Restoration Monitoring at Tārerekautuku Yarrs Lagoon Reports

Prepared by Lincoln High School, Level 3 Biology class, 2024

Edited by Willem Tolhoek

Tārerekautuku Yarrs Lagoon, part of the Lake Ellesmere wetland catchment, April 3rd 2024 (Photo: Donald Royds)

Science Department, Lincoln High School, Lincoln PO Box 69138. Lincoln 7640

Email: WTO@lincoln.school.nz

Contents:

Introduction

This report is a result of a collaboration between the Selwyn District Council, Lincoln University, Lincoln High School and Enviroschools. The idea for students to visit and undertake some environmental monitoring at Tārerekautuku Yarrs Lagoon was based of an idea from Mike Bowie who completed a similar, but more comprehensive project alongside Post-Graduate Students from Lincoln University in 2022. The aim of this report is to present a small snapshot of data collected on this trip. The trip in itself also acted as a template for future trips which we hope will be expanded into the future. We would like to thank the following individuals for their support during the project.

Acknowledgements:

Lincoln High School staff and students wish to thank the following people for their assistance:

- Matt Stanford- Enviroschools, ECAN
- Jennifer Gillette, Lincoln University
- Donald Royds, Lincoln University
- Mike Bowie
- David Thomas, DOC
- Helen McCughan, Freshwater Ecologist
- Will Toddhunter, DOC
- Craig Alexander, DOC
- Siobhán Culhane, ECAN
- Annabel Barnden, ECAN
- Denise Ford, Selwyn District Council
- Funding: Tait Foundation
- Landowners: Derek Pike and Daryl Petheram
- Mr Tolhoek's Year 13 Biology class of 2024

Chapter 1: Understanding macroinvertebrates and water characteristics in aquatic habitats of Yarrs Lagoon

Evy Dunbar, Shontelle Templeton, Lily Cooper and Siobhán Culhane (ECAN)

1.1 Introduction:

The aim of this study is to identify stream macroinvertebrates present at Yarrs Lagoon.

The study looked at one sampling stream site with Yarrs Lagoon. This site was near a recently erected foot bridge. This site was selected as macrophytes had not been cleared compared to areas further downstream. Sampling was low due to time restrictions for the sampling and poor weather conditions on the day.

Figure 1.1- map of Yarrs Lagoon with sampling site

1.2 Method:

Abiotic factors were measured at the site included dissolved oxygen, conductivity and water temperature. Macroinvertebrates were using an aquatic kick net. Three samples were taken at the site. Macroinvertebrates were identified and recorded using the presence or absence technique (figure 1.1 and 1.2).

Figure 1.2- sampling technique for freshwater macroinvertebrates

1.3 Results:

Table 1.1- Abiotic factors measured at site 1

Water measurement	Reading
Conductivity (mg/L)	N.A
Water temperature (oC)	12.9°c
Dissolved oxygen (mg/L)	4.91 mg/L

Table 1.2- Macroinvertebrates identified from kick net samples

Macroinvertebrates Taxa	**Presence/absence**
Amphipods	✓
Physa acuta (Acute bladder snail)	✓
Potamopyrgus (Mud Snail)	✓
Chironomid larvae (Lake fly)	✓
Oligochaeta (Earthworms & allies)	
Platyhelminthes (Flatworm)	
Sigara (Boatman)	
Damselfly (Xanthocnemis)	✓
Oxyethira (Micro caddisfly)	
Hydrobiosis (Caddis fly)	
Gyraulus (Snail)	
Triplectides (Stick case caddis larvae)	✓
Pycnocentria (Grainy cased caddis larve)	✓
Total species number	

Table 1.3- Macroinvertebrates Community Index Value

Macroinvertebrates Taxa	**MCI Value**
Amphipods	5
Physa acuta (Acute bladder snail)	3
Potamopyrgus (Mud Snail)	4
Chironomid larvae (Lake fly)	2
Oligochaeta (Earthworms & allies)	
Platyhelminthes (Flatworm)	
Sigara (Boatman)	
Damselfly (Xanthocnemis)	5
Oxyethira (Micro caddisfly)	
Hydrobiosis (Caddis fly)	
Gyraulus (Snail)	
Triplectides (Stick case caddis larvae)	5
Pycnocentria (Grainy cased caddis larve)	5
Total MCI score	29 (poor)

1.4 Discussion:

Dissolved oxygen readings were relatively average (4.91 mg/L) for this environment. The MCI was calculated after data collection; the overall value was 29. MCI is assigned to invertebrates based on their susceptivity to pollution. The overall MCI value indicates that there is an abundance of invertebrates present that are able to with-stand environments that have a high water toxicity. In comparison to Bowie et al (2022), the total MCI was significantly less at 29. This previous study had an average MCI of 80, this could be due to the recent dredging

which has significantly reduced the available habitat for these invertebrates. Hopefully, future sampling will see these numbers increase to previous levels.

This data was supported by the *fish monitoring group* who reported the following:

"Interestingly, there is one very small Pynocentria in the tray with the stick-cased caddis larvae. Damselfly larvae caught in one of the Gee minnow traps, but I don't think that made it to the datasheet. Invertebrate numbers were extremely low, with less than five individuals seen when all the nets/traps were added together (sometimes quite a few can get caught) - not surprising given the recent instream macrophyte removal."

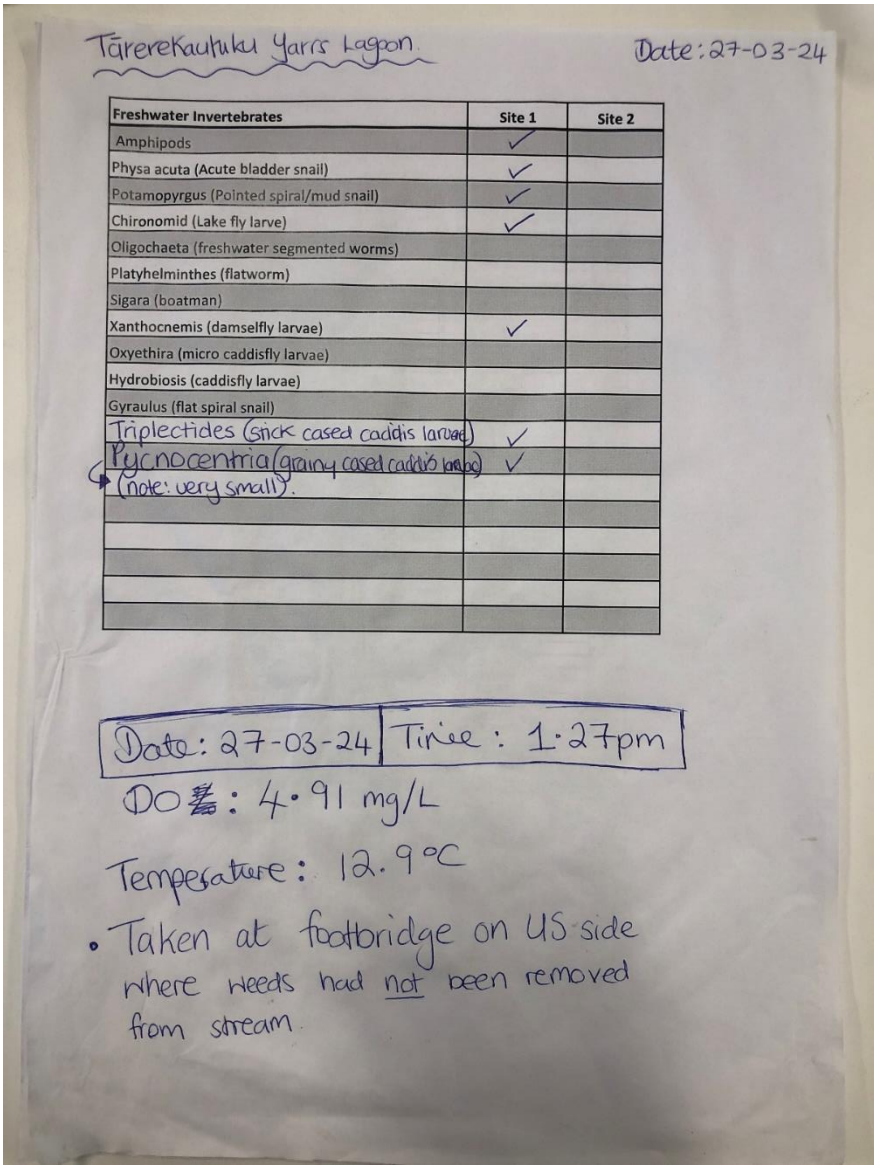
1.5 References:

