



Northland Freshwater Fish Monitoring: Summer 2022/2023

Northland Freshwater Fish Monitoring: Summer 2022/2023

Prepared by

Brandon Ruehle
Northland Regional Council
36 Water Street
Whangārei 0110

Corresponding Author

Brandon Ruehle
Email: brandonr@nrc.govt.nz
Freshwater Ecologist

Document Information

Northland Regional Council, Natural Resources Science Report No: TR2023/FEW/02
Report Date: 21/07/2023

Internally reviewed by: Richard Griffiths and Roselyn Naidu.

Document status: Final

Citation Advice

Ruehle, B (2023). *Northland Freshwater Fish Monitoring: Summer 2022/2023*. Northland Regional Council, Whangārei, New Zealand 0110. Report No: TR2023/ FEW/02.

Acknowledgements

This work could not have been completed without the work and commitment of Megha Sethi, Council's Ecological Monitoring Officer, as well as hardworking summer students Alicia Rutherford and Shavonne Toko. We would also like to acknowledge the support of the Science and Water Quality Field Operations teams. Finally, special thanks to Auckland Council staff for their invaluable assistance sampling Tanekaha Track Stream at King Rd.

Disclaimer: Users are reminded that Northland Regional Council data is provided in good faith and is valid at the date of publication. However, data may change as additional information becomes available. For this reason, information provided here is intended for short-term use only. Users are advised to check figures are still valid for future projects and should carefully consider the accuracy/quality of information provided before using it for decisions that concern personal or public safety. Similar caution should be applied for the conduct of business that involves monetary or operational consequences. The Northland Regional Council, its employees and external suppliers of data, while providing this information in good faith, accept no responsibility for any loss, damage, injury in value to any person, service or otherwise resulting from its use. All data provided is in NZ Standard Time. During daylight saving, data is one hour behind NZ Daylight Time.

CONTENTS

Background	1
Methods.....	1
Electrofishing	1
Netting.....	2
Fish IBI.....	2
Results and Discussion	8
Conclusions and Recommendations	11
References	11

Background

Northland Regional Council's (council) fish monitoring programme takes place annually between December 1st and April 30th in accordance with Joy et al. (2013) protocol and NPS-FM (2020) requirements. There are 26 fish monitoring sites listed in the Environmental Monitoring Plan River Water Quality and Ecology, but according to Ruehle (2023) not all of these are suitable for sampling. Some sites are too wide (i.e., >12m on average) and/or deep (i.e., >0.6m for more than 50% of the reach), and in general the network has too many sites at low elevation near the coast resulting in overly similar fish communities (Ruehle, 2023). As a result of the network favouring sites at low elevations near the coast, there is a bias towards species with poor climbing abilities making it unlikely to detect climbing species such as shortjaw kōkopu (nationally threatened), kōaro (at-risk declining), and banded kōkopu (not threatened) among others.

To address the concerns with the fish monitoring network eight sites were sampled for the first time in 2022/2023 (Table 1). Five of the added sites are located near the original State of the Environment (SOE) sites, as either tributaries or an upstream reach (i.e. Peria at Māra Whenua), but three were added (i.e. Wairoa Stream UT at Kerikeri Inlet Rd, Tanekaha Track Stream at King Rd, and UT Waimahanga Stream at Mt Taika Forest) to increase the number of smaller, native bush streams in the network.

Methods

We sampled 22 sites in summer 2022/2023 via electrofishing or netting (Table 1).

Electrofishing

Electrofishing monitoring was carried out using a Smith-Root LR-24 Electrofisher. The LR-24 was used preferentially over the other commonly used fishing machine, the NIWA Kainga EFM300, due to the fine-scale tuning (e.g., increase of voltage in increments of 5V vs 100V) of the machine's settings compared to the Kainga. To reduce the impact on the fish, standard settings for all sites were on 12% duty cycle, 30Hz, and pulsed current. Voltage varied from 100 – 300V depending on the conductivity recorded at the site; with lower voltages used at higher conductivities. The intent of electrofishing is to stun fish within the electrical field while keeping the intensity of the field low enough that when the machine is turned off or the fish moves out of the affected area it can swim away immediately.



