WAIAU TOA HAPUA/ CLARENCE RIVER MOUTH

Black-billed gull (*Larus bulleri*) and white-fronted tern (*Sterna striata*) monitoring and predator control 2022/2023

WMIL Wildlife Management International

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Waiau Toa Hapua/Clarence River mouth black-billed gull (*Larus bulleri*) and white-fronted tern (*Sterna striata*) monitoring and predator control 2022/2023.

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1	30/04/2023	Campbell Maclean, Keegan Miskimmin, Dan Burgin	Initial Draft
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Cover image: White-fronted terns (*Sterna striata*) and black-billed gulls (*Larus bulleri)* nesting in close proximity (© Dan Burgin).

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EXECUTIVE SUMMARY

This report summarises the results of predator trapping and bird counts, specifically for tarāpuka/black-billed gulls *(Larus bulleri)* and tara/white-fronted terns (*Sterna striata*), at the Waiau Toa Hapua/Clarence River mouth in northern Canterbury, New Zealand between September 2022 and April 2023.

The established kill-trap trapping network was re-opened in September 2022 along the true left, and true right of the Waiau Toa Hapua/Clarence River mouth. This network now consists of a combination of DOC150, DOC200, DOC250 and SA2 traps with the latter installed during this season. The aim of this trapping regime is to support the nesting success of the known black-billed gull and white-fronted tern colonies that breed together as part of a mixed colony at the Waiau Toa Hapua/Clarence River mouth, by minimising depredation events by introduced mammals.

A total of 167 mammalian predators were caught in kill traps over the season (September 2022 to April 2023) including 14 cats (*Felis catus*), 68 hedgehogs (*Erinaceus europaeus*), 13 mice (*Mus musculus*), 24 rats (*Rattus spp*.), 27 stoats (*Mustela erminea*) and 21 weasels (*Mustela erminea*).

Fortnightly bird counts suggest low breeding success of black-billed gulls and white-fronted terns during the 2022/23 breeding season with low numbers of white-fronted tern fledglings seen and no black-billed gull fledglings seen at the colony. Low breeding success was likely attributed to flooding events and possible predation events occurring in mid-December 2022 around the time of peak nesting. Human disturbance was also a factor with members of the public seen walking through and next to the colony as well as four-wheel drive vehicle tracks near the colony also being observed. It must be stated however, that firm conclusions of breeding success for these two species cannot be drawn due to the limited and low frequency of monitoring undertaken by WMIL.

All bird species were noted during the bird counts undertaken during each monitoring visit and recorded in eBird (Sullivan et al. 2009). Breeding behaviour was exhibited by several other shorebird species of note, including pohowera/banded dotterel (*Charadrius bicinctus*), tōrea pango/variable oystercatcher (*Haematopus unicolor*) and taranui/Caspian tern (*Hydroprogne caspia*). Four kawau tikitiki/spotted shag (*Phalacrocorax punctatus*) juveniles were also seen at the river-mouth on multiple visits.

Recommendations for continued work at the Waiau Toa Hapua/Clarence River mouth are provided including:

- Predator trapping should continue to operate from August to April to maximise predator catches.
- A targeted period of shooting and/or leg-hold trapping be undertaken in either July/August and/or February/March to specifically target cats.
- Southern black-backed gull (*Larus dominicanus*) numbers and colonies within range of the Clarence River mouth should be monitored and if necessary, culled to reduce predation impact on key shorebird species.
- The scope of key shorebird species monitoring should be continued and expanded to include remote trail camera use and a banding regime of both adults and chicks of black-billed gulls and white-fronted terns. This will better inform assessments on breeding success and other key metrics.
- Use of drone to assist with monitoring colony.
- Signage be installed to encourage users to park before the River mouth and walk on to the site, to leash any dogs, and also to look for banded birds (if the banding programme is conducted).

- Roping off of the colony once established to make the general public aware of the site and reduce the risk of disturbance and/or mortality.
- Additional bird monitoring be undertaken of nearby Ōhau colony site for black-billed gulls, white-fronted terns and red-billed gulls.
- Members of the local community should be engaged to help promote the importance of the Clarence River mouth and the key species that inhabit the area to help reduce human interference and disturbance of these species.
- Kāhu/swamp harrier banding to understand local population and whether this species is also a predator of black-billed gull and white-fronted tern nests.

Waiau Toa Hapua/Clarence River mouth black-billed gull (Larus bulleri) and white-fronted tern (Sterna striata) monitoring and predator control 2022/2023

1. INTRODUCTION

Braided river systems support an abundance of wildlife, both terrestrial, aquatic and avian species. At their River mouth, there is a mixing of riverine and marine ecosystems, causing gradual spatial changes to habitat and river morphology over time (Larson et al., 2013). Multiple species of birds utilise braided rivers as nesting grounds due to the formation of sand bars or 'sand-spits' causing small scale lagoons to form that encourage breeding of numerous shorebird species (O'Donnell, 2016).

The tarāpuka/black-billed gull (*Larus bulleri*) is New Zealand's only endemic gull and is largely restricted to the braided river systems of the eastern and southern South Island during the breeding season (Higgins & Davies 1996, McClellan & Habraken 2013). The location and sizes of black-billed gull colonies can vary from year to year, due to their low site fidelity, but have been observed to gather in colonies of over 10,000 birds in some Southland sites (McClellan & Habraken, 2013).

The tara/white-fronted tern (*Sterna striata*), is a New Zealand native coastal tern present throughout New Zealand, with juveniles and young breeders over-wintering in South-Eastern Australia. Although they have been observed to forage upstream on braided rivers, their breeding grounds are predominantly observed at estuaries and river-mouths (Mills, 2013). White-fronted terns have been recorded in colony sizes as large as 4,000 birds on the Rangitata River, South Canterbury (Weston & Fraser, 2020).

Colonies of black-billed gulls can be dense and mix with other colonial species such as tarāpunga/red-billed gull (*Larus novaehollandiae scopulinus)* and white-fronted terns (Higgins & Davies 1996, Heather & Robertson 2015, Mischler & Maloney, 2019). The definition of mixed in this document relates to the location of nests overlapping across species and a definitive line or buffer zone between each species within the colony is often lacking.

Both black-billed gull and white-fronted tern are listed as 'At Risk – Declining' by the New Zealand Threat Classification System (Robertson et al. 2021). Threats to both species include flooding, introduced predators, avian predators, loss of habitat due to increased spread of invasive plants and human disturbance from gravel extraction and recreational users of braided river systems, as well as human induced climate change (Craig et al. 2000, Dowding & Murphy 2001, Sanders & Maloney 2002, McClellan 2008, McClellan & Habraken 2013, Caruso et al. 2013, O'Donnell et al. 2015, Wildlands 2017, Mischler 2018).

The Waiau Toa Hapua/Clarence River mouth (hereafter: River mouth) in northern Canterbury supports a diversity of breeding birds including a large mixed-species colony of black-billed gull, red-billed gull, and white-fronted tern that frequently breed together at the River mouth each year which has been the focus of research and conservation management since 2012 (Bell 2020). Black-billed gull breeding success at the River mouth colony in the past has been very low (Bell 2020), with the primary cause being related to depredation by karoro/Southern black-backed gulls (*Larus dominicanus*) in

conjunction with mammalian predators and human disturbance. Culling operations of the southern black-backed gulls at an upstream site in 2016/2017 and at the River mouth site in 2017/2018 are believed to have helped to deter their breeding at the River mouth site. Southern black-backed gulls were first observed re-breeding at the River mouth in 2020, with 13 nests detected (Mike Bell, pers. comms., 2021), and no nests were observed at the River mouth this year. However, juvenile Southern black-backed gulls were detected during bird counts this season, suggesting successful breeding nearby.

Environment Canterbury, Kaikoura Water Zone Committee, Land Information New Zealand (LINZ), and Boffa Miskell has funded monitoring and conservation management action at the Clarence River mouth to improve the breeding success of the black-billed gulls and white-fronted terns at this site. This report presents the results of monitoring and conservation management actions undertaken at the River mouth during the 2022/23 breeding season.

