

# Upper Rangitata Trapping Project

Annual Report 2019-20

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Wrybill and chick. Photo Lauren Buccholz



Department of  
Conservation  
*Te Papa Atawhai*

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## SUMMARY

- This is the fifth season of trapping in the Upper Rangitata. We report on the results of the predator trapping operation, rabbit control and outcome monitoring.
- The Rangitata trap network comprises 332 DOC150 double-sets, 272 DOC250 single-sets, 72 cat traps (Conibear and 'Twizel' cat trap combined total), 177 Timms and 398 #1.5 Victor leg-hold traps.
- A total of 1793 predators were destroyed using both kill traps and live-capture traps. This is 22% fewer predators than last year.
- No southern black-backed gull control operations were carried out this season.
- As with last year, significant flooding events in November and December negatively impacted on wrybill and black-fronted tern productivity in all rivers where outcome monitoring was undertaken.
- Twenty-nine wrybill nests were monitored in the Rangitata, hatching success for the 25 nests with known outcome was 0.84. Fledgling success was recorded as 0-0.08 with only two chicks thought to have fledged.
- Thirty-one black-fronted tern nests were monitored, with hatching success for the 29 nests with known outcome of 0.1. No chicks were known to fledge.
- In the upper reaches of the south branch of the Hakatere/Ashburton river, two wrybill nests were detected, and both were lost to predators prior to egg hatch. In addition, 42 black-fronted tern nests with known outcome recorded a hatching success of 0.29. Only four nests were known to have been preyed upon. No fledglings were recorded.
- No black-fronted tern colonies were identified in the lower reaches of the Rangitata river.

## INTRODUCTION

The Upper Rangitata River Predator Control Project is now in its fifth year of landscape-scale predator control to increase braided river bird survival and productivity. The project is focused on the recovery of two key bird species: wrybill/ngutuparore (*Anarhynchus frontalis*: nationally vulnerable) and black-fronted tern/tarapirohe (*Chlidonias albobriatus*: nationally endangered), but additional bird and reptile species are expected to benefit. The project is funded by Environment Canterbury (ECan) and the Department of Conservation (DOC). Further information regarding the background of the project is available in previous annual reports.

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The predator control project is run in conjunction with large scale weed control programme funded by ECan, DOC and Land Information New Zealand (LINZ).

Environment Canterbury also conduct a predator trapping project in the upper reaches of the south branch of the Hakatere/Ashburton river. DOC staff undertake outcome monitoring for this project by monitoring wrybill and black-fronted terns between Buicks Bridge and the Hakatere Corner.

This report covers the methodology and results of predator trapping and outcome (wrybill and black-fronted tern) monitoring for the 2019/20 season.

*Project staff*

DOC150 and DOC250 traps, together with Timms and SA2 or other cat traps, are serviced primarily by DOC staff, with the assistance of contractors to service the trap lines on the true left of the river in the vicinity of Mt Harper. Victor leg-hold trapping rounds, and rabbit control is carried out by contractors while project outcome monitoring is carried out by DOC staff and volunteers.

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## METHODS

### Animal Pest Control

Traps are located on both sides of the Rangitata River from approximately 4km upstream of the confluence of the Potts and Rangitata rivers, to immediately upstream of the Rangitata Gorge (Fig. 1). Access to traps is with the kind permission of landowners.

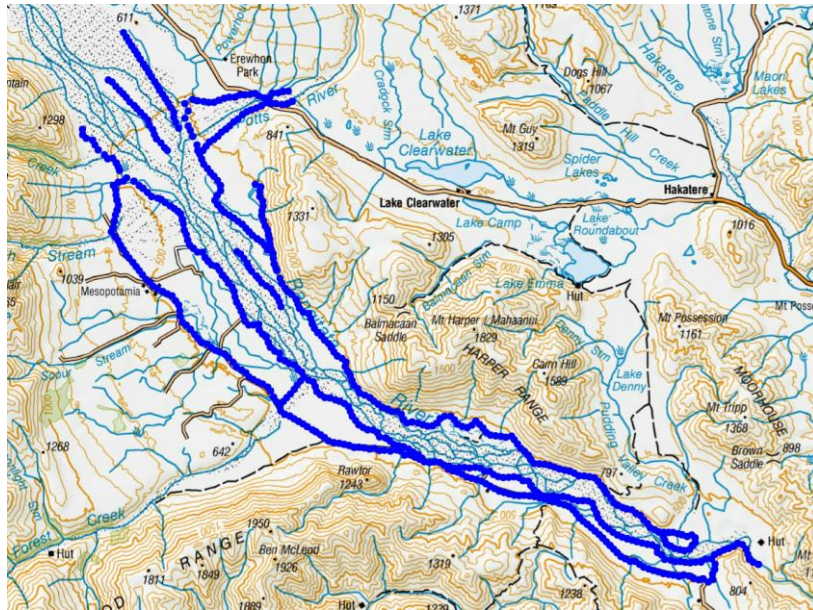


Fig 1. Trap lines in the Upper Rangitata.

