MARLBOROUGH DISTRICT COUNCIL

Coastal Water Quality - Monitoring 2016/2017

Key Points

- Council has an ongoing Sounds monitoring programme to determine water quality
- The data lets us distinguish between natural vs anthropogenic changes in conditions
- Nutrients such as nitrate can have direct effects on water quality
- The main external sources of extra nitrate are 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 which have various negative follow-on effects
- Monitoring results show that nitrate levels are within desirable limits
- Council's monitoring data feeds into the hydrodynamic models

What is Marlborough District Council doing?

Long-term monitoring is essential to identify any changes in the water quality over time and to determine how water quality is affected by inputs from different sources.

Council monitors and collects samples and data monthly in Tōtaranui/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 and determine their causes by inter-linking it with other measurements taken around the same period e.g. rainfall.

Council has been monitoring Tōtaranui/Queen Charlotte Sound since 2011, and Te Hoiere/Pelorus Sound since 2012. There are a total of 11 sites in each Sound that are sampled throughout the main channel of each Sound, and in the major side-arms (Figure 1).

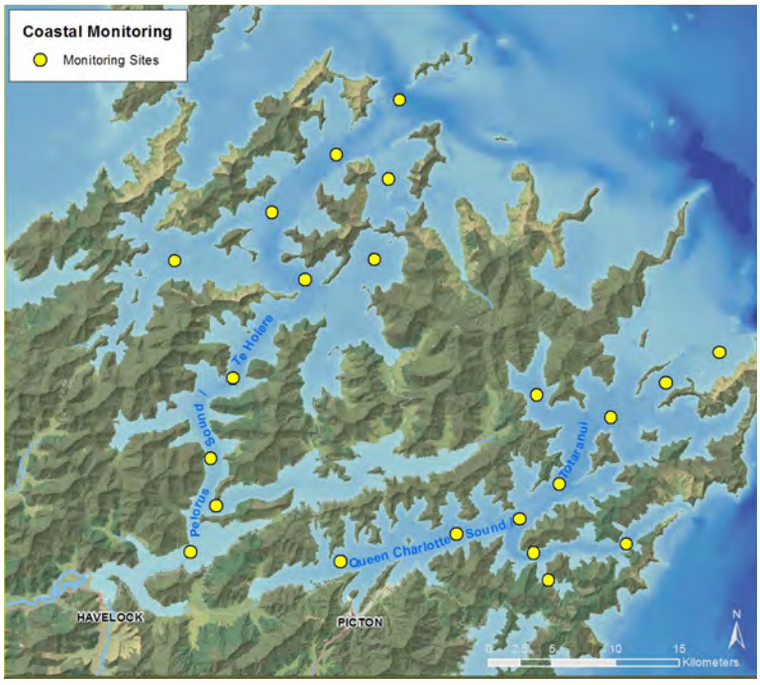

Figure 1: Map of sampling site locations in the Marlborough Sounds.

What we measure

- Chlorophyll-*a* and dissolved oxygen. These are important indicators of ecosystem health.
- Various nutrients, including nitrate, directly influence the health of the ecosystem.
- 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 as it changes with depth. The changes in water temperature, salinity and other physical measures with increasing depth provide information about the amount of mixing in the water column and the direction of water movement.

Why we measure?

Our measurements show the movement of the water and resulting transportation patterns of nutrients in the system, as detailed in NIWA's hydrodynamic models. This allows us to predict how the system will respond to changes in e.g. 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 adds to a baseline dataset over time — something that we can use as "normal" values to compare results to 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 are affected by nutrient input, and these trends can be detected over time compared to baseline levels and values within certain thresholds.

Nitrate is one of the main nutrients required by algae for photosynthesis. Therefore an increase in nitrate concentrations can lead to increased algal growth (higher chlorophyll-*a* concentrations). This can lead to greener or "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.

