Faecal indicator bacteria at recreational bathing sites

This factsheet presents an analysis of suitability of recreational bathing sites for swimming, based on concentrations of faecal indicator bacteria recorded during the October-March summer bathing seasons from 2015 to 2020 and presented in Land, Air, Water Aotearoa's recreational bathing raw water quality dataset. The Auckland region has been excluded from the analyses for reasons outlined in the 'Data for this indicator' section

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Key facts

- Based on monitoring undertaken between 2015–20, 54.8% of freshwater bathing sites (rivers and lakes) and 9.4% of marine bathing sites (beaches) could be considered unsafe for swimming at any time.
- Bathing sites in more urban areas were less likely to receive a 'good' or 'excellent' long-term grade than in rural areas.
- During the 2019/20 bathing season, 70.0% of monitored river swimming sites, 38.0% of beach sites and 27.6% of lake sites were unsafe to swim at on at least one occasion.
- In the 2019/20 bathing season, 18.8% of monitored river swimming sites, 3.4% of lake sites and 3.6% of beach sites were frequently unsuitable for swimming, with 20.0% or more of routine monitoring results showing they were unsafe to swim.

Faecal indicator bacteria and health

Faecal indicator bacteria (FIB) occur in the gut of warm-blooded animals – including humans. They may be introduced to the environment through animal or bird excrement, stock effluent, wastewater discharge, and run-off from contaminated soil. The presence of FIB in recreational water may impact human health by causing gastrointestinal illnesses and infections of the ears, eyes, nasal cavity, skin, and upper respiratory tract (Land, Air, Water Aotearoa 2021).

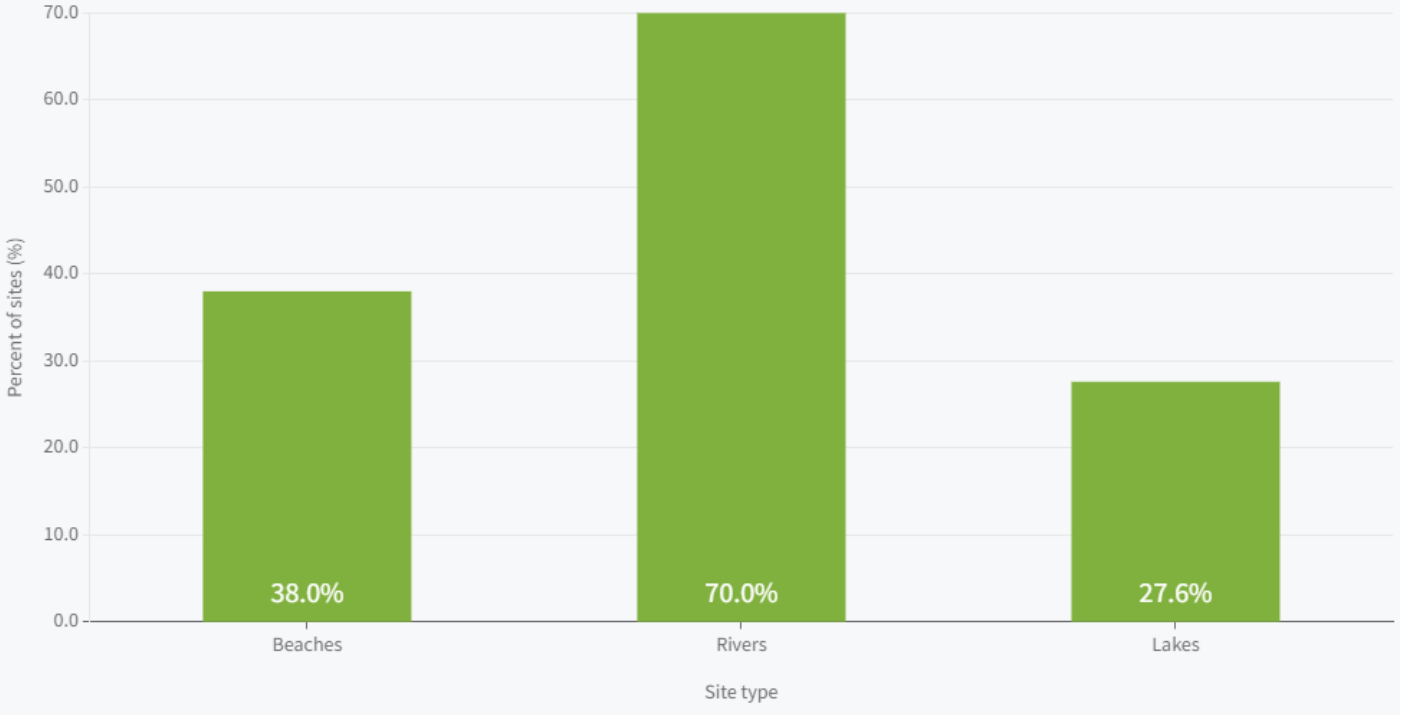
Testing for the presence of FIB as a measure of suitability for recreation is a common practice internationally. As it is difficult to test for the full range of pathogens that may be present in the water, bacteria like E. coli and Enterococci are used as indicators as their presence implies that other microorganisms such as Campylobacter, Cryptosporidium, or Giardia may also be present (McBride & Soller 2017).