Fish monitoring team electrofishing at Peria at Māra Whenua

Monitoring occurred in teams of 3–4, with at least two team members being electrofishing certified. Two personnel actively fished, one wearing the electrofisher and the other one holding the pole/stop net downstream of the fisher, and the rest of the team members recover fish from the net, measure their size and record data. For each site, 150m of stream was measured and marked with flagging posts at 15m intervals laying out 10 subreaches

prior to fishing each subreach. In each subreach, sampling was conducted from downstream to upstream so that stunned fish would drift into the stop net. Beginning with the net against one bank, the fisher would actively fish an area the width of the stop net beginning 3–5m upstream of the netter and working downstream to the net. After recovering the fish from the net, the netter moved laterally 1 net width across the stream, continuing with the fishing method until the opposite bank was reached. The same procedure was repeated moving upstream at 3–5m intervals, covering a total distance of 150m. At the end of a subreach, the wetted width (m), depth and middle of channel (m), and total fishing time (min) were recorded. Fishing time is used as a measure of effort to ensure standardisation among sampling teams and seasons.



Auckland Council staff joining the Fish Monitoring Team for joint-training at Tanekaha Track Stream at King Rd.

Fish were identified to species level and total length was measured (TL; mm, length from tip of the nose to tip of the caudal fin) and recorded. The first 50 fish of each species were measured and then the first 10 fish per subreach of that species were measured and the remaining fish were counted. Kōura, freshwater crayfish, *Paranephrops* spp. were not measured but the number of individuals was recorded. Freshwater shrimp *Parataya* spp. and mosquitofish *Gambusia affinis* were counted and placed into 1 of the 5 categories: 0, 1-9, 10-99, 100-1000, or over 1000.

Netting

The netting method was applied up to 150m of stream using 6 fyke nets and 12 Gee minnow traps (GMTs). The downstream end, upstream end, and midpoint of the sample reach were marked with flagging posts. Three fyke nets were set upstream of the midpoint, three downstream, and two GMTs were set within 5m of each fyke, one up- and one downstream. Fyke nets were set with the open end and wing facing downstream and at an angle to the bank. Stakes were used to anchor either end of the net, with the cod end anchored to the bank, in place. The nets were left out overnight and recovered the next day. Beginning with the most downstream set of nets (i.e., fyke and 2 GMTs) fish were recovered, identified to species level, measured, and released. Fish measurements and data entry followed the same methodology as Electrofishing. Wetted width and depth were not measured at netting sites.

Fish IBI

The National Policy Statement for Freshwater Management (NPS-FM, 2020) includes the Fish Index of Biotic Integrity (IBI) as an attribute to inform on ecosystem health. Fish IBI is a score calculated by taking into account a site's elevation and distance to the coast as well as six native species metrics: 1) the total number of species, 2) the number of benthic riffle, 3) the number of benthic pool

species, 4) the number of pelagic pool species, 5) the number of degradation tolerant species, and the 6) proportion of native to introduced species. The resulting score is used to estimate the health of the fish community at a site and consequently inform on the state of the local ecosystem. Elevation and the distance to the coast are included as they are strong predictors of fish diversity in New Zealand. Fish IBI was calculated for each site using a Microsoft Excel macro developed (Joy, 2019). Index values range from 0 to 60, with 0 indicating no fish present and 60 indicating high presence of fish.

Table 1 Fish monitoring sites as listed in the Environmental Monitoring Plan River Water Quality and Ecology. Alternate sites are also listed where applicable and those sampled for the first time are in **red**.

