



North and Coastal Otago

Annual Monitoring Summary

2006-2007

Key points

- A higher number of water courses were classified as poor in 2007 than in 2006, primarily due to the poor water quality in the mainstem Tokomairiro as well as low dissolved oxygen levels in the lower Kakanui and Shag Rivers.
- Dunedin's urban streams, the Tokomairiro and Waiareka Creek had high concentrations of the bacteria *E. coli*.
- Dunedin's urban streams and Waiareka Creek had the highest concentrations of nutrients.
- Northern Otago coastal rivers generally showed better water quality than both Dunedin's urban streams and south Otago's rivers.
- There is a reasonable correlation between water quality and biological health.

Between June 2006 and the end of May 2007 the Otago Regional Council monitored 23 river and stream sites in the northern and coastal areas of Otago in order to assess the current state of water quality. Seven of these sites were monitored as part of a Tokomairiro River water quality investigation. Historical results and longer term trend analysis is available in the 2007 SOE report.

Discharges to water in the north and coastal Otago river catchments are comprised largely of treated sewage and industrial discharges, with many being discharged directly into the coastal environment. Land use has the greatest effect on water quality and the sites with poorer water quality are generally intensively farmed, such as in the Tokomairiro catchment or have urban catchments such as the Dunedin city streams.

photos courtesy of Stephen Moore



Guidelines & standards

- The ANZECC (2000) guidelines outline trigger values for water quality aspects that put stress on river and stream health. This specifies a level below which the risk of adverse biological effect is low. Note: the ANZECC trigger values used here are for lowland rivers (< 150m).
- Otago's water quality standards are outlined in the Regional Plan: Water, which sets targets to maintain and improve water quality within the region.
- The DoH (1992) guidelines for contact recreation waters recommend a season median of 126 E. coli/100 ml.

Water quality results

Sites were classified using a water quality index, derived from median values of seven indicator variables: turbidity, dissolved oxygen (percentage saturation), total nitrogen, nitrite-nitrate nitrogen, total phosphorus, dissolved reactive phosphorus, and Escherichia coli (E.coli) bacteria.

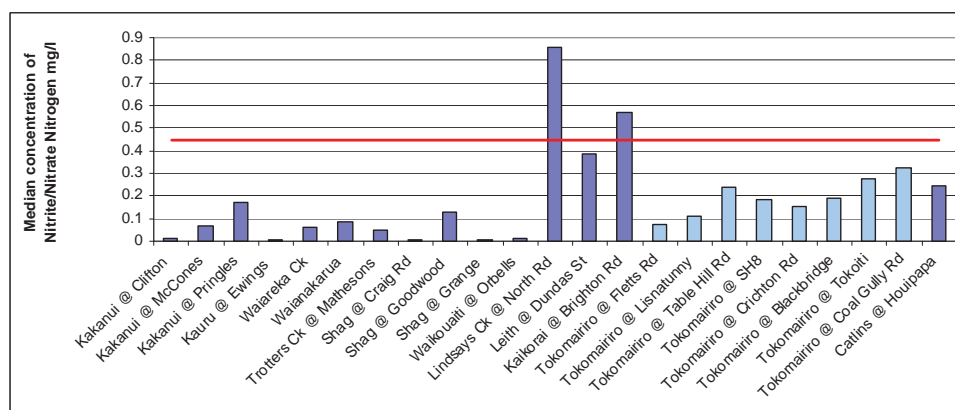
Median values of these variables were compared with ANZECC and Department of Health guideline levels, enabling classification of water quality into one of the following groups:

Very Good	All seven values comply with guideline values
Good	Five or six median values comply (dissolved oxygen must comply)
Fair	Three or four median values comply (dissolved oxygen must comply)
Poor	Two or fewer median values comply with guideline values
Poor (Low DO)	Dissolved oxygen falls below 80% saturation.

Selected water quality indicators are displayed in the graphs and discussed below. Overall these graphs show that water quality is generally good or very good, with poorer quality in Dunedin's urban streams and some south Otago rivers.

