Annual Summary Report 2024

Water Quality and Ecosystem Health in Otago Rivers and Lakes

Otago Regional Council monitors surface water quality at over 100 river and lake sites across the Otago Region.

We use a combination of monthly water sample collection, continuous data sensors and annual surveys of stream life to assess the following components of ecosystem health:

WATER QUALITY

- **Nitrogen** and **Phosphorus** - are essential nutrients for plant growth. Increased levels of these nutrients can contribute to algal blooms and excessive growth of aquatic plants. In lakes, we measure **total nitrogen** (TN) and **total phosphorus** (TP). In rivers, we measure **dissolved reactive phosphorus** (DRP). We also measure forms that can be toxic to aquatic life - **ammoniacal nitrogen** and **nitrate nitrogen**.

- **Dissolved Oxygen** – the amount of oxygen dissolved in water. Low dissolved oxygen (DO) levels can affect fish and other aquatic organisms that require oxygen to breathe. Decaying organic matter (aquatic plants and algae) and high temperatures can reduce DO levels. In deep lakes which seasonally stratify into distinct layers, we measure DO at the lake bottom and in the mid-hypolimnion (bottom layer).

- **Suspended fine sediment** – fine particulate matter (sand, silt or clay) in the water column that can impact water clarity. Sediment naturally occurs in rivers due to processes like water movement, erosion and weathering of rocks. However, activities such as agriculture, horticulture, forestry and earthworks can increase fine sediment inputs.

PHYSICAL HABITAT

- **Deposited fine sediment** – fine particulate matter (sand, silt or clay) that settles on the bed of a river. It can fill spaces betweeen cobbles and reduce habitat for aquatic life.

Eagle Technology, Land Information New Zealand, GBBCO, Community maps contributors

Otago Regional Council

ECOYSTEM PROCESSES

- **Ecosystem metabolism** – the production of oxygen and carbon dioxide by all the organisms that make up the ecosystem. It represents how energy is created (primary production) and used (respiration) within an aquatic ecosystem and is a functional indicator of ecosystem health.

AQUATIC LIFE

The range and diversity of flora and fauna in our waterways are measured by the following indicator groups:

- **Macroinvertebrates** – freshwater invertebrates such as insects, worms and snails. These organisms are sensitive to changes in water quality and habitat. The **Macroinvertebrate Community Index** (MCI) is a measure based on the presence of these organisms.
- **Fish** – we use the **Fish Index of Biotic Integrity** (Fish IBI) to assess the richness of fish species by comparing the fish species present at a site to the expected species in the absence of human impacts.
- **Periphyton** – algae and slime that grows on the rocks and other stable substrates that make up the streambed, measured as chlorophyll a. Periphyton is an important food resource in the aquatic food webs but can proliferate and become a nuisance. Excess growth is related to nutrient levels, amount of shading, temperature, stream substrate and the number of flushing flows.
- **Phytoplankton** – algae that grows in the water column of lakes, measured as chlorophyll a. It is often closely linked to the amount of nutrient enrichment in a lake ecosystem.
- **Lake Submerged Plants** – aquatic plant communities in lakes. Community composition is measured by underwater divers using the **Lake Submerged Plant Indicators** (LakeSPI) method and reported as a **Native Condition Index** and an **Invasive Impact Index**.

We also monitor water quality properties important for human health:

HUMAN CONTACT

- ***E. coli*** – *Escherichia coli* are faecal indicator bacteria found in the gut of warm-blooded animals. We measure *E. coli* monthly throughout the year at our SOE monitoring sites and during the summer bathing season at popular primary contact recreation sites.

- **Cyanobacteria** – microscopic organisms that multiply and form blooms, which can be suspended in the water column (planktonic) or attached to rocks (benthic). Also known as toxic algae or blue/green algae, some species produce toxins that are harmful to animlas.

This summary report presents a regional overview of the current state of the ecosystem health and human contact values as described by the **National Policy Statement – Freshwater Management** (NPS-FM). We use 5 years of data (2019-2024) to assess current state. For each indicator, results from each site are graded A-E according to the attribute bands of the National Objectives Framework in the NPS-FM. For some attributes there is a defined 'national bottom line' indicating a minimum acceptable standard.

