Waiau Toa/Clarence and Wakaputawatea/Acheron rivers tarapirohe/black-fronted tern monitoring project - 2024/25 operational report

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Cover Image:
Tarapirohe/black-fronted tern *(Chlidonias albostriatus)* chick hiding quietly in amongst the rocks to avoid being spotted by field workers during colony checks. © Josh Overend 2024.

Contents

EXECUTIVE SUMMARY

This report provides a summary of results from the fourth monitoring season of the current five-year (2021/22 - 2025/26) tarapirohe/black-fronted tern *(Chlidonias albostriatus)* Phase 2 collaborative monitoring project with Wildlife Management International Limited (WMIL), the Department of Conservation (DOC) and Environment Canterbury (ECan).

Ground based monitoring was undertaken from October 2024 through to February 2025, and a single helicopter survey was conducted on 14 November 2024 to understand tarapirohe colony locations and numbers. The monitoring area extended from Lake Tennyson to just downstream of the Waiau Toa/Clarence River and Wakaputawatea/Acheron River confluence, and from the Severn Shelter on the Wakaputawatea down to the Waiau Toa confluence. Active nests were first detected on the Waiau Toa between 14 and 18 October 2024 and on the Wakaputawatea between 14 and 18 November 2024.

The monitored area is divided into two zones, the treatment zone (a continuous stretch of river under predator control with chick shelters placed on all breeding colonies and some historically enhanced islands), and the non-treatment zone (no trapping, chick shelters, or enhancement work carried out).

Throughout the 2024/25 tarapirohe breeding season, a total of 351 nests in 16 colonies were detected. Of these, a total of 315 active nests were monitored across 10 colonies on the Waiau Toa and Wakaputawatea. Of these 315 nests, 93% (n=293) nests were situated on the Waiau Toa, and 7% (n=22) were situated on the Wakaputawatea. All 315 (100%) nests had a known outcome, and, of these, 53% (n=166) nests hatched ≥ one egg (0.53 hatched per nest). Between 75 and 158 chicks fledged (0.24 and 0.5 fledglings per nest) from these monitored colonies.

The leading causes of nest failure this season were predation events (50%; n=75) and flooding (30%; n=45). Throughout the season the Waiau Toa flow reached up to 120 m^3/s, flooding islands in their entirety whilst also falling to 3.89 m^3/s, drying out channels and connecting islands to the mainland which allowed introduced mammalian predators to cross and lead to increased predation of tarapirohe colonies. Mean river flow for the Waiau Toa from October through to end of February is 11.42 m^3/s (2012-2024). River hydrology therefore had a major influence on nest success this season with two major floods impacting nesting colonies in October 2024 and January 2025 as well as the drying up of channels in December 2024 allowing predators access to sites which were previously islands. The decision to change the definition of an island colony to a mainland colony when it becomes attached to the mainland during low flows does create complications in the analysis. Islands in braided river systems are complex and dynamic, and further discussion about how best to define and analyse these colonies should continue into future seasons.

Predation events occurred across both treatment and non-treatment zones. At the egg stage, predation was responsible for 41% (n=36) of nest failures in the treatment area and 64% (n=39) of nest failures in the non-treatment area. Trail cameras were deployed on 27% (n=85) monitored nests and helped to determine ngeru/cats *(Felis catus) and* tori hura/ferret *(Mustela furo)* as the top two predators. The cameras also recorded predation from a spur-winged plover *(Vanellus miles novaehollandiae),* a hea/hare *(Lepus europaeus occidentalis),* and a toriura/stoat *(Mustela erminea)*. Some major predation events could be attributed to a single individual. A single cat was likely responsible for the failure of 54 eggs and 103 chicks over seven nights on Bridge Island. A single ferret was likely responsible for the failure of 17 nests over a few nights at 2-3 Pylon colony. No kāhu/Australasian harrier (*Circus approximans*) predation events were recorded this season. However, predator species couldn't be identified for 79% (n=59) of predated nests, as cameras weren't deployed on these. Continued banding of kāhu and monitoring will continue to elucidate this potential predation pressure on tarapirohe nests.

There has been a marked decrease in the number of tarapirohe and colonies in the monitored area on the Wakaputawatea river, a pattern seen over the past four seasons, whilst numbers on the Waiau Toa have increased. Reasons for this are likely the pressure from introduced mammalian predation and flooding in the dynamic braided river habitat, as well as tarapirohe shifting between rivers. Further

monitoring of the entire catchment is required to better understand what the leading causes of these declines are.

Chick shelters were deployed in treatment areas to provide tarapirohe chicks refuge from the elements and aerial predators. A total of 48 chick shelters were deployed, with 46% (n=22) on natural islands and 54% (n=26) on mainland colonies within the treatment areas. Of the 48 shelters deployed, 48% (n=19) had trail cameras deployed to assess tarapirohe chick shelter use. Chick shelter use was split into two periods, one to seven days after hatching, and eight or more days after hatching. In the first period, 68% (n=13) of the 19 available chick shelters were used by tarapirohe chicks. Of the remaining nests with available chick shelters and with chicks that survived past the first period (four in total), all chick shelters were used by tarapirohe chicks. WMIL believes chick shelters can contribute to chick fledging success and population sustainability, by mitigating impacts of predation and climate change where increased temperatures and increases in the frequency and magnitude of storm events in Aotearoa New Zealand are expected.

Hatching success was higher this season than the highest average of 42.8% reported at this site between 2012-2014. Further analyses of both Phase 1 and Phase 2 data from this project will need to be undertaken to fully understand whether predator control and habitat enhancement are improving tarapirohe breeding success. Historic island enhancements appear to potentially benefit tarapirohe breeding, but the islands require consistent maintenance particularly before/after flooding events, and further analysis of the dataset is required. Anthropogenic disturbance continues to be a threat to breeding colonies too, and WMIL supports continued advocacy through signage at this site.

This season's results continue to highlight the pressing challenges of tarapirohe conservation management in such a dynamic environment where large fluctuations in river levels have profound impacts through flooding and increased risk of predation at lower flows over the course of one breeding season. With climate change also acting to exacerbate these impacts, the Waiau Toa catchment tarapirohe population is likely going to continue to experience more pressure when they breed here.

WMIL has the following recommendations:

- Helicopter surveys continue to be carried out during the peak of the breeding season and the helicopter survey area is extended to increase coverage and better detect whether the population has moved outside of the current survey area.
- Tarapirohe data is collected in consistent 1km sections during helicopter surveys to obtain more fine scale data on both rivers to better determine how numbers are changing between seasons.
- Continue to select a maximum of 8-10 colonies to monitor throughout the season. These should be split between non-treatment and treatment areas and be determined following the helicopter survey.
- Undertake a regular check of non-monitored colonies to understand the population dynamic on the river.
- Continue to use chick shelters as a means to help colonies within the treatment areas as an additional treatment type.
- Review the current classification of "island" and "mainland", as well as "treatment" and "non-treatment", to ensure consistency going into next season, particularly when an island becomes attached to the mainland during the season at low flows.
- Continue to band both adults and chicks.
- Continue to carry out leg-hold trapping during peak nesting and chick rearing periods, particularly at larger colonies.
- Consider targeted predator control around known colonies utilising other methods rather than just predator traps, including the use of toxins and shooting to target cats and mustelids.
- Increasing advocacy signage at key locations such as the Cobb Cottage campsite to increase awareness and encourage visitors to report band sightings to WMIL and/or DOC.
- Island enhancements continue to be undertaken before the 2025/26 season. Appendix 4 outlines the recommendations for island enhancements.

Waiau Toa/Clarence and Wakaputawatea/Acheron rivers tarapirohe/black-fronted tern monitoring project - 2024/25 operational report

1 INTRODUCTION

Environment Canterbury (ECan) and the Department of Conservation (DOC) have co-funded a five-year project aimed at monitoring and improving the breeding success of tarapirohe/black-fronted tern *(Chlidonias albostriatus)* on the Waiau Toa/Clarence and Wakaputawatea/Acheron rivers.

This report, produced by Wildlife Management International Ltd. (WMIL), provides a summary of the 2024/25 tarapirohe breeding season on the Waiau Toa and Wakaputawatea rivers. Recommendations for future tarapirohe monitoring are also provided. For ease of reading, repeated information from previous seasons' reports regarding methods has not been included. Please refer to Connor-McClean et al. (2023) for these sections (available upon request from WMIL or online on the BRaid website).

Te Reo names are used throughout the document for all bird species and place names after the first use (e.g., tarapirohe/black-fronted tern) and common English names for all mammalian predator species after the first use (e.g., ngeru/cat).

