WEST COAST
REGIONAL COUNCIL

West Coast Lakes Aquatic Weed Surveillance 2024

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Executive Summary

The West Coast Regional Council contracted TC Environmental to conduct Aquatic Pest Plant Surveillance in 13 Lakes throughout the West Coast Region between the 29th of January and the 5th of February 2024. LakeSPI (Submerged Plant Indicators) methods were used at six of the 13 lakes to assess the ecological condition. None of the freshwater pest plant species of interest to New Zealand were visually detected at any new sites. Lagarosiphon major was noted in two lakes, where it was previously known to be present, Lake Ianthe and Lake Paringa.

Environmental DNA (eDNA) monitoring was undertaken as a complementary method to the dive team in five of the lakes. Samples were analysed for pest plants and pest fish.

This project was co-funded by the West Coast Regional Council, the Department of Conservation and Manawa Energy.

1. Introduction

The West Coast Regional Council has a duty to gather information, undertake research, and monitor the state of the environment under Section 35 of the Resource Management Act (1991). Furthermore, the National Policy Statement for Freshwater Management (NPS-FM) 2020 sets out objectives and policies for freshwater management under the RMA, it requires regional councils to monitor the health of freshwater ecosystems, including lakes, to ensure they meet water quality and ecological standards. The NPS-FM specifies that councils must establish monitoring plans that include measures of ecosystem health, such as the Submerged Plant Indicator (SPI), which is used to assess the ecological condition of lakes. Additionally, the regional council are required to collect data on pest populations and monitor and report on the effectiveness of their pest management activities under the National Policy Direction for Pest Management (NPD) 2015.

To meet these legislative requirements and fulfil set regional objectives the West Coast Regional Council (WCRC) partner with the Department of Conservation (DOC) to undertake lake SPI monitoring in combination with an annual surveillance programme to detect incursions of introduced aquatic weeds within West Coast Lakes. Each summer a number of lakes are selected for surveillance based on incursion risk and previous surveillance history.

This annual surveillance program was established in 2019. Prior to establishment of the program, aquatic pest surveillance was carried out ad hoc by NIWA, MPI and DOC (Boffa Miskell Ltd (2021). While a number of problem species have previously been recorded in West Coast waterbodies (Champion & Clayton, 2004; Champion & Larned, 2015; Lass, 2019; BOPRC, 2021; Rayes and Scott-Simmonds, 2022 & 2023), of most concern are the submerged macrophytes; *Lagarosiphon major, Ceratophyllum demersum* and *Egeria densa*, of which *L. major* is already known in Lake Paringa, Ianthe and the Kapitea Reservoir.

Numerous reports have described West Coast lakes as “of outstanding natural value compared to most other regions of New Zealand”. Despite the presence of invasive species in the region, this statement remains true with lakes still holding high ecological and recreational values. Early detection of introduced aquatic plants is vital in managing new incursions (National Institute of Water and Atmospheric Research, 2019).

This report provides diver surveillance results for 53 sites within 13 West Coast Lakes located between Haast and Greymouth, West Coast (Figure 1). An additional 2-3 LakeSPI transects were undertaken in six lakes to provide a current ecological condition based on submerged plant indicators (SPI). Multi-species eDNA samples were also collected at numerous sites as a complimentary tool for early detection of introduced aquatic weeds and fish.

2. Methods

Thirteen West Coast Lakes located between Haast and Greymouth were visited between January and March 2024 (Figure 1). Within these lakes a total of 58 sites were surveyed for introduced aquatic macrophytes following similar methodology to previous surveys (BOPRC, 2019 & 2021; Rayes and Scott-Simmonds, 2022 & 2023). The lakes surveyed are presented in Table 1. Additional LakeSPI transects were conducted within six of the lakes to assess current ecological condition of each lake.

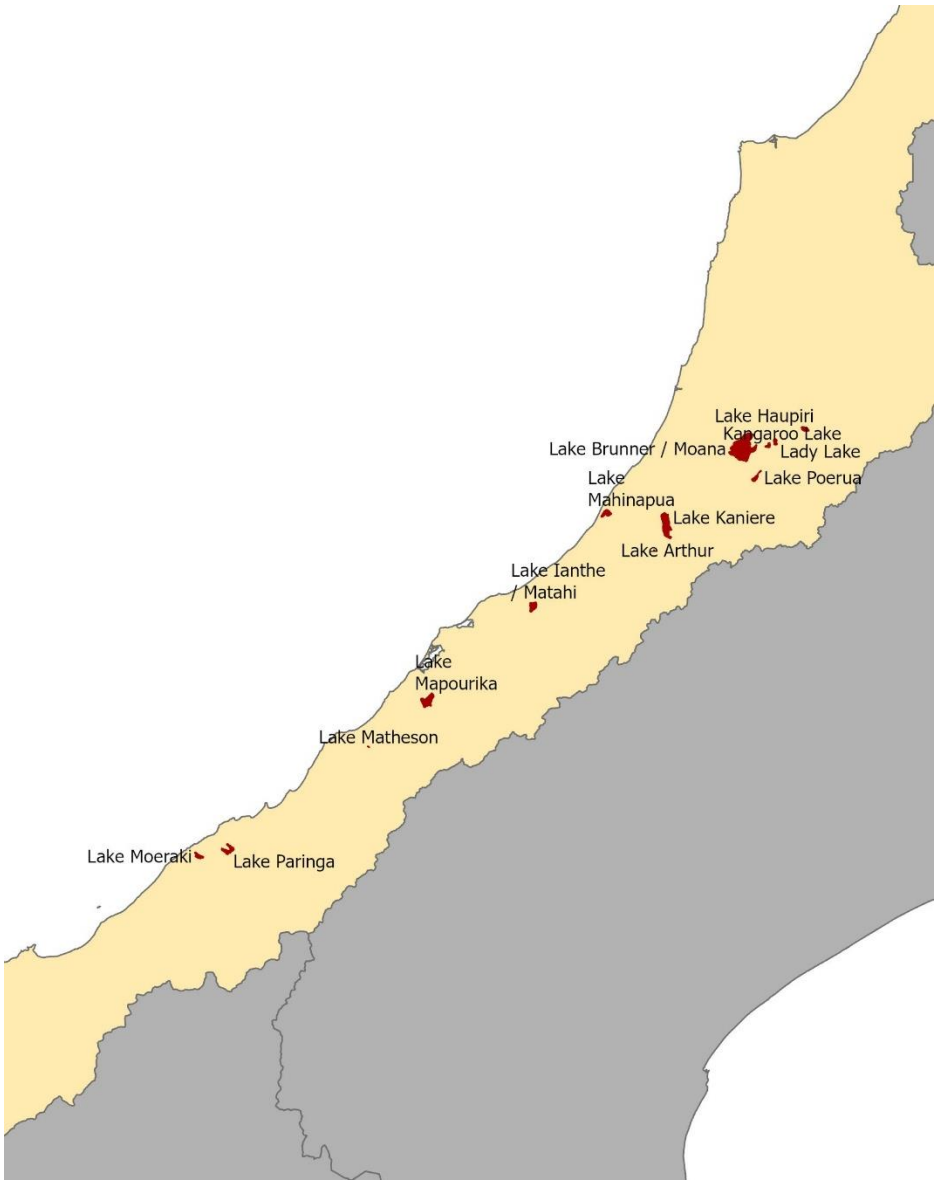

Figure 1: Location of West Coast Lakes surveyed during summer 2024.

2.1 Underwater visual surveillance

Underwater surveillance was undertaken by divers using SCUBA or snorkel (where less than 2m depth) who performed a systematic grid search at each site (Table 1). The spacing between divers varied between 1 and 2 m depending on the nature of the lake bathymetry, vegetation cover and in-water visibility. To begin the search, divers entered the water via shore or vessel and swam to the deepest extent of the submerged macrophytes before undertaking a grid pattern back and forward working their way into the shallows. At some sites it was not possible for divers to reach any depth due to the shallow nature of the lakes, therefore divers focused on the area surrounding the entry points.

GoPro footage representative of each site was captured during the dives. A GPS unit was also towed above one diver to track the area of survey and a buffer included using ArcGIS to account for the area covered by the second diver (Appendix 5). Details of common native plant species were also recorded during each dive (Appendix 3).

In addition, shoreline surveillance directly adjacent to each site was conducted by foot to detect any washed-up weeds.

To ensure no transfer of weed species between lakes, dive gear, field equipment and the vessel were thoroughly disinfected and lakes with known L. major were left to the end of the fieldwork.

Table 1: Lakes, dates and sites surveyed for invasive aquatic macrophytes in 2024.

Lake	**Date Surveyed**	**Sites Surveyed**	**Number of additional LakeSPI transects**
Brunner	23/02/2024	Moana boat ramp, Yacht club, Crooked River Mouth, Cashmere Bay, Orangipuku River Mouth, Mitchells Boat Ramp, Hohonu River Mouth	-
Kaniere	29/01/2024	Canoe Cove, Sunny Bight, Hans Bay	-
Mapourika	30/01/2024	Boat ramp, DOC area, Okarito River outlet	-
Moeraki	01/02/2024	North ramp, South ramp	-
Paringa	02/02/2024	Main ramp, Lodge ramp	-
Mahinapua	05/02/2024	Main ramp, Daylight Bight, Picnic Bay	-
Ianthe	04/02/2024	Jetty, Ianthe Creek Outlet, The Landing	-
Haupiri	20/02/2024	Main Ramp	4
Lady	21/02/2024	Roadside	4
Poerua	21/02/2024	Main Ramp and Northeast Arm	2
Kangaroo	23/02/2024	LakeSPI	4
Arthur	25/02/2024	LakeSPI	4
Matheson	03/02/2024	LakeSPI	4

2.2 LakeSPI

LakeSPI has been developed as a management tool, which utilises Submerged Plant Indicators (SPI) to assess the ecological condition of New Zealand Lakes (Clayton & Edwards, 2006). The method can be repeated over time to monitor trends in lake condition and is intended to compliment other lake assessment methods.

