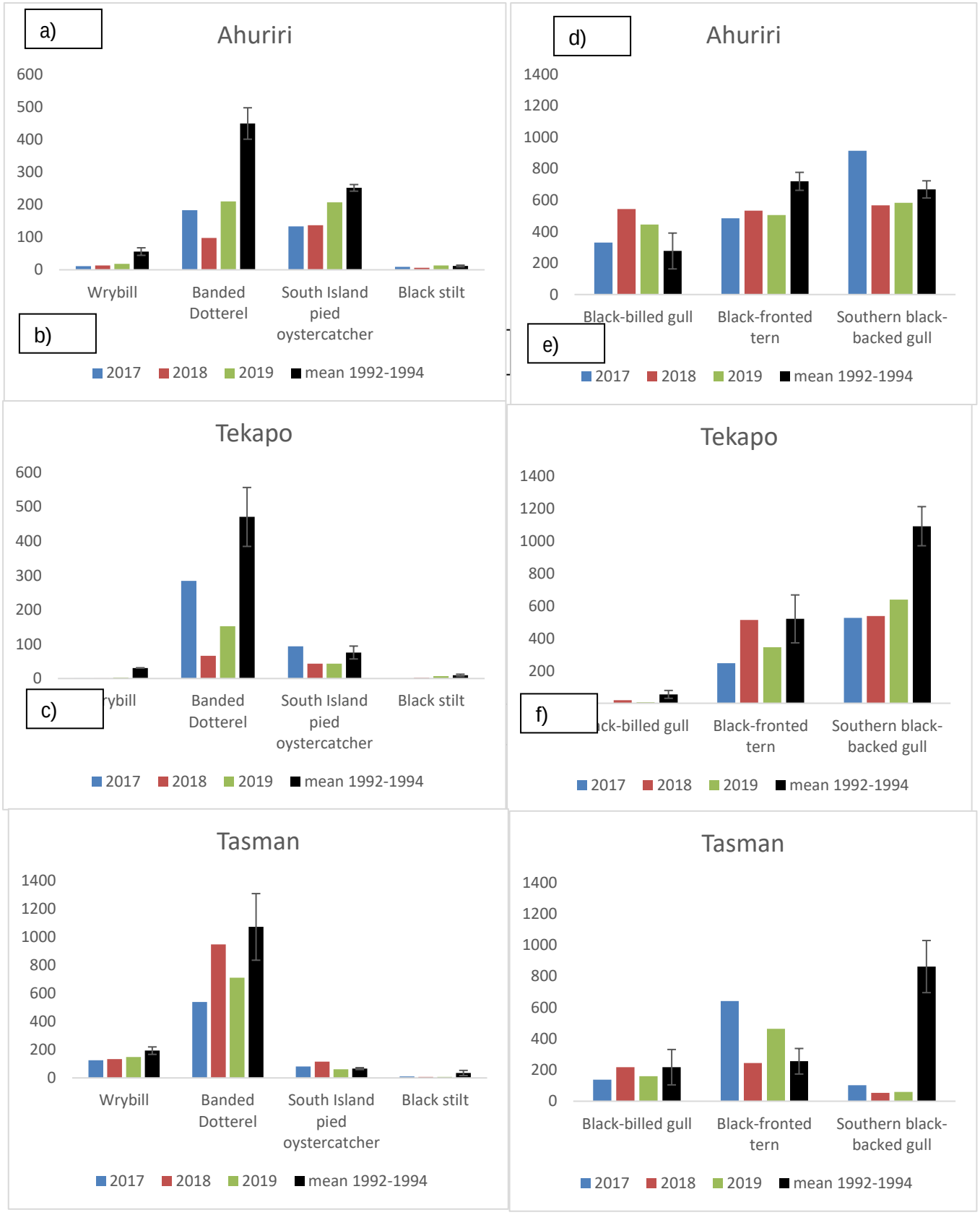


Figure 14: Ahuriri, Tekapo, Tasman braided river bird counts from most recent 2017-2019 cycle compared to mean ± SEM from 1992-1994 cycle showing both; a-c, (non-colony forming birds) and d-f (colony-forming birds) breeding bird numbers

In October 2019, we completed the third and final braided river bird count for both the Ahuriri and Tekapō Rivers in this 3yr cycle. Annual walk through bird surveys and outcome monitoring were continued for the Tasman River. Figure 13 (a-b) report spatial and temporal data on several braided river bird species breeding colonies in these three rivers gaining an insight into site selection for these species over different years. Figure 14 shows the total adult bird numbers graphed for selected species for the 2017-19 cycle and compared with the 1992-1994, (a previous cycle selected at random for comparison). Species selected include non-colony forming birds (a-c) and colony forming birds (d-f). Table 4 shows the complete three years of counts of all adult birds from the surveys in this current cycle. The 2017-2019 and 1992-1994 datasets are only snapshots of the bird population and factors such as differences in observer identification capabilities (especially in duck species) and river accessibility all affect the count numbers.