2 METHODS

2.1 Treatment and non-treatment zones

The monitored area is divided into two zones. The treatment zone, a continuous stretch of river under introduced mammalian predator control, with chick shelters deployed and includes historically enhanced islands, which have had work done to enhance water flow around the island, increase island height, and suppress weeds. The second zone is the non-treatment zone, with no predator control or island enhancement works. Historical information regarding island enhancements is detailed in Connor-McClean et al. (2023).

2.2 Kāhu/Australasian swamp harrier banding

Ray & Burgin (2024) details kāhu/Australasian swamp harrier *(Circus approximans)* banding and monitoring methods. The purpose of the banding is to continue to try understand the extent of nest predation behaviour in the local kāhu population on tarapirohe nests. Kāhu are documented as having predated tarapirohe nests (Stein 2010, Bell 2017, Connor-McClean and Bell 2018).

2.3 Tarapirohe/black-fronted tern monitoring

Please refer to the 2022/23 report (Connor-McClean et al. 2023) for further details on tarapirohe survey methods, monitoring, and chick shelter use. This year, a major deviation from previous seasons was that not all colonies were monitored. Instead, a subset of 10 colonies was selected for monitoring throughout the season on the Waiau Toa and Wakaputawatea rivers, consisting of five treatment and five non-treatment colonies. A further six colonies were identified on the Waiau Toa but were not monitored after the end of November 2024 due to the capacity limits of the project. WMIL and the clients (DOC and ECan) made a collaborative decision regarding which colonies to monitor. Those not monitored were excluded based on either low nest numbers, location, and/or early failure.

Figure 1 shows the surveyed areas and locations of all tarapirohe colonies along the Waiau Toa and Wakaputawatea rivers.

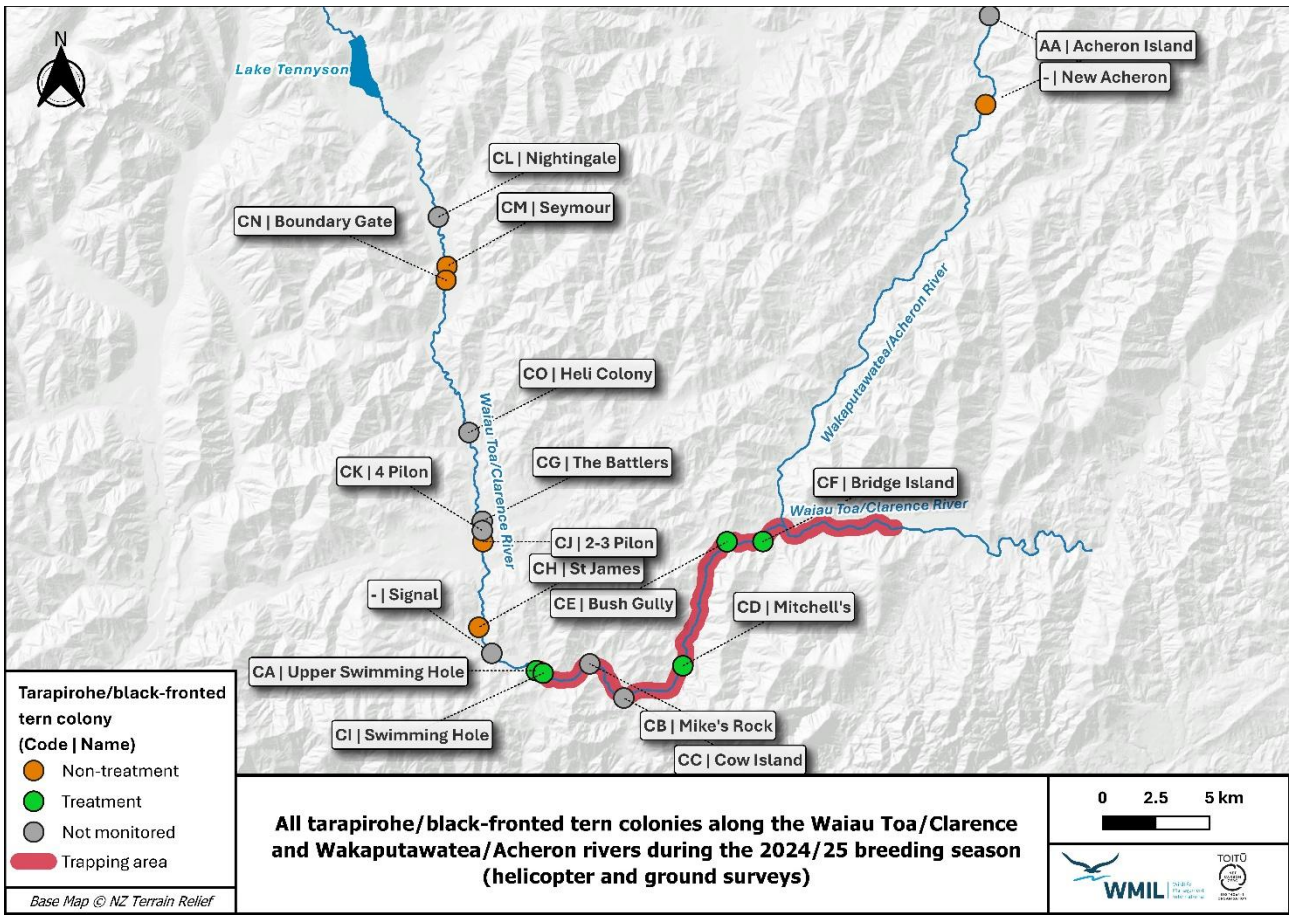

Figure 1. *Tarapirohe/black-fronted tern colonies along the Waiau Toa/Clarence and Wakaputawatea/Acheron rivers during the 2024/25 breeding season (identified from helicopter and walking surveys). New Acheron and Signal colonies were not given a Colony Code and are marked by "-".*

2.4 Predator control

Trapping is now undertaken by J&S Mears Contracting between August and February each year. Trapping results are available on Trap NZ under the *Upper Waiau Toa/Clarence Trapping Project* and are not reported on in this report.

OSPRI did not carry out any aerial sodium fluoroacetate (1080) operations to target paihamu/common brushtail possum (*Trichosurus vulpecula*) this season but have in previous seasons from 2021-2023 (Figure 2). However, in September 2024, DOC trialled a new 1080 bait to target ngeru/feral cats (*Felis catus*) in the Edwards Valley (DOC 2024) (Figure 2).