While the presence of a small amount of FIB (typically measured in terms of the number of bacteria per 100ml of water) may pose little to no danger to swimmers, higher concentrations may pose a risk to children, the elderly, or people with compromised immune systems. Concentrations of FIB may, and often do, rise to levels where swimming is not recommended for anyone.

Many bathing sites were occasionally unsafe to swim at

In the 2019–20 bathing season, 116 beaches (38% of those surveyed that season) were unsafe to swim at on at least one occasion, as were 175 (70%) rivers and 16 (27.6%) lakes (Figure 1). In total, 50.1% of all sites were unsafe to swim at least once.

Figure 1 Percentage of sites that tested unsafe for swimming on at least one occasion, 2019/20

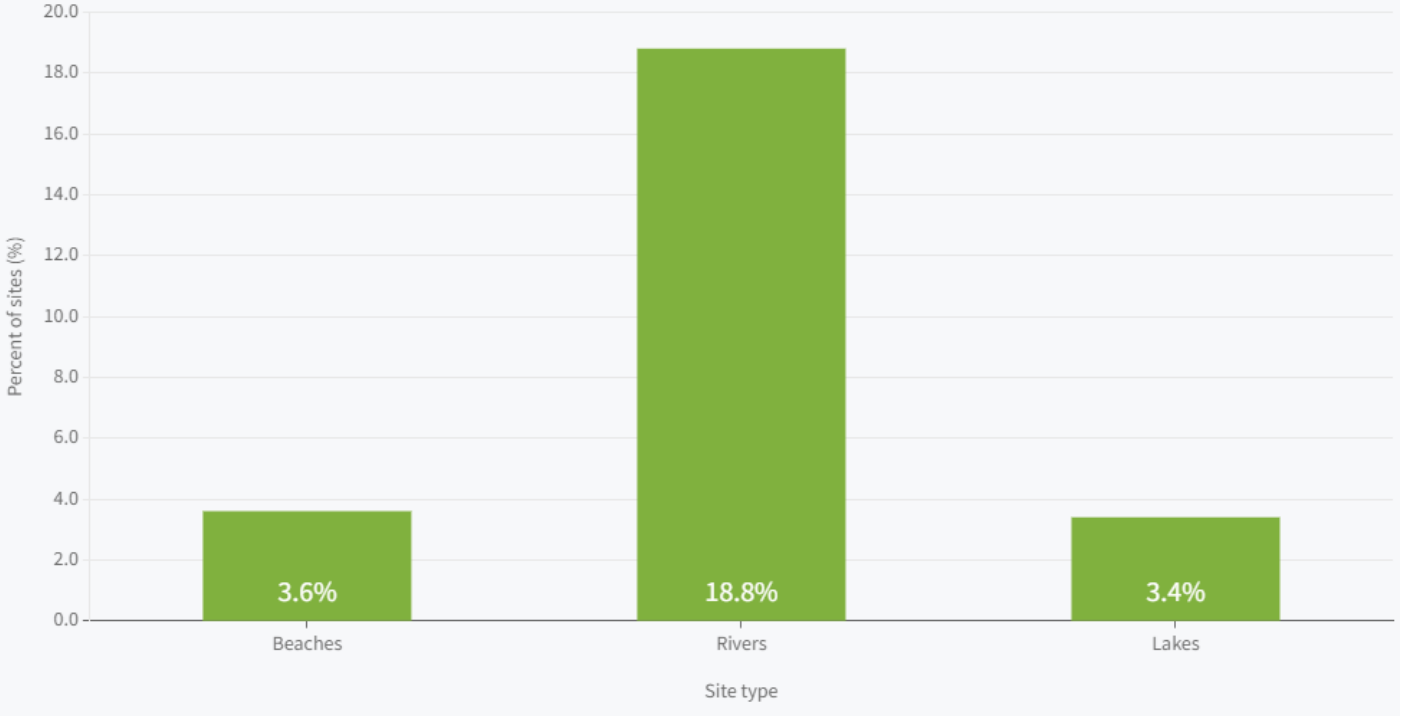


Source: Land, Air, Water Aotearoa 2020

Rivers are far more likely to be frequently unsafe to swim