Gluckman P. (2017). New Zealand's Fresh Waters: Values, State, Trends and Human Impacts 120, https://www.pmcsa.org.nz/wp-content/uploads/PMCSA-FreshwaterReport.pdf

Franklin P.A. (2014) Dissolved oxygen criteria for freshwater fish in New Zealand: a revised approach, New Zealand Journal of Marine and Freshwater Research, 48:1, 112-126, DOI: 10.1080/00288330.2013.827123

Stark JD, & Maxted JR (2007). A user guide for the Macroinvertebrate Community Index. Prepared for the Ministry for the Environment. Cawthron Report No.1166. p58

1.6 Appendix:



Tārerekautuku Yarrs Lagoon

Date: 27-03-24

Freshwater Invertebrates	Site 1	Site 2
Amphipods	✓	
Physa acuta (Acute bladder snail)	✓	
Potamopyrgus (Pointed spiral/mud snail)	✓	
Chironomid (Lake fly larve)	✓	
Oligochaeta (freshwater segmented worms)		
Platyhelminthes (flatworm)		
Sigara (boatman)		
Xanthocnemis (damselfly larvae)	✓	
Oxyethira (micro caddisfly larvae)		
Hydrobiosis (caddisfly larvae)		
Gyraulus (flat spiral snail)		
Triplectides (stick cased caddis larvae)	✓	
Pycnocentria (grainy cased caddis larvae) (note: very small).	✓	

Date: 27-03-24 | Time: 1:27pm

DO: 4.91 mg/L

Temperature: 12.9°C

- Taken at footbridge on US side where weeds had not been removed from stream

Chapter 2: Fish monitoring at Tārerekautuku Yarrs Lagoon

Emma Wheeler, Arsh Galani and Helen McCughan, Freshwater Ecologist

2.1 Introduction:

The aim of this study is to identify fish species present at Yarrs Lagoon. Fish sampling was completed within the same sampling site where previous data was collected by Bowie et al (2022), refer to Figure 2.1 below. We thank Helen McCughan (freshwater ecologit for their support setting up the traps and completing the monitoring with us on the day. A similar method, with some minor changes were followed due to time constraints.

Figure 2.1- Map of fish monitoring site set up for March 2024 sampling. This is in the same location that sampling was completed by Bowie et al in 2022 (image provided by Bowie et al, 2022)

2.2 Method:

Original fish monitoring by Bowie et al (2022) occured along the eastern drain from the Ararira / LII river northbound. This drain is about 3m wide with a substrate type of mud/silt and banks of pasture and scrub/willow. Initially in 2022, Six Fyke traps were set up with a G-minnow trap at each end at 25m intervals along a 150-metre reach of the drain from where it leaves the river.

In comparison, this sampling allowed for two trapping locations only, within the same 150m reach of the side channel that was sampled this time and last time.

Trap set one (1 fyke, 4mm mesh + 2 Gee minnows, 3mm mesh) at 0m, down at the confluence with the main channel, sticking out into the channel a bit.

Trap set two (1 fyke, 4mm mesh + 2 Gee minnows, 3mm mesh) at 75m, measured in the upstream direction from the confluence, along the stream to sample (side stream).

Reasons for the change in sampling method – from Helen McCaughan

Lifting and checking two trap sets is about all that is manageable for the students in the limited time available (allowing plenty of time for questions, discussions, fish looking and handling, etc).

This matches half of the recommended 150m reach but will effectively cover a longer distance due to fish movement (this side channel is so homogeneous extra traps won't really tell much anyway).

Having one almost in the main channel and the other one much further upstream in the side channel should show the difference between fish living up in the side channel and those in the main channel (that will be travelling past and get caught in the gear). This difference, between that first trap set and the other two, was discernible yesterday, especially with īnanga.

Figure 2.2- fish monitoring sampling method in action.

2.3 Results:

Table 2.1- Summary of fish monitoring

		Fyke			Gee	
Species identified	Number	Min (mmTL)	Max (mmTL)	No.	Min (mmTL)	Max (mmTL)
Inanga	34	62	84	31	63	91
Bully - common	340	41	87	94	33	62
Bully - unidentified	73	15	34	17	15	21
Eel - longfin	5	500	940	-		
Eel - shortfin	2	560	650	-		

The results show 340 common bullies were found in the fyke nett (length ranging from 41mmTL to 87mmTL), along with 73 unidentified bullies (length ranging from 15mmTL to 34mmTL). There were also 34 inanga fish ranging from 62mmTL to 84mmTL. Two types of eel were caught, including 5 long finned eels (length ranging from 500mmTL to 940mmTL), and short finned (560mmTL to 650mmTL). The fish caught in the smaller trap, the G Minnow trap, were 94 common bullies (length ranging 33mmTL to 62mmTL), along with 17 unidentified bullies (15mmTL to 21mmTL). Similar amount of inanga fish were caught in the G Minnow trap compared to the fyke nett which was 31 (length ranging 63mmTL to 91mmTL).

Additionally, one damselfly larvae was caught in one of the Gee minnow traps. During sampling it was noted that invertebrate numbers were extremely low, with less than five individuals seen when all the nets/traps were added together (sometimes quite a few can get caught). This was not unexpected given the recent instream macrophyte removal.