A more extensive understanding of LakeSPI methodology can be gained from the user manual and technical report:

https://niwa.co.nz/sites/niwa.co.nz/files/import/attachments/lakespi_report.pdf

https://niwa.co.nz/sites/niwa.co.nz/files/import/attachments/lakespi_manual.pdf

LakeSPI assessments typically include 5 representative sites within a lake and site selection aims to avoid unfavourable influences including boat ramps, river mouths and weed control areas. However, due to the locations of surveillance some transects were conducted in close proximity to these areas. During the previous four surveillance events, divers have also recorded LakeSPI details across the broader surveillance area. The current survey utilised standard LakeSPI transects, therefore some variation from previous results is expected.

A LakeSPI transect was completed at each surveillance site with results discussed below. An additional 2-3 LakeSPI transects were conducted in selected lakes to gain a more comprehensive understanding of macrophytes for LakeSPI analysis. Summarised transect results are provided for each lake in tables 3-8.

2.3 eDNA

Water samples were collected from above the macrophytes at 36 sites and processed for eDNA according to Wilderlab NZ methodology (Table 2, Appendix 4). These samples were later processed by Wilderlab for multi-species presence of plants and animals. Sites where eDNA samples were taken are displayed in Table 2 below and key introduced species are presented in Appendix 1 (an additional spreadsheet with all eDNA results is provided).

It should be noted that six replicates per site are recommended for comprehensive eDNA analyses. Currently, eDNA can be considered a complementary tool rather than a stand-alone approach and molecular techniques will likely improve in accuracy with time.

Table 2: eDNA sample sites and details

Site	Sample No.	Date Sample Taken	Volume (ml)	Lat	Long	Analysis
Haupiri 1	532124	2024-02-20	800	-42.564350	171.697532	Multispecies PCR
Haupiri 2	532130	2024-02-20	500	-42.564338	171.697583	Multispecies PCR
Haupiri 3	532127	2024-02-20	800	-42.543300	171.697613	Multispecies PCR
Haupiri 4	532140	2024-02-20	800	-42.564320	171.697637	Multispecies PCR
Haupiri 5	532125	2024-02-20	700	-42.564338	171.697644	Multispecies PCR
Haupiri 6	532123	2024-02-20	800	-42.564314	171.697646	Multispecies PCR
Matheson 1	532129	2024-02-03	1000	-43.440345	169.965492	Multispecies PCR
Matheson 2	532137	2024-02-03	1000	-43.440345	169.965492	Multispecies PCR
Matheson 3	532135	2024-02-03	1000	-43.440345	169.965492	Multispecies PCR
Matheson 4	532132	2024-02-03	750	-43.437949	169.963108	Multispecies PCR
Matheson 5	532126	2024-02-03	750	-43.437949	169.963108	Multispecies PCR
Matheson 6	532136	2024-02-03	750	-43.437949	169.963108	Multispecies PCR
Brunner Cashmere 1	532694	2024-02-23	650	-42.610257	171.500986	Multispecies PCR
Brunner Cashmere 2	532705	2024-02-23	650	-42.610303	171.501020	Multispecies PCR
Brunner Cashmere 3	532681	2024-02-23	650	-42.610328	171.501068	Multispecies PCR
Brunner TK 1	532730	2024-02-23	800	-42.614750	171.500625	Multispecies PCR
Brunner TK 2	532713	2024-02-23	800	-42.614659	171.500624	Multispecies PCR
Brunner TK 3	532724	2024-02-23	1000	-42.614574	171.500627	Multispecies PCR
Poerua 1	532717	2024-02-21	750	-42.713987	171.490355	Multispecies PCR
Poerua 2	532714	2024-02-21	800	-42.714018	171.490280	Multispecies PCR
Poerua 3	532691	2024-02-21	800	-42.714057	171.490222	Multispecies PCR
Poerua 4	532710	2024-02-21	800	-42.714068	171.490167	Multispecies PCR
Poerua 5	532720	2024-02-21	700	-42.714038	171.490077	Multispecies PCR
Poerua 6	532704	2024-02-21	700	-42.714095	171.490025	Multispecies PCR
Moeraki 1	532684	2024-02-01	1000	-43.732982	169.301054	Multispecies PCR
Moeraki 2	532723	2024-02-01	1000	-43.732875	169.301033	Multispecies PCR
Moeraki 3	532712	2024-02-01	1000	-43.732794	169.300998	Multispecies PCR
Moeraki 4	532685	2024-02-01	1000	-43.723436	169.277611	Multispecies PCR
Moeraki 5	532701	2024-02-01	1000	-43.723435	169.277785	Multispecies PCR
Moeraki 6	532733	2024-02-01	1000	-43.723304	169.277604	Multispecies PCR
Brunner Main 1	532707	2024-02-24	1000	-42.575994	171.470623	Multispecies PCR
Brunner Main 2	532690	2024-02-24	1000	-42.576122	171.470679	Multispecies PCR
Brunner Main 3	532761	2024-02-24	1000	-42.576009	171.470734	Multispecies PCR
Brunner Yacht 1	532689	2024-02-24	1000	-42.577325	171.477868	Multispecies PCR
Brunner Yacht 2	532708	2024-02-24	1000	-42.577377	171.478029	Multispecies PCR
Brunner Yacht 3	532693	2024-02-24	1000	-42.577343	171.478172	Multispecies PCR

3. Results and Discussion

No new incursions of invasive *Lagarosiphon major, Egeria densa* or *Ceratophyllum demersum* were detected during surveillance or LakeSPI diving, 2024. *Lagarosiphon major* remains a dominant species at surveillance sites in Lake Paringa and Ianthe, and *E. canadensis* was present in all lakes surveyed apart from Lakes Arthur and Matheson.

Other detected introduced weeds of less concern due to most presenting a non-invasive nature included, *Ranunculus trichophyllus, Potamogeton crispus, Ludwigia palustris, Utricularia geminiscapa* and *Juncus bulbosus*. *Aponogeton distachyos* (Cape pondweed) and *Nymphaea alba* were also observed in Lake Mahinapua.

Sites where introduced species were recorded during the present survey include:

Elodea canadensis – Haupiri, Lady, Kangaroo, Poerua, Kaniere, Mahinapua, Brunner, Ianthe, Mapourika, Paringa and Moeraki. *Elodea canadensis* was the dominant invasive in all lakes apart from those with *L. major*, and Arthur/Matheson where no *E. canadensis* was observed.

Lagarosiphon major – Ianthe and Paringa. Already known in these lakes with an extensive distribution in each.

Ranunculus trichophylls – Brunner (Orangipuku) and Poerua. Present as a minor component of the vegetation among indigenous species and recorded here previously (Champion & Clayton, 2004; Rayes and Scott-Simmonds, 2022).

Potamogeton crispus – Brunner and Mahinapua (lagoon). Minor component of overall vegetation and present among native vegetation. Previously recorded in both lakes (BOPRC, 2021, Rayes and Scott-Simmonds, 2022).

Ludwigia palustris – Haupiri, Lady, Kangaroo, Kaniere, Mahinapua, Brunner, Ianthe, Mapourika, Paringa and Moeraki. Previous records for all lakes aside from Moeraki (Champion & Clayton, 2004; Rayes and Scott-Simmonds, 2022 & 2023).

Utricularia geminiscapa – Mahinapua, Ianthe and Arthur. First recognised in Lake Mahinapua and Okarito Lagoon by Champion and Clayton (2004). Although it does not appear to be displacing native species, it is very common in Lake Arthur, growing above native milfoils. This was the first record in Lake Arthur.

Juncus bulbosus – Haupiri, Brunner, Kaniere, Mahinapua, Mapourika, Moeraki, Arthur and Matheson (around the jetty lookout). Aside from Lakes Mahinapua and Arthur where *J. bulbosus* is common, it appears to be a minor component of the marginal vegetation in the remaining lakes.

Aponogeton distachyos - Mahinapua, known here since 1950 (Champion & Clayton, 2004). It does not currently appear to be displacing native species at these sites.

Nymphaea alba – Mahinapua, previously known in this lake (Champion & Clayton, 2004; BOPRC, 2019).

Lake Haupiri

The surveillance area at Lake Haupiri was directly adjacent to the boat ramp and was very shallow across the whole survey area, with dark, tannin-stained water. An additional four LakeSPI transects were completed (Table 3 & figure 2).

The lake was dominated by native vegetation including charophytes, isoetes, milfoils and pondweeds. Elodea was the only recorded invasive species at less than 5% invasive ratio at all five transects. The shallow water introduced species, *L. palustris* remained present at low densities at four out of the five transects and *J. bulbosus* present a two (Appendix 1).

Table 3: Summary of LakeSPI features for Lake Haupiri 2024.

Site	Profile Length	Latitude	Longitude	Max depth native species >10% (m)	Max depth charophyte meadows >75% (m)	Max depth invasives >10% (m)	Ratio natives %
A	L	-42.564433	171.697817	2.3	2.3	1.2	>95
B	M	-42.569506	171.701866	2.3	2.3	-	>95
C	M	-42.572345	171.692232	3	2.5	1.6	>95
D	M	-42.568933	171.679206	2.1	2	1.6	>95
E	M	-42.561142	171.679206	2.8	2.7	-	>95

Figure 2: Locations of surveillance, Lake Haupiri. Main ramp (A), additional LakeSPI transects (B-E).

Figure 3: LakeSPI transect points in Lake Haupiri from top left to bottom right A, B, C & E.

Lady Lake

The Lady Lake survey area was accessed via the road through a narrow gap in the Raupō. The very dark water made observations difficult. Elodea was recorded at 6-25% compared to natives at site A. At the other sites Elodea was recoded at a lower <5% ratio compared to the native cover (Table 4). L. palustris was very common along the shallow margin at all sites aside from site C (Figure 4). Native vegetation included emergents, turf, charophytes, isoetes, milfoils and pondweeds.

Table 4: Summary of LakeSPI features for Lady Lake 2024.