### Trap type and bait

All kill traps are scheduled to be opened in July, closed in February and checked monthly during that period. They are baited with fresh rabbit, except during November and December when high ambient temperatures cause rapid deterioration of the fresh rabbit bait, and Erayz™ bait is used.

Live-capture traps (#1.5 Victor leg-hold) are armed in Autumn and Spring for a 10-day period. They are re-baited with fresh rabbit meat as required every 2-4 days depending on the state of the bait and environmental conditions. For the first time, traps in open areas (i.e. those not set in areas of vegetation) were set underneath a small plywood cover, which covered both the trap and bait. This was done in an effort to reduce the numbers of harriers caught after concerns were raised regarding the risk that catching large numbers of these predators in leg-hold traps posed to the reputation of the Department.

Table 1. Trap numbers and type in the Upper Rangitata in 2019/20.

Trap type	Number of traps
DOC150 double-set	332
DOC250 single-set	272
SA2/Conibear/'Twizel' cat traps	72 (Conibear and 'Twizel' cat traps)
Timms traps	177
#1.5 Victor leg-hold traps (live capture)	398

### Black-backed gull control

Sustained black-backed gull control over the previous four seasons has resulted in low numbers of gulls in the predator control area during the breeding season (~200 adults in September 2018 c.f. ~ 2000 individuals in 2015/16 (D. Bromwich *pers. comm.* 2019)). Disruption to gull colonies in December due to extensive flooding both last season and this year also helped control gull numbers in the Rangitata. Consequently, no black-backed gull control was undertaken this season.

### Rabbit control - spotlighting

A rabbit control operation, jointly funded by LINZ and DOC, was carried out between 18 May and 30 June 2019. Approximately 128 hours of spotlighting for rabbits, hares and predators was undertaken by Landcare Services under contract to DOC and LINZ throughout the Upper Rangitata Predator Control programme area.

### Rabbit control - calicivirus

In addition to the spotlighting described above, the K5 strain of the rabbit calicivirus was broadcast using carrot baits on land adjacent to the predator control area on 16 October 2019 by Landcare Services on behalf of DOC, ECan, LINZ and the Upper Rangitata Landcare Group. Virus release sites were chosen after consultation with local landowners and comprised four sites on the true left of the Rangitata River around Erewhon and Mt Potts, and fourteen sites on the true right from Bush Stream to White Rock. The release sites were pre-fed twice with

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fresh clean carrot washed only with water. Spotlight counts along a defined route were carried out on 13 August, prior to the virus deployment, and on 24 October and 7 November 2019, one week and three weeks after the virus was deployed.

## Outcome monitoring

### Breeding success of river birds

#### *Wrybills*

Protocols for finding and monitoring nests and chicks generally followed Leseberg et al. (2005). Surveys and monitoring were predominantly undertaken by Marcia Kimber, Anna Aichele and Clare Halpine from the Geraldine DOC office. Walking surveys for nesting wrybill and black-fronted tern pairs began in September 2019. Initially staff aimed to locate and monitor 60 nests through to fledgling or failure. Subsequent analysis showed that a sample size of 30 provided sufficient power, and consequently staff have aimed to locate and monitor a sample of 30 nests since the 2018/19 season.

Nests are checked every 3-7 days, as river conditions permit, until they have either hatched or failed. Empty nests are closely inspected for very small shell fragments (1-3mm), which indicate hatching. If there is no evidence of chicks, or small egg fragments indicating that eggs have hatched successfully, and the nest has not been destroyed by flooding, then the eggs are assumed to have been preyed upon as both black-backed gulls and stoats will remove whole eggs without breaking them (Steffens, 2010). Camera footage from tern nests on the Hakatere/Ashburton and Rakaia rivers during the 2017-2018 and 2018-2019 seasons also showed that harriers can remove whole eggs from nests without breaking them (Buchholz and Edwards, *unpublished data*).

Nesting pairs with chicks are re-visited approximately every seven days to determine chick survival rates. Chicks are counted as fledged when they can fly, or 40 days (Dowding 2013) from the last possible date of hatching based on the date at which chicks were first observed in the nest. If chicks are last observed seven days or less prior to last possible fledge date (i.e. the last possible hatch date plus 40 days), and no birds (adults or chicks) are observed in subsequent visits to the site, then the chick (or chicks) are considered as 'probably fledged' -

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and included in the upper range of the recorded number of fledglings. Due to their precocial nature, the cause of death or disappearance of wrybill chicks cannot usually be determined.

A sample of GPS tracking data recorded by staff undertaking outcome monitoring is provided in Appendix 1.

### *Black-fronted terns*

Monitoring protocols were as described in in Leseberg et al. (2005). Nest checks were carried out every 2-5 days, and hatched chicks were monitored up to fledging age to determine their survival.

As with previous years, outcome monitoring of tern nests in the Rangitata river outside the predator control area (i.e. in the lower Rangitata, downstream of the SH72 road bridge) was attempted.

In the Rangitata and the south branch of the Hakatere/Ashburton river, trail cameras (Ltl Acorn 5310) were used to help determine the outcome of nine black-fronted tern nests.



