Data and Information Committee Agenda
30 June 2022

Meeting held in the Council Chamber, Lvl 2 Philip Laing House
144 Rattray St, Dunedin (Councillors and staff only)
Members of the public may view the meeting live at: Otago Regional Council YouTube Channel

Members:
Cr Alexa Forbes, Co-Chair
Cr Michael Laws, Co-Chair
Cr Hilary Calvert
Cr Michael Deaker
Cr Carmen Hope
Cr Gary Kelliher
Cr Kevin Malcolm
Cr Andrew Noone
Cr Gretchen Robertson
Cr Bryan Scott
Cr Kate Wilson

Senior Officer: Pim Borren, interim Chief Executive

Meeting Support: Liz Spector, Governance Support Officer

30 June 2022 10:00 AM

Agenda Topic — Page

Minutes of a meeting of the Data and Information Committee held in the Council Chamber on Wednesday 9 March 2022 at 9:00 AM

Membership

Cr Alexa Forbes	*(Co-Chair)*
Cr Michael Laws	*(Co-Chair)*
Cr Hilary Calvert	
Cr Michael Deaker	
Cr Carmen Hope	
Cr Gary Kelliher	
Cr Kevin Malcolm	
Cr Andrew Noone	
Cr Gretchen Robertson	
Cr Bryan Scott	
Cr Kate Wilson	

Welcome

Committee Co-Chair Alexa Forbes welcomed Councillors and staff to the meeting at 10am. Staff present included Amanda Vercoe (GM Governance, Culture and Customer), Gwyneth Elsum (GM Strategy, Policy and Science) and Liz Spector (Governance Support, minutes). Present electronically were Sarah Gardner (Chief Executive), Nick Donnelly (GM Corporate Services), Gavin Palmer (GM Operations), Richard Saunders (GM Regulatory and Communications), Garry Maloney (Principal Advisor Transport Planning), Julian Phillips (Implementation Lead, Transport), Doug Rodgers (Manager Transport), Kyle Balderston (Team Leader Urban Growth and Development), Sarah Harrison (Air Quality Scientist), Simon Wilson (Manager Regulatory Data and Systems), Susan Wells (Team Leader Data and Systems), Tom Dyer (Manager Science), and Rachel Ozanne (Water Quality Scientist).

1. APOLOGIES

Resolution: Cr Robertson Moved, Cr Noone Seconded:
That the apologies for Cr Scott and the lateness of Cr Laws be accepted.

MOTION CARRIED

2. PUBLIC FORUM

No public forum was held.

3. CONFIRMATION OF AGENDA

The agenda was confirmed as published.

4. CONFLICT OF INTEREST

No conflicts of interest were advised.

5. CONFIRMATION OF MINUTES

Resolution: Cr Wilson Moved, Cr Calvert Seconded
That the minutes of the meeting held on 8 December 2021 be received and confirmed as a true and accurate record.

MOTION CARRIED

6. ACTIONS

Open Actions from resolutions of the Committee were reviewed. No updates were indicated.

7. MATTERS FOR CONSIDERATION

7.1. Annual Air Quality Report 2021

The report was provided to detail results of the annual State of the Environment (SoE) monitoring for air quality for 2021. The report also provided details on recent updates to World Health Organisation air quality guidelines. Air Quality Scientist Sarah Harrison was present electronically to respond to questions about the report. Chair Forbes thanked Ms Harrison and GM Gwyneth Elsum for the report and said it was critical to communicate this information to the wider community. Cr Noone asked a question about the core functions for ORC related to air quality. Ms Elsum said the ORC monitored and maintained air field stations for monitoring and compliance, and provided standard comms campaigns over winter months regarding air quality. She also noted work on the air plan would proceed as per established timelines.

Following further discussion, Cr Noone moved that the report be noted.

Resolution DAIC22-101: Cr Noone Moved, Cr Kelliher Seconded
That the Data and Information Committee:

*1) **Notes** this report.*

MOTION CARRIED

Cr Laws joined the meeting at 10:06 am.

7.2. Annual Water Quality and Biomonitoring Results (SoE Report Card)

The report presented State of Environment (SoE) monitoring results which assess Otago's water quality compliance with its *Regional Plan: Water for Otago* (Regional Plan Water, 2004), for Schedule 15 numerical limits and targets. Water Quality Scientist Rachel Ozanne was present electronically to respond to questions about the report. She noted the reports were informational and should not be used to make trend analyses against reports from previous years. Ms Ozanne said that type of analysis was reported with the five-year SoE report provided to the Committee in April 2021.

An in-depth discussion was held regarding why the data in the report couldn't be used to note trends in water quality. Cr Malcolm said it was important for the community to be able to see what is happening with waterways and he suggested a comms piece should go out showing the work underway at the Council is showing positive trends. Ms Ozanne said localised variables which may influence the data being collected are not included in the report, only the specific data. She said while it was tempting to compare year over year data, this report was not provided for that purpose.

Cr Malcolm moved the report be noted.

Resolution DAIC22-102: Cr Malcolm Moved, Cr Wilson Seconded
That the Committee:

*1) **Notes** this report.*

MOTION CARRIED

Cr Laws left the meeting at 10:28 am.
Cr Calvert left the meeting at 10:28 am.
Cr Calvert returned to the meeting at 10:39 am.
Cr Laws returned to the meeting at 10:39 am.

7.3. SoE Monitoring Biannual Update

The report was provided to update the Committee about the extent and quality of data captured by the environmental monitoring network operated by the ORC Environmental Monitoring team. The report covered the period 1 July 2021 – 31 December 2021. Tom Dyer (Manager Science), Simon Wilson (Manager Regulatory Data and Systems) and Susan Wells (Team Leader Data and Systems) were present electronically to respond to questions about the report. Mr Wilson noted the report is also provided to show the completeness and quality of data being gathered.

Cr Malcolm said it was important to show the community the work underway behind the scenes in water and air quality and he asked how this information was available for the public. Ms Wells said all the data is available on the ORC website in the water monitoring and alerts section.

Following further discussion, Cr Malcolm moved:

Resolution DAIC22-103: Cr Malcolm Moved, Cr Calvert Seconded
That the Committee:

*1) **Notes** this report which provides an SoE Monitoring Biannual Update.*

MOTION CARRIED

7.4. Quarterly Monitoring Report - Urban Development

This report presented the Urban Development Quarterly Monitoring Report (QMR) to December 2021 as required by the National Policy Statement on Urban Development 2020 (NPSUD). The report covered the period up to and including the last quarter of 2021 and updated since the previous QMR which was to March 2021. Gwyneth Elsum (Manager Strategy, Policy and Science) and Kyle Balderston (Team Leader Urban Growth and Development) were present to respond to questions about the report.

Following questions from Councillors, Councillor Noone moved to note the report.

Resolution DAIC22-104: Cr Noone Moved, Cr Calvert Seconded
That the Committee:

*1) **Notes** this report and the Quarterly Monitoring Report up to and including December 2021.*

MOTION CARRIED

7.5. Queenstown and Dunedin Patronage Report

This report was provided to update the Committee with statics on the performance of its public transport system (bus and ferry) and total mobility services for the first and second quarters of the 2021/22 financial year. Gavin Palmer (GM Operations, Doug Rodgers (Manager Transport), Julian Phillips (Implementation Lead, Transport) and Garry Maloney (Principal Advisor Transport Planning) were present electronically to respond to questions about the report.

Questions were responded to concerning customer complaints and the impact from COVID-19 on patronage and fares. Cr Noone asked when the real time network would be in place for Dunedin. Mr Phillips said Transport are testing real time output to screens in the Bus Hub and will push to the real time app hopefully within the next month. Cr Wilson asked what methods and systems were in place to get real time messaging to the communities. Mr Phillips noted Facebook, the ORC website, and apps such as My Little Local were used to provide updates to fluid situations such as roadworks.

Following further discussion, Cr Noone moved receipt of the report.

Resolution DAIC22-105: Cr Noone Moved, Cr Malcolm Seconded
That the Data and Information Committee:
***1) Notes** this report.*

MOTION CARRIED

Cr Noone left the meeting at 11:32 am.
Cr Noone returned to the meeting at 11:34 am.
Cr Wilson left the meeting at 11:34 am.
Cr Wilson returned to the meeting at 11:36 am.
Cr Laws left the meeting at 11:39 am.

8. CLOSURE

Chair Forbes noted this would be the final meeting of the Committee for GM Strategy, Policy and Planning Gwyneth Elsum and thanked her for all the work she had put into the role during her time at the ORC. Cr Noone then moved formal acknowledgement:

Resolution: Cr Noone Moved, Cr Malcolm Seconded
That the Committee:

1) ***Acknowledges*** *the significant contribution to the Otago Regional Council by Gwyneth Elsum, General Manager Strategy, Policy and Science and thanks her for her work during her tenure.*

MOTION CARRIED

There was no further business and Chairperson Forbes declared the meeting closed at 11:54 am.

_____ _____
Chairperson Date

Minutes of a meeting of the Data and Information Committee held in the Harvest Hotel Conference Centre (Cromwell) on Thursday 9 June 2022 at 1:00 PM

Membership

Cr Alexa Forbes	*(Co-Chair)*
Cr Michael Laws	*(Co-Chair)*
Cr Hilary Calvert	
Cr Michael Deaker	
Cr Carmen Hope	
Cr Gary Kelliher	
Cr Kevin Malcolm	
Cr Andrew Noone	
Cr Gretchen Robertson	
Cr Bryan Scott	
Cr Kate Wilson	

Welcome

Co-Chairperson Alexa Forbes welcomed Councillors, members of the public and staff to the meeting at 1:05 pm. Staff present included Gavin Palmer (GM Operations), Jean-Luc Payan (Manager Hazards), and Liz Spector (Governance Support). Staff present electronically included Pim Borren (interim Chief Executive), Nick Donnelly (GM Corporate Services), Anita Dawe (GM Policy and Science), and Tim van Woerden (Natural Hazards Analyst). Also present electronically were consultants Matthew Gardner (Land River Sea Consulting) and Sjoerd van Ballegooy (Tonkin + Taylor).

1. APOLOGIES

Resolution: Cr Noone Moved, Cr Kelliher Seconded:
That the apologies for Cr Deaker, Cr Robertson and Cr Laws (for lateness) be accepted.
MOTION CARRIED

2. PUBLIC FORUM

No public forum was held.

3. CONFIRMATION OF AGENDA

Cr Wilson Moved, Cr Hope Seconded
The agenda was confirmed as published.
MOTION CARRIED

4. CONFLICT OF INTEREST

No conflicts of interest were advised.

5. MATTERS FOR CONSIDERATION

5.1. Head of Lake Wakatipu flooding and liquefaction hazard investigations

The report was provided to present findings of investigations into flood and liquefaction hazards at the Dart-Rees floodplain and Glenorchy township and provided updates on other programmes for development of a natural hazard strategy for the area. Dr Jean-Luc Payan (Manager Natural Hazards) and Dr Gavin Palmer (GM Operations) were present to respond to questions on the report. Consultant Sjoerd van Ballegooey discussed the Glenorchy liquefaction vulnerability assessment carried out by Tonkin + Taylor and consultant Matthew Gardner discussed the flood hazard modelling report carried out by Land River Sea Consultants.

Following Councillor questions related to the investigations and presentations, Councillor Noone moved the staff recommendation.

Resolution DAIC22-106: Cr Noone Moved, Cr Wilson Seconded
That the Data and Information Committee:

1) ***Notes** this report.*
2) ***Notes** the report by Tonkin + Taylor Ltd; Glenorchy liquefaction vulnerability assessment, dated May 2022 and the report by Land River Sea Consulting Ltd; Dart-Rees flood hazard modelling, dated May 2022.*
3) ***Notes** the findings presented in these reports.*
4) ***Endorses** the use of the information presented in these reports to inform adaptation decision-making for Glenorchy.*
5) ***Notes** the Shepherd's Hut Creek debris flow event and the actions taken by ORC in response to that event.*
6) ***Notes** the establishment of the Queenstown-Lakes District Natural Hazards Steering Group which has further strengthened the working relationship between ORC and Queenstown-Lakes District Council staff on the management of natural hazards.*

MOTION CARRIED

6. CLOSURE

There was no further business and Co-Chair Alexa Forbes declared the meeting closed at 2:33 pm.

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Chairperson Date

OPEN ACTIONS FROM RESOLUTIONS OF THE DATA AND INFORMATION COMMITTEE AT 30 JUNE 2022

Meeting Date	Item	Status	Action Required	Assignee/s	Action Taken	Due Date
09/06/2021	HAZ2106 Active faults in the Dunedin City and Clutha Districts	Completed	Provide a report to the Strategy and Planning Committee by 31/12/2021 on options for incorporating the GNS Science active fault report and other fault information held by ORC into planning frameworks across Otago. **DAIC21-106**	General Manager Operations	**02/11/2021 Governance Support Officer** Dr Palmer advised the report will go to 9 December 2021 Council Meeting. **25/11/2021 Governance Support Officer** Dr Palmer advised the report will go to the 9 March 2022 Data and Information Committee meeting. **23/02/2022 Executive Assistant** A workshop on possible options has been held with the territorial authorities. Options are being developed to be reported to the April 2022 meeting of the Strategy and Planning Committee. **22/04/2022 Executive Assistant** A report was provided to the Strategy and Planning Committee on 13 April 2022 to inform the Committee of options for incorporating information on active faults held by ORC into planning frameworks across Otago and to seek endorsement of an approach to fault zone management across the region. A report will be provided to the relevant Council Committee by January 2023 on a recommended option and implementation plan, developed in collaboration with Territorial Authorities, for incorporating the tiered approach into planning frameworks across Otago.	31/12/2021

Meeting Date	Item	Status	Action Required	Assignee/s	Action Taken	Due Date
09/06/2021	SPS2132 Coastal Monitoring Programme	In Progress	Present a paper to the Strategy and Planning Committee in 2022 outlining monitoring options for a State of the Environment network and seek Council approval to implement the programme. **Res DAIC21-103**	General Manager Policy and Science, General Manager Strategy, Policy and Science, Manager Science	**09/12/2021 General Manager Strategy, Policy and Science** On track. **19/01/2022 Governance Support Officer** General Manager Strategy, Policy and Science: The Science Team are doing work such as coastal mapping that will provide input into the development of a coastal monitoring programme.	30/06/2022

7.1. Contact Recreation Monitoring 2021-2022

Prepared for:	Data and Information Committee
Report No.	SPS2225
Activity:	Governance Report
Author:	Rachel Ozanne, Senior Science – Water Quality, Tom Dyer, Manager Science
Endorsed by:	Anita Dawe, General Manager Policy and Science
Date:	29 June 2022

PURPOSE

[1] This report summarises contact recreation monitoring programme (the programme) undertaken at 29 sites in Otago's rivers, lakes, and coastal waters at weekly intervals between 6 December 2021 and 31 March 2022. Contact recreation monitoring focuses on human health risks relating to faecal contamination and/or potentially toxic cyanobacteria.

EXECUTIVE SUMMARY

[2] The programme follows the national microbiological water quality guidelines for marine and freshwater recreational areas (MfE & MoH, 2003[1]), the National Policy Statement for Freshwater Management 2020 (NPSFM, 2020[2]) and The New Zealand Guidelines for Cyanobacteria in Recreational Fresh Waters: Interim Guidelines[3](MfE & MoH, 2009).

[3] Weekly monitoring results and temporary health warnings are reported on the Land Air Water Aotearoa (LAWA) website[4]. LAWA also report a 'long term grade' for each recreational site alongside the weekly sampling result.

[4] In the 2021-2022 season across both coastal and freshwater sites 464 routine microbiological samples were taken, with faecal contamination resulting in the 'unsuitable for swimming' category being met on 19 occasions and the 'caution advised' category met on 10 occasions.

[5] For cyanobacteria, four river sites were monitored weekly, none of which had a benthic algae bloom (>50% cover cyanobacteria). However, two of the monitored lake sites (Butchers Dam and Lake Waihola) had a planktonic algae bloom that reached the 'action' red mode.

[6] Faecal source tracking was undertaken on four occasions. A ruminant and avian source was determined for the Manuherekia at Shaky Bridge. Otokia Creek at Brighton Beach

[1] https://environment.govt.nz/assets/Publications/Files/microbiological-quality-jun03.pdf

[2] https://environment.govt.nz/assets/Publications/Files/national-policy-statement-for-freshwater-management-2020.pdf

[3] http://www.mfe.govt.nz/sites/default/files/nz-guidelines-cyanobacteria-recreationalfresh-waters.pdf

[4] https://www.lawa.org.nz/

had a combination of avian, ruminant, and human sources in the three samples analysed.

[7] This document reports on the ORC recreational water quality programme including:
a. Legislative requirements
b. Microbiological water quality sampling results for the 2021/22 bathing season
c. River (benthic) and lake (planktonic) warnings for cyanobacteria over the 2021/22 season
d. Recommendations for the 2021/22 bathing season.

RECOMMENDATION

That the Committee:

1) ***Notes*** *this report.*

LEGISLATIVE REQUIREMENTS

[8] Two main sources of legislation define the monitoring required to assess the water quality of areas used for contact recreation - the Resource Management Act (1991) and the Health Act (1956). The responsibility for overseeing these Acts is shared between Regional Councils, Territorial Local Authorities (TLAs) and the District Health Boards.

[9] The National Policy Statement for Freshwater Management 2020 (NPSFM, 2020) provides national direction on how local and regional authorities should carry out their responsibilities under the Resource Management Act 1991 for managing freshwater.

[10] Human health for recreation is a compulsory freshwater value under the NPSFM 2020. This refers to the extent to which an FMU or part of an FMU supports people being able to connect with the water through a range of activities such as swimming, waka, boating, fishing, mahinga kai, and water skiing, in a range of different flows or levels.

[11] The NPSFM 2020 contains two attributes for human health for recreation, the first is aimed at State of Environment reporting and is based on 60 samples over a maximum of 5 years (Appendix 2A, Table 11). The second is a separate framework described in NPSFM 2020 (Appendix 2B, Table 22, Figure 1) for assessing human health for recreation, specifically for primary contact sites in lakes and rivers during the bathing season.

[12] Otago's recreational water quality monitoring programme follows guidance provided by the national microbiological water quality guidelines for marine and freshwater recreational areas (MfE/MoH 2003). The guidelines provide monitoring protocols and public health notification protocols to use when health risks at primary contact sites are detected.