2.4 Discussion

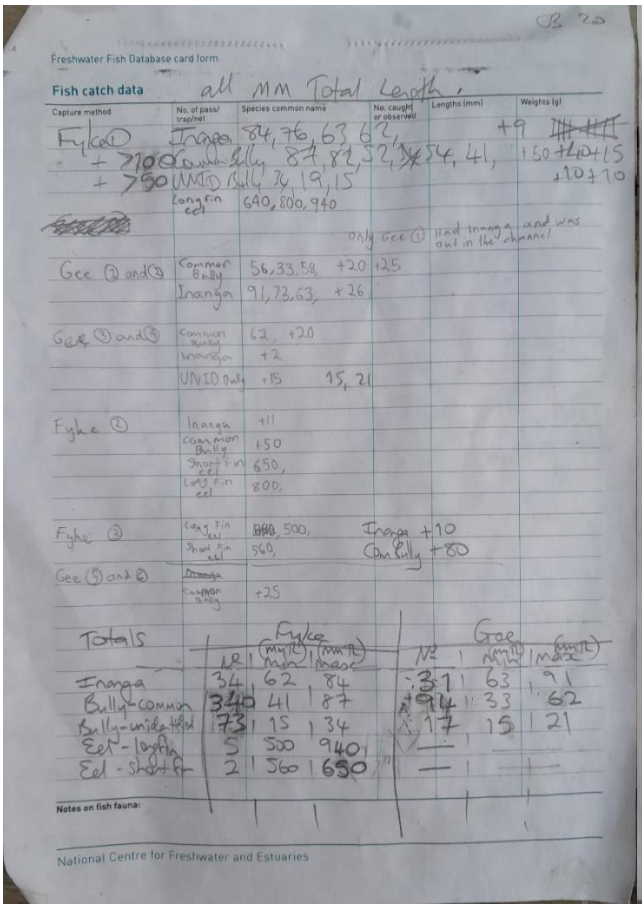
In the 2022 report for the Yarrs lagoon (Bowie et al, 2022), fish were successfully collected using fyke and G-minnow traps. The fyke traps contained NZ long fin eels (*Anguilla dieffenbachii*), shortfin eels (*Anguilla australis*), common bullies (*Gobiomorphus cotidianus*), and unidentified bully species (*Gobiomorphus spp.)*. In contrast, the G-minnow traps captured common bullies, unidentified bullies, giant bullies (*Gobiomorphus gobioides*), and Inanga (Galaxias maculatus), but no eel species. The detailed data and species distributions

were documented in appendix 3.8.2 and illustrated In figures 2.3 and 2.4. By 2024, we saw an average increase in common bully found in Fyke Traps compared to in 2022. We also see a similar number of long finned eels found in fyke traps and we see no change in shortfins found in both reports. We see an increase in inanga found in 2024. Sampling in 2022 found 2 inanga fish found in the six fyke nets but 34 found in 2024 (one fyke net). In the G-minnow traps we saw an average of 64 bullies found in 2022, and in 2024 94 bullies were found in the traps which seems to be a significant increase. We also saw 31 inangas found in the G-minnow traps in 2024 but compared to the 2022 were there were none which were found.

2.5 References:

Bowie et al (2022). *Establishment of Restoration Monitoring at Tārerekautuku Yarrs Lagoon*. Lincoln University Wildlife Management Report No. 75.

2.6 Appendix:


Freshwater Fish Database card form

Fish catch data — all mm Total Length.

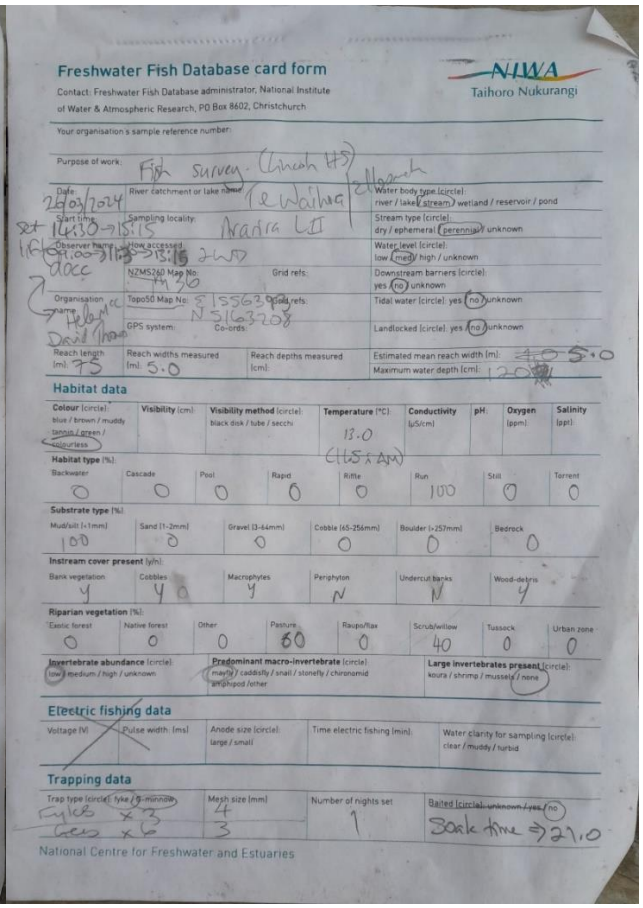
Capture method	No. of pass/ trap/net	Species common name	No. caught or observed	Lengths (mm)	Weights (g)
Fyke①		Inanga	84, 76, 63, 62,		+9
+ 700		Common Bully	87, 82, 57, 54, 41,		150 +10+15
+ 750	UNID	Bully	34, 19, 15		+10+10
		Long fin eel	640, 800, 940		
Gee ② and ③		Common Bully	56, 33, 58	+20 +25	
		Inanga	91, 73, 63	+26	
Gee ③ and ④		Common Bully	62,	+20	
		Inanga		+2	
	UNID	Bully		+15	15, 21
Fyke ②		Inanga		+11	
		Common Bully		+50	
		Short fin eel		650,	
		Long fin eel		800,	
Fyke ③		Long fin eel	1000, 500,	Inanga +10	
		Short fin eel	560,	Com Bully +80	
Gee ③ and ④		Inanga			
		Common Bully		+25	

Totals

	Fyke (mm) min	max	Gee (mm) min	max
Inanga	34 | 62	84	31 | 63	91
Bully - common	340 | 41	87	94 | 33	62
Bully - unidentified	73 | 15	34	17 | 15	21
Eel - long fin	5 | 500	940	—	—
Eel - short fin	2 | 560	650	—	—

Notes on fish fauna:

National Centre for Freshwater and Estuaries


Freshwater Fish Database card form

NIWA Taihoro Nukurangi

Contact: Freshwater Fish Database administrator, National Institute of Water & Atmospheric Research, PO Box 8602, Christchurch

Your organisation's sample reference number:

Purpose of work: Fish survey (Lincoln HS) Collapsed

Date: 24/03/2024 River catchment or lake name: Te Waihora

Start time: 14:30 → 15:15 Sampling locality: Ivanira LII

Observer name: Helen David Thomas How accessed: 2WD

NZMS260 Map No: — Grid refs: —

Topo50 Map No: — Grid refs: E 1556390 N 5163208

Organisation name: — GPS system: — Co-ords: —

Water body type (circle): river / lake / stream / wetland / reservoir / pond

Stream type (circle): dry / ephemeral / perennial / unknown

Water level (circle): low / med / high / unknown

Downstream barriers (circle): yes / no / unknown

Tidal water (circle): yes / no / unknown

Landlocked (circle): yes / no / unknown

Reach length (m): 75 Reach widths measured (m): 5.0 Reach depths measured (cm): —