2. METHODS

2.1 Predator trapping

Based on recommendations from previous years (Lamb et. al. 2022), the trapping network was expanded this season to create a loop on both the true right and left of the River mouth (Figure 1). The line that previously ran down the centre of the island in the river channel has been removed with these traps being used in the new lines. This was to reduce the risk of trap loss during flooding, and also due to previously low capture rates along this section.

To create the loops on either side of the river, double set DOC200 and DOC150 traps were added along with those previously in place. New traps were installed between late October 2022 to early November 2022 including eight SA2 Kat traps placed in chimney trap boxes (Figure 3).

Traps were baited on 1 September 2022, prior to the onset of the black-billed gull and white-fronted tern breeding season. Once traps were set, trap monitoring and re-baiting (with fresh rabbit meat and dehydrated rabbit) occurred approximately once each fortnight until 3 April 2022 when traps were shut down after the breeding season had ended. Trap results were recorded in TrapNZ within the Waiau Toa/Clarence River mouth Trapping project.

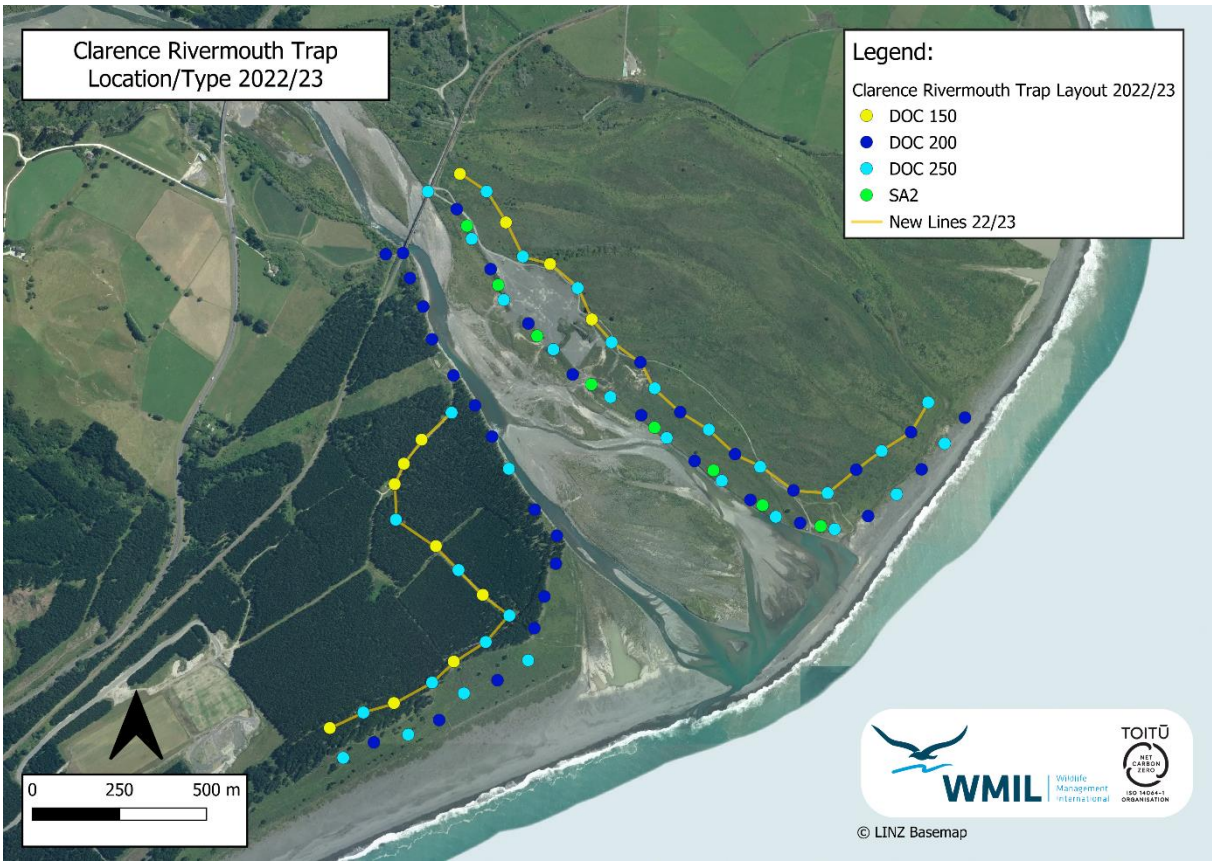


Figure 1. Location of traps situated along the Waiau Toa Hapua/Clarence River mouth for the 2022/2023 trapping season.

2.2 Bird monitoring

Counts of all bird species and other bird observations were undertaken at the River mouth during each fortnightly trap check with the assistance of binoculars. A particular focus was given to the known mixed species colony site at the River mouth. During each check the total number of individuals for all species were also recorded, as well as observations regarding breeding behaviour. When more than one count was carried out in a day, the highest number seen was reported in the results.

Key species included black-billed gulls, white-fronted terns, pohowera/banded dotterel (*Charadrius bicinctus bicinctus*), taranui/Caspian tern (*Hydroprogne caspia*), tōrea pango/variable oystercatcher (*Haematopus unicolor*), and tōrea/South Island pied oystercatcher (SIPO) (*Haematopus finschi*). Notes were also made on any threats or human impacts observed while undertaking counts. All bird counts and observations were recorded in eBird under the New Zealand Bird Atlas Portal (Sullivan et al. 2009).