Table 22 – *Escherichia coli* (*E. coli*) (primary contact sites)

Value	Human contact
Freshwater body Type	Primary contact sites in lakes and rivers (during the bathing season)
Attribute unit	95th percentile of *E. coli*/100 mL (number of *E. coli* per hundred millilitres)
Attribute band and description	**Numeric attribute state**
Excellent Estimated risk of *Campylobacter* infection has a < 0.1% occurrence, 95% of the time.	≤ 130
Good Estimated risk of *Campylobacter* infection has a 0.1 – 1.0% occurrence, 95% of the time.	> 130 and ≤ 260
Fair Estimated risk of *Campylobacter* infection has a 1 – 5% occurrence, 95% of the time.	> 260 and ≤ 540
National bottom line	**540**
Poor Estimated risk of *Campylobacter* infection has a > 5% occurrence, at least 5% of the time.	> 540
The narrative attribute state description assumes "% of time" equals "% of samples".	

Figure 1 NPSFM (2020) Appendix 2B, Table 22. Escherichia coli (E. coli) at primary contact sites

ROLES, RESPONSIBILITIES AND PROCEDURES

[13] Otago Regional Council (ORC) worked with the Southern District Health Board (SDHB), the territorial authorities and Environment Southland (ES) to ensure consistency in applying the contact recreation framework (provided by MfE/MoH 2003 and NPSFM,2020) across the SDHB region.

[14] The procedure agreed by the organisations involved for the 2021/2022 season for Otago is shown in Figure 2. In Otago, the Central Otago District Council (CODC), Dunedin City Council (DCC), Waitaki District Council (WDC) and Clutha District Council (CDC) rely on the ORC to provide follow up sampling if the 'action' level is reached, and to provide public information through sign installation (Figure 3) and media. The Queenstown Lakes District Council (QLDC) provides follow up monitoring and communication for sites monitored in their district.

2021/2022 sampling and response protocols

1) Signs were permanently installed at every ORC contact recreation monitoring site (Figure 3). The signs included the text 'check LAWA before you swim' and 'avoid swimming 48 hours after rainfall'
2) ORC did not sample lake sites if conditions were too dangerous for the sampler. For example, if the sampler was unable to get past the turbulent water of the wave zone safely.
3) ORC only resampled sites when results were greater than 540 *E. coli* per 100ml when:
    a) The sites were practicable to get to (resources and remoteness).
    b) The site had a long-term grade of 'good' or 'excellent' (LAWA), weather conditions had been settled and an unexpectedly high result had been returned.
4) ORC did not resample sites when satisfied that the elevated result was temporary
    a) if the original sample was taken when flows were above median flow
        - Outram (Taieri at Outram flow site)
        - Manuherekia (Manuherekia at Campground flow site)
        - Clutha at Dunorling Street (Clutha at Clyde flow site)
        - Waikouaiti at Bucklands (Waikouaiti 200m d/s confluence flow site)
    b) If >5mm rainfall had fallen in the in previous 24 hours
        - Otokia Creek (Dunedin at Musselburgh rain gauge)
        - Macandrew Bay (Dunedin at Musselburgh rain gauge)

Figure 2 Sampling and response protocols for 2021/2022

Figure 3 Macandrew Bay. The 'Can I Swim Here?' sign, with LAWA details can be seen on the right.

SAMPLING SITES

[15] Bacteria concentrations, used as indicators for faecal contamination, are monitored at 13 fresh water and eight coastal sites throughout Otago (as shown in Figure 4). The DCC samples eight additional coastal sites between Sandfly Bay and St Clair Beach and these results are added to ORC's summer recreational water quality monitoring reported on LAWA. The sampling by the DCC is a requirement of consents for Dunedin City's wastewater discharges.

[16] Benthic cyanobacteria cover was regularly monitored at the four river sites visited weekly during the contact recreation season, being Manuherekia at Shaky Bridge, Waikouaiti at Bucklands, Taieri at Waipiata and Taieri at Outram. Planktonic cyanobacteria was monitored at the five lake sites known to experience cyanobacteria

blooms, being Lake Waihola, Lake Hayes, Falls Dam, Tomahawk Lagoon and Butchers Dam. The sites are shown in Figure 4.

[17] Duplicate samples were taken for faecal source tracking (FST) at all freshwater and estuarine sites (other than Lake Dunstan and Lake Hawea). FST uses DNA and Polymerase Chain Reaction (PCR) analyses to identify the source of the bacteria (human, ruminant, dog or avian) in the samples.

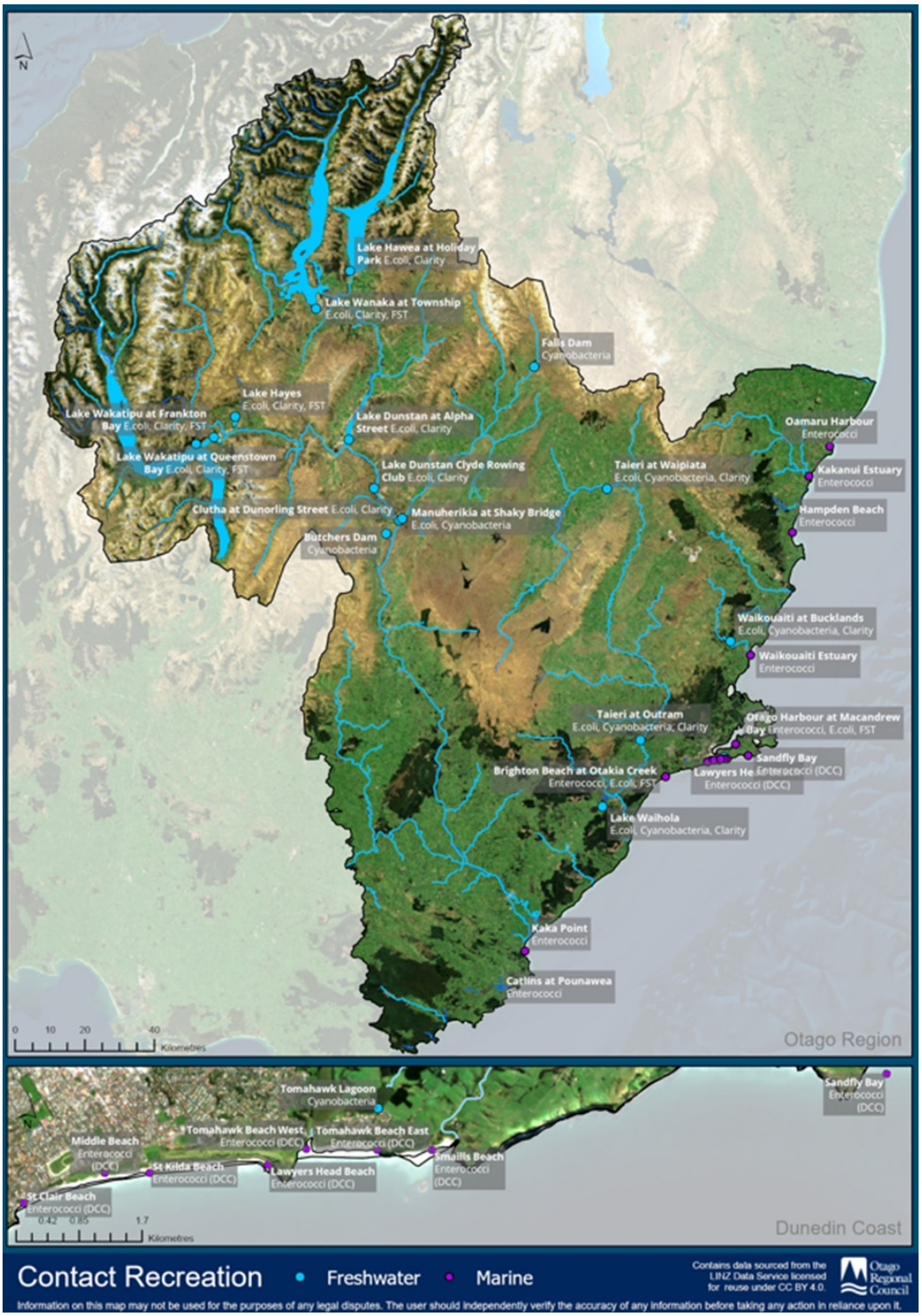

Figure 4 Map of contact recreation sites monitored for microbiological water quality (E. coli and Enterococci) and cyanobacteria in Otago.

MICROBIOLOGICAL MONITORING

[18] Weekly water quality sampling of recreational sites in the 2021/22 season began on 7 December 2021 and ran through until the end of March 2021. Twenty-nine sites were monitored for indicator bacteria.

[19] The water samples taken at Otago's contact recreation sites are tested for *Escherichia coli (E. coli)* in freshwater and enterococci in marine waters. These bacteria are used as indicators for other harmful pathogens.

[20] Results from sampling were compared against the National Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas (MfE/MoH, 2003) to assess the health risk for swimming. If faecal indicator bacteria concentrations exceeded the human health guidelines (MfE/MoH, 2023), results were shared with the SDHB and TAs and communicated to the public.

[21] LAWA reports the water quality results on their website, which is updated daily during summer with the latest risk assessment and the test data for swimming spots across New Zealand.

[22] The LAWA website shows weekly risk results (Figure 5) and a long-term grade for each swimming site (Figure 6). The weekly 'risk' categories are: 'generally suitable for swimming' (green - low infection risk); 'caution advised' (amber - moderate infection risk); and 'not suitable for swimming' (red - high infection risk). The four long term 'risk' grades are calculated using 95th percentile *E. coli* and enterococci values obtained over the last five years of monitoring.

Mode	Trigger level		Management response
	Beach: Enterococci / 100mL	**River/Lake: *E. coli*/100 mL**	
Surveillance	Equal to or less than 140 Enterococci / 100 mL	Equal to or less than 260 *E. coli* / 100 mL	Routine monitoring.
Alert	More than 140 Enterococci / 100 mL	More than 260 *E. coli* / 100 mL	Increase monitoring and investigate source.
Action	More than 280 Enterococci / 100 mL	More than 550 *E. coli* / 100 mL	Public warnings if required, increased monitoring and investigation of contaminant source.

Figure 5 Water quality guideline values and indicator organisms used to assess marine and freshwater recreational areas (MfE and MoH, 2003).

Long-term grade	Coastal beach sites	River and Lake sites
Excellent	95th percentile value of Enterococci / 100ml: 0 – 40 Description of risk: Risk of illness is less than 1% from contact with the water during the summer bathing period.	95th percentile value of *E. coli* /100ml: 0 – 130 Description of risk: Estimated risk of *Campylobacter* infection has a < 0.1% occurrence, 95% of the time.
Good	95th percentile value of Enterococci / 100ml: >40 – 200 Description of risk: Risk of illness is less than 5% from contact with the water during the summer bathing period.	95th percentile value of *E. coli* /100ml: >130 – 260 Description of risk: Estimated risk of *Campylobacter* infection has a 0.1 – 1.0% occurrence, 95% of the time.
Fair	95th percentile value of Enterococci / 100ml: >200-500 Description of risk: Risk of illness is between 5 and 10% from contact with the water during the summer bathing period.	95th percentile value of *E. coli* /100ml: >260 – 540 Description of risk: Estimated risk of *Campylobacter* infection has a 1 - 5% occurrence, 95% of the time.
Poor	95th percentile value of Enterococci / 100ml: > 500 Description of risk: Risk of illness is more than 10% from contact with the water during the summer bathing period.	95th percentile value of *E. coli* /100ml: > 540 Description of risk: Estimated risk of *Campylobacter* infection has >5% occurrence, at least 5% of the time

Figure 6 The long-term grade determines whether a site overall is excellent, good, fair, or poor for swimming over the recreational bathing season

CYANOBACTERIA MONITORING

[23] Cyanobacteria in rivers and lakes can pose a risk to human and animal health because it can produce cyanotoxins. In lakes, cyanobacterial species tend to float in the water (planktonic). In rivers, cyanobacterial species form dense mats on the riverbed (benthic).

[24] The New Zealand Guidelines for Cyanobacteria in Recreational Fresh Waters: Interim Guidelines[5] (MfE & MoH, 2009) contain suggested methods for monitoring and responding to benthic and planktonic cyanobacteria in streams, rivers, and lakes. The guidelines cover the health risks for swimming in recreational waters containing cyanobacteria, but not the risks for drinking water. The guidelines also do not address the health risks that cyanobacteria have for animals (*i.e.,* dogs or livestock) that contact or ingest water containing cyanobacteria.

[25] The ORC cyanobacteria monitoring and response methods for Otago follow the MfE/MoH (2009) guidelines (Figure 7 and Figure 8). They were developed in collaboration with ORC, SDHB and TAs.

[26] The ORC undertook weekly visual surveillance for potentially toxic benthic cyanobacteria growth at the four freshwater contact recreation sites (Figure 4). Planktonic

[5] https://environment.govt.nz/publications/new-zealand-guidelines-for-cyanobacteria-in-recreational-fresh-waters-interim-guidelines/

cyanobacteria was routinely monitored at five lake sites; Lake Waihola, Lake Hayes, Falls Dam, Tomahawk Lagoon and Butchers Dam (Figure 1).

[27] Other sites were also tested for cyanobacteria when unexpected seasonal blooms occurred, or when ORC staff became aware of potential blooms either through public notification or visual surveillance.

Alert level	**Actions** (See section 2.4 for the recommended framework for roles and responsibilities relating to actions, and the text box at the beginning of Section 3 for advice on interpreting the guidance in this table.)
Surveillance (green mode) *Situation 1:* The cell concentration of total cyanobacteria does not exceed 500 cells/mL.[a] *Situation 2:* The biovolume equivalent for the combined total of all cyanobacteria does not exceed 0.5 mm^3/L.	• Undertake weekly or fortnightly visual inspection[b] and sampling of water bodies where cyanobacteria are known to proliferate between spring and autumn.
Alert (amber mode) *Situation 1:* Biovolume equivalent of 0.5 to < 1.8 mm^3/L of potentially toxic cyanobacteria (see Tables 1 and 2); **or** *Situation 2*[c]*:* 0.5 to < 10 mm^3/L total biovolume of all cyanobacterial material.	• Increase sampling frequency to at least weekly.[d] • Notify the public health unit. • Multiple sites should be inspected and sampled.
Action (red mode) *Situation 1:* ≥ 12 µg/L total microcystins; **or** biovolume equivalent of ≥ 1.8 mm^3/L of potentially toxic cyanobacteria (see Tables 1 and 2); **or** *Situation 2*[c]*:* ≥ 10 mm^3/L total biovolume of all cyanobacterial material; **or** *Situation 3*[e]*:* cyanobacterial scums consistently present.	• Continue monitoring as for alert (amber mode).[d] • If potentially toxic taxa are present (see Table 1), then consider testing samples for cyanotoxins.[f] • Notify the public of a potential risk to health.

Figure 7 Alert-level framework for planktonic cyanobacteria (MfE, 2009)

Alert level[a]	Actions (See section 2.4 for the recommended framework for roles and responsibilities relating to actions, and the text box at the beginning of Section 3 for advice on interpreting the guidance in this table.)
Surveillance (green mode) Up to 20% coverage[b] of potentially toxigenic cyanobacteria (see Table 1) attached to substrate.	• Undertake fortnightly surveys between spring and autumn at representative locations in the water body where known mat proliferations occur and where there is recreational use.
Alert (amber mode) 20–50% coverage of potentially toxigenic cyanobacteria (see Table 1) attached to substrate.	• Notify the public health unit. • Increase sampling to weekly. • Recommend erecting an information sign that provides the public with information on the appearance of mats and the potential risks. • Consider increasing the number of survey sites to enable risks to recreational users to be more accurately assessed. • If toxigenic cyanobacteria (see Table 2) dominate the samples, testing for cyanotoxins is advised. If cyanotoxins are detected in mats or water samples, consult the testing laboratory to determine if levels are hazardous.
Action (red mode) *Situation 1:* Greater than 50% coverage of potentially toxigenic cyanobacteria (see Table 1) attached to substrate; **or** *Situation 2:* up to 50% where potentially toxigenic cyanobacteria are visibly detaching from the substrate, accumulating as scums along the river's edge or becoming exposed on the river's edge as the river level drops.	• Immediately notify the public health unit. • If potentially toxic taxa are present (see Table 2) then consider testing samples for cyanotoxins.. • Notify the public of the potential risk to health.

Figure 8 Alert-level framework for benthic cyanobacteria (MfE, 2009)

WATER QUALITY MONITORING RESULTS

[28] Table 1 and Table 2 show the LAWA results for ORC's recreational monitoring sites. Results are displayed as the percentage of the time results comply with each different category for the weekly results (2021/22) and the long-term grade (2016-2021). Table 3 shows the weekly results.

[29] Most of Otago's freshwater sites have a 'poor' long term grade. Only Lake Hawea has an 'excellent' long term grade and Lake Wakatipu at Frankton Bay has a 'fair' long term grade. Three sites - Lake Dunstan at Alpha Street, Lake Dunstan at Clyde and Clutha at Dunorling Street have not been monitored for long enough to have a long-term grade.

[30] The criterium for awarding a 'poor' long term grade is based on the 95th percentile of *E. coli*/100mL exceeding 540/100mL. Only a small number of elevated samples will place the site into the 'poor' long term grade category. An example is Wakatipu at Queenstown Bay (Figure 9) which has a 'poor' long term grade, although, in the last five years only 8% (four of 51 samples) exceeded 540 *E. coli*/100mL. Otokia Creek at Brighton is placed in the same category although 24% (21 of the 88 samples) exceeded 540 *E. coli*/100mL.

Figure 9 Lake Wakatipu at Queenstown Bay. Sample results from last five years.

[31] During the 2021-2022 season, five sites had an 'unsuitable for swimming' status on at least one occasion - Lake Dunstan at Alpha Street, Lake Hawea at Holiday Park, Manuherekia at Shaky Bridge, Taieri at Outram, Taieri at Waipiata and Waikouaiti at Bucklands (Table 1).

[32] Table 1 also compares each site to Table 22 of the NPSFM, 2020. The sites are compared to the estimated risk of Campylobacter infection. If the site is classified as 'excellent', the risk of campylobacter infection is <0.1% occurrence, 95% of the time. Seven sites received an 'excellent.' One site was classified as 'good' (0.1 – 1.0% occurrence, 95% of the time), three sites as 'fair' (1-5% occurrence, 95% of the time) and two sites were classified as being below the national bottom line or 'poor' (> 5% occurrence, at least 5% of the time).

Table 1 Results from freshwater contact recreation sampling December 2021 to March 2022. 'Suitable for swimming' shows water quality is good and risk to health is low (E. coli <260 cfu/100ml), 'caution advised' indicates the health risk has increased (E. coli 260-550 cfu/100ml) and 'unsuitable for swimming' indicates an unacceptable health risk (E. coli >550cfu/100ml). The long-term grade is taken from five years of results and reported on LAWA. The NPSFM grade is a 95th percentile of results taken over the contact recreation season.