Estimated mean reach width (m): 4 → 5.0 Maximum water depth (cm): 120

Habitat data

Colour (circle): blue / brown / muddy tannin / green / colourless	Visibility (cm)	Visibility method (circle): black disk / tube / secchi	Temperature (°C): 13.0 (11.5 AM)	Conductivity (µS/cm)	pH	Oxygen (ppm)	Salinity (ppt)

Habitat type (%):

Backwater	Cascade	Pool	Rapid	Riffle	Run	Still	Torrent
0	0	0	0	0	100	0	0

Substrate type (%):

Mud/silt (<1mm)	Sand (1–2mm)	Gravel (3–64mm)	Cobble (65–256mm)	Boulder (>257mm)	Bedrock
100	0	0	0	0	0

Instream cover present (y/n):

Bank vegetation	Cobbles	Macrophytes	Periphyton	Undercut banks	Wood-debris
y	y	y	N	N	y

Riparian vegetation (%):

Exotic forest	Native forest	Other	Pasture	Raupo/flax	Scrub/willow	Tussock	Urban zone
0	0	0	60	0	40	0	0

Invertebrate abundance (circle): low / medium / high / unknown

Predominant macro-invertebrate (circle): mayfly / caddisfly / snail / stonefly / chironomid amphipod /other

Large invertebrates present (circle): koura / shrimp / mussels / none

Electric fishing data

Voltage (V)	Pulse width (ms)	Anode size (circle): large / small	Time electric fishing (min)	Water clarity for sampling (circle): clear / muddy / turbid
—	—			

Trapping data

Trap type (circle): fyke / G-minnow	Mesh size (mm)	Number of nights set	Baited (circle): unknown / yes / no
Fykes ×3	4	1	Soak time ⇒ 21.0
Gees ×6	3		

National Centre for Freshwater and Estuaries

Chapter 3: Mammalian Pests and Lizards monitoring at Tārerekautuku Yarrs Lagoon

Jennifer Gillette (Lincoln University), David Thomas (DOC) and Craig Alexander (DOC)

3.1 Introduction:

The aim of each study was to monitor lizards and mammalian pests at Yarrs Lagoon. Both the Lizard sampling and mammalian pest sampling occurred in similar locations to Bowie et al (2022).

3.2 Methods:

Lizard Method: the method below is an adoption of the method from Bowie et al (2022)

Ten lizard monitoring sites were set up along the edge of the central block of vegetation between two north running drains at Yarrs Lagoon. The sites were each made of two different habitat types, forest edge and

grassland. Four of the sites were set up between the banks of the farm drains and the forest, while the remaining six were between grazed farmland and the forest.

Artificial cover objects (ACOs) were made of two layers of 40cm x 30cm onduline spaced with eight 2.5cm lengths of 10mm dowel. Each ACO was weighed down with some timber debris to reduce any movement. Sampling sites were set up about 50m apart with the ACOs of each habitat pair 20m apart where possible (Figure 3.1). This was at times limited due to grazed paddock fencing or drains being close to the forest edge. ACOs were left out for 10 days between March and April 2024. Checking for lizards was done by lifting both sheets of the ACO together into a pillowcase to prevent any individuals inside from escaping before recording the data. Onduline sheets were then separated in the pillowcase with one person ready to handle any lizards for measurements. Any lizards under the ACO (not between the two sheets) were to be observed by a second student helper to identify when possible. The snout-vent length (SVL) was to be recorded on all lizards using a digital caliper and any lizards. The state of the tails was also to be recorded to assess any damage and regrowth that may suggest potential predation attempts. After recording, ACOs were to be removed from the site and any lizards were to be placed back into the surrounding habitat.

Mammalian Pest Monitoring: the method below is an adoption of the method from Bowie et al (2022)

A transect was placed at Yarrs Lagoon and marked with flagging tape and GPS coordinates (Figure 3.2). The transect consisted of 10 marked locations, spaced approximately 20 metres apart. Dense vegetation and a relatively small study area did not allow locations to be set 50 metres apart as per DOC guidelines (Gillies & Williams, 2013). Ten Black Trakka tracking tunnels were placed at each location with inked cards and were baited with peanut butter and secured with paperclips. All tracking cards were collected after 10 days. Ten Chew cards and eight wax tags were stapled to trees at each location at approximately 20 cm above ground level. Chew cards and wax tags were left for 10 days. One trail camera was set up along the transect, these were not baited due to time constraints.

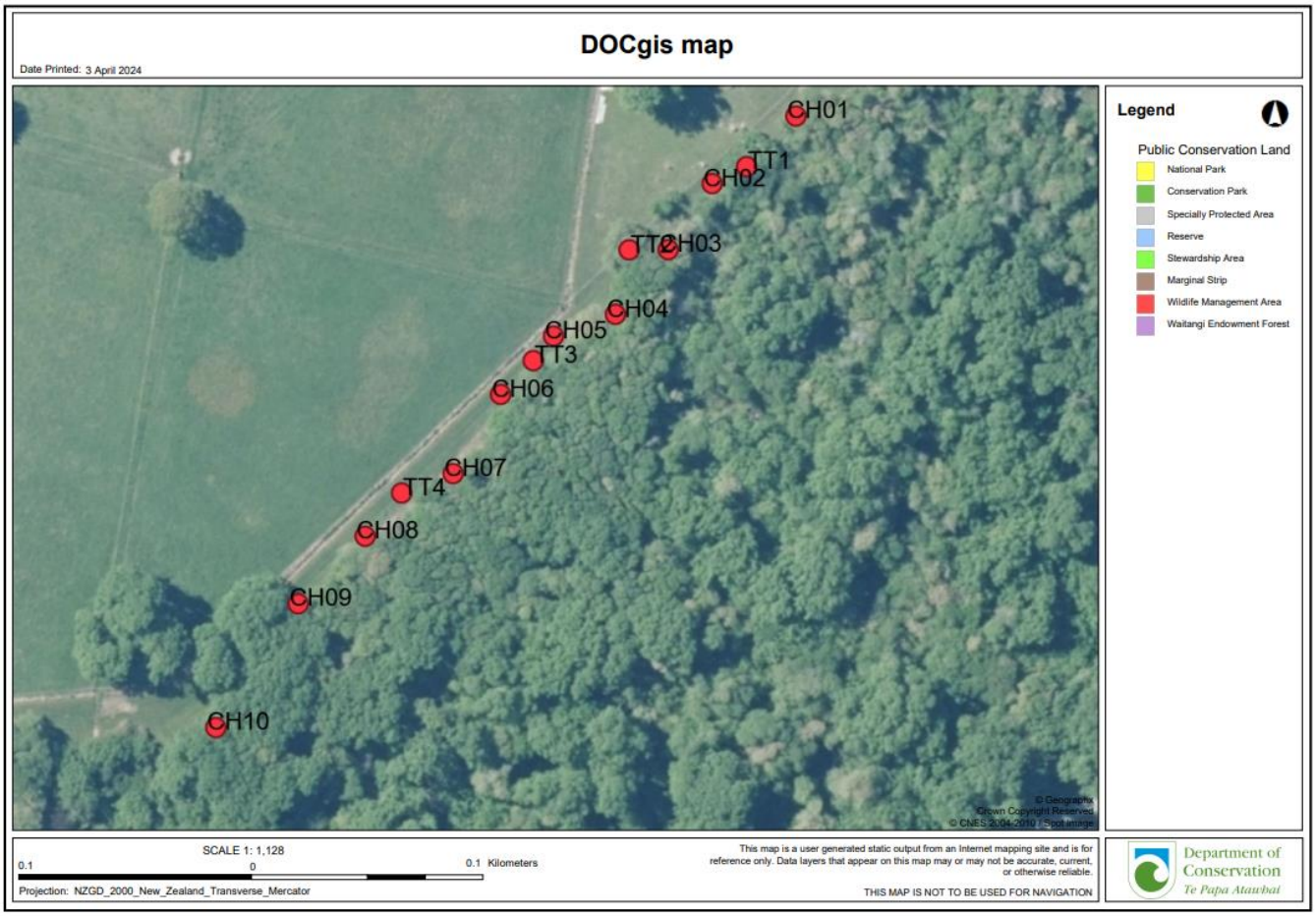


Figure 3.2- Map of mammalian pest sampling sites. Image created by David Thomas, Department of Conservation (2024)