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For both wrybill and black-fronted tern, the following breeding parameters were determined:

- a) Hatching success (probability of at least one egg, in a nest with known outcome, hatching)
- b) Egg success (probability of an egg hatching in a nest if it survives),
- c) Fledging success (probability of a chick fledging once it hatches),
- d) Breeding success (probability that an egg will successfully survive, hatch and fledge).

#### *Upper Rangitata river survey*

As with the previous season, the walk-through survey of the Rangitata river was not carried out as river levels during the planned survey period precluded the count being undertaken safely. Three periods of high river flow in November and December caused extensive damage to road and rail bridges across the Rangitata river and all road and rail crossings across the river were closed for several days in early December. The river peaked at 2307 cumecs (median flow is approximately 65 cumecs).

## **RESULTS**

### **Animal Pest Control**

#### *Kill traps*

All checks between July 2019 and January 2020 were carried out as scheduled. Trap lines were progressively closed from 11-19 March 2020. The number (and proportion) of each target predator species captured in kill traps in the 2019/20 season is shown in table 2.

Table 2. Number and proportion of species caught in kill traps in the Upper Rangitata in 2015/16-2019/20.

	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020
Cat	71	104	99	64	63
Ferret	56	139	115	62	131
Stoat	64	166	58	59	57
Weasel	24	60	34	25	34
Possum	41	119	77	19	14
Hedgehog	730	1754	1385	1159	892
Rat	95	334	236	281	77
Harrier hawk	0	0	0	0	0
<b>TOTAL PREDATORS</b>	<b>1,081</b>	<b>2,676</b>	<b>2,004</b>	<b>1,669</b>	<b>1,268</b>
Rabbit/Hare	54	100	-	1	159
Mouse	0	47	-	23	75
Exotic bird	-	-	-	0	16
<b>TOTAL OTHER</b>	<b>54</b>	<b>147</b>	<b>184</b>	<b>24</b>	<b>250</b>
<b>Total kill traps</b>	1,215	1,215	1,215	1,257	1,257
<b>Total trap nights (Captures per 100 trap nights)</b>	-	296,460 (0.90)	296,460 (0.68)	306,708 (0.54)	306,708 (0.41)
<b>Adjusted trap nights (Captures per 100 adjusted trap nights)</b>	-	254,115 (1.05)	263,640 (0.76)	281,313 (0.59)	283,938 (0.45)

### Live capture traps

The 97 live-capture traps on the true left of the Upper Rangitata were set for ten days from 1-10 May and 1 - 11 September 2019. The 301 traps on the true right were divided into two lines of approximately 150 traps each and set from 20-29 April and 6-15 May, and then again from 9-18 September and 26 September – 5 October 2019.

Table 3. Number and proportion of species caught in live-capture traps in the Upper Rangitata in 2015/16 - 2019/20.

	<b>2015/2016</b>	<b>2016/2017</b>	<b>2017/2018</b>	<b>2018/2019</b>	<b>2019/2020</b>
Cat	22	47	62	59	125
Ferret	20	25	53	48	65
Stoat	3	5	11	10	6
Weasel	0	0	0	0	0
Possum	20	20	51	43	57
Hedgehog	65	158	205	201	118
Rat	4	4	12	10	8
Black-backed gull		0	0	0	5
Harrier hawk		0	81	226*	141*
Rabbit/Hare	5	24	20	21	25
<b>TOTAL CAPTURES</b>	<b>134</b>	<b>283</b>	<b>487</b>	<b>618</b>	<b>550</b>
<b>Total leghold traps</b>	-	398	398	398	398
<b>Total trap nights</b> (Captures per 100 trap nights)	-	6,241 (4.53)	7,011 (6.95)	6,529 (9.47)	7,068 (7.78)
* Covers introduced mid 18/19 to reduce harrier catches					