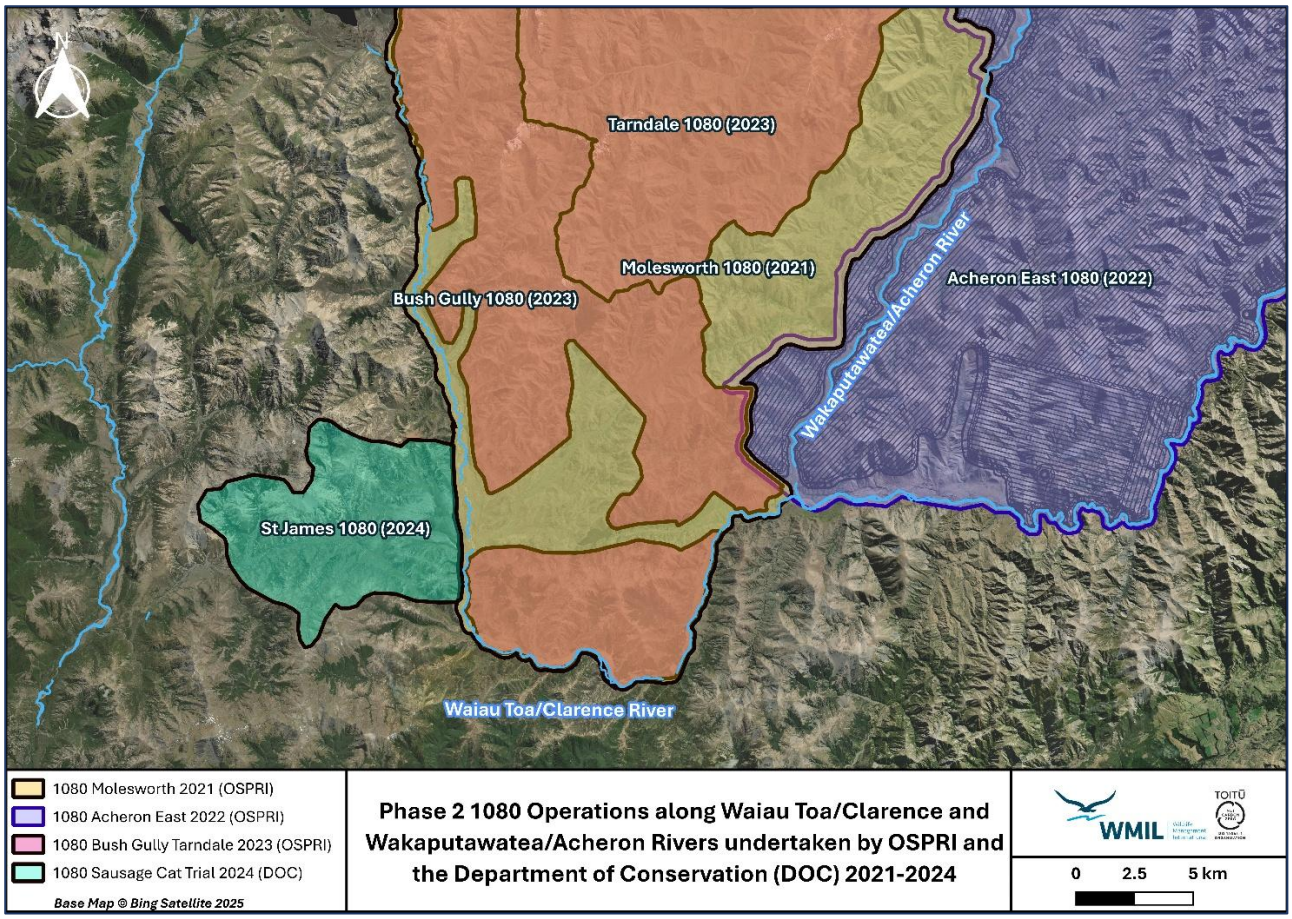

Figure 2. *Phase 2 1080 Operations along Waiau Toa/Clarence and Wakaputawatea/Acheron rivers undertaken by OSPRI and the Department of Conservation (DOC), 2021-2024.*

3 RESULTS

3.1 Enhanced islands

Prior to the beginning of the 2024/25 season, weed spraying was carried out by DOC. Both Bridge Island and Cow Island had some enhancement work done before the start of the 2024/25 season. However, Cow Island was hit hard by the flood in October 2024 and was not used for breeding by tarapirohe after that. Bridge Island was graded, and extensive weed control was undertaken. The true left channel of Bridge Island was not deepened and this channel dried out during the season. Although historically considered enhanced islands, Mitchell's, Swimming Hole and Upper Swimming Hole islands were too vegetated to be considered enhanced. Grass and weeds, mainly common broom (*Cytisus scoparius*) and rūpini/tree lupin (*Lupinus arboreus*), are present over large parts of the islands, limiting nesting areas for the tarapirohe (Figure 3). Bush Gully was too low lying to be considered enhanced and was flooded around December 2024, destroying all nests on the island. Due to this, **no** islands were considered as enhanced this season, and tables have been modified to reflect this. This should be taken into consideration in future analyses.

Figure 3. *Historically enhanced islands with comparison photos from the beginning (1 October 2024) and the end (9 January 2025) of the 2024/25 tarapirohe/black-fronted tern season.*

3.2 Kāhu/Australasian swamp harrier banding

No kāhu predation events or band resights were detected this monitoring season.

3.3 Tarapirohe/black-fronted tern monitoring

3.3.1 Waiau Toa/Clarence and Wakaputawatea/Acheron rivers surveys

3.3.1.1 Walkthrough surveys

Initial walkthrough surveys were completed from 30 September to 4 October 2024, on the Waiau Toa and the Wakaputawatea rivers. Although no tarapirohe nests were found, there were several scrapes, and the tarapirohe displayed agitated behaviour.

Eggs were first recorded on the Waiau Toa on 16 October 2024 at the Battlers colony (non-monitored) and then on 22 October 2024 at Upper Swimming Hole, Mike's Rock (non-monitored), Mitchell's, Bush Gully, and Bridge Island. On the Wakaputawatea, the first eggs were found at Acheron Island on 18 November 2024. First laying dates were slightly earlier than last season for the Waiau Toa colonies (17 October 2023) but later on the Wakaputawatea, with first eggs found on 25 October 2023. The birds nesting on the Wakaputawatea are thought to have had a delayed lay date this season due to weather events however, other factors such as parental quality, age, and experience as well as the length of the prospecting period (Nisbet & Welton 1984; Dittman & Becker 2003; Arnold et al. 2004) could have caused delayed laying dates and warrants further investigation for this species.

3.3.1.2 Helicopter Survey

A helicopter survey was conducted on 14 November 2024 from Lake Tennyson to just downstream of the Wakaputawatea and Waiau Toa confluence (the edge of the treatment zone). The Wakaputawatea was surveyed from the same confluence north to the Severn Shelter (Figure 4). A total of 426 tarapirohe were counted within 15 potential colony sites across both rivers during the helicopter survey (Table 1). Eight of these sites were new, highlighting the importance of the helicopter surveys. 10 of these were selected to be part of the monitored colonies (see Section 3.3.2).

There were 13 (six new) potential colony sites found on the Waiau Toa and 393 tarapirohe were seen, 40 of which were detected between sites. On the Wakaputawatea two new potential colony sites were recorded, and 33 tarapirohe were seen, of which five were detected between the sites. On the Wakaputawatea, just outside the survey area, two additional colonies with six and 25 tarapirohe respectively were detected but were not included in the counts. The helicopter survey confirmed that the number of tarapirohe within the Wakaputawatea survey area (n=33) was lower than in previous years (Table 1). Whereas, the Waiau Toa had an all-time high of 393 tarapirohe counted this season. It is important to note that in 2011, 2013, 2015, and 2018 monitoring covered longer stretches along the Wakaputawatea River than from 2021 onwards (Connor-McClean et al. 2024) and for consistency these values are not included in the analysis above. The helicopter surveys have been valuable to clarify colony locations and to estimate the number of birds within the surveyed sections of these rivers but further monitoring and analyses are needed to clarify population trends.