A brief qualitative review of the graphs would suggest that since 1994, the Ahuriri and Tekapo have suffered greater declines in braided river bird species: banded dotterels and wrybill (both rivers), black-billed gulls (Tekapo) and black-fronted terns (Ahuriri). However, the Tasman which has the benefit of significantly lower weed infestations and 15 years of predator control (both mammalian trapping and SBBG control) appears to show equal or increased numbers of braided river bird species compared to 1992. There are other historical records dating back to 1962 and going forward it would be a beneficial process to fully collate undertake quantitative analysis as to how bird populations have changed over the past 58 years.

Table 4 – Complete braided river bird species counts 2017-2019 cycle and mean for 1992-1994 cycle (as a random comparison)

	Ahuriri				*Tekapo*				*Tasman*			
	2017	2018	2019	1992-1994 (mean)	2017	2018	2019	1992-1994 (mean)	2017	2018	2019	1992-1994 (mean)
Australasian crested grebe	0		0	3	0	0	0	5	0	0	0	0
Australasian shoveler	0	4	0	38	0	0	3	35	0	0	0	6
Banded Dotterel	183	98	210	449	284	66	152	470	539	946	710	1070
Black shag	43	62	60	175	20	10	29	47	2	1	2	33
Black stilt	9	6	13	12	0	2	7	9	10	8	7	35
Black swan	10	41	31	142	0	8	7	58	6	9	9	1
Black-billed gull	331	544	445	277	0	19	6	55	138	218	160	218
Black-fronted tern	485	534	505	720	247	513	345	520	641	245	464	256
Canada goose	422	710	489	2189	213	285	420	810	179	292	117	1341
Caspian tern	11	2	7	16	4	2	6	15	2	0	2	5
Grey duck	0	8	4	40	62	20	29	29	0	2	0	3
Grey teal	4		5	142	0		18	496	0	0	0	80
Hybrid stilt	13	13	22	10	5	12	10	11	0	3	0	30
Indeterminate duck species	74	126	287	682	30	41	121	173	4	40	40	840
Little shag	4	4	1	31	0	6	5	19	0	0	0	3
Mallard	94	113	46	60	21	75	95	31	14	19	31	5
New Zealand scaup	0	8	22	477	0	0	0	584	0	0	0	15
Paradise shelduck	192	210	261	963	56	48	65	156	105	131	63	372
Pied stilt	74	74	106	132	41	63	82	120	1	8	8	76
South Island pied oystercatcher	133	137	207	252	94	43	43	76	81	115	62	66
Southern black-backed gull	914	568	583	669	526	537	638	1091	102	53	60	862
Spur-winged plover	50	43	22	157	28	24	11	59	6	25	10	65
Swamp harrier	23	33	23	24	17	24	15	19	0	4	9	5
White-faced heron	17	9	14	22	25	17	18	33	0	7	0	15
Wrybill	11	13	18	56	1	1	3	31	126	133	148	193

4.4.2 Australasian Bittern/ matuku hūrepo (*Botaurus poiciloptilus*)

In the most recent review of the Conservation Status of New Zealand birds (2016) the Australasian bittern threat ranking has been raised to nationally critical due to its ongoing decline throughout the country. Apart from a few historic (1930-1970s) records from this region (see Figure 16), very little is known about its habitat use and breeding behaviours in the Mackenzie Basin.

Since bitterns are too cryptic to easily see, initial presence/absence indexing is typically undertaken by placing acoustic recorders in likely locations and listening for the males' distinctive booms during the breeding season (Oct to Jan) as described by O'Donnell and Williams (2015). With this aim, 22 Acoustic Recording Devices (ARDs) were placed at various potential sites across the region (see Figure 15).

The ARDS were set to record only when male bittern booming is are most likely at dusk and dawn ; 04:00- 06:45 and 19:45-23:30 h. Sound files of 15 mins were recorded throughout these times. As there were such a large number of files, we selected eight per day to analyse and did not review sound files with high background noise, wind and rain. Currently bittern detection is a manual process, although an automated software is being developed within New Zealand.

Using free avian acoustic software https://ravensoundsoftware.com/software/raven-lite/, the spectrograms from the ARDs were reviewed visually and through listening (Figure 15). To date no bitterns have been detected but this is a long process and we are still reviewing the first ARD, with automated analysis to be undertaken later in 2020.