RWQMN Site	RWQMN Site ID	FMU	Fish Site	Fish Site ID	Sampled in 2022/2023	Reason Not Sampled	Sampling Method
Pukekura Stream at No2 Arterial Rd	330489	Aupōuri	Yes		No	Iwi engagement ongoing	
Victoria at Victoria Valley Road	105532	Awanui	Yes		Yes		Electrofishing
		Bay of Islands	Wairoa Stream UT at Kerikeri Inlet Rd	333762	Yes		Electrofishing
Waiharakeke at Stringers Rd	100007	Bay of Islands	Yes		No	Not suitable for fish monitoring.	
Waitangi at Waimate North Road	103178	Bay of Islands	Yes		Yes		Netting
		Bream Bay	Tanekaha Track Stream at King Road	333761	Yes		Electrofishing
Ruakaka at Flyger Road	105008	Bream Bay	Yes		Yes		Netting
Oruru at Oruru Road	108979	Doubtless Bay	Yes		No	Site is very tidal. Not suitable	Netting
Oruaiti at Windust Road	304641	Doubtless Bay	Yes		Yes		Netting
Peria River at Honeymoon Valley US Dutton Road	330512	Doubtless Bay	Peria at Māra Whenua	335340	Yes		Electrofishing
Mangonuiwae Stream at Awaroa Road	330491	Herekino-Whāngāpē	Yes		No	Iwi engagement ongoing	
Waitotoki Stream at Awaroa Road	330492	Herekino-Whāngāpē	Yes		No	Iwi engagement ongoing	
Waipapa at Forest Ranger	101751	Hokianga	Opaopao Stream at Forest Road	331866	Yes		Electrofishing
Tapapa at SH1	313165	Hokianga	Yes		Yes		Electrofishing
Mangahuru at Main Road	100237	Northern Wairoa	Yes		Yes		Netting
Opouteke at Suspension Bridge	102258	Northern Wairoa	Opouteke River UT at Confluence	333757	Yes		Electrofishing
Hakaru at Topuni	109021	Northern Wairoa	Hakaru River UT US at Topuni	332199	Yes		Electrofishing
Tangowahine at Tangowahine Valley Road	322490	Northern Wairoa	Yes		Yes		Electrofishing
Waipoua at SH12	103304	Waipoua	Waikohatu Stream at Visitor Centre	333758	Yes		Electrofishing
Waimamaku at SH12	109098	Waipoua	Yes		Yes		Electrofishing
Wairau at SH12	313168	Waipoua	Yes		No	Not suitable for fish monitoring	
Ngunguru at Coalhill Lane	110603	Whananaki Coast	Yes		No	Issues with landowner in previous year. Edge of suitability	Electrofishing
Punaruksu at Russell Road	313171	Whananaki Coast	Punaruksu River UT at Punaruksu Rd	333760	Yes		Electrofishing
		Whangārei	UT Waimahanga Stream at Mt Taika Forest	335338	Yes		Electrofishing
Waiarohia at Second Avenue	108359	Whangārei	Yes		Yes		Electrofishing
Otaika at Otaika Valley Road	110431	Whangārei	Yes		Yes		Electrofishing
Raumanga at Bernard Street	304709	Whangārei	Yes		Yes		Electrofishing
Pukenui at Kanehiana Drive	312177	Whangārei	Yes		Yes		Electrofishing
Hatea at Whareora Road	331352	Whangārei	Waikoromiko at Hatea Confluence	331834	Yes		Electrofishing

