



Estuary water quality

Annual Monitoring Summary

2006-2007

Key Points

- The Catlins, Waikouaiti and Kakanui estuaries have high dissolved reactive phosphorous (DRP).
- The Taieri estuary has high DRP and turbidity.
- The Tokomairiro estuary has very high DRP and high turbidity.



Catlins Estuary

Estuaries are transitional zones that are a complex blend of continuously changing habitats. The estuary itself is a well-defined body of water, bounded at its mouth by the ocean and at its head by the upper limit of the tides. It drains a much larger area, however, and pollutant-producing activities near or in tributaries may still adversely affect the estuary's water quality.

While some of the water in an estuary flows from the tributaries that feed it, the remainder moves in from the sea. When fresh and salt water meet, the two do not readily mix. Fresh water flowing in from tributaries is relatively light and overrides the wedge of more dense salt water moving in from the ocean. This density differential often causes layering or stratification of the water, which significantly affects both circulation and the chemical profile of an estuary.

Which estuaries do we monitor and what is monitored

In 2006-2007 the Waikouaiti, Shag, Taieri, Catlins, Kakanui and Tokomairiro estuaries were monitored three times, over the six hour low tide period. A Hydrolab DS5X meter was deployed to continuously monitor salinity, dissolved oxygen, turbidity, chlorophyll a (Chla) and temperature, and in addition, at hourly intervals depth profiles were taken with the Hydrolab DS5X and nutrient, metal and faecal bacteria samples were taken.

- Nitrogen: is generally the limiting nutrient to plant growth in marine systems, the amount of dissolved inorganic forms present (nitrite-nitrate nitrogen, ammonia) is particularly important as they are available for biological uptake and would indicate the likelihood of eutrophication.
- Phosphorus: is generally the limiting nutrient in freshwater systems.
- Chlorophyll a: is useful as it can be used as an indicator of algal biomass (ANZECC 2000).
- Turbidity: refers to how clear the water is. Turbidity increases when the amount of suspended solids such as clay, silt or plankton increase. If water becomes too turbid, it loses the ability to support a wide variety of plants and other aquatic organisms.

Generally an increase in nitrogen, Chla or turbidity within an estuary over time would be considered detrimental (Ward et. al. 1998), and suggest a decrease in the health of the estuary.

Other points to note

- Nutrient sampling highlighted naturally high levels of nitrogen from oceanic sources.
- Metal concentrations were elevated in three out of the six estuaries sampled.
- The MfE/MoH water contact recreation guideline (260 E.coli/100ml) was only breached on the Taieri estuary on one of the sampling occasions.
- Estuary monitoring is now a regular part of State of Environment monitoring. Water quality data over the low tide period will be collected on at least two occasions per annum for each estuary.



Kakanui Estuary

Recent ORC reports

- State of Environment Report, Surface Water Quality in Otago (May 2007)

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Provisional categories for key water quality parameters for Otago estuaries

Parameter	Units	Low	Medium	High	Very High
Turb	NTU	0 to 4	4.1 to 10	10.1 to 20	>20
Chla	µg/l	0 to 3	3.1 to 6	6.1 to 10	>10
NNN	µg/l	0 to 20	21 to 50	51 to 100	>100
DRP	µg/l	0 to 10	10.1 to 20	20.1 to 30	>30

Results

Results from the 2006 to 2007 estuary monitoring can be seen in the table below. It is clear that the Tokomairiro is the most highly degraded estuary, in large part due to the presence of a sewage outfall upstream, however land practices (intensive agriculture) in the Tokomairiro catchment also cause water quality degradation.

Median value for Turbidity, chlorophyll *a*, NNN and DRP concentrations in Otago estuaries.

Parameter	Units	Estuary					
		Shag	Taieri	Waikouaiti	Catlins	Kakanui	Tokomairiro
Turbidity	NTU	3.6	12.9	0.9	7	2.6	20
Chlorophyll <i>a</i>	µg/l	0.79	1.03	1.055	3.82	0.8	1.515
NNN	µg/l	0.084	31	25	25	47	46
DRP	µg/l	0.017	25	25	25	22	31

Stratification

Physical and chemical processes in estuaries are related to the extent of tidal flushing and stratification. Stratification is the layering of the estuary, which is generally associated with the inflow of denser salt water at depth and the outflow of more buoyant fresh water at the surface. Vertical stratification was very distinct in the Kakanui, Catlins and Waikouaiti estuaries. The Shag and Taieri estuaries were not stratified.

An example of stratification is shown below where an increase in depth in the Waikouaiti estuary also shows a marked increase in salinity.