3.3 Results:

Lizards:
Unfortunately, there were no signs of lizards at Yarrs Lagoon, including skins or scat. However, there was evidence of mammalian pests (Table 3.1), which can add value to the mammalian pest study.

Sampling type and location	Lizard observations	Other observations
Tracking tunnel by grass edge	None	1 – mice 2 – mice 3 – mice
Tracking tunnel by forest edge	None	None
Onduline lizard lounges	None	None

Mammalian pests:

Sampling type	Site number and pests identified	Site number with no pests identified
Tracking tunnel	04 – rats 02 – mice 01 – rats and mice	03
Chew cards	CH06 – rat CH01 – mouse CH02 – mouse CH03 – mouse CH04 – mouse CH07 – mouse CH09 – possum CH10 – possum	CH08 CH05
Wax tags	WO3 – mouse WO6 – mouse WO2 – mouse WO1 – mouse WO8 – mouse WO7 – mouse WO5 – rat	WO4
Trail camera	3:28 am – rat 3:35 am – rat 4:25 am – rat 4:28 am – rat and mouse 4:31 am – mouse 4:39 am – rat 4:53 am – rat 4:59 am – rat 5:53 am – rat 6:07 am – mouse 6:20 am – mouse 10:27 am – bird 10:46 pm – mouse 5:12 am – rat	4:16 am 3:25 pm 4:01 pm 4:16 am

3.4 Discussion
As we can see in the results above, there was a clear representation of mammalian pests, such as mice and rats, in the Yarrs Lagoon area, however, no lizards were found to be in the area. These results have led us to believe that there is a relationship between mammalian pests and lizards. Mammalian pests are likely to be predators of the lizards or provide competition for lizards. The fact that we see a large, clear indicator of mammalian pests while non for lizards suggests that this relationship is interspecific, and that the mammalian pests have a negative impact on the survival of the lizards in the Yarrs Lagoon area. Last year's results for the same study show a similar pattern. In 2023, it was found that there were no signs of lizards, including skins or

scat, however, there was strong evidence indicating the presence of mammalian pests, such as rats and mice. This further serves the conclusion that there is an interspecific relationship between the mammalian pests and lizards.

3.5 References

Bowie et al (2022). *Establishment of Restoration Monitoring at Tārerekautuku Yarrs Lagoon*. Lincoln University Wildlife Management Report No. 75.

Chapter 4: Baseline assessment of organisms present using eDNA sampling at Tārerekautuku Yarrs Lagoon

Farah Aladem, Saskia Hoorens van Heyningen, Ragavi Meiyalaghan, Giann van Heerden and Willem Tolhoek

4.1 Introduction:

The aim of this study is to identify species present within the Yarrs Lagoon area using the eDNA sampling technique.

The study looked at one sampling stream site with Yarrs Lagoon (Figure 4.1). This site was near a recently erected foot bridge. This site was selected as macrophytes had not been cleared compared to areas further downstream. Sampling was low due to time restrictions for the sampling and poor weather conditions on the day.

Figure 4.1- map of Yarrs Lagoon with sampling site

4.2 Method: *adapted from the Wilderlab instructions (2024)*

One eDNA sample was completed. DNA was collected using an eDNA kit from Wilderlab. The kit is designed to filter water and traps biological material. The DNA can then be extracted from the material captured on the filter in a lab. The kit includes a large syringe with a filter that captures particles containing eDNA. Preservative is then injected into the filter capsule to keep the DNA fresh while it is couriered to the laboratory for analysis.

Gloves were used to reduce the chances of contamination. The syringe was set up, then 1L of water from just below the surface of the water was pushed through the syringe (Figure 4.2). Following this, the filter was removed from the syringe and added with preservative to secure the sample. Date and location were added to the sampling bag before the sample was added.

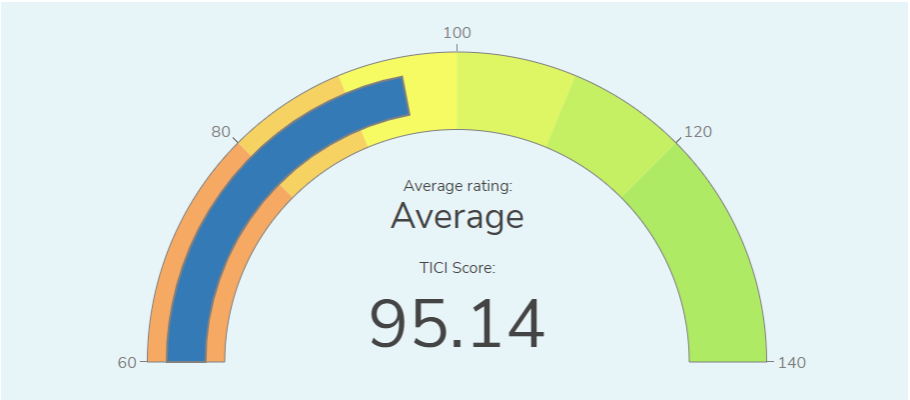
Figure 4.2- eDNA sampling technique being completed at Yarrs Lagoon

4.3 Results:

Full results can be found here:

https://s3.ap-southeast-2.amazonaws.com/wilderlab.openwaters/reports/8f9cdc5a64a04862.html

The results show (Figure 4.3) that the sample from the stream has a Taxon-Independent Community Index (TICI) value of 95.14. This suggests that the sample likely has an average ecological community, in terms of its stability and biodiversity. A higher score usually indicates greater biodiversity or a more evenly distributed species presence in the community. Refer to the index for a scale of this.



Sample number	TICI version	TICI score	TICI rating	TICI quantile	TICI nseqs	TICI reliability
536773	Riverine V1	95.14	Average	0.4	430	Very high

Figure 4.3- TICI value for Yarrs Lagoon

Another thing we found in figure 4.4 was that the bacterial taxa represented the largest proportion in the "wheel of life," suggesting that microbial life forms are a dominant component of the ecosystem. This prevalence of bacteria may reflect the lagoon's specific environmental conditions, such as nutrient availability, water quality, and habitat suitability for microbial growth.