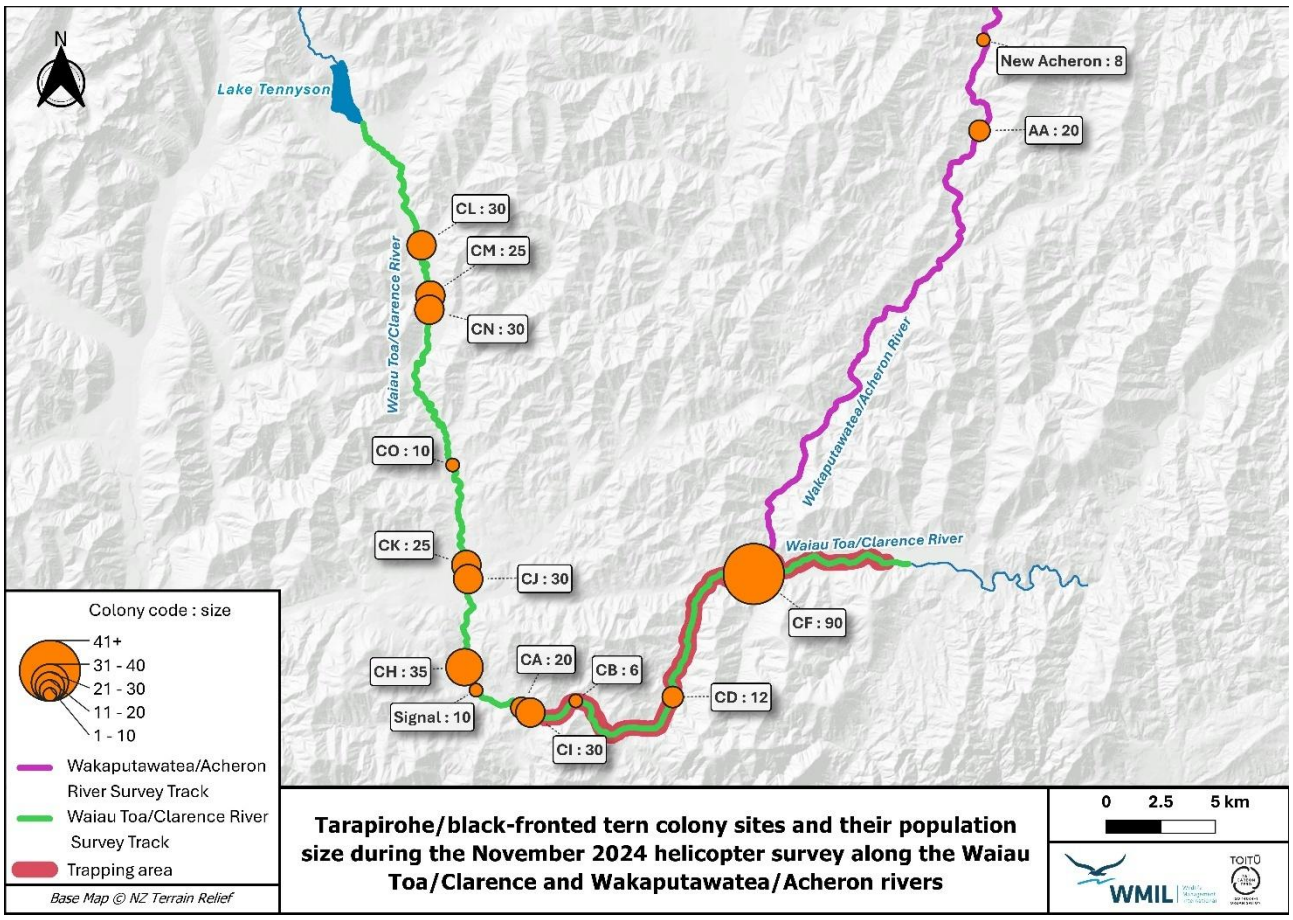

Figure 4. *Tarapirohe/black-fronted tern colony sites and their population size during the November 2024 helicopter survey along the Waiau Toa/Clarence and Wakaputawatea/Acheron rivers. The colony code is shown with two letters and the population size of the colony (colony code:size).*

Table 1: *Number of tarapirohe/black-fronted terns counted during helicopter surveys from 2021 to 2024.*

Year	Wakaputawatea/Acheron River	Waiau Toa/Clarence River	Combined Total
2021	72	269	**341**
2022	98	252	**350**
2023	82	370	**452**
2024	33	393	**426**

3.3.2 Size and distribution of monitored breeding colonies

Of the 10 monitored colonies, size ranged from 17 to 95 breeding pairs (Figure 5), with an average size of 32 breeding pairs per colony. A total of 315 tarapirohe nests were monitored throughout the 2024/25 season, equating to 630 breeding birds on the Waiau Toa and Wakaputawatea rivers combined. More tarapirohe breeding pairs were recorded on the upper Waiau Toa (n=293) than on the Wakaputawatea (n=22) which aligns with previous findings since the 2016/17 breeding season (Table 2).

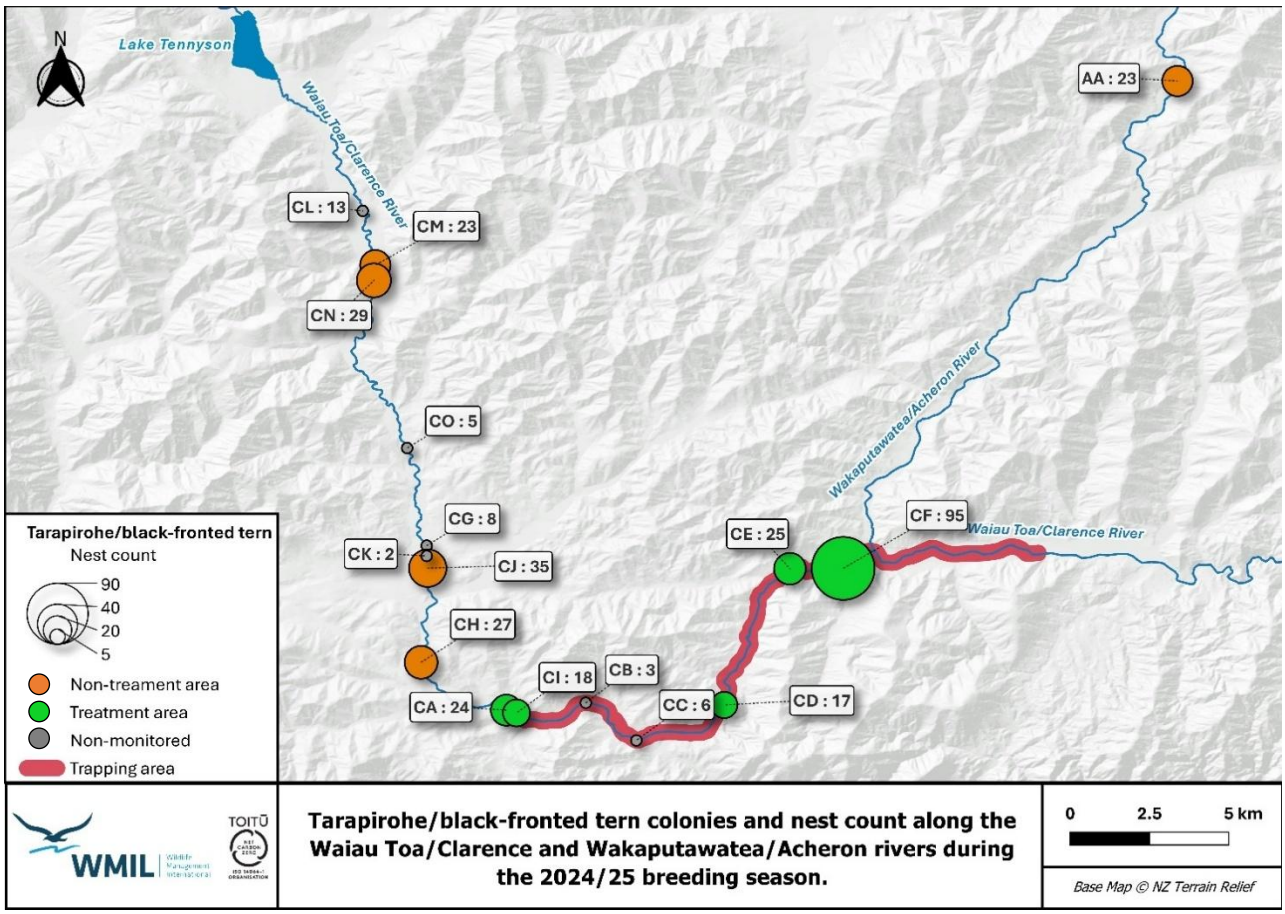

Figure 5. *Tarapirohe/black-fronted tern colonies and nest counts along the Waiau Toa/Clarence and Wakaputawatea/Acheron rivers during the 2024/25 breeding season. The colony code is shown with two letters and the total nest counts (colony code:nests).*

The maximum number of monitored nests that were active at the same time during the season was 210, with the highest number of active nests from 18-24 November. Significant flooding and predation events likely caused many breeding pairs to re-nest throughout the season and should be considered.

Table 2. *Number of nests and adult tarapirohe/black-fronted terns present on the Waiau Toa/Clarence and Wakaputawatea/Acheron rivers at the peak of each breeding season, 2012/13 to 2024/25.*

Season	Active nests Waiau Toa/Clarence River	Active nests Wakaputawatea/Acheron River	Total Nests
2012/13	177	202*	379
2013/14	151	209*	360
2014/15	154	149*	303
2015/16	92	93*	185
2016/17	275	118*	393
2017/18	170	137*	307
2018/19	211	52	263
2019/20	180	32	212
2021/22	185	56	241
2022/23	199	111	310
2023/24	269	56	325
2024/25^	293	22	315

***Note**: No monitoring was carried out in the 2020/21 season. The darker blue marks the second five-year study.*
^Monitoring was only carried out at 10 of the 16 colonies during the 2024/25 season, so total numbers are not a complete representation of the total tarapirohe/black-fronted tern population on these rivers.

3.3.3 Breeding Outcomes

Table 3 summarises the key outcomes regarding tarapirohe breeding success during the 2024/25 season along the two monitored rivers. 53% of monitored tarapirohe nests hatched at least one egg, which is higher than the 47% hatching success observed in the 2023/24 season. Of the nests that failed to hatch (n=149), 50% were predated (n=75). Split between the treatment and non-treatment areas, predation represents 41% (n=36) of the cause of failure in the treatment area and 64% (n=39) of the cause of failure in the non-treatment area. Predation was the primary cause of known nest failures with 24% of total nests predated, followed by flooding with 14% of total nests being flooded.

A total of 299 chicks successfully hatched from the 315 monitored nests. Of these, 75 fledglings were confirmed. A further 83 chicks were thought to have left the nest and may have fledged without any significant events, such as flooding or predation, that could have affected their success. More chicks fledged in the non-treatment zone this season than in the treatment zone. It is important to note that just under a third of the monitored nests (30%) were located on Bridge Island this year, an island that is in the treatment zone. This season several islands started as islands during the nesting period with eggs beginning to hatch, however river channels dried up resulting in predators gaining access to these sites and predation events occurring, which included Bridge Island. Therefore, for all further analyses if an island became a mainland the nests at these sites were classed as mainland. A total of 145 nests (46%) started the season on an island and were then reclassed as mainland due to the surrounding channels drying up.