	Weekly results (E.coli 2021-2022			Five-year results (E.coli 2016-2021)			LAWA	NPSFM Table 22
Freshwater sites	Suitable for Swimming (%)	Caution advised (%)	Unsuitable for Swimming (%)	Suitable for Swimming (%)	Caution advised (%)	Unsuitable for Swimming (%)	Long Term Grade	2021-2022 Grade
Clutha at Dunorling Street	100	0	0	ns	ns	ns	None	Excellent
Lake Dunstan at Alpha Street	94	0	6	94	0	6	None	Fair
Lake Dunstan at Clyde Rowing Club	100	0	0	100	0	0	None	Excellent
Lake Hawea at Holiday Park	94	0	6	99	0	1	Excellent	Good
Lake Hayes (Shallows)	100	0	0	88	6	6	Poor	Excellent
Lake Waihola at Jetty	100	0	0	96	2	3	Good	Excellent
Lake Wakatipu at Frankton Bay	100	0	0	95	2	3	Fair	Excellent
Lake Wakatipu at Queenstown Bay	100	0	0	88	6	6	Poor	Excellent
Lake Wanaka at Roys Bay	100	0	0	98	1	1	Good	Excellent
Manuherikia River at Shaky Bridge	76	18	6	75	18	7	Poor	fair
Taieri River at Outram Glen	75	6	19	81	11	7	Poor	Poor
Taieri River at Waipiata	75	12	12	74	17	9	Poor	Poor
Waikouaiti at Bucklands	80	13	7	87	7	5	Poor	fair

Table 2 Results from coastal contact recreation sampling December 2021 to March 2022. 'Suitable for swimming' shows water quality is good and risk to health is low (Enterococci <140 cfu/100ml), 'caution advised' indicates the health risk has increased (Enterococci* 140-280 *cfu/100ml) and 'unsuitable for swimming' indicates an unacceptable health risk (*Enterococci *>280 cfu/100ml)

	Weekly results (Enterococci) 2021-2022			Five year (Enterococci) 2016-2021			
Coastal sites	Suitable for Swimming (%)	Caution Advised (%)	Unsuitable for Swimming (%)	Suitable for Swimming (%)	Caution Advised (%)	Unsuitable for Swimming (%)	Long Term Grade
Brighton Beach at Otakia Creek	75	6	19	73	8	20	Poor
Catlins at Pounawea	100	0	0	96	2	2	Fair
Hampden Beach	87	7	7	94	4	2	Good
Kaka Point	100	0	0	99	0	1	Excellent
Kakanui Estuary	80	7	13	81	10	10	Poor
Lawyers Head Beach	88	0	12	94	1	5	Good
Middle Beach	100	0	0	96	1	2	Good
Oamaru Harbour	100	0	0	ns	ns	ns	None
Otago Harbour at Macandrew Bay	100	0	0	90	4	6	Fair
Sandfly Bay	100	0	0	98	2		Good
Smaills Beach	95	5	0	96	1	2	Good
St Clair Beach	91	5	5	97	2	1	Good
St Kilda Beach	100	0	0	99		1	Good
Tomahawk Beach East	100	0	0	95	1	4	Fair
Tomahawk Beach West	96	0	4	94	2	4	Fair
Waikouaiti Estuary	94	6	0	95	3	2	Good

[33] Most of Otago's coastal sites have a 'fair' or 'good' long term grade, with only Kaka Point having an 'excellent' long term grade. Otokia Creek and Kakanui Estuary have a 'poor' grade.

[34] Six coastal sites had an 'unsuitable for swimming' status on at least one occasion during the 2021/22 season; Brighton Beach at Otokia Creek, Hampden Beach, Kakanui Estuary, Lawyers Head Beach, St Clair Beach, Tomahawk Beach West, Otokia Creek and St Kilda Beach. An additional two sites had a 'caution advised' status on at least one occasion, being Smaills Beach and Waikouaiti Estuary.

[35] Appendix 1 shows water quality results for the 2021/22 season across both coastal and freshwater sites. Of the 464 samples taken, the 'unsuitable for swimming' category was met on 20 occasions, and the 'caution advised' category was met on 10 occasions.

FAECAL SOURCE TRACKING

[36] Faecal source tracking was undertaken on samples that had elevated concentrations of bacteria when environmental conditions were stable (river flows were low with no

recent rainfall). This occurred on three occasions at Otokia Creek and once at Manuherekia at Shaky Bridge.

Table 3 Results from faecal source tracking undertaken between December 2021 to March 2022.

Sample Date	Description	BacR by ddPCR	DG72 by ddPCR	GFD by ddPCR	Gull4 by ddPCR	HF183 by ddPCR	HumM2 by ddPCR
		Ruminant	Canine	Avian	Gull	Human	Human
		copies/100mL	copies/100mL	copies/100mL	copies/100mL	copies/100mL	copies/100mL
2022-01-05	Otokia at Brighton	<180	<180	680	830	<180	<180
2022-01-10	Otokia at Brighton	<180	<180	820	1400	<180	<180
2022-01-24	Otokia Creek at Brighton Rd	<180	<180	460	2700	440	220
2022-03-07	Manuherikia at Shaky Bridge	3800	<180	310	<180	<180	<180

[37] The FST DNA tests are strongly associated with but not exclusive to the species tested for, with the tests having some non-specificity. The levels of the different species DNA markers within the same sample cannot be compared. However, levels of the same marker in different samples can be compared. Both human markers are required to be present for a positive human result.

[38] The results from FST are shown in Table 3. Many results were below the detection limit (<180 copies/100mL). The bacterial contamination at Manuherekia at Shaky Bridge had an avian and ruminant source. The FST completed on Otokia Creek (three separate occasions) had an avian and gull source determined on every occasion and a human source on one occasion.

CYANOBACTERIA RESULTS

[39] Results from planktonic cyanobacteria tests in lakes during the 2021-2022 summer are summarised below and use the MfE 2009 reporting framework (Figure 6).

- Lake Hayes, Tomahawk Lagoon and Falls Dam did not have a cyanobacteria bloom.
- At Lake Waihola, *Anabaena lemmermani* was present most of the summer. The alert (amber mode) was reached on 13 December 2021 with a biovolume of 0.91 mm^3/L. The bloom remained and the action (red mode) was reached on 31 January 2022 which resulted in warning signs being erected at the site (Figure 9). The bloom had subsided after 8 February 2022, and no further 'alert' levels occurred at Lake Waihola for the remainder of the season.
- At Butchers Dam a bloom of *Anabaena lemmermanii* appeared suddenly after a few weeks of no visual algae. On 19 January 2022 the 'action' (red mode) was reached with a biovolume of 1.76 mm3/L which resulted in signs being erected (Figure 9). The bloom had subsided by 25 January.
- In May 2021 (outside of the contact recreation season) a cyanobacteria bloom occurred on Pinders Pond, Roxburgh. Warning signs were installed.

Figure 9 ***Benthic cyanobacteria warning sign on left, planktonic cyanobacteria warning sign on right***

[40] Results from benthic cyanobacteria testing in rivers and streams during the 2021/22 summer are assessed against the MfE 2009 reporting framework (Figure 7).

- None of the rivers regularly monitored for benthic algae cover (%) had a benthic algae bloom.
- In November 2021, the Environmental Monitoring Team noticed three instances of benthic cyanobacterial blooms when carrying out State of Environment water quality monitoring. The blooms were at Silverstream at Riccarton Road, Manuherekia at Ophir, and the Waianakarua North Branch at SH1. As the blooms were at 'action' level with >50% cover of cyanobacteria, signs were installed (Figure 9).

DISCUSSION

[41] Pre-season collaboration between ORC, ES, SDHB and TAs ensured consistency across the SDHB region for contact recreation monitoring, reporting and compliance with the NPSFM 2020. The procedures for ORC were the same as the 2020/21 season with the addition of a monitoring site at 'Clutha at Dunorling Street', a popular swimming spot in Alexandra.

[42] Otago experienced heavy rainfall before the samples were taken on 6 December which was the likely cause of the elevated bacteria concentrations at many sites (Table 3).

Heavy rainfall adversely affects water quality, as noted by LAWA - *'quality at many river and beach swimming spots is affected in wet weather because of urban or rural runoff'*[6].

[43] In the LAWA reporting framework, the long-term grades for contact recreation sites are assessed on the 95th percentile of results over five years. This statistical method means that a site may obtain a 'poor' long term grade category when only a handful few of the samples taken over five years are elevated above 540 *E. coli*/100mL.

[44] A site might be graded as 'excellent' over a single season but have a long-term grade of 'poor'.

[45] Results from the 2021-2022 season were compared to Table 22 of the NPSFM, 2020. Seven of the 13 freshwater sites monitored were classified as 'excellent', one site was classified as 'good', two sites were classified as 'fair', and two sites were classified as being below the national bottom line or 'poor'.

[46] FST indicated that avian bacterial DNA was present in all samples tested. The Manuherekia at Shaky Bridge also had a ruminant source, and at Otokia Creek, a marker for 'human' was present on one occasion. Otokia Creek had FST completed on three separate occasions.

[47] At the sites monitored for planktonic cyanobacteria, Lake Waihola had *Anabaena lemmermani* present most of the summer and Butchers Dam had a sudden, short lived bloom in mid-January. Cyanobacteria blooms in rivers and lakes cannot be predicted easily, but they are more likely after long stable spells of weather in nutrient-rich waterbodies.

CONSIDERATIONS

Strategic Framework and Policy Considerations

[48] Pinders Pond has been added to the contact recreation programme for 2022/23.

Financial Considerations

[49] The contact recreation monitoring programme is an existing and budgeted workstream.

Significance and Engagement Considerations

[50] This is not relevant for the contact monitoring programme, although staff note that the monitoring results are freely available via the LAWA website.

Legislative and Risk Considerations

[51] The contact recreating monitoring programme is consistent with relevant legislative frameworks, including the RMA and the NPSFM 2020.

Climate Change Considerations

[52] In the future sites and period of monitoring may need review and amendment as climate change considerations are factored in.

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6 https://www.lawa.org.nz/learn/factsheets/coastal-and-freshwater-recreation-monitoring/

Communications Considerations

[53] Consultation with TAs, SDHB, ES and ORC before the next season begins will start from September 2022. The communications plan is updated annually to reflect any changes in approach. The ORC Communications Team works with LAWA and other regional councils to ensure message alignment at a national level.

NEXT STEPS

[53] The contact recreation monitoring programme is an annual work programme and as such, it will recommence in December 2022.

[54] Pinders Pond will be an additional primary contact recreation site for the 2022/23 season.

ATTACHMENTS

1. Appendix 1 Weekly results from contact recreation monitoring 2021 2022 A4 [**7.1.1** - 1 page]

Appendix 1

Weekly results from contact recreation monitoring 2021-2022. Marine sites are shaded blue and results are expressed as #enterococci/100mL, all other sites are freshwater and results are expressed as #E. coli/100mL. Occassionally E.coli analysis was undertaken at marine sites the results are shown in brackets. Cells are highlighted in orange when results indicate bacterial concentrations at the 'caution advised' level, cells are highlighted in red when results indicate bacterial concentrations at the 'unsuitable for swimming' level. Cells marked with an asterisk had FST analysis undertaken.

Site	Median Flow	6-Dec-21	13-Dec-21	20-Dec-21	29/12/2021 DCC 31/12/22	5/01/2022 DCC 6/1/22	10/01/2022	17/01/2022 DCC 18/1/22	24/01/2022 DCC 27/1/22	31/01/2022 DCC 2/2/22	8/02/2022	14/02/2022	21/02/2022	28/02/2022	7/03/2022	14/03/2022	22/03/2022
Catlins at Pounawea		10	10	10	10	134	10	10	10	10	10	10	10	10	10	10	10
Clutha at Dunorling Street		9	5	5	3	4	45	4	3	1	96	3	9	7	10	2	2
Hampden Beach		281	41	10	10	10	10	6130	145	10	10	10	20	10	52	20	10
Kaka Point		10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Kakanui Estuary at Kakanui Bridge	1.29	>2140	74	73	122	86	52	20	ns	97	109	41	51	63	372	20	175
Lake Dunstan at Alpha Street		2	4	5	2	52	1	3	5	1	30	2	1203	16	16	38	1
Lake Dunstan at Clyde Rowing Club		4	11	3	1	23	1	4	12	17	17	5	6	1	19	31	1
Lake Hawea at Holiday Park		26	1	770	1	9	6	5	1	1	1	7	1	1	3	1	1
Lake Hayes (Shallows)		16	2	10	3	10	1	25	1	32	1	3	105	4	20	3	56
Lake Waihola at Jetty		61	4	12	2	6	4	16	4	17	1	1	4	11	5	18	14
Lake Wakatipu at Frankton Bay		145	1	1	19	2	1	2	1	2	26	1	1	1	1	2	19
Lake Wakatipu at Queenstown Bay		54	11	ns	3	75	23	51	12	12	14	26	10	16	46	22	5
Lake Wanaka at Roys Bay		149	4	20	1	4	2	6	6	1	13	1	1	1	23	1	6
Manuherikia River at Shaky Bridge	11.6	>2420	96	411	172	107	78	119	46	46	345	133	128	48	488*	62	67
Oamaru Harbour at Friendly Bay		52	10	<10	10	122	10	738	41	10	10	10	20	31	10	10	20
Otago Harbour at Macandrew Bay		10	10	10	10	10	20	52	20	10	10	10	10	10	41	30	10
Otokia Creek at Brighton		586 (613)	20	10	41	275*	20 (240)*	<10	373*	74	121	132	110	86	305	20	20
Pacific Ocean at Tahuna WWTP Lawyers Head Beach		10	10	20	100	20	10	110	50	600	120	10	10	10	360	10	10
Pacific Ocean at Tahuna WWTP Middle Beach		10	10	10	10	10	20	10	10	10	10	10	10	10	10	10	10
Pacific Ocean at Tahuna WWTP Sandfly Bay		10	10	10	10	20	10	10	10	10	10	10	10	10	10	10	10
Pacific Ocean at Tahuna WWTP Smaills Beach		10	10	10	10	10	10	10	10	20	600	10	10	10	10	10	10
Pacific Ocean at Tahuna WWTP St Clair Beach		50	10	10	10	170	10	10	20	600	10	10	10	10	10	10	10
Pacific Ocean at Tahuna WWTP St Kilda Beach		10	10	10	10	90	10	10	10	40	10	10	10	10	10	10	10
Pacific Ocean at Tahuna WWTP Tomahawk Beach (East)		10	10	10	10	10	10	10	10	10	60	10	10	10	10	10	10
Pacific Ocean at Tahuna WWTP Tomahawk Beach (West)		10	10	10	10	10	10	10	10	600	10	10	10	10	10	10	10
Taieri River at Outram Glen	15.86	579	93	921	1553	52	111	54	64	22	488	115	37	28	35	12	11
Taieri River at Waipiata	6.02	2420	228	816	921	123	44	43	41	101	435	119	276	225	91	61	48
Waikouaiti at Bucklands	1.34	>2420	108	228	345	42	67	22	ns	23	114	37	7	10	55	17	488
Waikouaiti Estuary		171	<10	95	10	10	10	20	10	10	10	10	10	10	10	10	20

7.2. Lake Snow Report

Prepared for:	Data and Information Committee
Report No.	SPS2221
Activity:	Governance Report
Author:	Hugo Borges, Scientist
Endorsed by:	Anita Dawe, General Manager Policy and Science
Date:	30 June 2022

PURPOSE

[1] To inform and update the Council on recent Lake Snow related research in Otago and New Zealand, to present the latest lake snow monitoring data from the Otago lakes, and to outline known future Lake Snow research to better understand the diatom *Lindavia intermedia*'s ecology to best manage the algal growth in the Otago lakes and mitigate its impacts.

EXECUTIVE SUMMARY

[2] A summary of recent *L. intermedia* and lake snow research in both Otago and New Zealand is presented demonstrating what has been done by both Otago Regional Council (ORC)and other organisations.

[3] ORC's Lake snow monitoring data are reported and show the prevalence of lake snow in four Otago Lakes (Wānaka, Wakatipu (Whakatipu Waimāori), Hāwea, and Dunstan) from 2016 to date.

[4] This paper also discusses the importance of further studies to better understand the biology and ecology of L. *intermedia* for better management strategies.

RECOMMENDATION

That the Committee:

*1) **Notes** this report.*

BACKGROUND

[5] Lake snow (also known as lake snot) is the name given to material formed by clumping together of microscopic bacteria and algae with a sticky, mucus-like polysaccharide material excreted by the microalgae diatom *Lindavia intermedia* (originally identified as *Cyclotella bodanica*).

[6] Lake snow has been prevalent in Lake Wānaka since 2004, where it has caused numerous problems. These include fouling fishing gear, abandonment of commercial trout fishing operations, and blocking hot water systems, washing machines and garden irrigation systems.

[7] Since 2015, mucilage episodes of lake snow affecting angling have been reported in other large lakes in the South Island, including Lake Coleridge (Canterbury), and more recently Lakes Hāwea and Dunstan (Otago), Tekapo (Takapō) and Benmore

(Canterbury), and Rotoiti (Nelson Lakes). Lakes that are subject to lake snow occurrence tend to be oligotrophic (poor in nutrients and abundant in dissolved oxygen). The microalgae *L. intermedia* has now been found in many other lakes with different trophic levels across the country, but only six lakes reported episodes of lake snow.

[8] There is little doubt now that the microalgae *L. intermedia* is a recent introduction to New Zealand, thought to have been present since 2002. Lake snow episodes, however, are a rare phenomenon and have occurred in only a few lakes globally, such as Lake Constance (Germany, Switzerland, and Austria), Lake Kinneret (Israel), Lake Youngs (WA, USA), Lake Kastoria (Greece), and more recently in New Zealand. Thus, *L. intermedia* is still a poorly understood subject, and we are only just starting to learn about its biology and ecology.

[9] As the phenomenon has spread to other oligo- and mesotrophic lakes, more issues have been observed. Lake snow has caused problems in hydroelectricity generation infrastructure and necessitated expensive upgrades to numerous municipal water supplies to remove mucilage from their raw lake water intakes. In the Queenstown Lakes region, aquatic mucilage has also been reported to attach to boat hulls and to swimmers' bodies. While causing obvious problems for water users, the recent phenomenon of mucilage in these lakes will also have repercussions for lake food webs and lake functioning, as it does in marine systems.

[10] The Otago Regional Council (ORC) has co-funded several studies to gather initial knowledge on lake snow and proper identification of the diatom in Otago. Workshops were organised with algae and lake specialists to prioritise research on the topic.