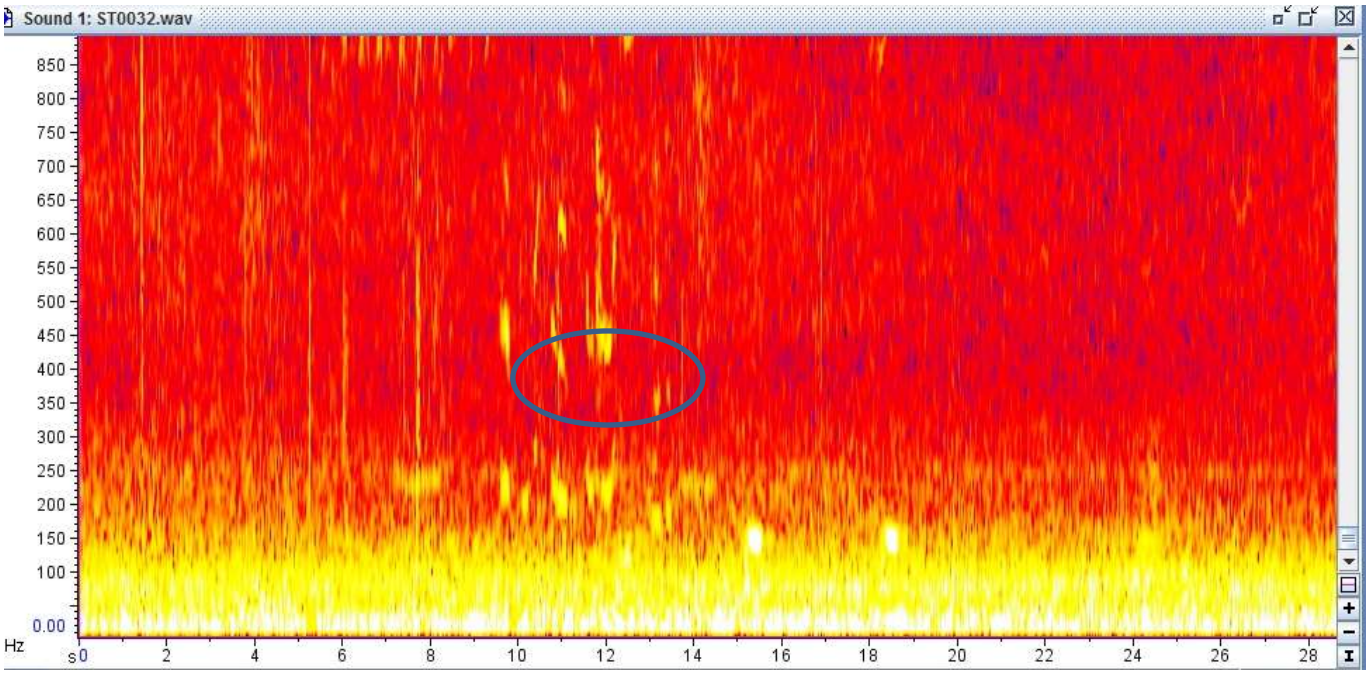


Figure 15: An example of a male bittern boom train (150Hz)

