Management and monitoring of shorebirds in the Ashley-Rakahuri River during the 2022-23 season

Ashley River from Smarts area, 19 January 2023

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1. Summary

The Ashley-Rakahuri Rivercare Group was formed in 1999. Its main goal is to protect key shorebird populations in the lower reaches of the Ashley-Rakahuri River, in the 21km stretch between the Okuku river junction and the upper estuary below the SH1 road bridge. This is the 18th annual report from the Group.

The Group's finances and administration are in good shape. We are mostly self-funded for our day-to-day existence, with finances coming from a trap making and selling project, donations and sponsorship via Karikaas Natural Dairy Products Ltd cheese sales. Grants for larger special projects (such as weed clearing) come from ECan and DOC.

Activities were focussed on management to assist the feeding and breeding of the threatened indigenous species in the river, particularly the wrybill (ngutupare), black-billed gull (tarapuka), black-fronted tern (tarapirohe) and banded dotterel (pohowera). Our work is focussed on addressing the main threats to the birds which can be summarized as habitat, predation and human disturbance.

ECan is currently overseeing and funding the writing of a long-term plan for the Ashley-Rakahuri river. This should become the guiding document for future management.

Annual bird count. Braided river bird numbers were very similar to those of 2021 – with numbers again influenced by birds losing their nests in Waimakariri floods. Results were also influenced by the survey being about 3 weeks later than usual – this would have resulted in more wrybill and banded dotterel being counted.

Nesting season monitoring. Sixteen wrybill nests were found from 14 pairs this year. The only evidence of predation was from harriers. Fledgling success was between 7 and 12 from the 14 pairs. A larger number than usual (162) of BFT nests were found this year, but this was probably due to renesting after flooding. Less evidence of rat predation was noted, but rats were caught in traps. They are increasingly trap-shy and perhaps even camera shy. Fledgling success was only about 1 for every 10 nests. After several attempts at nesting along the river and the top end of the estuary, black-billed gulls fledged about 367 chicks at the latter location – from some 456 nests. A small colony at Golf Links with around 95 nests produced about 30 fledglings. From the number of fledglings seen along the river, banded dotterel seemed to have a successful season. Pied stilts lost many nests to floods, their success rate (as with oystercatchers) is unknown.

Weeds. Due to spraying and floods, weeds were not a significant problem in the 2021 – 2022 and won't be next season. We cleared 27.2 ha before 2022 – 2023 season started.

Predator control. Along the river total predator catch was the highest ever – due to a Ship rat boom and to additional temporary traps. A total of 842 predators were caught, compared to 512 last year. Norway rats still seem to be our major predator, trap-shyness seems to be increasing, but numbers caught increased this year. More evidence is emerging of the importance of cats – taking BFT eggs, chicks and adults. The success of our trapping is best illustrated by BFT fledgling success, which remains extremely low at around 1 from 10 nests. Annual bird count figures do not reflect trapping success. This year though the main problem was flooding during the season.

At the estuary catch rate increased for the first time since trapping started in 2018. Rats were the main species to increase.

Human Disturbance. Human disturbance has not been a major issue along the river – due to blocking of access points and greater public knowledge of the effects of it. Motorbikes, quad bikes and dog walkers were still

present on the river. Crate day was again an issue upstream from the Okuku confluence. However, ARRG weren't monitoring nests, so we don't know what damage may have been done.

Gravel extraction. There were 3 gravel operations on the river. All companies were given presentations and suggestions on how to take gravel in a way which will enhance rather the deteriorate natural character. Some success is apparent.

2. Introduction

The braided rivers of the South Island are a unique habitat of outstanding importance to endemic wildlife (Cromarty & Scott 1996, Dowding & Moore 2006). In particular, they provide breeding habitat for a range of threatened shorebird species, some of which depend largely or entirely on braided rivers for their survival. Braided rivers commonly have large areas of bare, mobile shingle, multiple channels, and variable flows (O'Donnell & Moore 1983). However, their ecological values are increasingly threatened; most have been invaded by weeds and introduced mammalian predators, and are further degraded by a wide variety of human activities. This is well covered in DOC's publication 'Management and research priorities for conserving indigenous biodiversity on New Zealand's braided rivers' (O'Donnell *et al*, 2016).

The Ashley-Rakahuri is a medium-sized river located in North Canterbury. From the Ashley Gorge, the river flows east and enters the sea about 25 km north of Christchurch. Halfway to the coast it is joined by its major tributary, the Okuku river. In contrast to the larger snow-fed rivers, the Ashley-Rakahuri is fed by rainfall from the foothills and has relatively low flow rates. The estuary where the Ashley-Rakahuri drains into the Pacific Ocean has large areas of tidal mudflats and is recognised as one of the best shorebird feeding sites on the South Island's eastern coastline.

Ashley-Rakahuri / Saltwater creek estuary (2018).

The shorebird values of the Ashley-Rakahuri are well-recognised. The Ashley-Rakahuri River and estuary are included in a list of wetland sites which meet criteria prescribed to be of international importance by the International Union for the Conservation of Nature (IUCN) (Cromarty & Scott 1996). Following surveys of Canterbury rivers in the 1970s and early 1980s, the New Zealand Wildlife Service ranked their wildlife and conservation values; the Ashley-Rakahuri was one of five rivers given the highest possible ranking of 'Outstanding' (O'Donnell & Moore 1983). In 2009, declining bird numbers over the previous 25 years led to a reclassification of 'Regional' importance (Hughey *et al.* 2010). Together with the estuary, it is recognised as the most readily accessible site on the east coast for seeing a wide range of shorebirds.

The Ashley-Rakahuri Rivercare Group (ARRG) is a community group formed in 1999 to assist with management of the lower reaches of the Ashley River. Its main aims are to protect shorebirds and their habitat in the riverbed, to monitor breeding success, and to promote these activities to the wider public, while at the same time recognising other sympathetic users. In 2005, the Group became an incorporated society. Between 2004 and 2012, the Group received considerable 'set-up' funding from the Pacific Development and Conservation Trust, the New Zealand National Parks and Development Foundation, the Habitat and Protection Fund of World Wildlife Fund and the Lotteries Environment and Heritage Committee. Currently, the Group supports itself by local fund raising, sponsorship from Karikaas Natural Dairy Products Ltd, and donations, with larger projects funded by grants from outside agencies, particularly Environment Canterbury (ECan). The activities undertaken since 2004 have been described in the Group's annual reports (Dowding & Ledgard 2005, 2006, 2007, 2008, 2009, 2010; Ledgard &

Dowding 2011; Ledgard, Spurr and Crossland, 2012; Ledgard and Mugan, 2013; Ledgard & Dowding, 2014, Ledgard, 2015, 2016, 2017; Ledgard and Davey, 2018, 2019, 2020, 2021 and Davey, 2022), which also record the results of bird monitoring, habitat enhancement, predator control, and advocacy, and make recommendations for future management. The present report documents the management activities and monitoring of birds that were undertaken during the 2022/23 season. An analysis of longer-term results from 2000-2015 is given in the 2013-14 report, with a scientific paper by Eric Spurr and Nick Ledgard published in *Notornis* 63(2), 2016.

In the past, the river has provided breeding habitat for significant numbers of black-fronted terns (BFT) and many hundreds of pairs of black-billed gulls (BBG). In the 1990s and early 2000s, the number of gulls in particular declined substantially (Dowding & Ledgard 2005). The Ashley-Rakahuri used to be described as the most northerly river on which wrybills breed, following a southward contraction of the core range of the species over the past century (Riegen & Dowding 2003). However, a number of wrybill pairs have now been recorded breeding on the Waiau river, which is about 70 km north of the Ashley-Rakahuri. The Ashley birds remain the northern-most population which is known to have been stable for some time. These three key species have been the main focus of management activities of the Group; all are endemic, have declining national populations and are considered threatened. However banded dotterel (BD) require more focus – they are known to be threatened elsewhere in the country, and they are more at risk from predators along the Ashley where they often nest on the edges of the river, rather than on islands.

The threat categories of all New Zealand birds were revised in 2021. The most endangered species on the Ashley-Rakahuri River was thought to be the black-billed gull (BBG) at Nationally Critical, but this has now been downgraded to Declining following a census by Mischler, 2018. The black-fronted tern (BFT) is still classified as Nationally Endangered despite evidence of extremely poor breeding success from several locations – including the Ashley. This is the second highest ranking under the New Zealand scheme and reflects a predicted decline of 50-70% over 33 years.

The wrybill has been reclassified from Nationally Vulnerable to Nationally Increasing. The banded dotterel (BD), also has been allocated a new threat status – it is now Declining when it was previously Nationally Vulnerable. The other two main shorebird species which breed on the river, the pied stilt (PS, poaka) and the South Island pied oystercatcher (SIPO, torea), are listed as Declining and Not Threatened respectively.

Threats to these birds are summarized as follows:

Habitat Threats

- Weed growth on the fairway. These species require bare gravel to nest on and until recently, bird numbers have shown a close correspondence with the amount of bare gravel present. Floods of approximately 10-year return period are required to clear weeds, so weed clearing by hand, machine or by spraying is often necessary.
- Constriction of the fairway. All species but the banded dotterel strongly prefer islands to nest on, islands only occur in braided sections of the river, and constriction causes channelization. There doesn't appear to be any planning in place to reduce the current constriction, and indeed more tree planting on the berm is underway.
- Gravel extraction. Braided rivers only exist where there is a large amount of sediment, and gravel extraction has been linked internationally with the destruction of braiding. Bed levels have been declining along the Ashley since surveying began, yet large scale gravel extraction continues. Until recently there has been no attention paid to damage to bird habitat caused by extraction – nesting islands were taken away and flow around others cut off.
- There could well be food supply issues which we are not aware of.
- Climate change is predicted to bring about more floods. Floods are the most serious natural threat to the birds, an increase in nesting season flood frequency, combined with the other threats, could be disastrous. Warmer winter conditions could lead to greater predator numbers.

Predation

- Norway rats have been the main danger in recent years. BFT are most at risk with entire colonies being wiped out. These rats are at home on the river, so nesting on islands gives no protection. Often, they are trap-shy – and just a few rats can easily wipe out the eggs or chicks of a 20-nest colony. Other species are also affected. Feral cats are interpreted to be a significant predator of BFT and wrybill chicks. Hedgehogs are probably a serious danger to all species that don't nest on islands. Harriers have been observed to take eggs of BD and BFT and are a major predator of fledgling BBG. SBBG do not seem to be a major problem, they do not nest on the river and numbers are generally low.

Human Disturbance

- This is largely caused by four-wheel drives and motorbikes. At present the former aren't a major issue – due to blocking of access to the river, education and publicity. Motorbikes and quadbikes are out on the river more often that 4wds, but pose less of a threat. Dog walkers and other pedestrians are also a minor problem.

Future riverbed and bird management is currently the subject of a new plan by ECan Braided River Revival staff. The Ashley was chosen to be the first river to be subject to this process.

Locations mentioned in this report are shown Figure 1.

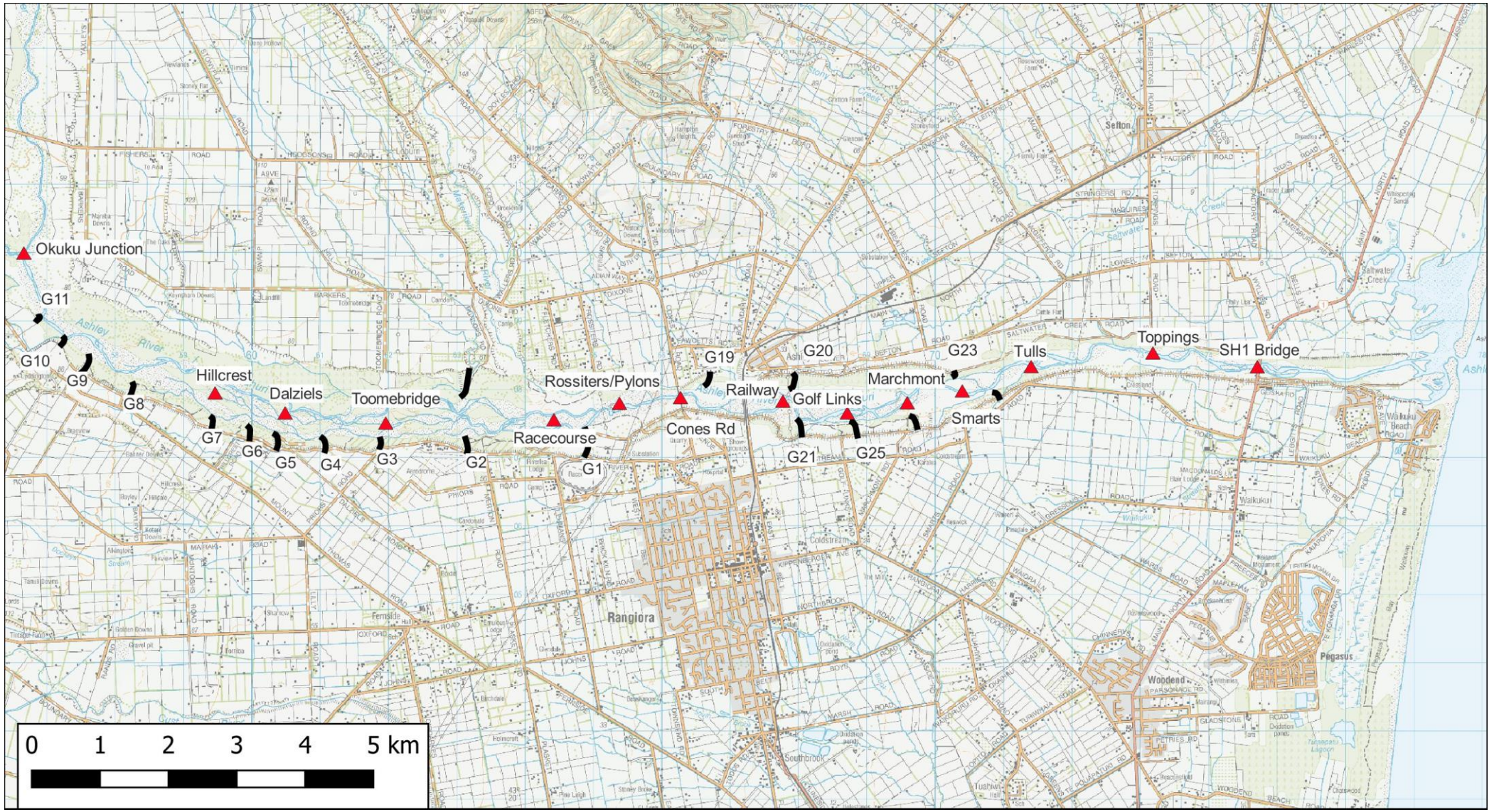

Figure 1. Locations

3. Annual Bird Survey

Surveying is a crucial part of our management activities – it allows us to some extent to judge the success of our efforts.

Surveying this year consisted of:

- The annual survey, for the 23rd consecutive year. This used to be from the Okuku junction to State Highway One (SH1), but for the last 5 years it has included the reach down to the estuary.
- Continuation of a monthly survey that Nick Ledgard has been doing in the Groyne 1 – Groyne 2 area.
- Last year ARRG surveyed from the gorge to the Okuku junction, in 2022 this was done by DOC.

This year the annual count was done on 10 December, due to flooding this was about 3 weeks later than usual. Flow was 8 cumecs at the gorge and conditions were warm with no wind. The usual four reaches were surveyed from about 9am with 17 participants. In the afternoon the reach from SH1 to the estuary was done by one surveyor. Figures and graphs shown in this report exclude those from this reach (unless stated or obvious) – for consistency with previous surveys. Birds were counted per kilometre, as is now standard in Canterbury.

As recommended last year, more radios were used. Better communication leads to less double counting and a better quality survey. In one reach results were relayed by radio and recorded only by the group leader, in others all participants recorded their own counts.

Results

Numbers for the main species of interest (banded dotterel (BD), black-fronted tern (BFT) wrybill, pied oystercatcher (SIPO), and pied stilt (PS) since 2000 are shown on Figure 2 and Figure 3. Numbers of black-billed gulls are not included as nesting colonies often overwhelm those of other species. Appendix 1 shows coordinates for kilometre reaches. Appendix 2 gives annual count figures per species from 2000. Appendix 3 gives bird counts by kilometre for the Okuku junction to SH1 and SH1 to the estuary. Figure 4 and Figure 5 show distribution of braided river bird species by kilometre, with that of 2021 for comparison.

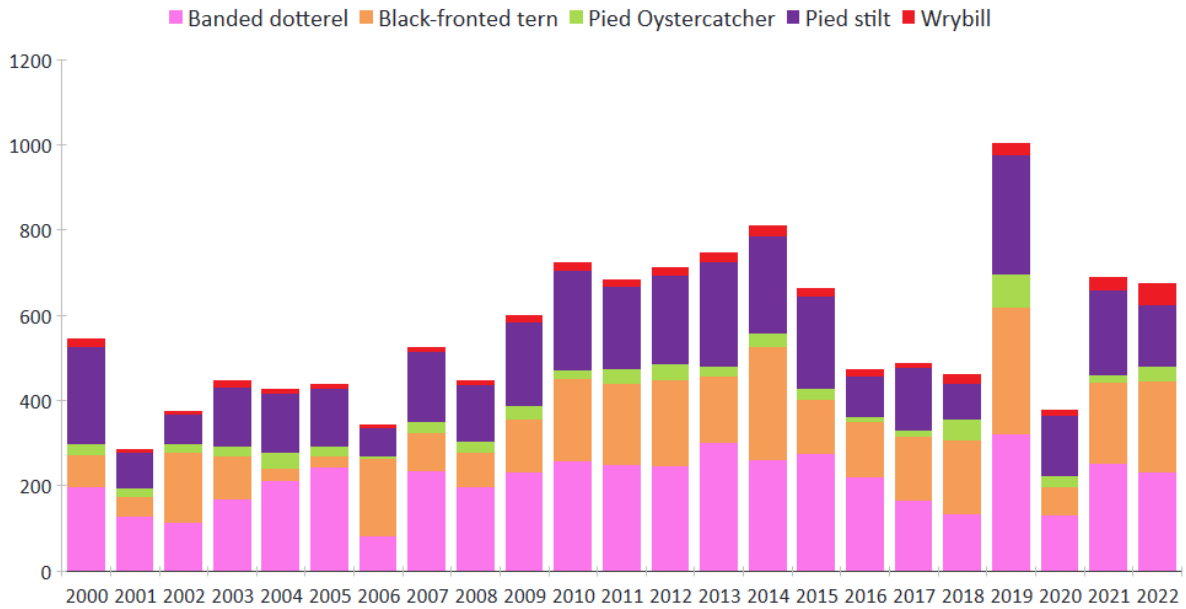

Figure 2. Braided river bird numbers since 2000

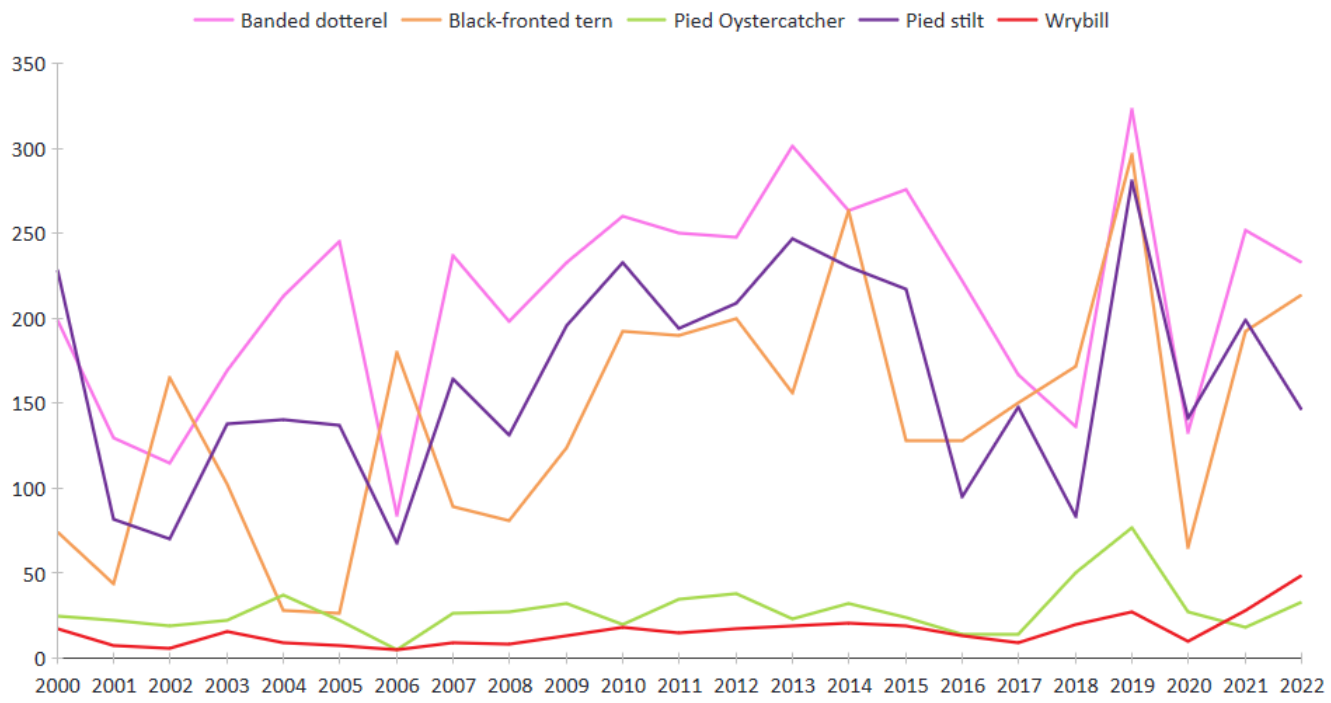

Figure 3. Braided river bird line graph

Figure 4 and Figure 5 show distribution of birds along the river, in 2022 with 2021 for comparison.

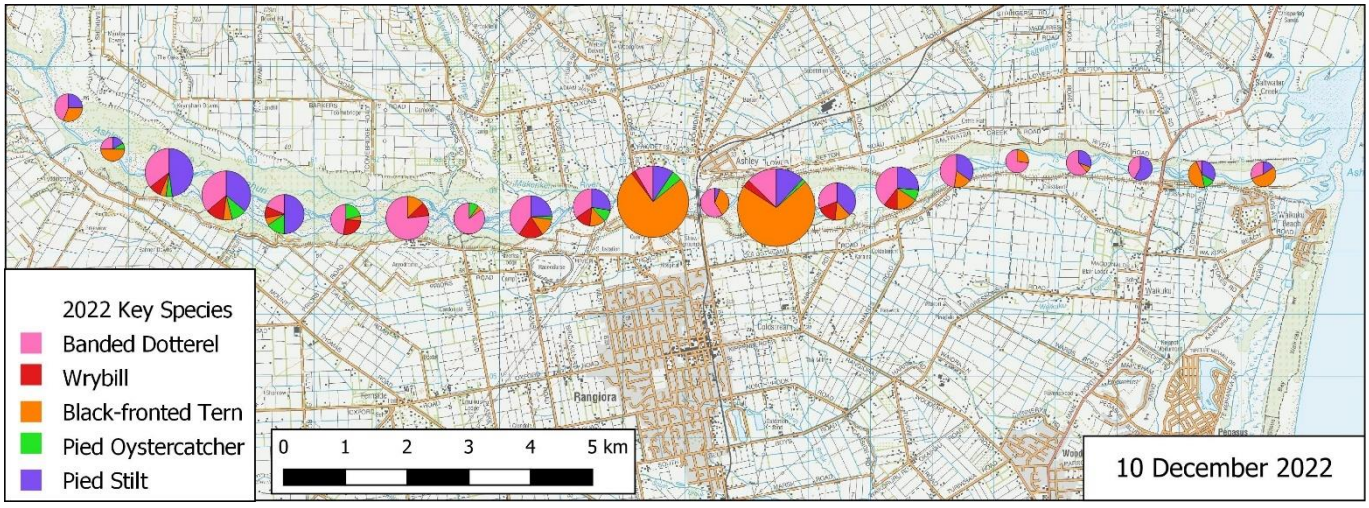

Figure 4. Braided river birds by kilometre, 2022

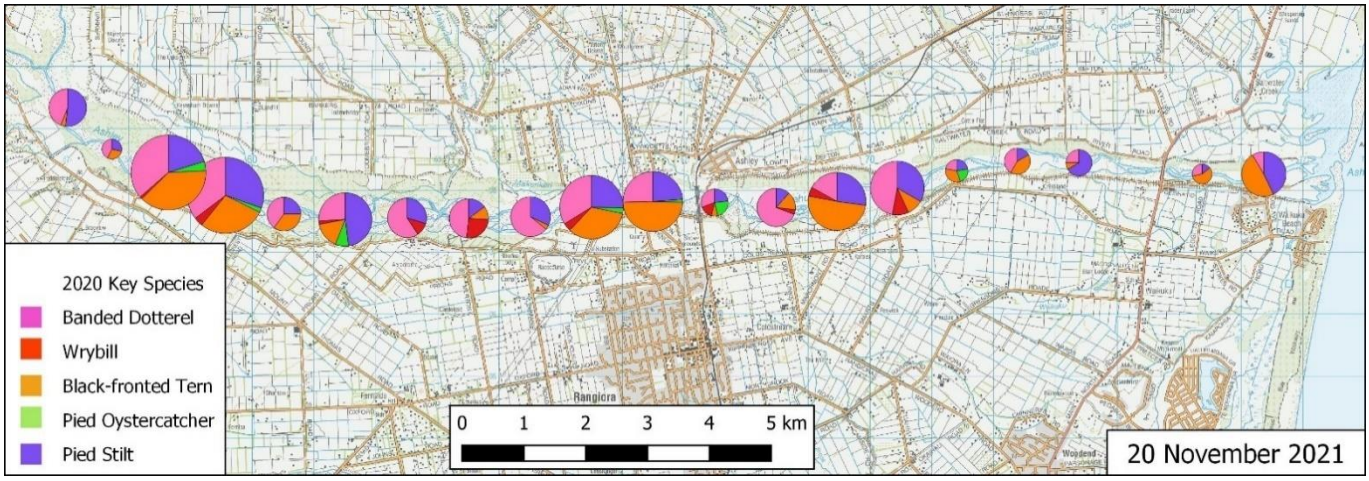

Figure 5. Braided river birds by kilometre, 2021

Results were very similar to those of 2021. Some factors that influenced bird numbers this year –

- Very little weed on the river meaning plenty of space to nest.
- Little human disturbance.
- Good numbers of surveyors on each section.
- Good weather – not too hot or windy.
- Later date – 3 weeks later than usual. This meant that more wrybill and BD chicks than normal would have fledged and thus been counted.
- The flood of 19 November – this measured 246 cumecs at the gorge and was the biggest November flood recorded since flow records began in 1972. This washed away almost all the BFT nests, probably many PS nests, at least 1 wrybill nest and probably several BD nests. It seems that the great majority of wrybill chicks survived, this is probably also true of BD chicks. Since then, BFT seemed to re-nest.
- Repeated floods on the Waimakariri almost certainly displaced birds to the Ashley. In the few weeks before the survey we were told that all BBG were flooded out of the Waimakariri and we were asked if they had come to the Ashley. We did have an influx of BBG and several new pairs of wrybill were seen. However, observations weren't sufficient to detect extra birds of other species.

Comments

- It is quite unusual to have so many birds, other than BBG, in short (single km) sections of the river. This was mainly because BFT have neatly nested within 1km sections. Those near Cones Road (km 11) were probably those predated and flooded out (19 November) from the earlier colony near G2. Those at Railway – Golf Links (km 13) were probably mainly birds that nested again in this area after the flood. However, numbers seem to have increased – perhaps birds from the Waimakariri. BFT numbers were the third highest on record. However what is most important is nesting success, not the number of birds present.
- There seemed to be few BFT hawking along the river outside kms 11 and 13 – maybe more were getting food from paddocks at this time of year.
- The 49 wrybill is easily a record – and many more than expected given that the number of nests found this year was very similar to last year. More chicks would have fledged given the count was about 3 weeks

later than usual, and in the last few weeks we had seen new arrivals to the river. However, it is possible that some BD fledglings were mistaken for wrybill.

- Numbers of most other species were within the normal range. There was a small colony of BBG in km 13 and a much larger one (>400 nests) at the estuary. Spur winged plover numbers were a record – with large flocks in the upper part of the river. However, some double counting might have happened. The distribution of these birds is quite erratic, large flocks visit the river from time to time. Duck numbers were very low.
- The general correlation between GD, BFT and PS numbers seems quite remarkable – given that they have different nesting and feeding requirements.
- It is perhaps surprising that there aren't more birds at the Okuku junction. There is usually quite a lot of bare gravel and feeding habitat there.

3.1 Annual Survey Conclusions

Braided river bird numbers were very similar to those of 2021 – with numbers again influenced by birds losing their nests in Waimakariri floods. Results were also influenced by the survey being about 3 weeks later than usual – this would have resulted in more wrybill and banded dotterel being counted.

Until 2016 there was a clear correspondence between the amount of bare gravel and bird numbers in our survey - Figure 6. In July 2017, just before the nesting season, a one in ten-year flood cleared the weeds which had almost entirely overgrown the fairway. There wasn't the expected immediate rebound in bird numbers and since then the main driver on them seems to have mainly been conditions on the Waimakariri – birds move to the Ashley when flooded out of the Waimakariri. This has happened in 2019, 2021 and 2022, and it is possibly masking an underlying downward trend. In 2019 several hundred new BBG nests appeared in a colony in which birds and nests were being regularly counted – following a flood in the Waimakariri. In 2021 weekly bird counts were being done between Rangiora and SH1, there was a noticeable increase following another Waimakariri flood.

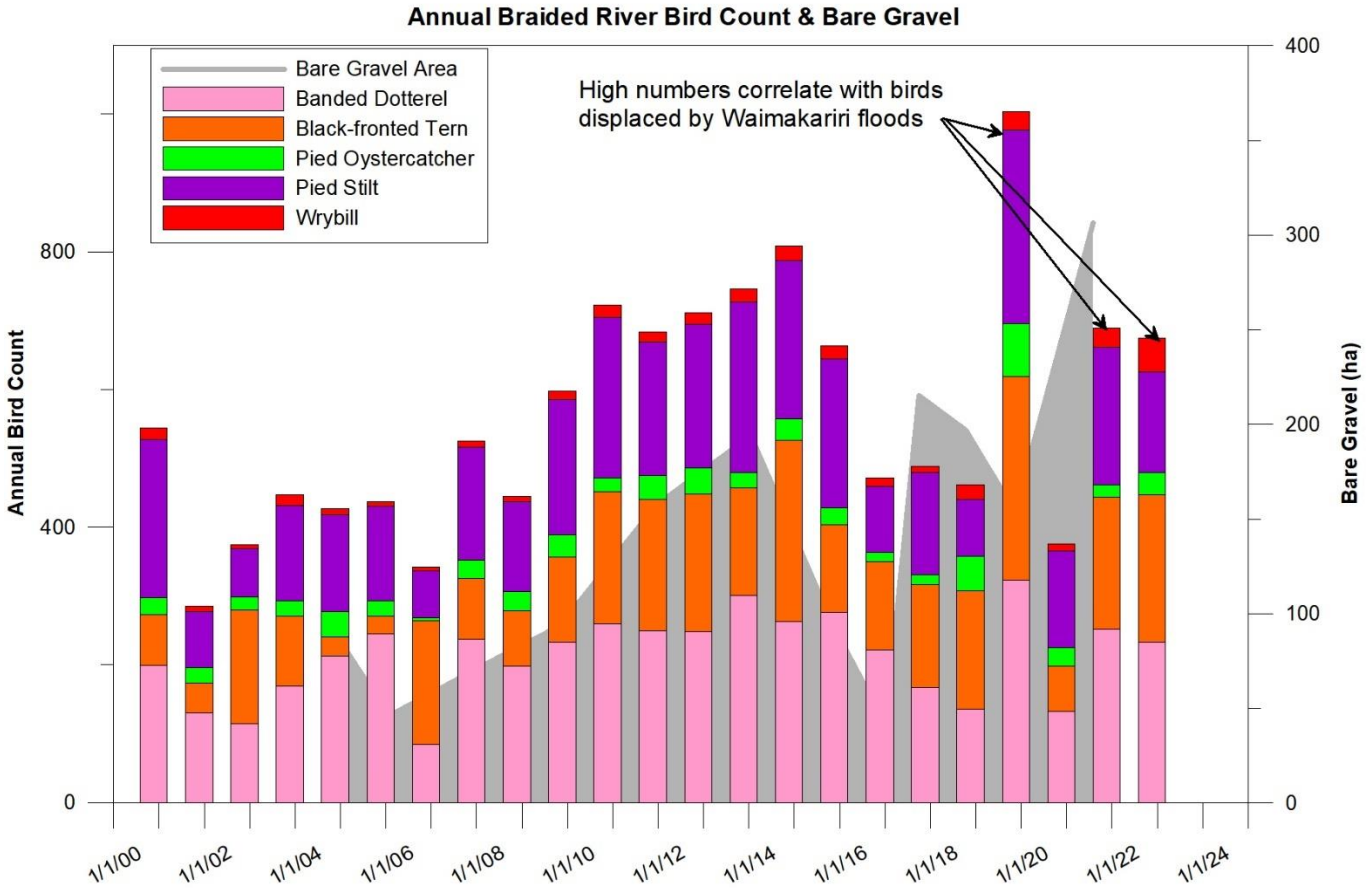

Figure 6. Bird numbers, bare gravel areas and flood influence

It is impossible to attribute the history of good bird numbers in our annual survey to trapping – as is sometimes done. The mechanism for this hasn't been explained. The situation is far too complicated for such a simplistic explanation. It seems almost certain that we don't have birds that strictly nest on the Ashley, but birds that sometimes nest here, sometimes elsewhere in Canterbury or possibly even further afield. Evidence for this:

- Wrybill return to the same place for nesting, but this (with the exception of BWBW) doesn't seem to be long term.
- Black-billed gulls can nest in hundreds one year, but not at all the next. Presumably they are nesting somewhere else.
- Recent work has shown that BFT are highly mobile – there is nothing to suggest that the same birds return year after year to breed on the Ashley. In addition, most bird species are only here for about half of every year. What happens to them outside this period?
- In the 2019 – 2020 season there were nearly twice as many braided river birds on the Ashley as in the previous season. Where did these excess birds come from if not another river? Figure 6 is not a record of a sedentary population with numbers growing from breeding success and falling with deaths. It has to be an illustration of a moving population with birds choosing a river to nest on based on its merits.

The thousands of SBBG that nest on the Waimakariri also likely to impact the numbers of birds in the Ashley. Nesting birds of other species are displaced to elsewhere on the Waimakariri, and very likely to other rivers.

Another probable impact is the effects of floods. Large floods clear weeds, but they also have an adverse impact on the habitat – they reduce the amount of braiding and make more deep and fast channels that are poorer feeding habitat. Islands are bigger – BFT prefer to nest close to the water and usually nest across multiple islands. Figure 7 shows the 2022 – 2023 BFT colony at Km 12 – 13 in 2021, Figure 8 shows it during nesting – with a number of shallow braids and several islands for the birds to nest across. Figure 9 shows how the July 2023 flood has altered the river layout. This effect can explain why bird numbers did not increase as expected after the July

2017 one in ten-year flood. Smaller floods, up to mean annual flood level, tend to increase the amount of braiding – this was noticed after the major 2021 flood.

Food supply is almost certainly to be an issue – especially following floods. If there is more food in or adjacent to other rivers, very mobile species such as BFT and BBG are more likely to nest there. We have noticed a reduction in small fish, bullies etc, in the river over time, and BFT seem to be increasingly feeding chicks with insects and worms instead of small fish.

Disturbance is very likely to be an issue. ARRG has been very successful in keeping vehicles and people out of the river in recent years – and the problem must be much less than it was – this will probably have led to an increase in numbers.