[11] ORC hosted the first lake snow experts' workshop on lake snow on 20 December 2016, during which a research plan was developed, prioritising research needed to inform and support management of lake snow. This plan has previously been presented to Council (2017/0705, 15 March 2017; 2017/0802, 14 June 2017). A second workshop on lake snow was hosted by ORC on 8 August 2018 presented to council on 19/09/2018 (2018/1065). The primary objectives of the second workshop were to revisit the main themes from the December 2016 workshop documented in Ryder (2017) ; discuss the findings from priority work streams identified by workshop participants in December 2016; further discuss research work planned; and identify if further work is required and to identify potentially feasible methods to manage the effects of lake snow.

[12] ORC recognised the need for new research programmes to be led by the Ministry of Primary Industries and in partnership with other Regional Councils as lake snow was recognised as a national issue, however, at the time there was limited interest in collaboration from the mentioned parties.

[13] ORC has expanded its lake snow monitoring network, and we now monitor five lakes monthly (Wānaka, Wakatipu (Whakatipu Waimāori), Hāwea, Hayes (Waiwhakaata), and Dunstan) for lake snow abundance.

DISCUSSION

Recent Lake Snow research in New Zealand

[14] Recent research on lake snow in New Zealand has focused on understanding the species involved with the phenomenon, when it arrived in the country, how to best monitor and quantify it in our lakes, and the distribution of *L. intermedia*.

[15] Novis and others (2017) described and identified the species of diatom associated with lake snow events in New Zealand. Light and ultrastructural microscopic studies of New Zealand populations, DNA sequencing and *comparison with published descriptions identified the species causing lake snow as L*. intermedia (Figure 1), part of the 'bodanicoid' complex.

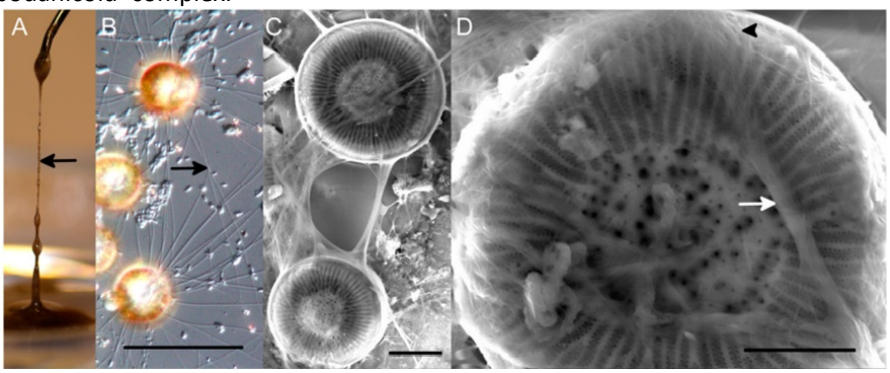

Figure 1 - Production of mucilage (extracellular polymeric substance - EPS) by *L. intermedia* from New Zealand. (Figure extracted from Novis *et al*., 2017)

[16] Novis and others prepared a report for ORC in 2017 to determine the origin of the New Zealand *L. intermedia* using molecular and morphological methods looking at the relationships between New Zealand, North American, and European populations. Specimens from Lake Youngs (USA) and all the New Zealand lakes tested were identical, both genetically and morphologically. Specimens from Cultus Lake (Canada) were distinct genetically according to all markers and were slightly different according to morphological data. The Lake Geneva (Switzerland) sample was the least similar to the New Zealand material. These observations represent a strong circumstantial case for transfer of *L. intermedia* to New Zealand from the Northern Hemisphere, particularly North America.

[17] In 2018, Schallenberg and Novis, prepared a thorough lake snow literature review based on international published literature to improve our knowledge. They looked at the shifts in lake phytoplankton community composition to dominance in lakes by centric diatoms like Lindavia and polysaccharide (mucilage) overproduction. For example, review of the climate connection to these phytoplankton shifts. Their review also summarised how lake/marine snow has been quantified in situ and in the lab; whether there are likely to be human health and ecological impacts of lake snow; and what is known of inter-lake dispersal mechanisms of diatoms.

[18] In 2018 the ORC commissioned NIWA to look at archived samples (freshwater, preserved slides, and collection of algae) from New Zealand lakes to try to confirm the time of the introduction of *L. intermedia* into New Zealand. NIWA's examination of 75 samples between 1970 to 2018 provided further evidence that *L. intermedia* is a recently introduced species in New Zealand. The earliest records of *L. intermedia* in New Zealand lakes were two samples collected in 2002 from Lakes Hayes (Waiwhakaata) and Aviemore. By 2005, *L. intermedia* was already widespread in New Zealand and present in

the outlets of nine lakes with a broad geographical spread, from Lake Moawhango (North Island) to Lake Gunn (South Island; Figure 2).

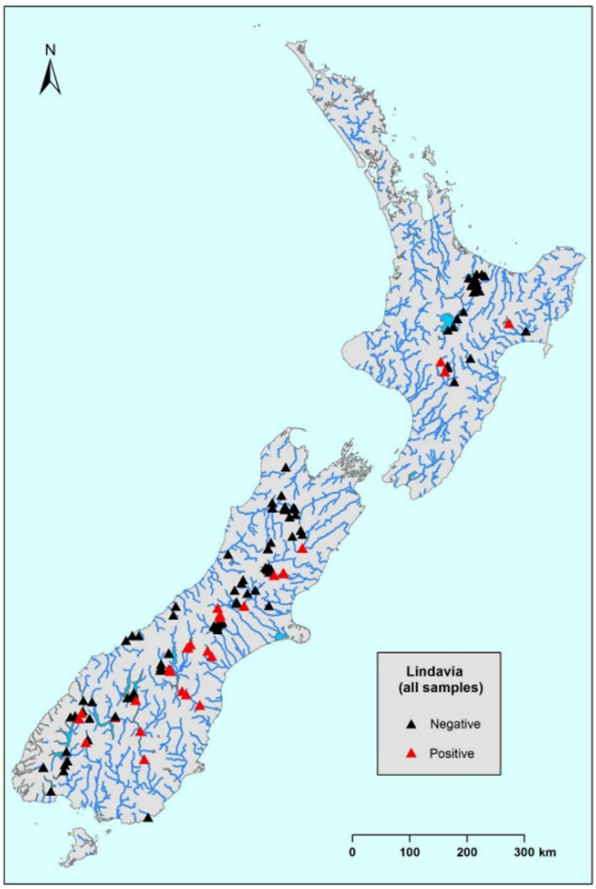

Figure 2 - Map showing locations of all samples that was positive/negative for the presence of *L. intermedia* from the NIWA collection between 1998 and 2018 (Figure extracted from Kilroy *et al*., 2018).

[19] In 2020, Novis and others looked at specific characteristics of the lake snow mucilage to understand its composition. They developed a molecular method to estimate *Lindavia* cell concentration and gene expression related to the production of mucilage. Their research confirmed that the fibres of lake snow are composed of chitin, and they identified two chitin genes (chs1 and 2) from *L. intermedia*. The results showed that *L. intermedia* abundance is always high when lake snow occurs, however when *L. intermedia* is abundant, lake snow is not always present. This suggests that chitin production is not always essential for *L. intermedia*. The result is consistent with the available data for chs2 gene expression (the gene involved with chitin production), showing higher transcription when lake snow is abundant. Lake snow production by *L. intermedia* therefore must be caused by something unrelated to its abundance

[20] Kilroy and others (2021) combined the *L. intermedia* distribution data from various sources with an existing dataset of environmental variables linked to ~ 3800 New Zealand lakes (area > 1 ha). They used a modelling approach based on the presence of the diatom and road access to lakes to describe the environmental niche occupied by *L. intermedia* and predict its potential distribution. The study showed that South Island lakes are more vulnerable to *L. intermedia*, highlighting that many additional South

Island lakes may be environmentally suitable for *L. intermedia*. Lakes with the highest probabilities occurred along the entire length of the South Island, and towards the east coast in Otago (Figure 3). The dataset and models thus indicated that humans are important (but not the only) vectors of this diatom within New Zealand. This finding emphasises the critical role of New Zealand biosecurity policy for reducing the spread of freshwater pests.

[21] Novis and others (2021) investigated ways to estimate mucilage concentration in lake water. The study goal was to develop a new method to quantify lake snow polysaccharide in lake water. The new method was compared to the current semiquantitative method (snow tows) currently used by regional councils to monitor presence and abundance of mucilage via dry weight. They adapted a chemical analysis method to measure chitin in lake snow so they could test the effectiveness of the new method. The new sampling method in this study used a submersible pump with a mesh to filter lake snow. The study found a correlation between snow tows and pump filtration data. In principle, the snow tow method (used by municipal authorities) could be calibrated and made quantifiable using the filtration method. The study also found that the amount and the adhesiveness of lake snow are key factors in its nuisance value and fouling characteristics, and suggested consideration be given to developing measures to prevent its spread.

[22] More recently, Schellenberg et al. (2022) studied patterns of pelagic mucilage biomass and chitin production by *L. intermedia* in four lakes in the South Island of New Zealand. They analysed seasonal variation and inter-lake differences in mucilage abundance as well as physico-chemical correlations and potential drivers of mucilage abundance in the lakes. They demonstrated that lake snow occurrences were episodic and did not have a consistent pattern in four study lakes. This finding is consistent with numerous studies of marine and lake mucilage events reported elsewhere. In two lakes, periods of high mucilage abundance were associated with low nitrate concentrations in lake waters. Thus, as chitin contains nitrogen, mucilage production probably contributes to nitrate depletion. Phosphorus concentrations in the study lakes were often near or below analytical detection limits, limiting the researchers' ability to study links between phosphorus availability and mucilage abundance.

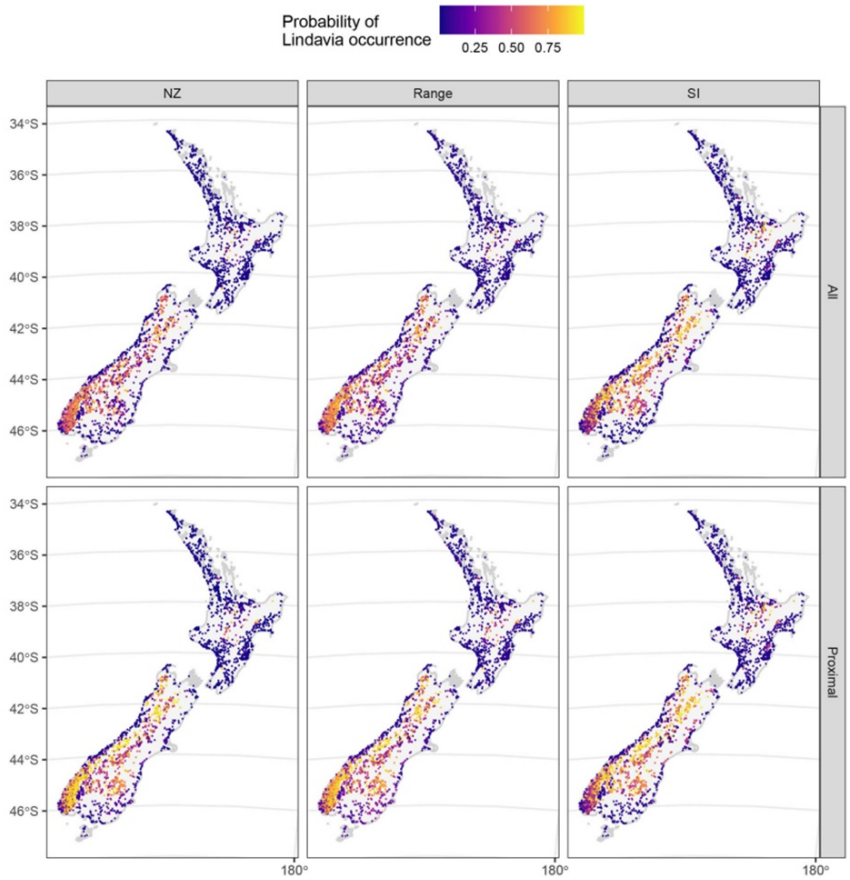

Figure 3 - Probability of presence of *L. intermedia* in New Zealand lakes predicted from six variants of a model showing different scenarios (Figure extracted from Kilroy *et al*., 2021).

Results from lake snow monitoring in Otago

[23] Snow tows were collected monthly on Otago Lakes from November 2016 to April 2022 on the open water sites and quarterly on the north sites (sites sampled on the northern part of the lake used for comparison of in-lake variation on the parameters monitored). The samples were collected by dragging a weighted fishing line approximately 90 m long through Lakes Wānaka, Wakatipu (Whakatipu Waimāori), Hāwea, and 15 m through Hayes and Dunstan (May 2019 to April 2022), at around 4 km per hour for approximately 1 km.

[24] Peaks of lake snow were most common in summer and autumn, but lake snow abundance also peaked in spring and in winter (Figure 4). Only Lake Wānaka showed some consistency seasonally, peaking on or around summer and low abundances over winter. Lake Dunstan presented the lowest abundance of lake snow among the other lakes. Lake Hayes (Waiwhakaata) had no lake snow during the studied period, and this has been related to the trophic level of the lake as Lake Hayes is classified as eutrophic (nutrient enriched).

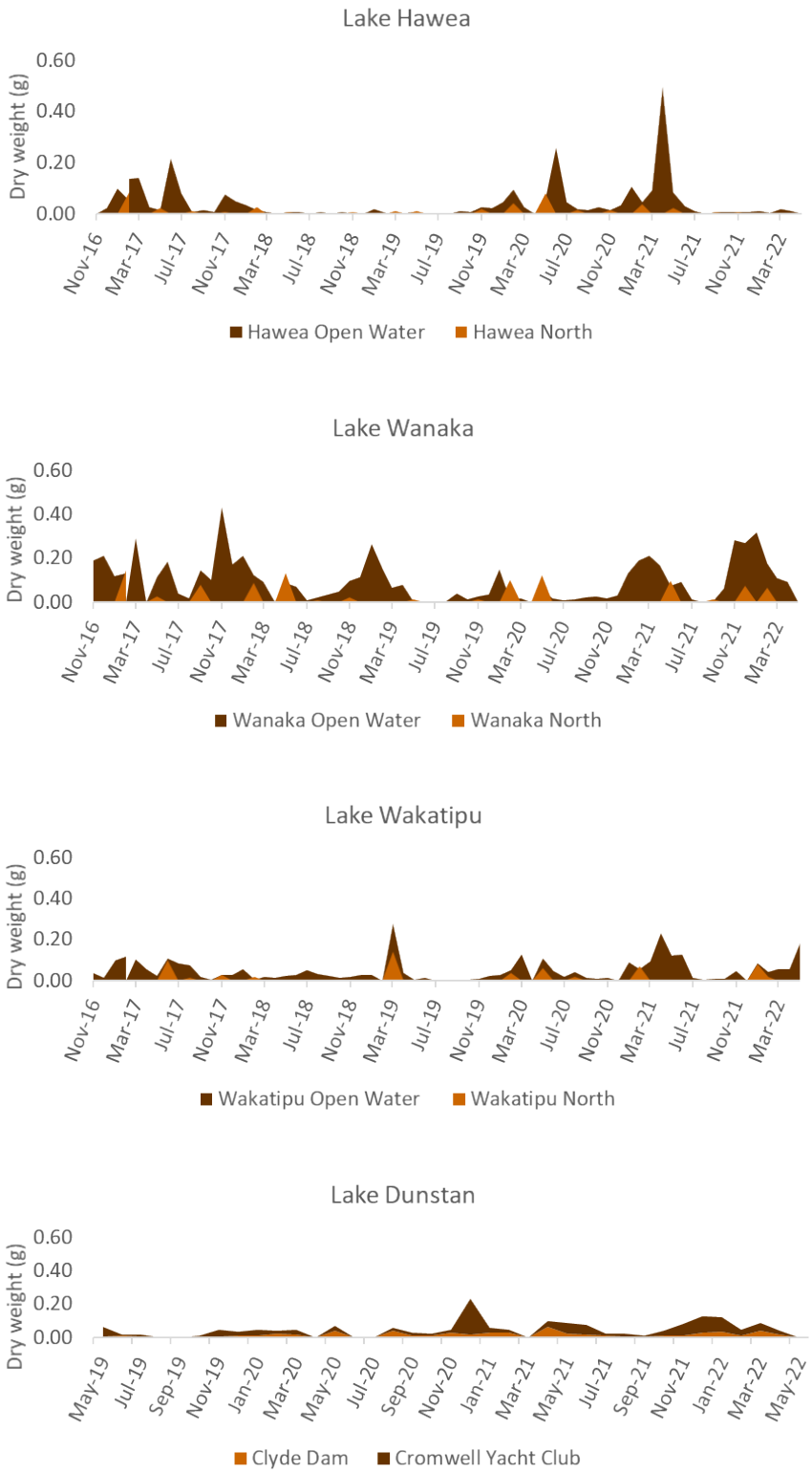

Figure 4 – Interannual and seasonal variation in mucilage abundance (lake snow) of Lakes Hāwea, Wānaka, Wakatipu from Nov 2016 to Apr 2022, and Dunstan from May 2019 to Apr 2022**.**

[25] Schallenberg et al. (2022) examined ORC's Lake snow dataset for Lakes Wānaka, Wakatipu (Whakatipu Waimāori) and Hāwea open water sites and observed a negative relationship between mucilage abundance and nitrate concentrations, suggesting the mucilage production probably contributes to nitrate depletion. They also looked at chlorophyl-a and mucilage and chitin abundance relationships but found little association in the three lakes.

[26] Their analysis revealed a chlorophyll-a time series which indicated increasing trends in phytoplankton biomass in Lakes Wānaka, Wakatipu (Whakatipu Waimāori), and Hāwea (Figure 5). These trends were not captured in our last State of the Environment report – Water Quality (2020) because of the data period analysed. These results highlight the stress these lakes are under and the need to better understand these environments for better management.