Site	Profile Length	Latitude	Longitude	Max depth native species >10% (m)	Max depth charophyte meadows >75% (m)	Max depth invasives >10% (m)	Ratio natives %
A	S	-42.599846	171.580601	3.4	2.7	2.3	>95
B	S	-42.604823	171.577756	3.0	2.5	1.0	>95
C	S	-42.609816	171.570585	3	2.9	-	>95
D	M	-42.600852	171.568858	3.3	3.2	2.4	76-95-
E	M	-42.594695	171.571034	3.5	2.7	-	>95

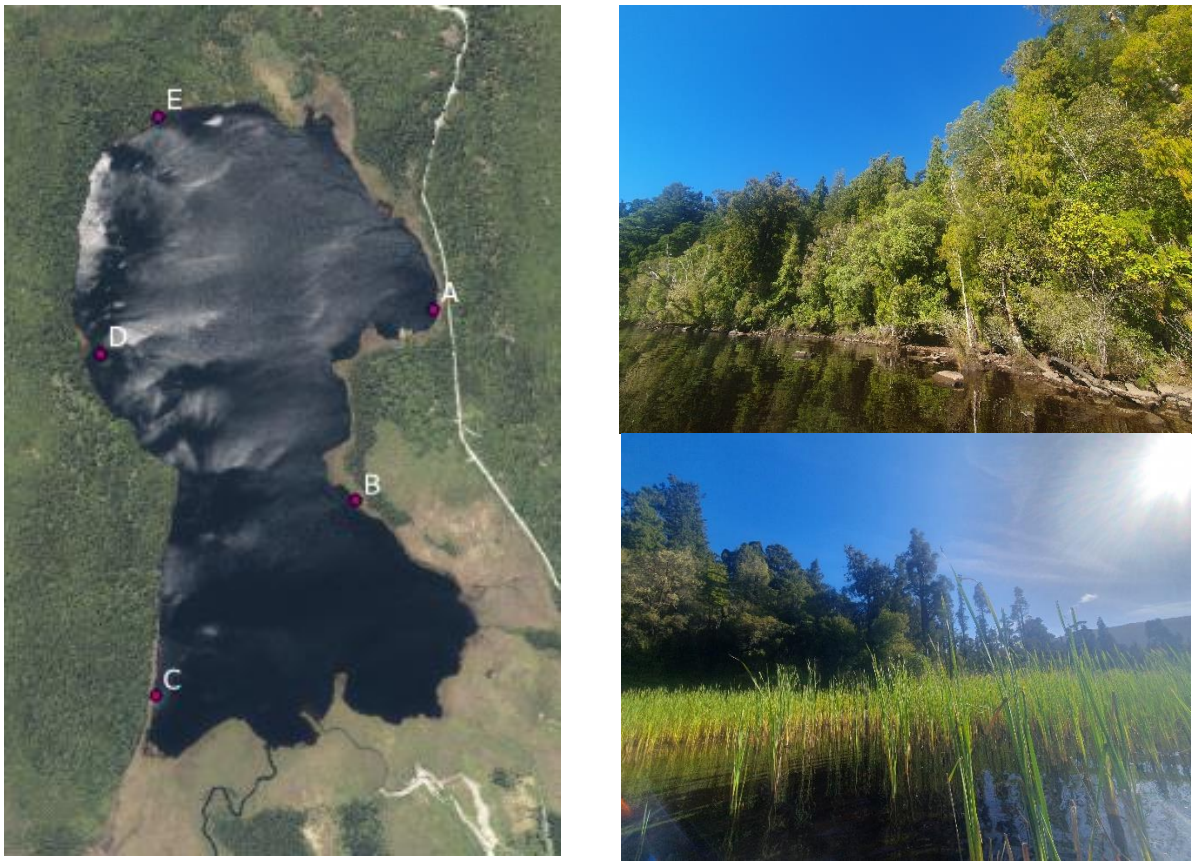

Figure 4: Locations of surveillance and LakeSPI transects in Lady Lake (left), Site D (top right

Kangaroo Lake

Kangaroo lake is characterised by its wide swampy margin, surrounded by predominantly beech forest. Native vegetation included emergents, turf, charophytes, milfoils, pondweeds and charophytes at a ratio of >95% to <5% invasives (table 5). Natives reached a depth of 4.3m while invasives at two of transects were shallower depths of 3.4m. The main invasive present was occasional *E. canadensis*. Introduced species, *L. palustris* was also recorded near the main ramp. Green agal mat was noted at sites along the northern edge of the lake at both site B and C (Figure 5).

Kangaroo Lake is on the NIWA LakeSPI database from 2002, 2015 and 2020. It is possible the records for 2015/2020 are an error as the last time LakeSPI was conducted here was 2002. These records also note species that were not observed by divers during this year's surveillance such as Egeria. Therefore, if comparing results to LakeSPI database only use 2002. It also appears NIWA used a 20m maximum depth for Kangaroo in 2002, which results in higher potential maximum native and LakeSPI scores (30 and 50). The divers adjusted this to a 9.5m maximum depth using the physical depth as the key 'natural' factor limiting maximum LakeSPI score potential (22 and 42) (Table 9).

Table 5: Summary of LakeSPI features for Kangaroo Lake 2024.

Site	Profile Length	Latitude	Longitude	Max depth native species >10% (m)	Max depth charophyte meadows >75% (m)	Max depth invasives >10% (m)	Ratio natives %
A	S	-42.616600	171.537083	4.1	3.9	-	>95
B	M	-42.613114	171.544002	4.1	4.0	3.3	>95
C	M	-42.605113	171.548891	4.3	4.1	-	>95
D	S	-42.609737	171.554180	4.1	3.9	-	>95
E	M	-42.615044	171.553677	4.1	3.9	3.4	>95

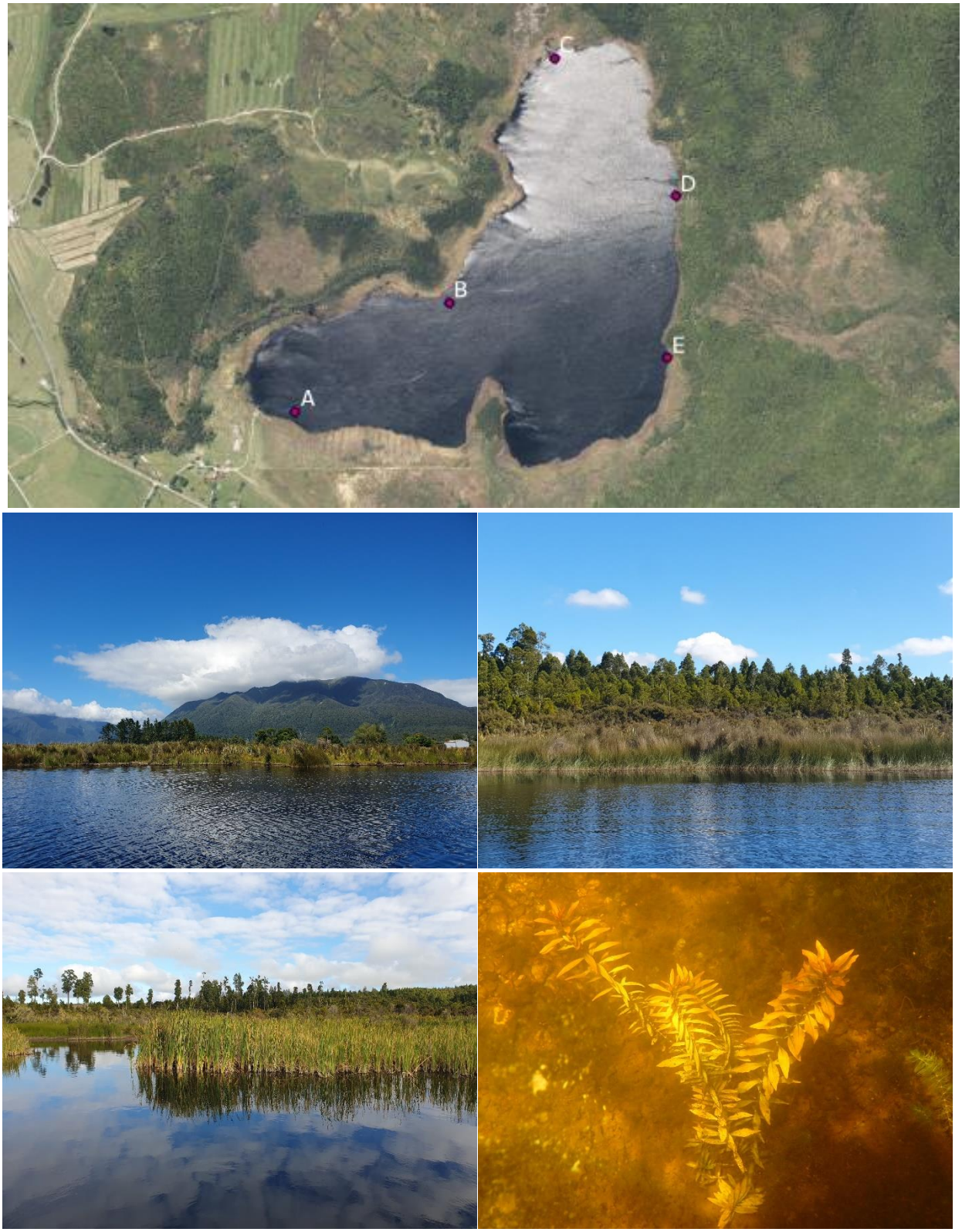

Figure 5: Locations of LakeSPI transects and surveillance, Kangaroo Lake. Main ramp via private access (A (top)). Photos of three transect locations (middle and bottom left). Photo of L. palustris (bottom right).

Lake Poerua

The transects in Lake Poerua were not ideal as the vegetation didn't end due to the shallow nature of the lake. After 200m divers stopped swimming out and recorded the depths where vegetation was observed too. Scores are likely unaffected as maximum vegetation scores would be the same even if vegetation covers the entire lake floor due to the maximum depth of 6.9m. Five LakeSPI transects were completed in this lake (figure 6).

The area adjacent to the Boat Ramp was characterised by a shallow plateau with vegetation extending out a significant distance. Native vegetation included emergents, turf, charophytes, isoetes, milfoils and pondweeds, at a ratio of 6-25% compared to 76-95% invasive. Invasive species present were dense areas of *E. canadensis* (99%) and to a much lesser amount, *R. trichophyllus* (1%) reaching a depth of 4.8m.

At the transect along the native margin located in the northern end of the lake (site C) native vegetation reached a depth of 6m. Native vegetation included charophytes and pondweeds at a ratio of 76-95% compared to 6-25% invasive. *E. canadensis* was present to depths of 5m and reached up to 1.7m in height.

At the other locations the divers observed native emergents, turf, charophytes, milfoils and pondweeds. Invasives were dense areas of *E. canadensis* at 51-75% ratio compared to 26-50-75% native (table 6). Introduced *L. palustris* was also present in the shallow margins throughout the lake.