3. RESULTS

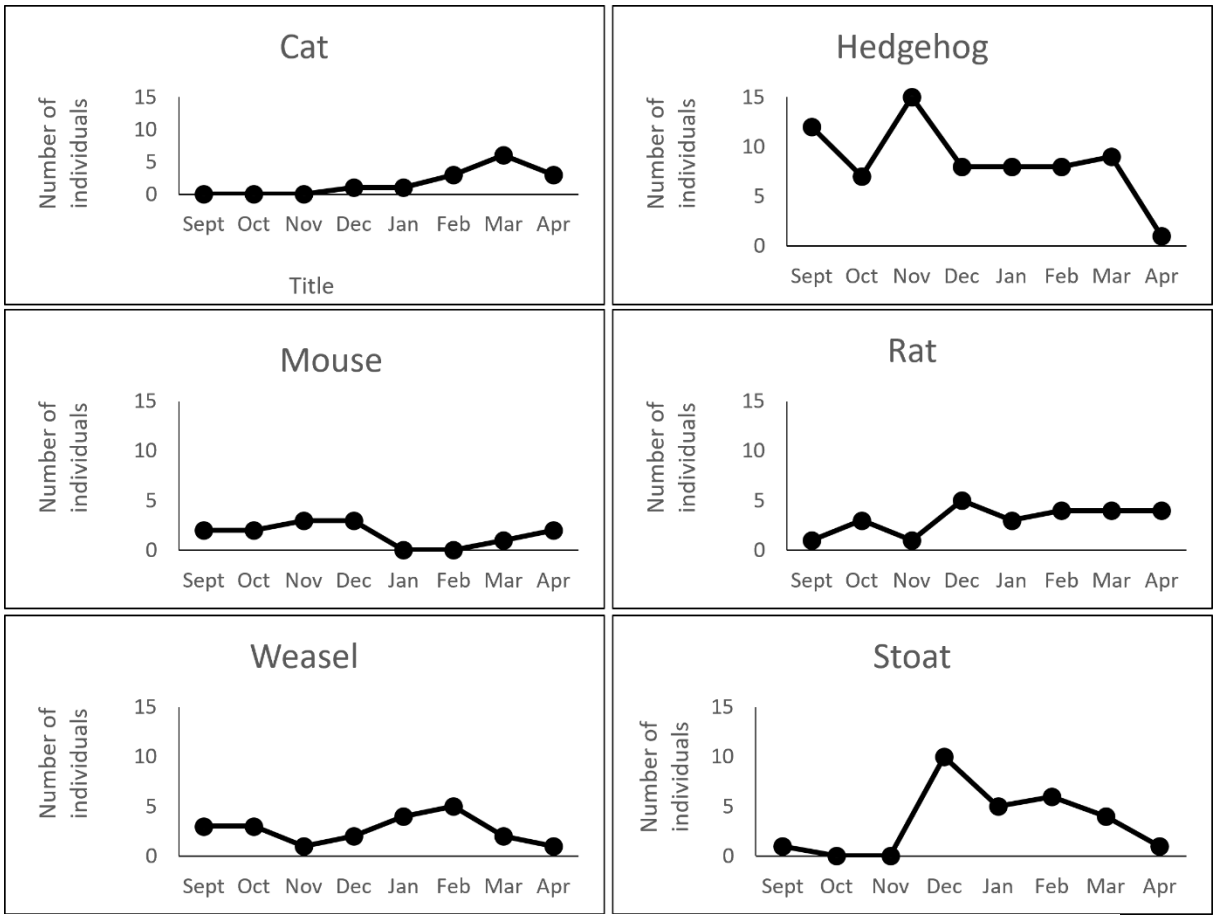
3.1 Trapping results

Over the course of 20,474 trap nights, a total of 167 mammalian predators were caught over the trapping network (Table 1) from September 2022 to April 2023. Taken as a proportion, DOC200 traps (49% of traps deployed) caught 58% of the predators across the season, DOC250 traps (26% of traps deployed) caught 30% and DOC150 traps (18% of traps deployed) caught 11% of the cumulative catches (Table 1). Note that DOC200 and DOC150 traps are installed as double set. SA2 Kat traps represent 6% of traps deployed and caught 1% of total catches, but it should be noted these were installed later in the season.

Table 1. Total number of predator species caught in kill traps at the Waiau Toa Hapua/Clarence River mouth between September 2022 and April 2023.

Predator species	DOC150	DOC200	DOC250	SA 2	Total
	(n = 24)	(n = 64)	(n = 33)	(n = 8)	(n = 129)
Cat (*Felis catus)*	0	4	8	2	14
Hedgehog (*Erinaceus europaeus)*	11	36	21	0	68
Mouse (*Mus musculus)*	0	11	2	0	13
Rat (*Rattus spp.*)	4	18	3	0	25
Stoat (*Mustela erminea)*	3	16	8	0	27
Weasel (*Mustela nivalis)*	0	12	9	0	21
TOTAL	**18**	**97**	**51**	**2**	**168**

The initial half of the season recorded low catch rates in mammalian predators, with no cats and low mustelid numbers caught between September 2022 to November 2022, as illustrated in Figure 3. However, catch rates gradually intensified in the summer months, with most species reaching their peak catch total between December 2022 and March 2023. Notably, no ferrets were captured throughout the season, whilst in comparison five ferrets were caught in the 2021/2022 season (Lamb et. al., 2022).



In addition to reporting catch total per species and catch per trap type, the amount of standardised 'trapping effort' is also reported here. Standardisation of trapping effort enables more precise comparisons between differing trapping networks, for example when trapping networks differ by the number of traps deployed, frequency of checks etc. Trapping effort is calculated as the number of catches per 100 trap nights:

$$catches\ per\ 100\ trap\ nights = \left(\frac{number\ caught}{number\ trap\ nights}\right) \times 100$$

On average, trap catches per 100 trap nights declined over the course of the season from September 2022 to April 2023 (Figure 4). During the 2021/2022 season trap rate increased on average throughout the season peaking at just under 3 traps per 100 trap nights in February 2022 before dropping at the conclusion of the trapping season (Figure 4).

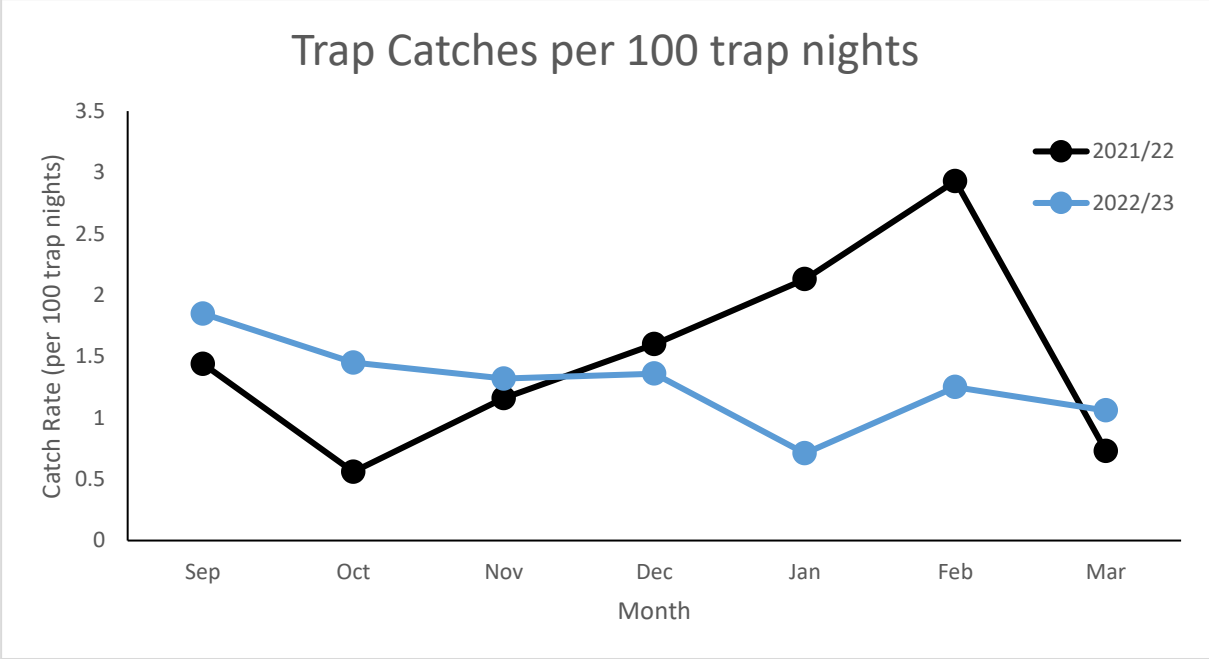


Figure 4. Monthly trap catches per 100 trapping nights of mammalian predators at the Waiau Toa Hapua/Clarence River mouth during the 2022/2023 trapping season.

During the trapping season, maximum trap catches were recorded in September, with a trapping rate of 1.85 predators per 100 trap nights. Throughout the season, the total catch rate remained consistently above 1 catch per 100 trap nights, except for January, where it decreased to 0.71 (Table 2). From December to January, the catch rates of almost all species showed a decline, with stoats exhibiting the most significant decline (0.49 in December – 0.18 in January) (Table 2).

Table 2. Monthly trap catches per 100 trapping nights of mammalian predators at the Waiau Toa Hapua/Clarence River mouth during the 2022/2023 trapping season.

Predator species	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Cat (*Felis catus)*	0	0	0	0.05	0.04	0.16	0.26
Hedgehog (*Erinaceus europaeus)*	1.17	0.68	0.99	0.39	0.28	0.43	0.29
Mouse (*Mus musculus)*	0.19	0.19	0.2	0	0	0	0.09
Rat (*Rattus* spp.)	0.1	0.29	0.07	0.24	0.11	0.22	0.2
Stoat (*Mustela erminea)*	0.1	0	0	0.49	0.18	0.33	0.14
Weasel (*Mustela nivalis)*	0.29	0.29	0.07	0.1	0.14	0.27	0.09
TOTAL	**1.85**	**1.45**	**1.32**	**1.36**	**0.71**	**1.25**	**1.06**

During the 2022/23 season, a consistent catch rate was observed on both sides of the river. The true right of the river showed hotspots around the train overbridge, while the stretch of land running horizontally to the ocean was a hotspot for the true left of the river (Figure 5). In comparison to the true right, a significant portion of the true left exhibited lower catch rates (Figure 5).

See Appendix 1 for breakdown in the distribution of species caught along the trapping network.