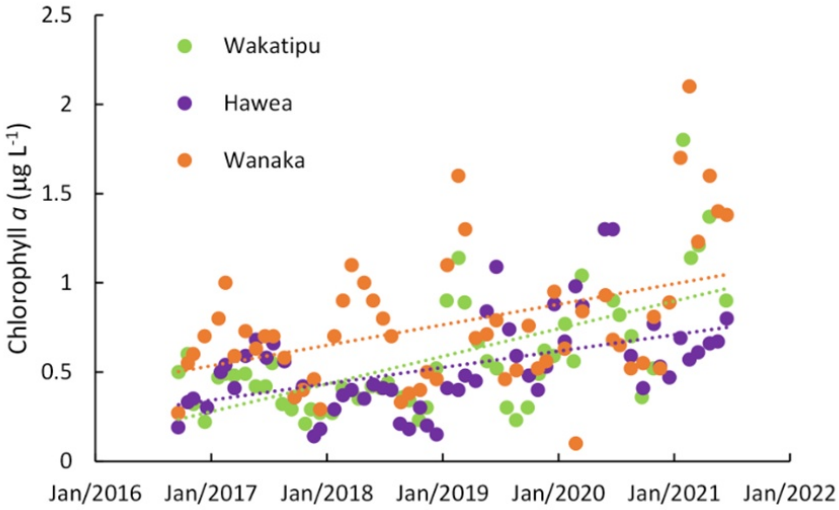

Figure 5 – Chlorophyll-a concentrations at 10m depth in the open water sites of Lakes Wakatipu, Hāwea, and Wānaka from 2016 to 2022(Figure extracted from Schallenberg *et al*., 2022).

Final considerations

[27] Early this year, a group of scientists, from New Zealand and abroad and including the support/collaboration of the ORC and local community groups, submitted a research proposal to the 2022 Endeavour Fund - Research Programmes (a Ministry of Business, Innovation and Employment fund). The proposal was entitled "Science for Safeguarding New Zealand's Great Lakes from Anthropogenic Pressures" and aimed to create new knowledge and new management pathways to safeguard the large iconic lakes of Otago (Lakes Wānaka, Wakatipu, and Hāwea). Although the proposal focused on the Otago Great Lakes, it would have significant transferability to other New Zealand Great Lakes.

[28] The main goals of the research programme were studying the impacts of invasive species, and nutrient availability; to discover how our changing climate is affecting the Otago Great Lakes, both in terms of the thermal stratification of water masses in the lakes, and in terms of these thermal impacts on lake water quality, productivity, and the flow of energy through the lake food webs up to native and sports fish. The programme also proposed to develop novel technologies for early warning monitoring of changes to

lakes' condition and functioning. This includes new molecular markers and the use of satellite imagery. This research expands on work already done with diverse stakeholders using a decision support system based on multi-criteria decision analysis to collaboratively develop lake attributes and set limits on these to ensure the values of the lakes are safeguarded.

[29] Unfortunately, the proposal was unsuccessful in the first selection round. This was a great opportunity to improve our knowledge of the Otago Great Lakes and understand what pressures our lakes are under from different perspectives. Some of the new research proposed included the study of *L. intermedia* which would have led to a greater understanding of lake snow ecology and interactions in the Otago Lakes ecosystems. There may be opportunities for the ORC to collaborate with other organisations and pursue other avenues to fund some of this important research.

[30] Although we have made some progress in identifying and understanding the initial story of *L. intermedia* in New Zealand, we still need to learn more about its ecological requirements and role in the New Zealand lakes environment to be able to create management strategies. Thus, supporting and attracting further research to our Otago Lakes is essential.

CONSIDERATIONS

Strategic Framework and Policy Considerations

[31] Understanding the factors that contribute to lake snow will enable us to monitor and develop strategies to minimise the incidence of its occurrence and enable development of interventions to better manage.

Financial Considerations

[32] No further lake snow research is specifically funded in Long Term Plan budgets.

Significance and Engagement Considerations

[33] There are no relevant significance and engagement considerations as a result of this paper. It is worth noting however that incidences of lake snow cause concern in our community, and its presence incurs disruption and financial cost. Research to further understand the contributing factors to lake snow will enable us to monitor and develop strategies to minimise the incidence.

Legislative and Risk Considerations

[34] NA

Climate Change Considerations

[35] Understanding contributing factors to lake snow will enable us to understand what impact climate change may have on the incidence in Otago lakes.

Communications Considerations

[36] There are no specific communication considerations as a result of this paper.

NEXT STEPS

[37] ORC will investigate opportunities to collaborate with other organisations and pursue other avenues to fund some of this important research into lake snow.

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ATTACHMENTS

Nil

7.3. Queenstown and Dunedin Patronage Report

Prepared for:	Data and Information Committee
Report No.	PPT2208
Activity:	Transport: Public Passenger Transport
Author:	Julian Phillips, Implementation Lead - Transport, Gemma Wilson – Analyst Transport, Jack Cowie – Total Mobility Coordinator
Endorsed by:	Gavin Palmer, General Manager Operations
Date:	30 June 2022

PURPOSE

[1] To update the Committee on the performance of its public transport (bus and ferry) and total mobility services, for the period 1 July 2021 to 31 May 2022 of the 2021/22 financial year.

NOTE: Unless otherwise stated, all data refers to the 11-month 2021/22 Financial Year to Date (YTD), being 1 July 2021 to 31 May 2022, compared to the equivalent period in the previous Financial Year, 1 July 2020 to 31 May 2021.

EXECUTIVE SUMMARY

[2] In Dunedin, YTD 2021/22 patronage is lower, at 2,145,204 trips (-13% overall), than the YTD 2020/21 period.

[3] Fare-free travel in July and August 2020 resulted in exceptional levels of patronage during those months, returning to typical levels in September and October 2020.

[4] Comparing YTD 2021/22 with pre-COVID YTD 2018/19, patronage has decreased by 8.5%. This figure provides an indication of the impact of COVID restrictions on boardings.

[5] YTD 2021/22 fare revenue for Dunedin is significantly higher (+14%) than YTD 2020/21, despite the continuation of the $2 fare trial. This is due to fare-free travel through July and August 2020, with the Bee Card introduced in Dunedin on 1 September 2020, alongside the introduction of the $2 flat fare trial.

[6] For Queenstown YTD 2021/22, patronage is lower, at -12% overall, compared to YTD 2020/21.

[7] Fare-free travel in July and August 2020 and up to 15 September 2020 (Bee Card launch date for Queenstown) resulted in higher levels of patronage during those months than might be expected for the period, decreasing in September and October 2020.

[8] Comparing YTD 2021/22 with pre-COVID YTD 2018/19, Queenstown patronage has decreased by 47%. This figure provides an indication of the impact of COVID restrictions on boardings.

[9] From 1 March 2022 to 16 June 2022 the Dunedin network experienced an average of 45 missed trips per day across 117,427 trips.

[10] The total number of missed trips for Dunedin during these 3.5 months was 4,917, or 4.1% of trips operated. This compares with a total of 526 missed trips for the preceding 8-month period from 1 July 2021 to 28 February 2022, or 0.23% of trips operated.

[11] From 1 March 2022 to 16 June 2022 the Queenstown network experienced an average of 1.9 missed trips per day across 30,996 trips.

[12] The total number of missed trips was 209, or 0.6% of trips operated. This compares with a total of 42 missed trips for the preceding 8-month period from 1 July 2021 to 28 February 2022, or 0.06% of trips operated.

[13] As at 7 June 2022, Otago has 79,042 registered Bee Card users.

[14] 156,270 cards have been issued and distributed in Otago, which equates to more than three-quarters of the combined population of Dunedin and Queenstown.

[15] The accuracy of Real Time Tracking (RTI) has been increased with the data feed now being derived from a hierarchy of on-bus devices, with the primary source now being the Bus Driver Console (RITS ticketing device), followed by E-Road and Wi-fi hardware.

[16] The Queenstown Ferry service is also included in this report, comparing YTD 2021/22 to YTD 2020/2021. YTD fare revenue has decreased by 2% to $249,861.56. YTD patronage has increased by 15% to 53,490.

[17] For Total Mobility, there has been a decrease of 19.0% in Otago patronage for YTD 2021/22, being 100,348 passenger trips compared to 81,225 for YTD 2020/21.

RECOMMENDATION

That the Data and Information Committee:

1) ***Notes*** *this report.*

BACKGROUND

[18] The Council (ORC) contracts public transport services in Dunedin and Queenstown to two transport operators; Ritchies and Go Bus. Network coverage is shown in Figures 1 and 2 (larger versions are in Attachments).

[19] Each Transport Operator is contracted to operate 'PTOM Units' (each unit being a collection of routes contracted to an operator, as defined by the 2014 Regional Public Transport Plan. PTOM stands for Public Transport Operating Model).

[20] There are 7 Units in total, 2 in Queenstown, both operated by Ritchies; and 5 in Dunedin, operated by both Ritchies and Go Bus.

[21] As can be seen in Figure 1, the Dunedin network comprises 23 routes that extend to Palmerston in the north and Mosgiel in the west.

[22] For YTD 2021/22, the Dunedin network has carried 2,145,204 passengers. This is 13% lower than YTD 2020/21 (2,228,137) and 8.5% lower than the last pre-COVID period YTD 2018/19 (2,098,491). The LTP has a target to increase patronage for 2021/22.

[23] The Queenstown network comprises five routes that extend to Arrowtown in the east to Jack's Point in the south (see Figure 2).

[24] For YTD 2021/22, the Queenstown network has carried 713,423 passengers. This is 12% lower than YTD 2020/21 (742,949) and 46.9% lower than the last pre-COVID period YTD 2018/19 (1,225,244). As for Dunedin, the LTP has a target to increase in patronage for 2021/22.

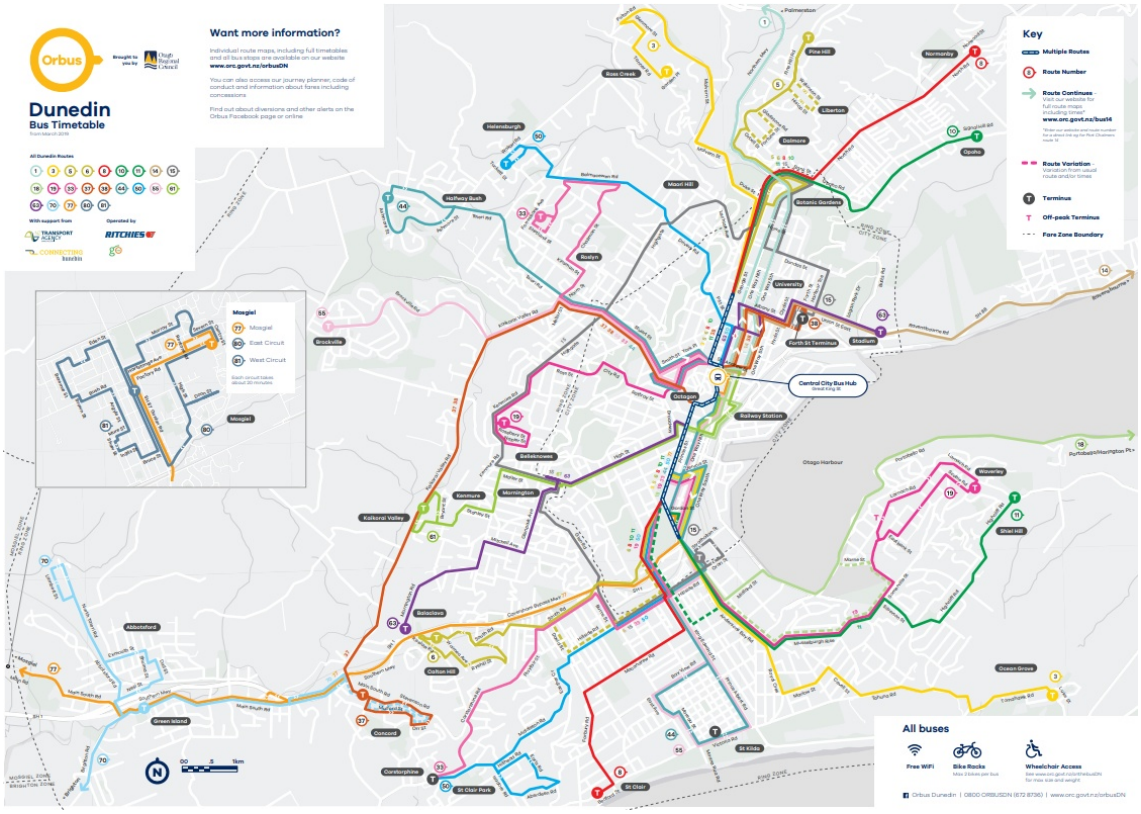


Figure 1: Dunedin network

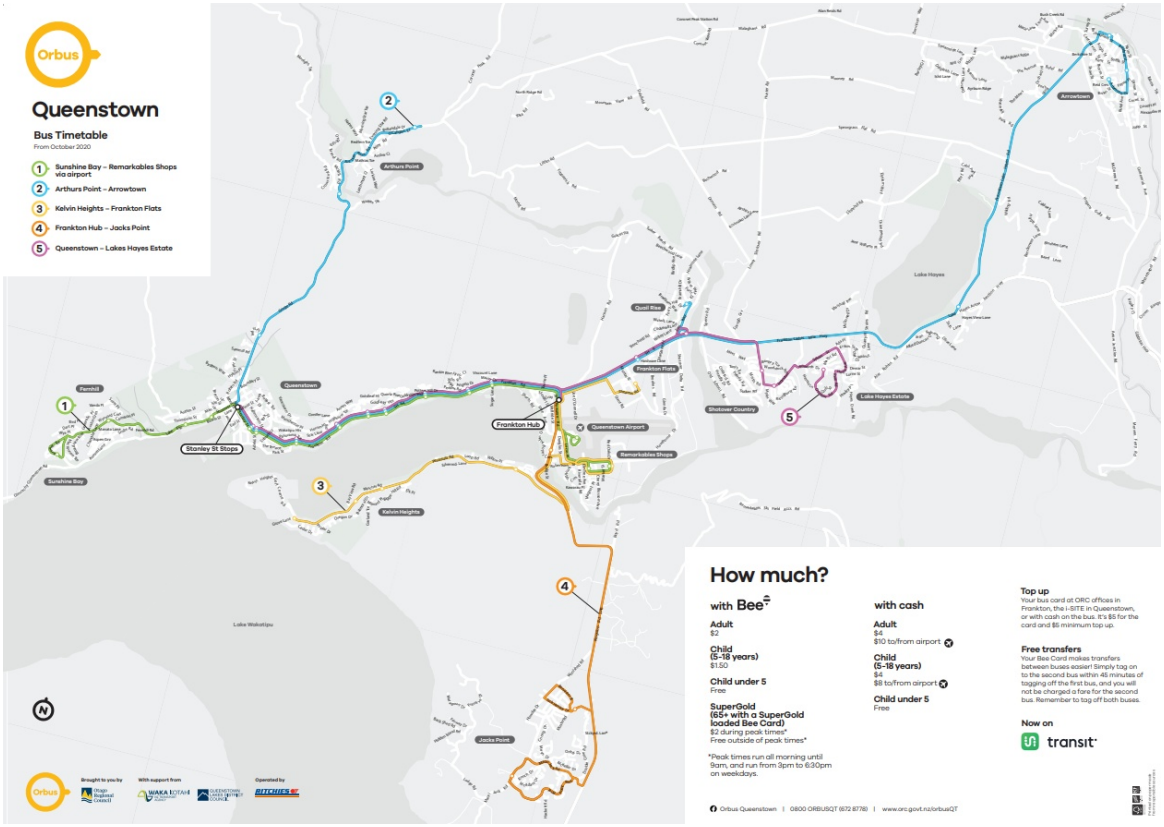


Figure 2: Queenstown network

[25] The following report summarises patronage trends across both networks, comparing the YTD 2021/22 to YTD 2020/21, with a comparison to the last pre-COVID period, which is YTD 2018/19. Monthly statistics comparing the previous years are also provided. It also addresses customer complaints and provides information on the Total Mobility scheme and use of the Real Time information system. Trip cancellation data is also reviewed, in the context of increased levels of missed trips caused by staff absence due to COVID-19 illness[1].

DISCUSSION

PUBLIC TRANSPORT – DUNEDIN

[26] In Dunedin, the impacts of COVID-19 restrictions continue to affect patronage, although it is recovering.

[27] Patronage for the months prior to November 2021 impact the overall YTD comparison. These preceding months were affected by the Level 2, 3 and 4 restrictions. Level 3 continued to 7 September 2021 and Level 2 until 1 December 2021, superseded by the COVID-19 Protection Framework which remains in place at the time of writing.

[28] For YTD 2021/22, Dunedin is tracking at 87% of when compared to YTD 2020/21, noting that in July and August 2020 travel in Dunedin was fare-free and therefore patronage was atypically higher for this reason.

[1] Missed trips are defined as where the contractor fails to operate a trip in accordance with the timetable and includes trips cancelled by the operator.

[29] Comparing YTD 2021/22 against YTD 2018/19 (the last pre-COVID-19 period), Dunedin is tracking at 91.5%. This provides an indication of the relationship between COVID restrictions and Dunedin's performance, being a comparison with a year unaffected by COVID-19 restrictions.

Dunedin	July	August	September	October	November	December	January	February	March	April	May	June	Totals
2018/19 Patronage	195,272	235,930	221,438	212,965	223,894	177,520	172,142	213,992	246,593	198,745	245,477	204,362	**2,548,330**
2019/20 Patronage	220,652	235,666	230,329	224,285	226,692	182,910	181,525	228,477	175,526	26,802	68,709	197,681	**2,199,254**
2020/21 Patronage	293,294	278,162	209,278	224,799	223,263	190,821	160,848	201,611	250,266	195,795	243,550	234,783	**2,706,470**
2021/22 Patronage	231,082	144,505	170,397	196,538	223,952	185,219	156,857	190,746	213,639	185,831	246,438		**2,145,204**

Figure 3: Dunedin patronage statistics Financial Year 2018/19 to 2021/22

[30] Increasing levels of missed trips have been experienced across the network, a nationwide issue due primarily to increased levels of driver absence caused by COVID-19.

[31] From 1 March 2022 to 16 June 2022, the Dunedin network experienced an average of 45 missed trips per day, across 117,427 trips.

[32] The total number of missed trips was 4,917, or 4.1% of trips operated. This compares with a total of 526 missed trips for the preceding 8-month period from 1 July 2021 to 28 February 2022, or 0.23% of trips operated.

[33] Figure 4 tracks daily missed trips, which trend to a peak at the end of May 2022 before trending down towards mid-June 2022.