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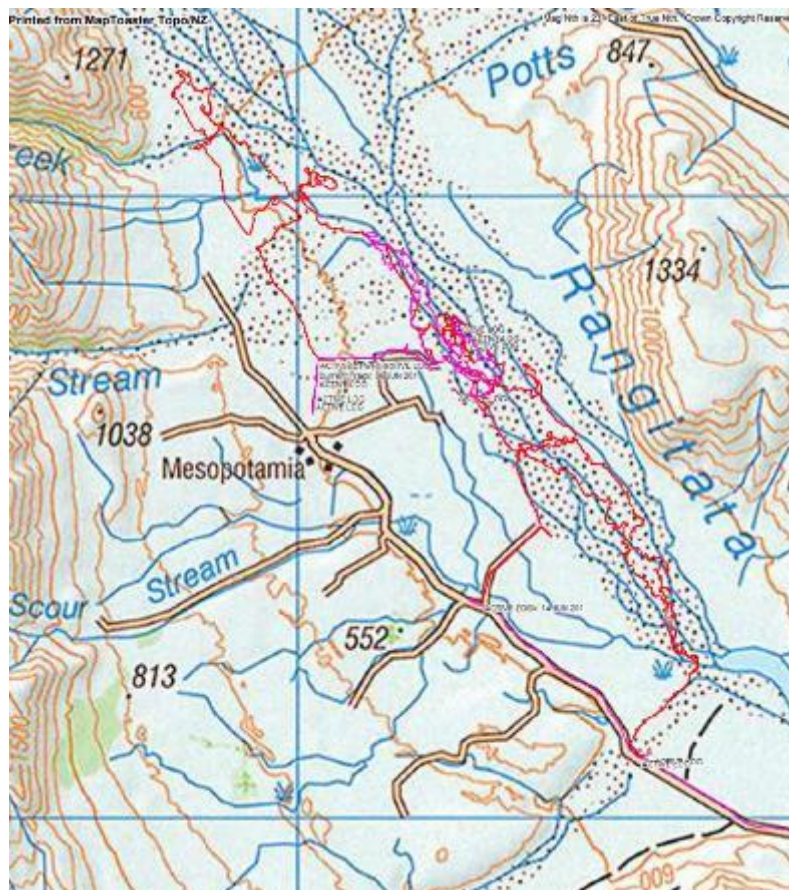
### Rabbit Control - Spotlighting

In the Upper Rangitata, a total of 838 rabbits were destroyed in the operation jointly funded by LINZ and DOC on the true right of the Rangitata River between Black Birch Creek and Forest Creek (see Fig. 2).

Fig. 2. GPS tracks of contractors undertaking rabbit control (spotlighting) in the Upper Rangitata – 2019/20

### Rabbit Control - Calicivirus

On 13 August, two months before the K5 operation 11.1 rabbits per km were recorded during a spotlight count along a defined route. One week after the operation (24 October) 16.1 rabbits per km was recorded, and this increased to 28.9 rabbits per km on 7 November -



three weeks after the operation. These spotlight counts indicate that the K5 release had negligible effect on rabbit populations in the targeted area. However, anecdotal reports from contractors working in the area in May 2020 suggest that the population has subsequently

crashed – with very low numbers present some seven months after the operation. It is likely that this population reduction is the result the calicivirus passing through the area, although whether this was a result of the October K5 release, or a different strain that was already present or has arrived in the area subsequently, is unknown.

Overall control summary

Table 4. The total number of animals destroyed in the Upper Rangitata in 2018/19 - 2019/20 – all trap types.

	Upper Rangitata 2018/19	Upper Rangitata 2019/20
Cat	123	188
Ferret	110	196
Stoat	69	63
Weasel	25	34
Possum	62	71
Hedgehog	1360	1010
Rat	291	85
Black-backed gull	37	5
Harrier hawk	226	141
<b>TOTAL PREDATORS</b>	<b>2303</b>	<b>1793</b>
Rabbit/Hare	140	184
Mouse	23	75
Exotic bird	0	16
<b>TOTAL OTHER</b>	<b>163</b>	<b>275</b>

The figure below shows the numbers of key predators (cats, ferrets, stoats, weasels and hedgehogs) destroyed in all trap types for the duration of both the Upper Rakaia and Upper Rangitata predator control projects.