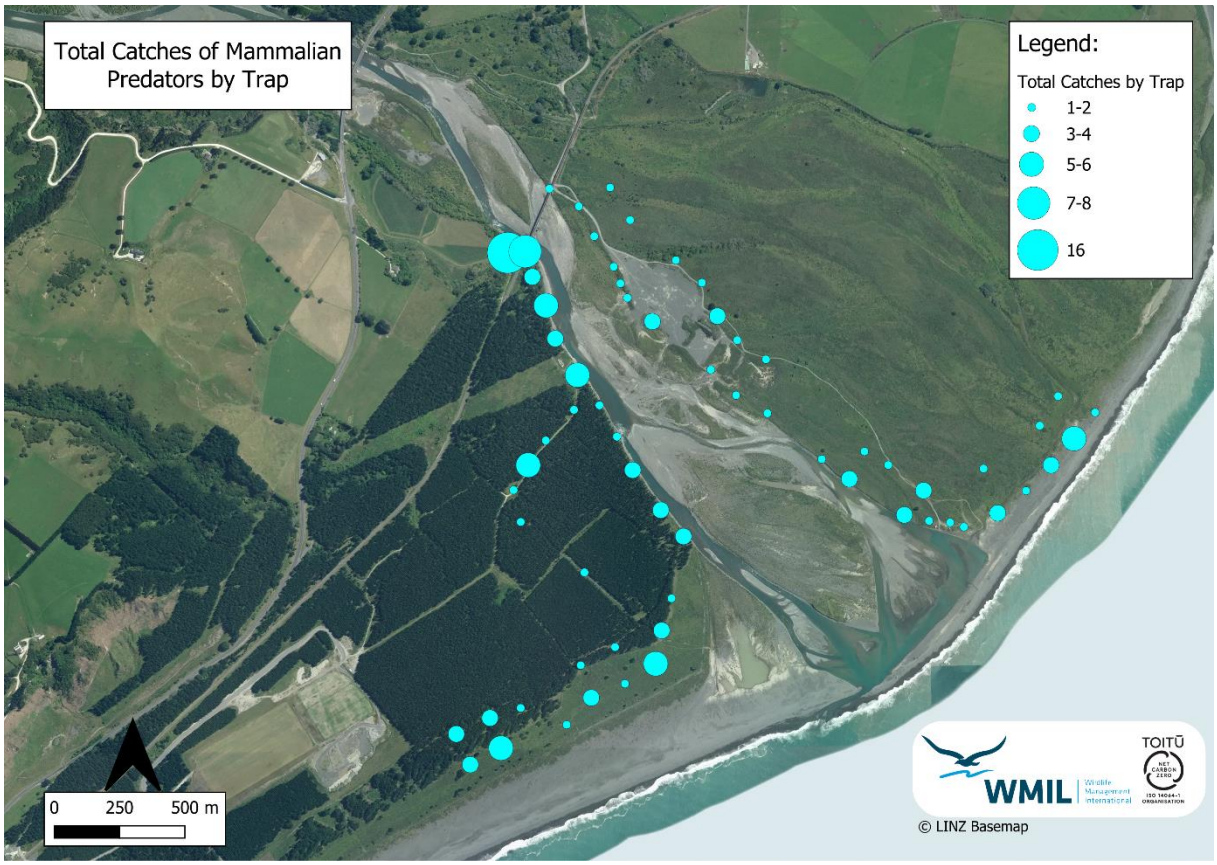


Figure 5. Distribution of mammalian predator catches across the trapping network at the Waiau Toa Hapua/Clarence River mouth during the 2022/2023 season. Traps that caught nothing are not shown.

3.2 Bird monitoring

In total, 42 bird species were recorded at the River mouth during the 2022/2023 Season. A full list of all species detected at the River mouth can be viewed in Appendix 2. Key species of interest (black-billed gull, white-fronted tern, banded dotterel, Caspian tern, variable oystercatcher and SIPO), are reported on below.

The presence of black-billed gulls and white-fronted terns were observed at the start of the trapping season, eventually forming a 'mixed-species' colony with red-billed gulls on a sandspit at the River mouth (Figures 7 & 8). After initially detecting large amounts there was a period in early November 2022 when white-fronted tern numbers dropped off from 300 down to 55. Nesting was then first observed on 7 December 2022 for all three species (Table 3 & 4), with black-billed gull nests reaching a high of 21 nest on 19 December 2022. However, evidence of hatching (chicks or fledglings) was never observed for black-billed gulls.

Fifty white-fronted tern nests were counted on 7 December 2022, with hatching confirmed a fortnight later (chicks seen amongst the colony). An accurate count of white-fronted tern chicks was never conducted, but roughly 20 chicks were seen on 19 December 2022 (some nests still unhatched), and a minimum count of 21 fledglings were observed on 2 February 2023.

A reduction in black-billed gull and white fronted tern numbers occurred twice between 28 October 2022 and 9 November 2022, and 19 December 2022 and 9 January 2023. Reasons for this are unknown. The highest count of red-billed gull numbers was observed on 19 December (340). Although only 80 black-billed gulls were observed on this date, their similar plumage and frame size

can be difficult to distinguish in such close-proximity (see black-billed gull/red-billed gull' in Table 5). Only two red-billed gull nests were observed (Table 5).

Caspian tern numbers were high, with 8 being the highest seen (9 November 2022), and juveniles seen at the end of the season in April 2023. Despite no nests being found this season by WMIL staff, one was observed and documented by Heath Melville on 1 November 2022 (Figure 6 – H.Melville, 2023 *pers comms.).* Caspian terns were observed to display aggressive, defensive behaviour towards observers on at least one occasion (Burgin 2022b) backing up this observation. Evidence of breeding was recorded in 2021/2022 when one Caspian tern nest was found (Miskimmin*,* 2022 *pers comms.*). Further attempts will be made next season to better detect these breeding locations.

Southern black-backed gulls were also observed throughout the monitoring season. Though no evidence of nesting was observed, juveniles were seen at the end of the season indicating successful breeding (Table 5).

Two banded dotterel chicks were seen on 9 November 2022 and a high of 36 individuals were seen on 8 March 2023. Variable oystercatcher and SIPO were both observed at the River mouth during the season, but no evidence of breeding detected.

A pied shag (*Phalacrocorax varius*) breeding colony has been recorded in both 2021/2022 (Burgin 2021) and 2022/2023 (Burgin 2022a) monitoring of the River mouth. The colony is at the start of the trap-line on the true right. Multiple shag species have also been observed at the River mouth colony, including recently fledged pied shags and juvenile spotted shags (Burgin 2022b).

At least one public disturbance was observed at the Clarence River mouth. On 13 February 23, WMIL staff observed members of the public walk directly through the colony on their way to the ocean unaware that birds were nesting at the time causing a major disturbance.

Multiple flood events occurred over the breeding season which likely disturbed the colonies in changing the formation of the spit.

Table 3. Highest number of adult black-billed gulls observed, number of nests, observations on nesting behaviour, numbers of chicks and fledglings present at the Waiau Toa Hapua/Clarence River mouth between September 2022 and March 2023. Highest count for the season shown in bold.

Note: *Red-billed and black-billed gulls were unable to be distinguished on the 17 February (BBLG/SG).

	2022								2023							
	1-Sep	**13-Sep**	**28-Sep**	**12-Oct**	**28-Oct**	**9-Nov**	**22-Nov**	**7-Dec**	**19-Dec**	**9-Jan**	**18-Jan**	**2-Feb**	**17-Feb**	**8-Mar**	**20-Mar**	**3-April**
Adults	25	31	10	30	**150**	50	30	35	80	10	2	12	<150*	0	12	0
Nests	0	0	0	0	0	0	0	15	**22**	0	0	0	0	0	0	0
Chicks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fledglings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 4. Highest number of white-fronted terns observed, number of nests, observations on nesting behaviour, number of chicks and fledglings present at the Waiau Toa Hapua/Clarence River mouth Between September 2022 and March 2023. Highest count for the season shown in bold.