Table 6: Summary of LakeSPI features for Lake Poerua 2024.

Site	Profile Length	Latitude	Longitude	Max depth native species >10% (m)	Max depth charophyte meadows >75% (m)	Max depth invasives >10% (m)	Ratio natives %
A	L	-42.713176	171.491465	4.5	4.5	4.8	6-25
B	L	-42.705403	171.786879	>4.3	>4.3	>4.3	26-25
C	L	-42.699058	171.497324	6	5.6	5.0	76-95
D	L	-42.700855	171.503500	>5.4	>5.4	>5.4	26-50
E	L	-42.708323	171.498494	>5.8	>5.8	>5.4	26-50

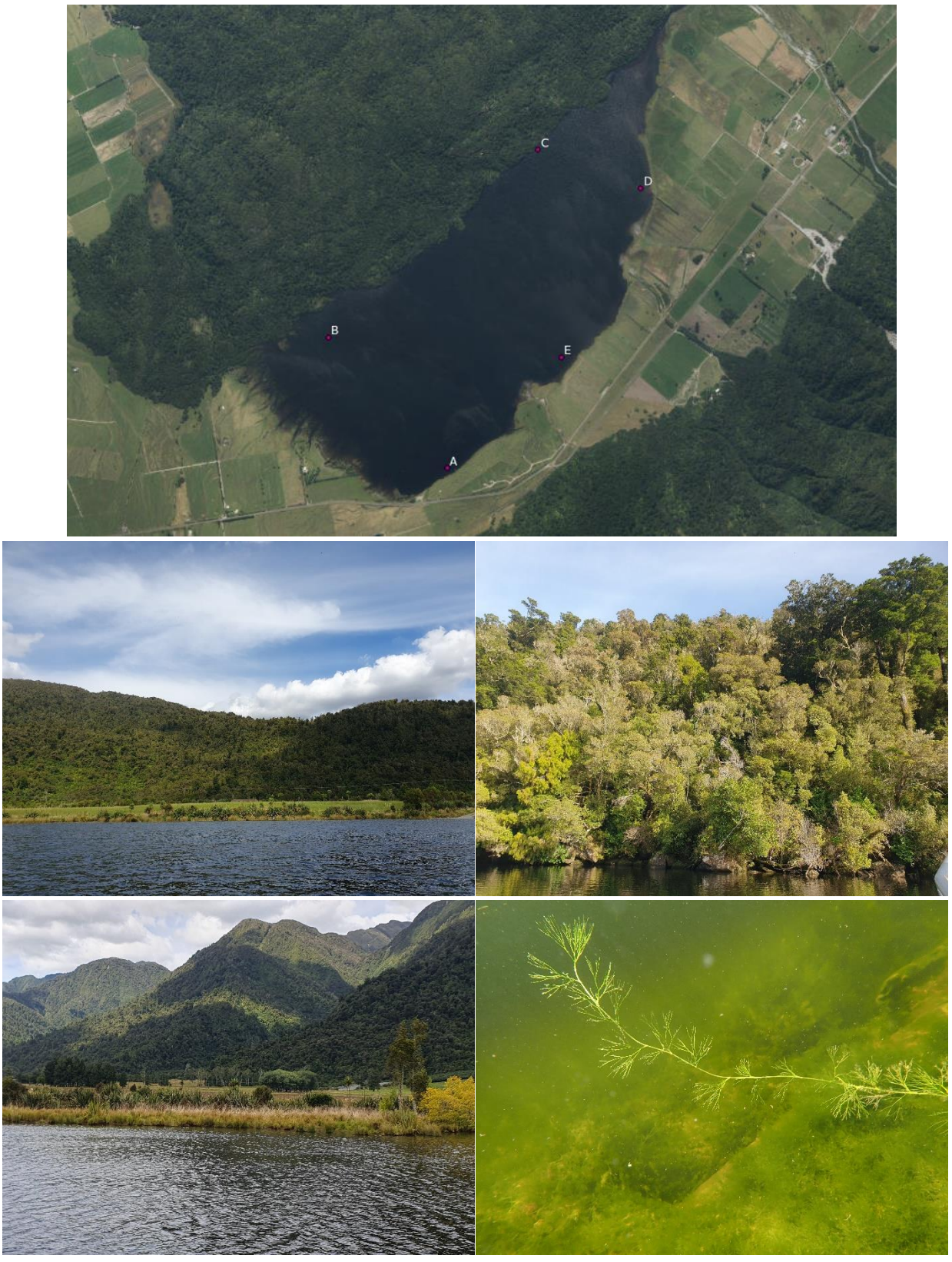

Figure 6: Locations of LakeSPI transects and surveillance, Lake Poerua. Photos of three transect locations (middle and bottom left). Photo of Ranunculus trichophylls (bottom right).

Lake Arthur

Lake Arthur was more difficult to access, as it's surrounded by native forest vegetation (figure 7). The divers were able to get a kayak through the vegetation to carry gear during the surveillance. Lake Arthur was shallow throughout the entire lake reaching depths of 2.6m, this meant there was no end to the vegetation. Native vegetation included emergents, turf, milfoils and pondweeds at a ratio of 51-75% in the southwestern side of the lake and 76-95% at the other sites (table 7). While native milfoils were abundant, so were introduced species *J. bulbosus* and *Utricularia geminiscapa*.

Table 7: Summary of LakeSPI features for Lake Arthur 2024.

Site	Profile Length	Latitude	Longitude	Max depth native species >10% (m)	Max depth charophyte meadows >75% (m)	Max depth invasives >10% (m)	Ratio natives %
A	L	-42.904451	171.096145	2.6	-	2.6	51-75
B	L	-42.903065	171.09636	2.6	-	2.6	76-95
C	L	-42.903421	171.09767	2.6	-	2.6	76-95
D	L	-42.904096	171.098737	2.5	-	2.5	76-95
E	L	-42.905263	171.097842	2.1	-	2.1	51-75

Figure 7: Locations of the LakeSPI transects, Lake Arthur.

Figure 8: Photos of the LakeSPI transect locations, A (top, left), B (top, right), C (middle, left), D (middle right), and E (bottom).

Lake Matheson

Only four LakeSPI transects were conducted in Lake Matheson due to its small size and access (figure 9). Vegetation in the lake was largely characterised by a very narrow band of bryophytes (not accounted for in LakeSPI) along with emergents, turf plants and milfoils. The only invasive species recorded was *Juncus bulbous,* which was observed occasionally at two of the transects, located surrounding the jetty area, and in nearby streams walking into the lake. Invasive vegetation ratio was <5% compared to >95% native (table 8). Another LakeSPI site at the western end could possibly be added in future.

Table 8: Summary of LakeSPI features for Lake Matheson 2024.

Site	Profile Length	Latitude	Longitude	Max depth native species >10% (m)	Max depth charophyte meadows >75% (m)	Max depth invasives >10% (m)	Ratio natives %
A	S	-43.440294	169.965507	3.0	-	0.5	>95
B	S	-43.439550	169.966929	2.6	-	-	>95
C	S	-43.438230	169.964363	2.6	-	-	>95
D	S	-43.438861	169.962960	2.1	-	-	>95

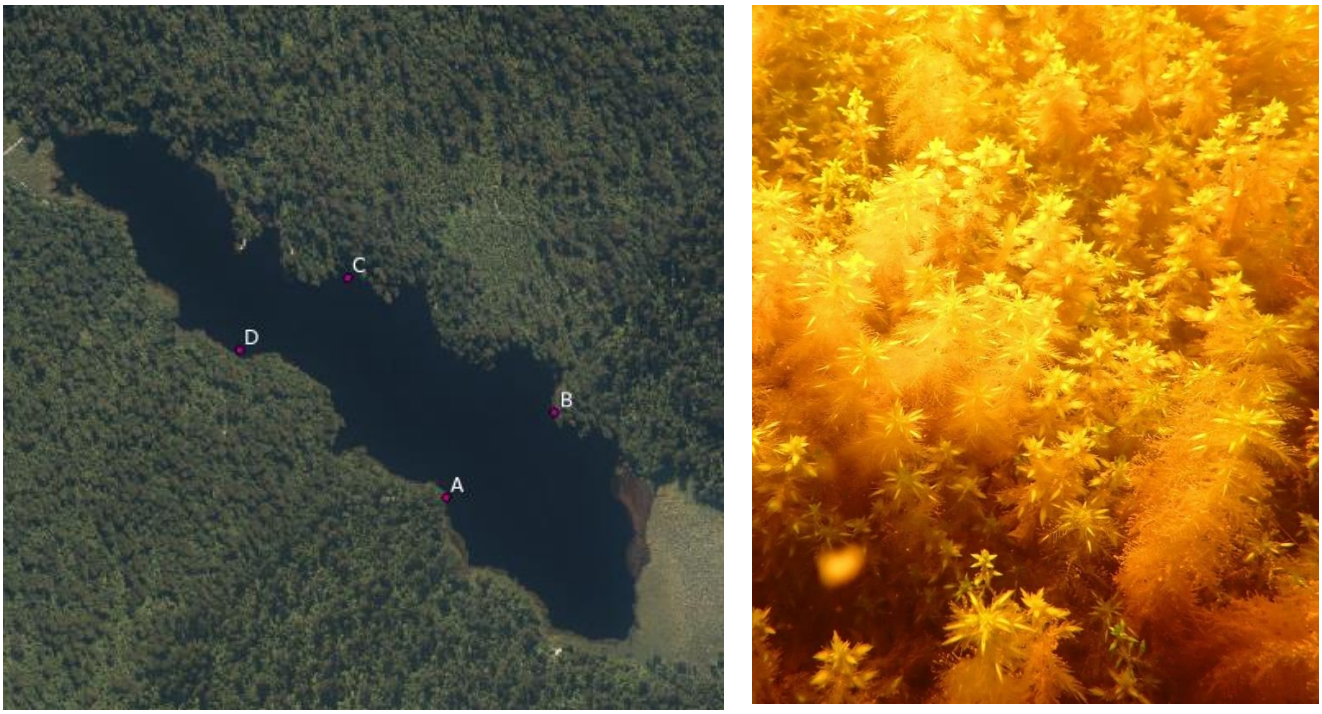

Figure 9: Locations of LakeSPI transects (left) and photo of Bryophytes (right) in Lake Matheson.