Learn more about these measures at **LAWA Glossary & Factsheets**

View our monitoirng sites and explore the data **LAWA – Otago Region**

RIVER ECOSYSTEM HEALTH

Attribute band:

A Excellent B Good C Fair D Poor

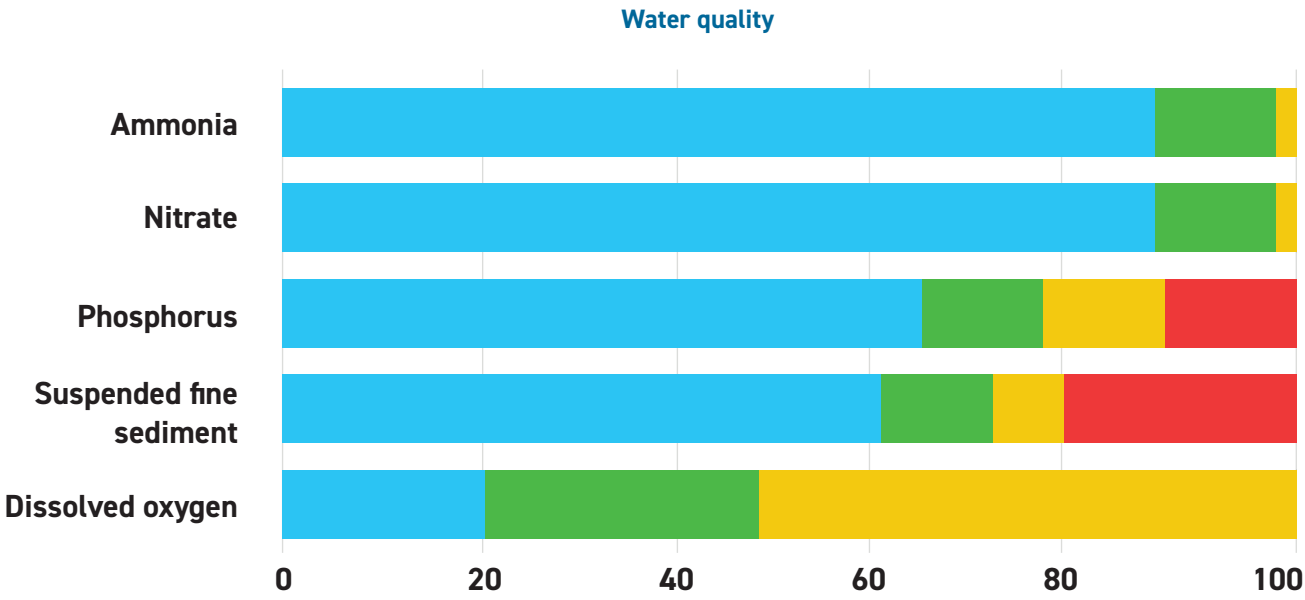


Figure 1 | Percentage of rivers sites graded as A, B,C or D for five water quality attributes

Otago's water quality is typically excellent at higher elevation sites under predominately native vegetation or conservation land cover. These sites tend to be in the upper catchments of the large lakes (e.g. Hāwea, Whakatipu and Wānaka) and tributaries of the upper Clutha Mata-Au. The poorest water quality is found in urban streams (e.g. Dunedin & Coast FMU) and in the lowland rivers and stream of catchments where intensive agriculture is the predominant land use (e.g., Manuherekia Rohe, Lower Clutha Rohe, North Otago FMU).

All except two sites are above the national bottom line for ammonia and nitrate and all sites are above the national bottom line for dissolved oxygen. Grades for dissolved oxygen are interim and based on data for 15 sites only. We are continuing to deploy continuous monitoring sensors across the network and extend our data records.

About a quarter of sites do not meet the national bottom line for suspended fine sediment (graded D). Some sites have naturally elevated suspended sediment levels. Thirteen sites (13 %) are graded D for dissolved reactive phosphorus indicating that levels are higher than natural conditions.