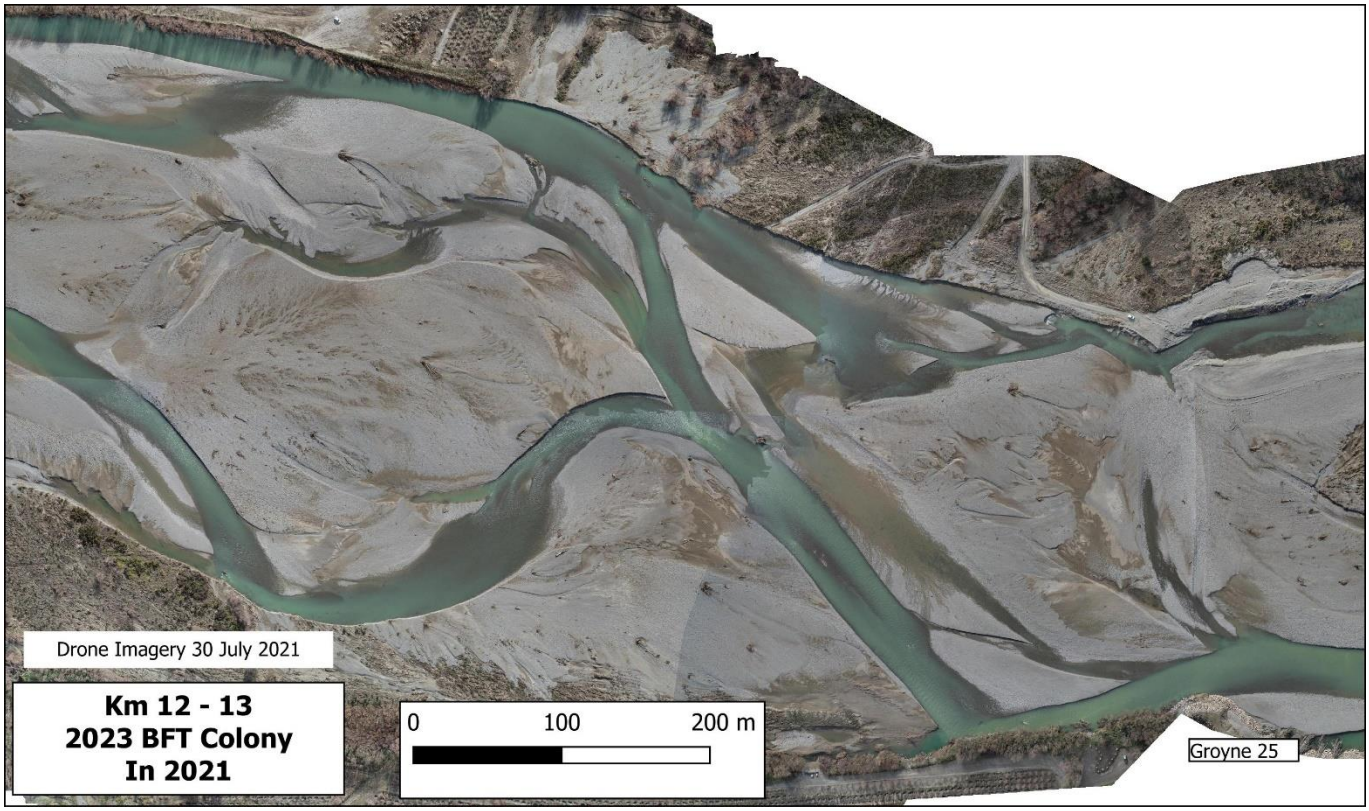

Figure 7. Km 12 - 13 area in 2021

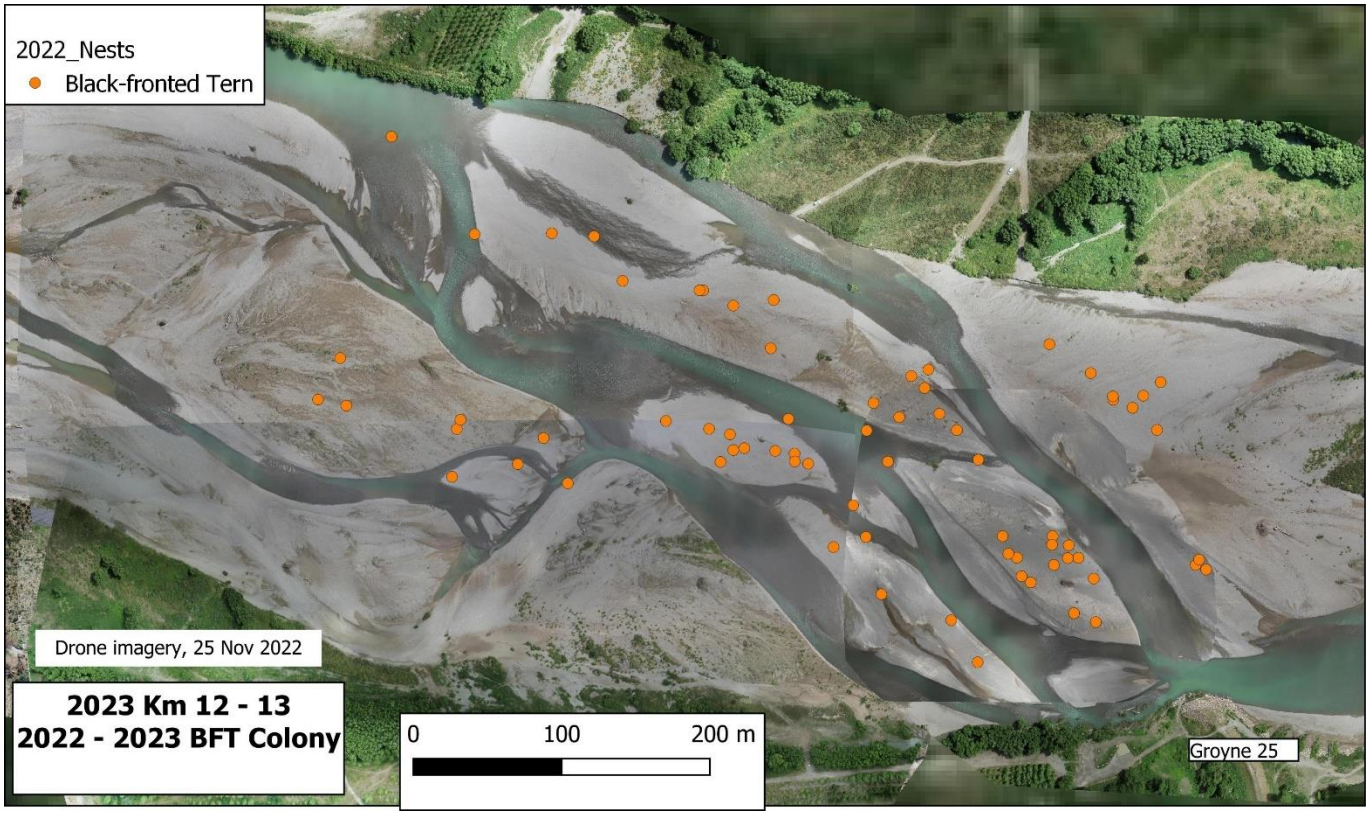

Figure 8. Km 12 - 13 area in November 2022

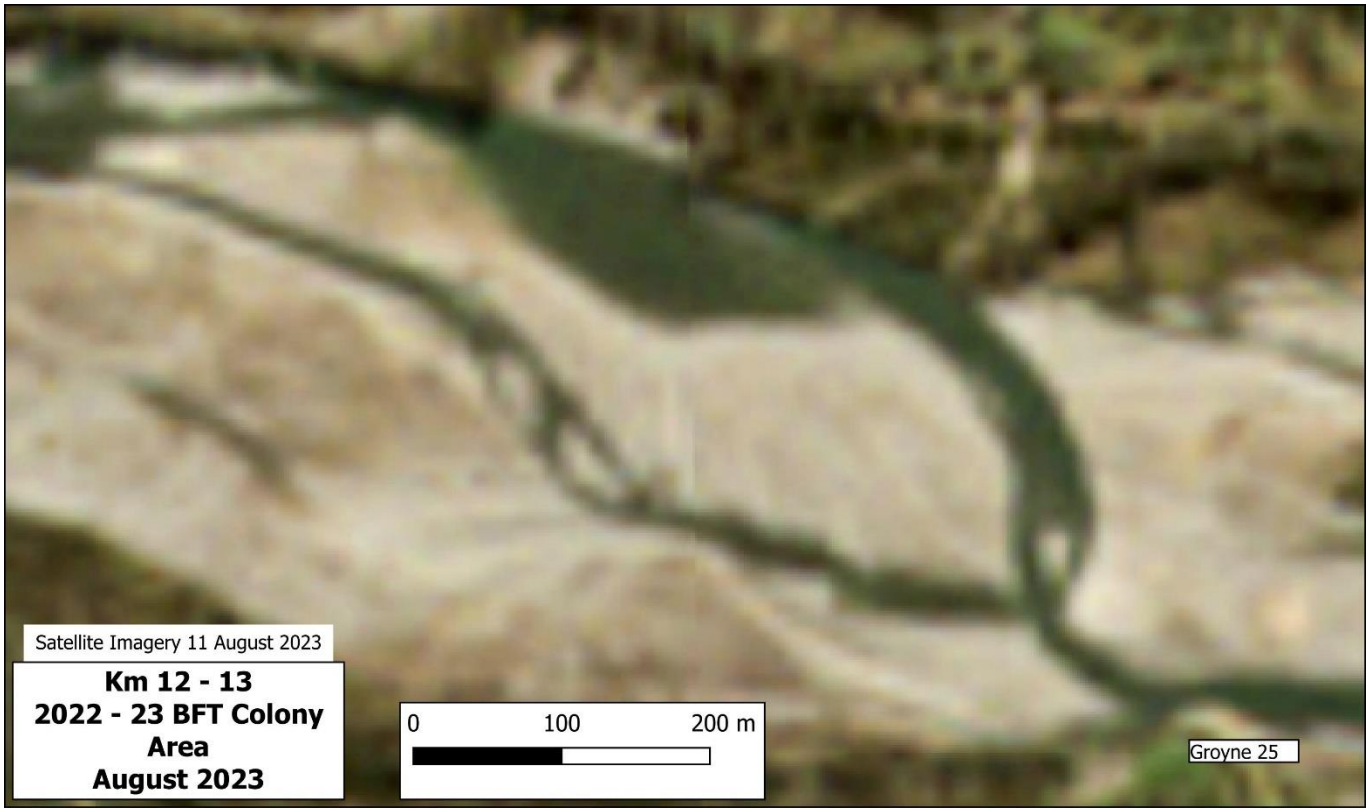

Figure 9. Km 12 - 13 area in August 2023 showing how flood altered river layout

4. Nesting Season Monitoring

4.1 Wrybill

Wrybill nesting has been closely monitored for many years. The nests of this species are relatively easy to find and nest numbers are not so large as to preclude finding and monitoring them all. Fledgling success is also feasible to determine – but with a lot of work. However it is by no means sure that fledgling wybill escape predators, especailly cats, and actually leave the river to attain breeding adulthood.

This year 16 nests (as tabulated below and shown in Figure 12 were found, the presence of another was suspected near Groyne 9. However two of these nests were second attempts, the first attempts being lost to predators. Six birds were banded (by Simon Elkington of DOC) on nests. Five of these were female.

No.	Bands	Locn	Found	East	North	Htchd	Fldgd	Notes
1	-	Smarts	26/10/22	1570710	5208084	No	No	Lost in Nov flood
2	BRBR (F)	Smarts	11/10/22	1570432	5207942	Yes	Yes	Immed nth of gravel operations, probably renest of No. 3. Banded 2022
3	BRBR?	Smarts	11/9/22	1570107	5207643	No	No	Eggs prob taken by harrier 12/9/22
4	KOWO (F)	Marchmont	20/9/22	1569871	5207883	Yes	No	Just hatched chicks taken by harrier – 13/10/22. Banded 2021
5.	KOYG (F)	Marchmont	4/10/22	1569683	5207930	Yes	Yes	Banded 2022, shifted chicks to Golf Links
6.	KOWO	Golf Links	25/11/22	1568719	5207729	Yes	Yes	Chick in nest when found.
7.	KOYO (F)	Rossiters/Pylon	10/10/22	1565563	5207769	Yes	No	Banded 2022
8.	-	Rossiters	13/10/22	1565097	5207740	Yes	1	
9.	KOWG (F)	Upper Rossiters	10/10/22	1564895	5207717	?	?	
10.	KOWY	Groyne 2	2/11/22	1563283	5207522	Yes	?	Banded 2021, nested 170m upstream from 2021 location.
11.	B(WBW)	Groyne 2	2/11/22	1563168	5207554	Yes	1	Long time nester
12.		Upper G2	?			Yes	?	No coords
13.	KOYY (F)	Hillcrest	10/10/22	1559580	5207788	Yes	1	Banded 2022
14.	KOYW (M)	Hillcrest upper	10/10/22	1559412	5207979	Yes	?	Banded 2022
15.	KOWB (F)	Swamp Road	10/10/22	1559075	5208059	Yes	1	Banded 2022
16.	KOWR (F)	Upper Swamp Rd	3/10/22	1558542	5208185	Yes	?	Banded 2022

In summary - 13 nests hatched eggs, 7 produced fledglings and 5 may have done. No pairs clearly produced more than one fledgling, so success can be stated as 7 – 12 chicks from 14 pairs (productivity of 0.5 – 0.85).

Points of interest:

- The male BW-BW (now just B, Figure 11), which has nested on the river in the G2 area for a number of years, produced a fledgling – his 15th since he was banded in 2010. In August 2023 he was observed at the estuary, hopefully intending to nest again on the Ashley – and did so at Groyne 2.
- The female KOWO was first observed in 2022 at the estuary on 7 August. In 2021 she had nested twice and lost both pairs of chicks to predators (probably cats) before they could fledge. In 2022 she nested 200m WSW of the 2021 location but lost her chicks almost immediately upon hatching to a harrier (Figure 10). She nested again 1.2km to the west in the Golf Links area and seems to have produced a fledgling.
- Trail cameras were placed at 5 of the nests with the only predator seen being a harrier. Wrybill are less vulnerable to nest predation than BFT. Their chicks are probably also less vulnerable as they very quickly leave the nest and are highly mobile.
- Favoured nesting locations were at Smarts, Rossiters, Groyne 2 and from Hillcrest to Swamp Road - Figure 12. Most if not all nests were on islands and were made early enough for most to have hatched eggs before the flood of 19 November.
- Fledgling wrybill were seen feeding in shallow braids near the gravel processing area at Smarts until 26 March – at which stage they weren't accompanied by adults.

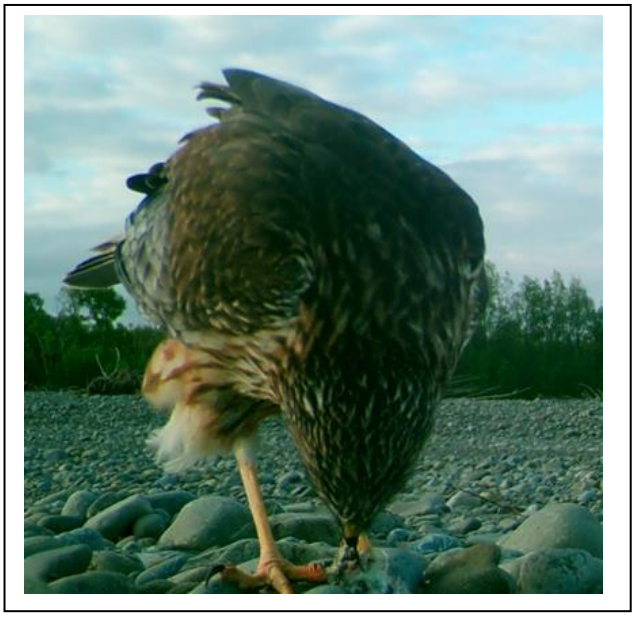

Figure 10. Harrier eating wrybill chicks

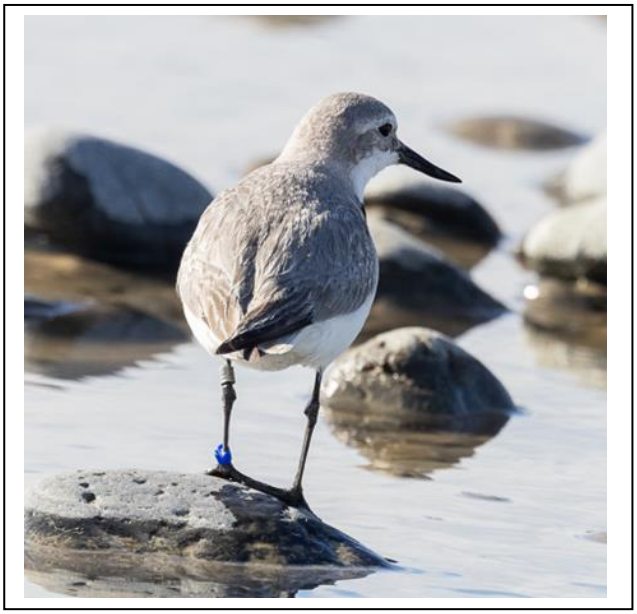

Figure 11. Wrybill BWBW

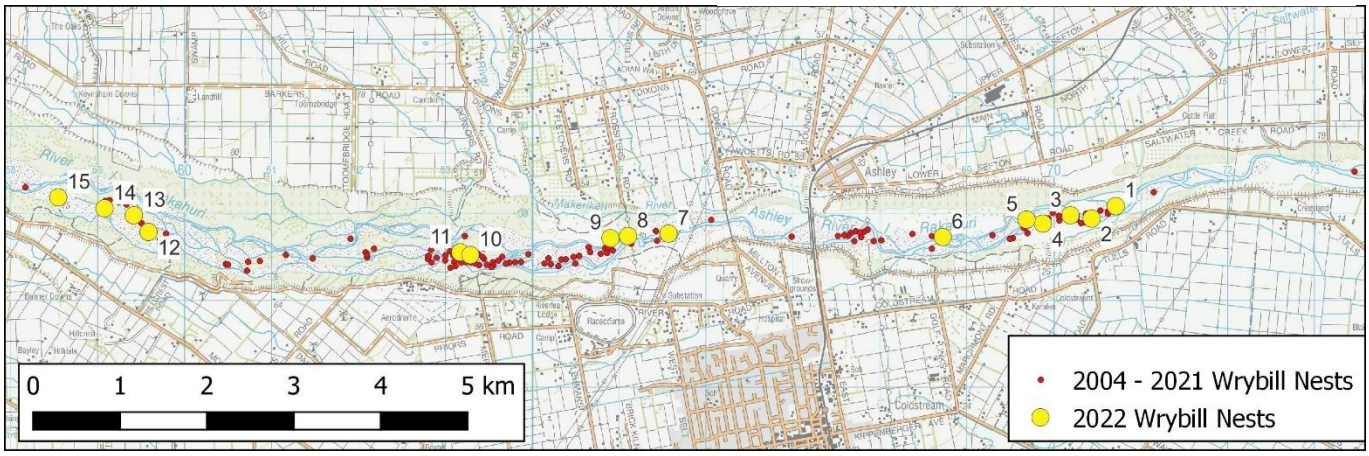

Figure 12. Wrybill nest locations, 2004 - 2022

4.2 Black-fronted Tern

BFT are by far the least successful nesters on the river, so more effort was put into monitoring and trying to protect them than for other species. This year there were BFT colonies in 4 locations between just upstream from G2 and Smarts (Figure 13). There were a few individual nests off G2 and Rossiters and just below the SH1 bridge. Also, there was a small colony on the south side of the river where it enters the estuary – off the Kings Ave entrance.

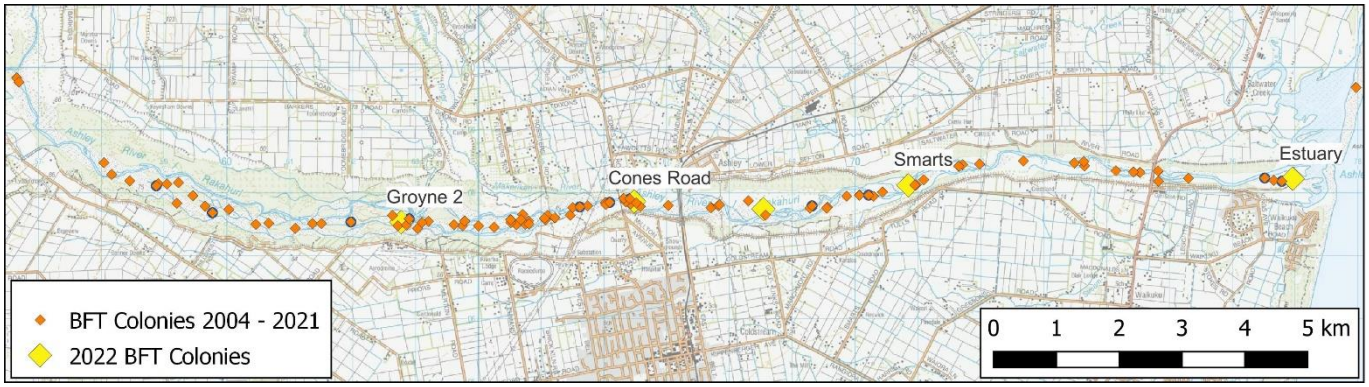

Figure 13. BFT colony locations - 2004 - 2021

Colonies were found from at least weekly inspections of the likely nesting sites – and less frequent inspections of less likely sites. Monitoring of the colonies was not done on a strict schedule, but approximately two to three times a week. This consisted of:

- Location of new nests and usually checking of others that had been previously found.
- Installing, shifting and downloading of trail cameras at nests.
- Installing, checking, rebaiting and shifting of traps. At most colonies one trail camera was placed at a trap to monitor trapping success.

Locations of nests etc. were recorded in QField and transferred into QGIS.

Trail cameras used were Moultrie M 4000-i and A-900i. These are not the best on the market, but are value for money at around $300. Using expensive cameras would be risky in a flood-prone environment where there are many people around. Cameras were attached to low stones where they are very difficult to see – usually less than 2m from a nest. This can result in poor focus, but mounting them further away results in poorer motion detection. Better results would be obtained from mounting them higher and pointing them downwards, e.g. on a stake, but they would be much more visible.

Statistics tabulated below have a significant margin of error. There would almost certainly be nests that weren't found (but no more than an additional 10%) however almost certainly no colonies of significant size were missed. Fledgling counts are very difficult, and those given are likely to be a little less than reality – it seems likely that predators, especially cats, took some before they left the river. Despite the deployment of many trail cameras, outcomes at many nests had to be interpreted. Eggs in some nests could have been predated by harriers, not Norway rats, but the latter are the most likely culprit. This year, whilst rats were caught at the colonies, they seemed to be avoiding the traps and even cameras.

Locn	Nests	Hatch	Unknown	Abd	Rat	Cat	Unknown Pred.	Harrier	Stoat	Flood	Human Disturb	Fldged
Upstream from G2	26	1	0	6	1	0	4	0	**2**	13	0	0
Cones Road	51	11	2	3	0	0	12	1	**0**	24	0	7
Km 12 – 13	71	20	3	2	0	3	8	0	**0**	36	0	10
Lr Smarts	8	1	0	2	0	0	0	1	**0**	5	0	0
SH1	2	0	0	0	0	0	0	0	**0**	2	0	0

Other	4	0	3	1	0	0	0	0	**0**	0	0	0
Total	**162**	**33**	**8**	**14**	**1**	**3**	**24**	**2**	**2**	**80**	**0**	**17**

Figure 14 shows timings of the colonies – from first nest found (probably only a few days between nests being made and them found) to last nest occupied. The flood of November 2022 took out all remaining nests from the G2 and Lower Smarts colonies, but not all from Km 12 – 13. The flood of 20 December washed away many nests on the Km 12 – 13 and Cones Rd colonies. The former had multiple nesting attempts, perhaps birds with failed nests from the earlier colonies, and re-nests from this colony after the November flood. The total number of pairs of birds that nested this year on the Ashley is not known.

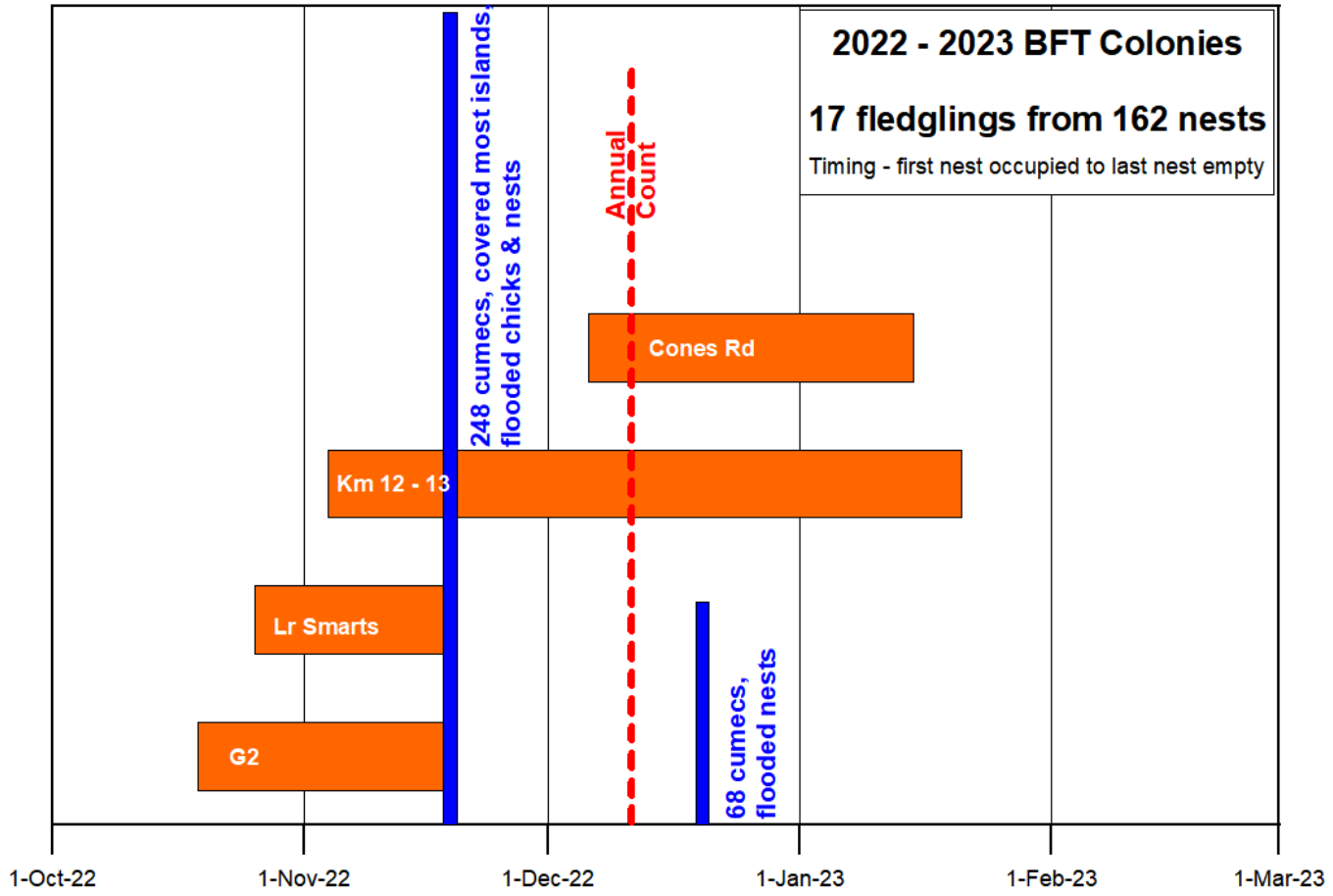

Figure 14. Timing of BFT colonies

Groyne 2 Colony

The first nests were found here on 19 October, and repeated visits showed 26 to be present – the last nest was found on 15 November. Nests were in an area of 1.9 ha – so a density of a nest per 730 square metres. The area was calculated by drawing a line around the outer nests. The closest pair of nests were 6m apart, more typically they were about 20m apart – as per usual on this river. This colony was very similar to the G3 colony of 2021 – it straddled several islands. The channel layout on Figure 15 is from Sentinel imagery and was reasonably accurate during nesting here. The area was dotted with willow trunks and other large driftwood – ideal sites for Norway rats to take cover and to place traps.

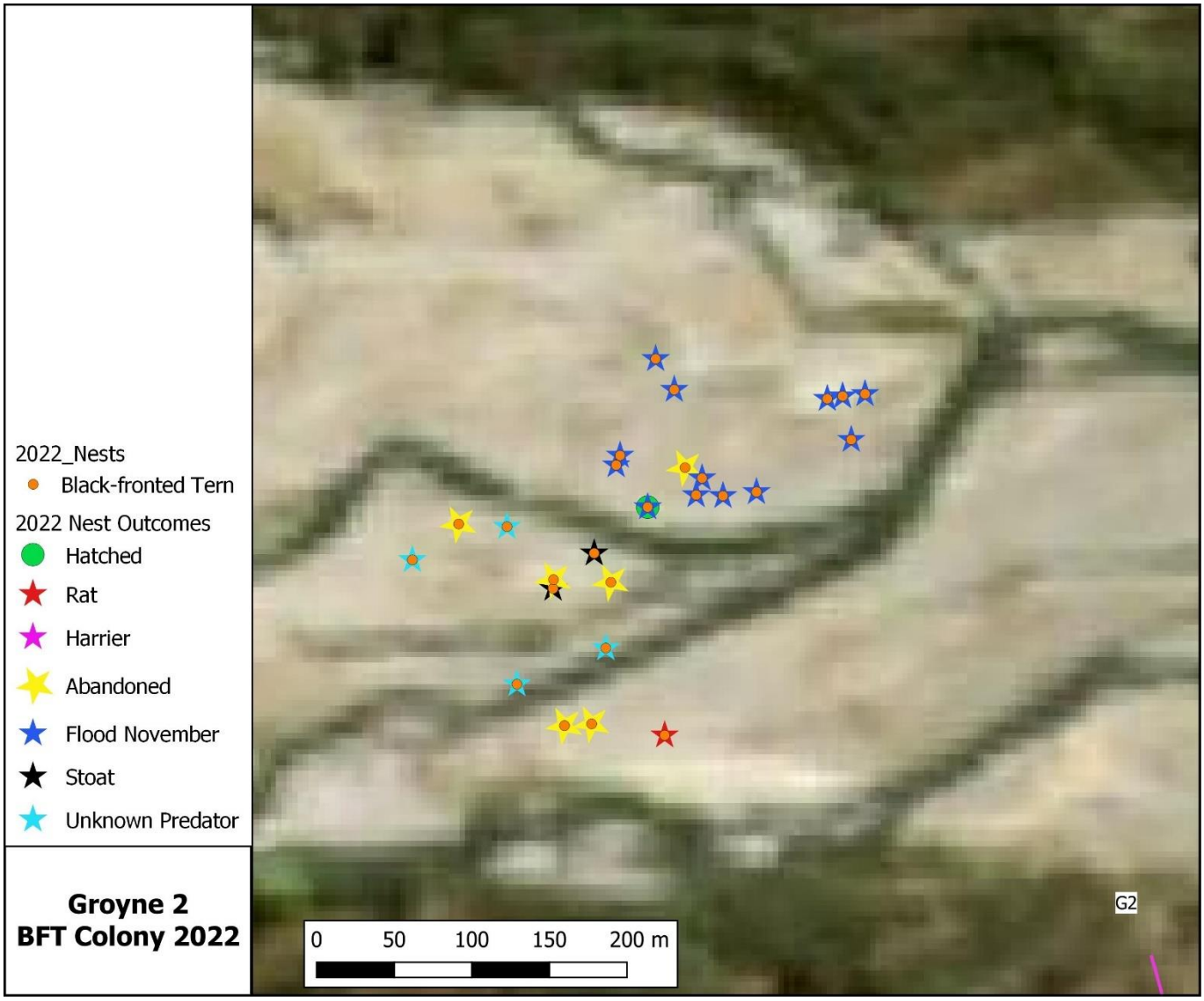

Figure 15. G2 BFT nests and outcomes

Five trail cameras were deployed at a total of 9 sites – mainly nests, but also at a trap and near the south bank - Figure 16. Experience last year suggested rats got into the G3 colony from the south bank – this can be inferred again in 2022. Eleven traps were placed in or around the colony – 5 DOC 150 run through and 6 Fenn traps in wire mesh enclosures. The main bait used was a mixture of peanut butter and cat biscuits. Trapping Line H runs along the southern berm and Line C along the northern in this area – trap placement is about 100m.

Only one nest hatched chicks in this colony – this was as floodwaters were rising on 18 November, on 19th November they covered the area, and these chicks cannot have survived. Thirteen other nests were lost to this flood – which was the biggest November flood since records began at the gorge. By the time of the flood, all southern nests had already been predated or abandoned. Islands in this part of the river tend to be quite low – which is a major problem. Otherwise, this appears to be the best braided river bird habitat – the river is the widest here and has the most braids – with good feeding habitat.

At least two adult BFT were taken from their nests by a stoat (Figure 17) – this probably caused abandonment of some other nests. A dead PS with crushed skull was found just a few metres from where one of the BFT was killed. No remnants of the predated BFT were found – they seem to have been carried several hundred metres from their nest to be eaten.

Eggs from one nest were recorded as taken by rats, another 4 were recorded as taken by an unknown predator – but highly likely to be Norway rats. Leona Kirk of Wildlife Protection Services visited the area with her dog Bail on 1 November and found signs of rats within and adjacent to the colony area – with a predated egg found under a

log and another which may have been dropped in transit. Rats were often seen on trail camera photos in 2021 carrying eggs away from nests. Conditions for rat detection were bad – very hot and windy – and no rat nests were found. Rats were not seen on trail camera photos. In the 2022 season there was a lot of evidence of rat presence, but they seemed to not only avoid traps but also avoid trail cameras. The only predator caught in the traps was one Norway rat – in the westernmost trap.

The northernmost abandoned nest was caused by a hedgehog visit (Figure 18). The hedgehog disturbed the bird, sniffed the eggs, then walked on. Despite the eggs being left, the BFT didn't return. In 3 years of fairly intensive trail camera use (up to 15 installed with hundreds of thousands of photos), this is the first hedgehog seen. This nest was on a large island, quite vegetated in places, and the hedgehog may have been living there for some time. Otherwise, the evidence is that hedgehogs strongly avoid water and only get to islands when flow dries up around them.

There was little sign of vehicles having gone through this colony and other human disturbance doesn't seem to have been an issue.

Productivity from this colony was zero.

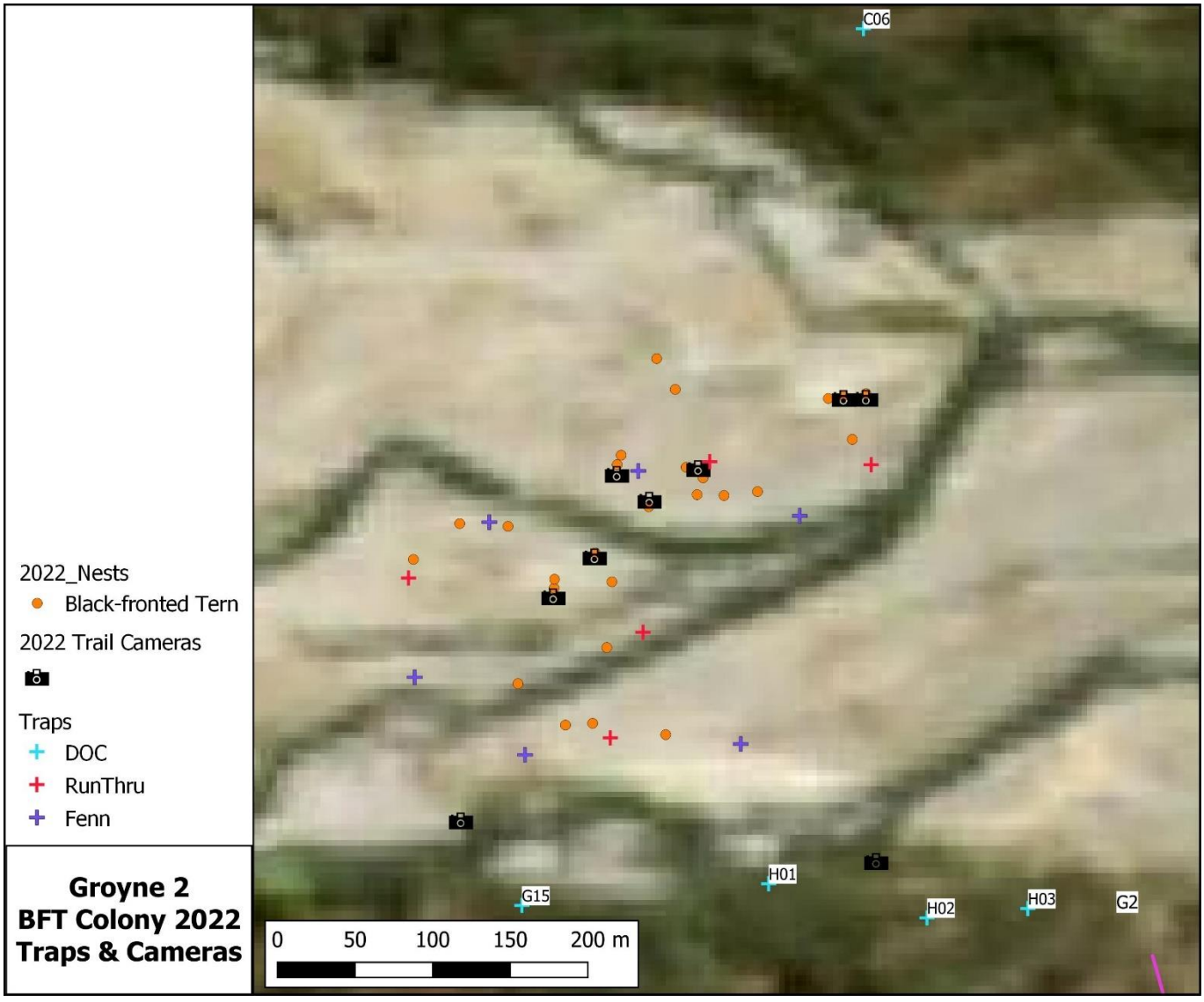

Figure 16. G2 BFT nests, traps and trail cameras

Figure 17. Stoat killing BFT at nest.