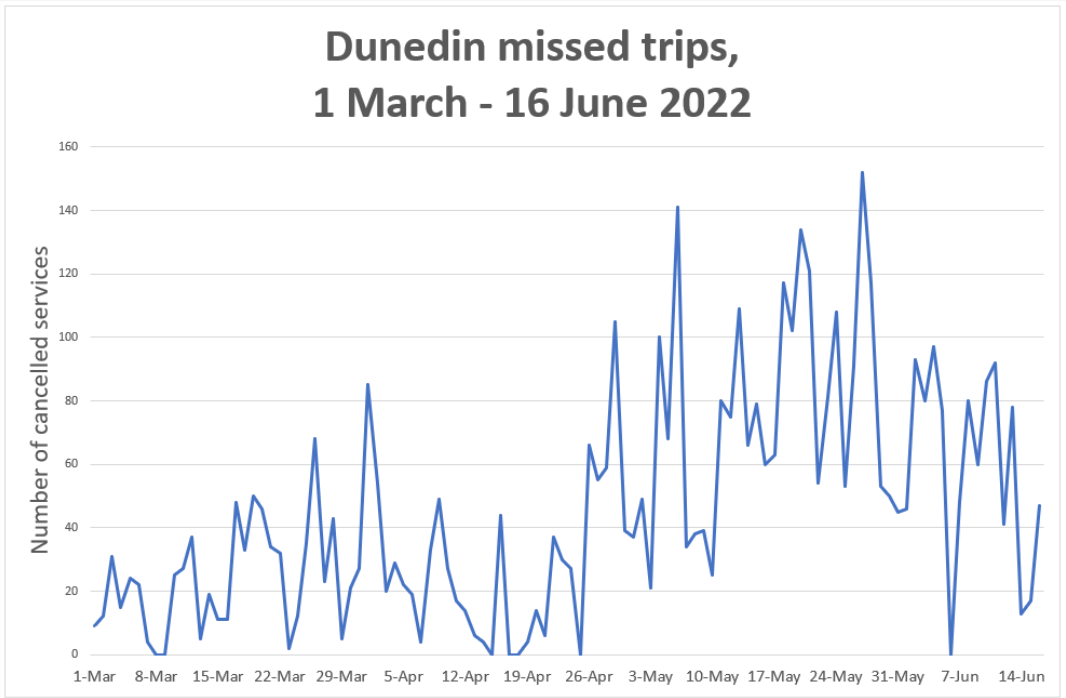


Figure 4: Dunedin missed trips, 1 March 2022 to 16 June 2022

[34] Figure 5 shows the annualised relationship between the varying COVID-19 alert levels on patronage for Dunedin, together with the increases in patronage associated with pre-Bee Card fare-free travel:

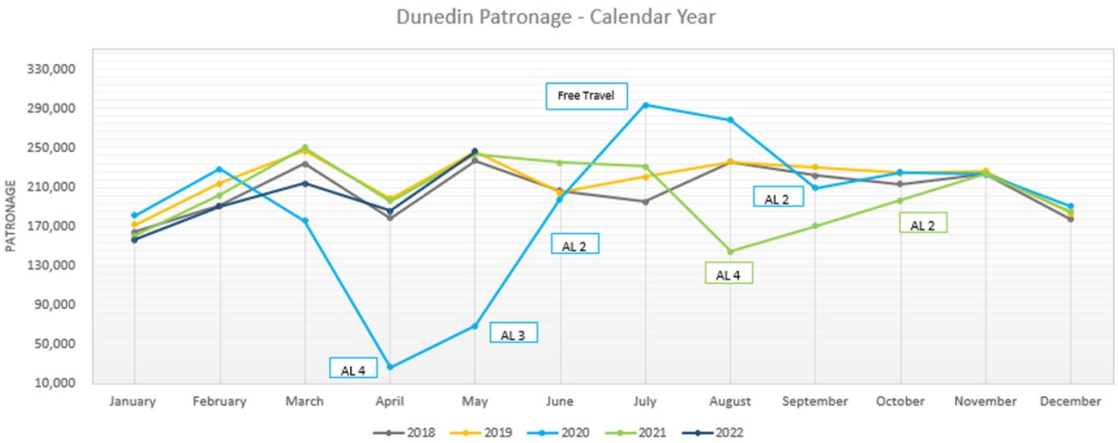


Figure 5: Relationship between COVID-19 alert levels and patronage

[35] Figures 6 to 8 chart YTD unit revenue and patronage, as well as detail on the most recent month's data.

[36] Revenue and budgeting assumptions for the Dunedin network are impacted by COVID-19 and the ongoing $2 fare trial in Dunedin.

[37] In Dunedin, revenue is $2,012,396 against a budget of $3,950,000, a variance of -$1,937,604.

Dunedin Public Transport Report

May 2022

Dunedin fare revenue and patronage for May 2022 is up compared to May 2021.

Fare revenue for the Financial YTD is up 14% compared to the previous YTD due to the months July/August 2020 being fare free. Patronage YTD is down 13%, this is because August and September 2021 patronage was affected by Alert Level 4 lockdowns and comparing this to the 2020/2021 financial year when we had high patronage numbers due to free fares over July/August 2020.

Fare Revenue May 2022

$311,545.04

▲ 0.2% vs May 2021

2021/22 Fare Revenue
financial year to date

$2,677,157

▲ 14% vs 2020/2021

Concession Type
May 2022

Adult Card	54%
Adult Cash	4%
Child Card	27%
Child Cash	0.6%
SuperGold	14%

Patronage May 2022

246,438

▲ 1% vs May 2021

▲ 259% vs May 2020

2021/22 Patronage
financial year to date

2,145,204

▼ 13% vs 2020/2021

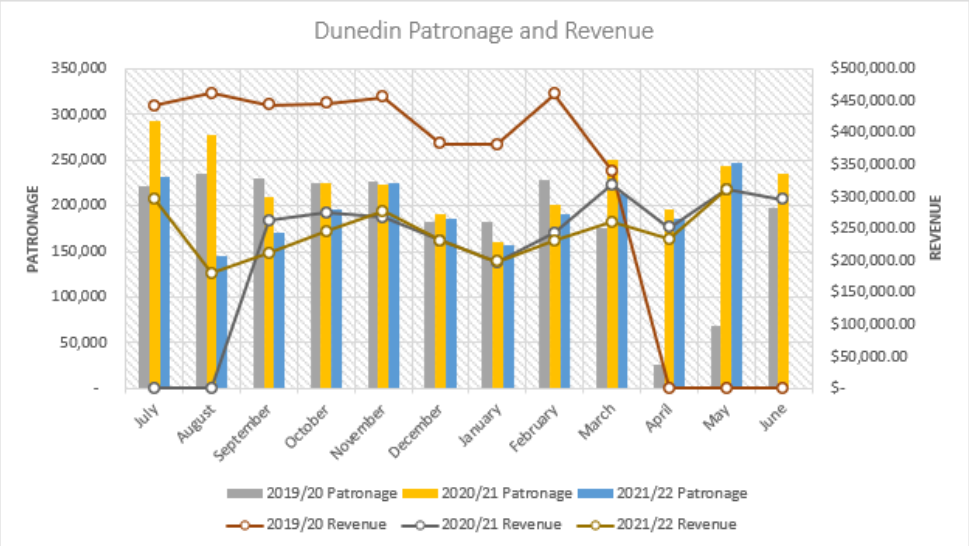
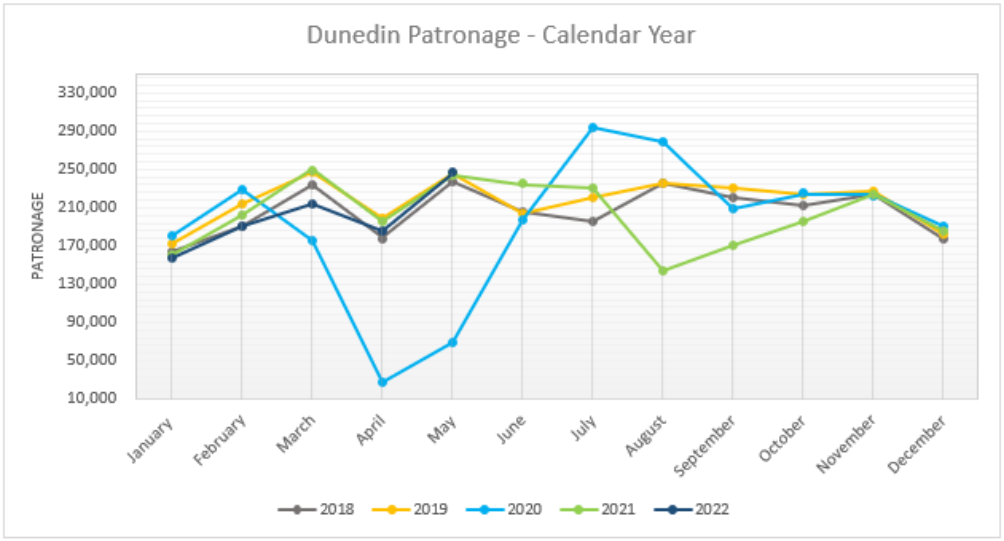


Figure 6: Dunedin Patronage and Revenue, YTD 2021/22



Unit 1	Unit 2	Dunedin Transitional Services/Unit 3	Unit 4	Unit 5
• Balaclava • Logan Park • Concord • Port Chalmers • Northern services • Peninsula	• St Clair • Normanby • Corstorphine • Wakari • St Clair Park • Helensburgh	• Pine Hill • Lookout Point • Shiel Hill • Opoho • Ridge Runner	• Brockville/Half. Bush/St Kilda • Waverley • Ocean Grove • Ross Creek • Belleknowes • Kenmure	• Mosgiel • Mosgiel Loop • Abbotsford

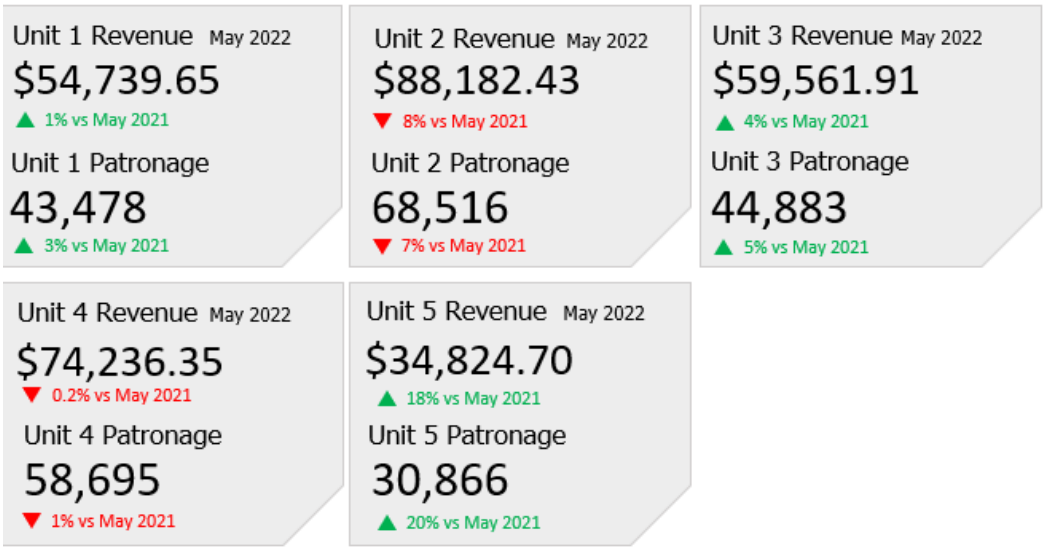
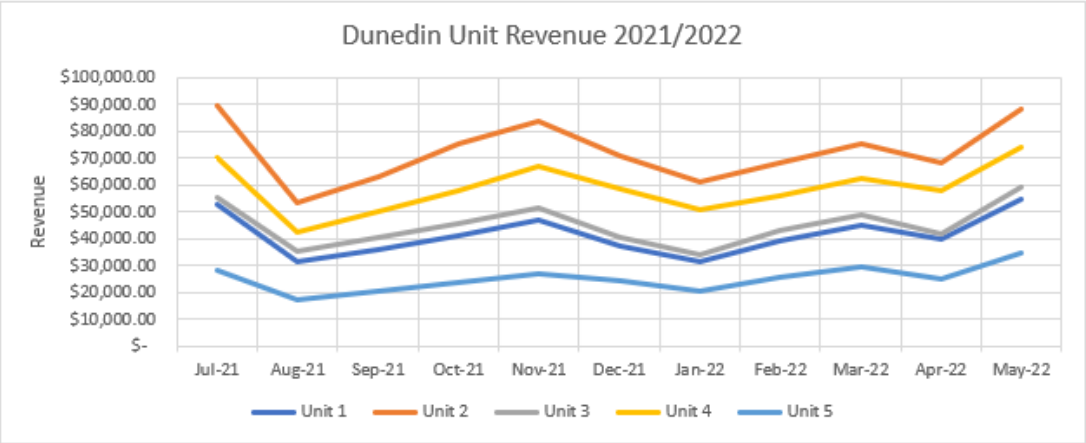


Figure 7: Dunedin weekly patronage, Unit Revenue and Unit Patronage



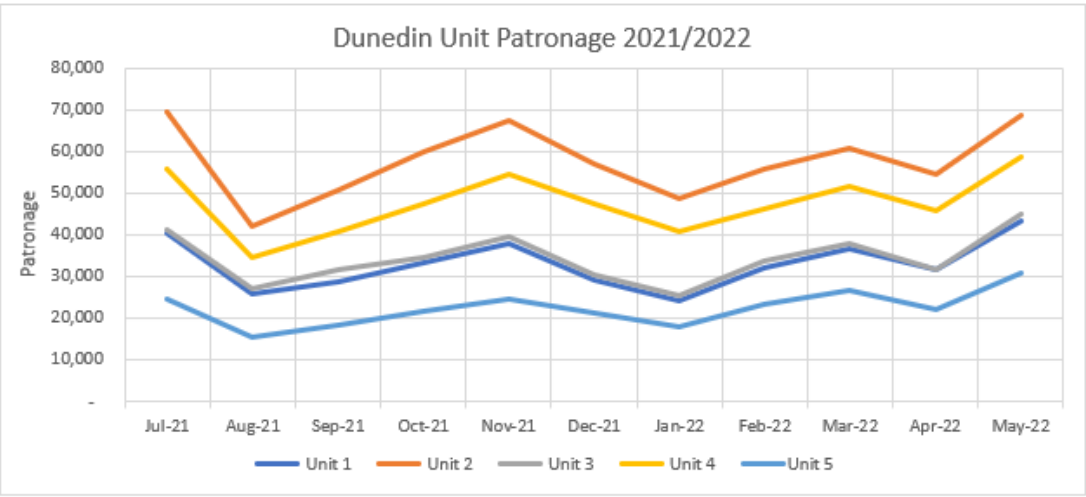


Figure 8: Dunedin Unit revenue and patronage

DUNEDIN SCHOOL SERVICES

[38] As previously advised to Council, towards the end of 2021, Otago Road Services (ORS) decided to cease operating its commercial Dunedin school bus services. Many of the services enabled students to attend a school of choice, rather than the closest school to their home. In recognising that would have an impact on the community, in December 2021, the Council authorised the Chief Executive to approve minor changes to the Dunedin bus network to address resulting school connectivity issues[2]. Solutions that have been put in place to date are:

a. A variation to the Unit 3 contract which provides a service from Green Island to Kings and Queens High Schools (Route 40C).

b. A variation to the Unit 5 contract for a service from Green Island to Kaikorai Valley College (route 70).

c. Additional overflow buses at peak times as required.

[2] *Ministry Review of Wakatipu Basin School Bus Services and Dunedin Changes*, Report OPS2106, Report to 9 December 2021 meeting of Otago Regional Council

[39] In combination with pre-existing routes 18C and 18D, which provides a direct connection between the Portobello/Harington Point bus route and Bayfield School, these services delivered an average of 632 pupils per day from launch.

[40] Monitoring these services (routes 77, 40C, 70 and 18c/d) across a 2-week period from 1 February 2022, daily child patronage increased from 361 passengers on 1 February 2022 to an average of 632 child passengers per day by 14 February 2022[3] (Figure 9).

	1/02/2022	2/02/2022	3/02/2022	4/02/2022
Daily Totals	361	458	685	538
Daily % change	-	27%	50%	-21%

	8/02/2022	9/02/2022	10/02/2022	11/02/2022
Daily Totals	742	764	723	727
Daily % change	38%	3%	-5%	1%

	14/02/2022
Daily Totals	686
Daily % change	-6%

Figure 9: Child patronage on Dunedin routes 77, 40C, 70 and 18c/d, 1 to 14 February 2022

PUBLIC TRANSPORT – QUEENSTOWN

[41] For Queenstown, patronage and revenue continue to be low. An Infometrics report commissioned by QLDC notes that "parts of the transport and logistics industry have been weakened by factors such as reduced commuter travel". Business closures due to the significant reduction in visiting overseas tourists have a knock-on effect on the demand for public transport. However, the patronage recovery rate has slowly been increasing from October to date. (source: impact-of-covid19-on-queenstown-lakes-economy-v6.pdf (qldc.govt.nz)).

[42] YTD 2021/22, Queenstown is tracking at 88% compared to YTD 2020/21, noting that from 1 July 2020 to 15 September 2020, travel in Queenstown was fare-free and patronage atypically higher for this reason.

[43] Comparing YTD 2021/22 against YTD 2018/19, the last full pre-COVID-19 financial year where patronage was significantly higher, Queenstown is tracking at 53%. This provides an indication of the relationship between COVID restrictions and Queenstown's performance, being a comparison with a year unaffected by COVID-19 restrictions.

Queenstown	July	August	September	October	November	December	January	February	March	April	May	June	Totals
2018/19 Patronage	122,752	117,442	103,974	111,657	125,600	118,997	136,055	129,439	134,084	125,244	118,077	124,736	**1,468,057**
2019/20 Patronage	136,766	129,011	121,416	120,662	128,440	128,282	136,985	131,102	90,746	9,919	42,577	73,597	**1,249,503**
2020/21 Patronage	100,951	98,102	72,143	73,385	71,464	69,096	68,550	60,717	62,613	65,928	66,863	79,251	**889,063**
2021/22 Patronage	95,248	51,010	51,987	66,690	64,895	66,507	69,147	52,471	53,524	68,158	73,786		**713,423**

Figure 10: Queenstown patronage statistics Financial Year 2018/19 to 2021/22

[44] As for the Dunedin network, increasing levels of missed trips have been experienced across the network, a nationwide issue due primarily to increased levels of driver absence caused by COVID-19.

[45] From 1 March 2022 to 16 June 2022, the Queenstown network experienced an average of 1.9 missed trips per day, across 30,996 trips.

[3] Monday 7 February 2022 was a public holiday.

[46] The total number of missed trips was 209, or 0.6% of trips operated. This compares with a total of 42 missed trips for the preceding 8-month period from 1 July 2021 to 28 February 2022, or 0.06% of trips operated.

[47] Figure 11 tracks daily missed trips, which were minimal until mid-May 2022, at which point the trend has moved upwards, albeit at a proportionately lower level when compared to the Dunedin network.