Nutrients

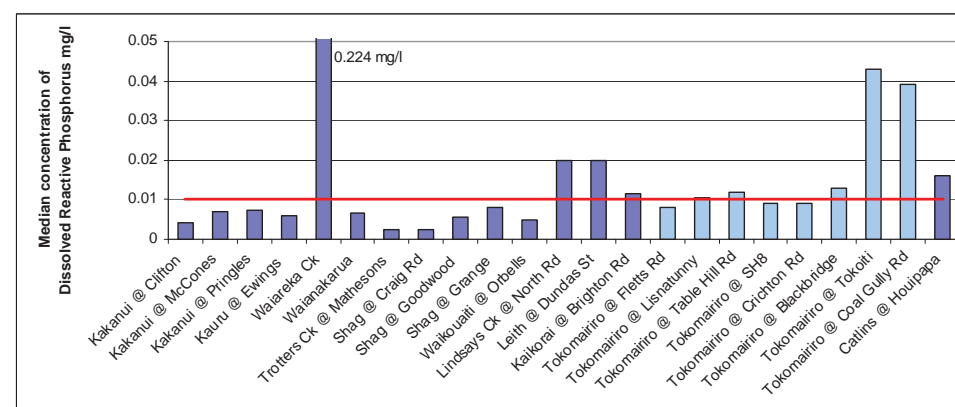
Nitrite-nitrate nitrogen (NNN) is a form of nitrogen primarily derived from land drainage. It is an important nutrient for algae and other plant growth, but can be harmful in higher concentrations. The median concentration of NNN was above the ANZECC trigger value at two sites: the Kaikorai and Lindsay's Creek, both Dunedin urban streams. The Water of Leith also approached the trigger value while the remainder of sites had median values well below the default trigger.



Note

The red lines on these graphs indicate the ANZECC trigger value or the DoH guideline level. The graphs represent both core SoE water quality monitoring (colour coded blue) as well as targeted catchment monitoring in the Tokomairiro River (colour coded turquoise).

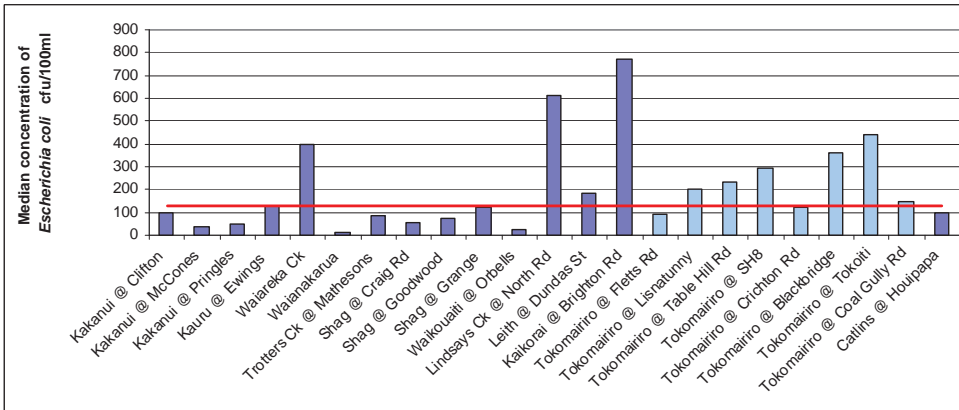
Median dissolved reactive phosphorus (DRP) concentrations were above the ANZECC trigger value for nearly half of all sites analysed. These high-DRP sites include Waiareka Creek, Dunedin's urban streams, most of the Tokomairiro River sites and the Catlins at Houipapa. Rivers of the north Otago coast generally showed median DRP concentrations lower than the trigger value, with the exception of Waiareka Creek.



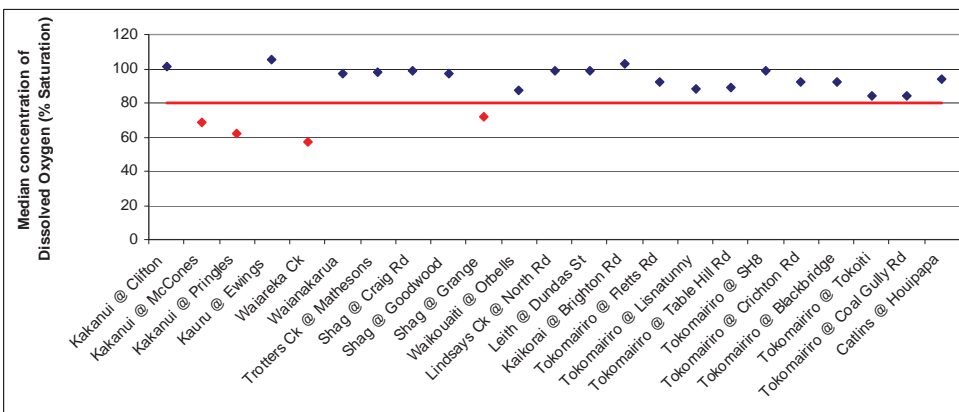
Bacteria

Median levels of *E. coli* bacteria were above the DoH guideline level (126 cfu/100ml) at 11 of the 23 sites analysed. Levels were highest in Dunedin's urban streams, and at sites in the Tokomairiro and Waiareka Creek. The streams of the north Otago coast generally had *E. coli* levels below the guideline value.

Dissolved Oxygen



Dissolved oxygen saturations should be above 80 percent, and below this saturation is considered insufficient for biological health. The median saturation was below the trigger value of 80 percent at four sites. The two sites in the lower Kakanui River, the Shag River at Grange Road and Waiareka Creek had low dissolved oxygen saturation. In 2005 Waiareka Creek had extremely low dissolved oxygen saturation (20.9 percent), this situation has improved, probably due to increased flow from the North Otago Irrigation Scheme.