At the national level, 47 river sites (18.8% of all those monitored) were found to be unsuitable for swimming on 20.0% or more of the occasions they were surveyed in the 2019–20 bathing season, along with 11 beach sites (3.6%) and two freshwater lakes (3.4%) (Figure 2).

Figure 2 Percentage of bathing sites that tested unsafe for swimming more than 20.0% of the time, 2019/20



Source: Land, Air, Water Aotearoa 2020

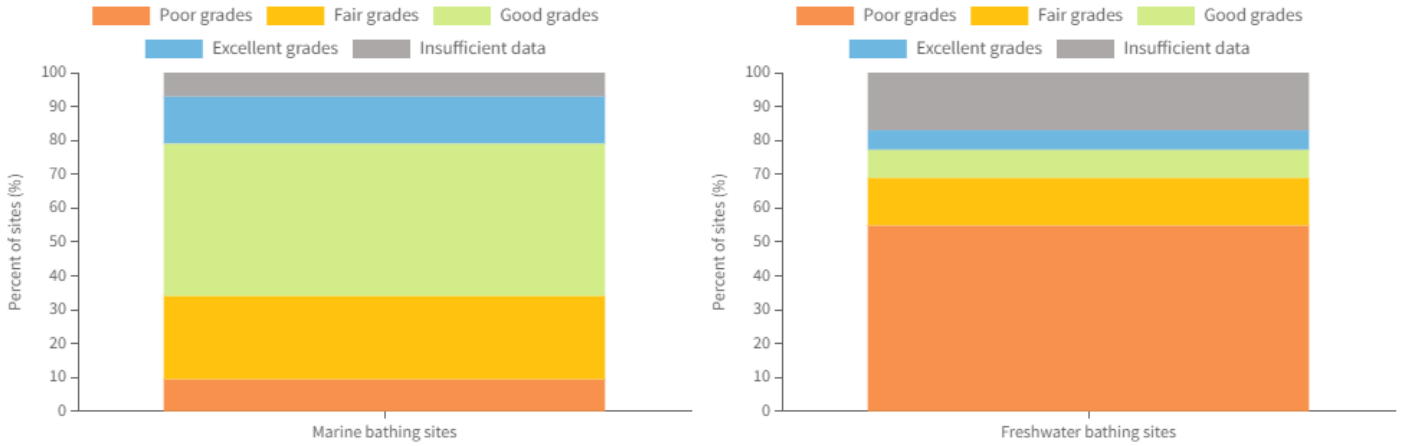
Long-term risk is generally high at freshwater sites and usually low at marine ones

Between 2015–20, the long-term bacterial risk at marine bathing sites was generally low across all regions, with just 9.4% of the 309 monitored sites receiving a 'poor' grade, making them unsuitable for swimming (Figure 3a). Beaches tend to have lower concentrations of FIB as contaminants are more rapidly diluted by currents and the larger volume of water.

In contrast to marine bathing sites, more than half of all freshwater bathing sites were unsuitable for swimming, with 54.8% of all monitored river and lake sites receiving a 'poor' grade between 2015–20 (Figure 3b).