	2022								2023							
	1-Sep	**13-Sep**	**28-Sep**	**12-Oct**	**28-Oct**	**9-Nov**	**22-Nov**	**7-Dec**	**19-Dec**	**9-Jan**	**18-Jan**	**2-Feb**	**17-Feb**	**8-Mar**	**20-Mar**	**3-April**
Adults	60	44	**350**	**350**	300	55	340	180	250	73	114	220	160	16 (No longer on Spit)	170	11
Nests	0	0	0	0	0	0	Nesting	**50**	47	0	5	0	0	0	0	0
Chicks	0	0	0	0	0	0	0	0	**>47** (eggs and single chicks seen)	0	Present	0	0	0	0	0
Fledglings	0	0	0	0	0	0	0	0	0	0	11	**21**	0	1 (No longer on spit)	0	0

Table 5. Highest number of red-billed gull (including instances when red-billed gull/black-billed gull couldn't be distinguished), Caspian tern, banded dotterel, South Island pied oystercatcher (SIPO) Variable oystercatcher and Southern black-backed gull seen for each trip at the Waiau Toa Hapua/Clarence River mouth between September 2022 and April 2023. Observations of nests, chicks and fledglings are in brackets. Highest count for the season shown in bold.

	2021							2022								
	1-Sep	**13-Sep**	**28-Sep**	**12-Oct**	**28-Oct**	**9-Nov**	**22-Nov**	**7-Dec**	**19-Dec**	**9-Jan**	**18-Jan**	**2-Feb**	**17-Feb**	**8-Mar**	**23-Mar**	**3-Apr**
Red-billed gull	0	102	24	20	200	250	32	170 (5 on nests)	**370** (2 on nests)	16	10	180	N/A	1	2	19
Black-billed/red-billed gull		133	34	50	350	300	62	305	**450**	26	12	275	150	1	44	19
Caspian tern	5	1	1 (non-breeding plumage)	4	1	**8**	5	3	2	5	3		1	6	7	7 (juveniles seen)
Banded dotterel	1	2		3	7	6 (2 chicks seen with parents)	3	4	1	5	7	2	7	**36**	8	11
SIPO			1		**8**	1	3									
Variable oystercatcher					**2**											
Southern Black-backed gull	22	28	29	15	27	45	32	60	23	47	12	**95**	40	22	30	6

4. DISCUSSION

4.1 Predator trapping

Mammalian predators pose a significant threat to the long-term survival of black-billed gulls and white-fronted terns and many of New Zealand's native and endemic species. Based on recommendations from previous years (Lamb et al 2022), traps were installed on both sides of the Waiau Toa Hapua/Clarence River mouth to create a loop on both sides of the river (Figure 1). Traps on either side of the river were effective in catching large numbers of predators (Table 1). Although traps on the true left were effective in catching predators, less were caught on this side in comparison to the true right (Figure 5). Public access, continual disturbance and reduced habitat availability likely restricts predator movements in and around this area for large periods of time likely leading to reduced catch rates. Interestingly predator catches decreased significantly in the month of January especially in stoats. This is likely as a result of increased food availability at this time of year.

This year, eight SA2 Kat traps were introduced in place of legholds for targeting cats on the true left of the river. In order to reduce the risk to the public, livestock and bycatch, the SA2 Kat traps were placed in chimney traps (Figure 2). Interestingly more cats were caught in DOC traps throughout the season than in SA2 Kat traps, however this may be in part because the SA2 Kat traps were installed later on in the season. Although low catch rates were recorded using SA2 Kat traps, cat catches overall were low for large parts of the season. In order to better support the efforts of targeting cats, it is recommended that a period of either shooting, or leghold trapping be undertaken to compliment the kill trap network.

4.2 Species monitoring

Depredation, flooding, and disturbance by people are all factors influencing black-billed gull and white-fronted tern breeding success. Flooding events and depredation likely led to suspected low breeding success of the black-billed gull and white-fronted tern colony at the Waiau Toa Hapua/Clarence River mouth during the 2022/2023 breeding season. Nesting was first observed around mid-November, however disturbance (possible flooding) in late October and mid-December appeared to have disrupted breeding.

Though no specific evidence of predation (e.g., eaten eggs, dead adults, etc.) was found during counts when the colony was accessible by land, the high catch rate of mammalian predators indicate that black-billed gulls and white-fronted terns are at continuous risk of depredation. There were high numbers of mustelids and cats caught on the true left (the side of the river usually accessible to the colony). More intensive monitoring (e.g., remote cameras) would likely lead to a greater understanding of the influence of predation at this colony. A detailed proposal can be found in the recommendations section of this report. Additionally, breeding success was hard to quantify due to the limited and infrequent monitoring undertaken as part of this contract. The origin of the white-fronted tern fledglings that were detected as part of the counts remains unknown, particularly as to whether they were from the River mouth colony or the known neighbouring colonies along the coast. To gain better insight into breeding success of both black-billed gulls and white-fronted terns, as well as individual movements between colonies, we recommend implementing a chick banding programme. Additionally, to understand site fidelity of breeding adults, we recommend an adult banding programme. Further details of this are given below in the recommendations section.

It is not clear what the breeding success of the other nesting native/endemic species present at the Waiau Toa Hapua/Clarence River mouth (e.g., banded dotterel, variable oyster catcher, SIPO, Caspian tern, and red-bill gull). Chicks of banded dotterels were seen during the season suggesting successful breeding. Red-bill gulls occupied the same mixed-species colony as black-billed and white-fronted terns and it is thereby assumed that red-billed breeding success was also low due to flooding events and human disturbance. However, further monitoring could provide a clearer understanding of this in

the future. Of particular interest would be undertaking additional bird monitoring at the nearby Ōhau colony site for black-billed gulls, white-fronted terns, and red-billed gulls to understand numbers at this nearby colony site.

An expansion of monitoring on other birds that utilise the Clarence River mouth area is strongly recommended to provide a more complete understanding of how predator control is contributing to increased breeding success across a variety of species at this site.

4.3 Human disturbance

Recreational vehicle users at the River mouth are thought to pose a significant risk to nesting black-billed gull and white-fronted terns. Tire tracks were visible within 50m of the colony during the season. WMIL staff witnessed from afar members of the public driving and walking directly through the colony. Greater signage, advocacy, and fencing off the area from the public would help to mitigate recreational user impact of the colony.

5. Recommendations

It is recommended that:

- **Coordination of timing-specific trapping is continued.**
  - Due to captures rates for several target species showing peaks in February and/or constant capture rates throughout September to March, fortnightly trap checks should continue from August to April each season.
  - Due to catch rates of cats being quite low during the trapping season WMIL recommends a targeted period of shooting and/or leg-hold trapping be undertaken in either July/August and/or February/March to specifically target this predator.
- **Southern black-backed gull monitoring is completed.**
  - As southern black-backed gulls are significant predators of key species at the River mouth, monitoring of the formation of southern black-backed gull colonies at or near to the Waiau Toa Hapua/Clarence River mouth should occur throughout the season.
  - If a large aggregation or breeding colony establishes at or close to the River mouth, a culling operation or egg-oiling (i.e., to prevent hatching of eggs) programme should be implemented.
- **Key species (black-billed gull and white-fronted tern) monitoring continues through bird counts, trail camera monitoring, and banding.**
  - The understanding of black-billed gull and white-fronted tern breeding success is currently limited to simple fortnightly counts at the colony after the trap check. To increase understanding of breeding success and threats to the colony, additional monitoring should be undertaken.
  - Counts are proposed to be undertaken weekly alongside the use of trail cameras to monitor nesting behaviour, breeding attempts, breeding outcomes and productivity. Counts should include adult counts, nest counts, and chick and fledgling counts as well as information on the colony (boundaries, density, species makeup, etc.).
  - Banding of black-billed gull and white-fronted tern (and red-billed gull if present) chicks and adults is recommended to provide valuable data on fledgling success, species movements, site fidelity and many other valuable data metrics. Currently little is known about recruitment of white-fronted terns and black billed gulls back to the colony. Multiple banding sessions should be conducted at egg incubation (to band adults), and towards the end of chick rearing to band chicks. These will then inform the conservation management undertaken at this site.
  - Flooding and its effect on the colony is currently poorly understood, however it is predicted to have impacts on the colony. To better understand the scale of these impacts on the colony and breeding success, additional bird counts and colony checks should be completed during a

major flooding event and directly after a flooding event. Undertaking additional bird monitoring at the nearby Ōhau colony site for black-billed gulls, white-fronted terns, and red-billed gulls to understand numbers at this nearby colony site is also recommended.