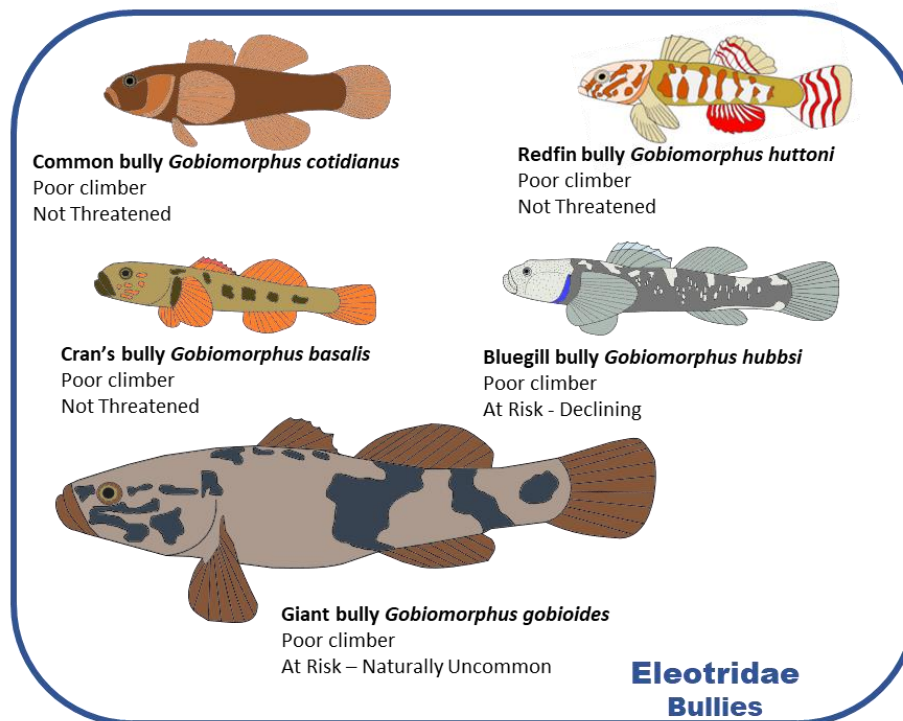
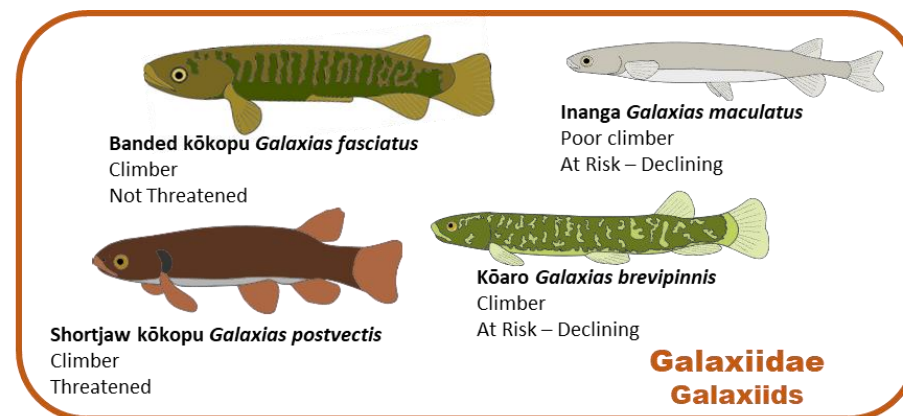
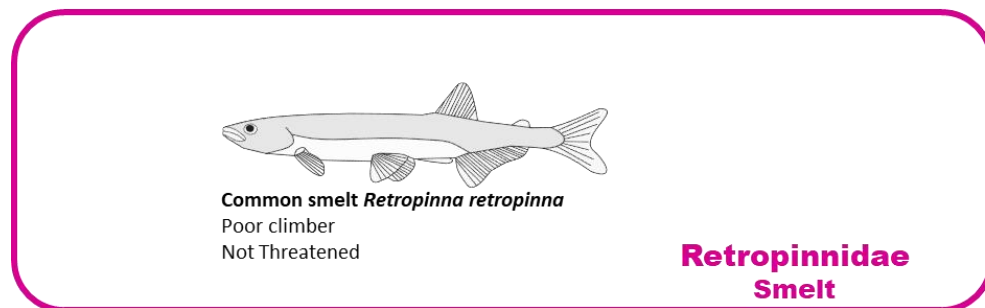
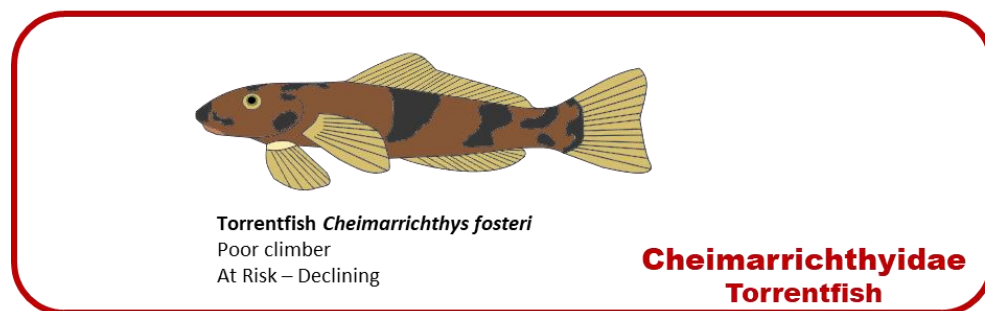
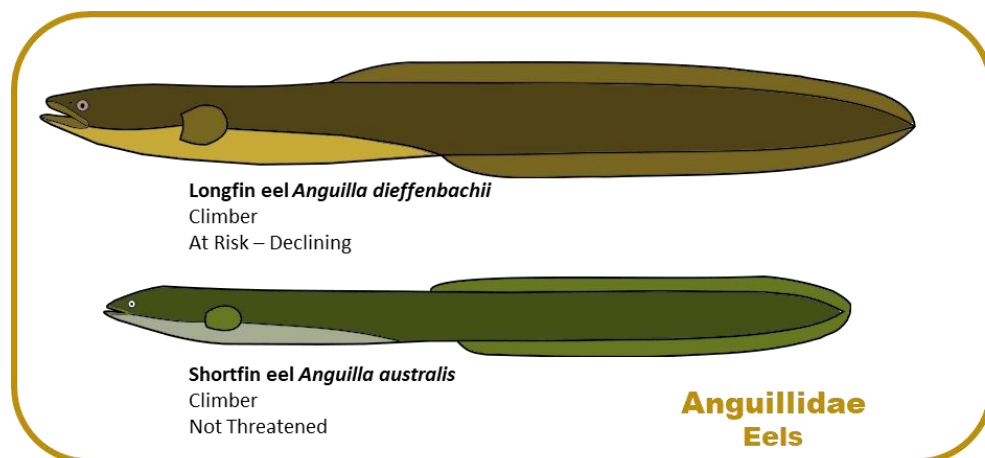


Figure 1 Native fish species collected during the 2022/2023 summer sampling season.