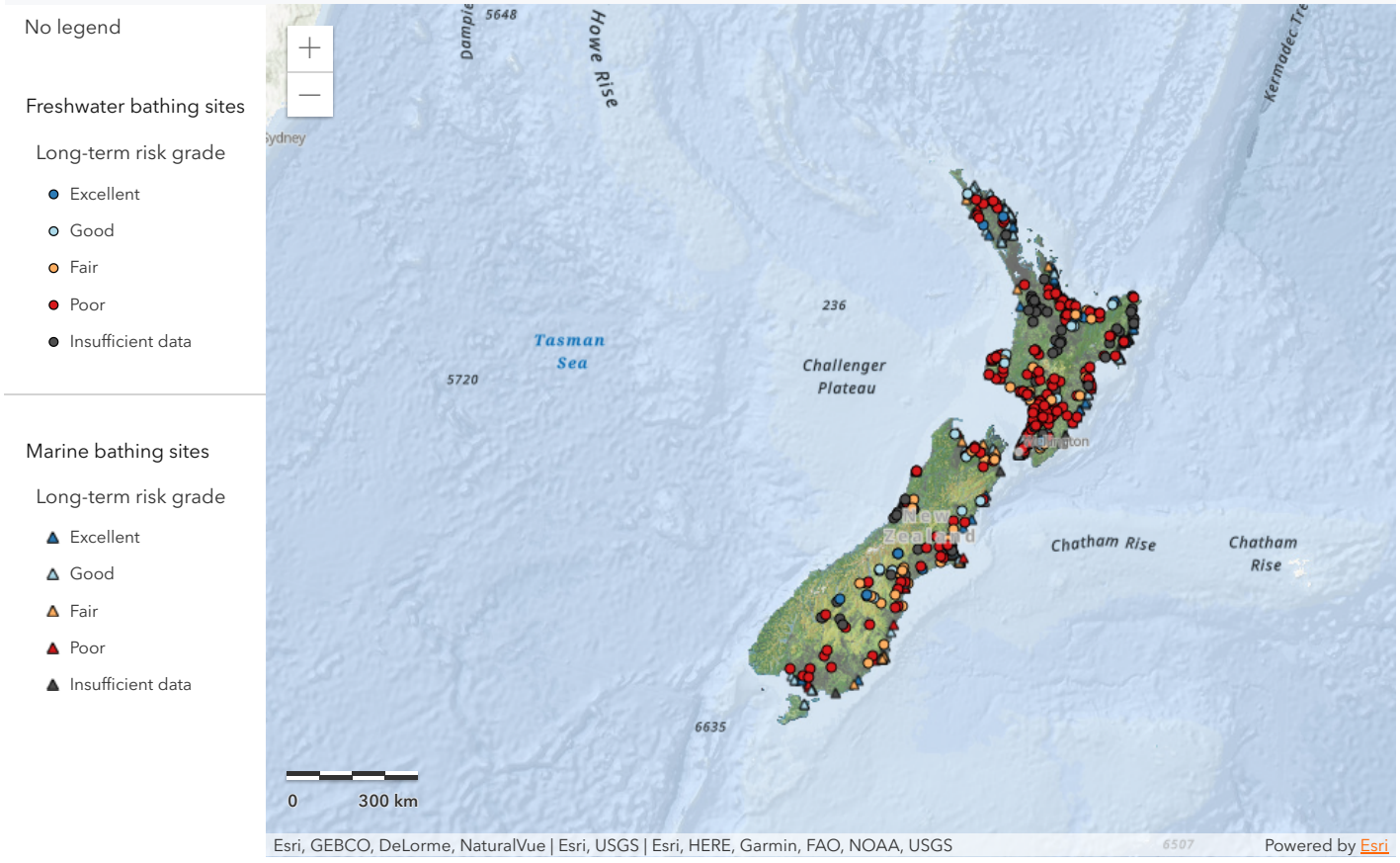
For more information about bacterial risk at the regional level, see the 'Regional Council' factsheet and Figure 4 below.

Figures 3a-b Bacterial risk for marine bathing sites (left) and freshwater bathing sites (right), 2015–20



Source: Land, Air, Water Aotearoa 2020

Figure 4 Long-term bacterial risk for freshwater and marine bathing sites, 2015–20