As females can renest after nest failures it is not possible to accurately calculate the number of females which have attempted to breed unless adults are banded. Therefore, this data has not been included in Table 3. Additionally, due to the highly mobile nature of chicks soon after hatching, WMIL cannot confidently identify which nests fledglings have come from. Therefore, this field has been left blank in Table 3, except for mainland treatment colonies where no fledglings were produced. To assign fledglings to nests, chicks would need to be banded while they are still in the nest, but at that age, they would be much too small to do this.

Table 3. *Tarapirohe/black-fronted tern breeding success during the 2024/25 season along the Waiau Toa/Clarence and Wakaputawatea/Acheron rivers separated by habitat and treatment type.*

Tarapirohe breeding outcomes 2024/25	Overall	Treatment		Non-treatment	
		Natural Island	Mainland	Natural Island	Mainland
Egg stage					
Total no. of nests (A)	**315**	81	98	69	67
No. nests with known outcome (B)	**315**	81	98	69	67
No. nests in B that hatched ≥ 1 egg (C)	**166**	35	56	42	33
No. nests that failed	**149**	42	46	27	34
Total no. of eggs	**572**	147	181	122	122
Of the nests in (B):					
No. eggs laid where fate known (D)	**572**	147	181	122	122
No. eggs where fate unknown	**0**	0	0	0	0
Of the eggs in (D):					
Total number of eggs that hatched	**299**	61	103	77	58
Total number of eggs that died in incubation	**5**	1	0	4	0
Number of eggs that failed from other causes	**268**	85	78	41	64
Hatching success (per nest) (E) = C/B	**0.53**	0.43	0.57	0.61	0.49
Nest Failure					
Total number of nests that failed	**149**	42	46	27	34
Nest failure because of:					
Predation	**75**	3	33	13	26
Desertion (fertile eggs)	**27**	10	5	8	4
Flooding	**45**	33	4	4	4
Died during incubation/ infertile	**2**	0	0	2	0
Failed, cause unknown	**0**	0	0	0	0
Chick stage					
Fledging Success					
Total number of females that attempted to breed	-	-	-	-	-
No. nests that hatched ≥ 1 egg	**166**	35	56	42	33
No. nests that fledged ≥1 chick (when/where possible)	**-**	-	0	-	-
No. nests that lost all chicks	**75**	1	56	6	12
No. nests with unknown fledgling outcome	**91**	34	0	36	21
No. chicks fledged as min - max (F)	**75 -158**	**27 - 58**	**0 - 0**	**36 - 66**	**12 - 34**
Fledging success (per nest, as min/max) (G) = F/A	**0.24-0.5**	**0.33 - 0.72**	**0 - 0**	**0.52 - 0.96**	**0.18 - 0.51**
**During the season some river channels dried out and some islands became part of the mainland, nests which became mainland are classed as mainland for this analysis.*					

Figure 6 below shows overall tarapirohe egg stage outcomes by colony location and treatment type for the 2024/25 breeding season. It reveals natural islands in the non-treatment area having higher hatching rates, and the opposite in the treatment area. There were large predation percentages for mainland colonies compared to island colonies. Higher numbers of nests failed due to flooding on

natural islands in both areas, but with slightly more nest failures due to flooding in the treatment areas. Abandoned proportions were higher on islands, and only a small proportion of nests were found to fail due to being infertile in the non-treatment island colonies.

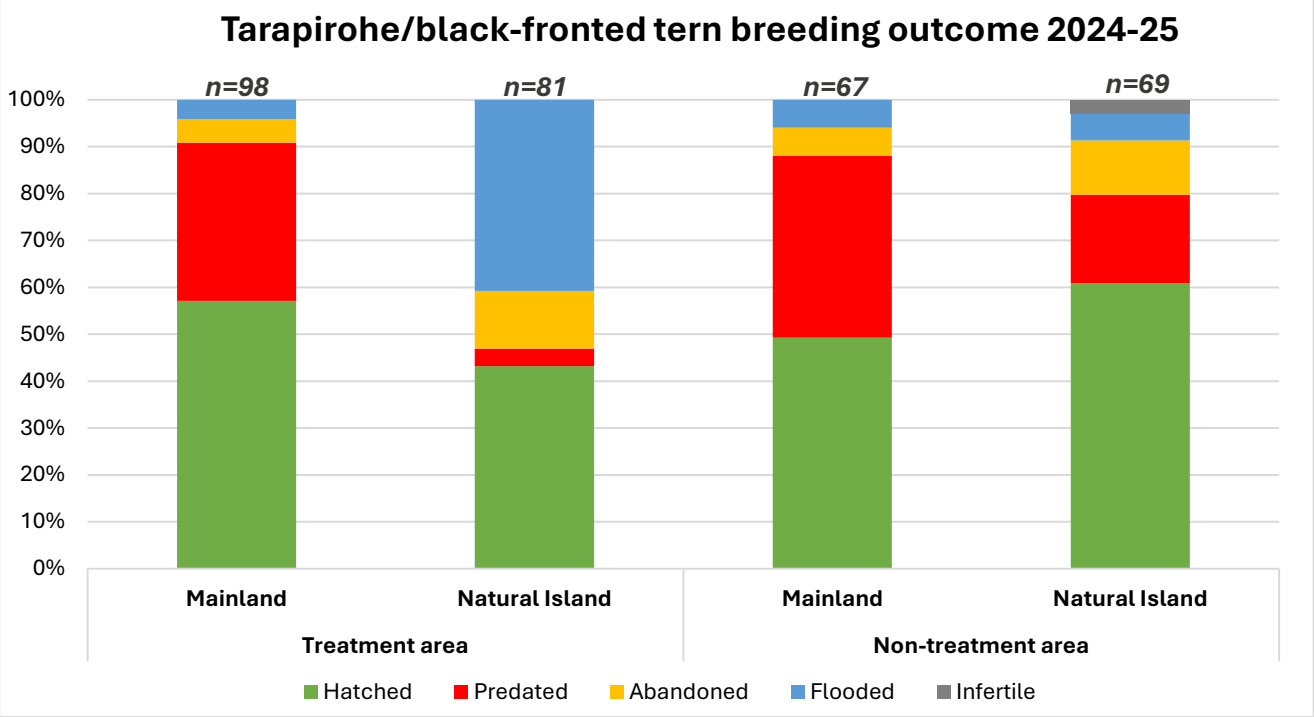

Figure 6. *Tarapirohe/black-fronted tern egg stage outcome (%) by colony location and treatment type (2024/25).*

3.3.4 Camera monitoring of nests

Trail cameras were deployed on 27% (n=85) of monitored nests this season. Coverage varied from 10% to 50% between colonies depending on location, accessibility, and discovery date (Appendix 1). Some cameras were moved before high rainfall events to avoid potentially being lost during flooding.

3.3.5 Predation events

Of the 75 nest predation events, 79% were classed as unknown (n=59), with 41% (n=24) occurring in the predator control treatment areas compared to 59% (n=35) in the non-treatment areas. Of the 75 nests that failed at the egg stage due to predation, 23% (n=17) of them were filmed, and 94% (n=16) of those were able to be identified to a specific predator (Table 4).

Cats were responsible for most predation events on monitored nests this season. This was mainly due to the large-scale predation event on Bridge Island when the river levels dropped to very low levels. Nest checks and remote trail camera footage revealed a single cat predated 54 eggs as well as 103 chicks and two adult tarapirohe over eight days. Cats were also likely responsible for two other main predation events at Seymour and Nightingale. A single ferret was found to predate 17 nests at the 2–3 Pylon colony over several nights. Only one stoat predation was observed in the treatment area at Mitchell's at a nest on the mainland. Of note were spur-winged plover (*Vanellus miles novaehollandiae*) predations, the first time WMIL has detected this during this project.