Lake Brunner

Seven sites were surveyed at Lake Brunner (figure 10).

The surveyed area by the **Main Ramp** was shallow (<3m) with invasive *E. canadensis* (95%) and *P. crispus* (5%) recorded. Introduced*, L. palustris* was also present. Native presence included turf, charophytes, isoetes, milfoils and pondweeds at a ratio of 51-75% compared to 26-50% invasives. The nature of invasive cover was closed with dense areas of *E. canadensis* reaching 1.6m height.

The **Yacht Club** surveillance area was consistently shallow (<3m) with invasive *E. canadensis* present at 1m height to depths of >4m. Native vegetation included emergents, turf, charophytes, isoetes, milfoils and pondweeds at 51%-75% compared to 26-50% invasives. Introduced *L. palustris* was also present.

The vegetation surrounding **Hohonu River Mouth** remained patchy and was bare in most places. *Elodea canadensis* was occasional, but present at 26-50% ratio compared to natives at 51% -75%. Patches of *E. canadensis* were less than 1m in height. Native charophytes and pondweeds were also present. The bank dropped off relatively steeply, with vegetation recorded to a depth of 4m.

Vegetation adjacent to **Mitchell's Ramp** extended to 5.5m depth for natives and 4.5m for invasives. *Elodea canadensis* was the dominant invasive species, with *introduced L. palustris* also present at the site. Dense areas of *E. canadensis* reached 1.5m in height. Native species included turf, charophytes, isoetes, milfoils and pondweeds, at a ratio of 26-50% compared to 51-75% invasives.

The area surrounding the **Orangipuku River Mouth** was shallow (<3m) with dense *E. canadensis* dominating the site, reaching a height of 2.5m. A small amount of *P. crispus* and *R. trichophyllus* were noted. Native vegetation present included emergents, turf, charophytes, milfoils and pondweeds, at a ratio of 6-25% compared to invasives at 76-95%.

The site at **Cashmere boat ramp** was dark and silty with filamentous algae blanketing macrophytes. Vegetation was dominated by dense *E. canadensis*, 2m tall, at a ratio of 76-95% compared with 6-25% natives. Native vegetation included turf, charophytes and pondweeds. Charophytes were recorded down to 5.2m and *E. canadensis*, 3.6m.

The area surrounding the **Crooked River Mouth** was mainly bare, with patchy vegetation. Native vegetation consisted of emergents, turf, charophytes and pondweeds extending to a depth of 5.1m. Invasive *E. canadensis* was occasional in cover extending to 5.2m depth and reaching 1.6m in height. The ratio of vegetation was 6-25% native to 76-95% invasive.

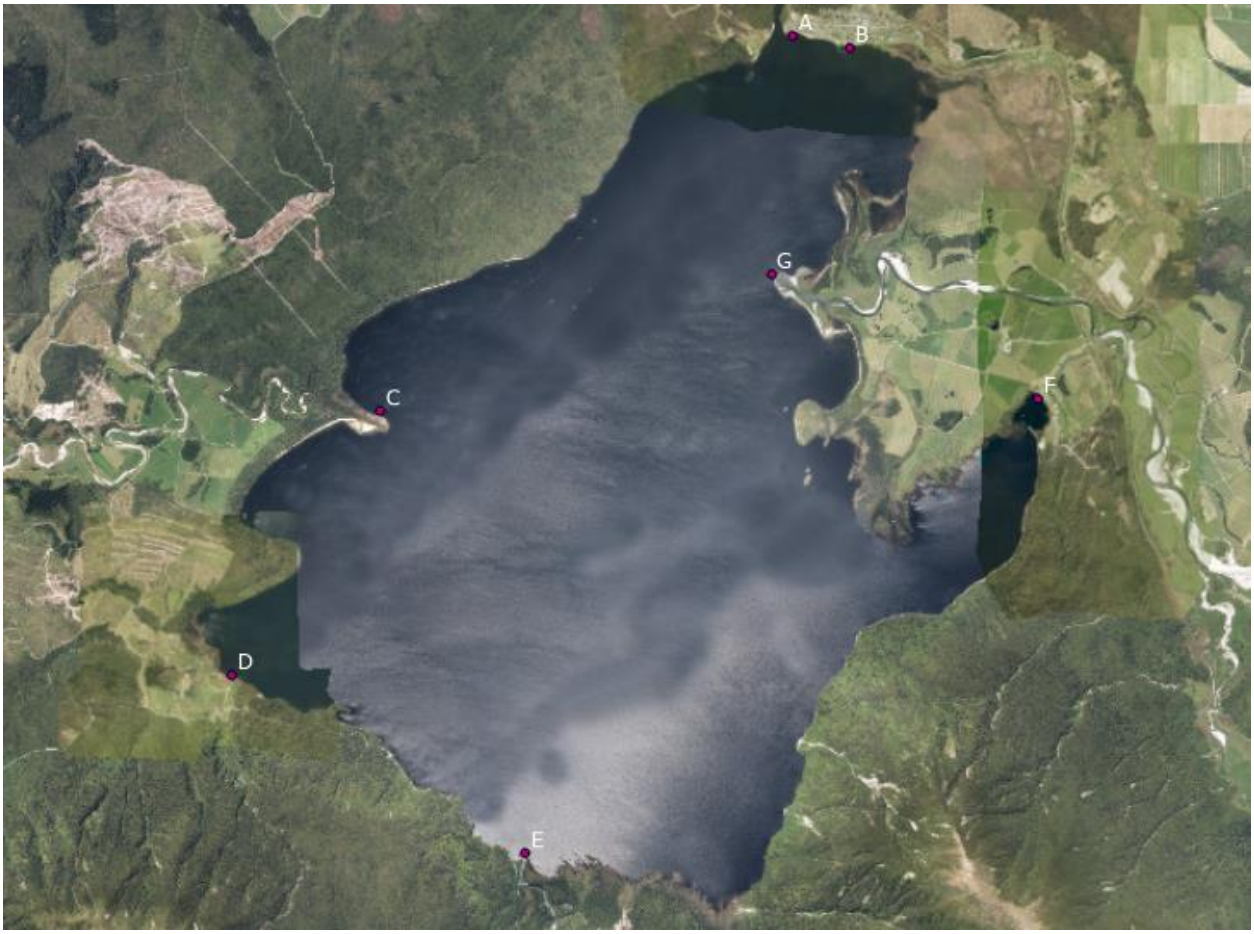

Figure 10: Locations of surveillance, Lake Brunner. The Main Ramp (A), Yacht club (B), Hohonu River Mouth (C), Mitchell's Ramp (D), Orangipuku River Mouth (E), Cashmere boat ramp (F), and the Crooked River Mouth (G).

Lake Kaniere

Hans Bay surveillance included a band of vegetation adjacent to the boat ramp. Native charophytes extended to a depth of 7m. Other natives present included turf plants, isoetes, milfoils and pondweeds at 51-75% ratio compared to invasive, 26-50%. Dense areas of *E. canadensis* were present down to 5.1m reaching a height of 0.92m. *J. bulbosus* was also present.

Canoe Cove surveillance included the area around the outlet and walkway. Native vegetation was recorded to a depth of 6.7m and included turf, charophytes, isoetes, and milfoils at a ratio of 95% native to 5% invasive species. *Elodea canadensis* was the only invasive species recorded with occasional cover. Introduced species *Juncus bulbosus* was also present.

Sunny Bight surveillance included a shallow shelf area which sloped off to the edge of the charophytes at 6.3m. Native vegetation was diverse and included emergents, turf, charophytes, isoetes, milfoils and pondweeds at 51-75% ratio compared to 26-50% invasives. Invasive species included dense areas of *E. canadensis* down to 5.2m and 1m in height. *Ludwigia palustris* was also recorded at the surveillance site.

Figure 11: Locations of surveillance, Lake Kaniere. Hans Bay (A), Canoe Cove (B), and Sunny Bright (C).

Lake Mahinapua

Mahinapua main ramp surveillance included the very shallow (<2m) area to the left and lakeward from the jetty. The water visibility during surveillance was very poor making it difficult to distinguish species. Invasive species, *E. canadensis, J. bulbosus* and *U. geminiscapa* were present at the site, in addition to floating *N. alba* and *A. distachyos*. Native species on the transect included emergents, charophytes, milfoils and pondweeds at a ratio of 95% compared to 5% invasives. Native vegetation reached a maximum depth of >2.2m.

Daylight Bight was also very shallow (<1.5m) across the entire survey site, directly out from Johnnies Creek and the treetop walkway. Native vegetation included emergents, turfing, charophytes, isoetes, and milfoils at 51-75% ratio. The invasive vegetation cover increased on previous years with a ratio of 26-50% due to an increased abundance of *J. bulbosus*. Other introduced species recorded include *E. canadensis, U. geminiscapa* and *L. palustris*.

Picnic Bay surveillance was conducted at the end of Picnic Point Track. The majority of the area was shallow (<1m), with a drop-off to 3m offshore. Native emergents, turf, charophytes, isoetes, and milfoils were all present at 95% ratio compared to 5% invasives. The main invasive present was occasional specimens of *E. canadensis* and less often*, U. geminiscapa*. Introduced *L. palustris* and *J. bulbosus* were also present along the margins with the *J. bulbosus* cover reaching a maximum depth of 1m.

Figure 12: Locations of surveillance, Lake Mahinapua. Main ramp (A), Daylight bright (B), and Picnic Bay (C).