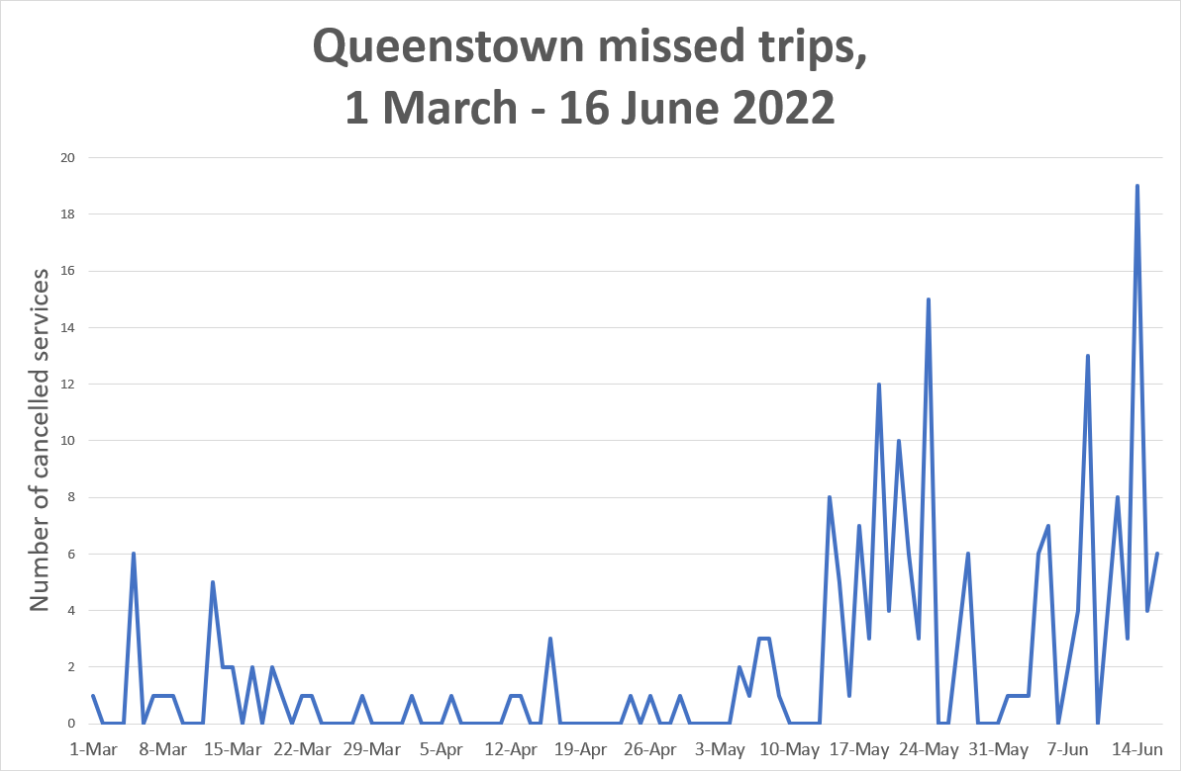


Figure 11: Queenstown missed trips, 1 March 2022 to 16 June 2022

[48] Figure 12 shows the annualised relationship between the varying COVID-19 alert levels on patronage for Queenstown, together with the increases in patronage associated with pre-Bee Card fare-free travel.

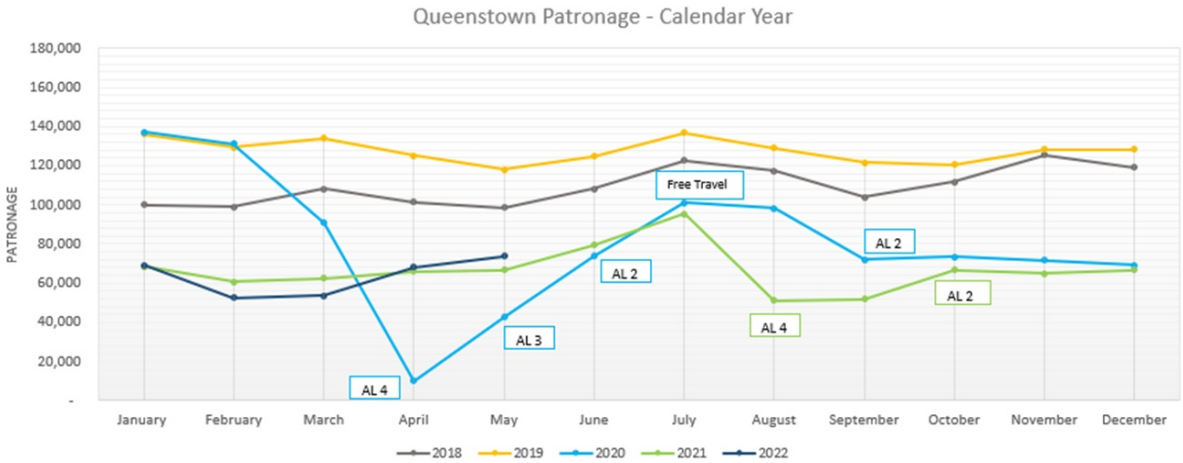


Figure 12: Relationship between COVID-19 alert levels and patronage

[49] Figures 13 to 15 chart YTD unit revenue and patronage, as well as detail on the most recent month's data.

[50] Revenue and budgeting assumptions for the Queenstown network are impacted by low levels of patronage.

[51] In Queenstown, Revenue is $1,073,318.80 against a budget of $2,520,837, a variance of -$1,447,519.20.

Queenstown Public Transport

May 2022

Queenstown patronage and revenue for May 2022 continues to be compared to May 2021.

Fare revenue for the financial YTD is up 22% compared to the previous YTD due to the months July/August 2020 when we had free fares. Patronage YTD is down 12%, this is because August and September 2021 patronage was affected by Alert Level 4 lockdowns and comparing to the 2020/2021 financial year when we had high patronage numbers due to the free fares over July/August 2020.

Fare Revenue May 2022

$125,610.87

▲ 12% vs May 2021

2021/22 Fare Revenue
financial year to date

$1,189,297

▲ 22% vs 2020/2021 YTD

Concession Type
May 2022

Adult Card	77%
Adult Cash	6%
Child Card	14%
Child Cash	0.3%
SuperGold	2%

Patronage May 2022

73,786

▲ 10% vs May 2021

▲ 73% vs May 2020

2021/22 Patronage
financial year to date

713,453

▼ 12% vs 2020/2021 YTD

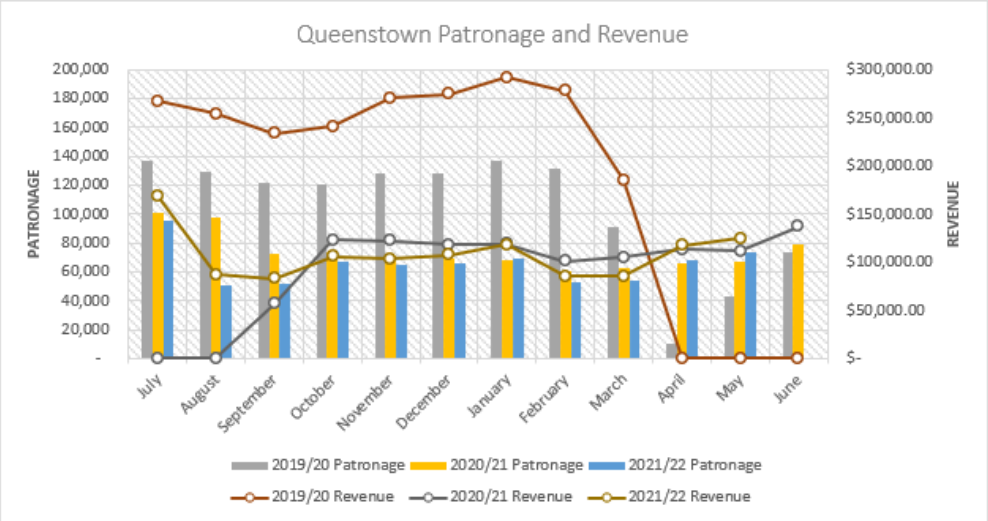
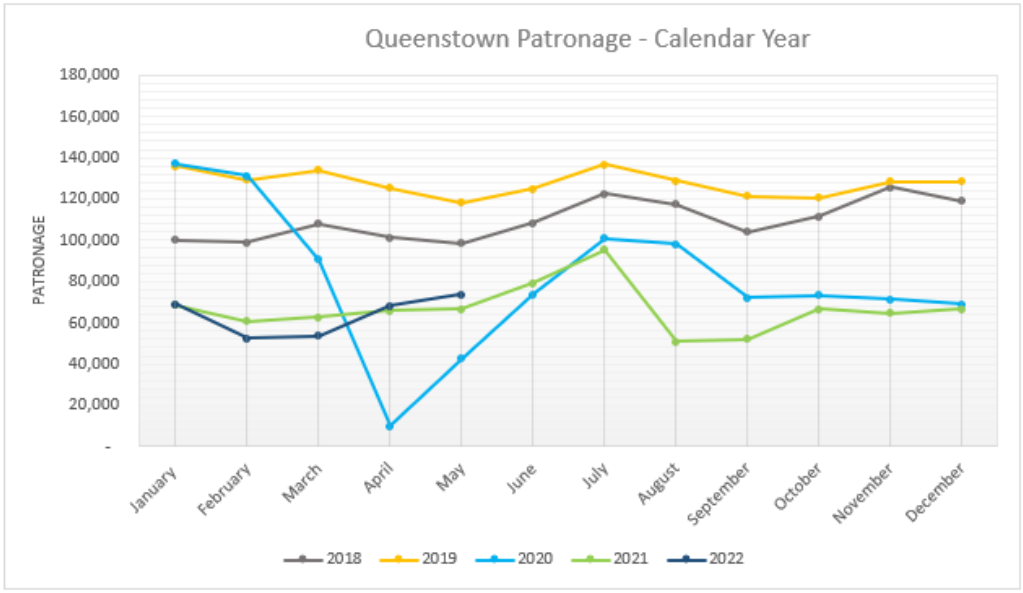


Figure 13: Queenstown patronage and revenue, YTD 2021/22



The weekly patronage graph above shows us the full calendar year view of patronage per week.

Unit 6

- Fernhill – Remarkables Park
- Jacks Point – Frankton Hub
- Lake Hayes - Queenstown

Unit 7

- Arthurs Point – Arrowtown
- Kelvin Heights – Frankton Flats

Unit 6 Revenue May 2022

$101,035.65

▲ 13% vs May 2021

Unit 6 Patronage

58,517

▲ 11% vs May 2021

Unit 7 Revenue May 2022

$24,575.22

▲ 9% vs May 2021

Unit 7 Patronage

15,269

▲ 9% vs May 2021

Figure 14: Queenstown weekly patronage, Unit Revenue and Unit Patronage

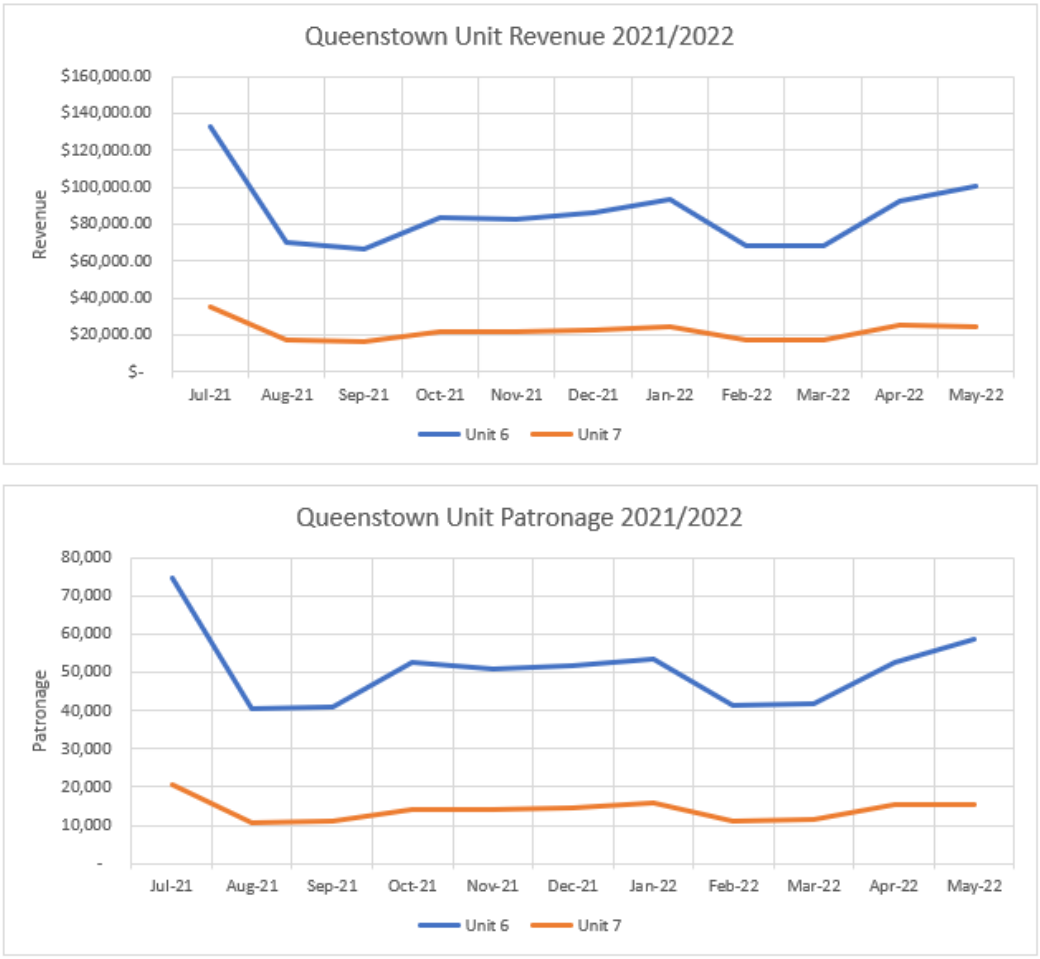


Figure 15: Queenstown Unit revenue and patronage

QUEENSTOWN FERRY

[52] The Queenstown Ferry service provides a daily timetabled ferry service on Lake Wakatipu, contracted between Go Orange (now RealNZ) and ORC from October 2020 to date.

[53] The ferry serves Queenstown Bay (Steamer Wharf), Queenstown Marina, the Hilton Hotel and Bayview (Kelvin Heights), between 7:30am and 10:30pm.

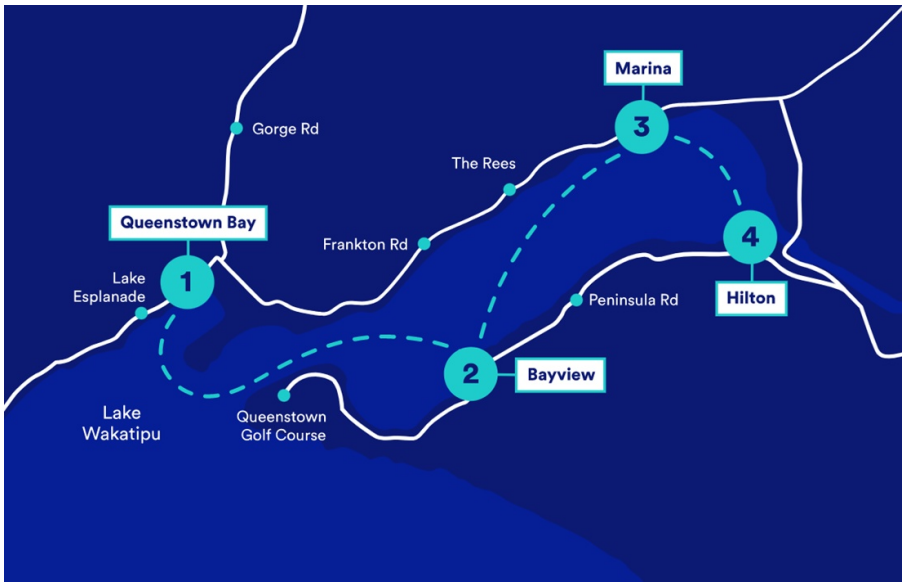


Figure 16: Queenstown Ferry Route Map

[54] YTD 2021/22, fare revenue has decreased by 2% and patronage has increased by 14% on the Queenstown Ferry service compared to YTD 2020/21.

[55] Fare revenue has decreased by 2% to $249,861.56.

[56] Patronage has increased by 14% to 53,490.

[57] The reason for the increase in patronage alongside a decrease in revenue may be a result of the service being primarily used by residents whilst tourism levels are low. Locals benefit from a multi-trip card which discounts the total trip cost.

[58] Additionally, a '50% off one-way and return ferry tickets' promotion was in place for April, May and June 2022.

[59] Budgeted expenditure for YTD 2021/22 is $990,000, whilst actual expenditure is $381,878.

[60] Budgets were determined by the Queenstown ferry Business Case estimate, based on a higher level of service. A full financial overview was provided to Council in Report No. PPT2209 (public excluded) on 25 May 2022.

[61] Queenstown water ferries are significantly affected by seasonal/holiday travel patterns, which continue to be affected by COVID 19 restrictions.

[62] Ticketing equipment has been supplied for implementation of the Ferry Service into the Bee Card system. The ticketing will be operational by 1 August 2022.

Queenstown Ferry

May 2022

Queenstown ferry patronage and revenue for May 2022 is up compared to May 2021.