Table 4. *All predation events at the egg stage by predator species, habitat, and trapping treatment type for the 2024/25 tarapirohe/black-fronted breeding season.*

Colony Location		Predator species						
		Cat	Ferret	Stoat	Hare	SWP	Unknown	Total
Treatment (Trapping)	Natural	0	0	0	0	2	2	4
	Mainland	9	0	1	0	0	22	32
	Total	**9**	**0**	**1**	**0**	**2**	**24**	**36**
Non-Treatment (No-Trapping)	Natural	0	0	0	1	0	12	13
	Mainland	1	2	0	0	0	23	26
	Total	**1**	**2**	**0**	**1**	**0**	**35**	**39**
Combined Total		**10**	**2**	**1**	**1**	**2**	**59**	**75**

SWP = Spur-winged plover (Vanellus miles novaehollandiae)

3.3.6 River Hydrology

This season, hatching and fledgling success were significantly affected by the river hydrology (Figure 7). Flooding was the second biggest reason for nest failure this season, responsible for 30% (n=45) of nest failures (Table 3). Two large flood events happened at the end of October and December 2024 (Figure 8) with flows peaking at 124.92 m^3/s at Jollies Pass. For reference mean river flow for the Waiau Toa was calculated at 11.42 m^3/s between October and the end of February over a 12-year period (2012-2024). Both flood events were responsible for the destruction of colonies and therefore a high number of nests wiping out Bush Gully, and the non-monitored colonies Mike's Rock, Cow Island and The Battlers. These events flooded a significant number of nests at Upper Swimming Hole, Mitchell's and St. James.

Alternatively, during December 2024, the river levels dropped to such low levels (3.89 m^3/s on 7 December 2024 at Jollies Pass) that islands were connected to the mainland causing major predation events at Bridge Island, St James, Seymour and 2-3 Pilon colonies. 2-3 Pylon and St. James lost ~ 50% of nests. Overall, 81% (n=61) of predation at the egg stage happened when the islands were connected to the mainland.

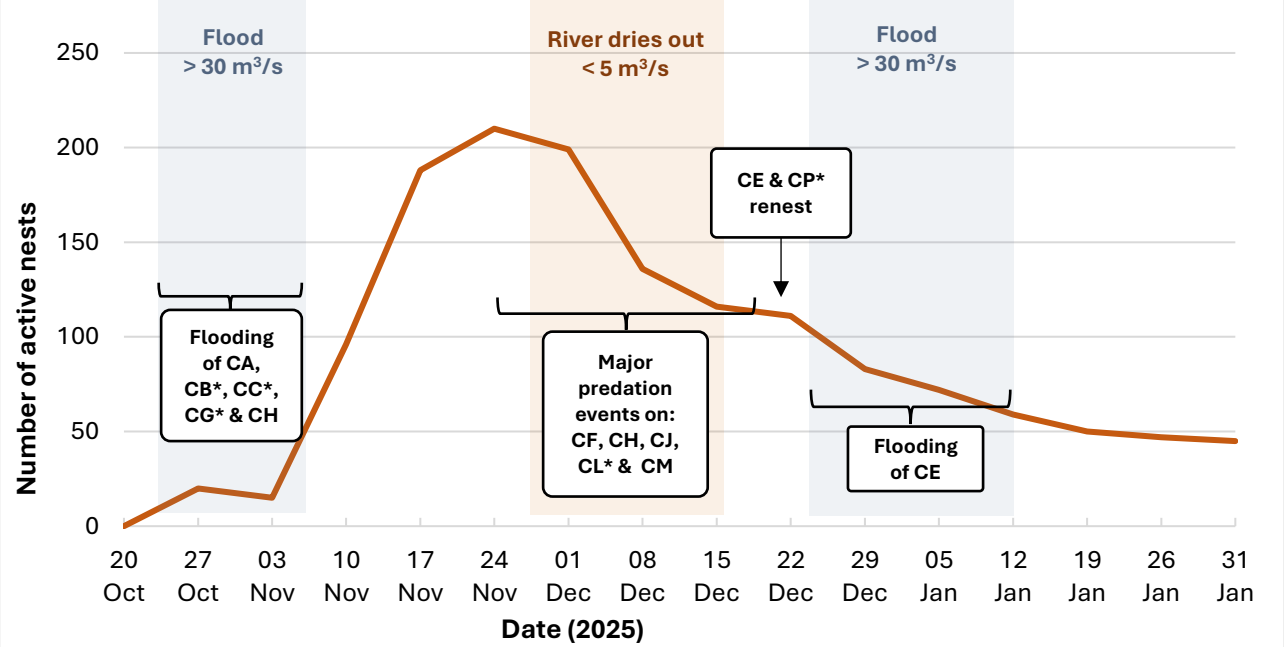

Figure 7. *Monitored active nests through the 2024/25 breeding season and significant events. Active nests = Nests found – Nests that lost all their eggs and/or chicks. *Not part of the selected colonies for monitoring.*

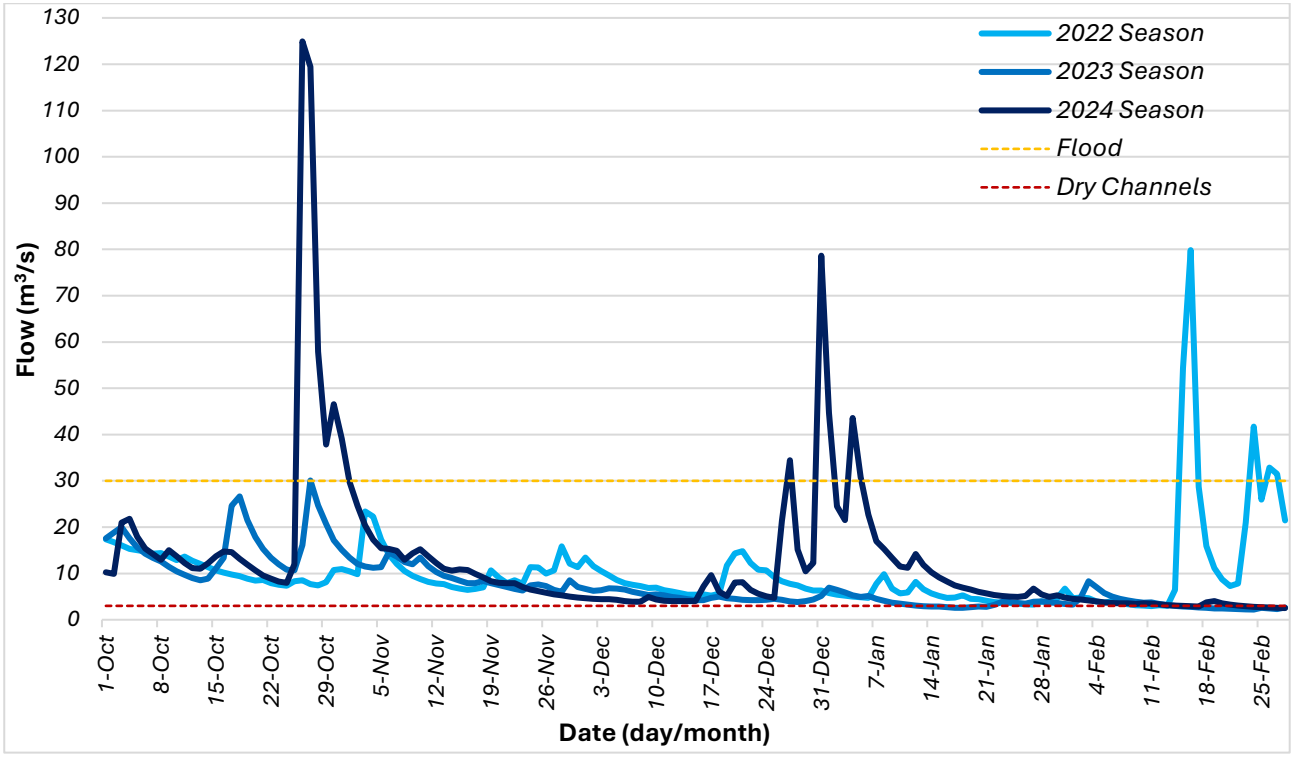

Figure 8. *Average daily flow rates of the Waiau Toa/Clarence River for the 2022-2024 seasons © Environment Canterbury/NIWA Waiau Toa/Clarence River flow data at Jollies (ECan 2025).*

3.3.7 Chick shelter use

A total of 48 shelters were deployed across colonies within the treatment zone on tarapirohe nests, with coverage of nests between 20% to 39% in these colonies (Appendix 2). Just one nest with two eggs was abandoned shortly after the chick shelter installation. WMIL placed 46% (n=22) of shelters at nests on natural islands with the remainder (n=26) at nests on the mainland. Of those 48 nests with a chick shelter, 69% (n=33) were monitored by a trail camera with 44% (n=21) of these monitored nests hatching. Of those 21 nests, 90% (n=19) were analysed. Two nests were removed from the analysis due to having incomplete data.

Chick shelter use analysis was split into two periods:

1. Interactions of the chicks from day one (hatching) to day seven,
2. Interactions of the chicks from day eight and beyond.