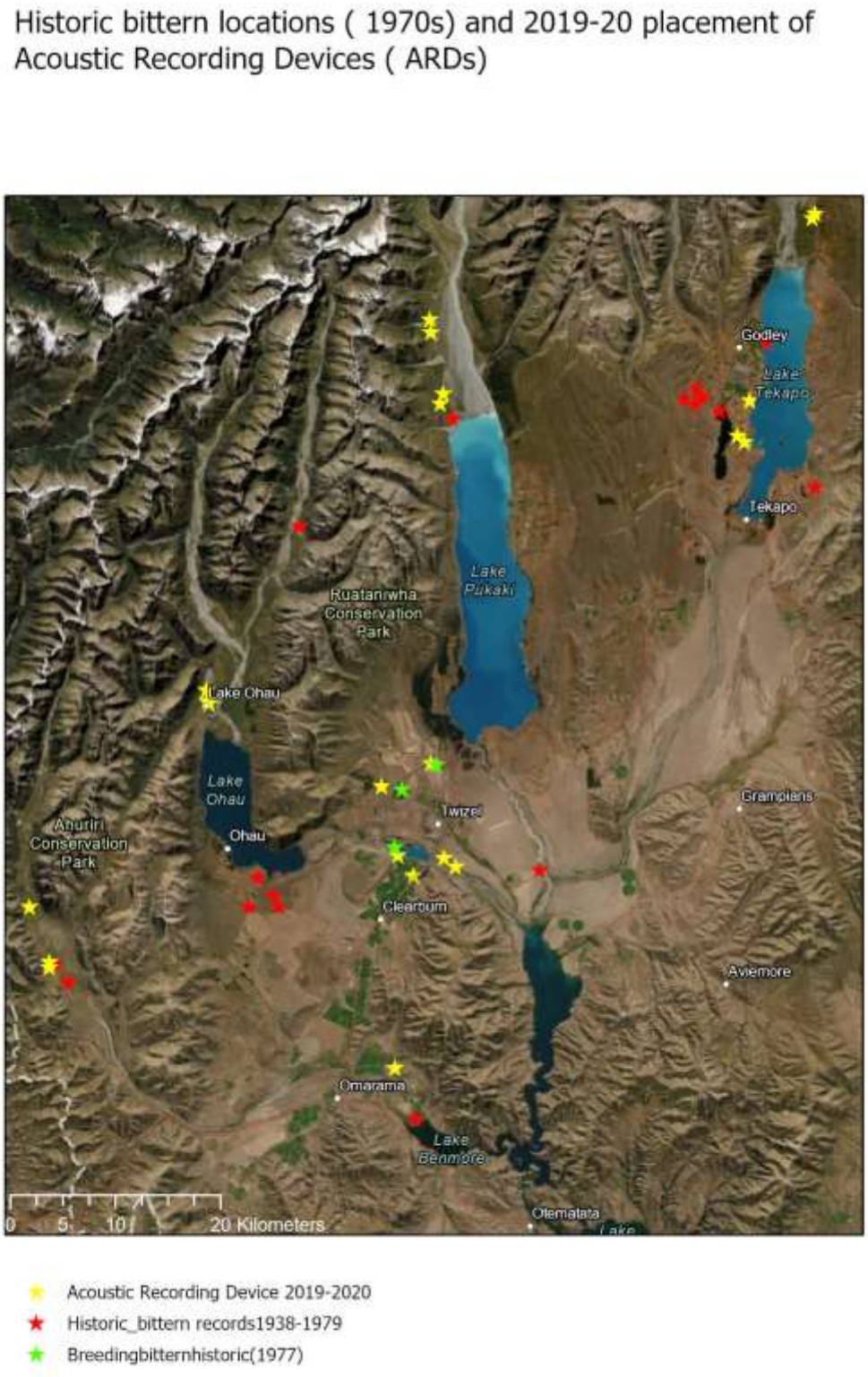


Figure 16: Historic records of bittern locations (calls and sightings) and 2019 placement of acoustic recording devices

Oligosoma prasinum- Mackenzie skink
Nationally vulnerable

Oligosoma waimatense- scree skink, Nationally Vulnerable

Oligosoma longipes, long –toed skink
Nationally vulnerable

Oligosoma maccanni, McCaans skink,
Not threatened

Lizards of the Upper Waitaki/ Mackenzie basin

Naultinus gemmeus, jewelled gecko, Declining

Oligosoma aff. Chloronata"West Otago", Lake skink,
Nationally vulnerable

Oligosoma aff. Polychroma, Grass skink, At risk

Woodworthia "Southern Alps",
Southern alps gecko, Not Threatened

Figure 17: Lizards of the Mackenzie basin

4.4.3 General lizard surveying using ACOs (Artificial cover objects)

This survey was undertaken to better understand Mackenzie basin lizard species (see Figure 17) presence/absence by surveying sites with historic sightings and new areas. Methodology best practice (including assumptions) was followed based on Lettink and Monks (2012). Artificial cover objects (constructed from sections of roofing material called onduline - shown in Figure 18) are easy to deploy and collect, requiring far less effort than digging pitfall traps and therefore causing less habitat disturbance.

Figure 18: ACOs or artificial retreats which lizards take cover under, set out in transect lines for survey of lizard presence/absence

Eighty ACOs in total were deployed in October 2019 in a configuration of two lines (each comprising 10 ACOs) at four sites: Tekapo Scientific Reserve, Tekapo River True Right, Pukaki River True Right, Lower Ohau River True Right. ACOs were spaced at approximately 10m intervals.