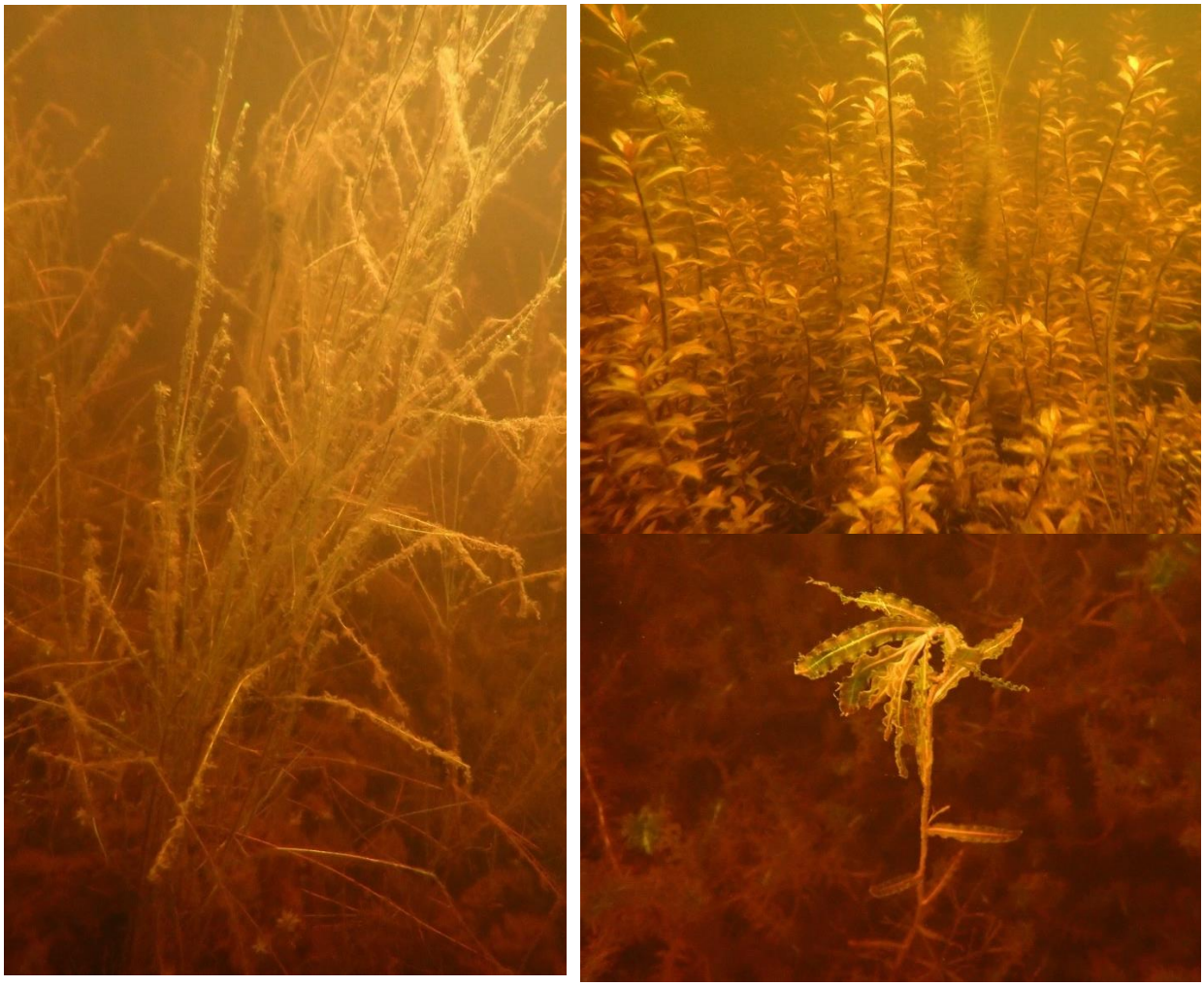

Figure 13: Pictures of Juncus bulbosus (left), Ludwigia palustris (top right) and Potamogeton crispus (bottom right) in Lake Mahinapua.

Lake Ianthe

The native vegetation observed adjacent to the main ramp at Lake Ianthe included emergents, turf, charophytes, isoetes, pondweeds and milfoils reaching depths of 5.3m. The ratio of natives was >95% compared to <5% invasive. *Lagarosiphon major* was present at lower abundance than previous years, however new shoots were observed starting to come through. *L. palustris* was also present at this site.

Native vegetation out from the landing extended to 5.9m, with emergents, turf, charophytes, isoetes, milfoils and pondweeds present to depths of 5.9m. The ratio of natives on the transect was >95% compared to <5% invasives. Large areas of *L. major* were seen clearly having died off, although new shoots were observed growing amongst these areas.

The shallow area surrounding Ianthe Creek Outlet had a ratio of 26-50% natives to 51-75% invasives. The invasive present was *L. major* in dense patches, 2.1 m high, among charophytes and other natives. Native emergents, turfing species, charophytes, isoetes, milfoils and pondweeds were present. The surveillance area was expansive and shallow, the maximum depths for both native and invasive vegetation was >2.4 m. Occasional specimens of *E. canadensis* were also present.

Figure 14: Locations of surveillance, Lake Ianthe. Main Ramp (A), The Landing (B), and Ianthe Creek Outlet (C).

Lake Mapourika

Native vegetation adjacent to the main ramp (site A, figure 15) included emergents turf, isoetes, milfoils and charophytes down to 5.4m depth. The native ratio was 51-75% to 26-50% invasive, dominated by *E. canadensis*. The *E. canadensis* was measured at 1.3m height and formed a dense, closed canopy band down to 4.7m depth. Introduced species, *L. palustris* and *J. bulbosus* were also recorded at this site.

At the transect located near the DOC Area (site B, figure 15), Native vegetation included emergents, turf, isoetes, milfoils, pondweeds and charophytes at a ratio of 76-95% to 6-25% invasives. Natives reached a depth of 5.8m while invasives were shallower at 3.7m. *Invasive E. canadensis* of 1.1m height formed a dense, closed canopy and was the dominant invasive present. Introduced species, *L. palustris* and *J. bulbosus* were also recorded at this site.

The native vegetation observed surrounding Okarito River mouth (site C, figure 15) included emergents, turf, charophytes, isoetes, pondweeds and milfoils at a ratio of 51-75% and reached depths of 5.2m. The ratio of invasives present increased upon previous years being 26-50% invasive with a notable increase in abundance of *E. canadensis*. Where present, *E. canadensis* formed a dense, closed canopy at 1.7m height and reaching depths of 4.3m. *L. palustris* and *J. bulbosus* were also present on the margins.

Figure 15: Locations of surveillance, Lake Mapourika. Main Ramp (A), DOC Area (B), and Okarito outlet (C.)

Lake Paringa

At the Lake Paringa Main Ramp, the ratio of invasive species was 51-75% which was 20-50% lower than previous years. Divers noted that large areas of *Lagarosiphon* had died off, however, new shoots were beginning to appear. *L. major* extended down to 3.2m depth, reaching 1.4m height. Native vegetation on the transect included turf, charophytes, milfoils and pondweeds, at a ratio of 26-50% present to depth of 5.6m.

At the Paringa Lodge transect a large shallow platform extended over 100m out from the jetty before eventually dropping away. *Lagarosiphon major* was dense at the site reaching 2.8m height and 4m depth. It largely accounted for 76- 95% of the observed vegetation with *E. canadensis* and *L. palustris* also present to a lesser extent. Emergents, turf, charophyte and milfoils were among the native vegetation observed on the transect at a 6- 25% ratio. Charophytes extended down to 6m depth. Closer to the jetty, a green filamentous algae was observed blanketing the bottom.

Figure 16: Locations of surveillance, Lake Paringa. Main Ramp (A) and Paringa Lodge (B).

Lake Moeraki

Surveillance was undertaken in areas surrounding the two Lake Moeraki boat ramps (figure 17). *Elodea canadensis* was the dominant vegetation at both sites and was the only invasive species recorded.

The northern ramp site was also dominated by dense *E. canadensis* at 1.8m height and down to 4.8m depth. Invasive ratio was > 95% compared to natives. Native emergents, turf, charophytes, milfoils and pondweeds and were present down to 6.5m depth.

Dense *E. canadensis* was recorded at the southern ramp site in Lake Moeraki down to 4.8m depth and 2.85m height. Native emergents, charophytes, and pondweeds were present at a 6-25% ratio compared to 76-95% invasives. *J. bulbosus* was also observed at this site.

Figure 17: Locations of surveillance, Lake Moeraki. Southern ramp (B) and Northern ramp (A).

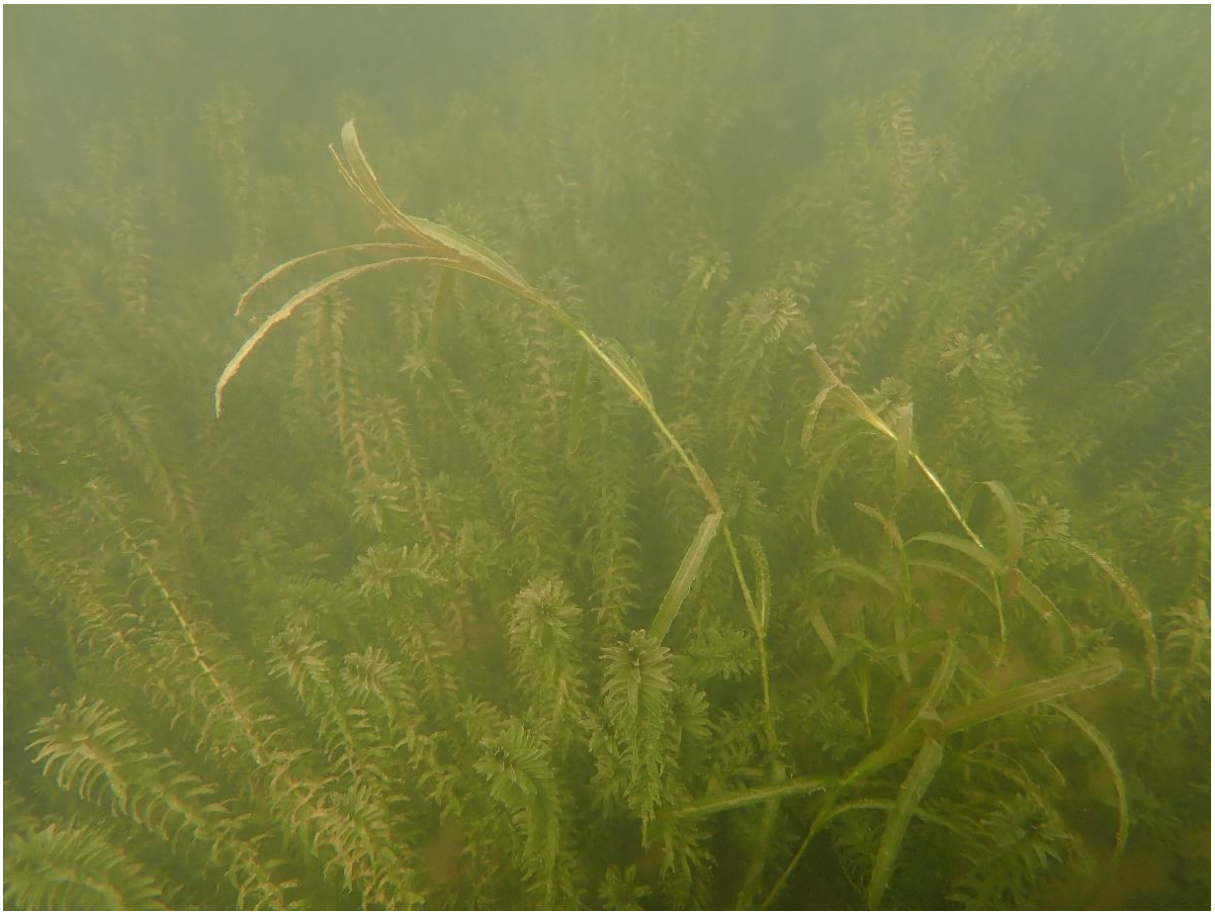

Figure 18: Elodea (left) and native pondweeds (right) in Lake Moeraki.

