MARLBOROUGH DISTRICT COUNCIL

Coastal Water Quality - Monitoring 2015/2016

Key Points

- MDC has an ongoing Sounds monitoring programme to determine water quality
- It is important to distinguish between natural changes in conditions vs anthropogenic
- Nitrate is an important nutrient to monitor as it can have direct effects on water quality
- The major sources of excess nitrate is from the surrounding land and from fish farms
- Algal growth, measured as chlorophyll-*a*, increases with an increase in nitrate
- This may lead to algal blooms and lowered dissolved oxygen in the bottom waters
- Monitoring results show that nitrate levels are within desirable limits

What is Marlborough District Council doing?

Monitoring is essential in order to pick up any changes in the water quality over time and to determine how water quality is affected by inputs from different sources.

MDC monitors and collect samples monthly in the Totaranui/Queen Charlotte Sound and Te Hoiere/ Pelorus Sound. This gives a good indication of natural seasonal changes and catchment influences, and long-term data enables us to identify irregularities.

MDC has been monitoring Totaranui/Queen Charlotte Sound since 2011, and Te Hoiere/Pelorus Sound since 2012. There are a total of 11 sites in each Sound that get sampled throughout the main axis and in the major side-arms.

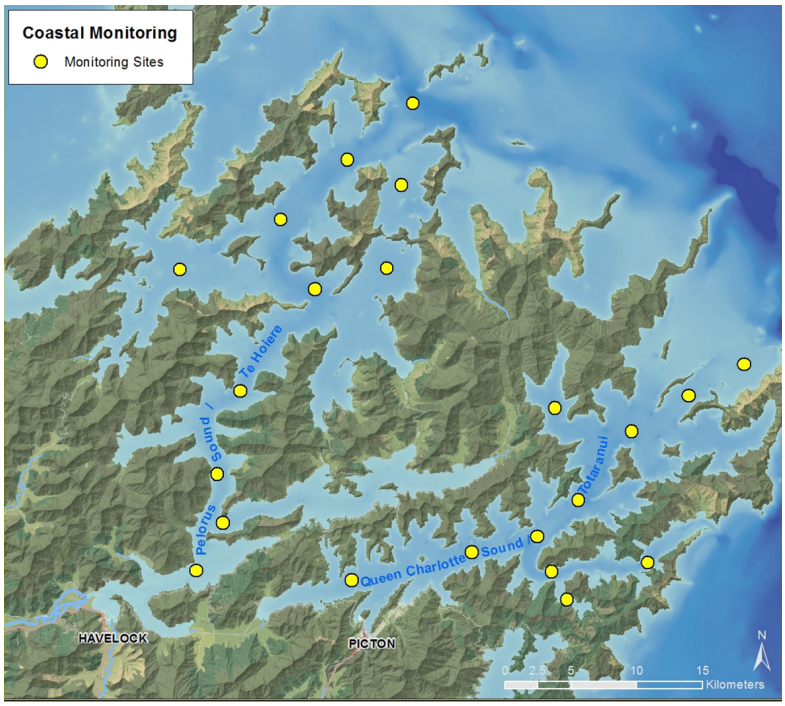

Figure 1: Map of sampling site locations in the Marlborough Sounds.

What we measure

Nitrate, chlorophyll-*a* and dissolved oxygen. These are important indicators of ecosystem health. We also measure the amount of sediment particles in the water. Fine sediment affects the clarity of the water and can therefore impact on the aesthetic values of the Sounds. It can also smother the sea bed, reducing biodiversity.

Physical properties of the water column change with depth. The changes in water temperature, salinity and other physical measures with depth provide information about the amount of mixing that occurs in the water column.

Various nutrients important to the health of the ecosystem are also measured, including phosphorus and silicon.

Why we measure

These measurements show the movement of the water and resulting transportation of nutrients in the system, as detailed in NIWA's hydrodynamic models. This allows us to predict how the system will respond to changing nutrient levels. We can see which changes need to be made to promote the sustainability and health of the Sounds, as summarised in the State of the Environment Report (2015).

This is especially important in the Marlborough Sounds, where high aquaculture use and farming in the catchments have the potential to cause nutrient enrichment and change the trophic state of the ecosystem.

The monitoring data is vital in establishing baseline measurements—something that we can use as "normal" values over time to compare results that may indicate changes.

What is chlorophyll-*a*?

Chlorophyll-*a* is the main colour pigment of algae used for photosynthesis. The measurement of chlorophyll-*a* is an efficient way of monitoring the amount of algae in the water. Algae drive productivity through the food chain, therefore high chlorophyll-*a* concentrations are an indication of high algae concentrations.

The importance of chlorophyll-*a*, dissolved oxygen and nitrate

Chlorophyll-*a* and dissolved oxygen can change as a result of altered nutrient input, and these trends can be detected over time and compared to baseline levels.