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 current level of fish farming to change the trophic state of the water; however, in order to ensure the sustainable use of the Sounds, ongoing monitoring is needed to confirm whether adverse effects on the surrounding marine environment unexpectedly develop.

Currently chlorophyll-*a* appears to have not been affected by nutrients from fish farms.

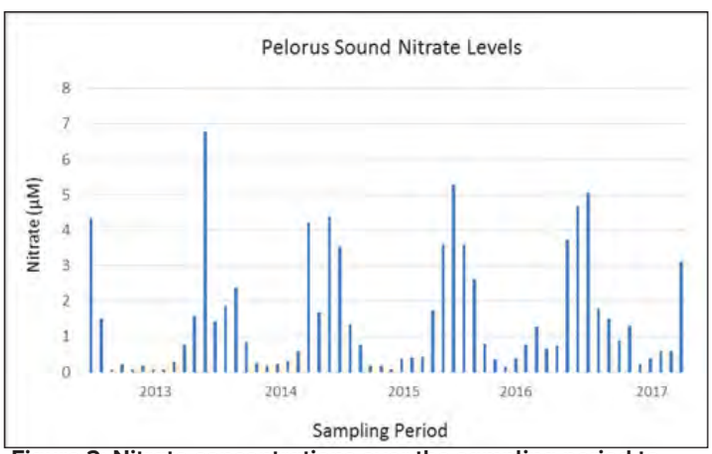

Figure 2: Nitrate concentrations over the sampling period to date in the Te Hoiere/Pelorus Sound.

Seasonal Patterns

Chlorophyll-*a* shows a seasonal pattern affected by different concentrations of nutrients (mainly nitrate) and seasonal light conditions. Nitrate concentrations increase during winter when river flows are higher (Figure 2), as rivers and streams are the main source of nitrate from land. Because no large rivers flow into Tōtaranui/Queen Charlotte Sound the seasonal nitrate patterns are not as strong compared to Te Hoiere/ Pelorus Sound.

Nutrient-rich oceanic waters from the Cook Strait coming into the outer Sounds also bring in nitrate.

Despite the higher nitrate concentrations, algal biomass is low in winter due to reduced growth caused by lower water temperatures and shorter days (Figure 3). This acts as a break to naturally "reset" the system.

Dissolved oxygen changes throughout the seasons as the water column becomes layered during warmer months, and mixed during colder months. This is an area subject to ongoing research to characterise these seasonal patterns more clearly.

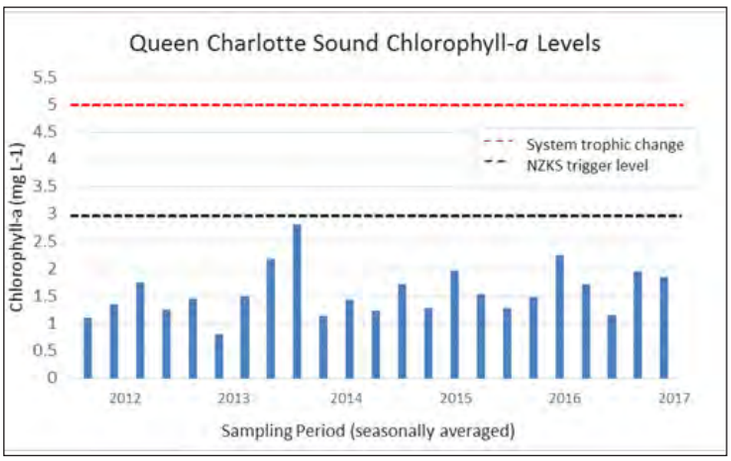

Figure 3: Average chlorophyll-*a* concentrations over the course of a year in the Totaranui/Queen Charlotte Sound.

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 thereof, as well as management of effects of aquaculture.

Published July 2017
(Ref E325-002-001)

For more information on coastal water quality go to
www.marlborough.govt.nz/environmental/coastal

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