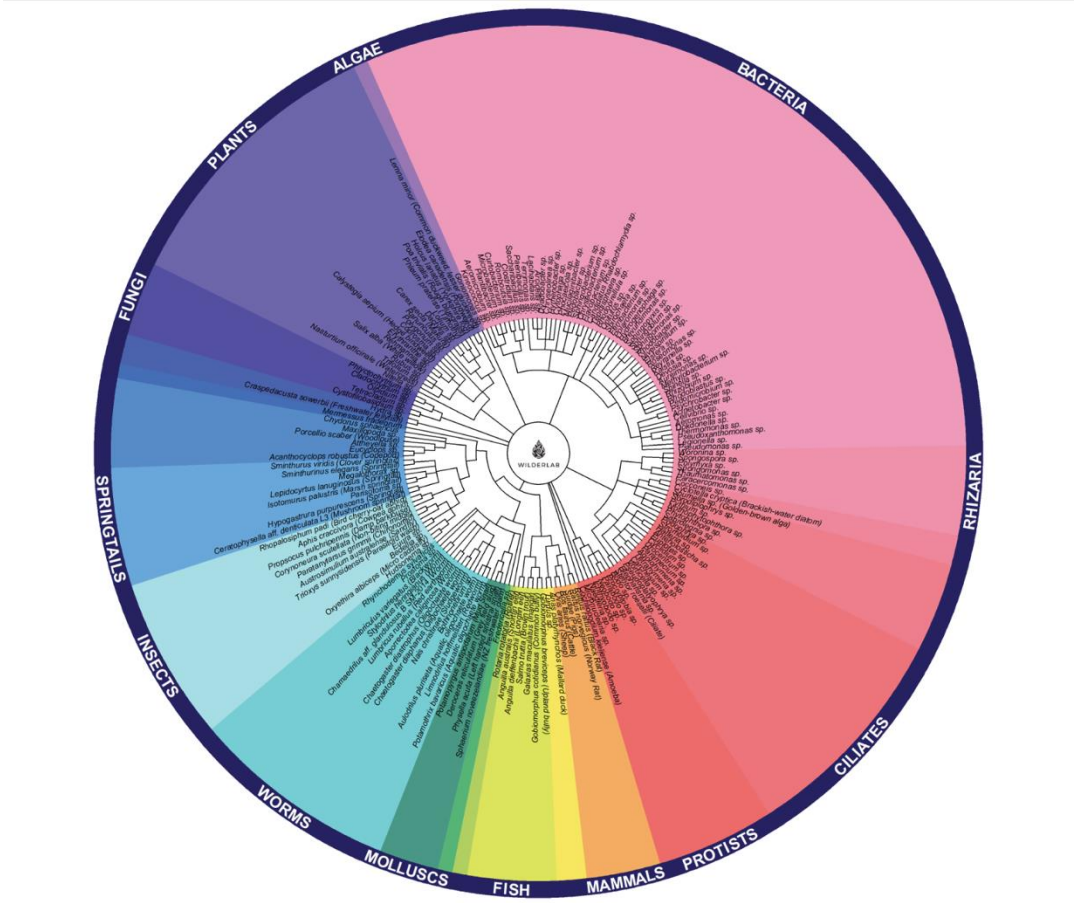


Figure 4.4- Wheel of life for taxonomic groups from eDNA sample at Yarrs Lagoon

The presence of black rat (Rattus rattus) was also indicated in our results. This species is considered invasive in many ecosystems, and its detection in the lagoon raises concerns about its potential impact on native species.

4.4 Discussion:

With global biodiversity declining with an increasing rate. The need for effective polices increases as well. Fortunately, with eDNA metabarcoding (method of plant and animal identification based on DNA identification and rapid DNA sequencing) provides a strong and consistent solution that can survey at a reasonable cost. The river taxon independent community index allows wilderlab to track the health of waterways. The score reflects the ecological health on a scale under different land uses. Our sample reflected an average score, whereas score further upstream from our sample job number 603771 has a lower score of 92.39 it is still considered average. As sample 603771 contained much less bacteria, more algae, birds, fish and insects.

The results from our eDNA sampling at Yarr's Lagoon provide important insights into the biodiversity and ecological dynamics of the area. The average Taxon-Independent Community Index (TICI) value of 95.14 suggests that the lagoon supports an average and well-structured community. This mid-level of biodiversity can be interpreted as a positive indicator of the ecosystem's health, potentially reflecting a stable environment with a wide range of taxa contributing to its ecological processes.

However, the accidental dropping of sampling equipment into the lagoon during collection could have introduced contamination, potentially affecting the accuracy of the eDNA results. This mishap raises concerns about the potential introduction of external DNA or the disruption of the sample's integrity. The contamination

could have led to the detection of foreign taxa or distorted the actual composition of the lagoon's biotic community.

Moreover, the detection of black rat (Rattus rattus), as outlined in our results, must be interpreted with caution due to the risk of contamination. Although black rats are known to inhabit similar ecosystems and pose significant ecological risks, the possibility of erroneous detection due to sample contamination cannot be fully ruled out.

One limitation of this study was the single sampling event, which may not fully capture seasonal or temporal variations in biodiversity. Moreover, the eDNA method, while powerful, is sensitive to contamination and the presence of DNA from organisms that may not be currently residing in the area. Repeated sampling across different seasons could provide a more comprehensive view of the lagoon's ecological dynamics.

4.5 Appendix:

Link to full eDNA results: https://s3.ap-southeast-2.amazonaws.com/wilderlab.openwaters/reports/8f9cdc5a64a04862.html

Chapter 5: Drone and arial photography of Tārerekautuku Yarrs Lagoon

Ross Hess, Cailan Van Der Molen, Josh Williams and Donald Royds (Lincoln University)

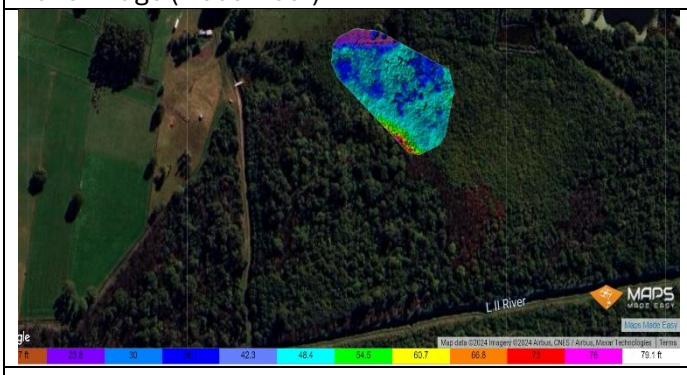
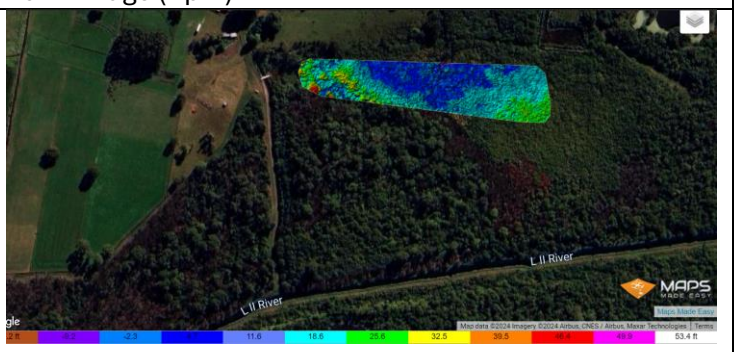
5.1 Introduction:

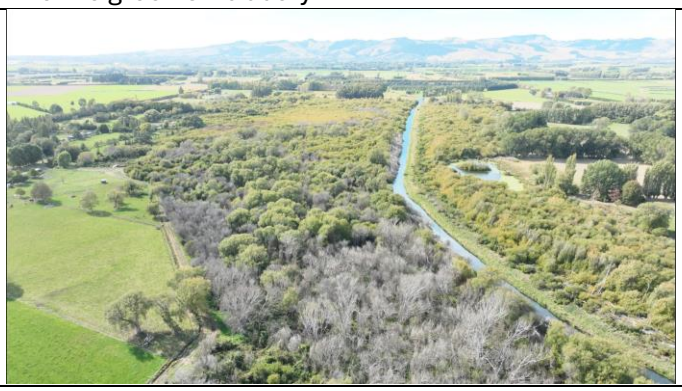
The aim of this study was to complete aerial drone photography over Yarrs Lagoon and compare these images to a similar study completed in 2015. This should allow comparisons to be made and show progress on habitat restoration.

5.2 Method:

Aerial drone photography was initially set to be completed on the day of the field trip in March. Due to the weather conditions on the day this was not possible. Instead, image were created in early April.

5.3 Results:

2015 image (December)	2024 image (April)
	
Observations: Little bit of red foliage, the mean height looks higher in the highlighted area.	Observations: difference in height in highlighted area, seems taller.

	
Observations: Flat sectioned pastures next to dense lush trees and shrubs. Dead or dying shrubs in the centre bottom. A stream running through the dense vegetation off to the left.	Observations: Lots of dead willows mixed in between sporadic live trees and shrubs. Flat plain off in the far top right. Stream off to the right.
	
Observations: Shrubs are less pronounced as they haven't had as much time to develop and grow.	Observations: Shrubs are more pronounced. They have had time to grow and are thriving from natural resources. Dead willows are dense and scattered everywhere
	
Observations: minimal dead trees, (hardly any),	Observations: Large amount of dead willows on left side of stream with scattered willow on the right side nestled into the green shrubbery
	
Observations: Flat sectioned pastures next to dense lush trees and shrubs. Dead or dying shrubs in the	Observations: Dead williow trees on the bottoms surrounded by green shrubbery. Stream running though

bottom right. A stream running through the dense vegetation off to the top left.	
	
Observations: flat bush, not as much light reaching the ground. Patches of open ground.	Observations less gray/dark trees, more green and larger.
	
Observations: Stream looks thinner, and the trees look less big. Not as much dead willows	Observations: stream is bigger and wider and trees are also bigger, more willow trees are dead.

5.4 Discussion:

There has been a concerted effort from the Selwyn District Council to kill a large number of willows. This is because willows are an exotic plant and prevens the growth of native flora. Willows are large canopy trees that block sunlight preventing smaller forest floor native fauna from receiving the necessary sunlight. This invasive species also disrupts natural water cycles in ecosystems as they use up far more water than native plants, preventing native flora from receiving water. The willows large dense branches drop far more leaves than native plants and can block water ways like the L II River at Yarrs Lagoon. These leaves decompose quickly in detritus, releasing chemicals into waterways which deter natural fauna from water ways and leaf consumption. There has been an evident conservation effort to kill and remove these invasive willow trees in order to ensure the survival of native flora. This is evident in the photos showing a large difference in dead organisms a year apart, with a number of willow trees dead or dying, only leaving trunks and branches to slowly be broken down.

5.5 References:

https://riversofcarbon.org.au/resources/willows-willow-management/

https://www.selwyn.govt.nz/community/our-natural-environment/community-restoration-projects/trerekautuku-yarrs-lagoon-reserve-management-plan

Chapter 6: Weed identification at Tārerekautuku Yarrs Lagoon

Hayden Lockheart, Kwadwo Amoafo, Conor Wilson and Will Toddhunter (DOC)

6.1 Introduction:

The aim of this study was to complete sampling to monitor vegetation and how the composition may change over time. A line transect and one 10mx10m plot size was completed due to time constraints and poor weather.

Figure 6.1- Approx location of transect line used for sampling

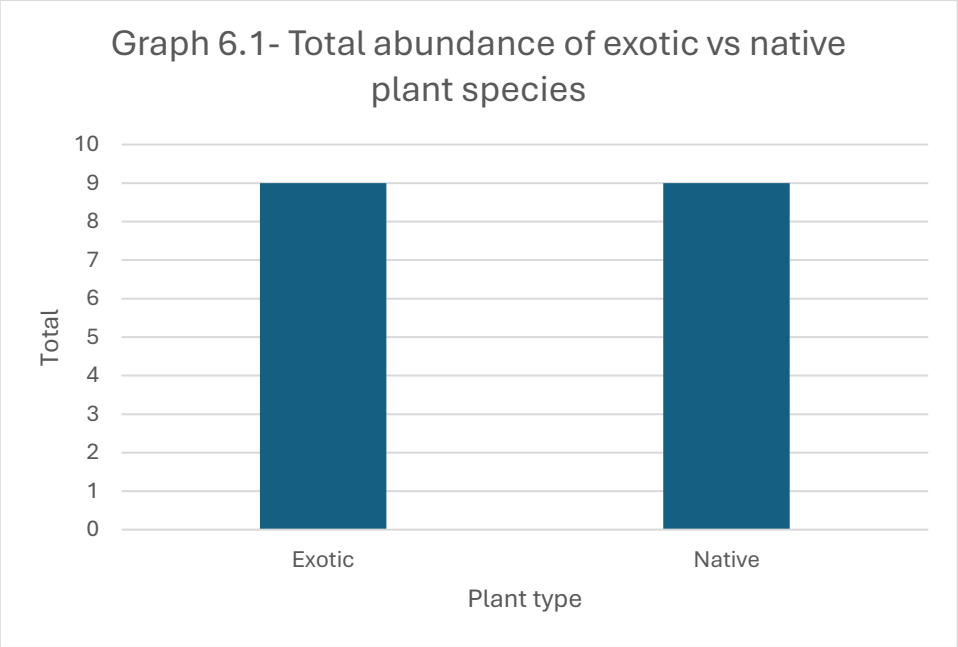
6.2 Method: *the method below is an adoption of the method from Stammer (2010)*