4. LakeSPI

LakeSPI results are presented in Table 9 along with a current ecological condition. A higher LakeSPI or Native Index reflects a better lake condition, while a higher Invasive Index, a poorer lake condition. Overall, the lakes in the current survey have either a moderate or high ecological condition.

Table 9 LakeSPI results from West Coast Lakes 2024

Lake	Current condition	LakeSPI Index	Native Index	Invasive Index
Haupiri	Moderate	50%	44.3%	34.07%
Lady	Moderate	49.2%	42%	34.1%
Kangaroo	High	61.4%	58.2%	29.6%
Poerua	Moderate	46.5%	61%	64.5%
Arthur	High	55.3%	62.9%	45.9%
Matheson	High	65.4%	40.6%	4.6%

* Physical depth of each lake was used as the key 'natural' factor limiting LakeSPI score potential. Alternatively, scores can be adjusted for photic depth in dystrophic lakes where data is available.

5. Recommendations

Overall, the West Coast lakes continue to present moderate to high value ecosystems in regard to native submerged vegetation and a lack of major invasive macrophytes, with no new incursions of invasive *Lagarosiphon major, Egeria densa* or *Ceratophyllum demersum* detected during this year's surveillance or LakeSPI dives.

Therefore, early detection of invasive weed species remains an important component to lake preservation and ensures the regional council can meet the objectives it has set in the West Coast Regional Pest management plan (2018). In lakes containing major invasive weeds (Ianthe, Paringa and Kapitea), surveillance also enables a routine assessment of change to aquatic vegetation and informs management actions.

The main threat to the West Coast lakes remains the spread of *L. major* from Ianthe, Paringa or Kapitea Reservoir. Based on findings of the current survey it is recommended that WCRC and DOC consider the following:

- Continue to undertake routine lake weed surveillance within the West Coast region. Those lakes with ease of access, high use areas, high natural value, and close proximity to other lakes containing problematic invasives (i.e., *L. major*) should be prioritised.
- Annual surveillance is suggested for lakes Brunner, Kaniere, Mahinapua, Mapourika, Ianthe, Paringa and Moeraki.
- For lower risk lakes such as Hochstetter a comprehensive surveillance survey should be undertaken every 5 years.
- While the current surveillance transects in Lake Brunner are good for monitoring change, when it comes time to complete the next LakeSPI assessment, the divers suggest introducing at least three more sites (total of 10) in order to get better representation of the large lake.
- Maintain an adaptive management approach and contingency plan for responding rapidly to any new weed incursion.
- Undertake a review of interpretation/signs at main entry points to ensure public are suitably aware of the risks and prevention methods to stop the spread of aquatic weeds. Consider the use of personnel (for example, a summer student or volunteers) at Lake Brunner during peak periods to educate the public around the risks of spreading invasive weeds through recreation.
- Installation of weed cordons within high use areas as a tool to compliment other biosecurity measures.
- While providing a good reference, the previous lake conditions online from 2002 cannot be compared to the current results due to differing survey sites and updates relating to lake depth information. Where possible in future surveys the current sites should be repeated to better detect any change.

6. References

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Appendix

Appendix 1: Table of Introduced submerged macrophytes observed during LakeSPI dive surveys.

Lake	Macrophyte							
	Lagarosiphon major	*Elodea canadensis*	*Ludwigia palustris*	*Aponogeton distachyos*	*Utricularia gemniscapa*	*Juncus bulbosus*	*Ranunculus trichophyllus*	*Potamogeton crispus*
Haupiri 1 Main Ramp		+	+					
Haupiri 2		+	+					
Haupiri 3		+	+			+		
Haupiri 4		+	+			+		
Haupiri 5		+						
Lady 1 Entrance		+	+					
Lady 2		+	+					
Lady 3		+						
Lady 4		+	+					
Lady 5		+	+					
Kangaroo 1		+	+					
Kangaroo 2		+						
Kangaroo 3		+						
Kangaroo 4		+						
Kangaroo 5		+						
Poerua 1 (main ramp)		+					+	
Poerua 2		+					+	
Poerua 3		+						
Poerua 4		+						
Poerua 5		+						
Arthur					+	+		
Matheson						+		

Appendix 2: Table of Introduced submerged macrophytes observed during surveillance diving.

Lake	Macrophyte							
	Lagarosiphon major	*Elodea canadensis*	*Ludwigia palustris*	*Aponogeton distachyos*	*Utricularia gemniscapa*	*Juncus bulbosus*	*Ranunculus trichophyllus*	*Potamogeton crispus*
Brunner Main Ramp		+	+					+
Brunner Yacht Club		+	+					
Brunner Hohonu		+	+					
Brunner Mitchell's		+	+			+		
Brunner Cashmere Bay		+	+					
Brunner Orangipuku		+	+				+	+
Brunner Crooked River		+						
Kaniere Hans Bay		+				+		
Kaniere Canoe Cove		+				+		
Kaniere Sunny Bight		+	+					
Mahinapua Main Ramp		+	+	+	+	+		+
Mahinapua Daylight Bight		+	+		+	+		
Mahinapua Picnic Bay		+	+	+	+	+		
Ianthe Main Ramp	+		+					
Ianthe Landing	+		+		+			
Ianthe Outlet	+	+	+					
Mapourika Main Ramp		+	+			+		
Mapourika DOC Area		+	+			+		
Mapourika Outlet		+	+			+		
Paringa Main Ramp	+							
Paringa Lodge Jetty	+		+					
Moeraki North Ramp		+	+					
Moeraki South Ramp		+				+		

Appendix 3: Table of Common indigenous vegetation observed at each lake from surveillance sites.

	Hochstetter	Brunner Main Ramp	Brunner Yacht Club	Brunner Hohonu River Mouth	Brunner Mitchel's Ramp	Brunner Orangipuku Mouth	Brunner Cashmere Bay	Brunner Crooked River Mouth
Chara sp.	+	+	+	+	+	+	+	+
Nitella sp.		+	+		+		+	
Elatine gratioloides	+	+			+			
Glossostigma sp.	+	+			+	+		
Isoetes.	+	+	+		+	+	+	
Lilaeopsis novae-zelandiae	+	+	+			+		
Myriophyllum triphyllum		+	+		+	+	+	
Myriophyllum propinquum	+	+	+	+	+	+	+	
Potamogeton cheesemanii		+	+			+		
Potamogeton ochreatus		+	+	+	+	+	+	+
Ranunculus amphitrichus		+	+		+			
Ranunculus limosella	+	+	+		+	+		
Lobelia perpusilla					+			
Callitriche petriei		+	+		+			

Appendix 3: Table of Common indigenous vegetation observed at each lake from surveillance sites.

	Kapitea North Ramp	Kapitea West Ramp	Kapitea Inlet	Kaniere Sunny Bight	Kaniere Hans Bay	Kaniere Canoe Cove	Mahinapua Main Ramp	Mahinapua Daylight Bight	Mahinapua Picnic Bay
Chara sp.	+	+	+	+	+	+	+	+	+
Nitella sp.	+	+		+	+	+	+	+	+
Elatine gratioloides			+	+	+	+			
Glossostigma sp.	+	+	+	+		+			+
Isoetes				+	+	+	+	+	+
Lilaeopsis novae-zelandiae		+		+		+		+	
Myriophyllum triphyllum				+	+	+		+	
Myriophyllum propinquum	+	+	+	+	+	+	+	+	+
Potamogeton cheesemanii		+	+	+			+		
Potamogeton ochreatus	+	+	+	+	+	+	+	+	+
Ranunculus amphitrichus								+	+
Ranunculus limnosella					+				
Lobelia perpusilla			+	+	+			+	+
Callitriche petriei	+	+		+	+			+	+
Crassula sp				+	+	+	+		
Pilularia novae-zelandiae				+	+				

Appendix 3: Table of Common indigenous vegetation observed at each lake from surveillance sites.

	Ianthe Main Ramp	Ianthe The Landing	Ianthe Creek Outlet	Mapourika Main Ramp	Mapourika DOC area	Mapourika Okarito Outlet	Paringa Main Ramp	Paringa Lodge jetty	Moeraki North	Moeraki South
Chara sp.	+	+	+	+	+	+	+	+	+	+
Nitella sp.	+	+		+	+	+	+	+	+	+
Elatine gratioloides		+					+	+		+
Glossostigma sp.	+	+	+	+	+		+	+	+	+
Isoetes	+	+	+	+	+	+	+		+	
Lilaeopsis novae-zelandiae				+		+	+		+	+
Myriophyllum triphyllum	+	+			+		+	+		+
Myriophyllum propinquum	+	+	+	+	+	+	+	+	+	+
Potamogeton cheesemanii	+	+				+			+	
Potamogeton ochreatus	+	+	+	+			+	+	+	+
Ranunculus amphitrichus					+	+			+	+
Ranunculus limnosella	+			+	+	+	+		+	
Lobelia perpusilla			+						+	+
Callitriche petriei	+				+		+	+		
Crassula sp.			+	+	+					
Pilularia novae-zelandiae				+					+	

Appendix 4:

eDNA Methodology (as per Wilderlab NZ instructions)

1. Take the gloves out of the sample bag, put them on, and take out the large syringe.

2. Draw up 50 ml of water from just below the surface of the water. Take care not to suck up any sediment from the bottom.