Other analytes

- Ammoniacal nitrogen is the combination of ammonium ions and ammonia (NH₃). Levels of ammoniacal nitrogen were well below the ANZECC guideline level of 0.9 mg/l in all samples analysed. NH₃ is the main toxic component of ammoniacal nitrogen, the toxicity of which is dependent on pH and temperature. Taking these factors into account, levels of NH₃ were also well below the guideline value (0.021 mg/l) at all sites.
- Water at all sites was neutral with respect to pH, falling within ANZECC guideline levels.
- Turbidity was only elevated above trigger values in the Catlins at Houipapa, a naturally tannic river.
- Five sites had median concentrations of total nitrogen elevated above the trigger level (0.614 mg/l): Waiareka Creek (0.785 mg/l), Lindsays Creek (1.09 mg/l), Leith at Dundas Street (0.635 mg/l), Kaikorai at Brighton Road (1.135 mg/l) and the Tokomairiro at Tokoiti (0.62 mg/l). These results are very similar to those of 2005/06 analyses.
- Eleven of the sites had median concentrations of total phosphorus above the trigger level (0.033 mg/l). Waiareka Creek showed the most significant elevation at 0.29 mg/l, a much higher concentration than last year (0.199 mg/l). Dunedin's urban streams and the Tokomairiro also showed elevated concentrations of phosphorus.

Ecosystem health

Ecosystem health takes into account a wide range of inter-linked factors, such as water quality, habitat and instream biota. It is generally assessed using two communities that are important to the food chain in rivers and streams: streambed macroinvertebrates (e.g. insects, crustaceans, snails, worms) and periphyton (e.g. algae).

These biological indices put a large amount of information into a compact form. They are therefore inherently coarse tools that give a broad view of general patterns. However, they are useful as the presence or absence, abundance and distribution of species can inform us greatly about the quality and condition of the site at which they live.

A key component of the MCI index is the availability of suitable habitat. The MCI index is designed specifically for stony riffle substrates in flowing water, MCI values can vary due to the availability of suitable habitat and not necessarily due to water quality. As substrate type can vary greatly between riffles it is often more appropriate to compare changes in MCI values at the same site over a period of time rather than between sites throughout the catchment. However, by understanding the limitation of the MCI index it still can be useful for picking up improvements or deterioration in water quality at individual sites over time.

Criteria for macroinvertebrate health

Macroinvertebrate Index	Poor	Average	Good	Excellent
MCI	<80	80 - 99	100 - 120	>120
SQMCI	<4	4 - 5	5 - 6	>6
Total species	<10	10 - 20	20 - 30	>30
Total EPT species	<5	5 - 15	15 - 20	>20

North and Coastal Otago macroinvertebrate health 2006/07

Site	MCI Score	SQMCI Score	No. Taxa	EPT Taxa
Kakanui @ Clifton	110	6.5	16	8
Kakanui @ McCones	88	3.7	17	9
Kakanui @ Pringles	90	4.2	16	9
Kauru @ Ewings	106	6.7	17	8
Waiareka Ck	60	4.4	9	0
Waianakarua	109	6.7	17	9
Trotters Ck @ Mathesons	81	3.7	14	4
Shag @ Craig Rd	91	6.2	14	7
Shag @ Goodwood	103	4.2	7	4
Shag @ Grange	98	6.4	9	5
Waikouaiti @ Orbells	88	4.5	18	8
Lindsays Ck @ North Rd	95	2.9	15	7
Leith @ Dundas St	99	5.1	18	9
Kaikorai @ Brighton Rd	73	1.7	8	0
Catlins @ Houipapa	114	5.3	17	11

There is no change to previous years. Excellent SQMCI scores are found in the Shag, Kakanui and Waianakura catchments where both water quality and habitat are good. Poorer macroinvertebrate health is generally found in the lower catchments, where habitat for macroinvertebrates is compromised, generally through sediment build up. Dunedins urban streams, have poorer habitat as well as poorer water quality which impacts on macroinvertebrate health.

Biological indices

- EPT species – this index is a sum of the total number of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) species collected.
- MCI – The Macroinvertebrate Community Index is based on adding the “pollution tolerance” scores of all species found at a site. Species that are very sensitive to pollution score highly whereas more pollution tolerant species receive a low score.
- SQMCI – The Semi-quantitative Macroinvertebrate Community Index is a variation of the MCI that accounts for the abundance of pollution sensitive and tolerant species.

Recent ORC reports

- Water Quality of the Tokomairiro River, May 2007.
- State of Environment Report, Surface Water Quality in Otago (May 2007).

Contact

Otago Regional Council
Ph: 0800 474 082

www.orc.govt.nz