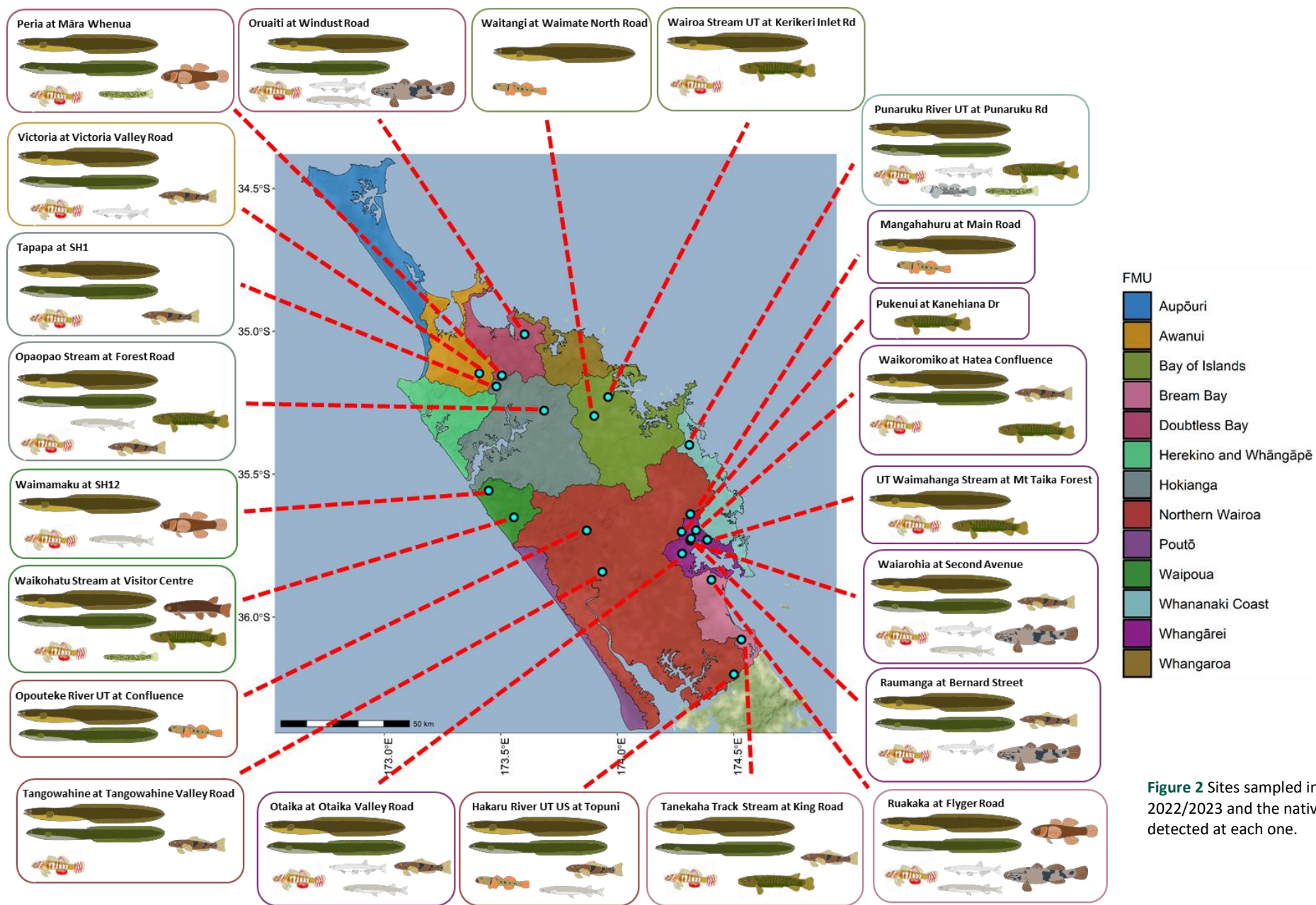


Figure 2 Sites sampled in summer 2022/2023 and the native species detected at each one.