- Due to restricted access (river flow and peak flood events), drones should be used to help understand changes in the colony extents throughout the season and to improve bird counts.
- Signage similar to that currently installed at gate entrance is installed at the two main beach access points at the end of the 4WD (Figure 9). The signs should encourage users to park before the River mouth and walk on to the site, to leash any dogs, and also to look for banded birds (if the banding programme is conducted).

- **Roping off the colony once established.**
  - Any black-billed gull and/or white-fronted tern colony established at the River mouth should be roped off from recreational vehicle access. Recreational truck users are often found either driving directly up to the colony, or even driving over the colony, destroying nests and killing birds.
- **A *community champion(s)* group to conduct advocacy for nesting species in the area is organised.**
  - These would be members of the local community that know the area and often use the River mouth area for recreation. The main goal for the community champion(s) would be to engage with other recreational users about the species present, where they are located, and the risks they face and how other recreational users can mitigate their disturbance of the birds.
- **Kāhu/Swamp harrier (*Circus approximans*) banding**
  - Swamp harriers' prey upon many shorebird species that nest along braided rivers. Leg hold trapping resulted in multiple captures of swamp harriers during the 2021/2022 season (Lamb et al. 2022). Banding swamp harriers over time would help to understand the population size

and enable research on an otherwise inaccessible species, as well as provide a means to identify birds who may predate black-billed gull and/or white-fronted tern nests through the use of trail cameras. Banding and research on swamp harriers would require either a Wildlife Act Authority or having the Department of Conservation as a stakeholder in the project and operating this aspect of the work under their departmental authority.

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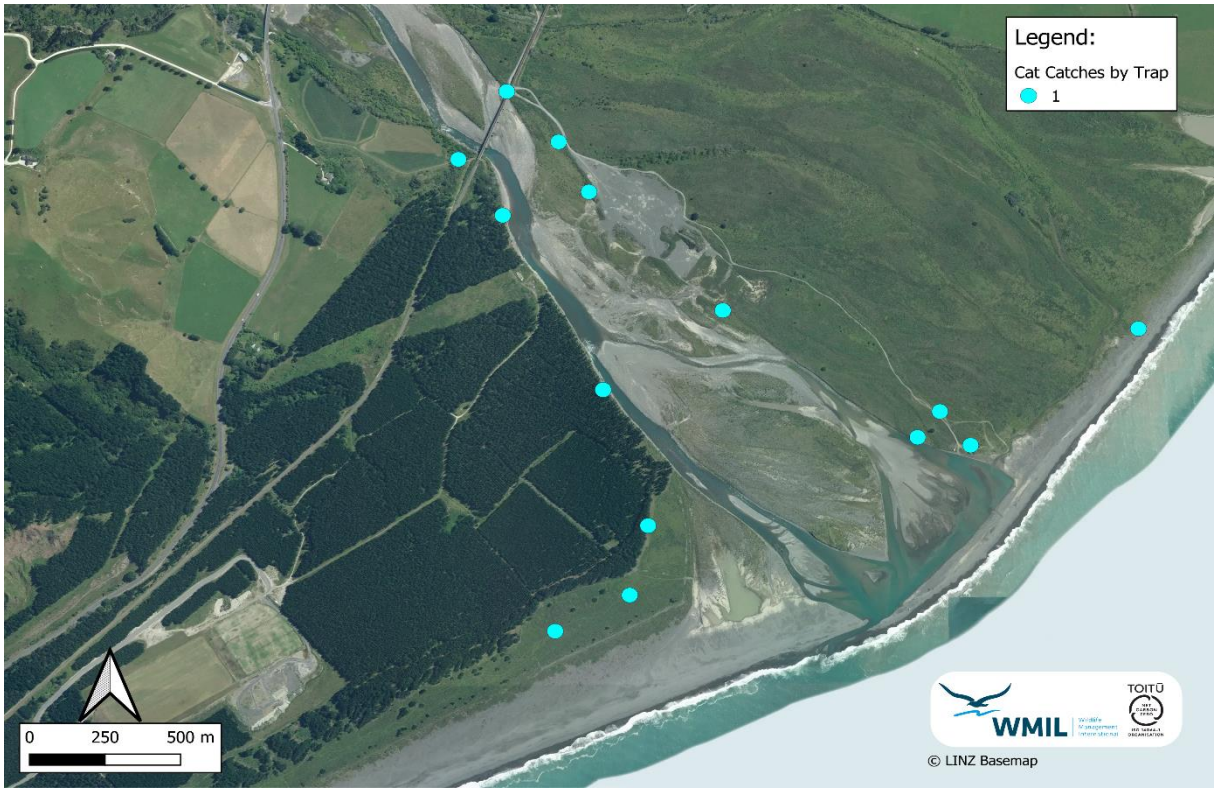
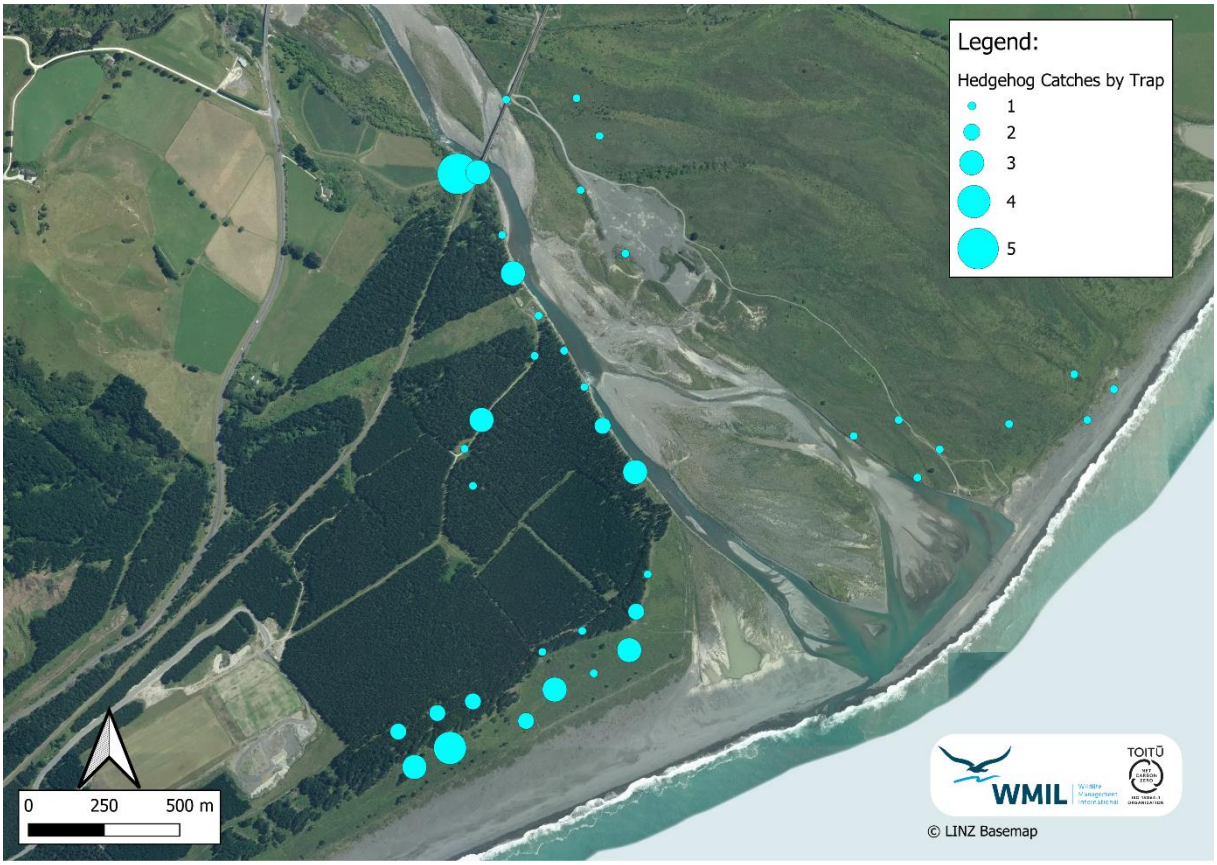
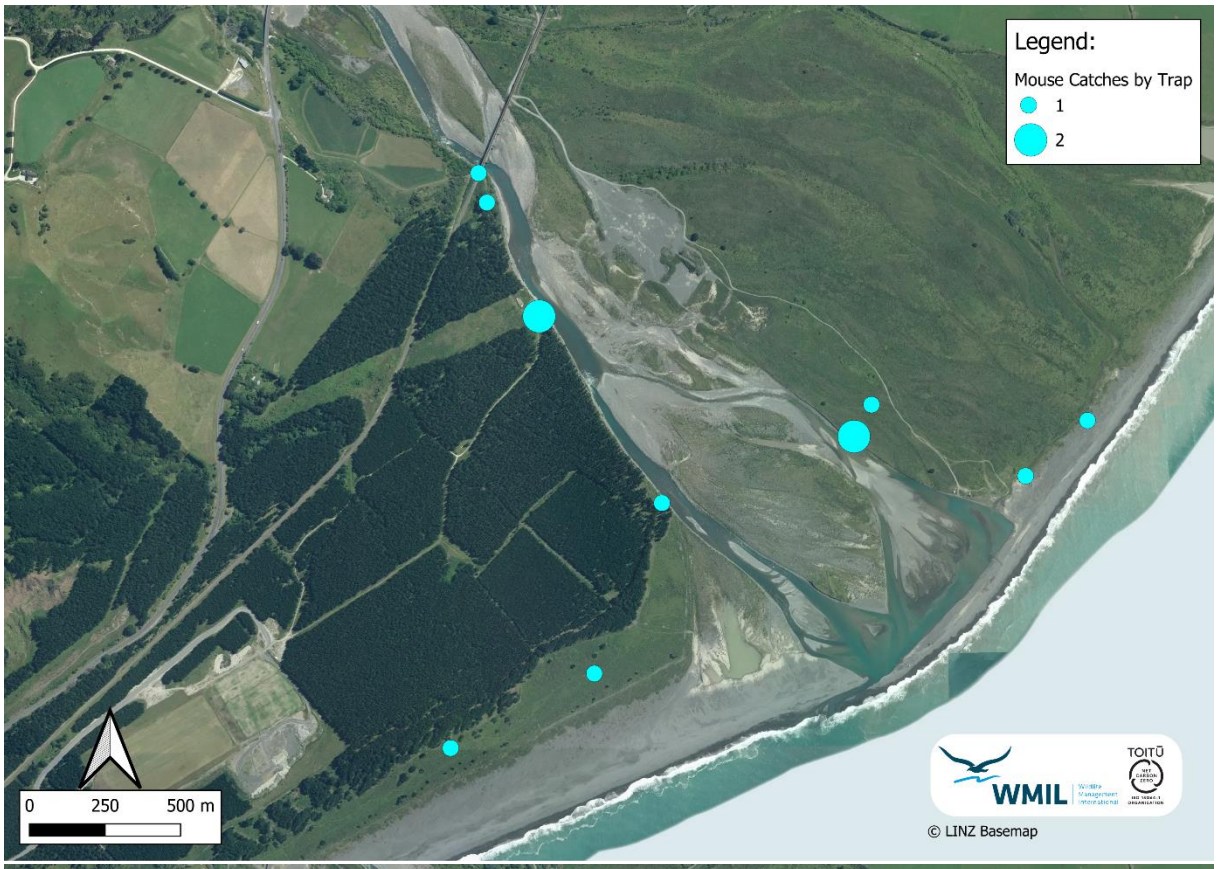
8. APPENDICES