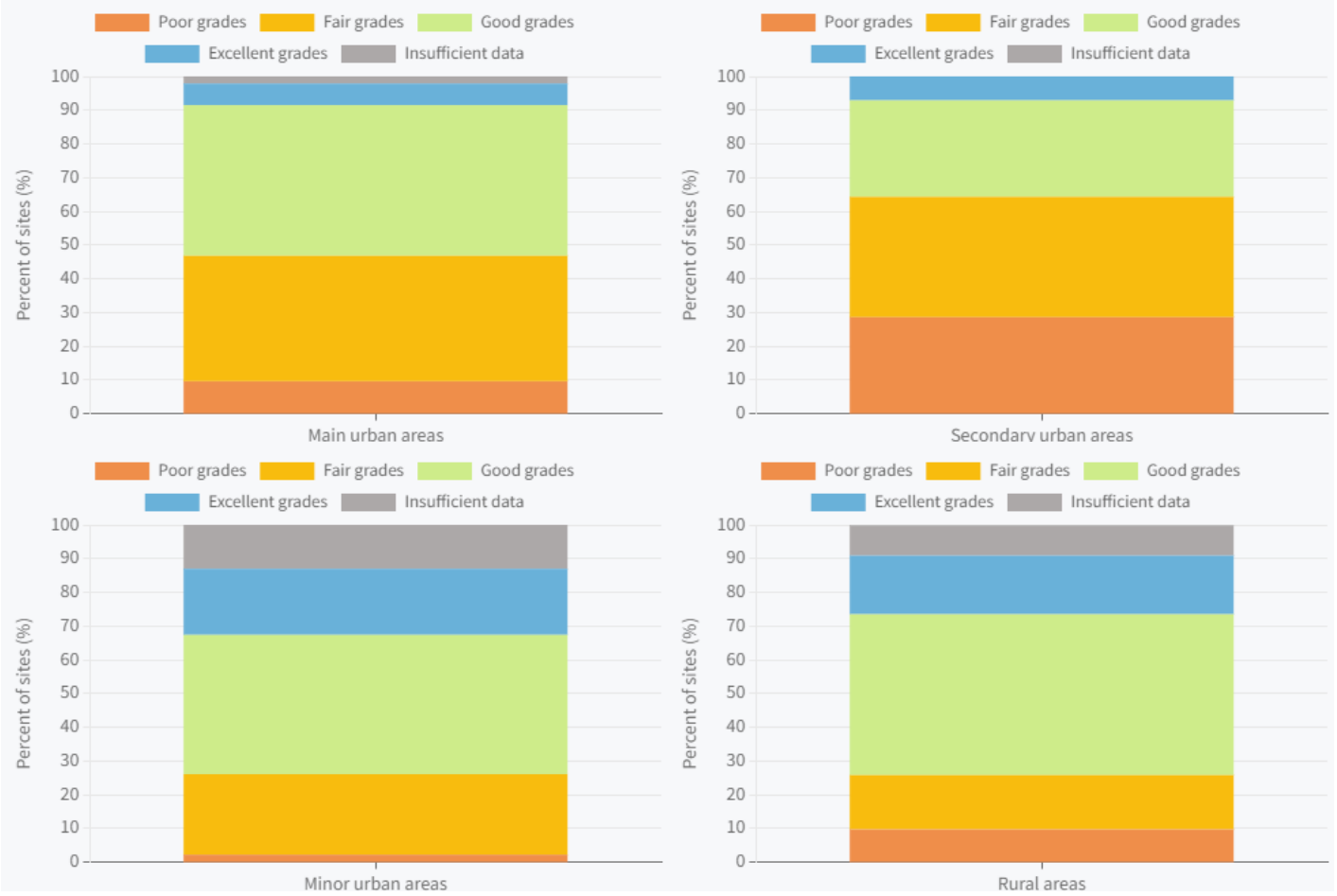


Source: Land, Air, Water Aotearoa 2020

Bathing sites in urban areas are less likely to receive the best risk grades

Monitored marine swimming sites in main and secondary urban areas had roughly half as many sites that received 'excellent' grades (Figures 5a & 5b) compared to those in minor urban or rural areas (5c & 5d).

Figures 5a-d Bacterial risk at marine bathing sites, by urban/rural classification, 2015–20



Source: Land, Air, Water Aotearoa 2020

No freshwater bathing sites in the main or secondary urban areas of New Zealand received an 'excellent' grade (Figures 6a & 6b). Overall, urban areas also had a greater share of 'poor' graded sites than rural areas (6d). Secondary urban areas were under-monitored compared to the other areas, more than a third of sites in such areas were not monitored often enough to derive a valid long-term risk grade (6c).