Figure 18. Hedgehog visits BFT nest, sniffs but doesn't eat eggs.

Cones Road Colonies

Similarly to last year, this area hosted a major colony (Figure 19). Fifty-one nests were found across several islands along 800m of the river – these represented more than one phase of nesting. Some of the nests are likely to have been made by birds displaced from the G2 colony. This is a site prone to human disturbance, but there didn't seem to be any significant issues this year. Only one nest (just down from the bridge) was found (4 November) prior to the November 19 flood. The remainder were found between 6 December and 15 January 2023. Many of

these were lost to the 20 December flood, and there were 6 found post this flood. The central part of the island upstream from the bridge was high and wasn't covered by the November flood. Most other spots were quite low and vulnerable to flooding.

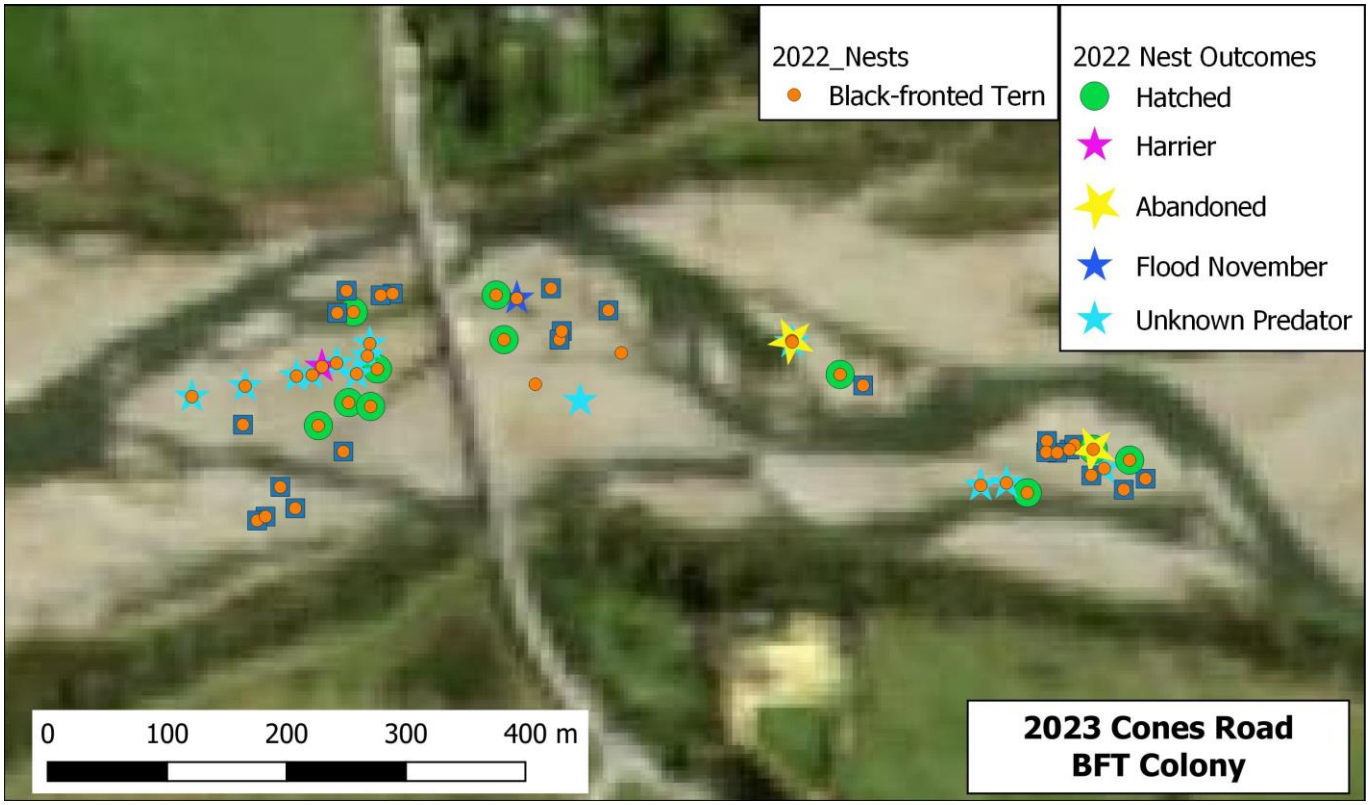

Figure 19. Cones Road BFT colony nests and outcomes

Trail cameras were posted at 5 locations (Figure 20), this was fewer than optimal as they would have been prone to theft or flooding in this area. Traps were placed at 14 spots – again fewer than desired due to the same reasons. Most of the traps were Fenn – placed in mesh covers. These are easier to deploy and harder to see. Haze fencing was put either side of one of these, but nothing was caught in this trap.

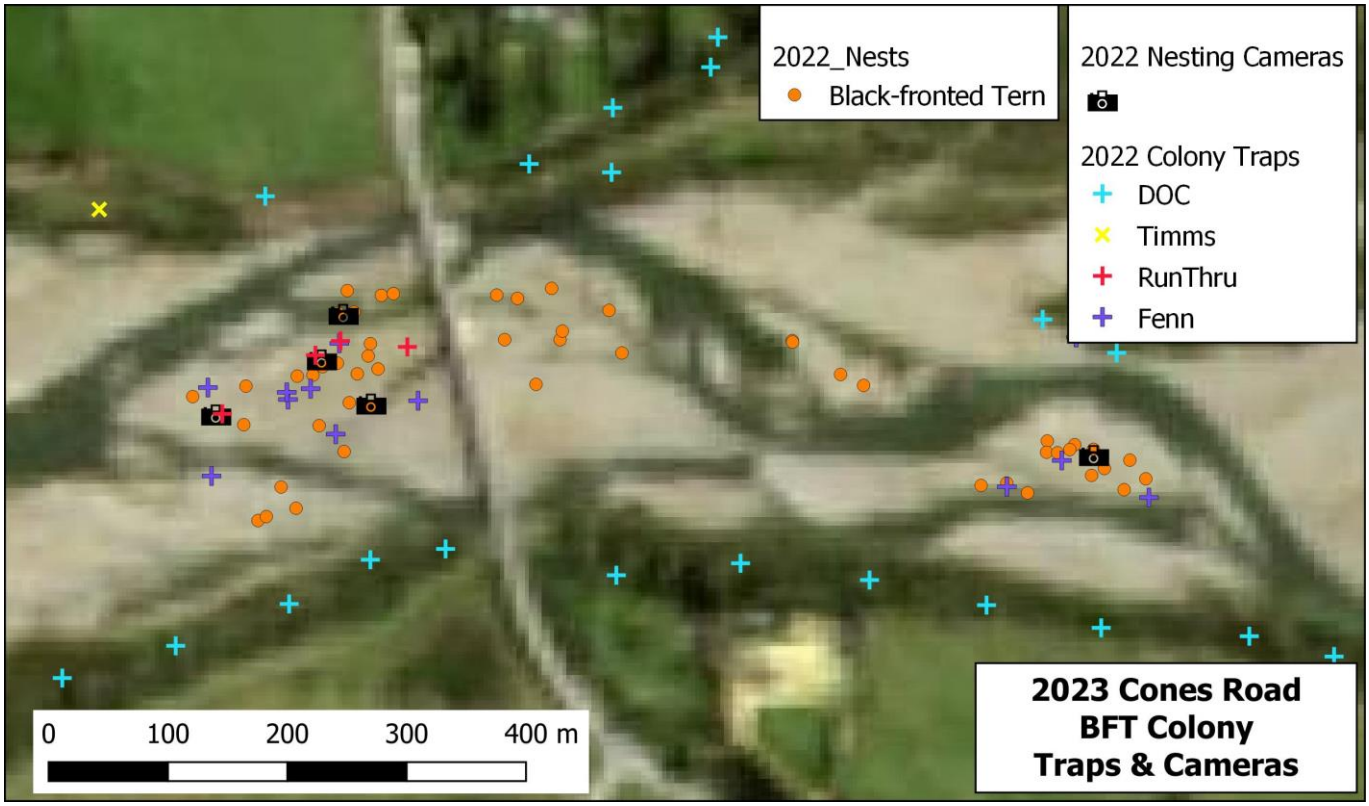

Figure 20. Cones Road colony nests, traps, trail cameras

Chicks were hatched from eleven nests, but some of those from the eastern area would have been lost to flooding. Twenty-three nests were lost to the December flood and one to the November flood. A harrier took the eggs from one nest (Figure 21), and unknown predators robbed another 12 nests (Figure 22). Rats were present in the area, and they are suspected of most of the damage. We haven't previously seen evidence of harriers systematically targeting colonies as rats do. Last year, in this location, there were many trail camera photos of rats taking eggs and visiting traps. This year there were none. The Norway rats now appear to be not only avoiding traps but also trail cameras. The blue star on the south-central part of Figure 20 indicates a predated BFT egg, probably dropped by a rat. Just two Norway rats were caught within the colony area – in trap 220804 the northernmost trap west of the bridge. Two further Norway rats were caught in the traps along the edge of the vegetated island north of the eastern part of the colony, but after the end of the season. Three hedgehogs were also caught here, late in the season.

The outcomes from 2 nests were uncertain, but they probably failed. Two nests were abandoned, one with a dead chick in it.

Seven BFT fledglings were seen just below the bridge on 21 January, his is a good outcome from the eleven nests that hatched chicks – productivity of 0.64. Figure 23 shows one being fed an insect, in previous years small fish have been by far the dominant food, this year more insects and worms seemed to be fed to the chicks.

Figure 21. Harrier taking BFT egg.

Figure 22. Predated BFT egg

Figure 23. BFT chick being fed an insect.

Kilometre 12 – 13 Colonies

A major multi-phase colony here spanned a number of islands – some of the western nests were in the area of the large 2019 Railway BFT colony. The eastern nests were on an island which was intermittently connected to the north bank and included a large area of mature vegetation within which several hedgehogs were caught a few years ago. It would have been cheap and easy to keep water flowing along the north side of this.

The BFT colony area was also host to a small BBG colony, at least 8 PS nests and one wrybill nest (KOWO second attempt).

A total of 71 BFT nests were found (Figure 24), the first on 4 November, the last on 19 January. The last nest was abandoned after the eggs were knocked out of the nest on the night of 28 January. Birds on nests this late in the season show evidence of heat stress (continuously open beaks), and are usually not successful in hatching eggs or raising chicks if they are hatched. On other rivers chick shelters have perhaps alleviated this. Twenty-one nests were lost to the 19 November flood, and 15 to the December 20 flood. Figure 24 also shows the area not inundated by the December flood, the November flood covered all but the crest of the narrow eastern island and some of the large island to the north of it. Only one nest on the narrow island was found before the November flood, and three after the December one. Chicks were hatched at 20 nests. Only one of the nests that hatched chicks was found before the 19 November flood – the remainder were found between 25 November and 31 December.

Trail cameras were placed at a total of 19 locations (Figure 25), individual units were moved around as required.

There were traps placed at 35 locations around the area – some had to be shifted because of floods and were returned to a different location. Traps consisted of 8 Fenns, 6 live cat traps (for a few days in each location), 18 run through DOC 200 and 3 Timms traps (Figure 25). A total of 5 cats, 4 Norway rats and 2 hedgehogs were caught by these traps (Figure 26). Three of these cats were half grown kittens, 2 were caught in a DOC 150 run through, the other in a live capture trap. It seems that the cat that was predating eggs and birds wasn't caught. Later in the season the braid to the south of the western trapped hedgehogs was dry. Given the number of predators caught, and the trap shyness of Norway rats in the last few years, this was a successful colony.

There were permanent traps on the berm along the north and south sides of the river – placed at 100m intervals.

Eight nests were lost to unknown predators – Norway rats, cats and harriers are likely culprits. Three nests were lost to a cat – as documented with trail camera evidence (Figure 27). It took eggs from 2 nests and chicks from a third. It likely took at least two fledglings from the mid-eastern island, as piles of feathers were found. It also could be seen on a trail camera image carrying an adult BFT. Two nests were abandoned, and outcomes were uncertain from three. To reach the nests it raided, it must have crossed water – some crossings could have been paddled, but at least one crossing must have involved swimming. This cat was likely the mother of 3 large kittens trapped in the southwest part of the colony area.

There was a lot of human disturbance (vehicles and dog walkers) in this area – much more than in the other colony areas. The fact that there were no known nest casualties to this shows how resilient BFT are. Perhaps the worst incident was at 4pm on 10 December when someone chose to throw sticks for his dog in the northeastern part of the colony – having walked out onto the river past one of our signs. A trail camera captured photos of a bare foot and a dog within centimetres of the camera – which was knocked over. The bird came back and one of the 2 eggs hatched. Last photos were of the chick being fed by its parents. On 6 January at 6pm a 4wd came within centimetres of a nest and camera, the bird returned 2 minutes later. Photos were taken of several other incidents when dogs were being walked in or very close to the colony area.

Counting fledglings in this location was difficult – due to the fact that nesting was done over a long time period with several generations of fledglings produced – but 10 fledglings (productivity per nest 0.14) were interpreted to have been produced from here. Quite large numbers of chicks could be seen running around late in the season, many of these were probably lost to predators. At least one was taken tens of metres into the air by a BBG – then dropped (Figure 28).

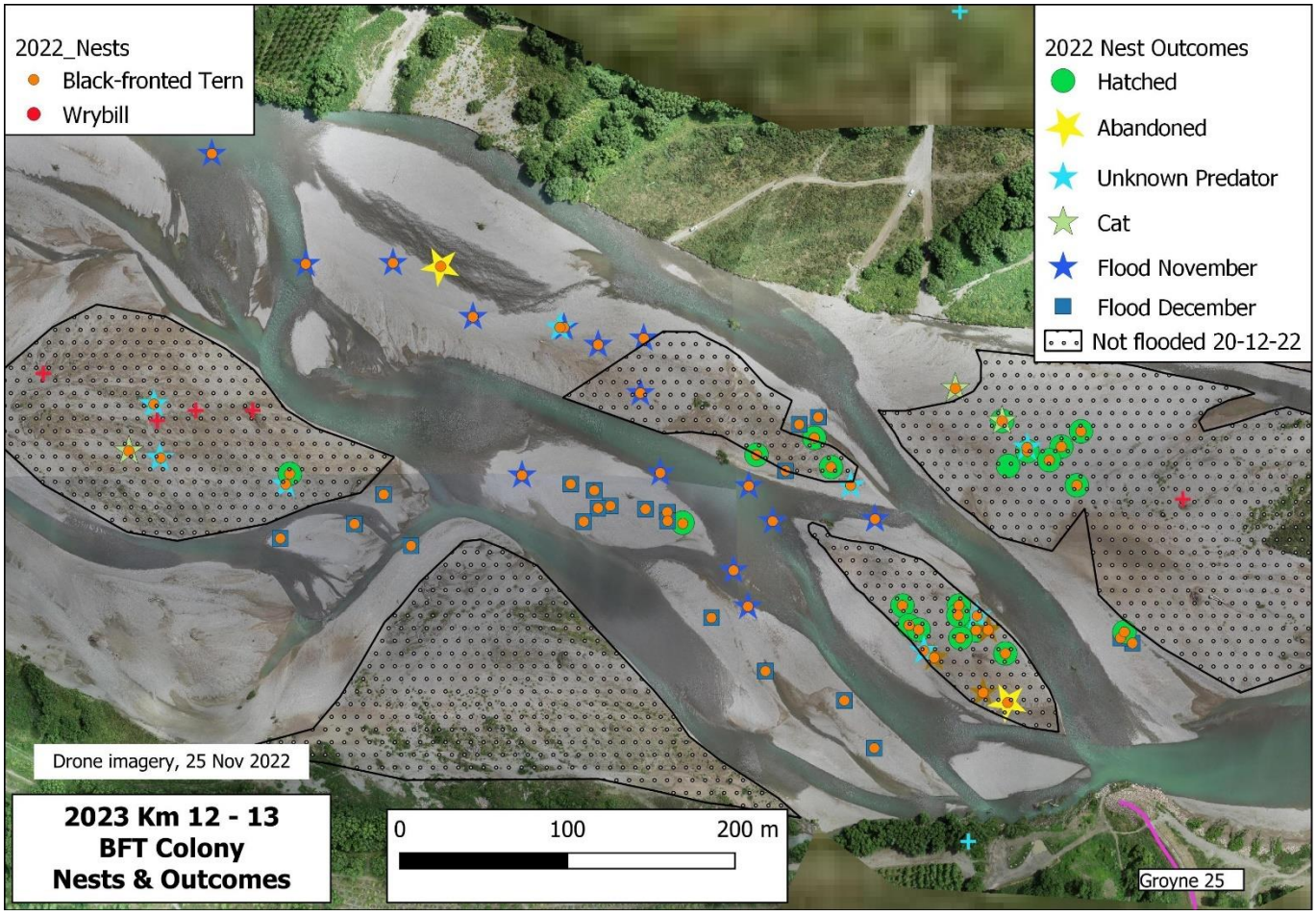

Figure 24. Km 12-13 nests, outcomes and area not flooded on 20 December.

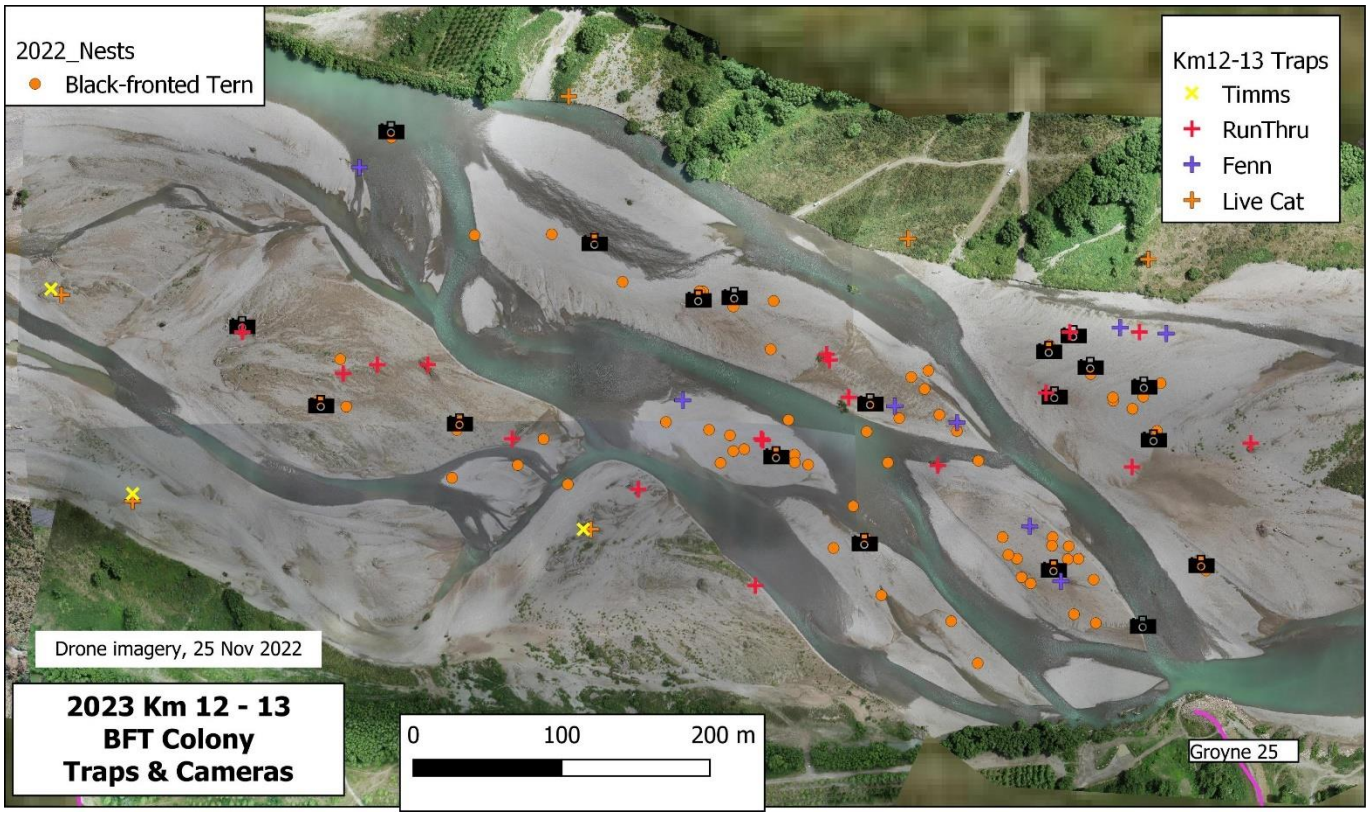

Figure 25. Km 12-13 nests, traps and trail cameras

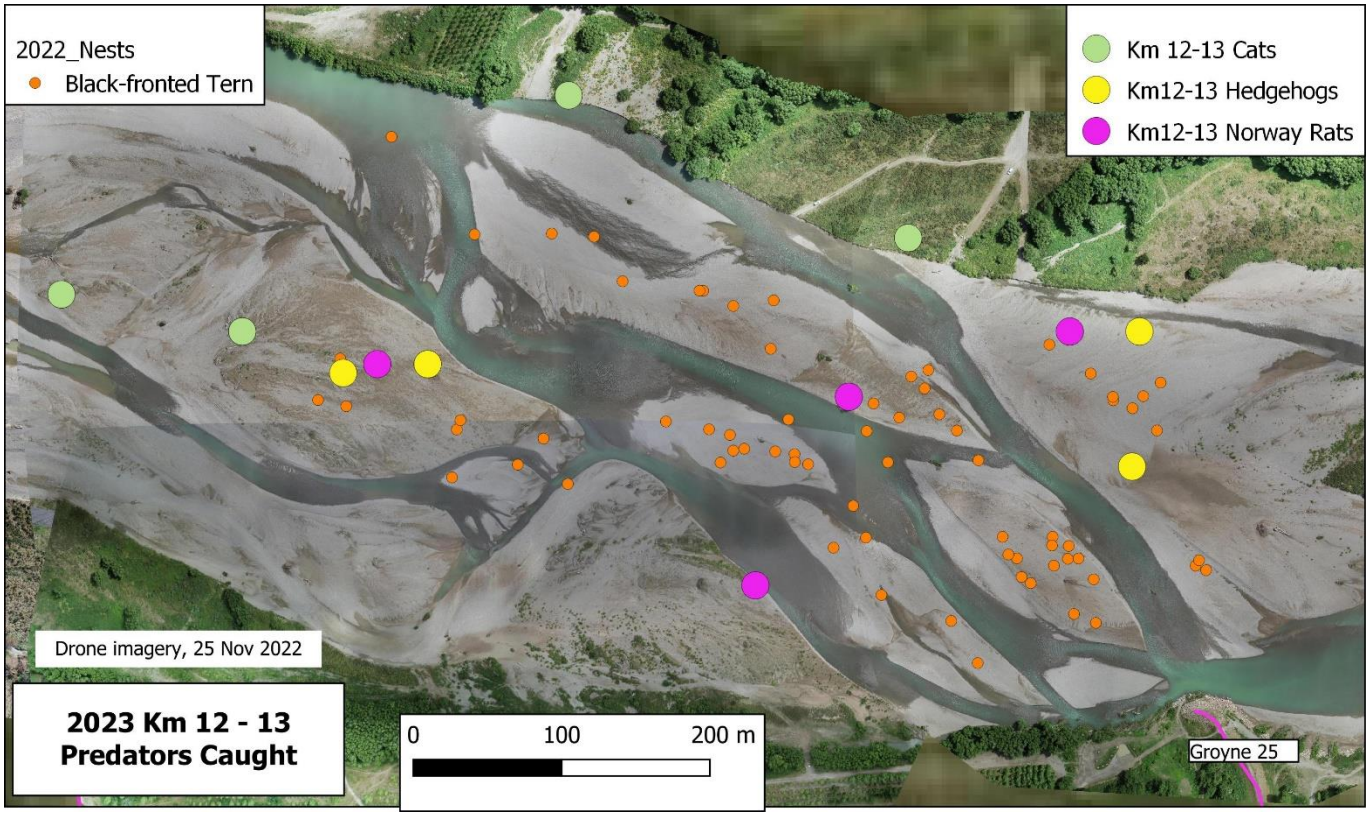

Figure 26. Km 12-13 nests and predator catch.

Figure 27. Cat eating BFT chicks

Figure 28. BBG carrying and dropping BFT chick.

Lower Smarts Colony

Only 8 nests were found here - just downstream from the SSW gravel processing area (Figure 29). Three nests were on islands, the remainder had no water protection from the north. Two of the nests were abandoned before eggs were laid, one nest was taken by a harrier, and 5 were washed away by the November 19 flood. A chick hatched on 14 November was observed in one of the nests on the day of the flood – it can't have escaped. On 5 November a harrier visited this nest, but didn't take the eggs – possibly it was attracted by the camera. A wrybill nesting nearby also lost its nest in the flood – and didn't seem to re-nest in the area.

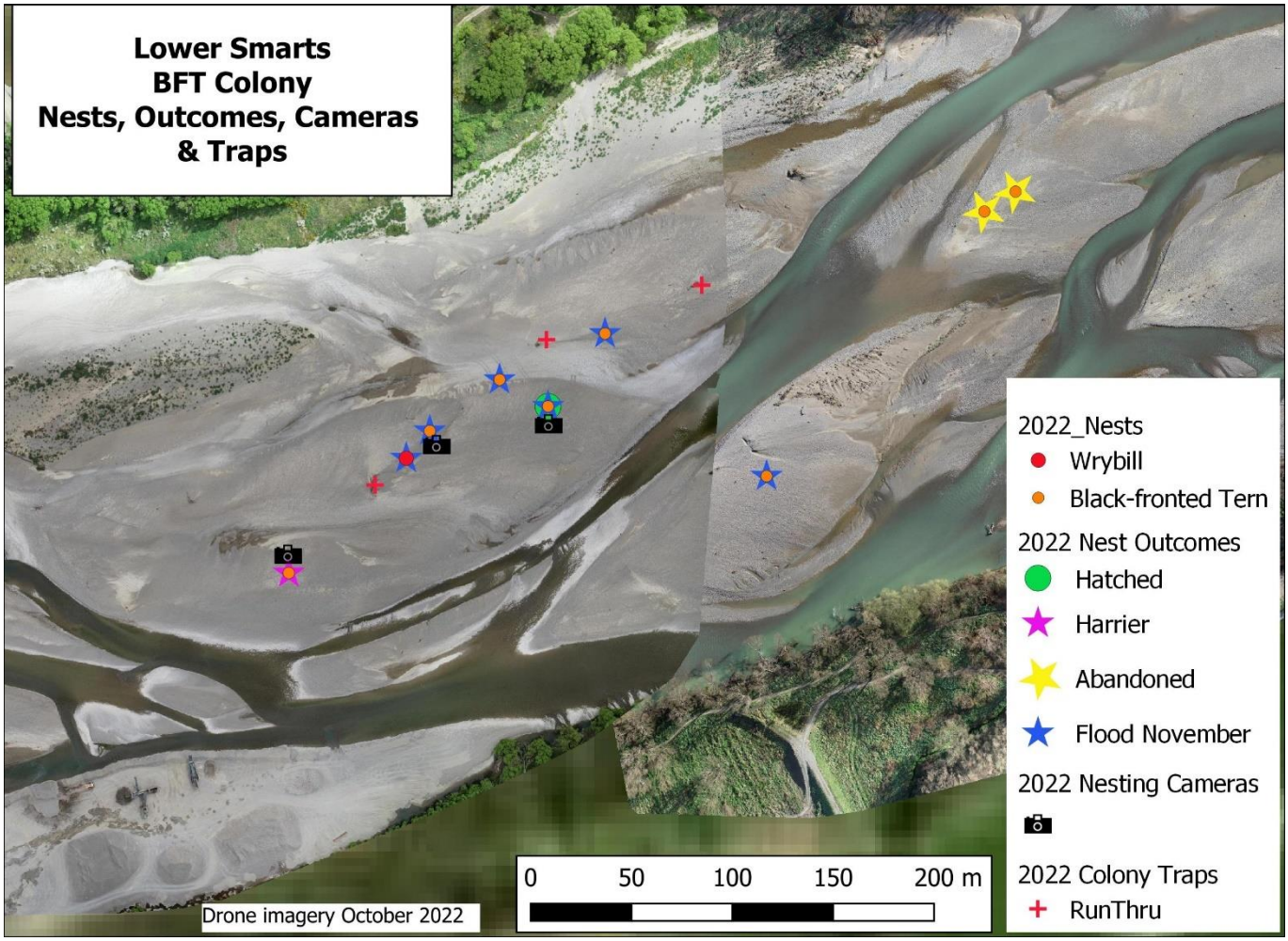

Figure 29. Lower Smarts BFT colony

There were 3 DOC 150 run through traps on site, nothing was caught. Rat detection dogs visited the area on 2 November, no signs of rats were found. Three trail cameras were used.

BFT nesting productivity was zero.

Other

In early November staff of Wildlife Management International reported seeing BFT nesting immediately below the SH1 bridge. On 14 November 2 nests were found, they didn't survive the 19 November flood. Two more nests were found off the mouth of the Makerikeri on 15 November, they would have been washed away. There was at least one nest a few hundred metres downstream from the G2 colony, the one that was found was abandoned. A nest in the Swamp Road was found whilst being made on 3 October, it wasn't followed up but was assumed unsuccessful. BFT productivity was zero.

There were about 12 BFT nests found where the river meets the estuary. These are outside the normal ARRG area and are not included in the table above. Two fledglings seem to have been produced from this heavily disturbed

area – possible productivity was zero. This will be reported fully in the MSc thesis of Eleanor Gunby. Possible productivity

4.3 Banded Dotterel

Only 5 BD nests were located by GPS – these were from just above the SH1 bridge to Rossiters. BD nests can be extremely hard to find along the river, 10% are quite easy, 90% are impossible without very large inputs of time. The annual survey showed BD numbers were fairly consistent along the river (Figure 30) – but with a peak of 33 birds seen in km 6-7 just off the airport – Groyne 2 area. BD are generally the most abundant braided river bird counted along the river (excluding BBG), this year was no different, but numbers were probably boosted by more fledglings due to the later survey date.

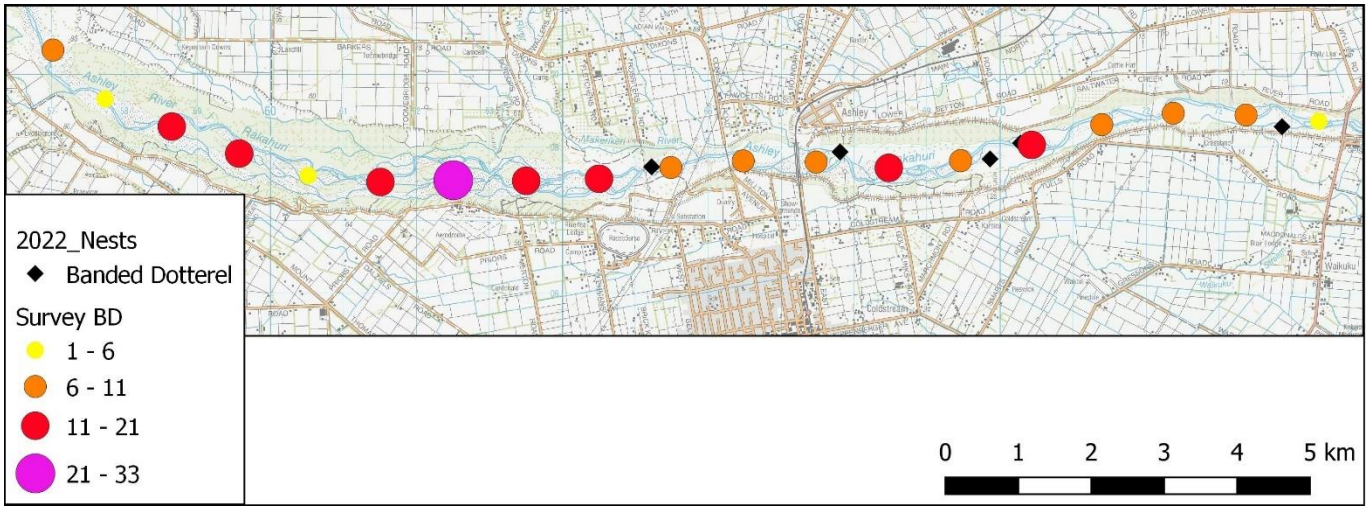

Figure 30. Banded dotterel survey numbers

On monitoring trips to the river many BD fledglings (e.g. Figure 31) were seen and the impression was that it was a good season for them. Once again, we plan to locate and monitor more nests next season – and make more use of the thermo-scope.

Figure 31. Young BD disturbs insects.

At the estuary no nests were made along the sand spits – where they nested in large numbers in the 1990s. Only about ten nests were found where the river enters the estuary. Eggs were successfully hatched, but monitoring was insufficient to measure fledgling success. This will be more fully reported in the thesis of Eleanor Gunby.

4.4 Black-billed Gull

This season there was (eventually) a successful colony at the estuary, and a small less successful one along the river. At least two unsuccessful attempts were made along the river before a colony was successfully started - off the Golf Links Rd access to the river.

Several hundred gulls started gathering about 150m above the Cones Rd bridge from late August – on 26 August 200 were estimated, and on 3 September 400 were counted from photos taken off the bridge – but on occasions there were probably significantly more than this. On 15 September there was nest building and mating going on, but on 18 September the site was abandoned. On 19th September at least 100 nests were present, but only one had eggs. There were fresh human tracks leading into the colony, but the reason for desertion is not certain. These birds then shifted to Smarts – immediately north of the gravel processing area – but were there only for a few days and perhaps later moved to the estuary.

BBG also attempted to nest off the Swamp Road access to the river. On 22 August 42 were seen, on 3 October there were 200 (with no nests present) and on 13 October there were 30 birds. On 11 October about 10 abandoned nests were found. On several occasions helicopters, probably training flights, were seen flying low, hovering and even landing in this area – Figure 32, from 25 October. This, and other pilot behaviour was brought up in a major meeting between the Civil Aviation Authority and Rangiora pilots in Rangiora on 18 April. It was made clear by the Deputy Director of the CAA that pilots from the Rangiora airfield had a very bad safety record, including for flying at below legal altitudes. It is unclear whether this disturbance may have been a factor in desertion of nests. At the same time as the gulls were in the area, a BFT colony seemed to be developing nearby, this didn't eventuate – perhaps also due to disturbance.

On 25 November 15 BBG were counted out from the Golf Links entrance to the river - within survey kilometres 12 to 13. However more than this were present on the day of the 19 November flood – they were sitting on the eventual colony island, just above water level. Numbers had built up to about 350 on 2 December. This colony was within the area of the BFT colony. On 19 December 80 nests were counted from drone photographs (Figure 33).