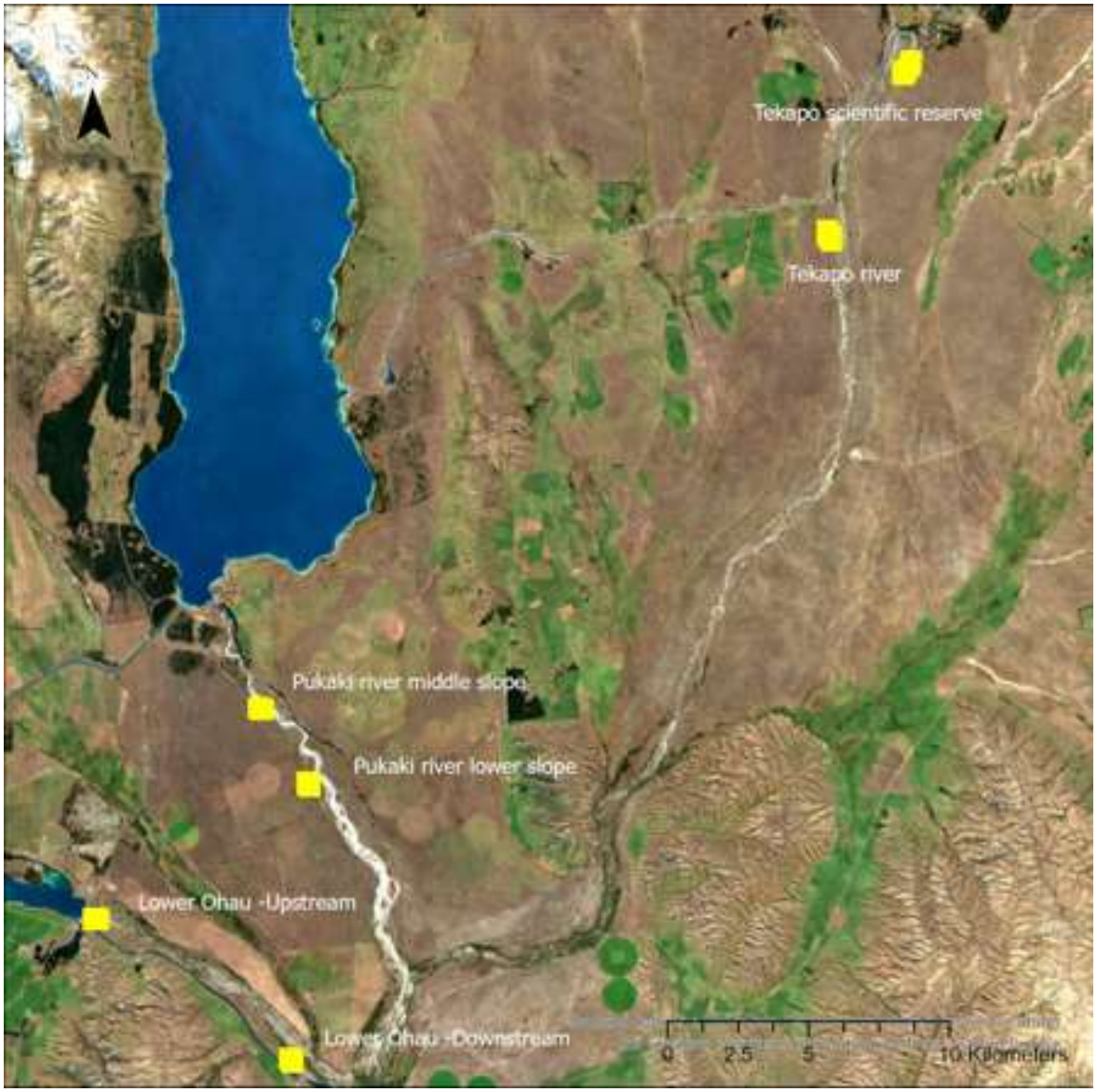


Figure 19: Locations of the eight artificial retreat transect lines set up for lizard monitoring in 2019-2020

Final ACO checks were undertaken monthly until 24th January 2020 (when they were retrieved). Lizards are ectothermic therefore ACOs were only checked when the ambient temperature was not too hot or cold (<5 °C and >25 °C).

During the three checks of the 80 ACO retreats 25 skinks were found; 18 McCanns skinks, two Southern Grass skinks and 4 unknown escapees. The highest number of skinks (seven) was found at the Tekapo river true right. This information will be entered into the national NZ amphibian and reptile distribution scheme (ARDS).

4.4.4 Southern Crested Grebe Surveys

In January 2020, PRR undertook kāmana/Southern crested grebe (*Podiceps cristatus* australis; Nationally Vulnerable) (Figure 20), surveys throughout the upper Waitaki Basin. Waterbodies which best aligned with the 1980 and 2004 nationwide surveys of crested grebes (Sagar, 1981; Jensen and Snoyink, 2005) were selected. Over two days in January, two observers counted grebes and other waterfowl from a single two-person kayak as the following waterbodies were circumnavigated: Lake Ruataniwha, Wairepo Arm, Kellands Ponds, Lake Alexandrina and Lake McGregor. The number of adult crested grebes were counted, with individual birds seen patrolling lakeshores or breeding habitat assumed to indicate an unseen partner incubating eggs.

Figure 20: Southern crested grebe shaking off a chick. Photo: Anja Kohler at Lake Te Anau

Counts from the January 2019 and 2020 surveys are compared with those from the 1980 and 2004 nationwide surveys involving some of the same lakes in Table 5 below (Sagar, 1981; Jensen and Snoyink, 2005). It is worth noting that differences in methods and variable observers used in these historic surveys may account for the large variation in counts. In the 1980 and 2004 surveys birds were primarily counted from the lake shore and on large lakes such as Lakes Alexandrina and Ruataniwha the total number of adult grebe present were likely underestimated as a result.

Table 5: Total observed adult crested grebe counts (with estimated counts indicated in brackets if different) from the January 2020 crested grebe survey of five lakes in the upper Waitaki Basin compared with the 1980, 2004, 2019 nationwide surveys of crested grebes.

Survey Locations	Nov-Dec 1980 (Sagar, 1981)	Jan 2004 (Jensen and Snoyink, 2005)	Jan_2019	Jan_20 (Adult)	Jan_20 (Chick Juvenile)
Lake Ruataniwha	Not Surveyed	0	9(10)	6	0
Wairepo Arm	Not Surveyed	6	20(*21*)	19	1
Kellands Ponds	Not Surveyed	Not Surveyed	7	17	1
Lake Alexandrina	38	11	92(*93*)	93	0
Lake McGreggor	8	0	19	14	0
Lake Murray	Not Surveyed	0	0	Not Surveyed	Not Surveyed
Glenmore Tarns	4	Not Surveyed	Not Surveyed	Not Surveyed	Not Surveyed
Lake Tekapō	0	Not Surveyed	Not Surveyed	Not Surveyed	Not Surveyed
Lake Pūkakī	0	Not Surveyed	Not Surveyed	Not Surveyed	Not Surveyed
Lake Ōhau	0	Not Surveyed	Not Surveyed	Not Surveyed	Not Surveyed
Lake Middleton	Not Surveyed	0	Not Surveyed	Not Surveyed	Not Surveyed
Raupo Lagoon	0	Not Surveyed	Not Surveyed	Not Surveyed	Not Surveyed
Swan Lagoon	0	Not Surveyed	Not Surveyed	Not Surveyed	Not Surveyed
Lake Benmore	0	15(*20*)	Not Surveyed	Not Surveyed	Not Surveyed
Totals	*50*	*32(37)*	*147(150)*	*149*	*2*

Overall crested grebe numbers appear to be stable over the last two surveys. Other native and endemic waterfowl observed during our 2020 crested grebe surveys included New Zealand Scaup (*Aythya novaeseelandiae*; Not Threatened), Australian Coot (*Fulica atra australis*; Naturally Uncommon), Grey Duck (*Anas superciliosa*; Nationally Critical), Black Swan (*Cygnus atratus*; Not Threatened), Little Shag (*Phalacrocorax melanoleucos*; Not Threatened), Black Shag (*Phalacrocorax carbo*; Naturally Uncommon), Kakī and Pied Stilt (*Himantopus himantopus leucocephalus*; Not Threatened). Introduced Canadian Goose (*Branta canadensis*) and Mallard duck (*Anas platyrhynchos*) were common on most of the waterbodies surveyed.