WMIL analysed 90% (n=19) of the nests for interactions in period one, and 20% (n=4) of the nests were analysed for interactions in period two. The drop in the number of nests analysed between the two periods is due to predation at nine of the nests, and missing data at six of the nests.

In the first period 68% (n=13) of shelters were used by chicks. In the second period only four nests with chick shelters still had chicks and weren't missing data. All of these shelters were used by chicks during that period. Overall, 68% (n=13) of shelters were used over the two periods. Chick shelters were usually not used in the first two days of hatching. Appendix 3 provides further details on chick shelter use from the analysis.

The chick shelters were used by tarapirohe adults and chicks in a range of climatic conditions, from high temperatures to heavy downpours. Adults were also seen brooding and feeding chicks under the shelter, suggesting the shelter does not alter normal chick-rearing behaviours (Figure 9). Chicks were also seen using the shelters at normal temperatures and/or when parents were present.

Figure 9. Tarapirohe/black-fronted tern chicks (A) and adults (B) interacting with the chick shelters © WMIL.

3.4 Tarapirohe/black-fronted tern banding and resighting

3.4.1 Tarapirohe/black-fronted tern banding

Tarapirohe banding was undertaken during November and December 2024. Catching adults this season proved to be challenging with only two adults caught at the St James colony, and one at the Shark Tooth colony on the Waiau Uwha River.

Chick banding was carried out from 13 - 15 December 2024 with extra WMIL staff and ECan staff assisting. A total of 44 chicks were banded on the Waiau Toa and 23 at the Shark's Tooth colony along the Waiau Uwha. Banding totals over the past four years are shown in Table 5. All banding data can be retrieved from the DOC FALCON banding database under the '*Black-fronted tern study*' project.

Table 5. Tarapirohe/black-fronted tern banding totals between the 2021/22 – 2024/25 seasons.

	2021/22	2022/23	2023/24	2024/25
Adults	31	20	10	3
Chicks	18	93	41	80
Total	**49**	**113**	**51**	**83**
Total banded (2021-2025):			**296**	

3.4.2 Tarapirohe/black-fronted tern band re-sights

There were 20 individual band and/or yellow flag resights made this season. One was from a dead adult found on Acheron Island, with the rest coming from nest cameras. Of the resighted tarapirohe, 19 were on the same river they were banded. All sightings of individuals were from birds originally banded over the course of the project (two from 2013, five from 2016, four from 2017, four from 2021, three from 2022, and two from 2023). Nest cameras remain the best and least invasive way to resight bands.

4 DISCUSSION

4.1 Local population size and distribution of breeding colonies

The local population size of tarapirohe colonies across both rivers has changed over the course of this monitoring period (2021-2024), with a marked decrease on the Wakaputawatea river. Decreases are likely attributable to less extensive helicopter and ground surveys than those in 2018 being undertaken,

and so certain colonies may have been missed. Tarapirohe have been shown to use the same sections of river in successive seasons (Bell 2017) as well as having been found to have low site-fidelity with some individuals and colonies moving between neighbouring river systems (Keedwell 2002, Hamblin 2017). Further monitoring and analysis of colony location and site fidelity, particularly for individuals through more banding and resighting, could help better elucidate these potential variations. This may help show that birds are shifting to other parts of the river between seasons in response to the dynamic braided river environment (Hamblin 2017) rather than actual population declines. Additionally, setting up consistent, and evenly spaced (say 1 km) sections of river to monitor each season during helicopter surveys could help undertaking population number monitoring and is recommended below. Declines have been documented in the past for this species (O'Donnell & Hoare 2011, Bell 2017) and so further population analysis would be valuable to understand how the population within the catchment is faring.

4.2 Tarapirohe/black-fronted tern breeding outcomes

River hydrology had a major influence on nest success this season with two major floods and low river flows causing nest success declines. Low river levels caused major colony declines through predation of their nests after the islands became part of the mainland and a large proportion (81%) of predation at the egg stage occurred at this point. This likely caused an increased rate of re-nesting to compensate. The changing definition of an island colony to a mainland colony when it became attached to the mainland during low flows, creates complications in analyses. Islands in braided river systems are complex and dynamic, and it warrants further discussion about how best to define and analyse these situations consistently moving forward.

Hatching success this season (53%) was higher than 2023/24 (47%) but lower than 2022/23 (68%) and slightly higher in the non-treatment area (55%) than in the treatment area (51%). Hatching success this season was also higher than the highest average of 42.8% reported at this site between 2012-2014 (Bell 2017), and that reported on other rivers such as the Ohau River; 50.2% (Keedwell 2005). Predator control and habitat enhancement are current management tools to try increase tarapirohe breeding success (Keedwell 2005, Bell 2017) and may be gradually helping hatching success increase, however further detailed analysis of both Phase 1 and Phase 2 data from this project is warranted to better understand this.

Fledgling success was lower this season at 0.24-0.50 (min-max) fledglings per nest compared to 0.31-0.54 in the 2023/24 season. This is likely due to three colonies (Bridge Island, St James, and Seymour) experiencing heavy predation during the chick stage and resulting in no chicks being detected fledging from Bridge Island or Seymour Island. Fledgling success was considerably higher in the non-treatment area (0.42) than in the treatment area (0.15) and is likely due to the flooding events and low river levels which resulted in major predation events at colonies in the treatment area discussed above.

As noted above, some aspects of Table 3 are very hard to gather accurate data on, including the number of females which have attempted to breed and confidently identifying which nests fledglings have come from. To assign fledglings to nests, chicks would need to be banded while they are still in the nest, but at that age, they would be much too small to do this. In addition, situations where islands become mainland during different breeding stages are hard to encapsulate in the current table format, as found this season. Consideration should be taken to possibly update Table 3 in the future to take these into aspects and uncertainties account.

These results ultimately highlight the pressing challenges for the conservation management of this species in such a dynamic riverine environment. With climate change projections indicating increases in the frequency and magnitude of storm events, and temperatures (Bodeker et al. 2022), the Waiau Toa catchment will likely continue to experience large fluctuations in river flow, increasing the pressure on tarapirohe breeding here.

4.3 Nest predation

Predation was the main reason for nest failure this season and as discussed above, was exacerbated by low river flows causing island colonies to become connected to the mainland. The large proportion of monitored nests failing due to predation (49%) highlights the continued high impact introduced mammalian predators continue to have on tarapirohe breeding. Cats were the main confirmed predator this season, being involved in the failure of multiple colonies. At Bridge Island where a significant proportion of nests were lost to a single cat over the course of a fortnight in December 2024, the state of the channels was likely a key factor with the river in low flow (less than or equal to 5 m^3/s) likely allowing the cat to walk to the island from the mainland. Traps are present around Bridge Island, including Steve Allen traps, demonstrating how difficult this predator is to trap and how challenging it is to protect tarapirohe nesting colonies.

WMIL field staff did observe kāhu being successfully chased off by adult tarapirohe and a few nests were found with eggs completely gone, which could be an indication of avian predation. However, no kāhu predation events were recorded this season. For the first time in this project, spur-winged plovers were responsible for two confirmed nest failures in two different colonies (Mitchells and Bridge Island). This species has been documented predating northern New Zealand dotterel (*Charadrius obscurus aquilonius*) eggs (Wills et al. 2003) highlighting interspecific predation in shorebirds (Kubelka 2020).

4.4 Chick shelters

This season, chick shelters have again proven to be an effective management tool for tarapirohe. One chick shelter was recorded being used by two different pairs of chicks over the first (1-7 days after hatching) and second periods of analysis (8+ days after hatching). The closest nests where these chicks could have come from were situated more than 20 m away. This is the second season where adults have been detected using the chick shelters for either brooding or feeding their chicks in the shade.

WMIL believe that artificial shelters can help prevent chick fatality due to heat exhaustion, and provide safe coverage from aerial predators, thereby increasing the likelihood of chicks surviving to fledging. In combination with other management techniques chick shelters could make a substantial contribution to population sustainability particularly to mitigate impacts from climate change (Bodeker et al. 2022).

4.5 Island enhancement

Good quality islands either natural or enhanced appear to be a beneficial tool for tarapirohe breeding success. The islands do require consistent upkeep to avoid losing the benefits and the strategy for enhancing islands may require more frequent intervention to ensure they stay enhanced for the entirety of the breeding season. Further analysis of the Phase 1 and Phase 2 datasets would be needed to fully understand if the current management practices of island enhancement and the suppression of introduced mammalian predators during the nesting season are pivotal to the continued recovery of this Nationally Endangered tern (Robertson et al. 2021, Bell 2023).