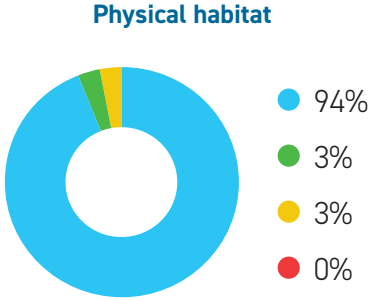


Figure 2 | Percentage of rivers sites graded A, B,C or D for deposited fine sediment.

All sites are above the national bottom line. Grades are interim as a 5-year data record is not yet available.

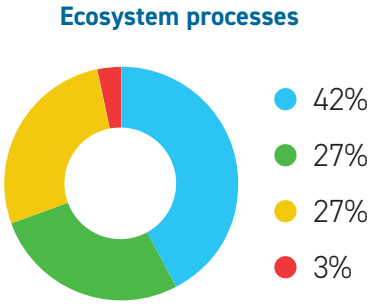


Figure 3 | Percentage of rivers sites graded A, B,C or D for ecosystem metabolism.

Grades are interim as a 5-year data record is not yet available and there is no national guidance on attribute grades within the NPS-FM.

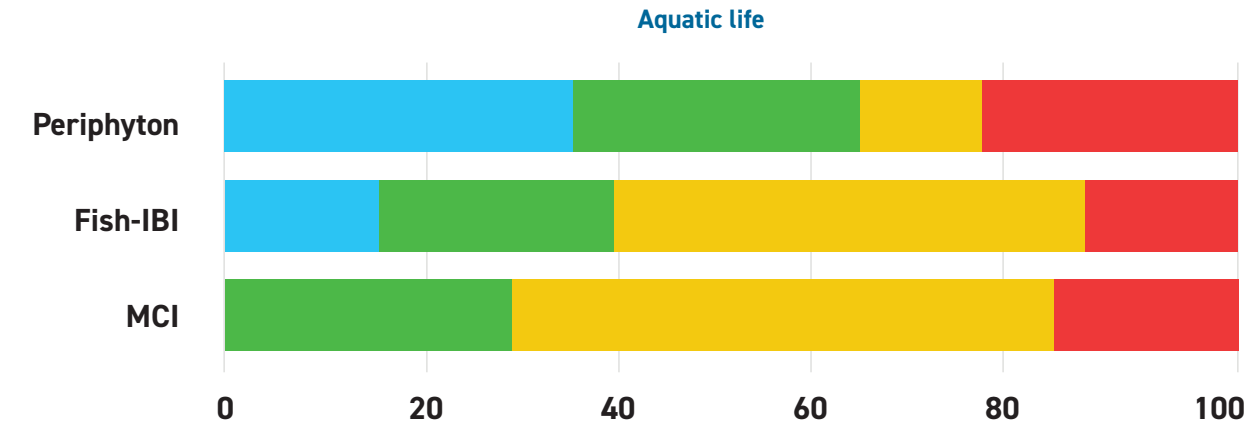


Figure 4 | Percentage of river sites graded A, B, C or D for aquatic life attributes

Eight of the 32 sites we monitored for periphyton are below the national bottom line. For the Macroinvertebrate Community Index (MCI), six of 32 sites are below the national bottom line. About 60 % of the 13 sites assessed for Fish-IBI are graded C or D, indicating that some habitat loss and/or migratory access has impacted fish communities at these locations.

LAKE ECOSYSTEM HEALTH

Attribute band:

A Excellent B Good C Fair D Poor

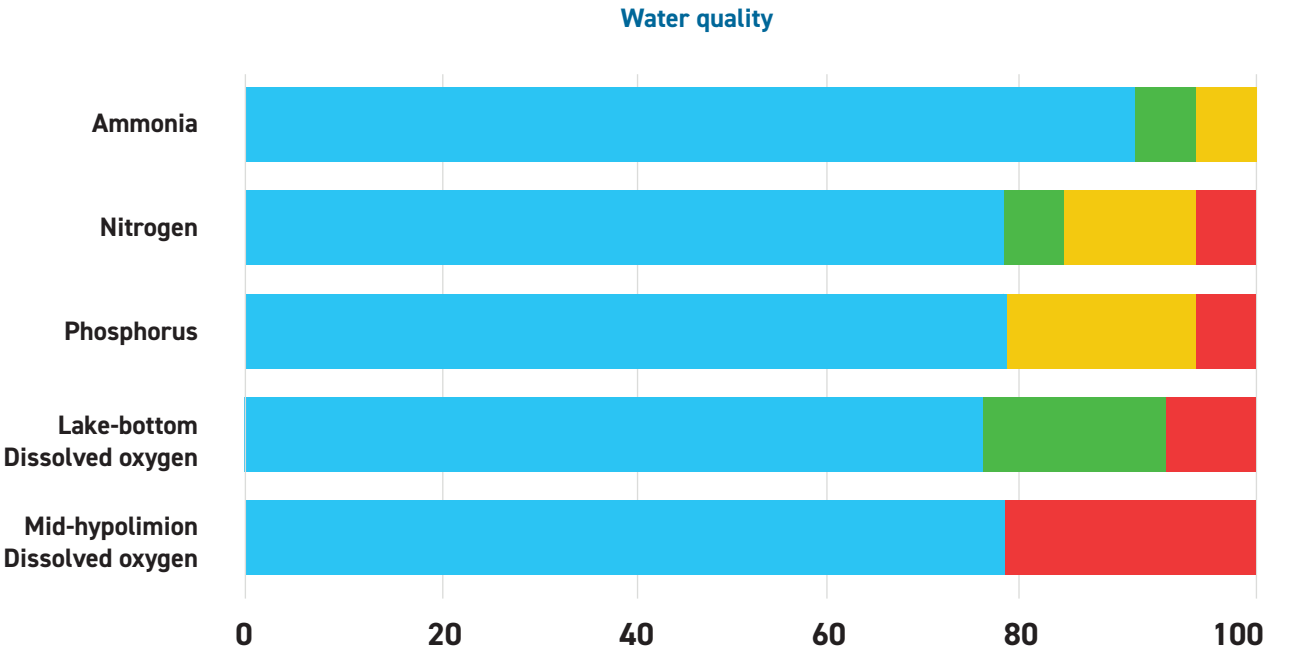


Figure 5 | Percentage of lake sites graded A, B,C or D for five water quality attributes.

We monitor eight lakes across Otago – the large lakes in the Upper Lakes and Dunstan Rohe (Lakes Whakatipu, Hāwea, Wānaka and Dunstan) have excellent water quality and low nutrient levels. Lake Tuakitoto is the only site not meeting the national bottom line for total nitrogen, phosphorus, and ammonia. Lakes Hayes, Waihola and Onslow are also impacted by elevated nutrient levels. Lake Hayes does not meet the national bottom line for lake-bottom dissolved oxygen or mid-hypolimnetic dissolved oxygen.

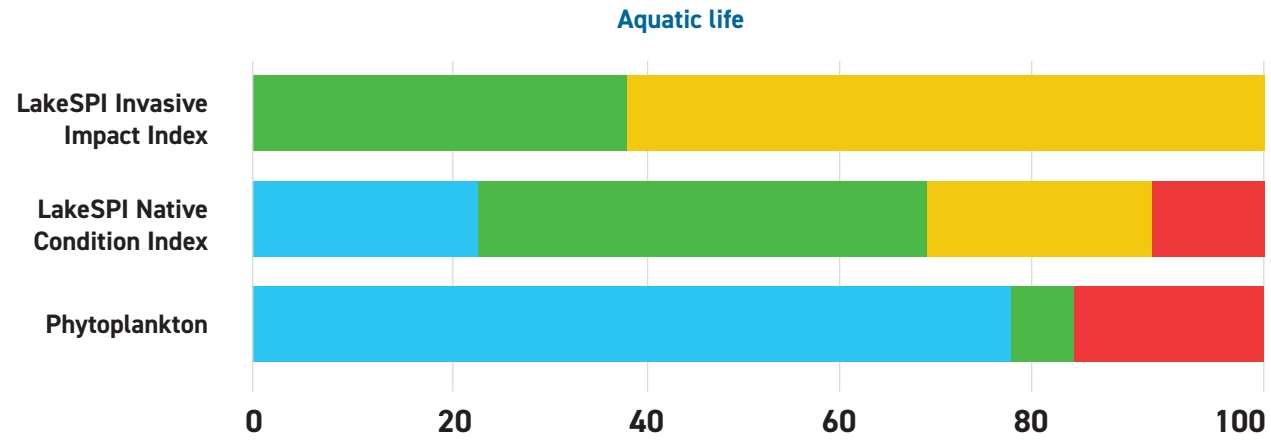


Figure 6 | Percentage of lake sites graded A, B, C or D for aquatic life attributes

Three lakes do not meet the national bottom line for phytoplankton – Lake Hayes, Lake Tuakitoto and Lake Waihola.