4.4.5 Freshwater Fish Management

Objectives Four and Five include assisting with DOC's freshwater fish distributional surveys, monitoring fish populations and protection of fish species by appropriate installation of trout barriers and removal of invasive fish species.

Ongoing trout removal above the two barriers installed on spring-fed tributaries of Fork Stream has continued this season. Quite a bit of time is required in follow-up visits before the site can be declared free of trout and be truly beneficial to the three key species it has been installed to protect: the bignose galaxias (*Galaxias macronasus*; Nationally Vulnerable) the upland longjaw galaxias (Waitaki River; *Galaxias* aff. *prognathus* "Waitaki River"; Nationally Vulnerable) which are both endemic to the upper Waitaki Basin, and the alpine galaxias (*Galaxias paucispondylus*; Naturally Uncommon).

Trout removal above the barrier installed on the true right tributary in 2017 remains the priority given the effort that has already gone into removing trout from it. PRR, in collaboration with other DOC staff, ECan and New Zealand Defence Force staff, have continued to electric fish out the resident trout above this barrier since it's installation and trout are now down to relatively low numbers. There was some suspicion trout may be re-entering the system from below the barrier. To test this, a sample of trout fished out of the system last year were marked by cutting their adipose fins before being released below

the barrier. None of trout caught this year had trimmed fins which tends to indicate that they are not getting over the barrier. This year, as additional insurance, two extra boards were added to the barrier to increase the fall height of the water.

Figure 21: **Upland longjaw galaxias "Waitaki River"** (Photo: Dean Nelson)

Monitoring of lowland longjaw galaxias (Waitaki River; *Galaxias* aff. *cobitinis* "Waitaki River"; Nationally Critical;) and bignose galaxias above the trout barrier in a spring-fed tributary of Fraser Stream has continued. An unexpected consequence of removing trout from this site has been the increase in the population of both kōaro (*Galaxias brevipinnis*; Declining) and Canterbury galaxias (*Galaxias vulgaris*; Declining) which can both grow to over three times the size of the lowland longjaw galaxias. Unfortunately, when they reach a larger size, they can prey on the smaller lowland longjaw galaxias and bignose galaxias so consequently, any kōaro or Canterbury galaxias that are caught using electric fishing or Gee minnow fish traps are being transferred below the barrier. Additionally, an aluminium lip has been installed on the barrier as kōaro are very adept at climbing wet surfaces, even if they are vertical.

Lowland longjaw galaxias at the site seem to be responding well to these additional management techniques with 115 caught in the two monitoring sites during the annual March survey compared with only six caught in the same two sites in late 2016. 118 bignose galaxias were caught in the same two sites indicating that both species can co-exist in this habitat.

Another continuing management priority at this site is the control of the invasive bog herb Monkey Musk (*Erythranthe guttata)* which is encroaching on the spring head and has the potential to bind up the gravel that these fish require to burrow into for protection and spawning.

PRR and DOC national freshwater staff along with a contractor funded by ECan spent time returning to historic survey sites for upland longjaw galaxias in the Tasman, Cass, Godley and Macaulay Rivers. While there were not large numbers of these fish caught, generally if the right habitat of small riffles was targeted, fish were found. Generally, these small riffles were too shallow for trout to occupy. Unfortunately, the second week planned with the contractor in the Dobson, Hopkins and Ahuriri Rivers had to be cancelled due to the COVID-19 lockdown.

4.4.6 Lake Benmore Gullies management and skink monitoring

There are two small gullies on the shore of Lake Benmore which hold relict populations of Lakes skink and scree skink (*Oligosoma waimatense*; Nationally Vulnerable) which were initially found back in 1997.

Figure 22: Scree skink (*Oligosoma waimatense*) in typical habitat in the Lake Benmore Gullies

In 2010, visiting herpetologist Marieke Lettink did some lizard monitoring training for staff at these sites and confirmed the presence of both species. In the intervening time, several weed species such as poplar (*Populus* sp.) willow (*Salix* sp.), silver birch (*Betula pendula*) and sweet briar (*Rosa rubiginosa*) have become more prolific. They cause problems to the lizards in several ways by shading the areas of habitat that the skinks need to bask in, covering the rocky habitat and creating cover for predators, and the leaves they shed fill the gaps in the rocks that the skinks rely on for protection.

During September 2019, contractors and staff cut down and sprayed as many of these trees and shrubs as possible and most of the felled material was carted away from the site. Follow-up spraying will need to occur for several years to ensure that any re-growth is controlled.

At the same time, the Waitaki District Council funded a fence along the roadside to prevent off-road vehicle access to these vulnerable sites.