4.6 Anthropogenic Disturbance

The Molesworth Recreation Reserve is utilised extensively for recreation, which often leads to close and problematic encounters between humans and ground-nesting braided river birds, such as tarapirohe. WMIL staff have seen members of the public investigating nest cameras and is concerned this could lead to nest abandonment or chicks fleeing into the river. This season, WMIL staff observed a fisherman walking through the Bridge Island colony while chicks and eggs were present and 4WD tracks were seen going through the Upper Swimming Hole colony.

5 RECOMMENDATIONS

Based on the last nine years monitoring tarapirohe along the Waiau Toa and Wakaputawatea rivers, WMIL has the following recommendations for future monitoring work on this species:

5.1 Tarapirohe/black-fronted tern monitoring

- Helicopter surveys continue to be carried out during the peak of the breeding season.
- Extending the helicopter survey area to increase coverage and better detect whether the population has moved outside of the current survey area.
- Tarapirohe data is collected in consistent 1km sections during helicopter surveys to obtain more fine scale data on both rivers to better determine how numbers are changing between seasons.
- Continue to select a maximum of 8-10 colonies to monitor throughout the season. These should be split between non-treatment and treatment areas and be determined by the helicopter survey.
- Undertake a regular check of non-monitored tarapirohe colonies to better understand the population dynamic on the river particularly re-nesting and relocation events.
- Continue to use chick shelters as a means to help colonies within the treatment areas as an additional treatment type.
- Review the current classification of “island” and “mainland”, as well as “treatment” and “non-treatment”, to ensure consistency next season, particularly when an island becomes attached to the mainland during the season at low flows.

5.2 Tarapirohe/black-fronted tern banding

- Continue to band both adults and chicks, capturing adults on the nest using a drop trap and chicks at the colonies.

5.3 Predator suppression/monitoring

- Continue to carry out leg-hold trapping during peak nesting and chick rearing periods, particularly at larger colonies.
- Consider targeted predator control around known colonies utilising other methods rather than just predator traps, including the use of toxins and shooting to target cats and mustelids.

5.4 Advocacy

- Increasing advocacy signage at key locations such as the Cobb Cottage campsite to increase awareness and encourage visitors to report band sightings to WMIL and/or DOC. This could be an opportunity for local iwi to participate and influence the interpretation design, ensuring te ao Māori inclusion.

5.5 Island enhancements

Island enhancements continue to be undertaken before the 2025/26 season. Appendix 4 outlines the recommendations for island enhancements.

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8 APPENDICES

Appendix 1. *Tarapirohe/black-fronted tern nest trail camera deployment coverage by colony on the Waiau Toa/Clarence and Wakaputawatea/Acheron rivers during the 2024/25 season.*

River	Colony	Total Nests	# Cameras Deployed	Colony Coverage
Waiau Toa/Clarence River	Upper Swimming Hole	24	6	25%
	Mitchell's	17	8	47%
	Bush Gully	25	3	12%
	Bridge Island	95	27	28%
	St. James	27	7	26%
	Swimming Hole	18	4	22%
	2-3 Pylon	35	10	29%
	Seymour	23	6	26%
	Boundary Gate	29	3	10%
	Total	**293**	**74**	**25%**
Wakaputawatea/Acheron River	Acheron Island	22	11	50%
	Total	**22**	**11**	**50%**
Combined Total		**315**	**85**	**27%**

Appendix 2. *Tarapirohe/black-fronted tern chick shelter deployment by colony in treatment area.*

Colony	Colony Chick Shelter Deployment			Total Nests	Chick Shelter Coverage
	Natural Island	Mainland	Combined		
Upper Swimming Hole	7	0	**7**	24	29%
Mitchell's	4	0	**4**	17	24%
Bush Gully	4	1	**5**	25	20%
Bridge Island	0	25	**25**	95	26%
Swimming Hole	7	0	**7**	18	39%
Total	**22**	**26**	**48**	**179**	**27%**

Appendix 3. *Chick shelter use over two periods (1-7 days and 8+ days).*

Nest Code	Chicks hatched	1-7 days			8+ days		Assumed reason(s) for shelter use
		Use	# of chicks	Status	Use	# of chicks	
CA 21	1	Yes	1	Active	No data	-	Heat / GC
CD 12	2	Yes	2	Active	Yes	2	Heat / Rain / GC
CD 13	2	Unknown	-	Active	No data	-	-
CD 14	2	Yes	2	Active	Yes	2	Heat / GC
CD 16	2	Yes	2	Active	Yes	2	Heat / GC
CF 03	2	No	0	Predated	-	-	-
CF 17	2	No	0	Predated	-	-	-
CF 27	2	Yes	2	Active	No data	-	GC
CF 36	2	No	0	Predated	-	-	-
CF 38	3	No	0	Predated	-	-	-
CF 39	2	Yes	2	Predated	-	-	Heat / GC
CF 52	2	Yes	2	Active	No data	-	GC
CF 56	1	Yes	1	Predated	-	-	Heat / GC
CF 68	2	Yes	2	Predated	-	-	Heat / GC
CF 69	2	Unknown	-	Predated	-	-	-
CF 79	2	Yes	2	Predated	-	-	GC
CI 05	2	Yes	2	Active	No data	-	Heat / GC
CI 07	2	Yes	0	Active	Yes	2*	GC
CI 11	2	Yes	2	Active	No data	-	GC

Footnotes:
Chick shelter use is represented by 'Yes' (shelter used), 'No' (shelter not used), 'Unknown' (data was partially missing on the SD card with no evidence of chicks using the shelter) or 'No data' (all data is missing for that period). Reasons for 'No data' included no data on SD cards, SD cards being full and one camera missing.
The status column represents the status of the nest at the end of the first period, either active with chicks present, or the chicks had been predated.
GC = General Cover (parent present and/or no extreme weather)
**Chicks confirmed as not from this nest. Closest nests with two hatched chicks were ~20m and 23m away.*

Appendix 4. *Condition of enhanced islands on the Waiau Toa/Clarence River at the end of the 2024/25 season and maintenance required. Note: red= highest priority, yellow= moderate priority, grey= no longer recommended for enhancement works. All recommendations are correct at the time of writing but are subject to change depending on conditions of the river.*

Colony Code	Colony Name	Condition at end of 2024/25 season	Maintenance Required
CA	Upper Swimming Hole	Flood created a stronger back channel, blocking off the original middle, enhanced channel. Even wide flow around enlarged island. High vegetation density with silty top layer.	Focus on enhancing parts of the island due to its huge size. Push gravel from the middle, dried-up channel up over the top of the vegetation. Could try scraping the top layer; however, suspected silt and grass may result in limited nesting gravels uncovered. Raise the height of the upper, true right edge.
CI	Swimming Hole	The island is heavily vegetated (predominantly grasses) with a silty ground layer. Channel's robust and surrounding island.	Removing the top layer of vegetation is not recommended due to the lack of gravel on the island. The island is no longer recommended for enhancements at this stage.
CB	Mike's Rock	Wide channels surround the island. The upstream end of the island is very low lying and susceptible to flooding. True left channel very wide and shallow during low flow. Vegetation in pockets along the edges and high points. Suitable nesting gravels.	Island height to be raised at upstream end. Enhance by depending channel on true left side. Push gravels from the channel onto the island to raise island height. Clear line of thick broom from downstream end.
CC	Cow Island	The original island is now connected to the mainland on the true right side. A smaller, natural island has formed at the downstream end, which had nesting attempts this season. Very low lying, no vegetation. Suitable nesting gravels.	Focusing on smaller downstream islands, build up island height with surrounding channels. Access to the island may be quite difficult and may require crossing 2 - 3 river channels. Only attempt if possible to do so.
CD	Mitchell's	Island surrounded by wide, deep river channels. Island height optimal to avoid flooding. Vegetation has spread over the island with dense broom and sprouting seedlings.	Weed management required (broom control). Weed spraying by hand is preferred to prevent altering the island's robust shape and height. Island height could be raised at the upstream end whilst maintaining even flow down both channels.
CE	Bush Gully (Natural Island)	Natural island with wide, deep channels surrounding island. Island clear of vegetation. Slightly low lying and at risk to high flooding events.	Raise island height.
CF	Bridge Island	True left channel narrow at upstream end. Trickling during low flow makes the island easily accessible. Several jumping rocks are scattered in the true left channel. The island is covered in weeds and woody vegetation. Island height is great to avoid flooding.	Deepened true left side (4 m wide to prevent cats jumping along and avoiding water thinning out in wide areas at low flow rates). Remove the stepping stone in the True left channel and widen the upstream end of the channel. Weed management required in parts. If the true left channel is not deepened, other enhancements are not recommended.