On 13 January, after the chicks had left the area, 95 nests were counted on the ground. It seems likely that this discrepancy was due to more nests being made in the intervening period. Several of the nests contained eggs that had been predated and there were just a few dead chicks. No remnants of chicks taken by ground predators were seen in the area, and no remnants of chicks taken by harriers were found along the riverbanks – where they are normally found.

After leaving the nesting area, a creche was formed 180m to the southeast on the northern side of a popular swimming pool off the end of G25. Between 30 and 40 chicks were counted here over a period of almost 2 weeks. Signs were put up in the area, but they were ignored by people (swimming, sometimes with dogs and on motorbikes) who came too close to the birds – sometimes almost surrounding them and showing them no respect (Figure 34). Astonishingly the great majority of the chicks seem to have fledged – they moved upriver and were seen near the Cones Rd bridge on 28 January.

It seems likely that the small number of chicks, less than 50% of the nest numbers, was due to abandonment of nests – there was some predation, but there wasn't enough evidence to suggest that this was the main problem.

Figure 32. Helicopter hovering low over potential BBG and BFT nesting area.

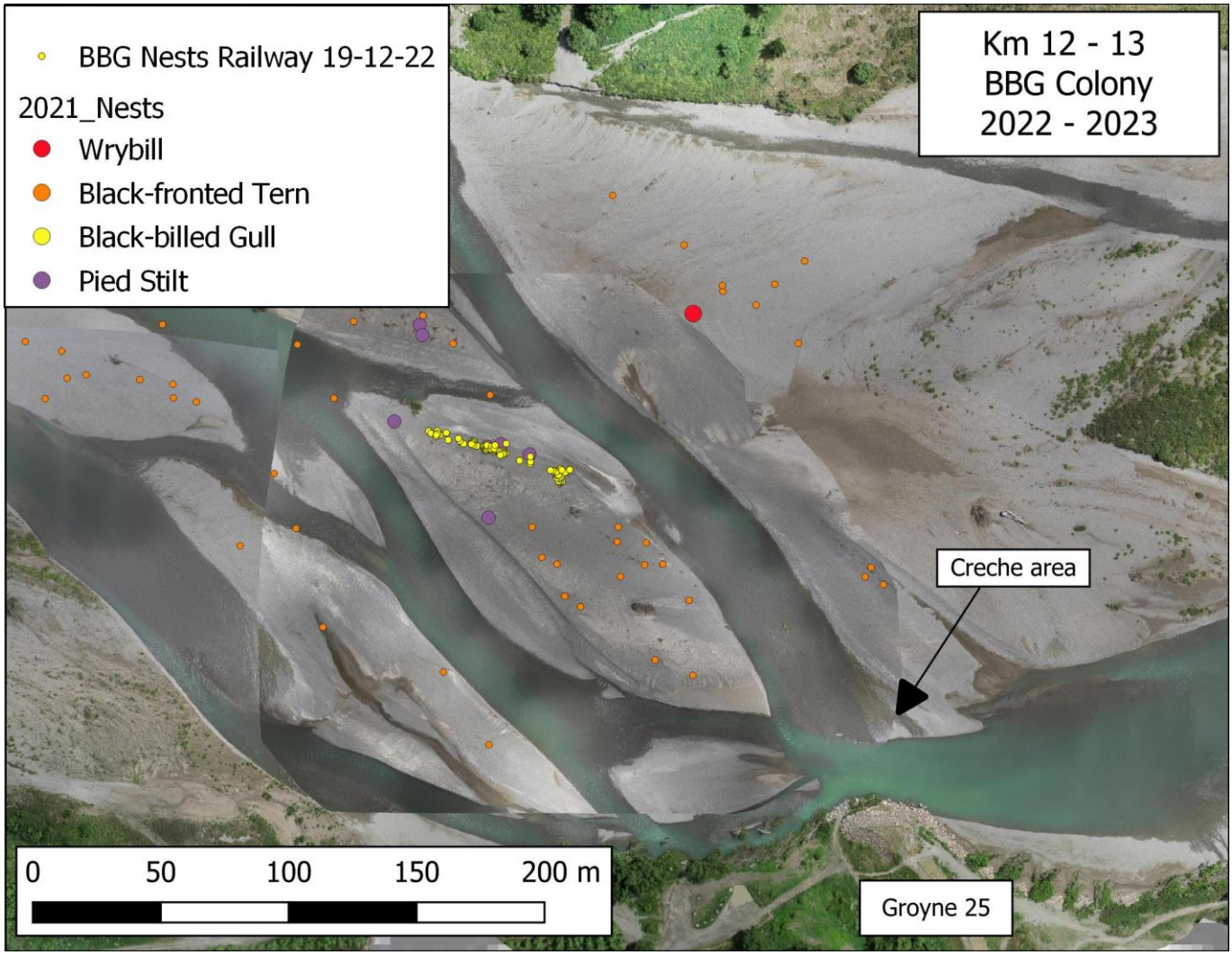

Figure 33. BBG and other nests at Km 12-13

Figure 34. Swimmers, dogs and motorbikes close to BBG creche.

The first attempt at BBG nesting at the estuary was just southeast of the end of Raupo Berm, almost exactly where they nested in 2021 – 2022 (Figure 35). On 7 September there were approximately 150 gulls in the area, about 800 on 14 September, on 22 September they were mating with about 400 on site, on 3 October there was an estimated 1,000 and on October 12 773 gulls were counted from a drone photograph. This site was plagued by disturbance – e.g. 4wds driving rapidly through the middle of the gathered gulls (recorded on trail camera photos) a man throwing a tennis ball into them for his dog to retrieve etc. By 29 October the site had been abandoned with about 50 nests left – most near the south end of the site, a few to the north. There were just a few broken eggshells remaining. The lack of eggs possibly suggests predation by SBBG – whether they caused abandonment or whether they predated the eggs after the colony was abandoned due to disturbance is unknown. Whitebaiters living off the end of Raupo Berm didn't see what happened.

The birds seemed to immediately move 130m to the southwest and on 29 October there were about 250 there, some already seeming to be on nests. Among them were a few red-billed gulls. On 2 November a count from ground photos showed 105 birds present, many on nests. On 7 November there were no birds left, and 26 empty nests. Eggs had been predated or stolen – if they had actually been laid. Again, the reason for this abandonment isn't known, but SBBG may have had a role.

The gulls shifted again, this time another 90m to the southwest. This area was off the beaten track quite high above water level – the best site. On 12 November 822 gulls were counted from drone photographs and on 16 November 375 nests were counted - from drone photos taken from 50m altitude. It seems likely that more nests were made after this date as 456 nests were counted by Eleanor Gunby after the birds shifted away. At least 367 fledglings were produced. Productivity was approximately 80%.

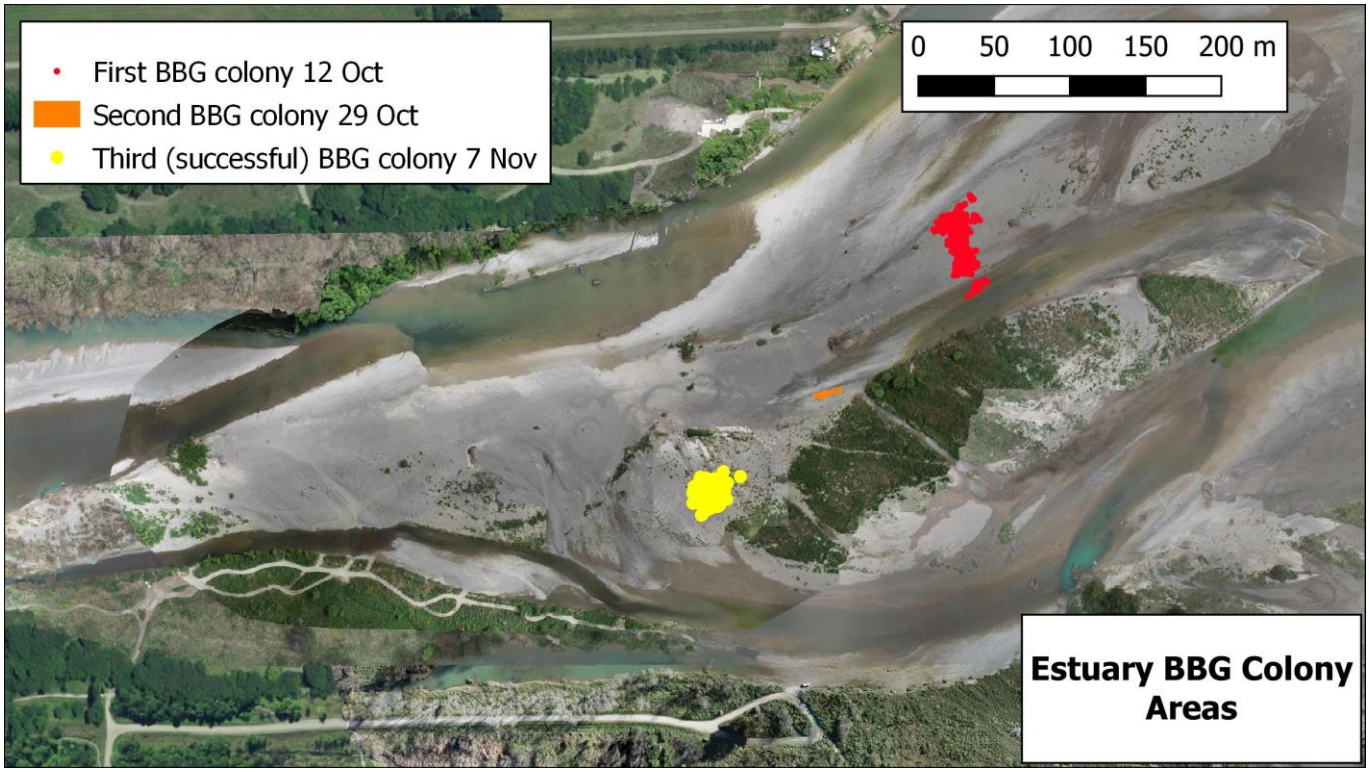

Figure 35. BBG nesting at the estuary

4.5 Pied Oystercatcher and Pied Stilt

No SIPO nests were recorded this year, but no special attempt was made to find any – partly as they can desert nests if disturbed. This year there were 33 seen in the annual survey – slightly above the average of 28.

Twelve PS nests were found and GPS located – 9 in the Railway – Golf Links area, 3 between the Rangiora bridges. In the former area nests were very close to the BGG and BFT colonies, but tended to be on the very edges of islands. Most nests seemed to survive floods and quite large numbers of fledglings were later seen.

4.6 Nesting Season Conclusions

- This year there were 16 wrybill nests from 14 pairs. Thirteen nests hatched eggs, 7 produced fledglings and 5 may have done. Success rate was 7 – 12 chicks from 14 pairs – productivity of somewhere between 0.5 and 0.85 fledglings per pair.
- Success rate for BFT was again very low – with 17 fledglings noted as produced from 162 nests – a success rate of 0.1 per nest. Eighty nests were recorded as taken by floods, 24 by unknown predators (rat, cat, harrier?), 2 by harriers, 1 by a rat, and 14 nests were abandoned. Figure 36 shows BFT count (which has a general upward trend) and fledgling productivity which has a downward trend. The disparity between these two trends shows that on the Ashley we don't have a resident nesting population, birds move between rivers. It seems likely that if some of the nests weren't taken by floods, they would later have been taken by predators.
- Black-billed gull were eventually successful in a colony at the estuary with 367 fledglings produced from 456 nests. A small colony with 95 nests at Golf Links produced only about 30 fledglings. Abandonment may have been the major problem.
- The success rate of BD nesting can only be inferred from the quite large numbers of fledglings seen along the river. Once again, we need to find and monitor BD nests.
- SIPO and PS nests were not monitored in detail. The latter lost nests in the floods.

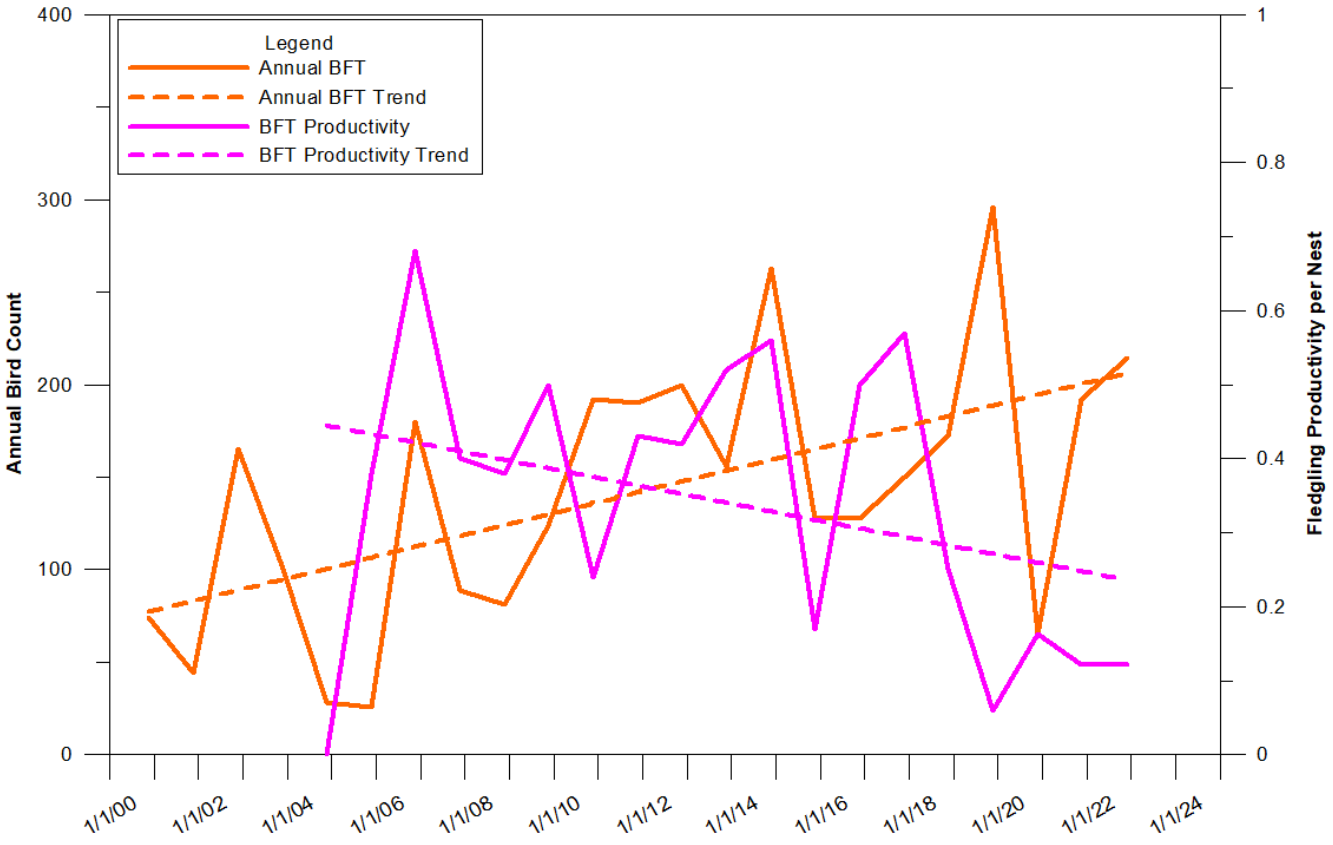

Figure 36. Annual BFT Count and BFT Fledgling Productivity

5. Weeds

Weed cover is a major influence on bird numbers along the Ashley – most braided river species will not nest among thick weeds. For a number of years a certain amount of weed removal has been done – by hand, dozer, grader, digger and specially designed tractor mounted ripper. The one in one-hundred-year flood event of May-

June 2021 cleared all but the most mature and well-established weed along the river. Unfortunately, by summer 2022 it had regrown quite thickly.

The weed spraying done by ECan, and described in last year's report, was successful and weeds weren't an issue to nesting birds this season.

Before the 2022 – 2023 nesting season there was some weed re-growth and it was decided to clear areas with the tractor mounted ripper. Five thousand dollars of funding was applied for and received from the Waimakariri Zone Committee and ARRG contributed another $4,000. The work was done by Cresslands Contracting at the rate of $290 per hour plus GST, 27.2 ha of weeds were cleared. First priority was high islands which have a history of nesting or were within an area with nesting history. Second priority was areas of thick young weed – which would seed and contribute to problems in later years. Yellow tree lupin does not tend to seed in its first year.

The machine generally worked well. Where the surface was flat and loose, the massive majority of lupin was ripped up. However, where conditions weren't so good, a significant amount of weeds, especially small gorse plants, were left behind. There was a slight problem with the right-hand side of the implement lifting up. Achieving good success rate with small gorse plants with shallow roots is almost impossible, these would need to be sprayed.

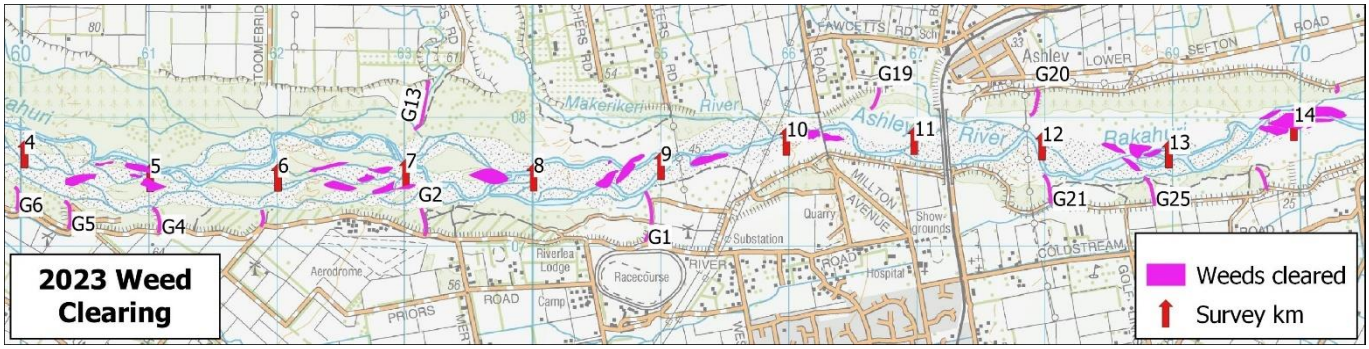

Figure 37. Weed clearing prior to 2023 nesting season.

The flood of 393 cumecs on 23 July 2023 remobilized most of the gravel in the river, taking away the majority of the remaining light weeds – lupin etc. Weeds will not be a problem in the coming season.

5.1 Weeds Conclusions

Due to spraying and floods, weeds were not a significant problem in the 2021 – 2022 and won't be next season. We cleared 27.2 ha before 2022 – 2023 season started.

6. Predator Control

6.1 River Traps

This year our network remained much the same as the previous year. But from mid-January to mid-June there were an additional 102 traps put out and checked by Excell Biosecurity, funded by the ECan Braided River Revival budget. These were installed along the south side of the river, between the airfield and Smarts – to the south of our existing traps. There was a gap from about 500m upstream of Millton Avenue and the railway bridge due to lack of sites to put traps.

Excell traps were a mixture of DOC200, DOC150 and Timms. The latter were only put at the upstream and downstream ends of the line to avoid catching domestic cats. Bait used in the Timms was fresh rabbit, in the DOC traps only salmon food pellets. Excell had found elsewhere that this is highly effective bait and that nothing else is required. This seemed to be borne out by experience here. The traps were placed at 100m intervals, the same as with ARRG traps and they were mainly checked at 2-week intervals – towards the end of the period this extended to about a month. Some of the traps were a little obvious to the public, but only 3 were stolen.

Excell recorded their data on the TrapNZ system. This was downloaded to include in the ARRG database. The traps were assigned to Lines S to X so they could be evaluated with ARRG data.

Checking frequency for ARRG traps was rather variable, and a couple of lines weren't checked enough. Total catch would have been higher if the recommended frequency of fortnightly had been adhered to. The bait system was working well – a new bait shed manager (Bob Roy) took over this during the year. Late in the reporting year a large container of salmon food pellets was purchased – it was suggested to trappers that they alternate the use of this with peanut butter. Eggs became very difficult to procure, so golf balls have been put in the DOC traps. Mayonnaise was also trialed for a period. Experience within the group and elsewhere is that golf balls work as well as eggs. As per usual, meat was obtained from New World for the Timms traps. This was salted and frozen. Meat is usually also put in the DOC traps.

About a dozen traps were lost in the 23 July flood – most from Lines F and I. A few traps are yet to be replaced. Three DOC 150 run through traps were lost from the fairway in the Km 12 to 13 area.

As of 28 August 2023, the following traps were along the river –

Total Current Traps	259
DOC	202
Fenn	1
RunThru	5
Sentinel	3
Timms	47
Trapinator	1

Average trap numbers in the year were 304.

Some time ago we purchased 6 Sentinel traps for use on feral cats. These came highly recommended from several sources.

Data given below includes that from trapping around nests and colonies on the fairway described above.

Figure 38 and Figure 39 show total catch since 2004 and catch per hundred trap nights.

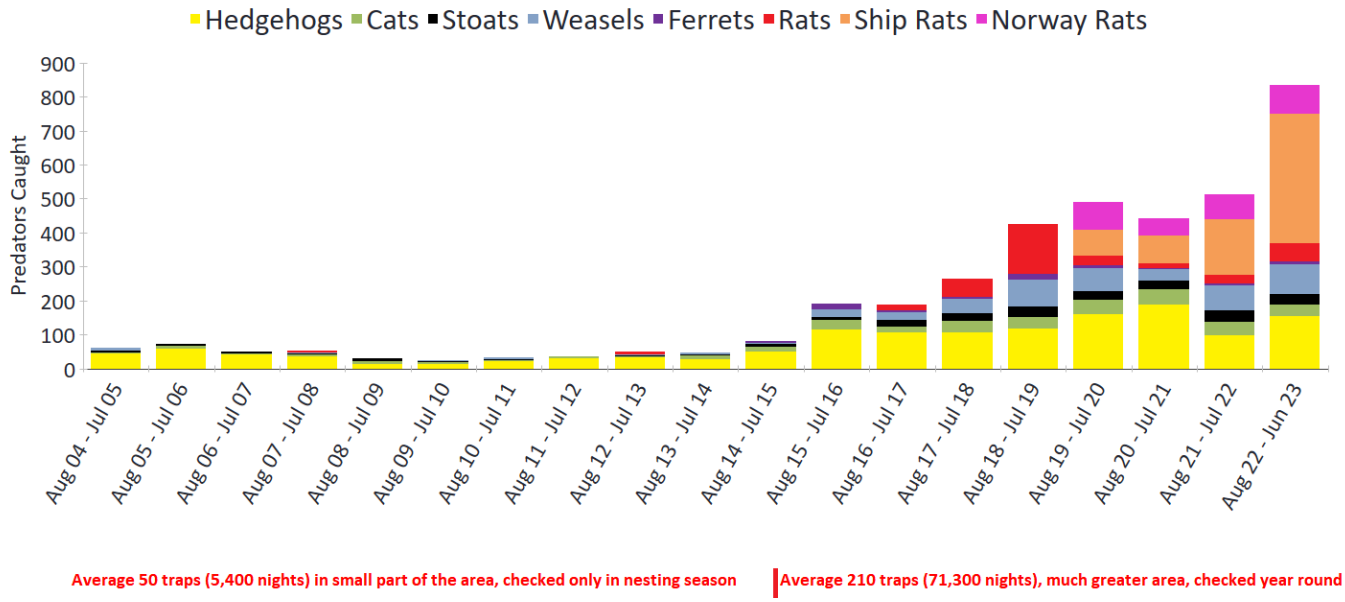

Figure 38 .Total catch since mid-2004

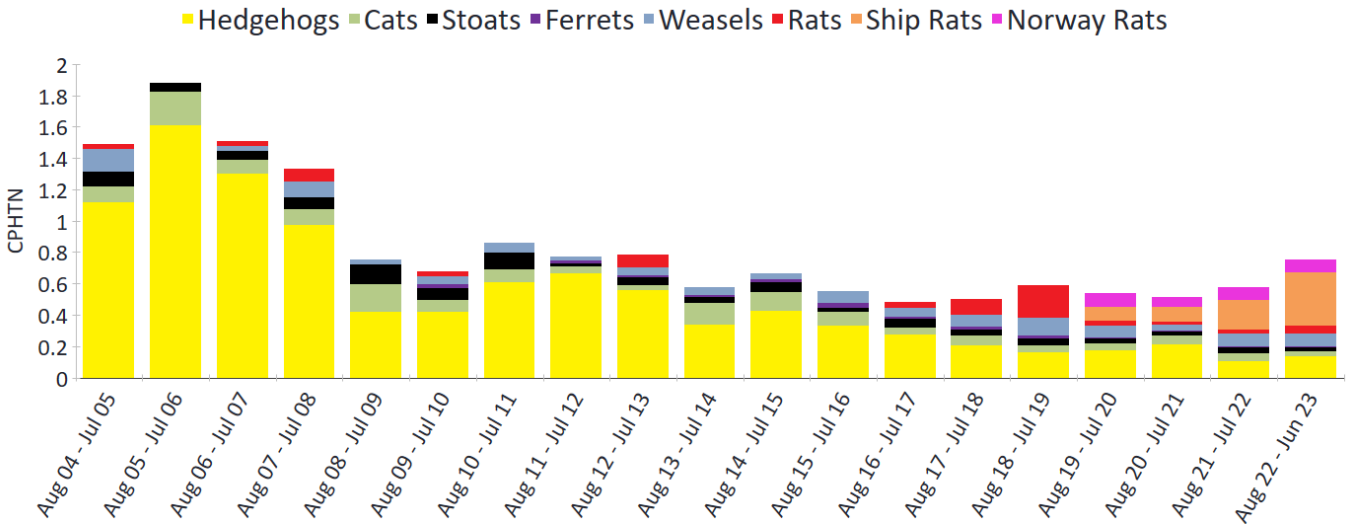

Figure 39. Catch per hundred trap nights since mid-2004.

The large increase in catch this year was due mainly to the Excell traps and to an ongoing Ship rat boom.

Figure 40 shows that the above plots should be treated with caution. There are several datasets in them – until 2015 we averaged about 5,000 trap nights with traps only checked during part of the nesting season. After this the number of traps increased rapidly and they were checked throughout the year. The decline in catch rate is due only to fewer hedgehogs caught. This probably does not mean that we are having an impact on hedgehog numbers – hedgehogs are known to be decreasing elsewhere. And it seems likely that earlier traps were put in areas where hedgehog numbers were high. Winter floods in the last few years will have reduced their numbers, as perhaps has the rat boom - rats are known to eat hibernating hedgehogs.

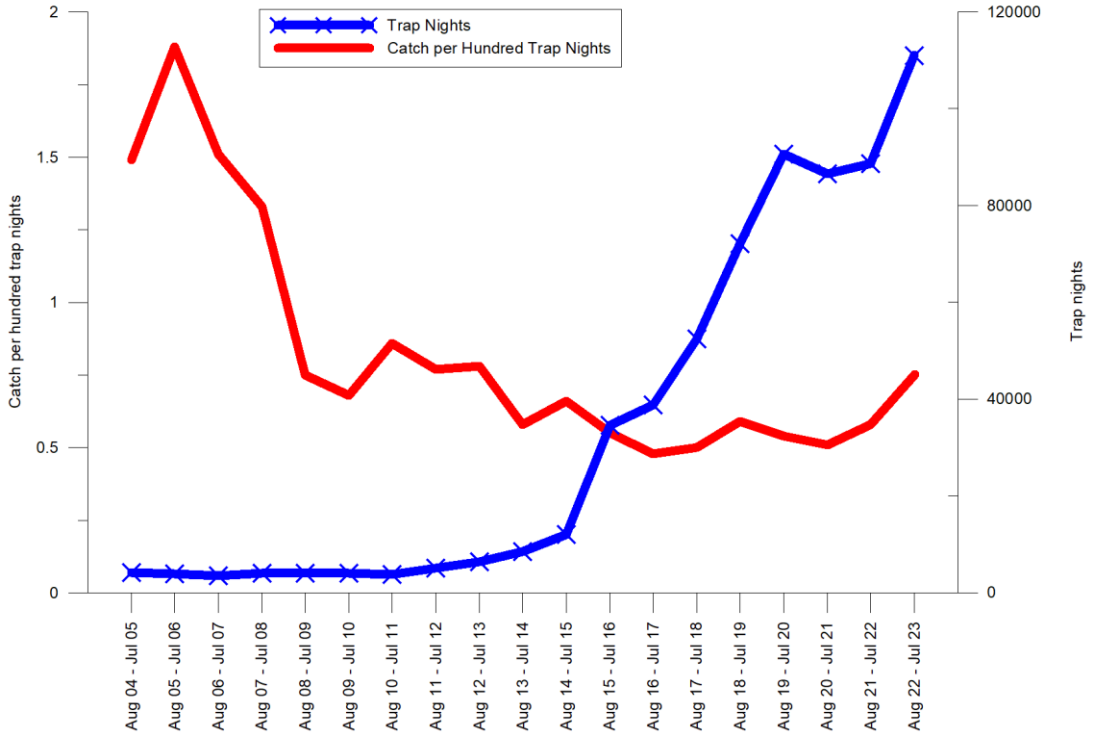

Figure 40. Catch per hundred trap nights and trap nights.

As previously mentioned, relatively high bird numbers in our annual survey have been attributed to trapping. If this is the case, it should be demonstrable in the data. The massive increase in trap nights since 2015 should have some effect on bird numbers (Figure 41), this is not the case. Influences clearly visible on the bird numbers are

the amount of bare gravel and the influxes from the Waimakariri when it floods. If trapping has any influence at all, it is utterly subsumed by other factors.

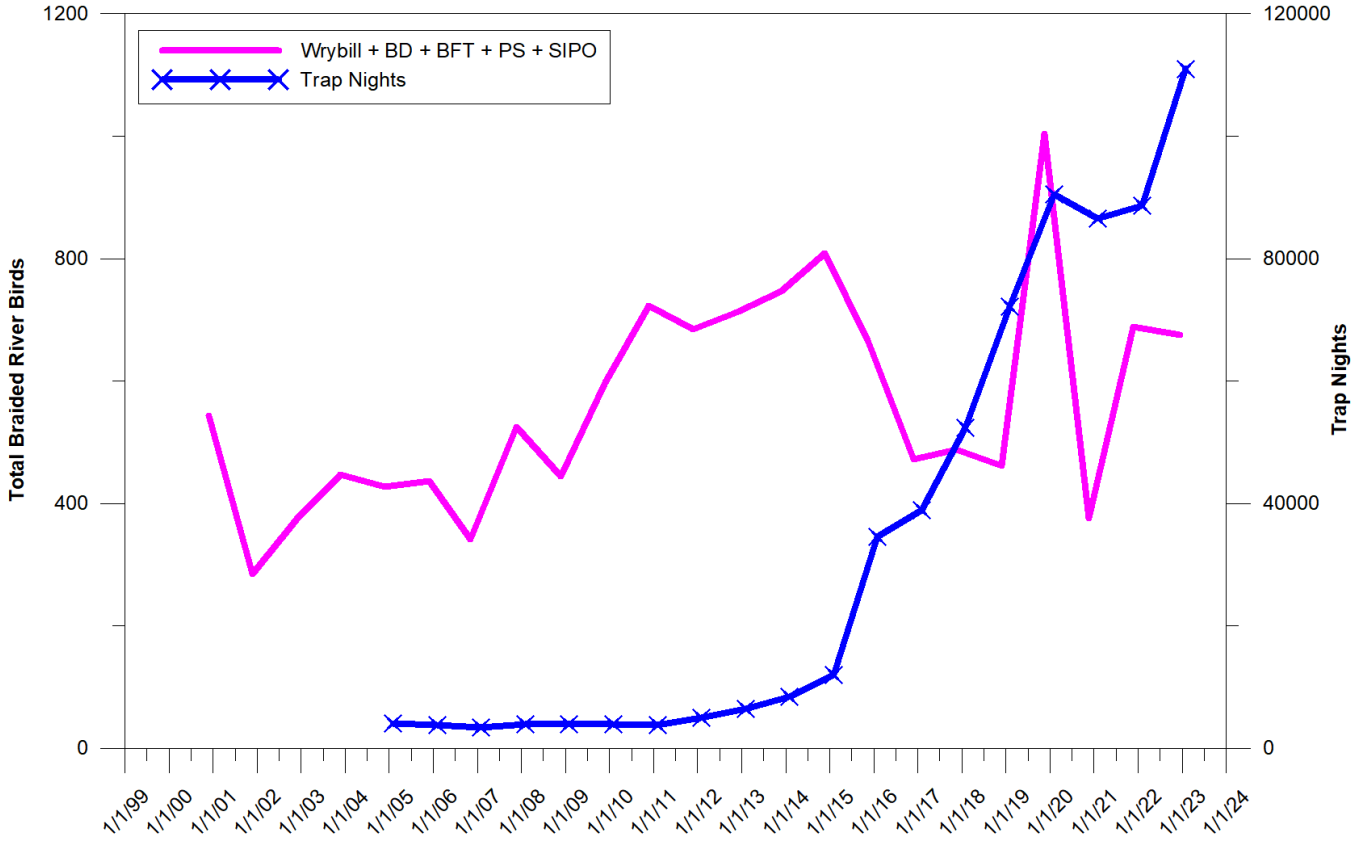

Figure 41. Annual bird count numbers and trap nights

To understand whether our trapping can possibly have an influence on predator numbers along the river, and thus (perhaps) bird numbers, a number of factors need to be known – such as the following:

- An indication of the density of each predator species on the fairway, berm, and surrounding countryside.
- The breeding rates of these animals.
- Feeding ranges.
- Ability of each species to recolonize areas where they have been killed.
- The effects of species competition, temperatures, floods and food supply on their numbers.
- What numbers of each predator are like elsewhere – could they be declining due to disease etc?

For example - some information about hedgehogs (from various sources):

- *Hedgehogs were once abundant over the whole of England but their population has fallen dramatically over the last 50 years. Coincidentally, their numbers have crashed in New Zealand over the last 50 years as well. There are as many explanations for these losses as there are specialists to dream them up, but it is most likely that the increasing use of pesticides has substantially cut into hedgehogs' insect and grub diets* – Brockie, 2018.
- The study done by Quill Yates on the Ashley that showed 22% of hedgehogs visiting a trap were actually caught.
- Hedgehog density could be 1.1 to 2.5 per hectare and range 0.8km (reference?). They rapidly reinvade and have 4 to 7 young per year. The area of berm where we currently have traps is 690 ha. Since 1/8/19 we have caught 608 hedgehogs. This is less than 1 per hectare of berm over 4 years and cannot be of much relevance given their breeding rate and ability to move and recolonize areas.

And Norway rats:

- Following about a 3-week gestation period, 12 to 18 rats are born to a female rat that can be as young as 8 weeks of age. A Norway rat can produce up to 12 litters per year.
- It has been estimated that, under ideal conditions, a single pair of Norway rats could produce 15,000 offspring in a year.
- From the Handbook of New Zealand Mammals - On Motuhoropapa Island., density was estimated to be 2.6–4.2 rats/ha; on Breaksea Island., at least 13 rats/ha. Norway rats have now been eradicated from all these islands.
- The average annual production of young rats can in reality be very high, e.g. 33.5 young/adult female on Kapiti I. One female rat living on the Ashley River could easily give rise to as many as we catch per year.

The only way that our single line trapping can impact on Norway rats is if they are under extreme stress from something else.

Some more sobering facts about our catch:

- Since our records began, we have caught 3,884 predators – or 0.56 per day.
- Since the data was kept more rigorously from August 2019, we have caught 2,229 predators at 1.5 per day.

Appendix 4 shows predator catch and trapping statistics since mid-2004. Rat species weren't distinguished until mid-2019, since then, on occasions, species wasn't or couldn't be determined.

Figure 42 shows the influence of the Excell trapping on total catch, Figure 43 shows the ongoing Ship rat boom. This has been exacerbated by the warm winter of 2022 – many of them seemed to have survived through it. This is shown more clearly in Figure 44. Ship rats haven't been seen on the fairway, but they are no doubt a major danger to birds that nest on the berm and to lizards and insects. They also would be a food source for cats and stoats.

The Excell trap lines actually had greater success than ARRG lines closer to the river.