14 Gee minnow traps were deployed in the gullies over four consecutive nights in late February 2020. Traps were baited with pieces of pear (canned in syrup), contained a handful of vegetation gathered from the surrounding area to give cover to captured animals and a small piece of wet sponge to help reduce thermal stress. All lizards captured were temporarily marked with a non-toxic permanent marker (allowing recaptures within the survey period to be easily detected), had their morphological measurements recorded, and were photographed to assess the potential of using natural markings for identification of individuals among seasons.

A total of 29 lizards were caught comprising 16 Lakes skinks, 3 scree skinks, 9 McCann's skinks and one Southern Alps gecko.

Some initial discussions have been held with the adjoining landowners about the possibility of placing some predator traps in the vicinity of the gullies and future monitoring should be done using pitfall traps which are considered best practice.

Objective 5: Protect and manage upper Waitaki wetlands

The man-made Ruataniwha and Waterwheel wetlands have continued to provide habitat for a range of native fauna and flora. PRR manages these wetlands by manipulating water levels and controlling weeds with the theory behind this being to provide suitable seasonally flooded/dewatered habitat for rare ephemeral plant species to thrive and improving feeding sites for wading birds. Water level management allows ponds to be drier for a longer period during late summer to allow significant ephemeral plant species to thrive. These species include the nationally endangered plants *Centipeda minima* (Waterwheel), *Isolepis basilaris* and *Dysphania pusilla* (Ruataniwha) (see Figure 23), and the native liverwort, *Riccia cavernosa*.

Figure 23: The nationally endangered *Dysphania pusilla* at Ruataniwha wetlands (Photo: Aalbert Rebergen)

4.5 Objective 6: Facilitate research by external agencies, including universities, to improve our understanding of the ecology of braided river systems.

While the Tasman Invertebrate study was finally completed several years ago, the final report written by Tara Murray from Canterbury University was received in late 2019, and final payment made upon completion.

This study of the invertebrate fauna of the Tasman River was commenced in 2005 to identify the effects of the Tasman River Predator Control Project on the ecosystem-wide recovery of the area. While work has continued for a number of years, finding the resources to identify the large numbers of samples collected (152,509 specimens) was difficult. In late 2015, an agreement was reached with the University of Canterbury to jointly analyse the existing identified samples and publish these results as a joint study with Susan Anderson, who completed much of the field work for the project. After unexpected delays, the final report written by Tara Murray from Canterbury University was received in late 2019, and final payment made upon completion.

A total of 919 unique recognisable taxonomic units (RTUs) were identified from specimens, representing 165 arthropod families, 21 orders and five classes (Murray, 2019).

Simplified methods recommended in this paper could be used to gain a comprehensive overview of invertebrate communities on braided rivers throughout the upper Waitaki Basin; much like the PRR led vegetation study of braided rivers in the upper Waitaki Basin in 2010 (Woolmore, 2011). Recommendations to exclude juvenile specimens and small taxa (<2mm in length) from processing and only identify specimens to family or genus level would reduce the total processing time significantly (Murray, 2019). For general biodiversity assessments, malaise traps with jars and troughs are recommended as providing the highest diversity of taxa detected (69% of RTUs), while being simple to set-up and reducing processing time (less juveniles captured).

5. Project River Recovery's relationship with the Te Manahuna Aoraki Project

November 2018 saw the official launch of the Te Manahuna Aoraki (TMA) Project – a landscape scale conservation project focusing on restoring the natural landscapes and threatened species of the upper Mackenzie Basin and Aoraki/Mt Cook National Park. The project will enhance biodiversity across 310,000 ha of land including braided river systems and alpine habitats. As such, there is some overlap with PRR on the rivers, wetlands and lakeshores in the project area from the Ben Ohau Range in the West to the Two Thumb Range in the East (see Figure 24). As part of the TMA Project the Cass, Godley and Macaulay Rivers bird surveys will be conducted on an annual basis and PRR will provide support on these as required and share knowledge gained from surveys of other species undertaken in overlapping areas.

This includes some of our major lakes and rivers including Lakes Pūkakī and Tekapō and the Tasman, Cass, Godley and Macaulay Rivers and Fork Stream. PRR is working in collaboration with TMA to gain ecosystem knowledge in these overlapping areas. PRR has also provided support in outcome monitoring of these riverbeds as required. TMA staff will endeavour provide support to PRR on braided river bird surveys elsewhere in the basin.