8.1 Appendix 1: Distribution of mammalian predators caught along the trapping network





WMIL: Maclean. C., Miskimmin, K., and Burgin, D. 2023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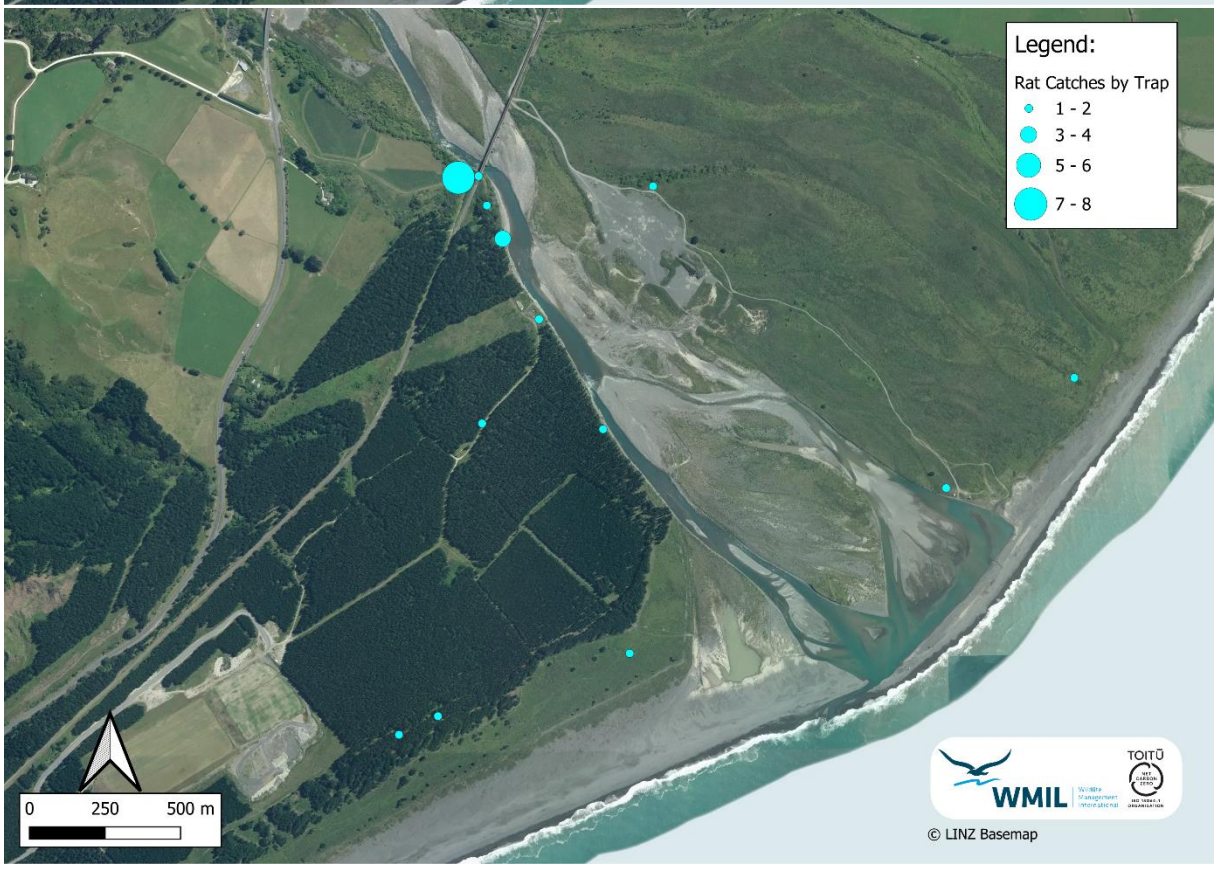
Mouse Catches by Trap
1
2
0
250
500 m
WMIL
TOITŪ
© LINZ Basemap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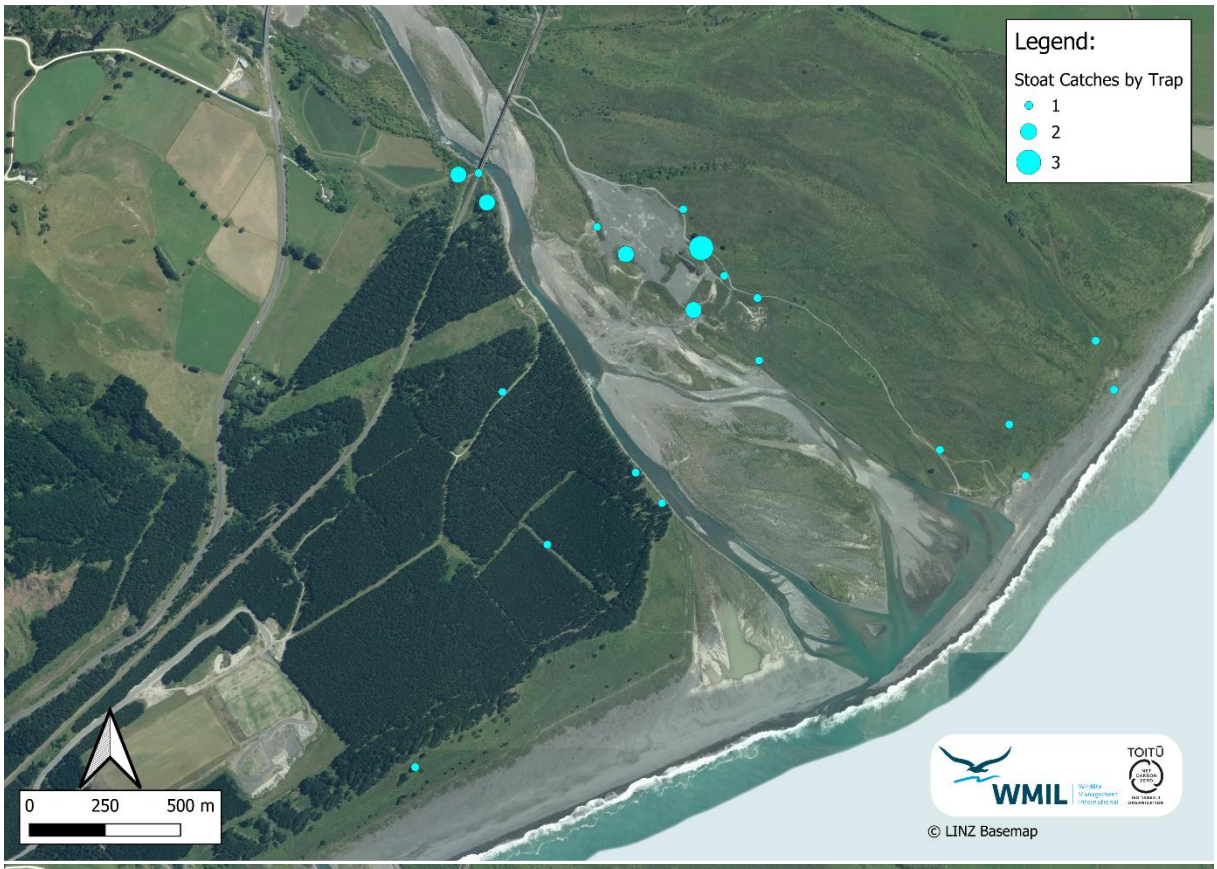
Rat Catches by Trap
1 - 2
3 - 4
5 - 6
7 - 8
0
250
500 m
WMIL
TOITŪ
© LINZ Basemap


Legend:
Stoat Catches by Trap
1
2
3
0
250
500 m
WMIL
TOITŪ
© LINZ Basemap


Legend:
Weasel Catches by Trap
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© LINZ Basemap

8.2 Appendix 2: All avian species present during bird counts at the Waiau Toa Hapua/Clarence River mouth September 2022 – April 2023

Species name	Scientific name	Threat ranking (Robertson et al. 2021)
Kakīānau|Black swan	*Cygnus atratus*	Introduced and Naturalised
Kuihi|Canada goose	*Branta canadensis*	Introduced and Naturalised
Pūtangitangi|Paradise shelduck	*Tadorna variegata*	Not Threatened
Kuruwhengi|Australasian Shoveler	*Spatula rhynchotis*	Not Threatened
Rakiraki|Mallard	*Anas platyrhynchos*	Introduced and Naturalised
Tētē-moroiti|Grey Teal	*Anas gracilis*	Not Threatened
Pāpango|New Zealand scaup	*Aythya novaeseelandiae*	Not Threatened
Kawaupaka|Little shag	*Phalacrocorax melanoleucos*	At Risk, Relict
Kawau tikitiki|Spotted shag	*Stictocarbo punctatus*	Threatened, Nationally Vulnerable
Kāruhiruhi|Pied shag	*Phalacrocorax varius varius*	Recovering
Māpunga|Black Shag	*Phalacrocorax carbo*	Relict
Kaikōura tītī|Hutton's shearwater	*Puffinus huttoni*	Threatened, Nationally Vulnerable
Pakahā|Fluttering shearwater	*Puffinus gavia*	At Risk, Relict
Tarāpuka|Black-billed gull	*Larus bulleri*	At Risk, Declining
Tarāpunga|Red-billed gull	*Larus novaehollandiae scopulinus*	At Risk, Declining