3. Screw the filter on the large syringe taking care not to overtighten.

4. Push the plunger down to squeeze the water out through the filter. Avoid getting air bubbles in the filter as they can be difficult to push through.

5. Unscrew the filter from the large syringe.

6. Repeat steps 2-5 until the filter is clogged and water is only dripping out, or until 1L is filtered (20

syringefuls), whichever comes first. If using a caulking gun do not force water through too hard or the filter may rupture.

7. Unscrew the filter, draw 50 ml of air into the large syringe, re-attach the filter, and holding the syringe vertically with the filter pointing down, force the air through to squeeze out the remaining water from the filter. Leave the filter attached to the large syringe for the next step.

8. Holding both the large syringe (with filter attached) and the small syringe (with black cap attached) in the same hand and in an upright position, unscrew the black cap from the small syringe and screw the black cap on to the outlet end of the filter. See figure (A) below.

9. Unscrew the filter (with the black cap still attached) from the large syringe and screw it on to the small syringe (B-C). Push the plunger to inject the preservative into the filter (D). Shake well while holding the plunger down. Do not remove the syringe or cap from the filter. Don't worry if there are air bubbles in the filter or if the plunger springs back – this is normal.

10. Place the filter with both the black cap and small syringe still attached into the clear zip-lock sample bag and seal (E).

11. Record the sample details on the ziplock bag in the space provided. Ensure that the coordinates are entered in WGS84 decimal format (for example -41.30951, 174.82110 as displayed on google maps).

12. Fill out the eDNA sample submission form at wilderlab.co.nz/submit-samples and include a hard copy with the samples.

13. Send the samples by standard courier (no refrigeration necessary) to:

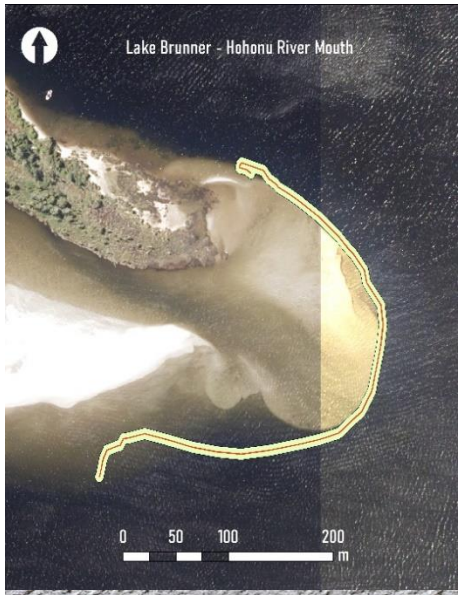
Wilderlab NZ Ltd

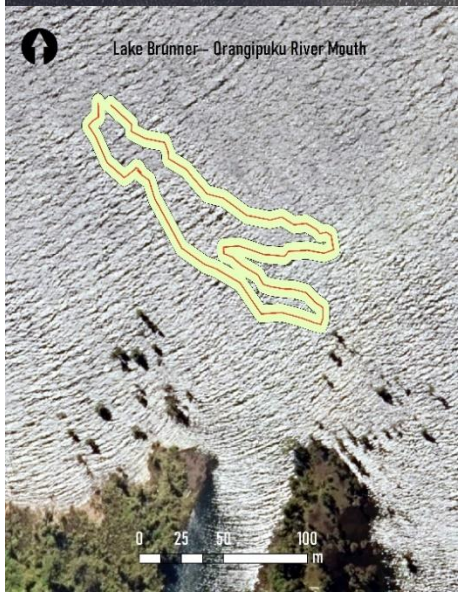
Level 2, 129 Park Road

Miramar

Wellington 6022

Appendix 5: GPS Tracks





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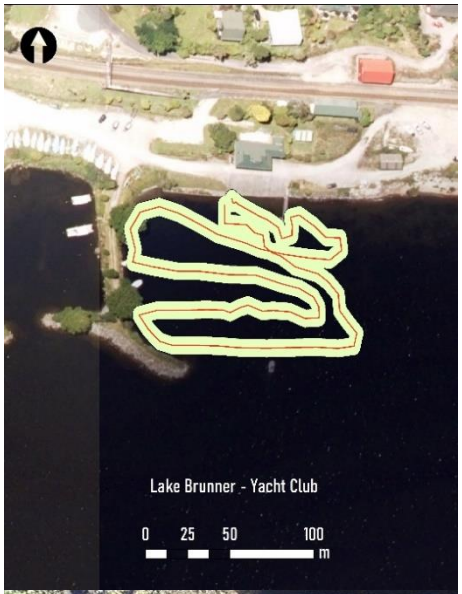

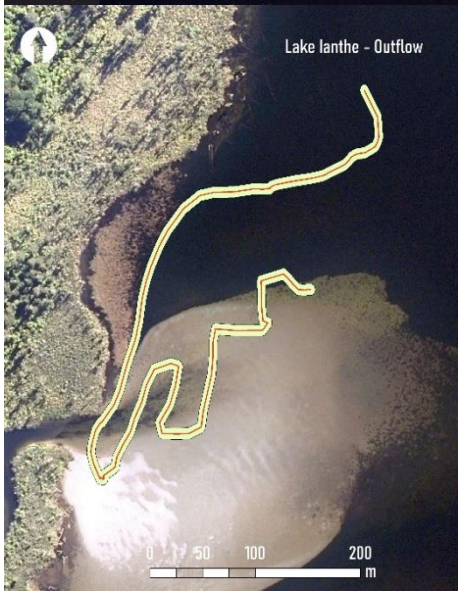

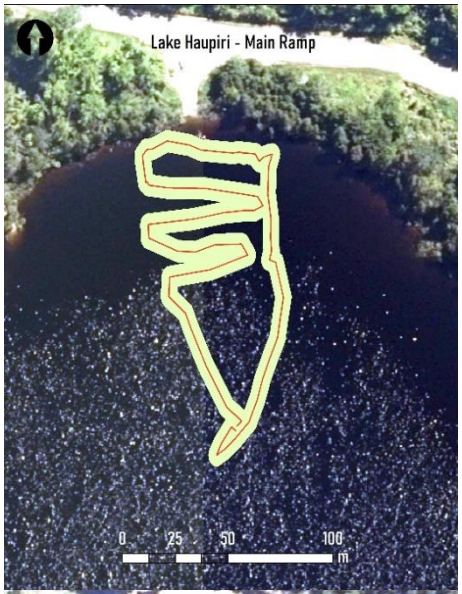

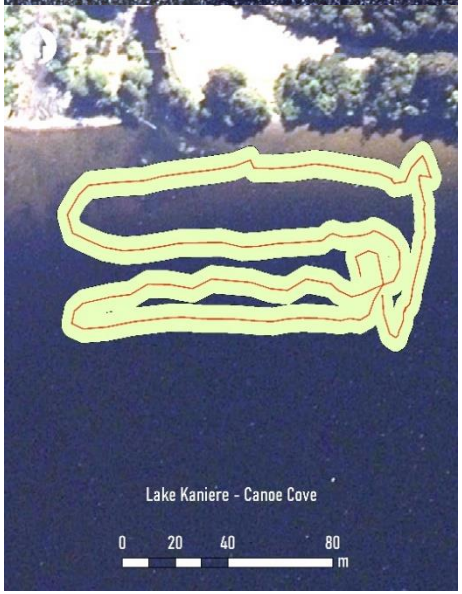

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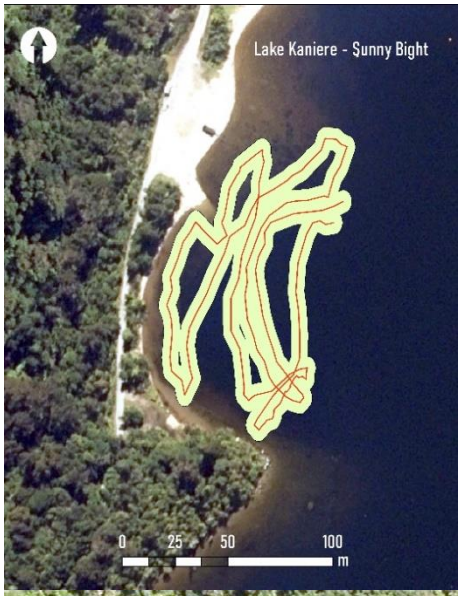

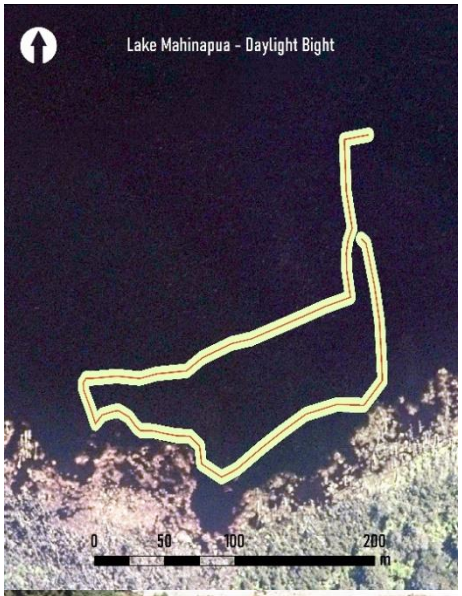

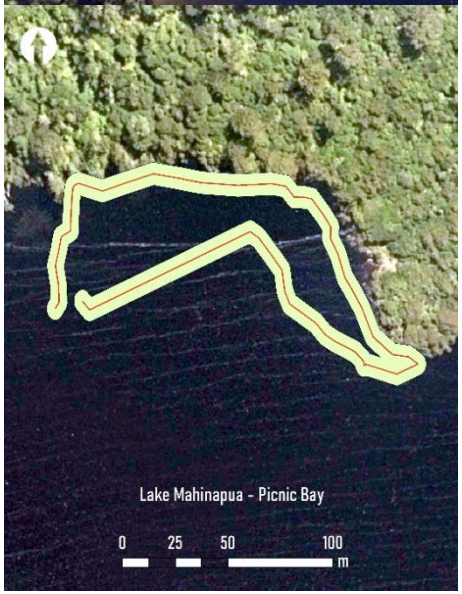

Appendix 5: GPS Tracks