Figure 3 *Gobiomorphus hubbsi* (front) and *G. huttoni* (back) encountered at Punaruku River UT at Punaruku Rd.



Figure 4 *Galaxias brevipinnis* encountered at Punaruku River UT at Punaruku Rd.



Figure 5 *Galaxias brevipinnis* encountered at Peria at Māra Whenua in Doubtless Bay area.

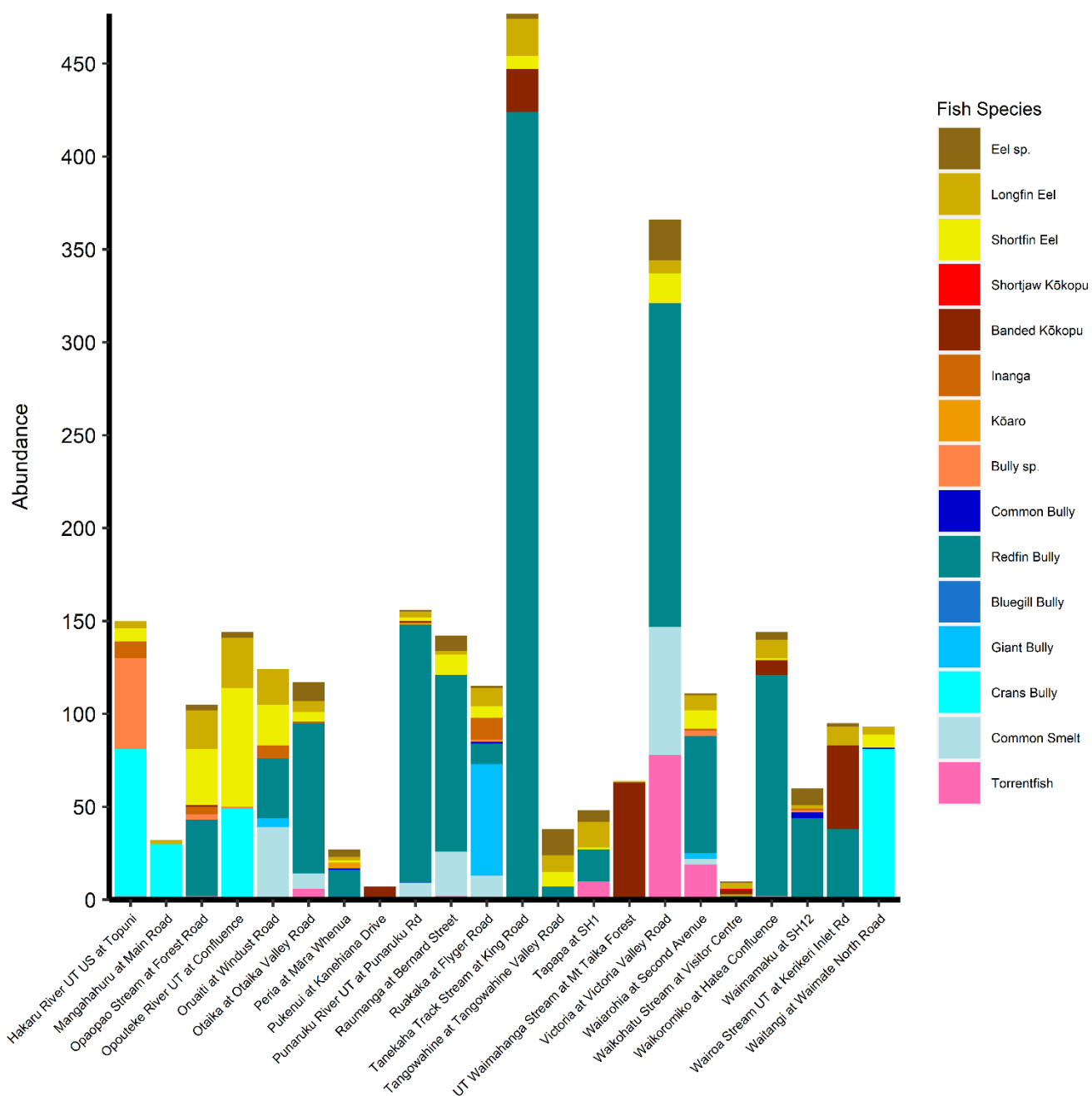


Figure 5 Abundance of each species collected at each site sampled in summer 2022/2023.