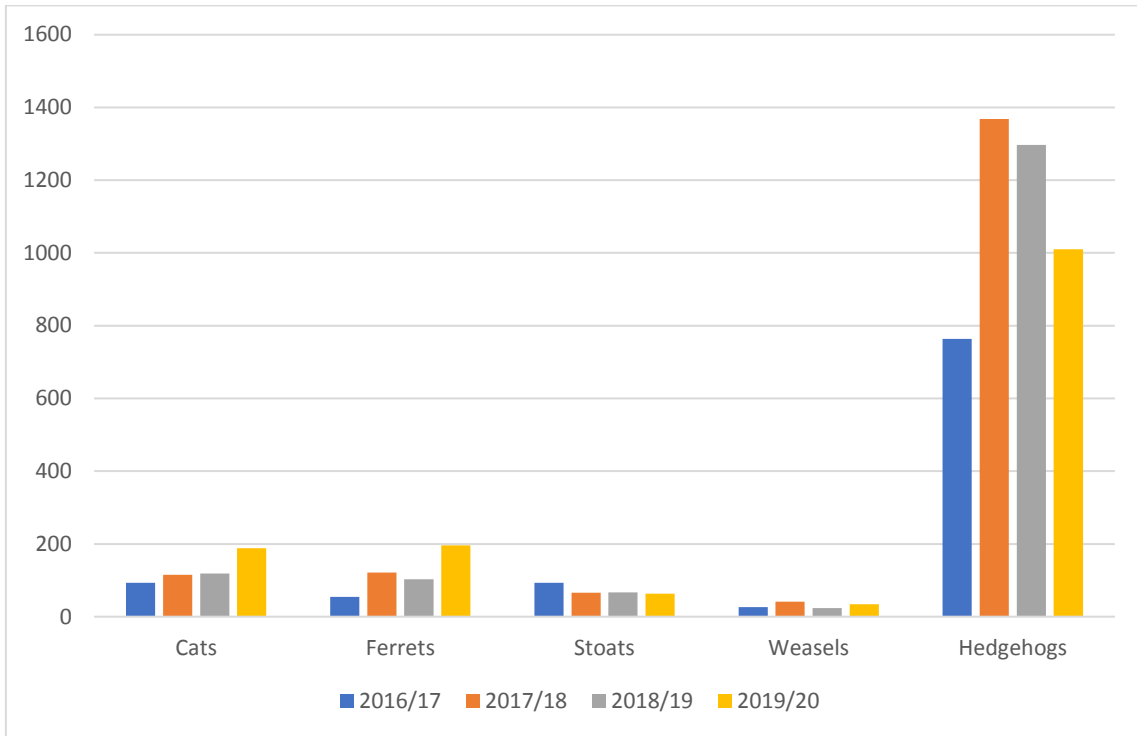


Fig 3. Number of cats, mustelids and hedgehogs destroyed in the Upper Rangitata by season (2016/17 – 2019/20).

## Outcome monitoring

### Breeding success of river birds



Fig 4. Wrybill and eggs – Upper Rangitata (photo: DOC)

### *Wrybill*

This breeding season 29 wrybill nests were monitored in the Upper Rangitata. The first nest was found on 20 September 2019 (when field surveys began), and the last nest on 9 October.

The outcome was known for 25 wrybill nests, with an overall hatching success rate for nests with known outcome of 0.84. Four nests failed to hatch any eggs this season; two nests were depredated, one was lost in a flood, and another was deserted by the adults. Wrybills laid 50 eggs in the 25 nests with known outcome, 35 of which were known to hatch. The fate of seven eggs was unknown, while of the eight eggs that failed to hatch, four were depredated, two were lost in floods and two were deserted.

Table 5: Number of nests, hatching and egg success rates for wrybill in the Upper

Rangitata: 2015/16 – 2019/20.

	2015/16	2016/17	2017/18	2018/19	2019/20
Total no. of nests	53	56	33	29	29
No. of nests with known outcome (A)	49	50	33	29	25
No. nests that hatch one egg or more (B)	38	39	25	27	21
No. of nests that failed (i.e zero eggs hatched)	11	14	8	2	4
Total no. eggs laid	104	106	65	57	50
<i>Of the nests in (A):</i>					
No. of eggs laid where fate known (C)	96	100	64	54	43
No. of eggs laid where fate unknown	8	6	1	3	7
<i>Of the eggs in (C):</i>					
No. of eggs infertile or died in incubation (D)	9	10	8	3	0
No. of eggs that failed - other causes	18	17	8	3	8
Total no. of eggs that hatched (E)	69	73	48	48	35
Hatching success (F)=B/A	0.78	0.78	0.76	0.93	0.84
Egg success (G)=(C-D)/C	0.91	0.9	0.86	0.94	1

Table 6: Causes of nest failures and egg loss for wrybill in the Upper Rangitata: 2015/16 – 2019/20.

	2015/16	2016/17	2017/18	2018/19	2019/20
<b>Causes of nest failure</b>					
Total no. of nests that failed	11	14	8	2	4
<i>Nest failure due to:</i>					
Predation	5	6	0	0	2
Flooding	4	1	0	0	1
Abandoned	N/A	3	3	0	1
Trampled by cattle	0	0	2	0	0
Destroyed by wrybills (eggs removed and broken by wrybills other than nesting pair)	0	0	1	0	0
Eggs removed from nest by wind	0	1	0	0	0
Died during incubation/infertile	2*	2	1	1	0
Mixed cause (cattle disturbance (one egg)/predation (one egg))	0	0	1	1	0
Failed - cause unknown	0	1	0	0	0
<b>Causes of egg failure</b>					
Total no. of eggs that failed	27	27	16	6	8
<i>Egg failure due to:</i>					
Predation	10	11	1	0	4
Flooding	8	2	0	3	2
Abandoned	N/A	5	1	0	2
Trampled by cattle	0	0	4	0	0
Destroyed by wrybills (eggs removed and broken by wrybills other than nesting pair)	0	0	2	0	0
Eggs removed from nest by wind	0	2	0	0	0
Died during incubation/infertile	9*	5	7	3	0
Failed - cause unknown	0	2	1	0	0

The fledging success rate for wrybills was low this year at 0-0.08, with only 0-2 of the 35 chicks that hatched thought to have fledged. Floods in the Rangitata during November prevented staff from monitoring many of the nests for a three-week period from 2-25 November, and during the early part of December. Although the actual cause of loss of these chicks is unknown, it is likely that most, if not all of them, were lost during the floods.



Table 7: Fledging and breeding success rates, and numbers of wrybill fledged, in the Upper Rangitata: 2017/18 - 2019/20.