Nitrate is one of the main nutrients required by algae for photosynthesis. Therefore an increase in nitrate concentrations can lead to increased algae growth resulting in higher chlorophyll-*a* concentrations. This can lead to "dirtier" looking water, which affects the aesthetics and recreational use of the Sounds. More importantly, it could cause very low oxygen concentrations in the bottom waters as the extra organic matter sinks to the bottom where it is broken down - a process that uses up the oxygen. If dissolved oxygen concentrations are too low, it may prove detrimental to the organisms living there and potentially cause significant long-term habitat damage and subsequent ecosystem degradation.

Fish Farms

If the fish farms are run with good practices and according to prescribed guidelines, there should not be a problem. The Sounds hydrodynamic models suggest that it is unlikely for the currently consented fish farms to change the trophic state of the water; however, in order to ensure the sustainable use of the Sounds, ongoing monitoring will confirm whether adverse effects on the surrounding marine environment exist.

Currently algae growth appears to have not been affected by an increase in nutrients from fish farms.

Seasonal Patterns

Chlorophyll-*a* shows a seasonal pattern that changes throughout the year due to different concentrations of nutrients (mainly nitrate) and light conditions available. Nitrate concentrations increase during winter when river flows are higher. Rivers and streams are the main source of nitrate from land. Because no large rivers flow into the Totaranui/Queen Charlotte Sound the seasonal nitrate patterns are not as strong compared to the Te Hoiere/Pelorus Sound.

Nutrient-rich oceanic waters from the Cook Strait coming into the outer Sounds also bring in nitrate, particularly in El Niño conditions.

Despite the higher nitrate concentrations in winter algal biomass (measured as chlorophyll-*a*) is low due to reduced growth caused by lower water temperatures and shorter days (*Figure 2*). This acts as a break to naturally reset the system. Algal biomass is usually highest late winter/early spring (*Figure 3*).

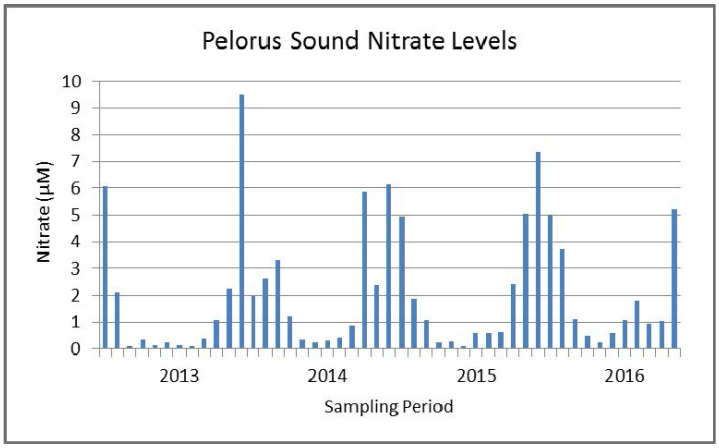

Figure 2: Nitrate concentrations over the sampling period to date in the Te Hoiere/Pelorus Sound.

Dissolved oxygen changes throughout the seasons as the water column becomes layered during warmer months, and mixed during colder months.

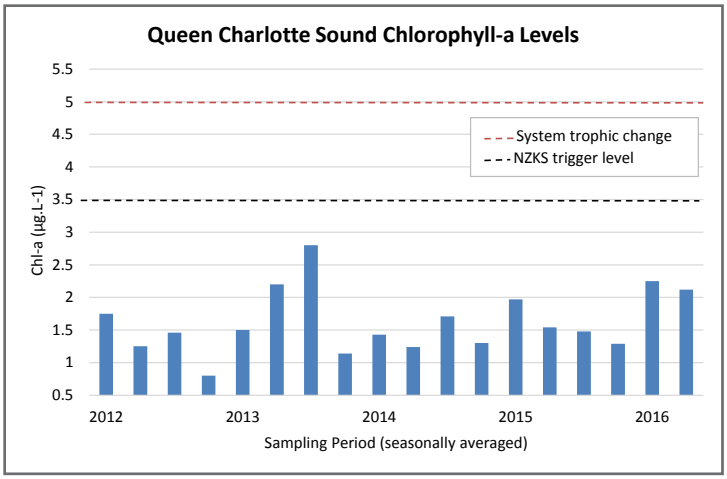

Figure 3: Average chlorophyll-a concentrations over the course of a year in the Totaranui/Queen C

Want to know more? www.marlborough.govt.nz

* *A Biophysical model for the Marlborough Sounds, Part One and Two* by NIWA simulates water movement through the Sounds and predict nutrient concentrations, and subsequent rates of phytosynthesis.
* *Water Quality in the Marlborough Sounds — Annual Monitoring report July 2014-June 2015* by NIWA over that monitoring period.
* *2015 State of the Environment's* Coastal chapter gives an overview of Marlborough's coastal environments, pressures on water quality and current state there of, as well as management of effects of aquaculture.

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For more information on coastal water quality go to
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