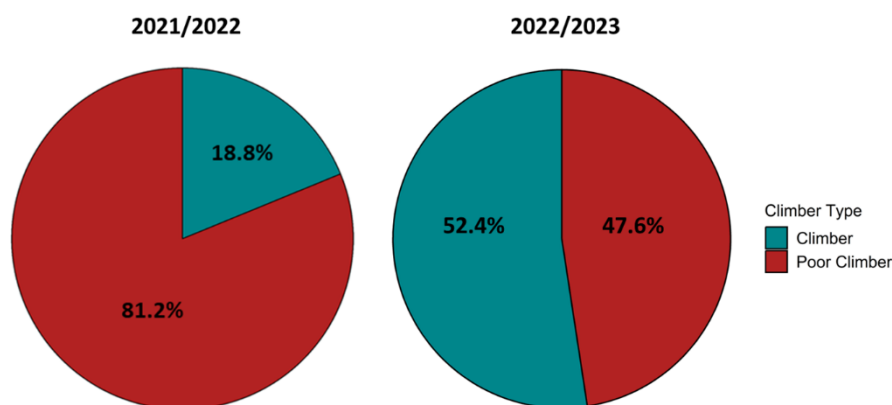


Figure 6 Pie charts showing the proportion of climbing vs poor climbing species encountered in summer 2021/2022 compared to summer 2022/2023.

Results and Discussion

We collected 13 different native species from 22 sites during the summer 2022/2023 sampling (Figure 1). Longfin eel *Anguilla dieffenbachii* and redfin bully *Gobiomorphus huttoni* were the most common species encountered with the former occurring at all sites and the latter at 17 of 22 sites (Figure 2). Shortjaw kōkopu *Galaxias postvectis* and bluegill bully *Gob. hubbsi* were not detected in the summer of 2021/2022 but were found at the new sites Waikohatu Stream at Visitor Centre (Waipoua Forest) and Punaruku River UT at Punaruku Rd respectively (Figure 2). The finding of *G. hubbsi* is particularly intriguing because it has not been officially recorded from the east coast of Northland and it confirms an eDNA detection taken for threatened and at-risk fish monitoring (Figure 3). Kōaro *Gal. brevipinnis* were also found at Punaruku River UT at Punaruku Rd as well as Peria at Māra Whenua marking the first official records for Northland's east coast and the Doubtless Bay area respectively (Figure 2, Figures 4-5).

Tanekaha Track Stream at King Rd, a new site, had the highest species abundance ($n = 477$) while Ruakaka at Flyger Road, Waiarohia at Second Avenue, and Punaruku River UT at Punaruku Rd had the greatest richness ($S = 7$) (Figure 5; Table 2). The proportion of climbing species encountered in 2022/2023 (52.4%) was higher than in 2021/2022 (18.8%) (Figure 6). This is due to the addition of sites where *Gal. postvectis*, *Gal. brevipinnis*, and particularly *Gal. fasciatus* are more likely to occur. Overall, the index of biotic integrity (IBI) scores for the region are good with only one site in C band, four in B band, and the rest in A band. Waitangi at Waimate North Road, the only C band site, is above multiple waterfalls, including Haruru Falls, which will exclude most migratory species except eels from the site.

Table 2 Index of Biotic Integrity (IBI) scores, richness, abundance, and metadata for each site sampled in summer 2022/2023.