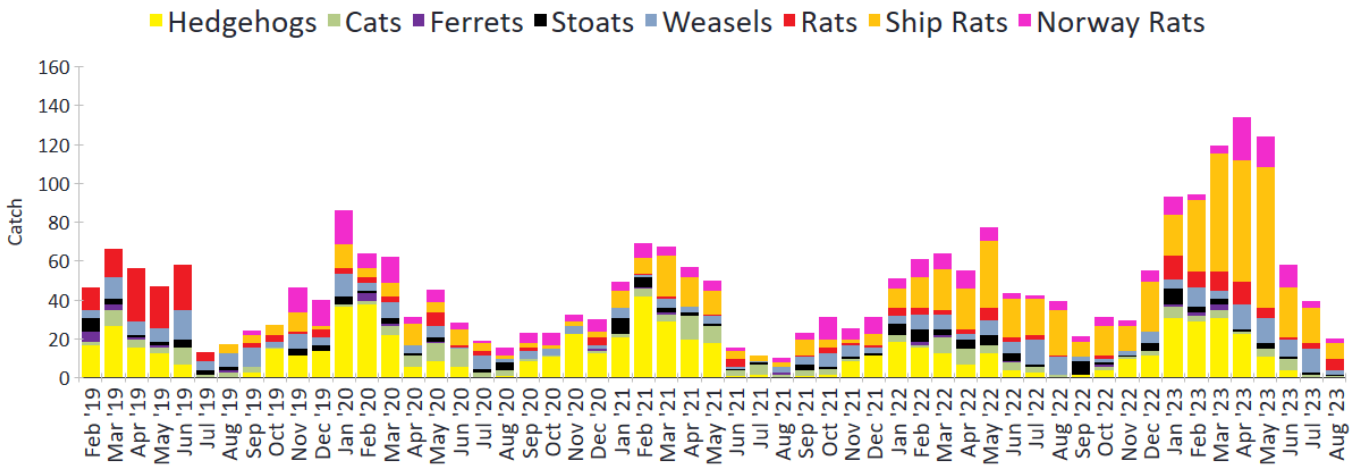

Figure 42. Monthly catch since February 2019

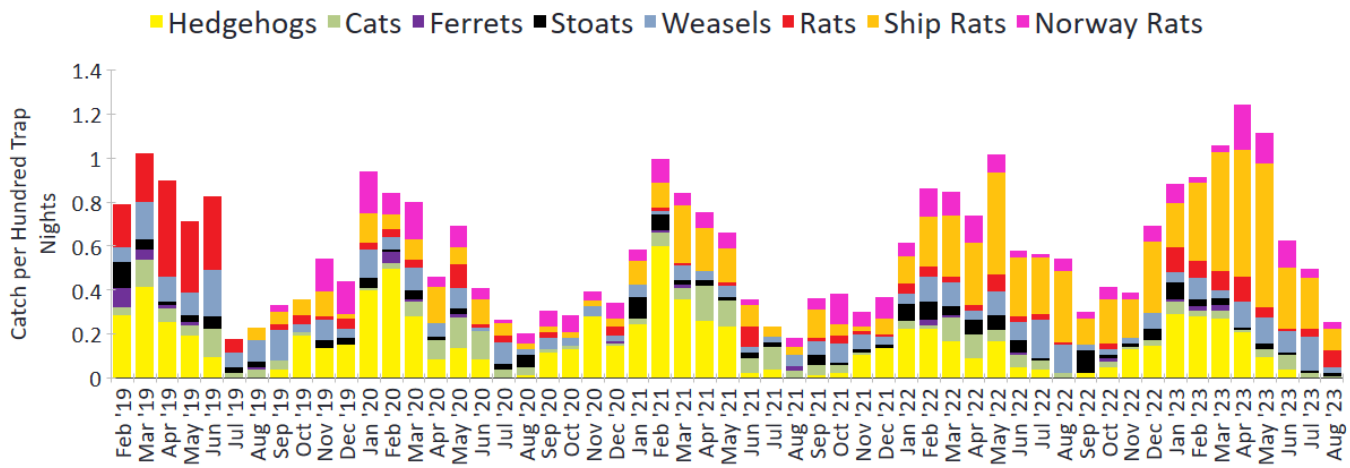

Figure 43. Monthly catch per hundred trap nights since February 2019

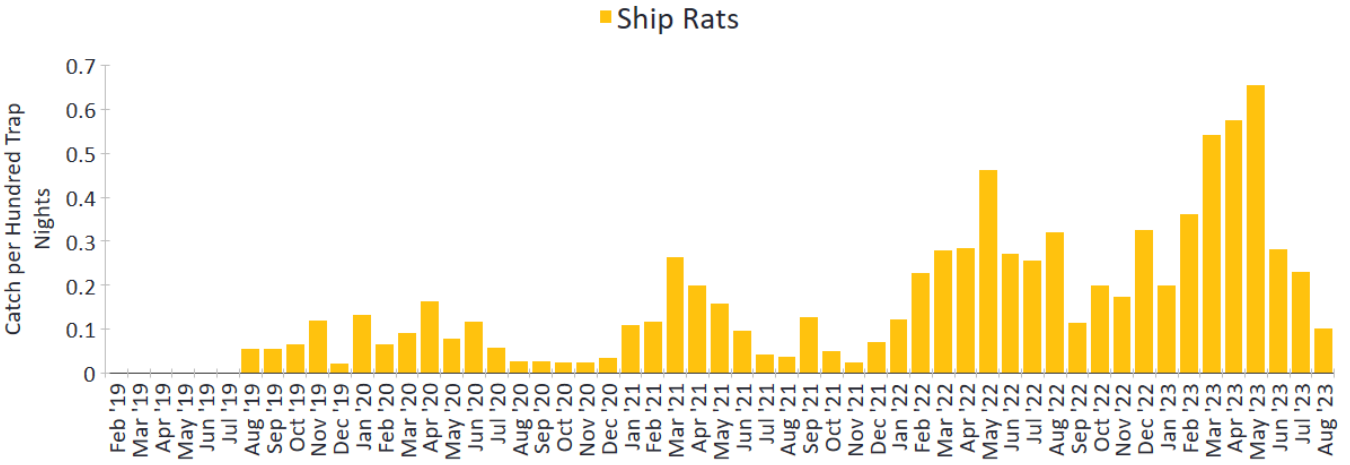

Figure 44. Monthly Ship rat catch per hundred trap nights.

The number of Norway rats (the most important predator on the river) caught in our traps doesn't show the same sort of boom as for Ship rats – Figure 45. However, our highest catch rate so far was in April 2023. Total Norway rat catch of 82 in the year was a record. As mentioned above, they seem to be increasingly trap-shy.

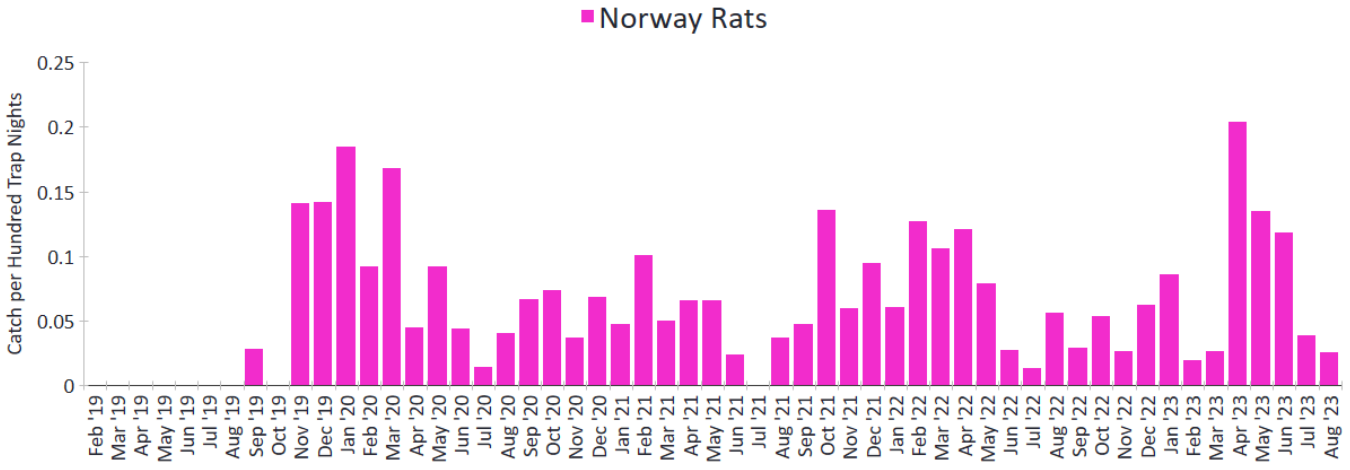

Figure 45. monthly Norway rat catch per hundred trap nights.

An effort was made to try to understand the rat boom which has happened in recent years. This was by analyzing temperature using NIWA Rangiora records. Data used was prior to the end of the current winter.

- Since 2004 annual winter temperature trends are – average frost temperature slightly up, frost days down, minimum temperature very slightly down (Figure 46). Overall, a warming trend. There might be better ways of showing the temperature change.
- It is difficult to see the rat boom being entirely dependent on temperature – if so, quite subtle temperature changes have very major effects. Our rat boom started in 2016 or 2017. A paper on ship rat invasion in the Craigieburn Forest Park (Harris et al., 2022) hypothesised two drivers of the increase in rat abundance: (1) more frequent mountain beech high-seed years providing more food for rats; and (2) warming winter temperatures (hardly any more than ours?) allowing rats to invade areas that were previously too cold.
- By three methods of reckoning the 2021 - 2022 winter was warm. Average daily frost temperature was highest since 2004, frost days were lowest, minimum temperature was second highest.
- On these plots monthly catch per hundred trap nights is assigned to the 15th of each month. We only have monthly catch collated since February 2019.
- It is assumed that catch rate roughly reflects predator abundance. Species such as Norway rats do though appear to be more trap-shy nowadays.
- Total predator catch rate (Figure 47) closely mirrors minimum daily temperature trends, however this is heavily dependent on the species with most catch – rats and hedgehogs. Temperature is very clearly a major influence on catch rate – probably due to predator death, hibernation by hedgehogs and some movement away from the river – rats to houses etc.
- Hedgehog catch very closely follows temperature (Figure 48), with the decline in 2022 almost certainly being the result of flooding. They of course hibernate in winter.
- Ship rat catch (Figure 49) will be a consequence of exponential rates of breeding, plus some temperature effect and maybe other factors - such as food supply and the next point below. The large increase in rat catch in 2022 followed an average winter, so the even bigger increase in 2023, following the unusually warm winter, cannot be only ascribed to temperature. However, there was a very unusually high ship rat catch in and immediately following winter 2022. Rat numbers lag temperature more than the hedgehog numbers do.
- Other factors to be considered in understanding rat catch per hundred trap nights are relative numbers of different trap types (Timms catch very few rats, DOC many – and we used to have a greater Timms/DOC ratio) and trap locations (traps in trees catch many more ship rats than traps in scrub – we have many more under trees nowadays to avoid flood loss.
    - On 1 Feb 2019, 55% of our traps were potentially rat catching. On 1 May 2023, 84% were potentially rat catching. But the big change happened in 2019 after the rat boom had started.
    - On Feb 1 2019 51% of traps were under trees, on 1 May 2023 70% of traps were under trees. Ship rat catch rate under trees is 2.4 times that under scrub. But the major change happened after the 2021 flood, long after the rat boom started.
- Cat maxima and minima significantly lag temperature. Maxima follow on from the end of the nesting seasons, minima coincide with the height of the nesting seasons – are cats less governed by temperature and go to the traps after the supply of young birds dries up?
- This temperature analysis shows little more than is obvious from monthly analysis.

A description in Studholme (1940) of a horde of Norway rats moving along a track near the Otaio beach, probably prior to 1900, was described as migratory behaviour. Perhaps there has been migratory waves of both types of rats into the Ashley area.

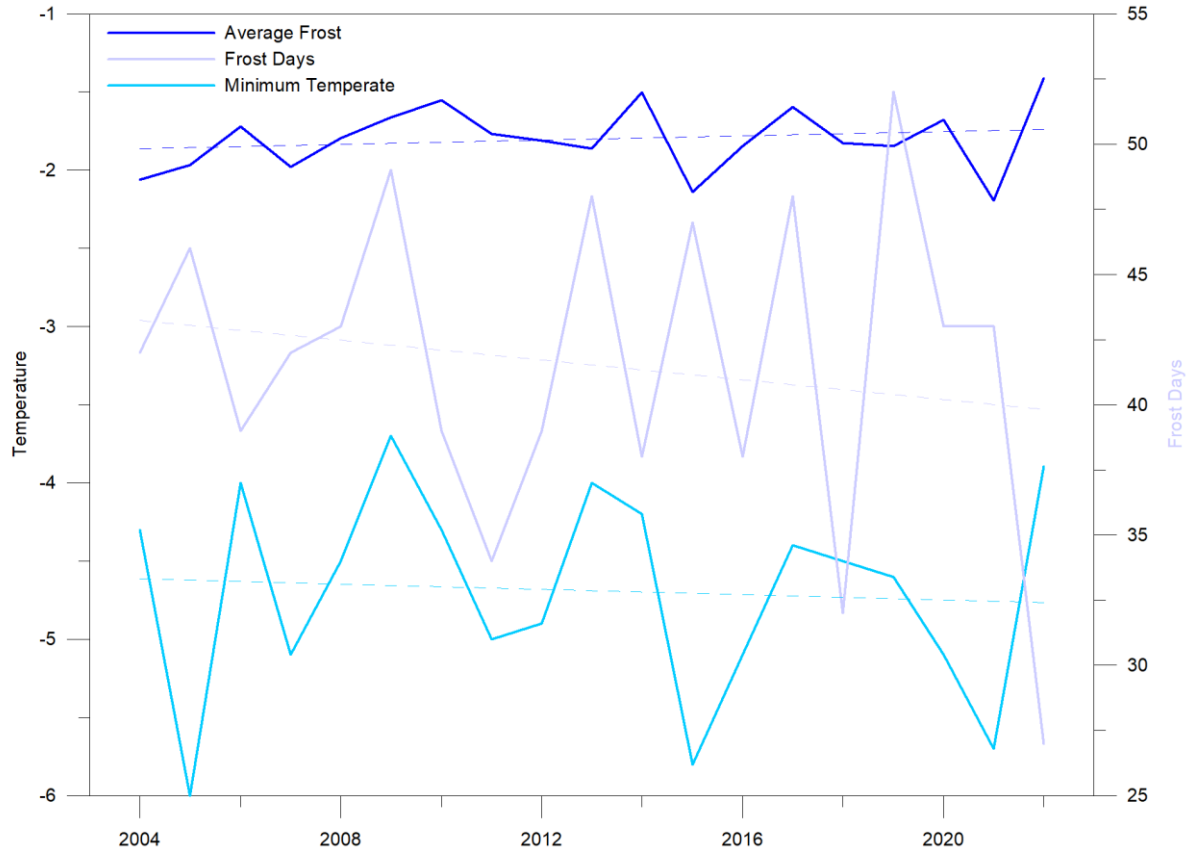

Figure 46. Rangiora average frost, frost days and minimum temperature

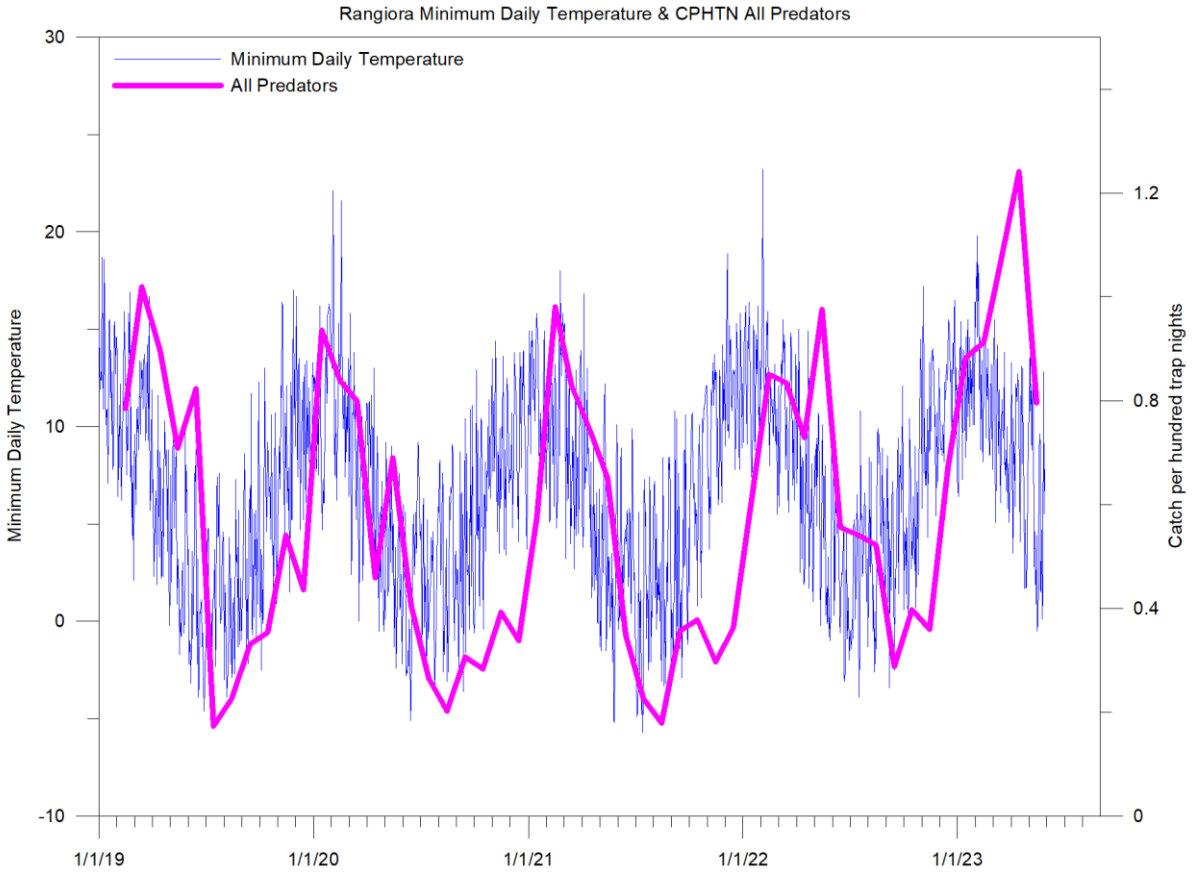

Figure 47. Rangiora minimum daily temperature and predator catch rate.

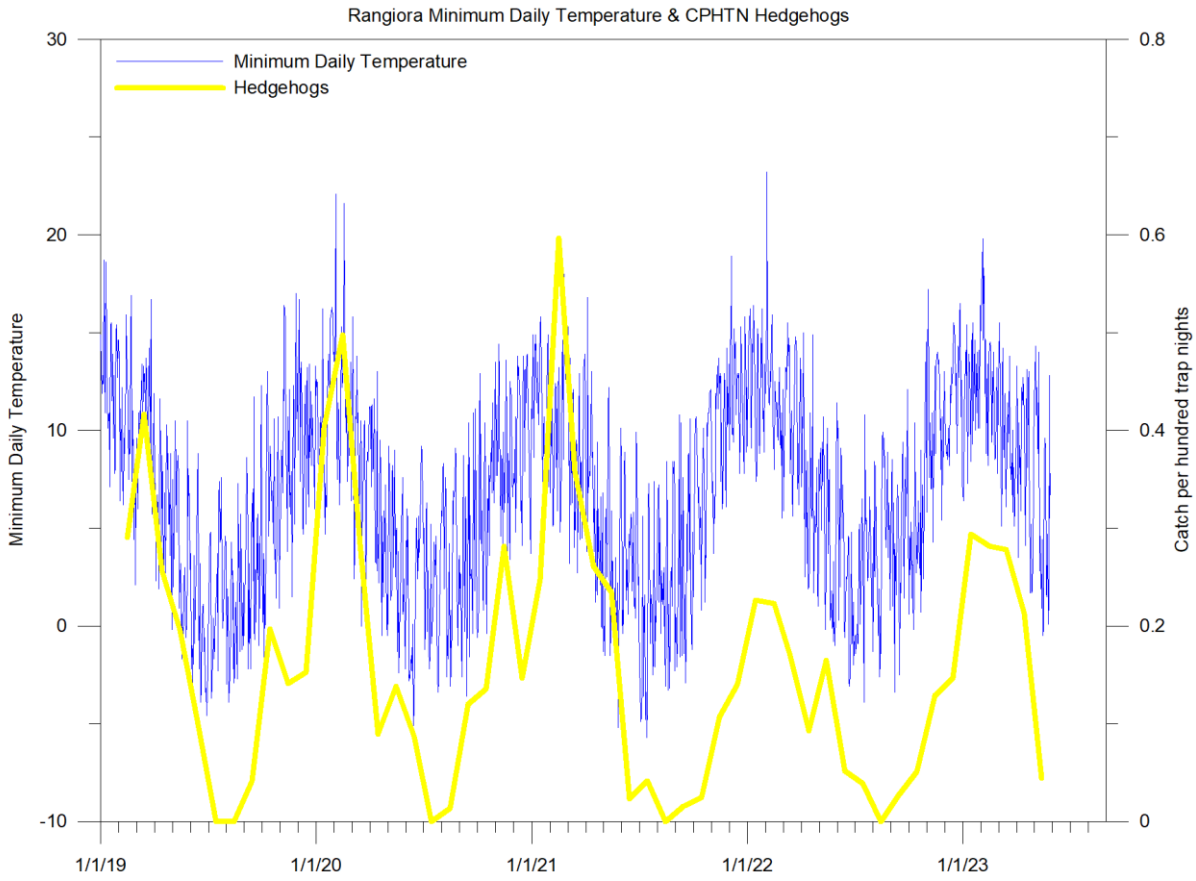

Figure 48. Rangiora minimum daily temperature and hedgehog catch rate.

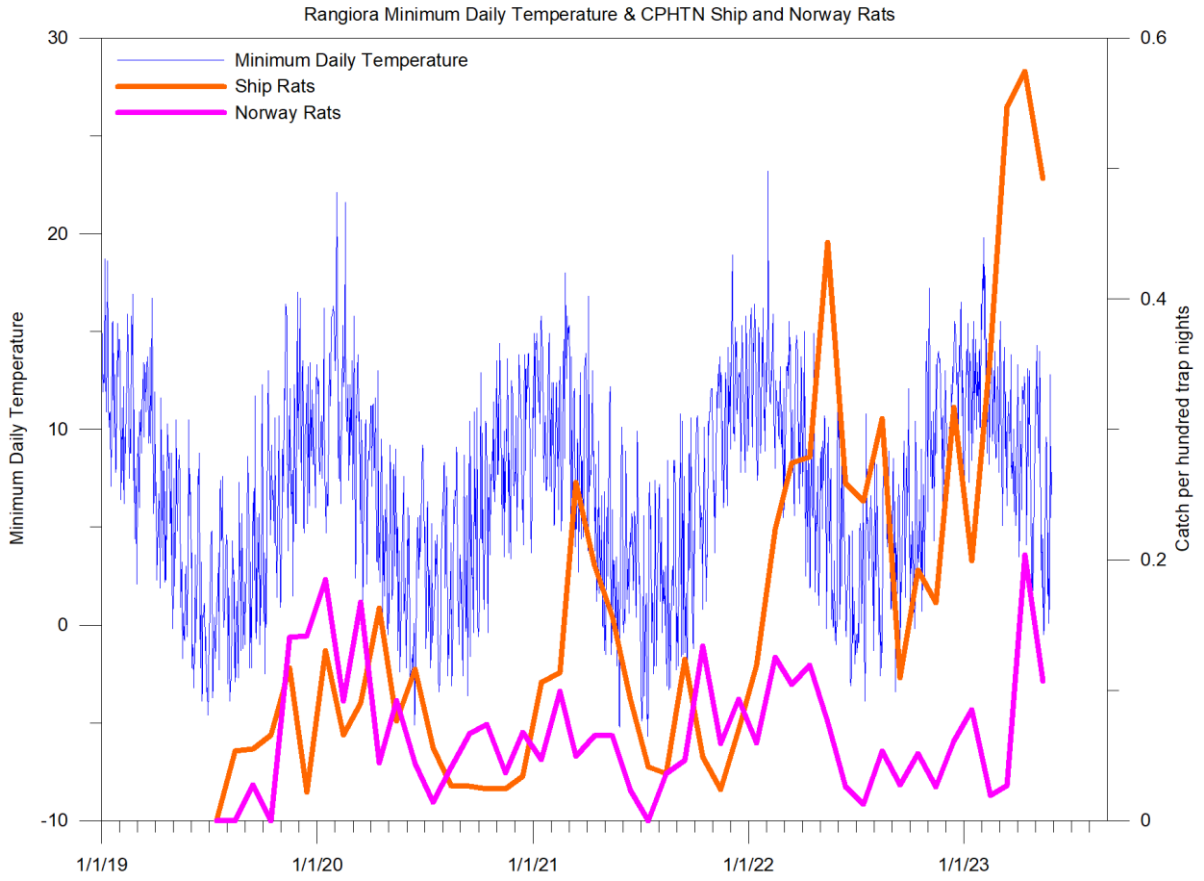

Figure 49 . Rangiora minimum daily temperature, Ship and Norway catch rates.

Figure 50 is an illustration of where predators were caught – pie size is an indication of total catch – maximum of 83 on Line E. This map doesn't take into account the number of traps on a line or the frequency of checking. The numbered lines are traps on the fairway, mainly only there during the nesting season.

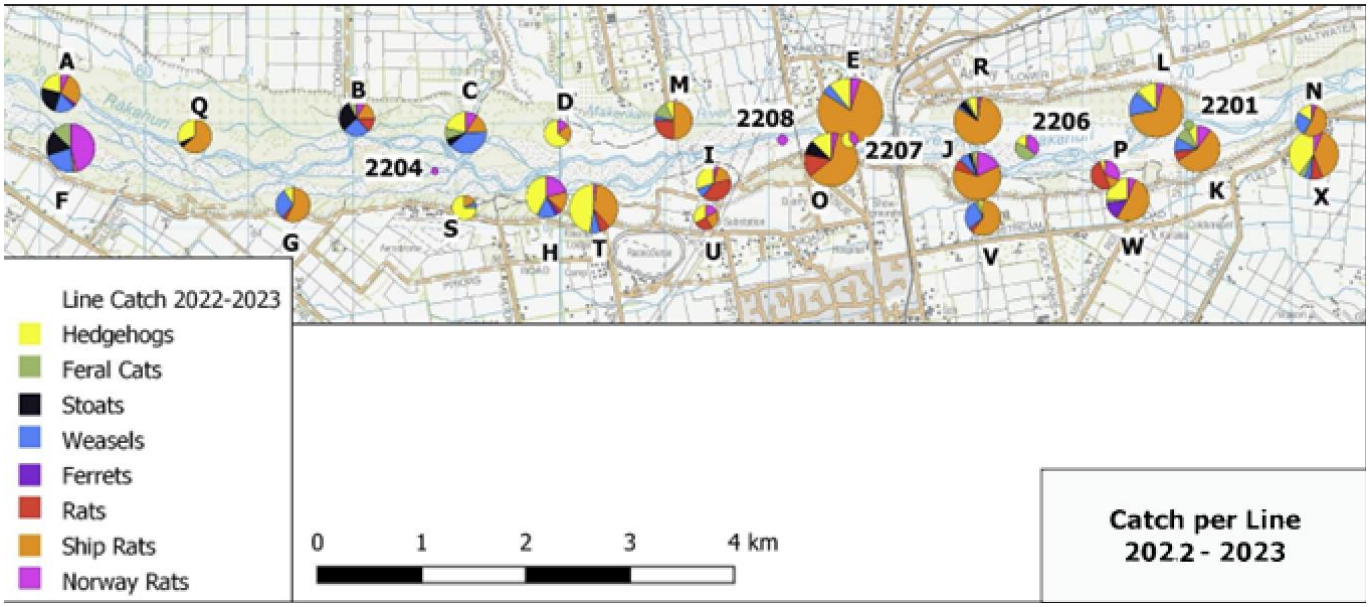

Figure 50. Catch per trap line.

Figure 51 shows the same information per line, but on a catch per hundred trap night basis.

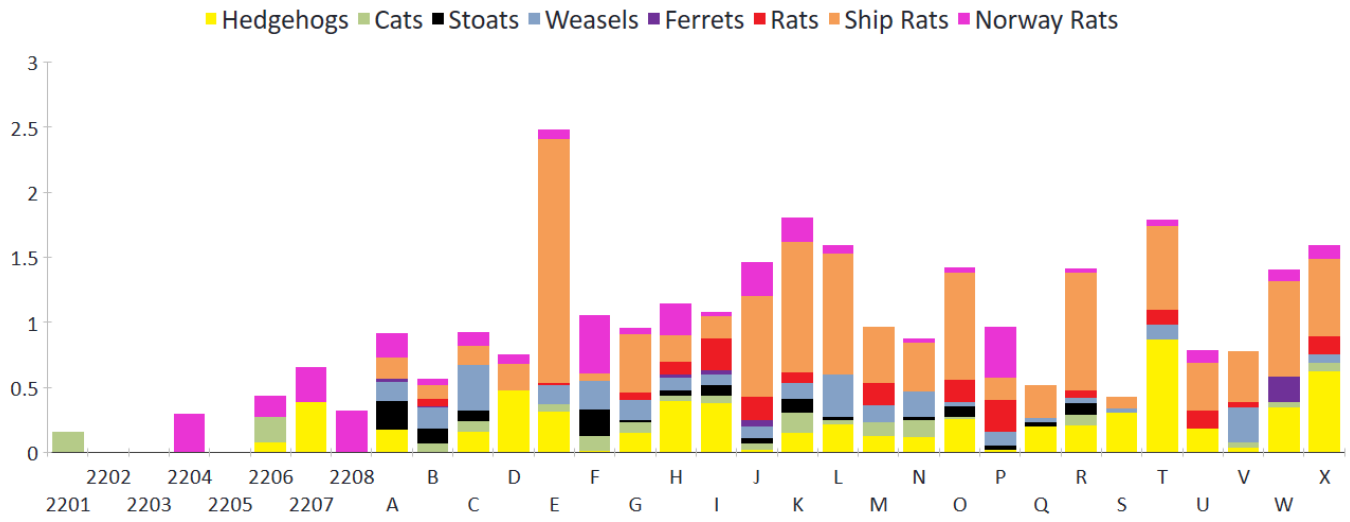

Figure 51. Catch per trap line per hundred trap nights.

Figure 52 shows Norway rat catch by trap.

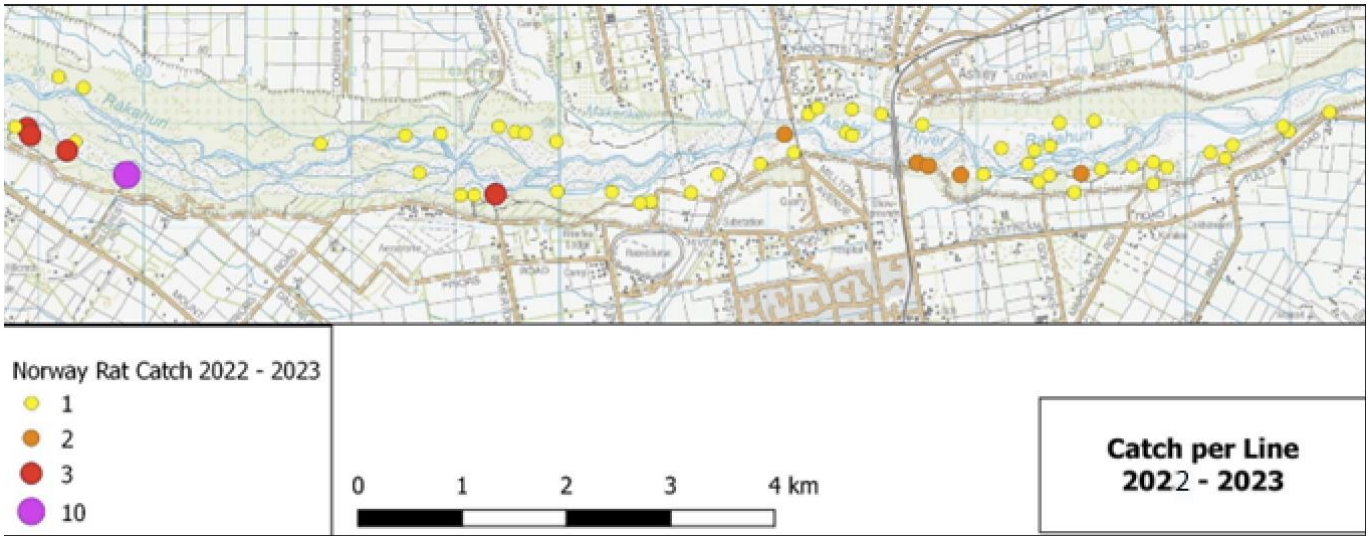

Figure 52. Norway rat catch per trap.

Some conclusions from the previous two illustrations:

- In some parts of the river there is a quite different suite of predators to other parts. This can be perhaps partly because of interactions between predators, e.g. Figure 53 (data from catch per line) shows a negative correlation between Ship rats and stoats. There is actually a positive correlation between Norway rats (a much more formidable animal) and stoats.

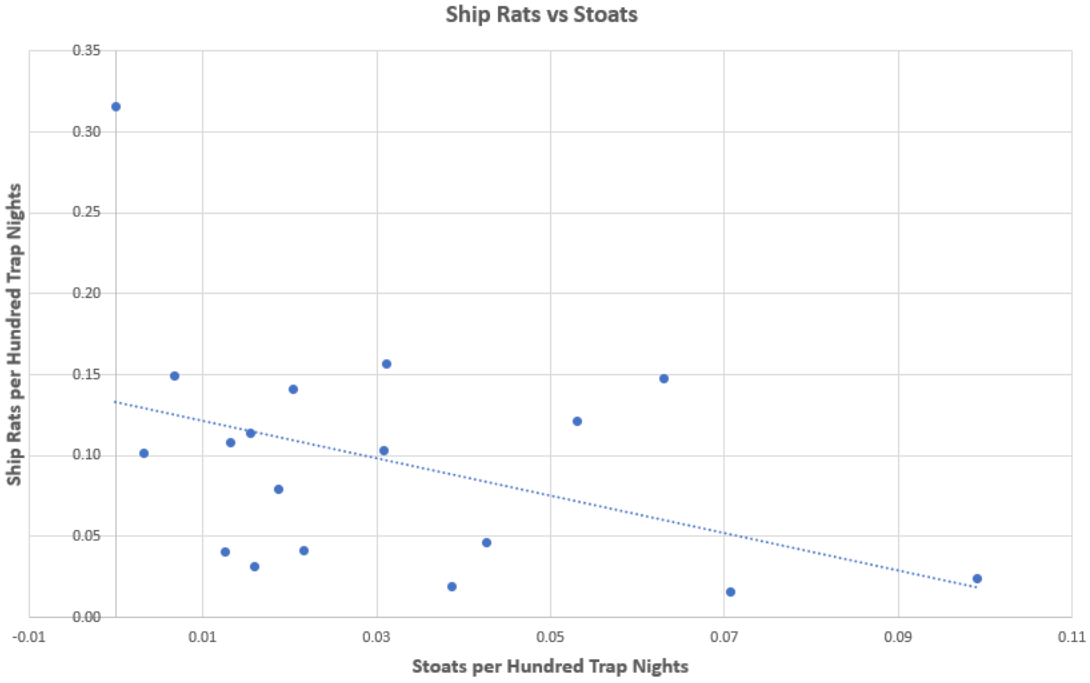

Figure 53. Correlation between Ship Rats and stoats on a per trap line basis

- Norway rats, the most important predator, had the highest catch rate along the southern bank of the river – but most especially along the uppermost line (F). One trap here caught 10 in the year, three others caught 3. For this reason the rat detection handler and dogs were first sent to Line F, then concentrated on the south bank downstream from the airfield. This seems to be prime Norway rat habitat and more trapping and perhaps poisoning is necessary.
- Stoat catch rate was highest in the upper part of the river – Lines A, B and F.
- Ship rat catch rate was highest downstream from the airfield, both sides of the river. Ship rats correlate with traps under trees, but this doesn't properly explain this distribution. Line F does have more traps in

scrub closer to the river though. For reason, Line N had a low Ship rat catch, despite most of the traps being under trees as is the line upstream from it – Line K. Perhaps Ship rats could be beneficial in that they could out compete Norway rats as has happened in the past throughout the country (King, 2019).