Karoro|Southern black-backed gull	*Larus dominicanus dominicanus*	Not Threatened
Taranui|Caspian tern	*Hydroprogne caspia*	Threatened, Nationally Vulnerable
Tarapirohe|Black-fronted tern	*Chlidonias albostriatus*	Threatened, Nationally Endangered
Tara|White-fronted tern	*Sterna striata striata*	At Risk, Declining
Poaka|Pied stilt	*Himantopus himantopus leucocephalus*	Not Threatened
Tōrea|South Island pied oystercatcher (SIPO)	*Haematopus finschi*	At Risk, Declining
Tōrea pango|Variable oystercatcher	*Haematopus unicolor*	Recovering
Spur-winged plover	*Vanellus miles novaehollandiae*	Not Threatened
Pohowera|Banded dotterel	*Charadrius bicinctus*	At Risk, Declining
White-faced heron	*Egretta novaehollandiae*	Not Threatened
Ngutu para|Wrybill	*Anarhynchus frontalis*	Nationally Increasing
Kōtuku ngutupapa|Royal spoonbill	*Platalea regia*	At Risk, Naturally Uncommon
Tikaokao|California quail	*Callipepla californica*	Introduced and Naturalised
Kererū aropari|Rock pigeon (Feral Pigeon)	*Columba livia*	Introduced and Naturalised
Makipai|Australian Magpie	*Gymnorhina tibicen*	Introduced and Naturalised
Kāhu|Swamp harrier	*Circus approximans*	Not Threatened
Warou|Welcome swallow	*Hirundo neoxena neoxena*	Not Threatened

Manu-kai-hua-rakau|Song thrush	*Turdus philomelos*	Introduced and Naturalised
Manu pango|Eurasian blackbird	*Turdus merula*	Introduced and Naturalised
Dunnock	*Prunella modularis*	Introduced and Naturalised
Tauhou|Silvereye	*Zosterops lateralis lateralis*	Not Threatened
Kairaka|Eurasian skylark	*Alauda arvensis*	Introduced and Naturalised
Hurukōwhai|Yellowhammer	*Emberiza citrinella*	Introduced and Naturalised
Pahirini|Chaffinch	*Fringilla coelebs*	Introduced and Naturalised
European Greenfinch	*Carduelis chloris*	Introduced and Naturalised
Kōurarini|European goldfinch	*Carduelis carduelis*	Introduced and Naturalised
Tāringi|European starling	*Sturnus vulgaris*	Introduced and Naturalised