Site Name	Site ID	FMU	Elevation	Distance to Coast	Species Richness	Species Abundance	IBI 2022/2023	Quality Band 2022/2023	IBI 2021/2022	Quality Band 2021/2022
Victoria at Victoria Valley Road	105532	Awanui	69	33.05	5	366	48	A		
Waitangi at Waimate North Road	103178	Bay of Islands	79	21.93	4	93	24	C	24	C
Wairoa Stream UT at Kerikeri Inlet Rd	333762	Bay of Islands	69	1.38	3	95	40	A		
Ruakaka at Flyger Road	105008	Bream Bay	17	2.00	7	115	52	A	52	A
Tanekaha Track Stream at King Road	333761	Bream Bay	87	5.16	5	477	48	A		
Oruaiti at Windust Road	304641	Doubtless Bay	19	5.56	6	124	46	A	44	A
Peria at Māra Whenua	335340	Doubtless Bay	79	26.05	5	27	46	A		
Tapapa at SH1	313165	Hokianga	80	12.10	4	48	38	A	40	A
Opaopao Stream at Forest Road	331866	Hokianga	29	7.18	6	105	54	A	54	A
Mangahuru at Main Rd	100237	Northern Wairoa	115	54.28	2	32	34	A	32	B
Tangowahine at Tangowahine Valley Road	322490	Northern Wairoa	19	2.31	4	38	32	B	18	C
Hakaru River UT US at Topuni	332199	Northern Wairoa	26	2.21	5	150	32	B		
Opouteke River UT at Confluence	333757	Northern Wairoa	59	62.10	3	144	28	B		
Waimamaku at SH12	109098	Waipoua	19	6.23	4	60	38	A	44	A
Waikohatu Stream at Visitor Centre	333758	Waipoua	99	12.20	5	10	56	A		
Punaru River UT at Punaru Rd	313171	Whananaki Coast	21	4.04	7	156	48	A		
Waiarohia at Second Avenue	108359	Whangārei	20	0.60	7	111	54	A	54	A
Otaika at Otaika Valley Road	110431	Whangārei	20	3.11	6	117	46	A	44	A
Raumanga at Bernard Street	304709	Whangārei	19	0.86	5	142	38	A	46	A
Pukenui at Kanehiana Drive	312177	Whangārei	162	8.17	1	7	32	B	32	B
Waikoromiko at Hatea Confluence	331834	Whangārei	23	2.35	5	144	40	A	54	A
UT Waimahanga Stream at Mt Taika Forest	335338	Whangārei	153	3.83	3	64	46	A		

Conclusions and Recommendations

The eight sites added in 2022/23 have increased the usability of the fish monitoring network for assessing the state of communities and species distributions within the region. Considering this, these sites should be kept in the network going forward. However, it should be noted that the Freshwater Quality and Ecology Monitoring Plan sites in Aupōuri and Herekino-Whāngāpē Freshwater management Units (FMU) have not been implemented, due to ongoing engagement with iwi, nor assessed for sampling suitability by experienced personnel (Table 1). Likewise, there are no sites proposed for Whangaroa or Poutō FMUs (Table 1). So, it is possible some or all of these FMUs will continue to be a knowledge gap in summer 2023/2024. Before the 2023/2024 sampling season, efforts need to be made to scope the Aupōuri and Herekino-Whāngāpē sites, and sites in Whangaroa and Poutō need to be strongly considered before summer 2024/2025.

Index of Biotic Integrity scores are good from a SOE perspective but these need to be treated with the proper context (Table 2). The scores are calculated using only the species richness for a site and IBI taxon scores (see Joy, 2019), but not the abundance of each taxon nor the condition of individuals. As a result, the scores should be interpreted in the context of 1) what species were present and 2) what factors might be excluding other species (e.g., habitat and/or passage). For instance, Pukenui at Kanehiana Drive has a B band score of 32 but only banded kōkopu *Galaxias fasciatus* were sampled, an eel was seen but not captured, because the site is upstream of the Whau Valley Dam (Table 2). The fish community is clearly depauperate, even by New Zealand standards, but receives a good SOE rating because *Gal. fasciatus* have a relatively high IBI taxon score (Ruehle, 2023). Conversely, Waitangi at Waimate North Road is the network's only C band site despite having greater diversity than Pukenui and having natural waterfalls that exclude many species. So, while the region looks good when it comes to national reporting, proper interpretation requires a site-specific context.

References

Joy MK, David B, Lake M (2013). New Zealand freshwater fish sampling protocols. *Massey University*. Palmerston North, New Zealand.

Joy MK (2019). A Fish Index of Biotic Integrity (IBI) for the Northland Region. Victoria University, Wellington New Zealand.

The National Policy Statement for Freshwater Management (NPS-FM) (2020).
<https://environment.govt.nz/acts-and-regulations/national-policy-statements/national-policy-statement-freshwater-management/>

Ruehle, B. (2023). Northland Freshwater Fish Monitoring 2021/2022. *Northland Regional Council*. Whangārei, New Zealand.

Ruehle, B., Sethi, M. (2023). Memo – Fish Monitoring Programme Updates. *Northland Regional Council*. Whangārei, New Zealand.

Northland Regional Council

P 0800 002 004

E info@nrc.govt.nz

W www.nrc.govt.nz