- There was a hedgehog hotspot near the airfield and another near Smarts.
- Timms traps are quite ineffective in catching cats, as shown from trail camera study on the Ashley, little can be made of the data. There are several different types of cat traps available now, we need to be using some of these.

Catch rate from the Excell lines, especially T, W, and X was high – a little higher than for the ARRG lines closer to the river. It would have been interesting to keep this trapping going for longer, and to put extra lines out from all our existing lines. But from the information to hand, there appears to be an inexhaustible supply of predators in the area which could only be handled by large scale trapping in farmland around the river.

Figure 54 shows catch per 100 trap nights for each species by location. Norway rat catch was highest on the fairway – on islands or fairway edge, but trap nights in these locations were much lower than on the berm. Hedgehogs weren't caught on islands, but were on the edge of the fairway. Cat catch rate was higher on the islands than on the berm – mainly due to a cat with kittens in the Railway area.

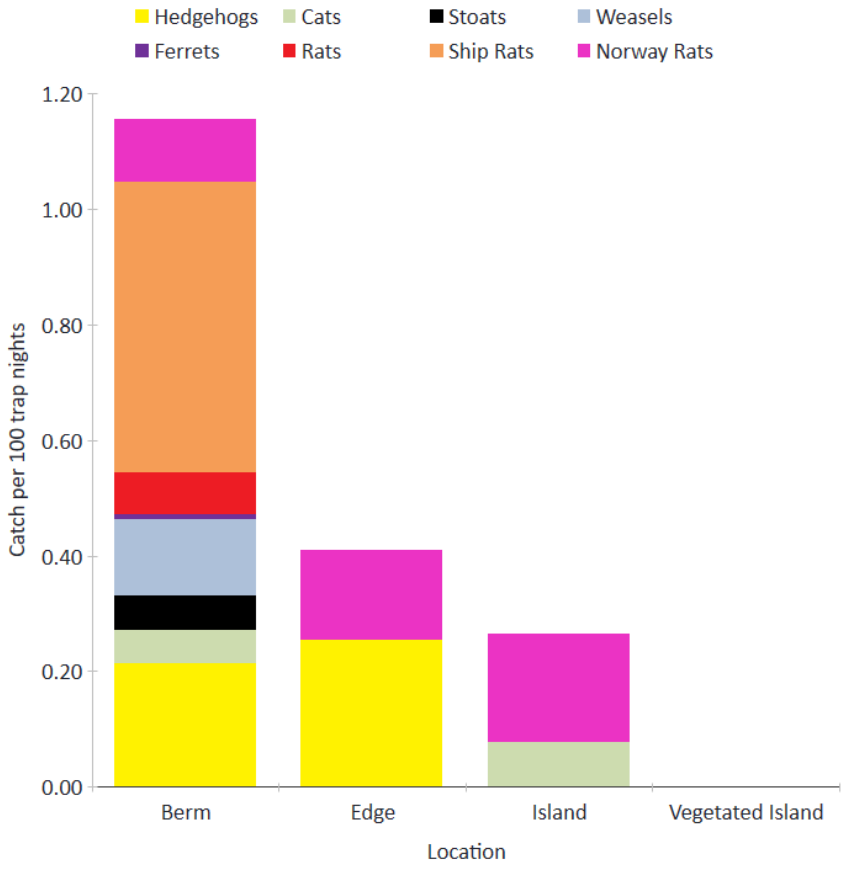

Figure 54. Catch per hundred trap nights by location.

Figure 55 shows that live cat trap catch rate was very much higher (off the scale of the chart) than that for Timms traps. These traps were only used for a period of a few days in a few different locations, before being shifted. If they had been left in one place, the rate would no doubt have been lower. But it seems clear that they are very much more successful than Timms. The problem is that they must be checked every day and cats caught must be shot (if adjudged feral) or released if domestic. We don't have the people to do this on a scale large enough to make a difference. The DOC 150 run through traps were the most successful for Norway rats, but this was largely because they were out on the river near colonies. Some were put in before and after the nesting season though – with little or no catch in these periods. Results from Fenn traps have been disappointing. It had been hoped that

they would be more effective against Norway rats for trap-shy animals than the larger DOC 150 traps. Latest results, after this reporting period, are different – with Fenns being much more effective.

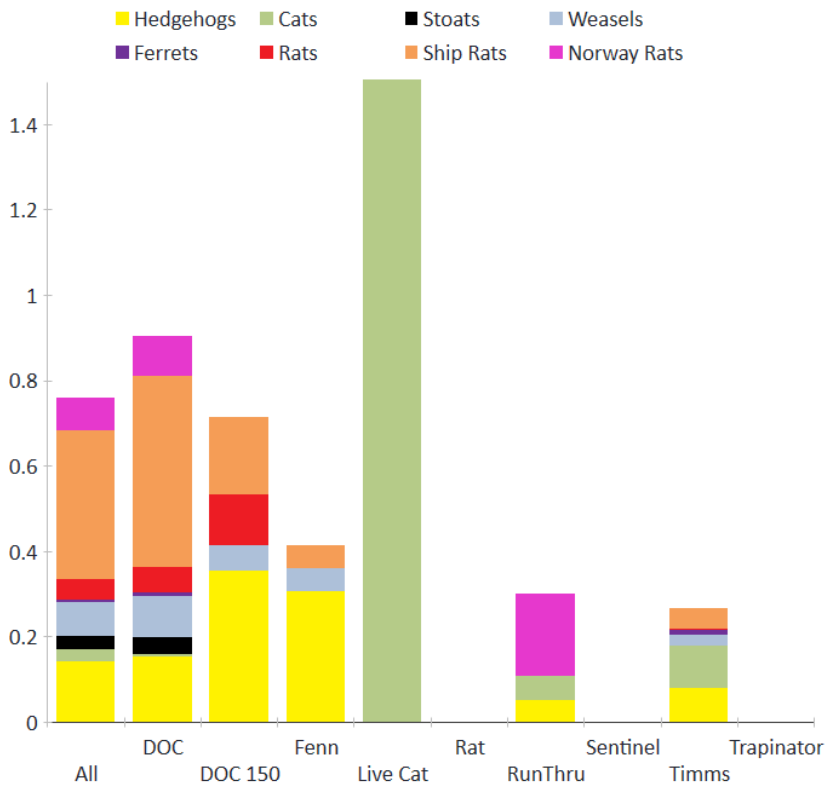

Figure 55 .Catch rate by trap type

Detection of Rats by Dogs

Wildlife Protection Services (Leona Kirk) carried out three days of work from 3 to 5 August 2023. The aim was to explore the southern berm and adjacent fairway to try and find Norway rat colonies that could be dealt with before the nesting season started. Her report is available through ARRG and she provided GPS points and tracks so her findings could be followed up.

The first area explored was Line F where by far the most evidence of Norway rats has been found in the last year. Figure 56 shows results (2022 imagery).

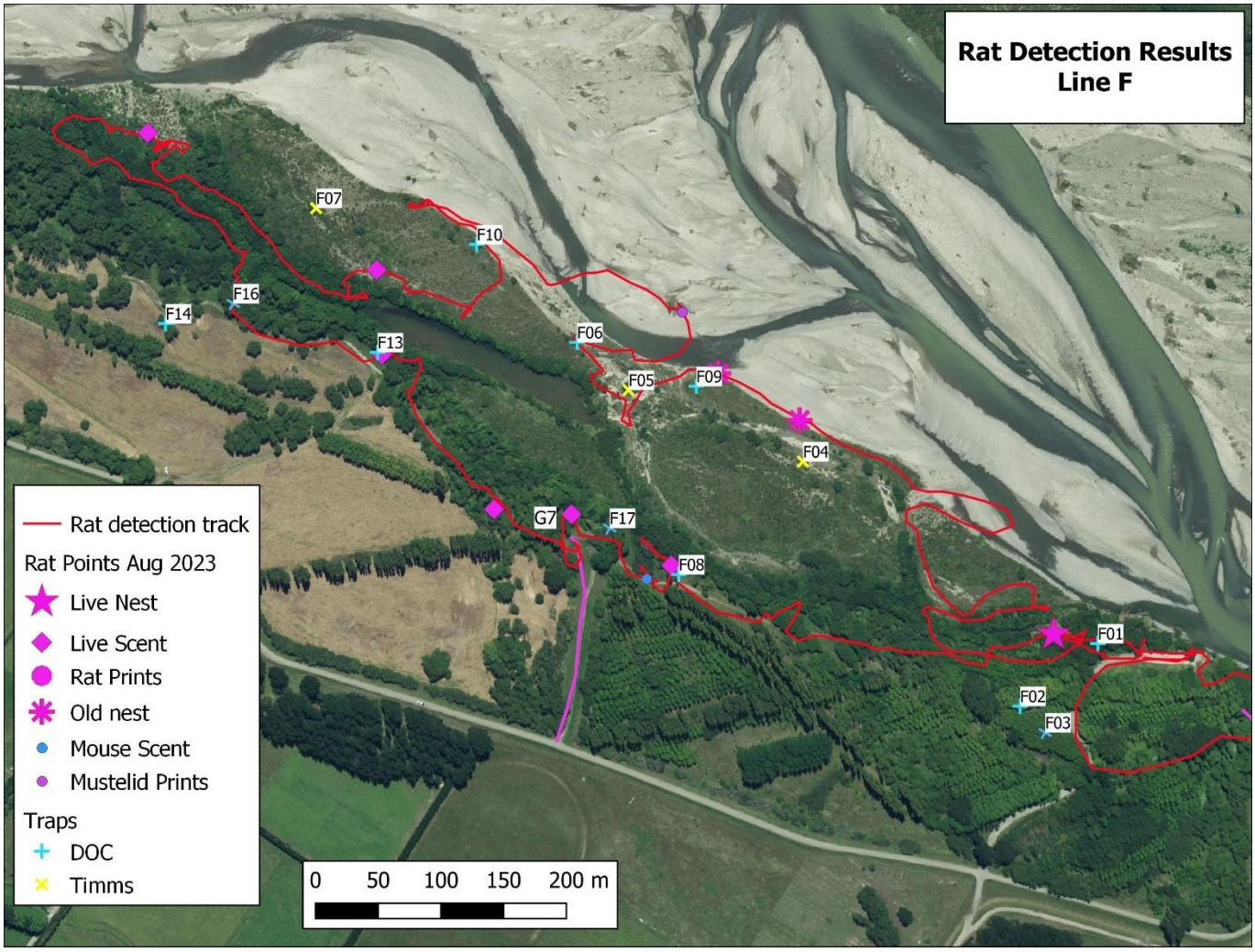

Figure 56. Rat detection results along Line F

An active rat burrow (star on map) was found about 35m from trap F01 in which 10 Norway rats had been caught in 2022 – 2023. This was just above water level, had 2 entrances and what looked to be another under construction upstream from it. When dug out it was found to go 30cm into the bank, then it followed the bank upstream for only about 4m (Figure 57). No rats were dislodged. Two interpreted old nests were found along the bank of the berm. They appeared to have been almost completely eroded by the July flood. Live scent was found in several places, and tracks were later found in mud upstream from the burrow.

In this area there is a large pond which has been cut off from the river but is fed by underflow. It has a stream running out of it which has been incised into muddy ground – the mud is probably partly there because of the presence of a groyne not far downstream. The entire area had been underwater in the recent flood, and the ground was still saturated, so rats could perhaps not be expected to be found in burrows.

More traps are needed in this area. Other similar places do exist along the river, these should also be targeted with more traps.

In several other locations down the berm rat prints and scent were found, not all these locations have been followed up. On the fairway just down from G4, the dogs indicated a rat nest under a big tree, other indications of rats were found nearby.

Off G2 a burrow was found in the berm bank, the dogs indicated live rats there. Trail camera photos of rats were obtained here. The burrow was dug out, but it extended for only a few tens of centimetres and no rats were found. Another indication of live rats was found on the bank of a small vegetated island – rats and a stoat were

Figure 57. Dug out rat burrow on river bank.

seen on trail camera photos here too. Rat prints and scent were found elsewhere in the area – mainly under piles of debris.

A large loader from Cresslands was used to move debris and flatten off the small island banks. Debris was also shifted on an island directly off from G2 where BFT were gathering. No rats were seen. It was planned to move the loader downstream to G1 and upstream to G4 to follow up similar rat sign, but the river crossings were dangerously soft.

On the edge of the fairway off G1, another very small rat burrow was found on a bank under some debris. Rats appeared on trail camera photos there too. There were other indications of rats nearby.

Eastward of the rail bridge, on the edges of the berm and fairway, prints and scent were found – but no sign of nests. Some of these indications could have been of Ship rats. A traverse out onto the fairway at Railway showed no indications of rats.

The July 23 flood would have cleared all rats from the fairway, it was interesting to see that they had gone out there soon after it – presumably looking for food. Most evidence outside the nesting season points to very few rats being there.

This sort of work requires significant follow up, which ARRG are not well placed to do. But it has given us a better idea of where to look for Norway rats.

Bait Trial and Trail Camera Predator Detection

A trial to compare the bait that ARRG uses (eggs, peanut butter, meat) with salmon food pellets and mayonnaise is being done on Line E. Three pairs of DOC 200 traps with these different baits were set out in very similar places under large willow trees, they were monitored with trail cameras. These locations were between 160 and 500m downstream from the Cones Rd bridge – on the north bank. In addition, the existing traps were baited with one of these three alternatives. Results have yet to be assessed, however it was realized just how difficult it is to carry out a meaningful trial. For example, all traps must be the same, a trial needs to consist of a large number of traps

being checked for a long time – probably at least year. Also, it would need to be done over several parts of the river where different predators are dominant. For example, no stoats and relatively few Norway rats have been caught on Line E for at least 4 years, and only one stoat has been seen on a trail camera photo. Line F has caught many stoats and Norway rats.

Some opinions on results –

- Mayonnaise appeared to be the less effective bait. Sometimes it wasn't even touched by mice. It tends to quickly grow a hard skin and probably lose its smell. Advice from Excell was that in their experience it isn't very effective.
- Salmon food pellets and our usual suite of baits seem similarly effective. However, the pellets can be completely eaten out by mice within a week.

Initially cameras were just placed at the pairs of traps – cameras 1 to 3. Then from 7 June an additional two traps were placed in very similar areas without traps or any bait. Figure 58 shows sums of distinct predator visits at each camera until late August 2023, the first graph shows just the three initial cameras, the second shows results from all cameras for the shorter time period.

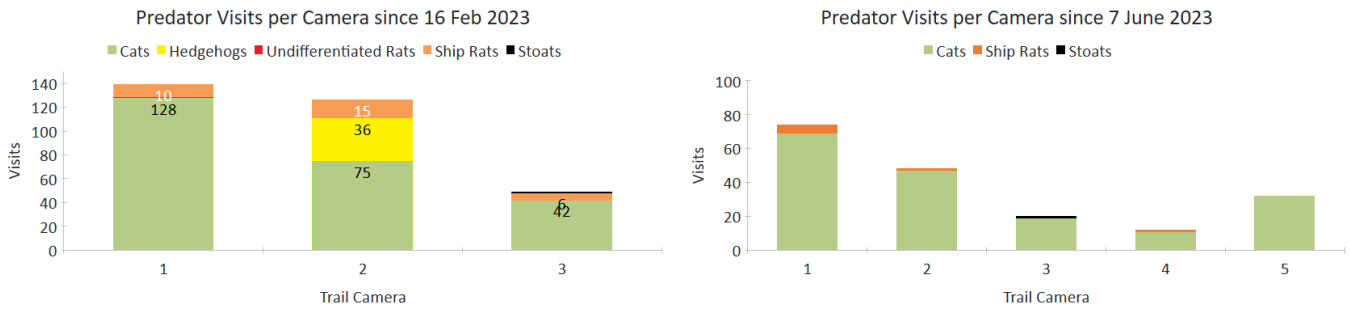

Figure 58. Predator visits at traps

Cats were the most common visitor, and 15 individual cats could be recognized – although this needs reassessed as small skinny tabbies can look very similar. Half a dozen of the cats were clearly domestic – large well fed good looking cats, one with a collar, one owned by a neighbour. The others were interpreted to be feral – small, skinny, mainly tabby but also tortoise shell and ginger, perhaps black. One was seen eating long-dead rats thrown out of traps. They are mainly night visitors. A few months into the trial most cat visits were by one particular small tabby – it was seen at all sites and at all times of day and night. Cats were often seen at the cameras without bait – showing them systematically patrolling the area. One Ship rat was seen at a camera without trap or bait. Cat kill traps cannot be used in this area due to proximity to houses.

Figure 59 shows all animal (cat, dog, rat, mustelid, possum, rabbit, hare and mouse) visits. Mice are the most frequent visitors (but only where there is bait to eat), they can run in and out every few minutes. Sometimes two can be seen at once. Possums very commonly visit or pass by the traps and rabbits are often seen at cameras 4 and 5. Possums have been known elsewhere to eat braided river bird eggs, but we have no evidence of this on the Ashley. There is a little more grass around cameras 4 and 5, probably explaining rabbit presence.

Figure 60 shows predator visits per day at cameras 1 to 3. Hedgehogs stopped visiting in April. Cat visits increased, but in the last couple of months they have been by one cat. Ship rat visits declined. One stoat was seen.

Figure 61 shows all animals at these traps – the most obvious feature being that mouse numbers increased rapidly from April.

Some conclusions:

- This work has shown that in this area the most common predator seen has been by far the cat – probably mainly feral ones. They are not only drawn to the traps, but systematically patrol the whole area.

- Visits by rats and mustelids are not that numerous – and this is the most productive trap line on the river. The impression is that the berm is not absolutely swarming with predators – despite record catches and no sign of reducing catch rates.
- The abundance of mice at the traps seem likely to attract larger predators. However, we are feeding and no doubt breeding them very well and the effect on insects and lizards near our traps might be measurable.
- Gaining a measure of predator abundance on the berm would be a massively difficult and expensive exercise with cameras or anything else – but cameras would be much preferable to tracking tunnels or chew cards.
- Cameras should be used though for detecting and further understanding the habitat of Norway rats – our most important predator. It appears that they frequent the bases of banks, especially in areas where they are muddy and burrowing is easy. Traps, or possibly poison, could then be placed for short periods in these places, long term trapping would probably result in traps being washed away.

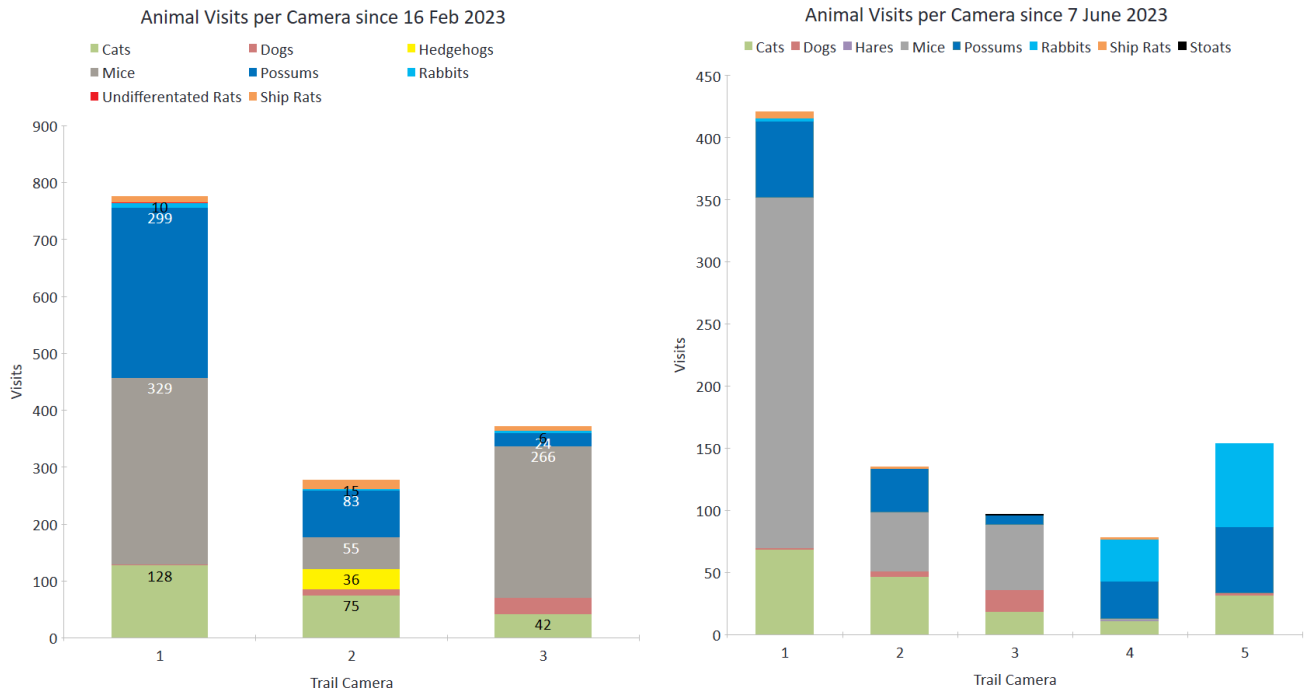

Figure 59. All animal visits to traps

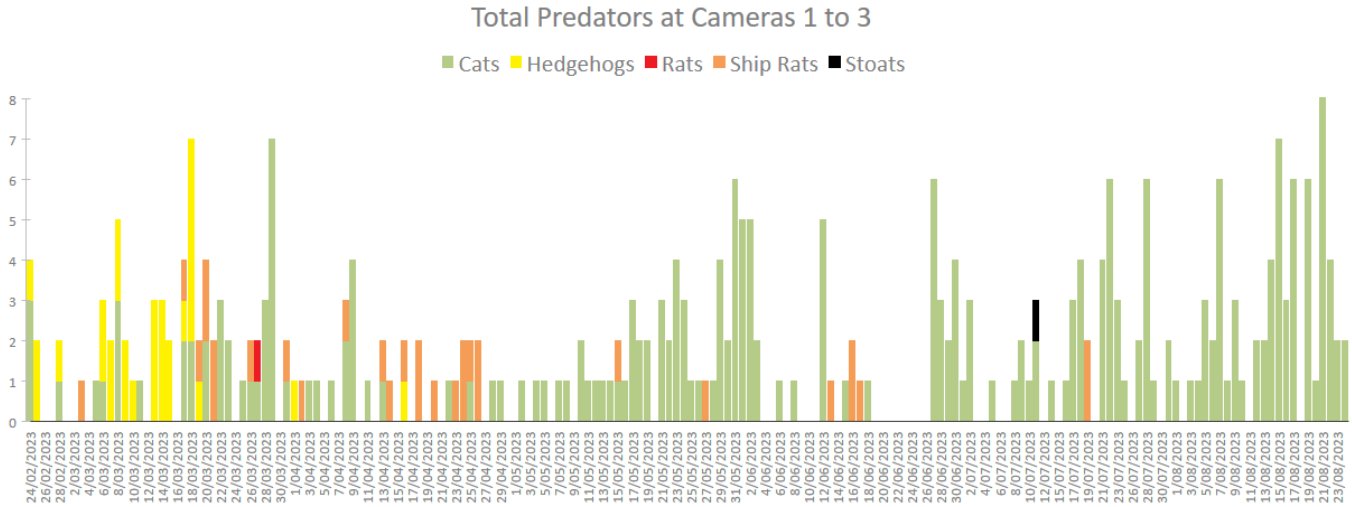

Figure 60. Total predator visits at traps over time

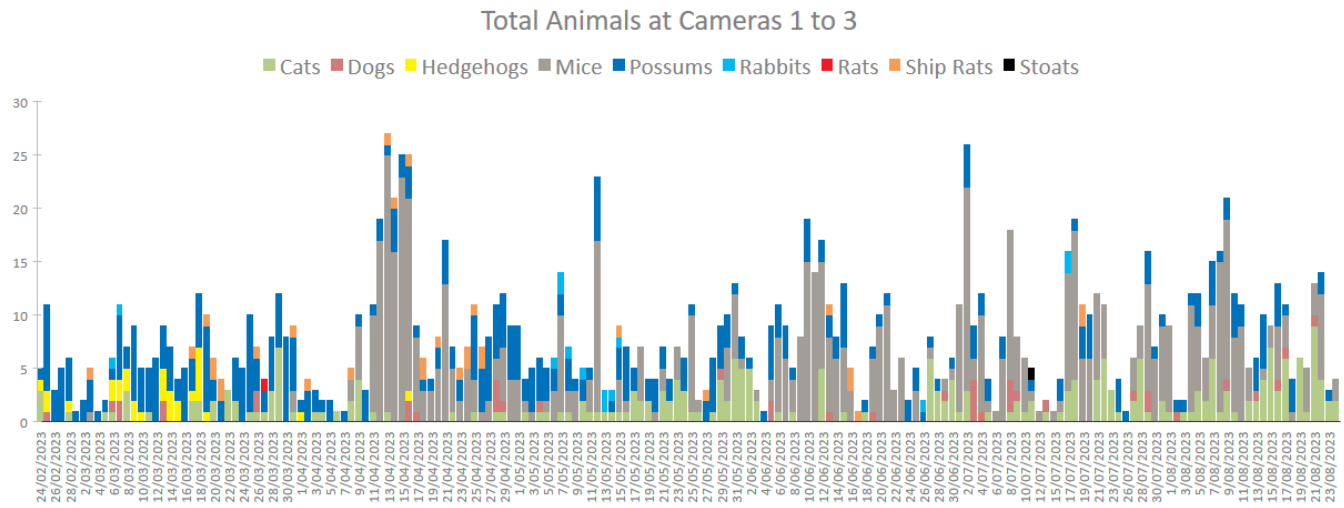

Figure 61. Total animal visits at traps over time

6.1.1 River Trapping Conclusions

- Along the river total catch this season was greater than ever due mainly to a Ship rat boom and to the temporary addition of around 100 traps paid for by ECan. Catch rate rose from 0.58 last year to 0.76 – mainly due to the Ship rats.
- Norway rats are our main predator, 83 were caught this year compared to 69 the previous year. Most were caught along the south bank of the river where we used the services of a dog handler prior to the 2023 season. Much evidence of rats was found and followed up, but no rats were killed.
- More evidence emerged that cats are a significant threat – a cat at one of the BFT colonies took eggs, chicks and at least one adult.
- Catch rate over time is not declining and there is no reason to believe we are having an impact on predator numbers. Comparing annual count numbers to trapping results is not a valid measure of success.
- Much further work is necessary on understanding and controlling Norway rats. Continued and increased use of dogs will be essential. Poison needs to be tried again. We need to hunt these rats, not wait for them to come to our traps – which they often avoid.
- More live cat trapping is needed.

6.2 Estuary Traps

The trap lines have remained very much the same as last year, other than a few slight movements and replacements for a few lost.

Total Active Traps	**127**
DOC	**112**
Timms	**2**
Trapinator	**13**

As with the river trapping, there have been some changes in trappers during the year – there are currently 9 volunteers. Bait used has remained the same – other than the addition of salmon food pellets and the substitution of golf balls for eggs.

Figure 62 shows monthly catch per hundred trap nights since trapping began in mid-2018.

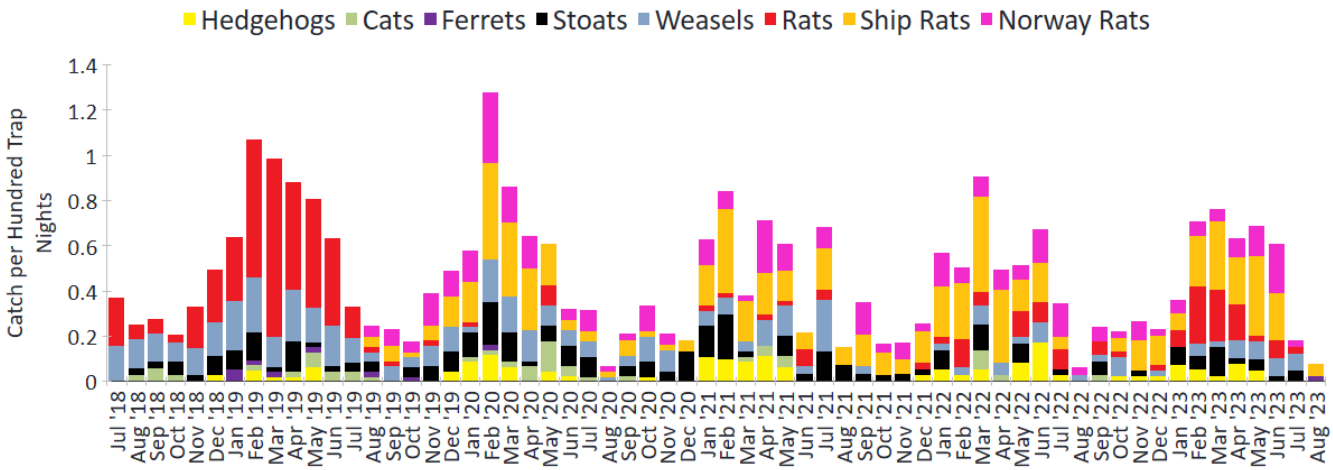

Figure 62. Estuary monthly catch

The following table shows catch since the start of trapping in mid-2018, Figure 63 shows that catch rate increased for the first time this year.

Period	Hhogs	Cats	Stoats	Wsls	Frts	Rats	S Rats	N Rats	Total	Trap Nights	Traps	CPHTN
Aug 18 - Jul 19	8	13	27	74	5	156	0	0	283	45,141	109	0.63
Aug 19 - Jul 20	17	17	44	51	3	8	84	58	282	49,654	135	0.54
Aug 20 - Jul 21	22	6	36	37	0	7	59	35	202	46,843	128	0.43
Aug 21 - Jul 22	16	4	17	12	0	18	71	33	171	45,346	124	0.38
Aug 22 - Jul 23	14	1	19	21	0	36	65	31	187	45,159	124	0.41
Total	**77**	**41**	**143**	**195**	**8**	**225**	**279**	**157**	**1125**	**232,143**		

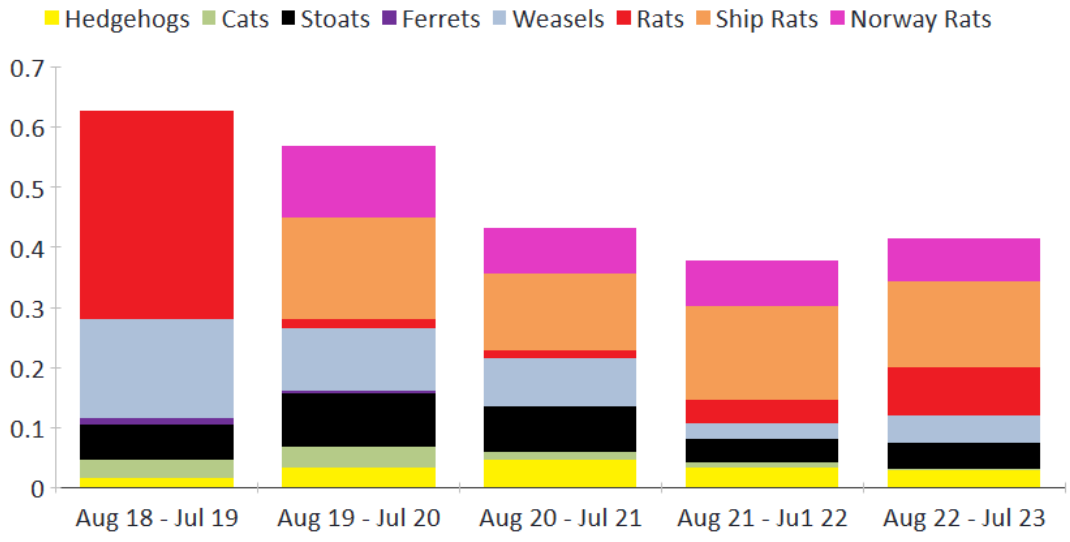

Figure 63. Estuary annual catch per hundred trap nights

Comments on the 2022 – 2023 Catch

- Total rat numbers were up slightly, mainly through unspecified rats.
- Weasel numbers were up slightly with hedgehogs and stoats very much the same.
- Cat numbers continue to decline – the Trapinators need to be checked.

Figure 64 and Figure 65 show species catch per line. Of particular note are:

- Traps on Line G was as usual the most productive line, with half the catch being Ship rats. This line is in trees along the edge of farmland.
- Norway rats appear to be most abundant on the lines between SH1 and the estuary proper – this is similar to previous findings.

Note that for most of the year the southern mouth of the estuary has been cut off.

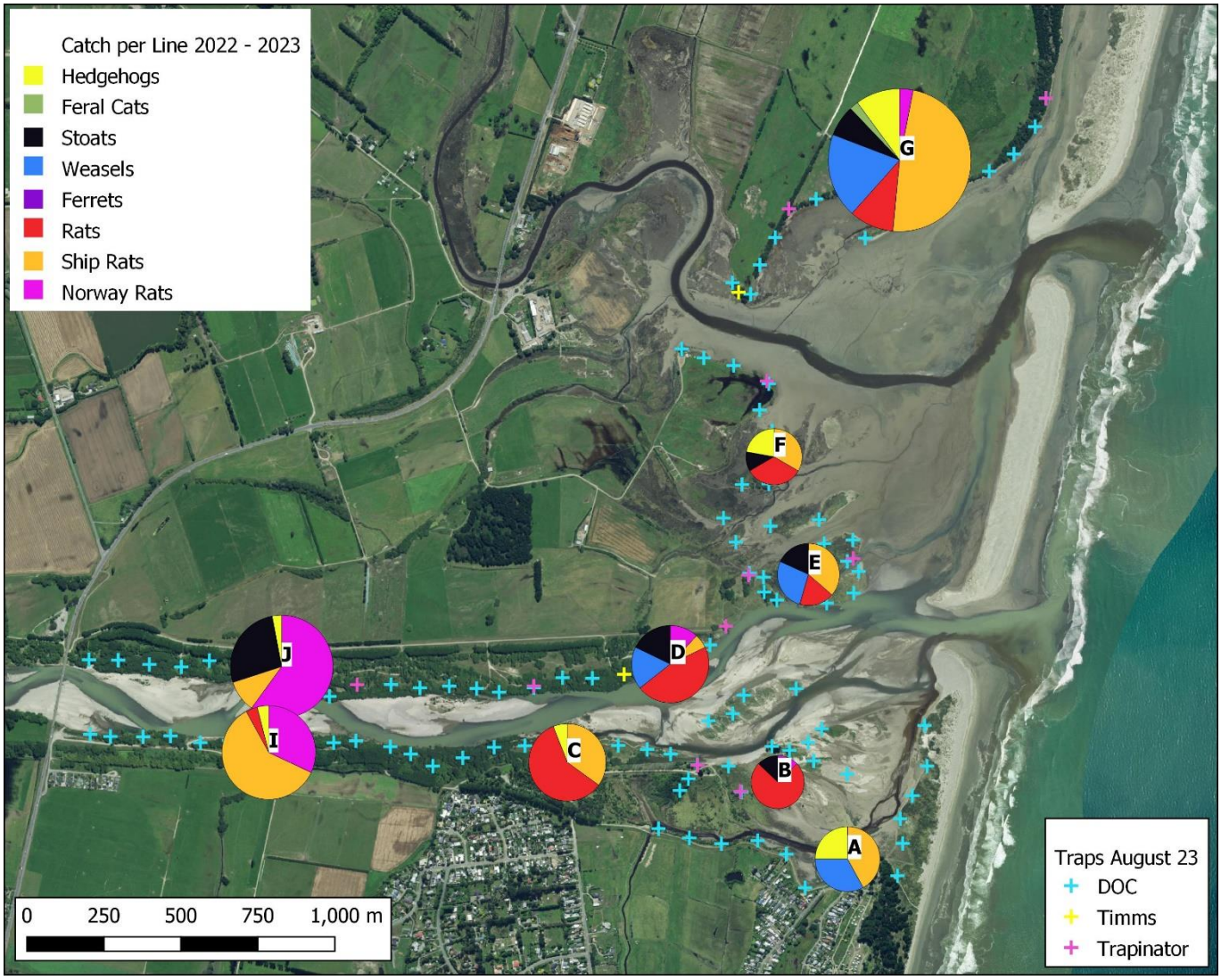

Figure 64. Estuary catch per line showing area.