Results of the Lake SPI Invasive Impact Index reflect moderate impacts from invasive plants at five of eight monitored sites (band C). Lake Tuakitoto is the only site below the national bottom line for the Native Condition Index.

HUMAN CONTACT

Attribute band:

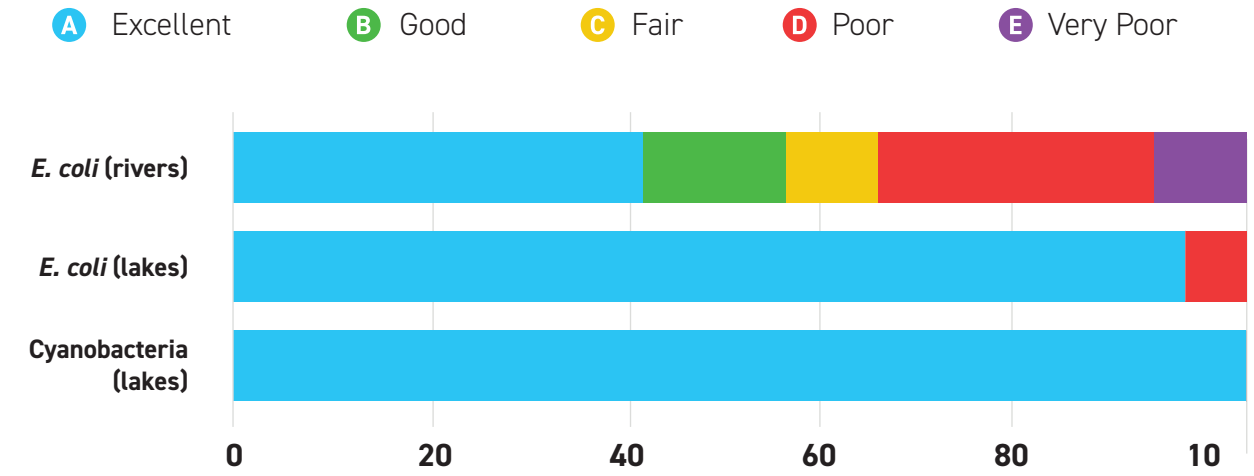
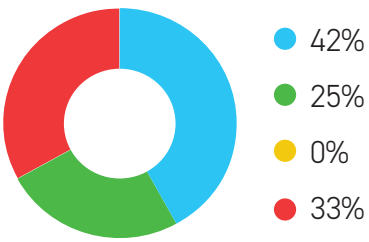


Figure 7 | Percentage of lake and river sites graded as A, B, C, D or E (E. coli only) for human health attributes. Data from year-round monthly monitoring.

All lake sites were in the A band for cyanobacteria, and 94% were in the A band for *E. coli* (Figure 7).

For *E. coli* in rivers, 27 % of sites are graded D, and 9 % are graded E. These tend to be lowland sites in catchments with larger areas of urban development and intensive agricultural land use (e.g., Lower Clutha Rohe, Manuherekia Rohe, Catlins FMU, Dunedin & Coast FMU, North Otago FMU). About 55 % of sites are in the A or B band; most are in the Upper Lakes and Dunstan Rohe or upper catchment areas with predominately native forest or conservation land cover.



During the summer we monitor 17 freshwater swimming sites weekly across Otago (Figure 8). Based on data for the last 5 summers, 67 % of sites are graded Excellent or Good. 33 % of sites are graded Poor (below the national bottom line).

Figure 8 | Percentage of sites grade Excellent, Good, Fair or Poor for E. coli at swimming sites (lakes and rivers). Data from weekly monitoring during the summer bathing season only.