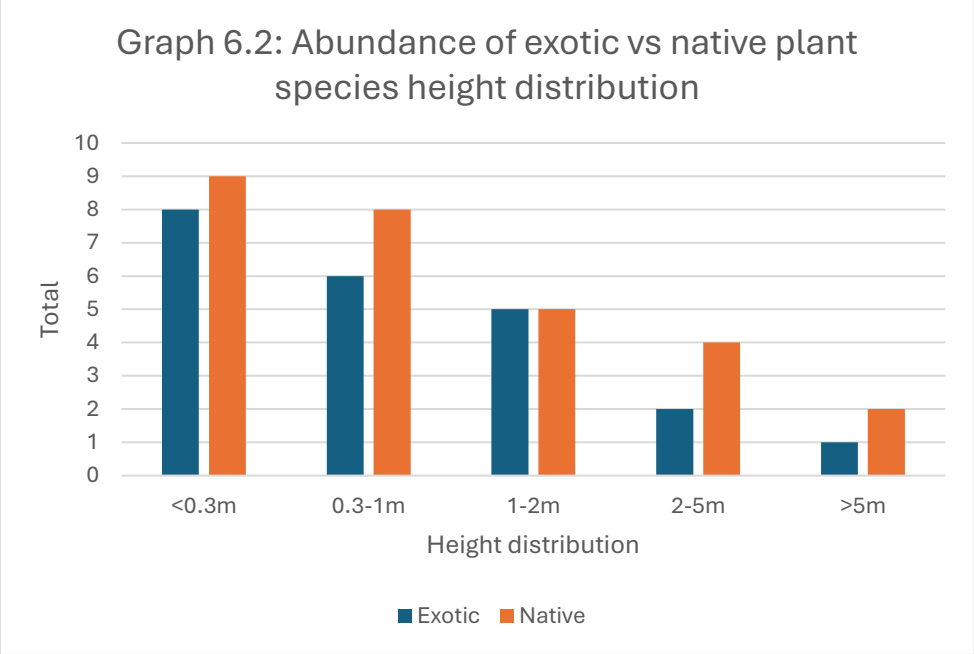
A transect was established along the edge of the existing forest edge (Figure 6.1). Tape was used to mark the start of the transect. At the first 10m interval the plot was established (10m x 10m). Various sampling techniques were used including percentage cover, species identification, height, canopy coverage and seedlings present.

6.3 Results:

		Height		Cover class: 1=<1%, 2=1-5%, 3=6-25%				
Classification	Cover %	Max	Avg	<0.3m	0.3-1m	1-2m	2-5m	>5m
Exotic	9.4	2.4	1.8	1.3	1.7	1.2	2.0	3.0
Native	5.7	1.6	1.2	1.2	1.5	1.8	2.0	1.5

Figure 6.2- Average percentage cover, height and cover class sorted by exotic vs native





6.4 Discussion:

In total 17 species were found in the herbaceous layer, 9 of which are native and 8 which are exotic.

Similar to the 2022 investigation it was found that blackberry is still dominating the understory with 50 percent coverage in this transect.

There is significant difference in coverage vs abundance when comparing exotics and native plant life. Natives were more abundant than the exotic's but the coverage for exotics was much higher. Some significant native species were missing from this transect such as manuka but more transects may remedy this.

No manuka was found in this transect which could be a cause for concern. There are a few other missing significant native species that would have been expected to be found.

6.5 References:

Stammer, Saskia (2010). *Monitoring Successional Processes in Yarr's Lagoon in Presence of Salix spp.; Canterbury, New Zealand*. Lincoln University.

6.6 Appendix:

WETLAND PLOT SHEET

Wetland name: Yarris lagoon **Date:** 27/03/2024 **Plot no:** YL 1

Plot size: 10m x 10m **Altitude:** 11m **GPS:** 1556301 E 5163294 N

Recorder: VT **Veg structure:** Forest **Composition1:** SAL cin

Species (* for exotics)	Cover %[2]	Height m		Cover class 1 <1%, 2 1–5%, 3 6–25%, 4 26–50%, 5 51–75%, 6 76–100%					Seed-ling #[3]	Notes
		Max	Avg	<0.3 m	0.3–1 m	1–2 m	2–5 m	>5 m		
Sal cin	25	12	10				2	3		
Car aus	2			1	1	1	2		2	
Mus gui	5			2	2	2	2	1		
* Rub fru	50	1,50	0,4	3	4	2				
Ble NOV	20	1	0.6	2	3					
* Sol dul	2	0.5	0.3	1	2					
Car vir	5	1		1	2					
Hyd ~~sp~~ het	<1			1						
* Son alp	<1	0.4	0.2	1						
Cot fab	7	3	2	1	1	2	2		20	
Cot pro	2	17,5	1,4	1	1	2				
* Sam nig	3	3	2	1	1	1	2			
Gal cupu	1	0.2	0.1	1						
Cyt sco	1	0.5	0.4	1	1					
* Lon. Ole	1	1,5	1	1	1	1				
Sol che	<1	1.1	1	1	1	1				
* Eri gum	<1	1.2	1.0	1	1	1				
Car x Cun	5	2.5	1.8	1	1	2	2			

Litter (total %)	5	**Bare Ground** (total %)	–	**Photo** (SW corner) N:	✓
Bryophytes (total %)	–	**Water** (total %)	–	**Photo** (SW corner) E:	✓

[1]Atkinson bird's eye view method, i.e. / or – for different or same height: 50–100%, 20–49% (10–19%) [1–9%]
[2]Live shoot biomass for each species; total plot cover usually >100%. Note dead foliage if >20% cover
[3]Woody seedling number: actual count for low numbers, otherwise estimate.

Field measurements:

Water table cm	–	Water conductivity µS	–
Water pH (if present)	–	Von Post index (peatlands)	–
Soil cores collected (√)	–	Foliage collected (list species)	–

Comments/additional species in vicinity in same vegetation type:

- plot was done with Lincoln Uni school.
- did not collect additional field measurements due to lack of time/ capacity. Primary purpose of plot was to introduce students to vegetation monitoring.
- Epi bil

			Height		Cover class						
Species name	Common name	Classification	Cover %	Max	Avg	<0.3m	0.3-1m	1-2m	2-5m	>5m	Seedlings
Salix cinerea	grey willow	Exotic	25	12	10				2	3	
Rubus fruticosus	blackberry	Exotic	50	1.5	0.4	3	4	2			
Solanum dulcamara	Black nightshade	Exotic	2	0.5	0.3	1	2				
Sonchus asper	Prickly sow thistle	Exotic	1	0.4	0.2	1					
Sambucus nigra	Black elder	Exotic	3	3	2	1	1	1	2		
Galium aparine	Goosegrass	Exotic	1	0.2	0.1	1					
Sonchus oleraceus	Sow thistle	Exotic	1	1.5	1	1	1	1			
Solanum chenopodioides	Velvety nightshade	Exotic	1	1.1	1	1	1	1			
Erigeron sumatrensis	None	Exotic	1	1.2	1	1	1	1			
Cordyline australis	Cabbage tree	Native	5			1	1	1	2	2	2
Muehlenbeckia australis	Large-leaved muehlenbeckia	Native	5			2	2	2	2	1	
Blechnum novae-zelandiae	palm leaf fern	Native	20	1	0.4	2	3				
Carex virgata	swamp sedge	Native	5	1		1	2				
Hydrocotyle heteromeria	Waxweed	Native	1			1					
Coprosma robusta	Glossy karamu	Native	7	3	2	1	1	2	2		20
Coprosma propinqua	Mingimingi	Native	2	1.5	1.4	1	1	2			
Pittosporum tenuifolium	Black matipo	Native	1	0.5	0.4	1	1				
Coprosma cuneata	None	Native	5	2.5	1.8	1	1	2	2		

Chapter 7: Baseline assessment of invertebrates at Tārerekautuku Yarrs Lagoon

Sampling not completed due to sickness during fieldtrip day