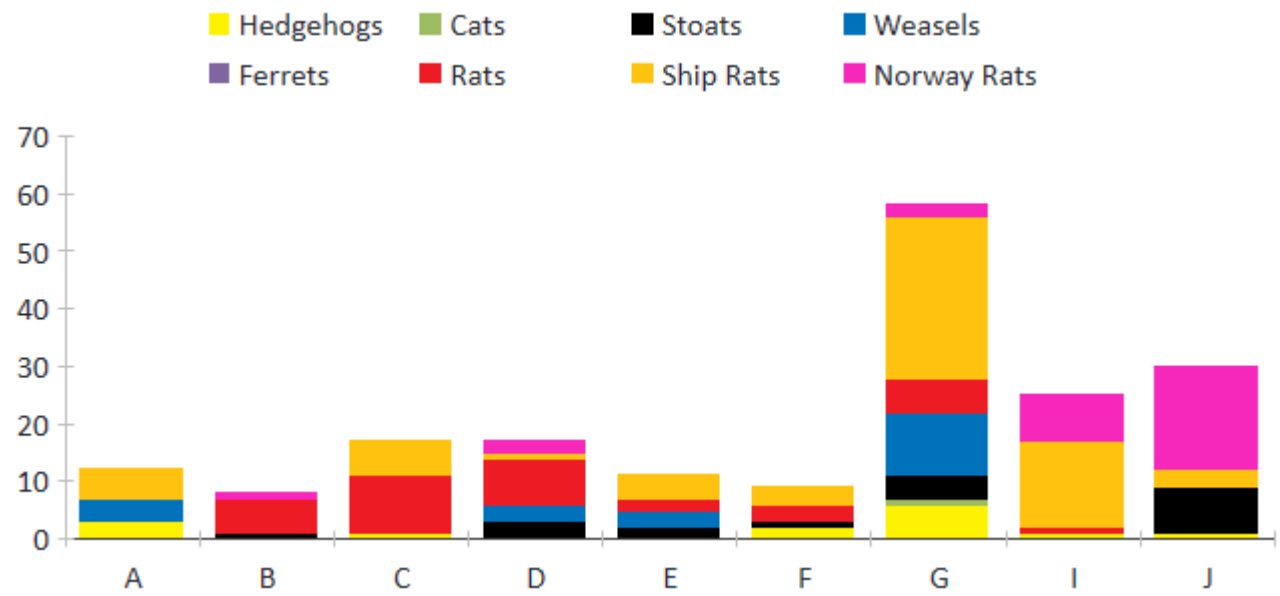

Figure 65. Estuary catch per line.

6.2.1 Estuary Trapping Conclusions

For the first time since we began trapping in 2018 catch rate has increased – due to greater rat numbers. Norway rats, the worst predator, have occurred in greatest numbers along the lower part of the river – before it meets the estuary. Some misidentification of rat species has happened along here, with Norway rats probably being under-represented.

7. Human Disturbance

Every nesting season, from 1 September to 31 January, ARRG and ECan block off as many entrances as possible to the river between the Okuku junction and SH1. ARRG scout out places to block and inform ECan of the number of new concrete blocks required and where to drop them. ECan supplies and transports the blocks and arranges a contractor to place them. ARRG then supervises the installation – usually this is spread over 2 days. The concrete blocks are dug in with the wire rope loop downwards – only the most determined 4wders will then move them. Some of the entrances to the river have gates, on or soon after 1 September ECan staff lock these, sometimes concrete blocks have to be placed inside the gates. ARRG place signs at most blocked entrances.

In the 2022 season 17 new blocks were required. There are several entrances which are difficult or impossible to block – these include at SH1, an area upstream from Toppings Road, near the Makerikeri junction, upstream from Swamp Road and from the Okuku River.

The impression this year was that fewer vehicles were out on the fairway. However, motorbikes and quadbikes were quite commonly seen. Figure 66 shows a 4wd straddling a BFT nest and a trail camera. The bird returned within about a minute. Another trail camera photo showed someone, in the same colony, throwing sticks for his dog. They knocked over the camera, which was about 1.5m from the nest. The bird returned and hatched a chick. Our birds are remarkably resistant to disturbance, but we need to keep such disturbance to a minimum.

Figure 66. 4wd within centimetres of BFT nest

A few 4wd and motorbike tracks were mapped through all the BFT colonies, but no nests were known to have been destroyed.

On Crate Day in 2022 a large number of 4wds drove between the Okuku junction and the Ashley gorge. This is outside the area of ARRG, but we monitor this and try to advocate for change. Hopefully stronger measures will be taken against this event in 2023.

Human Disturbance Conclusions

Given that all entrances to the river downstream from the Okuku confluence can't be blocked, the incidence of 4wd disturbance this year was low. There are problems with pedestrians, especially those with dogs, and with motorbikes and quad bikes. Efforts to warn and educate people should be maintained.

8. Gravel Extraction

Gravel extraction is of concern to ARRG for the following reasons:

- The cumulative impact of excessive gravel extraction in rivers (known internationally as instream mining) is to aid the conversion of braided rivers to single channel rivers. This has been documented in many peer-reviewed papers.
- Braided river birds on the Ashley nest preferentially on islands where they have a degree of safety from predators. High islands give some protection from floods. If the natural braided character of the river is destroyed by constriction and gravel extraction, obviously there will be no islands.
- Whilst gravel extraction often benefits the birds by removing weeds, it also often damages the nesting environment by lowering or removing islands and reducing flow around them.
- It can result in disturbance of birds, not just from mining operations, but also by improving access to the river for the public.
- These operations are often unsafe for the public and our members – especially where trucks cross stopbanks on narrow roads with no visibility.

Three extractors currently have consents on the river, and several more have been operating under authorizations downstream from the SH1 bridge. ARRG has given presentations to all the consent holders on the birds and especially on how to take gravel so as to improve rather than damage the natural character of the river – by creating shallow braids, preserving and enchancing islands and removing weeds. We also gave a presentation followed by a field visit, to consents officers.

We have been trying to emphasize to ECan that all applications for gravel should be accompanied with quite detailed mining plans (as are all mining applications internationally in reputable jurisdictions) to show how extraction can meet flood protection aims in a way that enhances the natural character of the river. These would include up to date imagery (drone, airphoto or satellite) with the proposed mining area and method shown. We do not seem to be achieving much traction on this, as the ECan emphasis is on rehabilitation plans – when if mining is done properly in the first place, very little rehabilitation is required. We have also been trying to improve safety standards – which have historically been dreadful. When ECan have machinery working, there are NO ENTRANCE signs. When gravel miners are operating, there are commonly no signs at all. This can lead to trucks driving rapidly over single lane stopbanks with no visibility.

As a result of complaints by ARRG to WorkSafe, WorkSafe asked ECan to call a meeting between these parties, extractors and local councils to discuss safety. This doesn't seem to have happened.

ARRG has also commented on the inadequacy of the Assessment of Environmental Effects submitted with consent applications. The quality of these strongly suggests that applicants see applications as rubber stamping exercises. Consultants who write these AEEs usually appear to have no firsthand knowledge of the rivers involved and they use the same document for all rivers – sometimes not even replacing all the river names. For example,

an application to take gravel from the Ashley can have Waipara River all through it. The only issue recognized for birds by these consultants tends to be disturbance, habitat issues are not recognized. ECan have long been aware of the poor quality of AEEs, but do not appear to be addressing it.

Southern Screenworks have 180,000 cubic metres granted (for 4 years from 20/12/21) between the railway bridge and SH1. They outlined two areas where the bed was above the calculated levels – in the Marchmont – Smarts area, and just above SH1. They started operations in the first half of 2022. The former area includes an important nesting location, especially for BFT and wrybill. SSW have been very cooperative with ARRG, genuinely interested in the birds and their habitat, and are very proactive regarding bird welfare and habitat and also on safety. They have refrained from taking gravel from a high and historically important nesting island, they paid for and carried out a diversion around a drying island (under ECan supervision) and applied for a consent to put in culverts to cross the river to take gravel from the northern side of the island. Unfortunately, this consent took 8 months to be granted and may not be exercisable during the nesting season. The recent flood has resulted in the island being perhaps too far from water to be used by BFT.

SOL applied to take 302,000 cubic metres from two locations – between the Rangiora road and railway bridges, and an area near the airport. They were granted 152,000 cubic metres over 4 years from 3/6/22 from the latter area. They have been rarely seen on site, but have been extracting in the method we suggested – creating a new and quite wide braid. Small floods wipe out signs of extraction, meaning that very little rehabilitation has been necessary. Unfortunately, safety standards are poor. Trucks leave the river over a single lane stopbank, usually with no signage. On one occasion perhaps a dozen trucks, from several companies, were operating.

Nor West Contracting Limited applied for 99,500 cubic metres from an area about 2km down from the Okuku confluence. They were granted 62,400 cubic metres on 20/7/22. Operations have also been done in the manner we suggested. In this area there aren't the dangers to the public that exist in most parts of the river.

There was to be a review of the Canterbury Regional Gravel Management Strategy during the year, but this has been postponed. Hopefully when it is revived, ARRG can submit on it.

Gravel Extraction Conclusions

Major progress has been made with the methods of gravel extraction – the three current consent holders seem to be cooperating with ARRG.

9. "Hedgehog" Consent

Work has been underway by ECan for quite some time to process a consent which will enable creation of islands and rechanneling of water around them. Guidelines for this work have been completed and hopefully the consent will be useable in the 2023 nesting season. Such a consent will –

- Encourage birds to nest in particular places – most species favour islands for nesting.
- Allow raising of islands to protect against floods.
- Provide some protection against predators – hedgehogs in particular do not seem to swim to islands. Good flow around islands will no doubt deter some cats.

In the 2022 SSW, at their own cost and with ECan approval and supervision, created a channel along the south side of the large island within their consent area. Unfortunately, few birds nested in the area.

10. Tree Planting

Several areas on the berm have been planted with native trees by ECan in the last few years. Due to lack of care, most of these plantings have had poor success. One which obviously was tended with spraying had almost 100% success, others which were allowed to grow over with grass had not much better than 50% success.

11. Braided River Revival

Several years ago ECan realized that the braided rivers in Canterbury have become much degraded over many decades. They instituted a braided river revival programme to address this. The Ashley/Rakahuri was chosen to be the first of nine rivers to have a plan written over the next ten years. ARRG were told that our river was first on the list because of the efforts we had made and knowledge of the river we had gained. This work was underway nearly 4 years ago by the time David Owen visited the river on October 25, 2019. We spoke several times with him, and visited the river with him at least twice, but were not asked to submit anything in writing, it was a mistake that we didn't do so.

It wasn't until 7 November 2022 that we saw a draft of this plan, we had asked to before this, but were told we couldn't until the iwi had finished with it.

What was initially referred to as a plan has now morphed into the Rakahuri/Ashley River Revival Strategy. Firm actions which we expected to be proposed have been replaced by a strategy to develop them. The strategy now appears to be a joint venture between ECan, Mahaanui Kurataiao Ltd (MKT) and Ngai Tuahuriri Runanga – something we were not initially aware of.

There are a number of major problems with this strategy, they include:

- Nearly four years into the process, no concrete action has been taken. Where will we be in ten years?
- Astonishingly the strategy does not explain why the Ashley needs to be revived, what is wrong with it, what caused these problems and exactly what is it that should be achieved? This is the most basic information which needs to be stated and quantified at the start. As an example of what needs stated and illustrated - ARRG work has shown that the fairway area of the river between the Okuku junction and SH1 is now 56% of that in 1942. The reasons for this are management related – lack of weed control, planting of pines and unnecessary restrictions of the river with willows and poplars.
- The strategy does not cover water quality, water quantity or the estuary. This is because agreement couldn't be reached with MKT on these issues.

ARRG provided detailed written feedback on the strategy and had a meeting with BBR staff in April 2023. There has been little reaction to our feedback. A local newspaper reported on June 8 that there will be public consultation on the strategy later this year. If the strategy is in the same state as when we last saw it, nothing useful can be expected to be achieved. If the problems are not clearly explained and illustrated to the public, people will have no idea what the issues are or the need for the strategy.

In February 2021 the website The Conversation published an article by nine river scientists entitled *Why we should release New Zealand's strangled rivers to lessen the impact of future floods*. More room for rivers would of course be just as important for the environment as for flood purposes, especially for braided river birds. Making room for rivers to move has become a catch phrase, and this was the title of the Rivers Group conference in 2022. An ECan engineer presented strongly in favour of this concept on this topic at the conference and also at the 2023 BRaid Seminar. One of the points he made was that positions of lines might need changed. This refers to (probably among other things) what is called, at least on the Ashley, the vegetation control line – basically a demarcation line between fairway and berm.

An April 2023 Stuff article illustrates how famers have encroached upon braided rivers. ECan comes out of this very well, as no mention is made of their role in encroaching on the Ashley, Orari or Opihi rivers.

Unfortunately, on the Ashley ECan engineers are continuing with all the old practices. New pole poplars are being planted which will cement in place the current area of the fairway – usually in places where public flood protection is obviously not the aim, but protection of ECan-owned commercial pine forest is. The wisdom of having the pine trees where the river used to flow and which need protection from floods has been brought up by ARRG many times – but our concerns have not been addressed.

In the last phase of poplar planting in June 2023, which we were informed of, we asked how it could be justified given the aim of giving rivers room to move. This was asked of several ECan staff, we have yet to get a reply, and the trees have been planted. ECan consistently ask for public feedback, but when they get informed feedback which they don't like, their default reaction is often to simply ignore it.

Figure 67 is from the 2021 Braid Seminar presentation – it shows where a fire burnt some pine forest and the pines were replanted and protected by pole poplars. Note that the river is quite constricted and single channel just upstream from here, and that the area planted is up to 400m from the stopbank. The willows fringing the edge of the river remained in place after the major flood of 2021.

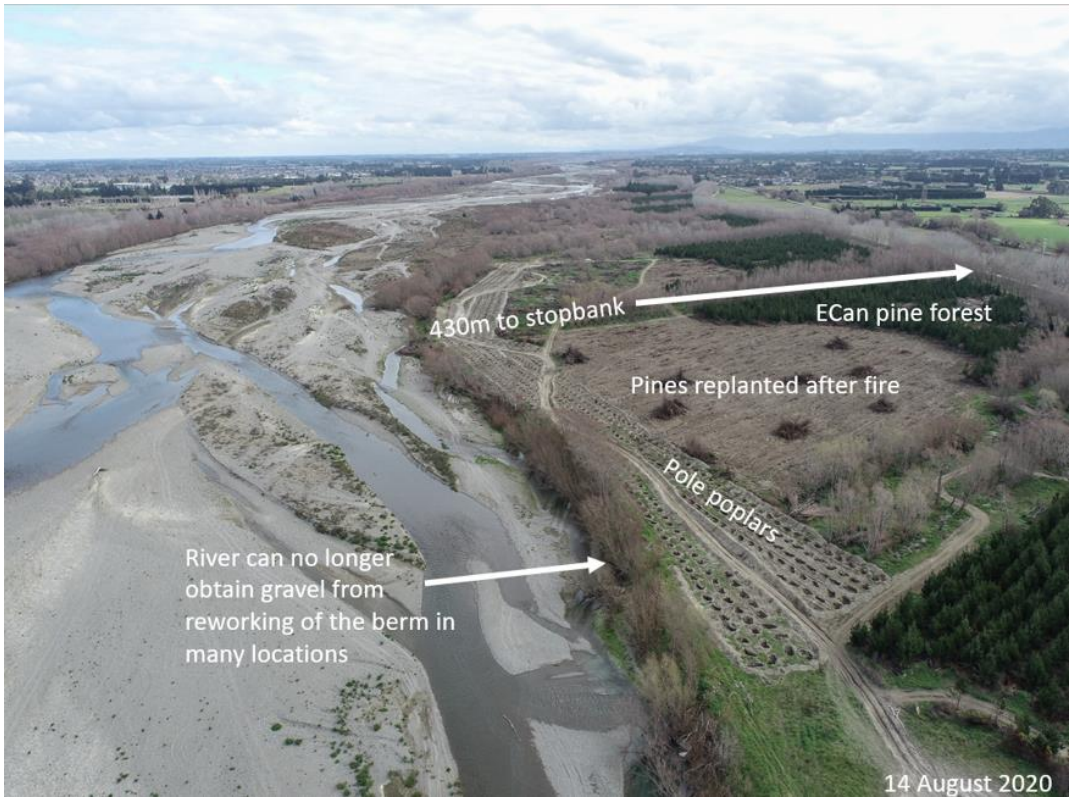

Figure 67. Area of new pines and poplars, August 2020

Figure 68 shows the same view in June 2023. The cleared areas were planted in August 2023 with more pole poplars.

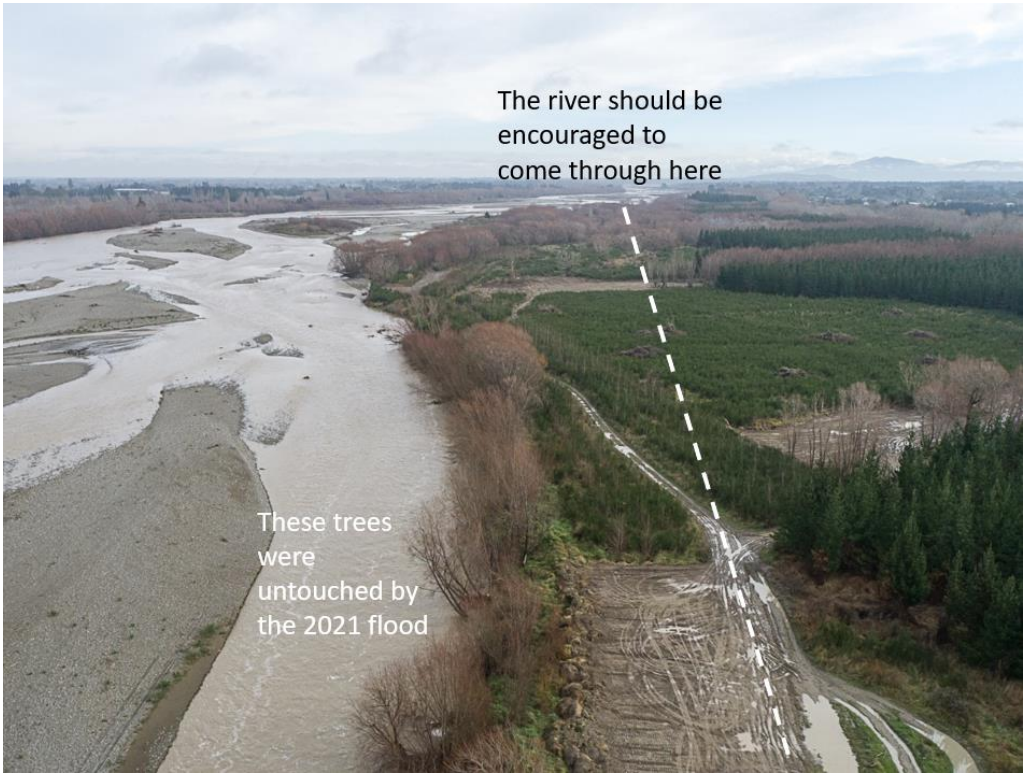

Figure 68. Same area as previous figure, August 2023

At the same time as planting trees to protect commercial pine forest, other places where there are real flood protection concerns seem neglected. Figure 69 shows the progression of erosion in recent floods just upstream from the Cones Rd bridge. The satellite image is from 2022. Another large flood will probably see the trees that protect the stopbank being eroded and some flow running along the edge of the stopbank immediately upstream from the bridge.

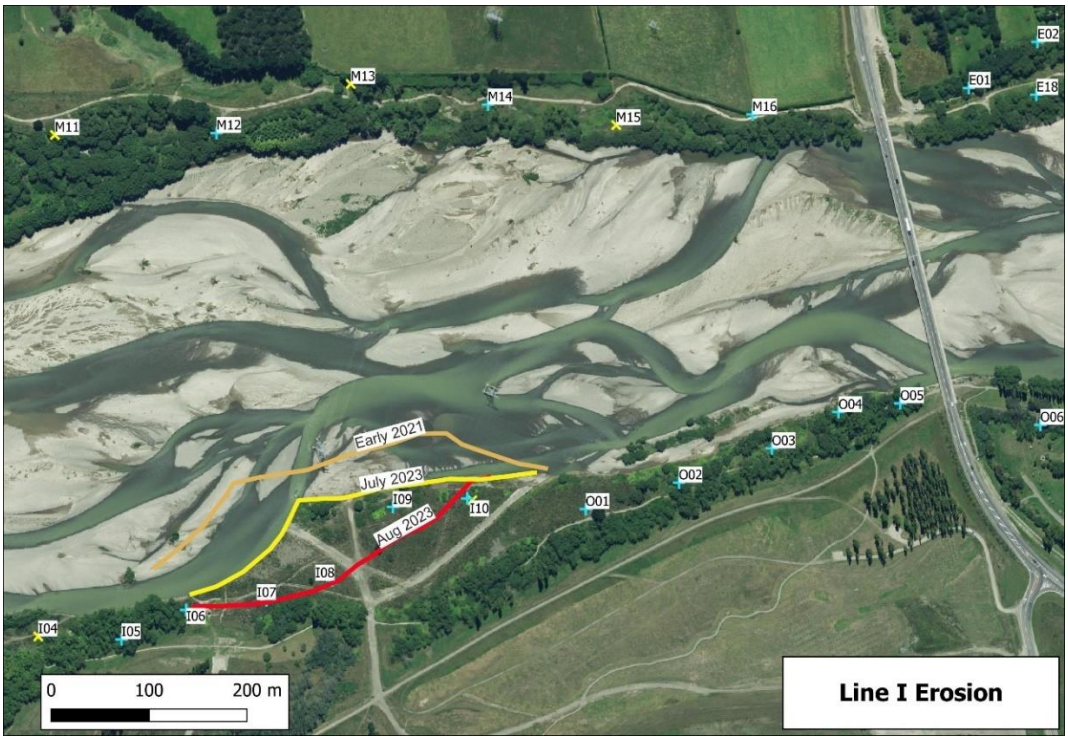

Figure 69. Erosion of an area upstream from Cones Road

Figure 70 shows the situation a few metres upstream from the bridge. The ECan flow monitoring equipment would be extremely vulnerable to the next flood, trees are falling into the river just upstream from it, the erosion is within about 5m of the stopbank and the riprap protecting it is obviously inadequate.

Figure 70. Erosion immediately upstream from Cones Road

The vegetated island (ARRG refer to this as the Golf Links Island) in the left midground of Figure 68 causes the river to consist of a single channel and to be forced against the south bank – where a lot of money has been spent on the groyne and in reinforcing the bank just down from it. Until the vegetation on this island is removed, probably by bulldozer, this situation will continue. ARRG have asked river engineers and BRR staff many many times for this to be addressed. At one stage firm agreement was made to do it, but nothing happened. There is a similar situation on the north bank between the Rangiora road and rail bridges. The river is forced against the south bank by mature gorse and broom on what should be fairway along the north side of the river. These islands are not only flood hazards, they restrict bird nesting and feeding habitat.

Progress was made in a recent field visit with BRR staff and river engineers. There are plans in development to spray the vegetated island mentioned above and some strips along the edge of the berm. There was agreement to explore encouraging erosion of these areas with some bulldozer work – making steep banks for the river to gain traction. If this isn't done, spraying alone probably won't be successful given the regrowth rate of weeds.

12. Upper Ashley River Braided River Revival Scheme

Spraying of weeds and removal of dead willows has been done along the Ashley between the Okuku junction and the gorge. This is outside the original geographic area (between the Okuku junction and SH1) of ARRG, but it impacts on our area. Explanations, from the ECan website, are given below:

> In late 2020 we secured from the Ministry of Business, Innovation and Employment's Kānoa – Regional Economic Development & Investment Unit (MBIE – REDIU), towards works to help improve climate resilience for the Ashley community and commenced in early 2021.
>
> Why are we doing this?

Flood protection

The Ashley River/Rakahuri is a key feature of the North Canterbury landscape and one that poses a major flood risk to the local community living on its floodplain. For this project, costing about $1 million, we are planning to remove exotic vegetation (mainly willow and brush weeds) which is currently choking a 21-kilometre section of the river between Ashley Gorge and the Okuku River confluence, and in the Okuku River. Left unchecked this vegetation is a flood and erosion risk, occupying the channel and forcing flood waters towards farmland. Weed growth can also contribute to the loss of aquatic habitats and nesting areas for native birds.

Protection and restoration of our braided rivers

Braided Rivers are a precious and iconic part of the Canterbury environment. We are prioritising the protection and restoration of their unique values as part of our *Braided River Revival/Whakahaumanu Ngā Awa ā Pākihi* work. As a result of the introduction and invasion of weeds, predators, and human activities, braided rivers and their bird species, plants, native fish and insects are under threat. Through this project in the Ashley River/Rakahuri, and others across the region, we are working on the restoration of our rivers normal braided character, which will in turn will enhance a range of natural biodiversity values, including natural braided river habitats.

ARRG asked for further documentation of this plan, we were especially interested in seeing how maintenance of this work would be carried out – as restoring the river will not be a single effort but will require work spread over decades.

When the idea of doing this work was first mooted, ARRG argued against it. We thought the money would be best spent looking after and improving that part of the river downstream from the Okuku junction – and if any money was left over, extending upstream. We thought that the large amount of funding involved for many years in maintaining any improvements made above the junction would impact on later funding for that downstream of it.

In mid-2023 ARRG (Grant Davey) spent about a week analyzing air and satellite photos of this part of the river dating back to 1942 in an effort to understand how the river became overgrown, what the impacts of it are, and what the impacts of restoring it might be. Imagery from 1942, 1956, 1970, 1977, 1998, 2000, 2017, 2020, 2021 and 2022 was used. The effects of the 2017 one in ten-year flood and the 2021 one in one hundred year flood were particularly looked at. Field visits were made to three locations – off the ends of Glentui-Bennetts Road, Bowicks Road and Garrymere Road. This is the sort of work that should have been done by ECan before applying for the funding. The results of it haven't been properly written up, but a case study of an area (around the Gary River confluence, was presented to ECan BRR staff. Some main points of the study are:

- The second objective of the revival work can't be argued with. But the flood risk in this section of the river is not clear – whilst the flood risk below the Okuku confluence is extremely high. Above the confluence there are no roads, bridges, buildings and very little farmland that is at risk from the river. The only possible significant flood risk perhaps comes from the faster moving (as it is channelized) water debouching into the fairway downstream of the Okuku. However, an ECan engineer informed us that their work might make the flow slower.
- It did not appear that any of the willow along the river was planted for flood protection, it seems to have spread from higher up and from tributaries and to have gradually built up over time. In 1956 there was little willow along the river, Glentui River and Washpool Stream appear to have been the source of some of it. From reading old books from Canterbury settlement days, fast-growing trees such as willows, poplar and gums were used for shelter and for firewood. Broom was also used for shelter. This may have been the original source of the willows and broom. The above-mentioned tributaries, and the Gary River, are still choked with willow – this will rapidly reinfest the Ashley requiring constant spraying.
- Prior to the 2021 flood approximately 153 ha of berm and vegetated islands between kilometres 0 and 13 down from the gorge had been sprayed – this area is extremely obvious on satellite images from April

2021. Both scrub and trees seem to have been very effectively killed and appeared totally brown. Much of the spraying was in areas which the river cannot possibly naturally reclaim the berm in decades (centuries?) – interiors of bends etc. In several locations areas up to more than 200m from the fairway edge were sprayed. Approximately 26 ha of willow trees were cleared from the area sprayed prior to the flood. Trees from the later sprayed area were also cleared, but this was not done prior to the 2022 air photos. Satellite images from February 2023 show the sprayed areas very green with regrowth.

Since the 2021 flood approximately 81.5 ha was sprayed between Km 13 and the Okuku junction – Km 22. This also includes broad swathes of berm which cannot be expected to return to fairway for decades/centuries. On satellite imagery these areas are already very green with regrowth. When will the next flood that can reclaim significant fairway area be?

- The below graph (Figure 71) depicts the changes in fairway area (not including heavily vegetated islands within the fairway) since 1942. There isn't full coverage of the area by 1942 photos, so the entire area of fairway was extrapolated with reference to the 1956 photos. The large floods in the early 1950s increased the fairway area over that in 1942. The 2021 flood, which was almost exactly a one in one-hundred-year event (AECOM New Zealand Limited, 2019) significantly increased the fairway area. It seems highly unlikely that spraying done prior to this flood would have influenced the fairway area.

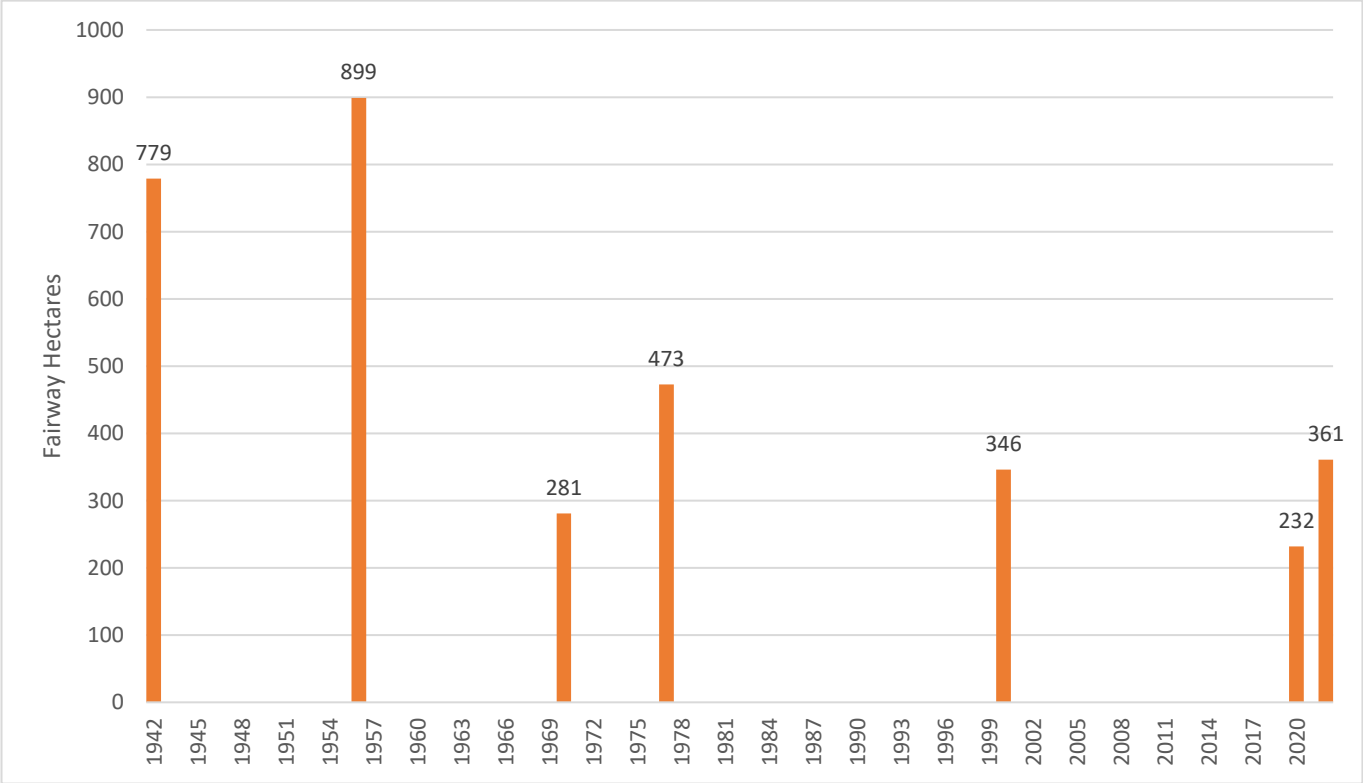

Figure 71. Fairway areas, Gorge to Okuku confluence, 1942 to 2022

- The next graph (Figure 72) shows how total length of braids in this section of river has changed over time. As has been seen when doing similar exercises for the lower Ashley and lower Opihi rivers, such large floods do not result in a significant increase in braiding, they can sometimes reduce the amount of braiding. The ratio of total braid length (45km in 2022) to reach length (22km) of just over two is almost the same as that for the lower Opihi (Davey work). In the lower part of the Ashley the ratio is approximately 3. Braided river birds require braiding, a ratio of 2 means a very poor environment for these birds. It may be many years before the river between the gorge and Okuku can become a significant habitat for these birds, or presumably other fauna and flora which require braided rivers.

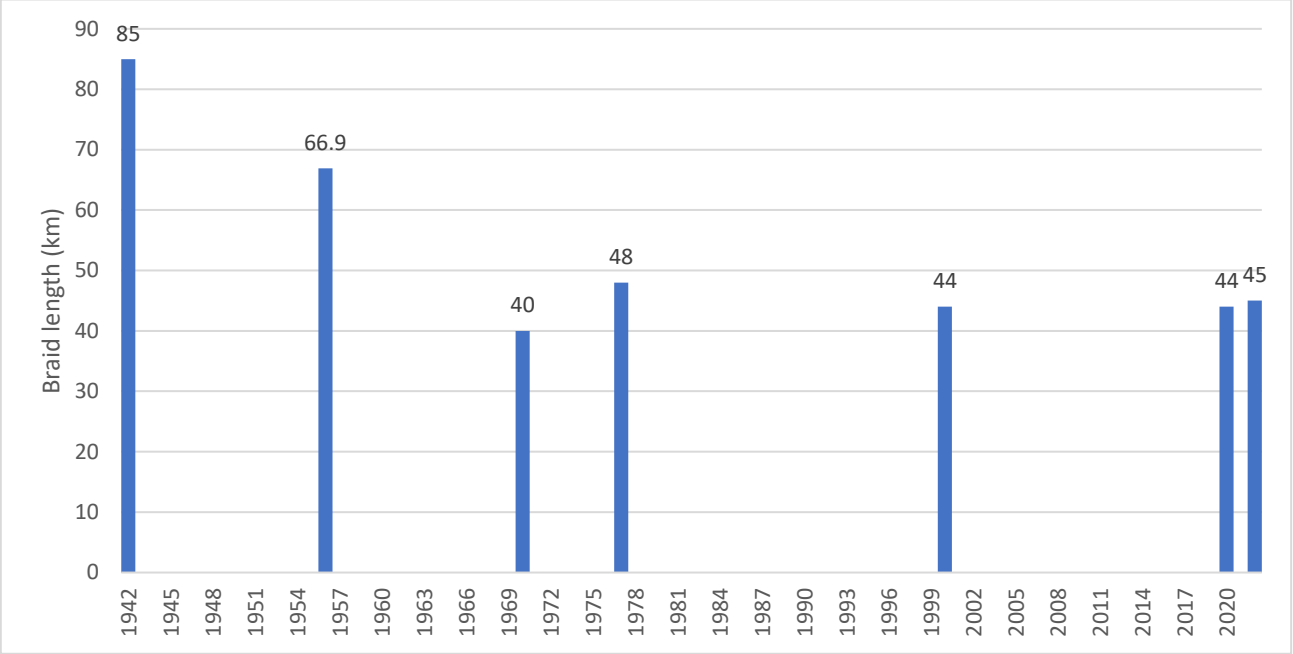

Figure 72. Kilometres of braids, Gorge to Okuku confluence, 1942 to 2022

- There has been next to no encroachment by farmers onto what was the 1956 fairway – 30.9ha compared with the area of the fairway of 899ha – 4%. 0.8 ha of this was pine trees. The constriction of the river has been by scrub and willows – mainly from the activities or lack of activity of the Catchment Board and ECan.
- As shown by the high (15m approx.) terrace risers, this is a rapidly incising section of river. During floods, when the river tops the berm, the vegetation causes water to flow slowly over it and fine sediment is deposited enhancing weed growth. The water flows faster in the channels and all the erosion is confined to these narrow intervals. Gravel extraction downstream will cause additional incision. As a consequence of the above, river channels here seem to have been incised about 1 – 2m below 1942 levels. For the river to expand over what was berm in 1942, the berm must be eroded. Figure 73 below is from 2020 Lidar data and is a cross section from just above the Gary confluence.