Fare revenue for the financial YTD is down 2% compared to the previous YTD and patronage YTD is up 15%

Fare Revenue May 2022

$24,083.68

▲ 5% vs May 2021

2021/22 Fare Revenue
financial year to date

$249,861.56

▼ 2% vs 2020/2021 YTD

Patronage May 2022

5,728

▲ 25% vs May 2021

2021/22 Patronage
financial year to date

53,490

▲ 15% vs 2020/2021 YTD

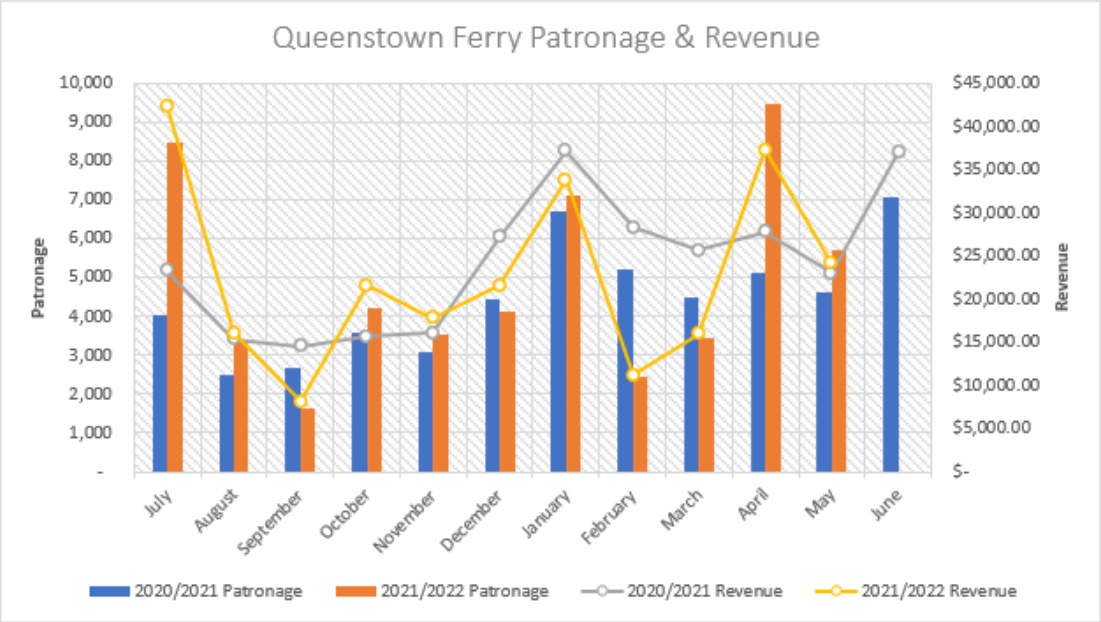


Figure 17: Queenstown Ferry Patronage and Revenue, YTD 2021/22

BEE CARD STATISTICS

[63] As at 7 June 2022, Otago has 79,042 registered Bee Card users.

[64] 156,270 cards have been issued and distributed in Otago, which equates to more than three-quarters of the combined population of Dunedin and Queenstown.

CUSTOMER FEEDBACK AND COMPLAINTS

[65] Figure 18 below captures feedback and complaints data, segregated by enquiry type, from November 2020 (when data collection began in this format) to May 2022.

[66] The table also provides for measurements against contractual (annual) KPI's, being:

a. Less than 1 complaint per 1,000 trips regarding vehicle cleanliness and comfort.
b. Less than 1 complaint per 3,000 trips regarding punctuality and driver behaviour.
c. Less than 1 complaint per 3,000 trips regarding incorrect fares.

[67] These are highlighted in yellow in the table and are tracking well within targets.

[68] For YTD 2021/22, 2,858,657 trips were recorded. 1,316 complaints have been recorded for this period, representing 0.046% of trips taken. Most complaints were around related to missed trips due to driver illnesses, exacerbating the already existing challenges of driver shortages. Communication of these disruptions was increased in media channels (website, Transit App, Facebook) and implemented on a daily basis. The operators also were required to be proactive in notifying Transport staff of any upcoming disruptions they were aware of.

[69] Complaints are categorised by type, with a new Bus Cancellations category introduced in February 2022 to monitor complaints related to increasing numbers of missed trips. These missed trips are primarily caused by driver absences due to COVID-19 and customer enquiries for this category contribute to a significant increase in complaints from February 2022 to date.

[70] An increasing number of complaints about driver behaviour has been noted. A revised set of customer experience-related key performance indicators have been included in the forthcoming Unit 3 PTOM contract, and these will be appended to all existing contracts. These KPIs focus on customer satisfaction, following best practice methodology in use across PTOM contracts in other regions

[71] Staff continue to follow up all complaints and take operational action where required. To address the concerns of passengers seeking live information related to missed trips, transport staff have introduced live alerts to the Transit app, which ensure passengers received push notifications to their mobile devices.

[72] Recent activity has also included:

a. Discussing a Community Needs Assessment report on Accessible Transport, provided by the Dunedin School of Nursing, and potential for a collaborative approach to address the issues raised;
b. Reinforcing messaging, QR codes and other matters related to COVID-19;
c. Working closely with operators to manage increased levels of school children using public transport services and reduced service levels due to COVID-related staff illness.

Complaints breakdown:	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22
Complaints related to the Bus Hub		2	-	-	-	-	-	0	0	1	2
Complaint about cost			1	-	-	-	-	0	0	0	0
Complaints about drivers	51	47	33	38	37	50	44	72	78	37	80
Complaint about passenger behaviour		1	2	-	2	1	1	4	1	0	0
Complaints about routes and times	8	3	2	2	4	2	3	44	16	11	
Complaints about ticketing	10	8	1	3	3	1	1	5	3	3	3
Complaints about on-street infrastructure	9	8	1	2	3	11	9	13	11		
Complaints about timeliness	32	16	13	18	55	17	13		10		
Complaints about timetables/schedules	7	7	1	1	2	1	-			7	
Complaint about on-bus wi-fi	1		-	-	1	-	-		1	1	
Complaints related to other unclassified issues	14	9	4	9	3	-	3	9	3		
Complaints about cleanliness/condition of bus			1	1	2	2	-	0	0		1
Complaints about transfers			-	-	-	-	-				
Complaints about Information/comms	2	5	-	2	1	5	1		9		
Complaints related to app/website	2		1	1	-			7	7		
Bus cancellations								29	63	34	94

Figure 18: Customer Feedback, YTD 2021/22

REAL TIME INFORMATION (RTI)

[73] The accuracy of RTI in Queenstown and Dunedin has been increased with the data feed now being derived from a hierarchy of on-bus devices, with the primary source now being the Bus Driver Console (RITS ticketing device), followed by E-Road and Wi-fi hardware.

[74] The device hierarchy means that if one device does not deliver an accurate signal, or fails, the system defaults to the next device in the hierarchy, meaning increased continuity of tracking and significantly less likelihood of unsuccessful vehicle tracking. Previously, the data feed was derived solely from on-bus wi-fi hardware.

[75] Operators have contractual Punctuality KPIs and are expected to deliver 95% of their trips on time; meaning that 95% or more of their scheduled trips leave the Terminus (origin stop) between 59 seconds before and 4 minutes & 59 seconds after the scheduled departure time.

[76] As at May 2022, Dunedin buses are running at an average of 2.42 minutes to schedule from the Terminus. Queenstown buses are running at an average of 1.27 minutes to schedule from the departure terminus.

[77] Transit, the real time tracking app, remains popular, following a promotional campaign carried out by the Communications team. In the period October 2021 to April 2022, passengers used the app over 667,000 times (574,075 user sessions in Dunedin and 93,196 in Queenstown). This data is provided by the app supplier and May 2022 data is not available at the time of writing this report.

[78] Figures 19 and 20 show Transit app usage for the period October 2021 to April 2022 for Dunedin and Queenstown:

a. 'Monthly Active Users' refers to the number of active users in that particular month. This means opening and the action of using the app, not just having it installed on a device;
b. 'Views refers to the number of times passengers opened Transit in that month;
c. 'Downloads' is the number of new downloads of the app each month;
d. 'Most Popular Lines' are the most popular routes, i.e. the routes for which the most people are using the Transit app;

e. 'Go Trips' refer to passengers utilising additional functionality in the app. The 'GO' feature enables users gets step by step navigation while helping to improve real-time vehicle locations;

f. 'Service alert subscribers' is the total number of users receiving alerts for individual routes (events, delays, roadworks, etc).

	DUNEDIN						
	Monthly Active Users	Sessions	Downloads	DAU's	Most popular lines (taps)	Go Trips	Service Alert Subscribers
Oct-21	2,820	71,970	329	514	8, 63, 3	1,567	973
Nov-21	2,942	77,695	337	553	8, 63, 3	1,667	1,054
Dec-21	2,825	63,947	272	445	8, 19, 63	1,361	1,105
Jan-22	2,722	66,423	351	444	8, 63, 3	1,539	1,182
Feb-22	3,217	80,498	514	588	8, 63, 77	2,013	1,287
Mar-22	3,845	110,225	725	702	8, 63, 77	2,936	1,611
Apr-22	4,125	103,317	411	732	8, 63, 3	2,593	1,713
May-22							
Jun-22							

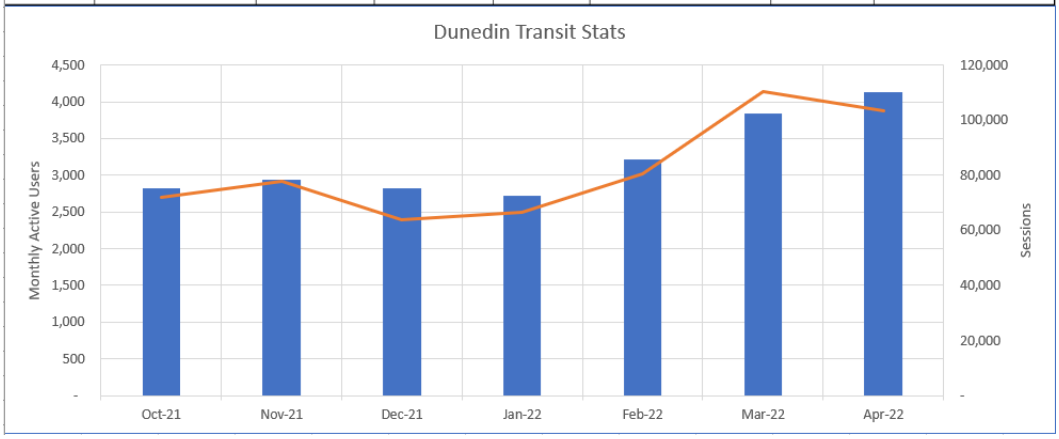


Figure 19: Transit app usage, October 2021 – April 2022, Dunedin

	QUEENSTOWN						
	Monthly Active Users	Sessions	Downloads	DAU's	Most popular lines (taps)	Go Trips	Service Alert Subscribers
Oct-21	697	13,581	135	103	1, 2, 5	203	86
Nov-21	635	11,733	100	94	1, 2, 5	178	90
Dec-21	717	14,270	130	98	1, 2, 5	232	102
Jan-22	691	13,290	138	88	1, 5, 2	235	110
Feb-22	555	10,855	76	77	1, 2, 5	267	121
Mar-22	642	11,678	140	86	1, 2, 5	252	158
Apr-22	871	17,789	122	123	1, 2, 5	319	171
May-22							
Jun-22							

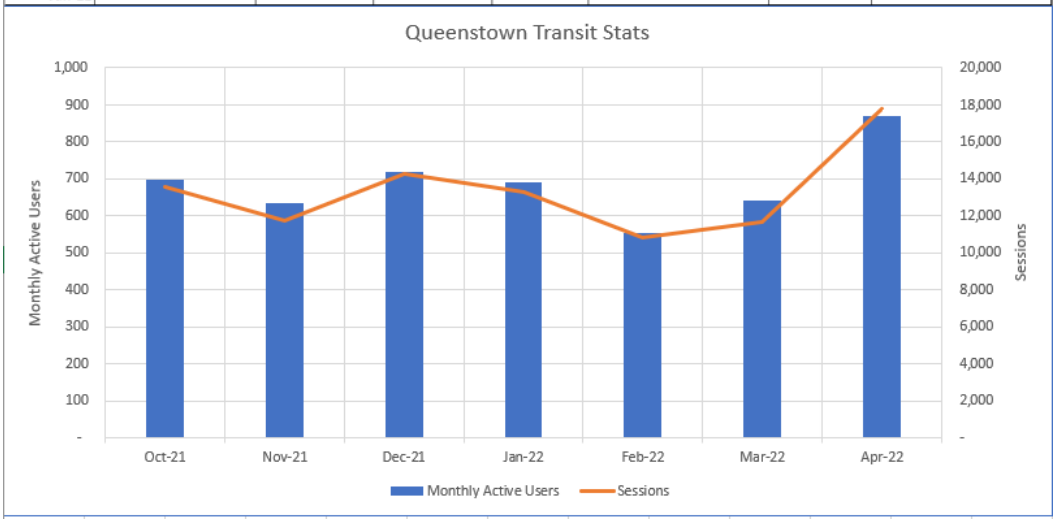


Figure 20: Transit app usage, October 2021 – April 2022, Queenstown

TOTAL MOBILITY

[79] Total Mobility is a nationwide scheme, administered by regional councils, that provides subsidised travel for people who are otherwise unable to access public transport. It does this by providing a swipe card which subsidises taxi travel by 50%, to a maximum of $25 subsidy in Otago. From April 2022 to August 2022, the subsidy has increased to 75%, (a maximum subsidy of $37.50).

[80] The percentage of trips operating within the maximum subsidy is 95.3%, with the remaining 4.7% trips exceeding a $50 fare and hence having their subsidy capped. Figure 21 below shows the number of trips split by price range.

Trip Count per Price Range 1 July 2021 – 31 May 2022								
$0-$10	$11-$20	$21-$30	$31-$40	$41-$50	$51-$60	$61-$70	$71-$80	$81 &above
21.2	45.4	18.7	6.4%	3.6%	1.6%	1.9%	0.75%	0.36%
95.3%					4.7%			

Figure 21: Total Mobility trips by price range, YTD 2021/22

[81] Figure 22 below, shows YTD 2021/2022 Patronage, whereby 'Trips' includes 'Hoist' trips. 'Hoist' refers to customers that require a wheelchair-accessible vehicle to travel, for which suppliers receive a separate reimbursement.

[82] For the 11 months shown below, the mean monthly number of trips per month was 7,384 and, on average, 13% required the use of a hoist.

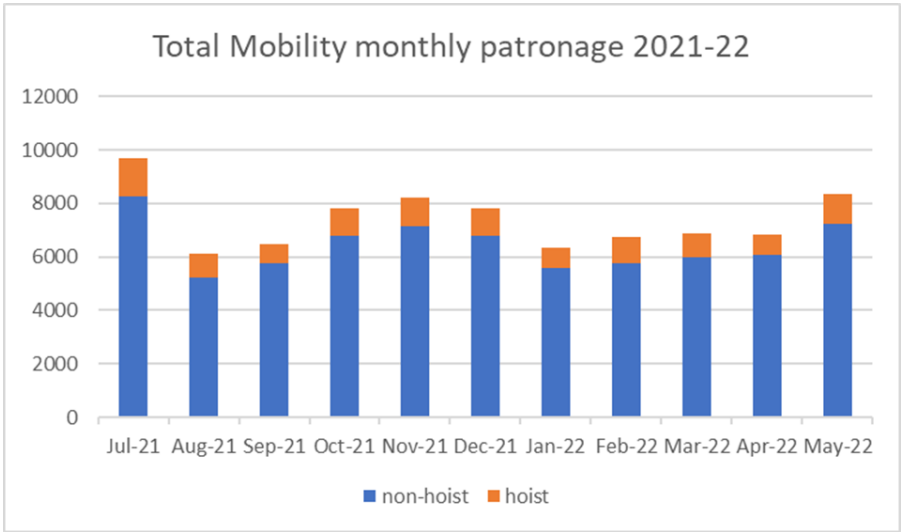


Figure 22: Total Mobility trip statistics

[83] 83.2% of trips take place in Dunedin and Mosgiel, followed by 12% in Oamaru, 3.3% in Wanaka and 1.5% in Queenstown.

[84] There has been a decrease of 19.0% in Otago patronage for YTD 2021/22, being 81,225 passenger trips vs 100,348 for YTD 2020/21.

[85] Between these two periods there is a 23.1% decrease in hoist trips for YTD 2021/22, being 10,669 hoist trips vs 14,056 for YTD 2020/21.

[86] Figure 23 below compares the relative patronage (normalised to the January 2021 figure) for the first 5 months of 2021, with the same months in 2022.

[87] In these months in 2022, half price fares have been in place. April 2022 was the first month for this. In relative terms, April 2022 saw a 0.47% decrease in patronage compared to March 2022, but this should be compared to an 8% decrease from March to April the previous year.

[88] May 2022, the second month of half price fares, saw a 21.9% increase in patronage compared to April 2022. This should be compared to a 5.3% increase in patronage from April to May the previous year.

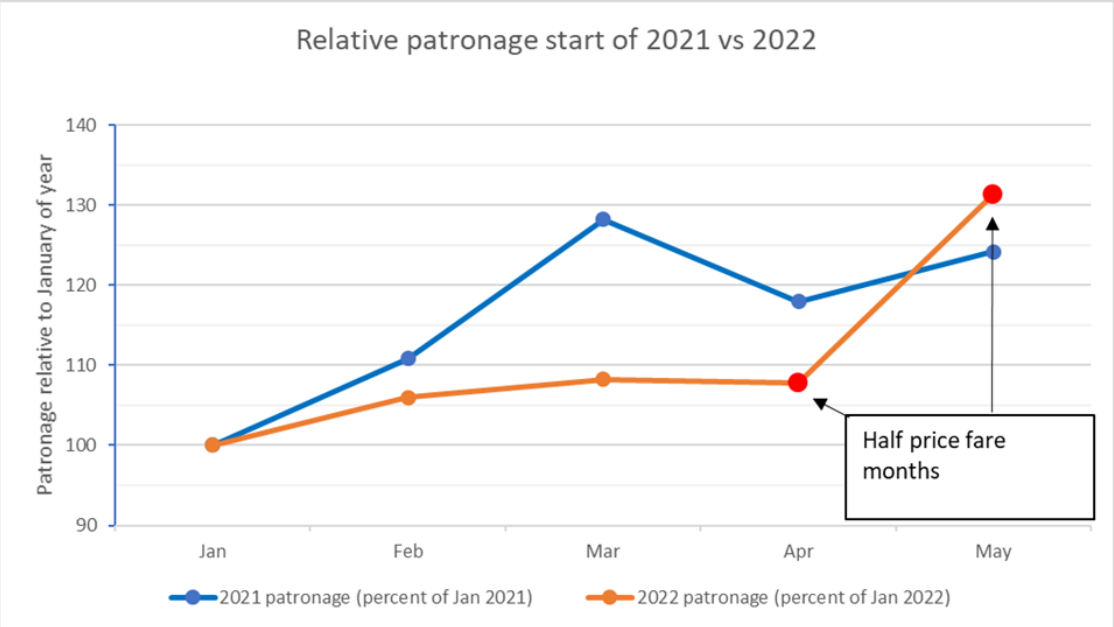


Figure 23: Relative Patronage comparison for Total Mobility, 2021 vs 2022

CONSIDERATIONS

Strategic Framework and Policy Considerations

[89] Not applicable.

Financial Considerations

[90] Not applicable.

Significance and Engagement Considerations

[91] Not applicable.

Legislative and Risk Considerations

[92] Not applicable.

Climate Change Considerations

[93] Not applicable.

Communications Considerations

[94] Not applicable.

NEXT STEPS

[95] Provide an update to the next Data and Information Committee on patronage and revenue for Dunedin and Queenstown. This update will be for the full 2021/22 Financial Year.

ATTACHMENTS

Nil