	2015/16	2016/17	2017/18	2018/19	2019/20
Total number of females that attempted to breed	49	52	29	29	25
No. of nests that hatched at least one egg	38	39	25	27	21
No. of nests that fledged at least one chick	16	15	10	17	2 <sup>1</sup>
No. of nests lost all chicks	1	6	2	2	0
No. of nests with unknown fledgling outcome	20	13	20	5	23
No. of chicks fledged as min-max (I)	17-18	21-24	11 to 14	23-28	0-2
Fledgling success as min-max (J) = I/E	0.25-0.26	0.29-0.33	0.23-0.29	0.48-0.58	0-0.057
Breeding success as min-max (F/GxJ)	0.18-0.18	0.2-0.23	0.15-0.19	0.42-0.51	0-0.048
Hatching success per female (E/H)	1.41	1.4	1.66	1.66	1.4
Fledgling success per female as min-max (I/H)	0.35-0.37	0.4	0.38-0.48	0.79-0.97	0-0.08

*Black-fronted tern – Upper Rangitata (within predator control area)*

In the Upper Rangitata river, only one small colony (ten nests) was detected, near the confluence of Forest Creek and the Rangitata. This colony was flooded in November, and the birds re-nested in a similar area (12 nests detected), but was flooded again in December. Thereafter, a smaller colony formed near the Forest Creek bridge (nine nests detected). A total of 31 nests were monitored in the Upper Rangitata, of which 29 had a known outcome, with three nests each producing a single chick, yielding a hatching success rate of 0.1.

Twenty-six tern nests failed, of which 24 were lost in floods, one was preyed on, and one which contained infertile eggs. (table 14). Black-fronted terns laid 51 eggs, the fate of which 48 were known. Of these, only 3 hatched. Of the remainder, 41 were lost in floods, two were depredated and two were infertile or died in early incubation.

Of the three observed colonies, only the one that established at Forest Creek bridge recorded any hatching success.

Table 8. Number of nests, hatching and egg success rates for black-fronted tern in the Rangitata: 2017/18 – 2019/20.

	2017/18 Upper Rangitata (Treatment)	2017/18 Lower Rangitata (Non-treatment)	2018/19 Upper Rangitata (Treatment)	2019/20 Upper Rangitata (Treatment)
Total no. of nests	49	23	69	31
No. of nests with known outcome (A)	41	23	68	29
No. nests that hatch one egg or more (B)	17	0	7	3
No. of nests that failed	24	23	61	26
Total no. eggs laid	89	41	116	51
<i>Of the nests in A:</i>				
No. of eggs laid where fate known (C)	73	41	114	48
No. of eggs laid where fate unknown	16	0	2	3
<i>Of the eggs in (C):</i>				
No. of eggs infertile or died in incubation (D)	5	0	17	2
No. of eggs that failed - other causes	41	41	84	43
Total no. of eggs that hatched (E)	27	0	13	3
Hatching success (F)=B/A	0.41	0	0.09	0.1
Egg success (G)=(C-D)/C	0.93	1	0.85	0.96

Table 9: Causes of nest failures and causes of egg loss in black-fronted terns in the Rangitata: 2017/18 -2019/20.

	2017/18 Upper Rangitata (Treatment)	2017/18 Lower Rangitata (Control)	2018/19 Upper Rangitata (Treatment)	2019/20 Upper Rangitata (Treatment)
<b>Causes of nest failure</b>				
Total no. of nests that failed	24	23	61	26
<i>Nest failure due to:</i>				
Predation	20	20	28	1
Flooding	0	0	19	24
Abandoned	3	0	3	0
Died during incubation/infertile	0	0	9	1
Vehicle	0	1	0	0
Mixed (one predation, one abandoned)	1	0	0	0
Failed - cause unknown	0	2	2	0
<b>Causes of egg failure</b>				
Total no. of eggs that failed	46	41	101	45
<i>Egg failure due to:</i>				
Predation	36	37	44	2
Flooding	0	0	31	41
Abandoned	5	3	5	0
Died during incubation/infertile	5	0	17	2
Vehicle	0	1	0	0
Failed - cause unknown	0	0	4	0

Table 10: Fledging and breeding success rates, and numbers of black-fronted terns fledged in the Upper Rangitata 2017/18 – 2019/20.

	2017/18 Upper Rangitata (Treatment)	2017/18 Lower Rangitata (Control)	2018/19 Upper Rangitata (Treatment)	2019/20 Upper Rangitata (Treatment)
Total number of nests monitored with known outcome(H)	49	23	69	29
No. of nests that hatched at least one egg	17	0	7	3
No. of nests that fledged at least one chick	1	0	0	0
No. of nests lost all chicks	24	23	7	3
No. of nests with unknown fledgling outcome	15	0	0	0
No. of chicks fledged as min-max (I)	1-16	0	0	0
Fledgling success as min-max (J) = I/E	0.04-0.59	0	0	0
Breeding success as min-max (FxGxJ)	0.02-0.22	0	0	0
Hatching success per nest (E/H)	0.55	0	0.19	0.1
Fledgling success per nest as min-max (I/H)	0.02-0.33	0	0	0

*Black-fronted tern – Lower Rangitata (outside predator control area)*

Monthly searches for nesting colonies were undertaken from September 2018 to mid-January 2019 over the lower Rangitata river from the Arundel road bridge to the sea, with no success. Consequently, no intensive monitoring of black-fronted tern nests outside the Upper Rangitata predator control area was undertaken.