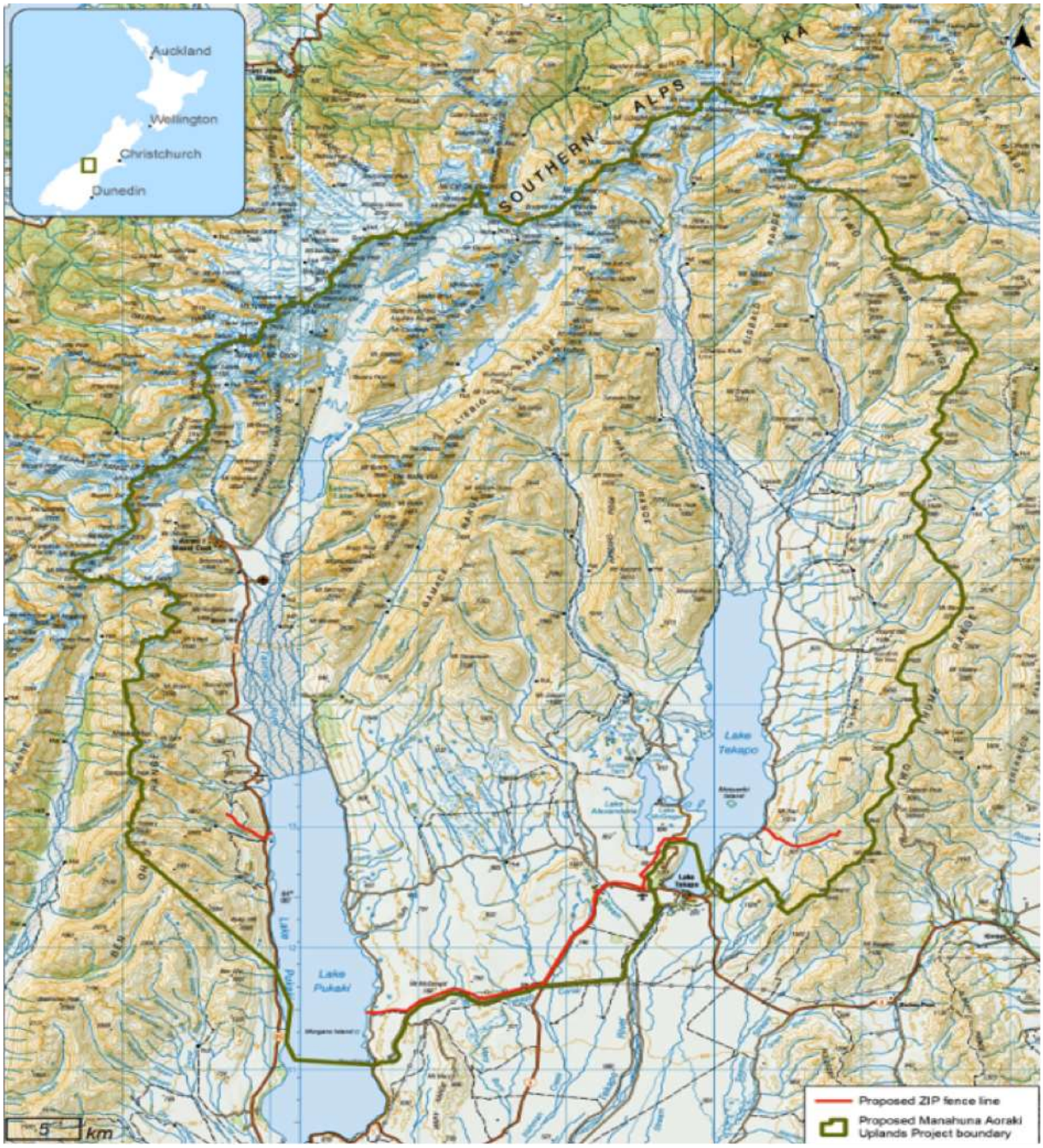


Figure 24: Map showing the operational area for the Te Manahuna Aoraki Project. The Green line **indicates the project's boundary and the red lines indicate the proposed locations for predator proof** fencing. Source: Te Manahuna Aoraki Website.

6. Project River Recovery's financial statements 1st July 2019 – 30th June 2020

Project River Recovery spent $553,821 in the 2019-2020 financial year. PRR's revenue and expenditure for the 2018-2019 financial year is itemised in table 5.

Table 6: Project River Recovery statement of financial performance for year ending 30th June 2020

	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010
	($000)	($000)	($000)	($000)	($000)	($000)	($000)	($000)	($000)	($000)	($000)
REVENUE											
Stakeholder Transfers	554	544	539	513	528	495	516	492	499	485	472
Other revenue	0	0	0	0	0	10	18	37	0	0	0
TOTAL REVENUE	*554*	*544*	*539*	*513*	*528*	*505*	*534*	*529*	*499*	*485*	*472*
EXPENDITURE											
Personnel costs											
Salaries	113	83	44	80	125	117	138	138	140	129	119
Wages	57	15	50	51	48	39	3	0	2	1	12
Other Personnel	0	0	0	0	-3	0	1	0	-3	-2	6
Total personnel costs	*170*	*98*	*93*	*132*	*170*	*156*	*141*	*138*	*139*	*128*	*137*
Administration costs											
Accommodation	20	20	22	20	20	27	27	27	27	26	26
Operating costs											
Professional fees	5	8	5	1	11	1	6	5	1	9	2
Travel	2	1	3	1	1	3	2	1	1	1	7
Vehicle expenses	36	34	35	36	36	35	39	40	41	42	38
Field operations	319	382	371	321	289	281	316	306	278	273	260
Information and publicity	2	1	1	2	1	2	1	2	1	4	6
Grants and miscellaneous	0	0	8	0	1	0	3	10	11	2	3
Total operating costs	*363*	*426*	*424*	*361*	*338*	*322*	*367*	*364*	*333*	*331*	*316*
TOTAL EXPENDITURE	554	544	539	513	528	505	535	529	499	485	479
NET SURPLUS (DEFICIT)	0	0	0	*0*	*-1*	*0*	*-1*	*0*	*0*	*0*	*-7*

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