Figures 6a-d Bacterial risk at freshwater bathing sites, by urban/rural classification, 2015–20

Source: Land, Air, Water Aotearoa 2020

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Interactive regional dashboard for water quality data

Data for this indicator

This indicator analyses the most recent data available from Land, Air Water Aotearoa (LAWA)'s recreational bathing dataset, published online in November 2020.

Data availability

As the Auckland region does not supply water quality sampling results to LAWA, the region has been excluded from the recreational bathing data set and, consequently, from all analyses in this factsheet, as field measurements and predicted data are not comparable.

Grading of sites

Two measurements of swim site quality are presented in this fact sheet. Firstly, the regular monitoring results, which are passed to LAWA by regional councils and are based on regular field sampling at each site. A grade is assigned to every measurement based on the concentration of FIB at the time of measurement. Concentrations of *E. Coli* are assessed at freshwater sites and Enterococci at marine sites, though some estuarine sites are tested for both.

Sampling is usually conducted at least once per week during the summer bathing season (the last week in October to the end of March). Grades are assigned to each measurement as below:

Grade	Criteria (*E. coli*)	Criteria (Enterococci)
Green	The site was safe to swim at the time of measurement.	
	Equal to or less than 260 *E. coli* per 100ml	Equal to or less than 140 Enterococci per 100ml
Amber	The site was generally safe at the time of measurement, but caution would be advised for children, the elderly, or those with compromised health	
	More than 260 *E. coli* per 100ml	More than 140 Enterococci per 100ml
Red	The site was not safe to swim at the time of measurement.	
	More than 550 *E. coli* per 100ml	More than 280 Enterococci per 100ml

Secondly, 'long-term bacterial risk' is calculated based on the value of all recorded FIB concentrations at a given swim site over the past five monitoring seasons. The overall risk is determined according to these criteria:

Grade	Criteria (*E. coli*)	Criteria (Enterococci)
Excellent	95th percentile value of *E.coli* /100ml: 0–130 *Estimated risk of Campylobacter infection is <0.1%, 95% of the time.*	95th percentile value of Enterococci /100ml: 0–40 *Estimated risk of contracting an illness is <1% during the summer bathing period*
Good	95th percentile value of *E.coli* /100ml: >130–260 *Estimated risk of Campylobacter infection is >0.1–1%, 95% of the time.*	95th percentile value of Enterococci /100ml: >40–200 *Estimated risk of contracting an illness is <5% during the summer bathing period*
Fair	95th percentile value of *E.coli* /100ml: >260–500 *Estimated risk of Campylobacter infection is 1%–5%, 95% of the time.*	95th percentile value of Enterococci /100ml: >200–500 *Estimated risk of contracting an illness is >5%–10% during the summer bathing period*
Poor	95th percentile value of *E.coli* /100ml: >500 *Estimated risk of Campylobacter infection is >5%, 95% of the time.*	95th percentile value of Enterococci /100ml: >500 *Estimated risk of contracting an illness is >5%–10% during the summer bathing period*

To receive a valid 'overall risk' grade, a site must have at least 50 sample results across the past five monitoring seasons (2015/16 – 2019/20) and must have been 'recently' monitored – i.e. it must have data recorded for the most recent two bathing seasons. Therefore, a site with more than 50 total measurements since 2015 but unmonitored in the 2019/20 swim season would be graded 'insufficient data'.

Samples taken as part of follow-up tests prompted by elevated FIB levels were excluded from the assessment. Where sites were monitored for both enterococci and *E.coli,* measurements of each FIB type were assessed separately, and the worse of the two resulting grades was assigned as the site's long-term grade.

For additional information, see the metadata link below.

References

Land, Air, Water Aotearoa. 2021. Factsheet: Coastal and freshwater monitoring. Retrieved from https://www.lawa.org.nz/learn/factsheets/coastal-and-freshwater-recreation-monitoring/ on 20/10/2021

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McBride G, Soller J. 2017. Technical Background for 2017 MfE' Clean Water' Swimmability Proposals for Rivers. NIWA

Other related topics include:
Waterborne diseases related to recreational water
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Citation
Environmental Health Intelligence NZ, 2021. *Faecal indictor bacteria at recreational bathing sites.* {Factsheet}. Wellington: Environmental Health Intelligence NZ, Massey University.

Further information
For descriptive information about the data Metadata Sheet

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