*Wrybill – Hakatere/Ashburton River – south branch*

This season two wrybill nests were detected and monitored in the south branch of the Hakatere/Ashburton River. The first nest was found on 3 October 2019 and the other five days later. Both nests were depredated within two weeks of discovery, and no re-nesting attempts were recorded.

*Black-fronted tern – Hakatere/Ashburton River – south branch*

The first eggs of the season were detected on 21 October 2019 with a colony forming once again midway between Buick's Bridge and Hakatere Corner. Following disruption from flooding events in November and December, many terns were still re-nesting in January 2020 – with the initial detection of 25 new nests in January. Four nests were still active when contracts for monitoring staff ended at the beginning of February and monitoring ceased. The outcome of these nests is recorded as unknown.

Despite the lengthy nesting season and repeated nesting attempts, no chicks are thought to have fledged from monitored nests. Hatching success was recorded at 0.29, with the cause of loss for half of the 30 nests known to have failed attributed to flooding. A further 10 nests were recorded as abandoned, although some of these are likely to have also been inundated for a period. Predation was recorded as the cause of loss for just four nests.

Seven nests were monitored with trail cameras, although technical issues with some cameras reduced their usefulness. Three nests with cameras were abandoned (the eggs from one of the nests were found to be infertile or died early in incubation), and one nest was successful. The outcome of the remaining three nests was unknown.

Table 11. Number of nests, hatching and egg success rates for black-fronted tern in the Hakatere South Branch 2019/20.

	Hakatere South Branch
Total no. of nests	61
No. of nests with known outcome (A)	42
No. nests that hatch one egg or more (B)	12
No. of nests that failed	30
Total no. eggs laid	80
<i>Of the nests in A:</i>	
No. of eggs laid where fate known (C)	74
No. of eggs laid where fate unknown	6
<i>Of the eggs in (C):</i>	
No. of eggs infertile or died in incubation (D)	4
No. of eggs that failed - other causes	53
Total no. of eggs that hatched (E)	17
<b>Hatching success (F)=B/A</b>	0.29
<b>Egg success (G)=(C-D)/C</b>	0.95

Table 12: Causes of nest failures and causes of egg loss in black-fronted terns in the Hakatere South Branch 2019/20.

<b>Causes of nest failure</b>	
Total no. of nests that failed	30
<i>Nest failure due to:</i>	
Predation	4
Flooding	15
Abandoned	10
Died during incubation/infertile	2
Failed - cause unknown	0
<b>Causes of egg failure</b>	
Total no. of eggs that failed	57
<i>Egg failure due to:</i>	
Predation	8
Flooding	28
Abandoned	17
Died during incubation/infertile	4
Failed - cause unknown	0

Table 13: Fledging and breeding success rates, and numbers of black-fronted terns fledged in the Hakatere South Branch 2019/20

Total number of nests monitored (H)	42
No. of nests that hatched at least one egg	12
No. of nests that fledged at least one chick	0
No. of nests lost all chicks	12
No. of nests with unknown fledgling outcome	0
No. of chicks fledged as min-max (I)	0
Fledgling success as min-max (J) = I/E	0
Breeding success as min-max (F×G×J)	0
Hatching success per nest (E/H)	0.29
Fledgling success per nest as min-max (I/H)	0

## DISCUSSION

### *Trapping*

A total of 1793 predators were caught in the Rangitata, a decrease of 22% overall. Hedgehogs and rat captures were down by 25% and 71% respectively, while the number of ferrets caught increased by 78% to 196. The reasons for these changes are unknown but may simply reflect natural variations in predator density in the catchment.

The number of harriers captured in live traps decreased 38% to 141. It is likely that this reflected the change of trapping practice whereby leg-hold traps in open areas were placed under a plywood cover. Conversely, the number of cats caught in live capture traps increased by 112% to 125. Whether this was a result of increased trap availability resulting from fewer harrier captures, or simply because cats were more abundant this season, is unknown.

Few traps were lost in the floods this year, largely due to increased effort in tethering traps with wire to vegetation or waratahs in the riverbed. Kill traps were serviced in all months scheduled, although some checks were delayed due to access issues resulting from the floods.

### *Outcome monitoring*

Within the predator control area in the Upper Rangitata, wrybill had a very poor season compared with previous years, with fledgling success per female calculated to be only 0-0.08 this year, compared with a range of 0.35-0.97 for the previous four seasons.

The floods experienced during November and December are thought to have destroyed all but two wrybill chicks from monitored nests. The floods also prevented staff from visiting nests as regularly as scheduled, with safety concerns preventing monitoring at most nest sites between 6 November and 27 December, except for a few days between 27 November and 2 December. No wrybills were seen to have fledged, although two birds are recorded as probable fledglings as they were at least 33 days old when last observed on the river.