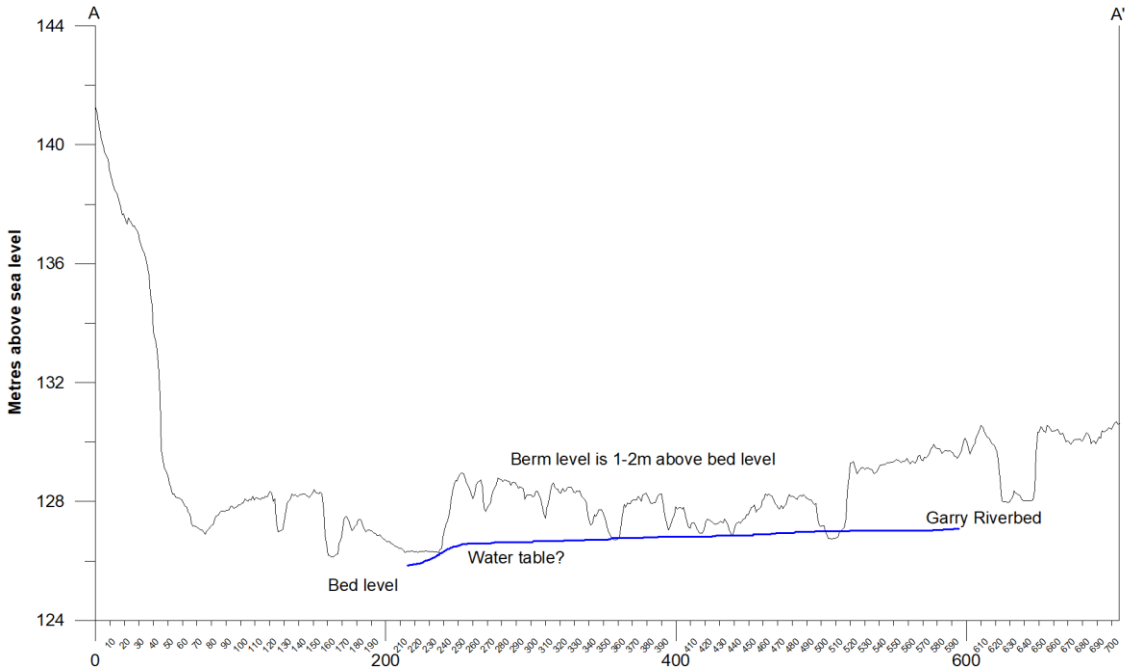

Figure 73. Lidar cross section, Garry River confluence

- From experience in the lower part of the river (and what has happened here), conversion of berm to river channel is always by bank erosion. The river running over part of the berm doesn't create channels, if it has no purchase, it can't erode. It may to some extent remove vegetation, but it doesn't significantly erode gravel. When floods ebb, the water will return to the old fairway channels – and to those parts of it extended by bank erosion. It would be expected that most erosion of the berm would occur where flow was directed at the bank rather than parallel to it. This proved to be the case. In the 2021 flood 53% of the eroded areas occurred at a bend in the fairway, 18% at a protrusion of the berm into the fairway, 18% for little apparent reason along the edge of the fairway and 18% was on islands. Steep banks will encourage erosion, as will flow directed at the bank by islands. The main process by which fairways grow will probably be by downstream migration of bends and protuberances – these areas should have preferential spraying or clearing done. Bends should also be created by earthmoving. If banks parallel to the flow of the river were steepened/dug out, this would also encourage erosion.

  Of the area eroded, 70% was scrub with some scattered willows, 26% was willows, 4% was pasture and 1% was pines. The percentage of 2020 fairway edge with trees was 52%, scrub 44%. So, vegetation is a good predictor of whether an area will get eroded or not. But when confronted with bank erosion – especially when the river is directed straight at the bank, willows are readily swept away. When willows and poplars are at fairway level, they are very difficult to erode. When atop a bank of a metre or even less, gorse and broom seem to do nothing to inhibit erosion – spraying this vegetation seems to achieve little.

- The precise objectives of the revival work in this area are not clear, but presumably they are to widen the fairway. If only 0.5m thickness of berm erosion is assumed in the 2021 flood (very conservative) the area measured from air photos as eroded results in more than 450,000 cubic metres of gravel being added to the fairway. This will be directly or indirectly the source of the large amount of gravel which accumulated in the lower part of the river and was deemed to be a flood hazard. Bringing the width of the fairway back to what it was in 1956 would contribute millions of cubic metres and a very large flood hazard to the area below the Okuku confluence. Thus, this work, if successful, will actually increase rather than decrease the flood hazards in the Ashley catchment.
- Since 2021 there has been rapid and significant growth of weeds on what was then the fairway. Figure 74, a 2023 photo, shows part of the area of a quite large and productive BFT colony in 2021 – the growth of broom makes this impossible as a nesting area now.

Figure 74. Broom regrowth of fairway - area of 2021 BFT colony

- Since gorse and broom etc. were sprayed on the berm, there has been impressive regrowth. Figure 75 shows the area along the edge of the spraying and willow clearing near the mouth of the Garry – sprayed since the 2021 flood.

Figure 75. Regrowth of area sprayed and cleared of willows.

- It might take longer to return the river to its 1956 state than it took to cause the damage. A few decades of damage will take many decades to reverse. Fixing the damage will involve geological processes (erosion) when damaging it was mainly due to botanical processes – tree and scrub growth. In places willow trees which weren't properly killed are growing again, and new willows are popping up. Gorse is also growing, but slower. What was the purpose of spraying such large areas if the weeds just regrow – do ECan have the funds to constantly spray this part of the river?

The first priority for revival of braided rivers needs to be looking after what currently exists. Overly ambitious schemes are probably counter-productive. There is much that needs to be done in parts of the river where work would be sustainable – see previous section.

In a recent field meeting with ECan staff some of our concerns were allayed and it seems that some spraying of fairway areas which are nesting habitat will be done. There is some expert opinion which is contrary to ours – that the work done to date will be successful in improving the river. However, we still don't understand why such large swathes of berm were sprayed and can't agree that significant advances can be made without expensive further work.

13. River Flow

Figure 76 shows maximum daily flow at the gorge during the year. This obviously doesn't show flow into the ARRG section of the river from the Okuku or Makerikeri etc., it but gives a good indication of flood events. There were two damaging floods during the nesting season, the worst being on 19 November, the 248 cumecs being sufficient to cover most islands and sweep away many BFT nests. This was the largest November flood on record – since 1972. A smaller (68 cumec) flood on 20 December also took away a number of black-fronted tern nests.

A flood of 394 cumecs on 23 July 2023 was sufficient to mobilize much of the gravel on the fairway and remove weeds – leaving nothing to impede nesting.

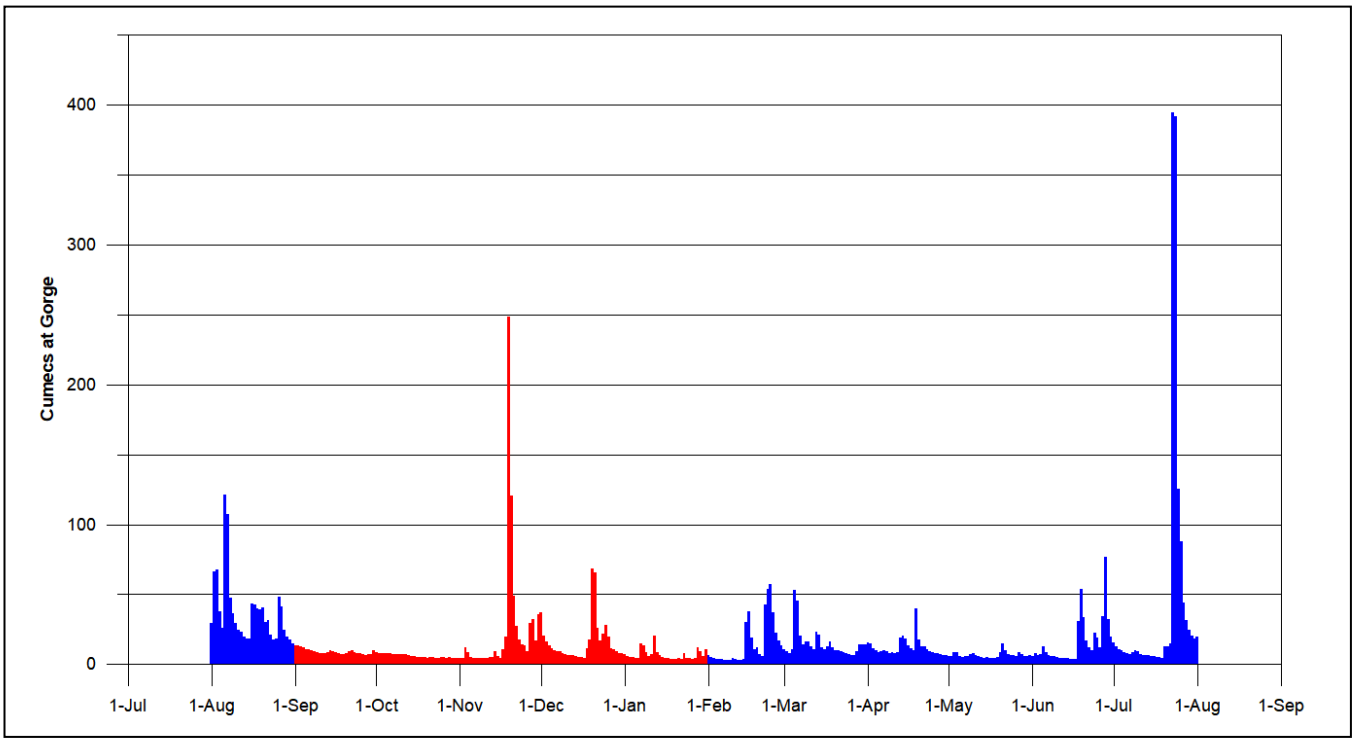

Figure 76. Maximum daily flow at gorge, red shows nesting season

14. Ashley Estuary Study

ARRG has been trapping around the estuary since mid-2018 but no work was done to assess the benefits of it. To remedy this we twice applied for (and gained) funding through the ECan Waimakariri Zone Committee and arranged for a student (Eleanor Gunby) under the supervision of a University of Canterbury academic and Rangiora Resident (Jim Briskie) to carry out an MSc thesis on the area. Aims of this were –

- To identify the causes of nest failure in waders and other waterbirds in the Ashley River
- To determine the role of local microhabitat features in nest success

- To assess the role of human disturbance on the foraging behaviour of waders
- To assess the role of black-backed gulls on the nesting behaviour of waders

As Eleanor was involved in course work and exams until mid-November, ARRG helped out with the study until then – so as to not lose key information from the beginning of the 2022 nesting season. The study area was flown by drone and a composite georeferenced image generated. This did not have surveyed ground control, so accuracy was limited to a few metres. A GIS workspace was set up with QGIS, this was used in the cell phone app QField to locate and monitor nests and to map the locations of some of the bird species. Figure 77 shows the study area and some of the observations made. A progress report written by Eleanor and delivered to ARRG in February 2023 is appended.

It became very readily apparent that there were major problems at the estuary – due to an infestation of southern black-backed gulls (SBBG) and to human disturbance – featuring pedestrians, dogs, vehicles and motorbikes, even aeroplanes. Some particulars:

- In 1993 there had been 33 BD nests (Kearvell, 2011) along the southern part of the spit. During the mid-1990s there were actually BD nests all along the spit (pers comm Andrew Crossland). In the early part of the 2022 – 2023 nesting season no nests were found and it was rare to even see a dotterel in this area. Two reasons for this were obvious – disturbance and the large population of SBBG. Detailed long-term study might possibly result in other explanations. During the early to mid part of the 2022 – 2023 nesting season there were two mouths of the river. Later on, the southern one closed leaving the entire spit much more open for disturbance. This was the case at the start of the 2023 – 2024 season.
- BD nesting was confined to a small area where the river meets the estuary – an area where vehicle and motorbike disturbance is rife – at all times of day and night.
- A large colony of white-fronted terns (WFT), estimated number of birds approximately 1,000 began nesting along the spit, just north of the mouth. The colony was dispersed at night by SBBG with the only evidence of its existence left being SBBG tracks and broken eggshells. A trail camera set up to observe the colony showed some SBBG in the colony area, but it had been bumped offline and evidence wasn't as clear as it could be.
- BBG made three attempts to form a colony off Raupo Berm where the river meets the estuary. Trail camera photos showed vehicles being driven through the birds during the day and at night. White baiters reported seeing someone throwing a ball into the massed birds for his dog to retrieve. The third colony attempt was successful – as the birds chose more secluded area where vehicles weren't driving through.

For these and other reasons, ARRG could not wait for completion of the thesis and commenced some advocacy work. Organizations and media approached have been:

- Waimakariri District Council staff.
- The WDC council.
- The Woodend – Sefton Community Board.
- Environment Canterbury staff from several sections.
- DOC.
- Forest and Bird.
- The Rangiora airfield and the Civil Aviation Authority.
- The North Canterbury News.
- A talk on estuary bird life was presented in the Waikuku Beach hall on through the Waimakariri Biodiversity Trust.

Results to date:

- ARRG is involved in the Northern Pegasus Bay Advisory Group and will be preparing a written submission for the Northern Pegasus Bay Bylaw review – submissions will be from November. We are aware though that without proper enforcement such bylaws have little impact. Most impact on disturbance issues can probably be gained from education and publicity.
- The ECan braided river revival team agreed to carry out a programme of SBBG nest and egg destruction through the 2023 – 2024 season.

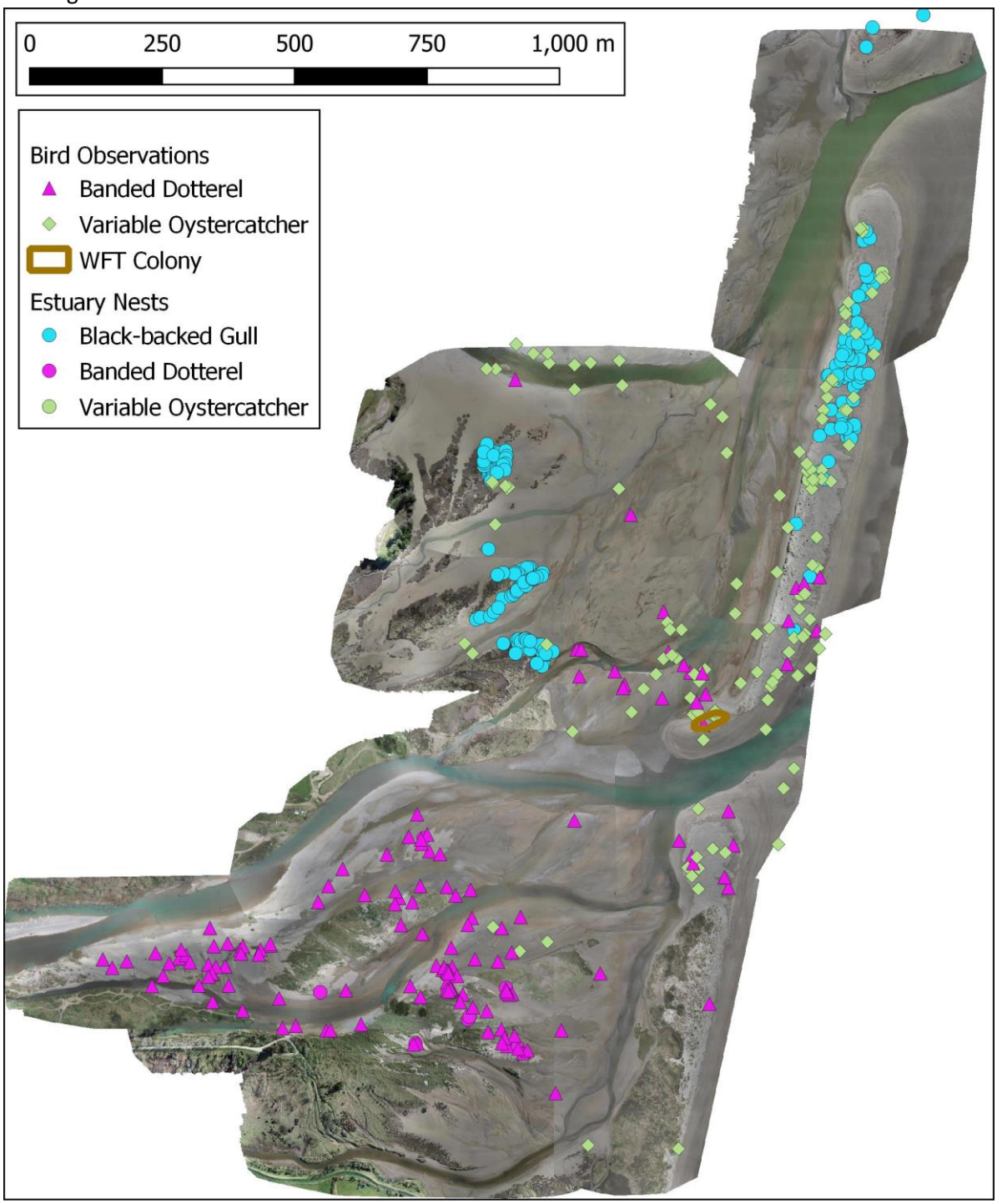

Figure 77. Estuary study area and some observations

15. Invertebrate study

ARRG volunteers again took part in a dryland invertebrate study on the river. It's a project run by DOC science advisor – threatened species, Dr Tara Murray, and funded by Environment Canterbury.

Unfortunately, we got off to a late start. Floods kept us out of the river, so the first action took place in the river on December 9th. As usual the project required us to set up one malaise trap and five pitfalls at six sites. These were left out for five days then dismantled and the samples collected and sent to DOC. We did the set up in December, January and February.

In January the equipment was vandalised with a malaise and pitfall parts thrown into the river at one site and at another two waratahs were stolen.

This project, done for the past three years, was a good fund raiser for ARRG and provided an opportunity for members to participate on some work on the river and get to know each other.

16. Administration

16.1 Structure and Meetings

A flat management structure continues to work successfully in the administration of the group. The Operations Team covers river work of bird counts, habitat maintenance, monitoring, and trapping and is led by Grant Davey. The Communications Team addresses stakeholders and media and is led by Judith Hughey, who maintains the Facebook page. Our website maintenance is contracted to Sonny Whitelaw. Promotional work is undertaken on an ad-hoc basis by available and interested group members. The Administration Team is led by Sue Mardon as Chairperson and Treasurer, with Minute Secretary tasks provided by Robert Clark. The group's email address secretaryarrg@gmail.com is managed jointly and provides outreach to 180 members.
Four General Meetings were held during the year including an Annual General Meeting. Meetings were attended by an average of twenty members, with ten apologies at each. Each of these meetings were preceded by a meeting of the Management Committee that is made up of two officers and six members elected at the previous AGM. Prior to meetings, team reports and agendas were sent to all members in our email group. This invited open discussion at meetings, better use of meeting time, and negated the need for supplying printed business papers at meetings.
Management Committee members each have different interest areas in ARRG work. Throughout the year members correspond by group email to share ideas, report on river conditions and bird sightings, to seek committee approval to undertake tasks and actions, and arrange meetings with stakeholders as required.

16.2 Communications

Public awareness of our group's aims and work has been maintained through our Facebook page, our website, and articles in the local newspapers and other media.
The website https://www.arrg.org.nz is updated with reports, news items, statistics, stories, and meeting dates that are forwarded to our website manager. Over the year online advertising of traps for sale has resulted in many queries, orders and sales.
Our Facebook page https://www.facebook.com/ashleyrivercare is administered by Judith Hughey who posts new items.
Judith also maintains a roster of Management Committee members who are interviewed monthly on the local CompassFM radio station to keep the community updated on happenings on the river. Judith also arranges guest speakers to open our general meetings.
Visits to North Canterbury schools have continued throughout the year. Nick Ledgard uses a power point presentation of the river and birds, shows the set of predators, and gives each child an endangered bird bookmark. The purpose is to educate children on the importance of continuing protection of the river's

endangered birds, to pass information onto their families, and hopefully interest the children as adult to continue the Group's work.
In September 2022 the group was involved with the Conservation Week River Cleanup Day. In March 2023 we took a display table to the Tuhaitara Open Day. Also, in March we were at the 3-day Waimakariri Volunteers Expo where we gained interest from new members.

16.3 Financial

This year the Group received income of $34,316 with expenditure of $27,655 giving an annual excess of $6,661, leaving a bank balance of $34,114.

Our team of twelve trap-makers manufactured 290 traps to sell and for stock during 10 trap making sessions. A bench drill press was purchased to assist in trap manufacture. We have accepted orders from outside the region from buyers prepared to pay freight costs. The income from trap sales and freight charged was $25,006, with expenses of $16,684 giving a profit of $8,322. In November the sell-price for DOC200s was increased to $85 due to increased material costs – an increase that has not affected trap demand. At the end of the financial year there were 24 traps in stock, with our traps in the field worth nearly $19,000.

Funding of $5,000 was gratefully received from the ECan Waimakariri Zone Committee for the 2022/23 Estuary project. We are also grateful for award-winning Karikaas Natural Dairy Products continued sponsorship of ARRG through sales of the Braided River Series of cheeses, and by promoting ARRG on their website https://www.karikaas.co.nz/shop/Karikaas+Cheese/Braid+Series.html

ARRG volunteers earned the group $3,000 through working on a DOC Invertebrate Monitoring Project on the river over the Summer of 2022/2023.

Held in stock are copies of the children's book "Ria the Reckless Wrybill," with copies being available directly from the Rangiora Wee Kiwi Kidz shop, as well as at the Pukorokoro Miranda Shorebird Centre gift shop. Wrybill banner pens are also held in stock.

The annual accounts have been checked by Community Capacity Accounting, Christchurch as being compliant with the Charities Act format, and that transactions have been accounted for correctly. Full accounts for the group are available online at https://register.charities.govt.nz by searching for Charity CC28335.

16.4 Administration and Financial Conclusion and Recommendations

- Compared to other years there has been less promotional work due to the lack of a dedicated promotions officer.
- Sales of promotional items could be publicised towards Christmas.
- We require volunteers to take various active roles: supervising trappers, secretarial tasks, treasurer duties, and promotional work. It would be heartening if from amongst our large membership, volunteers would come forward to help with these roles.
- Failing to find volunteers may necessitate paying contracted personnel to fill some ongoing work. This of course would entail increased and ongoing funding applications.
- The upcoming year will involve expenditure for equipment replacements such as trail cameras, repair of the malfunctioning Drone, and proposed projects for which funding will be required.

17. Recommendations:

- Continue working with ECan on the management of the river and development of their long-term Braided River Revival plan.

- Develop with ECan an extended and improved predator control programme. Further use of poison is probably necessary.
- Take the fight to the Norway rats. Their nesting colonies must be found and dealt with. Untargeted trapping and poisoning is not likely to work.
- Advocate more strongly with ECan on the bird habitat issues of the Ashley. Develop closer ties with groups such as Forest and Bird and BRaid to enhance this advocacy.
- Develop closer ties with other organizations, such as DOC and other volunteer groups that work with braided river birds in order to improve the quality of our efforts.
- Enhance our focus on the fairway of the river and recruit more people to help with this. We need to better understand the nesting environment and the predation threats. We need more people involved in predator control and nest monitoring on the river during the season.
- Continue with the annual bird survey and, at least on a biannual basis, extend this up to the Ashley gorge.
- Continue and expand our involvement with research projects on the Ashley. Currently planned are a continuation of the insect study, an MSc study on nesting around the Ashley, involvement in radio tracking of BFT, and perhaps a thesis study on Norway rats.
- Continue with public education efforts including school visits, radio talks, newspaper articles, and Facebook and website posts.
- The group currently has more than ample funding. It is more important to find ways to productively spend the funds than to find more.

17. Acknowledgements

We are particularly grateful for major past financial support from national agencies such as:

- World Wildlife's Habitat and Protection Fund
- Pacific Development and Conservation Trust
- New Zealand National Parks and Development Foundation
- Lottery Environment and Heritage Committee of the New Zealand Lottery Grants Board

Acknowledgment for significant more recent funding is owed to the Department of Conservation, ECan and its Waimakariri Zone Committee's Immediate Steps fund, the Waimakariri District Council, the Rata Foundation, Sargood Bequest, the Rangiora Lions Club, plus our first 'sponsor', Karikaas Dairy Products Ltd.

The Group is most grateful for a number of smaller donations received from a range of sources.

The Group works closely with ECan and its the Ashley-Rakahuri Regional Park staff, whose aspirations for the birds on the river mirror those of the Group.

The Group also thanks its members and their friends and families for help with bird monitoring, participation in the spring survey, advocacy, and attendance at meetings. Particular acknowledgement must go to the small band of trap-makers, and the trappers who maintain many traps over the full year.

The activities recorded in this report would not have been possible without the above support.

Appendix 1 – Survey Reach Boundaries

Ashley – Okuku to Estuary

Kilometre	East	North
0	1556736	5209752
1	1557309	5208936
2	1558164	5208422
3	1559122	5208143
4	1560025	5207718
5	1561007	5207533
6	1562006	5207536
7	1563006	5207573
8	1564004	5207537
9	1565000	5207627
10	1565980	5207817
11	1566980	5207822
12	1567979	5207780
13	1568970	5207717
14	1569947	5207931
15	1570920	5208162
16	1571876	5208441
17	1572874	5208487
18	1573871	5208409
19	1574866	5208314
20	1575862	5208240
21	1576863	5208318

Appendix 2 – 2022 Annual Count Data

Year	BD	BFT	SIPO	PS	Wrybill	BBG	SBBG	BF Dott	Black shag	Little shag	Black stilt	SW plover	Casp Tern	WF tern	Duck	P. Duck	C Goose	WF Heron	Harrier
2000	199	74	25	229	17	314	26		18	3	0	18	0	0					
2001	130	44	22	82	7	3	0		3	6	0	0	0	0					
2002	115	165	19	70	6	5	11		0	0	0	16	0	0					
2003	169	102	22	138	16	0	10		8	4	0	13	4	0					
2004	213	28	37	140	9	10	27		7	7	2	27	0	0					
2005	245	26	22	137	7	1	3		2	6	1	149	0	0					
2006	84	180	5	68	5	213	5		2	2	1	37	1	0					
2007	237	89	26	164	9	13	12		10	4	1	116	0	0					
2008	198	81	27	131	8	16	10		9	0	1	11	0	0					
2009	233	124	32	196	13	2	19		6	17	1	39	0	0					
2010	260	192	20	233	18	41	19		2	6	0	15	0	8					
2011	250	190	35	194	15	425	2		5	13	0	89	0	77					
2012	248	200	38	209	17	202	11		6	11	0	55	0	6					
2013	301	156	23	247	19	364	17		3	19	0	65	1	2					
2014	263	263	32	230	21	23	7		4	5	0	37	0	0					
2015	276	128	24	217	19	13	13		1	6	0	9	0	0					
2016	222	128	14	95	13	9	4		5	8	0	6	0	0					
2017	167	150	14	148	9	361	1		2	3	0	32	5	0					
2018	136	172	50	83	20	16	15		5	8	0	17	0	0	17	52	0	5	2
2019	323	296	77	281	27	4097	11	1	8	17	0	98	1	4	31	54	5	8	6
2020	133	65	27	141	10	1826	14	7	4	10	0	21	0	0	29	34	0	5	24
2021	252	192	18	199	28	7	11	5	0	14	0	12	0	0	61	173	0	5	3
2022	233	214	33	146	49	179	13	4	0	16	0	204	0	0	3	48	0	13	0

Appendix 3 – 2022 data by kilometre

Kilometre	BD	Wrybill	BFT	SIPO	PS	BBG	SBBG	BF Dott	Black Shag	Little Shag	SW Plover	Duck	P. Duck	White-faced Heron	Harrier
1	7	0	5	0	4	0	1	0	0	1	56	0	14	0	0
2	3	0	6	1	2	0	1	0	0	1	0	0	2	0	0
3	17	4	2	2	23	0	1	0	0	0	17	0	0	1	0
4	18	6	3	5	18	0	0	0	0	0	0	0	0	0	0
5	6	3	2	5	16	0	0	0	0	0	0	0	10	2	0
6	16	5	1	4	0	0	0	0	0	1	0	0	0	0	0
7	33	5	7	0	0	0	7	0	0	0	40	0	0	0	0
8	17	0	1	2	0	0	1	0	0	0	0	0	0	1	0
9	15	7	5	1	9	0	0	0	0	0	0	0	7	0	0
10	10	4	4	3	8	0	0	0	0	0	45	0	0	0	0
11	9	2	65	5	10	0	0	0	0	0	0	0	2	0	0
12	10	0	6	0	1	0	1	0	0	0	8	0	2	0	0
13	16	4	89	2	15	172	0	0	0	0	2	0	2	2	0
14	9	5	4	0	11	3	0	0	0	2	0	3	2	2	0
15	15	4	6	3	10	4	1	1	0	0	0	0	0	0	0
16	11	0	4	0	8	0	0	0	0	1	2	0	0	1	0
17	8	0	3	0	0	0	0	0	0	0	5	0	0	1	0
18	8	0	1	0	4	0	0	1	0	6	4	0	2	0	0
19	5	0	0	0	7	0	0	2	0	4	25	0	5	3	0
Total	233	49	214	33	146	179	13	4	0	16	204	3	48	13	0
20	1	0	7	2	5	3	0	1	0	5	4	0	2	2	0
21	4	0	7	0	2	500	1	0	0	1	0	0	0	0	0
Total	5	0	14	2	7	503	1	1	0	6	4	0	2	2	0

Appendix 4. Predators caught since 2004

Period	Hhogs	Cats	Stoats	Wsls	Frts	Rats	S. Rats	N. Rats	Total Rats	Total	Trap Nights	Trap Nos	CPTHN
Aug 04 - Jul 05	46	4	4	6	0	1	0	0	1	61	4,092	42	1.49
Aug 05 - Jul 06	62	8	2	0	0	0	0	0	0	72	3,834	44	1.88
Aug 06 - Jul 07	45	3	2	1	0	1	0	0	1	52	3,445	54	1.51
Aug 07 - Jul 08	39	4	3	4	0	3	0	0	3	53	3,983	54	1.33
Aug 08 - Jul 09	17	7	5	1	0	0	0	0	0	30	3,980	54	0.75
Aug 09 - Jul 10	17	3	3	2	1	1	0	0	1	27	3,981	42	0.68
Aug 10 - Jul 11	23	3	4	2	0	0	0	0	0	32	3,732	44	0.86
Aug 11 - Jul 12	34	2	1	1	1	0	0	0	0	39	5,048	54	0.77
Aug 12 - Jul 13	36	2	3	3	1	5	0	0	5	50	6,373	59	0.78
Aug 13 - Jul 14	29	12	3	4	1	0	0	0	0	49	8,466	48	0.58
Aug 14 - Jul 15	52	14	8	4	2	0	0	0	0	80	12,037	64	0.66
Aug 15 - Jul 16	117	30	8	23	12	0	0	0	0	190	34,595	125	0.55
Aug 16 - Jul 17	110	15	22	21	7	13	0	0	13	188	38,843	149	0.48
Aug 17 - Jul 18	110	34	21	42	7	49	0	0	49	263	52,409	182	0.5
Aug 18 - Jul 19	119	35	31	80	15	146	0	0	146	426	72,116	197	0.59
Aug 19 - Jul 20	162	42	25	70	7	29	77	77	183	489	90,517	248	0.54
Aug 20 - Jul 21	190	45	25	35	3	13	82	49	144	441	86,535	237	0.51
Aug 21 - Jul 22	100	40	35	72	5	27	164	69	260	512	88,654	243	0.58
Aug 22 - Jun 23	157	33	33	87	7	54	382	82	518	835	110,896	304	0.75
	1,465	**336**	**238**	**458**	**69**	**342**	**705**	**277**	**1,324**	**3,889**	**633,536**		

Appendix 5. Eleanor Gunby thesis update, February 2023

Nest success of shorebirds at the Ashley-Rakahuri/Saltwater Creek River Estuary

As requested by the Ashley-Rakahuri Rivercare Group (ARRG), I have been monitoring the nest success of shorebirds at the Ashley-Rakahuri/Saltwater Creek River Estuary over the 2022-2023 breeding season. The data collected will be used as part of my MSc thesis at the University of Canterbury, which is being completed under the supervision of Professor Jim Briskie. Nest monitoring early in the season was assisted by members of ARRG, particularly Grant Davey. Funding provided by ARRG was used to support my work through a scholarship. Funding from the University of Canterbury was also provided by my supervisor to cover the costs of transport to and from the study site. The aim is for data collection on nest success to be repeated during the 2023-2024 breeding season.

Nests were monitored during the period from 7 September 2022 to 6 February 2023. Visits to the site were usually conducted 2-4 times per week, depending on factors like the weather and tides. On each site visit, I searched for new nests and monitored the nests found previously. Where possible, nests were first viewed from a distance to reduce disturbance to the birds, and their status assessed as either still active or not active. For nests which were inactive, I made a closer inspection to determine the outcome (e.g., desertion, flooding). Nest outcomes were not always clear, and these are classified as unknown. However, I did note whether there were signs of faeces in the nest, which would indicate chicks had hatched and been present in the nest recently, and thus that the nest may have been successful.

As of 6th February 2023, preliminary estimates of nest outcomes are as follows:

Banded dotterels: 10 nests at Kings Ave (nine succeeded, one failed).

Black-backed gulls: three colonies with a total of 136 nests at Raupo Berm (97 succeeded, 14 failed, nine unknown but faeces present, 16 unknown); one colony of five nests at Kings Ave (two succeeded, three failed); one colony with 110 nests on the island spit (82 succeeded, two failed, seven unknown but faeces present, 19 unknown).

Black-billed gulls: one colony at Kings Ave of approximately 1,000 birds, which was abandoned. Two new colonies then formed. One had 34 nests and did not successfully produce chicks. The other colony had 456 nests and produced at least 367 fledglings. There were also three red-billed gull pairs nesting in this colony, two of which successfully produced two chicks each.

Black-fronted terns: three nests at Kings Ave (all three failed). A pair of chicks not associated with any of these nests were also seen, indicating there was one nest not located.

Pied stilts: five nests at Kings Ave (two failed, three unknown).

Variable oystercatcher: six nests on the island spit (five hatched, one failed); one nest with one variable oystercatcher and one South Island pied oystercatcher at Waikuku Beach (succeeded).

White-fronted terns: one pair at Kings Ave (succeeded). A large colony (estimated 950 birds on the ground) was beginning to establish on the island spit but was abandoned, with a walk-through of the site revealing broken eggshell fragments and black-backed gull tracks throughout.

Ultimately, detailed information on the nest success of each species, and the causes of nest failure, will be important for identifying those species most as risk from predators. This could allow those species to be targeted for increased predator control. The observation of mass desertion by some species in the estuary is also concerning, especially if this is being caused by human disturbance. Reducing human disturbance around the estuary is a difficult issue, given the present recreational value of the area. However, gathering qualitative information on the risks to the birds and the frequency of such large-scale events could help bolster the case for greater protection of this important bird habitat.

In addition to the monitoring of nest outcomes, I will continue gathering additional data for use in my MSc thesis. Firstly, I am currently measuring microhabitat features at nest sites, which will be used to determine whether, and how, microhabitat affects nest success. This involves measuring a variety of habitat features (e.g., substrate type,

distance to water, etc) to determine whether these variables can account for variation in nest success within and between species. Secondly, I plan to assess the role of human disturbance on shorebird foraging behaviour. Because the Ashley-Rakahuri/Saltwater Creek River Estuary is widely used by people for recreational purposes, like walking and fishing, I will be recording the foraging behaviour of birds in relation to levels of human disturbance. Particularly for post-breeding and pre-migratory birds, increased disturbance could affect their behaviour and reduce foraging success at a time of increased energetic needs. Thirdly, I plan to assess the potential role of black-backed gulls on shorebird nest success. Black-backed gulls are opportunistic predators, and other species nesting close to them may be at greater risk of predation or desertion. Determining whether black-backed gulls are the primary cause of predation/desertion of other species will be important for assessing whether they need to be considered in any management plan. Finally, I also plan to collect further data on shorebird nest success in the upcoming 2023-2024 breeding season, which will involve the use of trail cameras to determine the identity of nest predators.

Thanks to the funding from ARRG, which has helped support this research, and to members of ARRG, especially Grant Davey, for their assistance.

Appendix 6. ARRG office bearers and management structure

Chair:	Sue Mardon (suemardon02@gmail.com)
Secretary	Robert Clark
Treasurer:	Sue Mardon (suemardon02@gmail.com)

Management Teams

Operations Team Leader:	Grant Davey (grdavey@yahoo.com)
Administration Team Leader:	Sue Mardon (suemardon02@gmail.com)

The Management Committee has the capacity to make decision and approve small funding values requiring immediate attention for approval at the following General Meeting.

Members elected at the AGM were Chair, Treasurer, Secretary, Bev Alexander, Grant Davey, Judith Hughey, Bob Gumbrell, Nick Ledgard, Mike and Helen Hamblin.

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