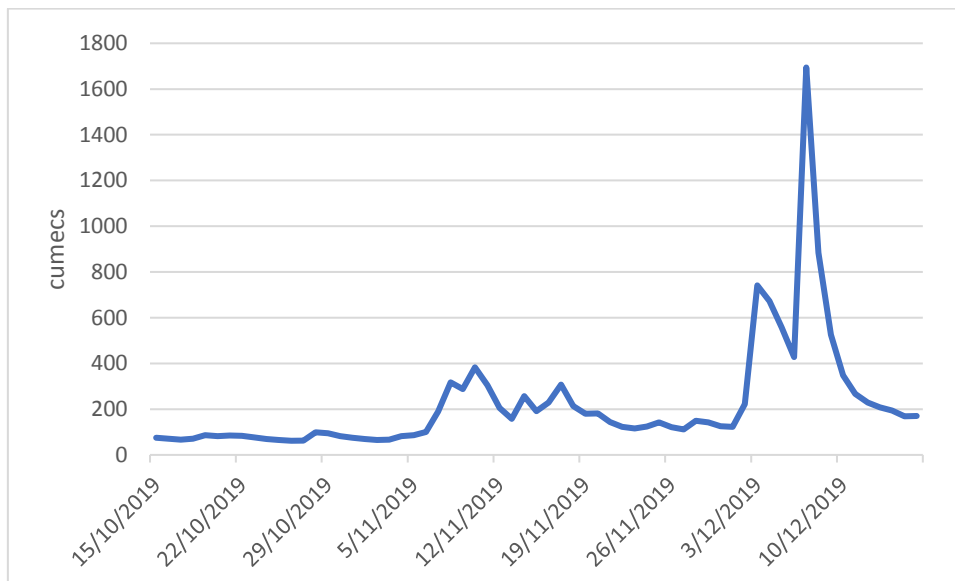


Fig 5. Rangitata river mean daily flow at Klondyke (data: ECan).

Black-fronted terns that were monitored within the treatment (trapping) area also failed to fledge any chicks. The colony at Forest Creek was inundated by rising floodwaters at some between from 5-7 November. Later re-nesting attempts, found on 28 November, were all destroyed by floods on 5-7 December. A small colony re-formed near the Forest Creek bridge in mid-December. The three successful nests, as well as the record of the depredated nest and the nest with infertile eggs were in this new colony. However, no monitored nests produced fledglings. Several nests were still active when staff monitoring the birds reached the end of their contracts. These nests are excluded from the data presented in this report.

In the lower Rangitata, outside the predator control area, nesting habitat for black-fronted terns is extremely difficult to find. There is extensive weed cover (primarily tree lupin, broom, gorse and false tamarisk) and sprawling black-backed gull colonies covering most riverside ground.

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As with last season, early summer floods have had a significant negative impact on bird breeding in the Upper Rangitata, with the floods in November occurring early enough to cause an almost total loss for wrybills at monitored nests, while the December floods inundated many re-nesting attempts by black-fronted terns.

While floods are natural events, if the frequency and severity of floods is increased due to changes in climate, this could have significant consequences for threatened braided river bird species.



Fig 6. Rangitata river SH1 bridge December 2019 (photo: stuff.co.nz)

### **Acknowledgements**

We wish to thank landowners adjacent to the project area for allowing access through their properties, and to ECan for funding assistance.

**APPENDIX 1 – Sample of outcome monitoring GPS tracks**

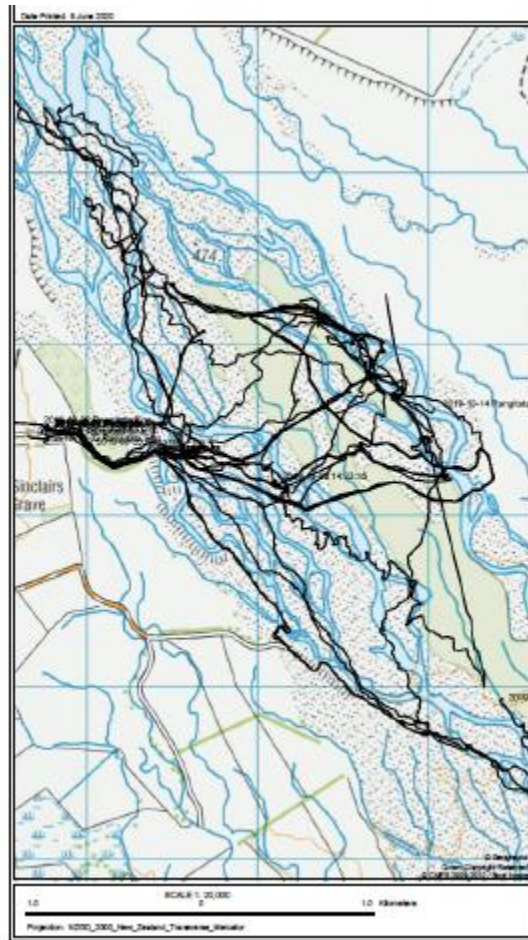


Fig 6. Sample of GPS tracking data of DOC staff undertaking outcome monitoring



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