Nutrients and floating algae in the Waikato River

This infosheet provides information on a Technical Leaders Group summary of a number of studies on the relationships between nitrogen, phosphorus and floating algae in the Waikato River system.

It is important to understand how floating algal growth responds to total nitrogen and total phosphorus. As part of the proposed plan change, the following characteristics (or 'attributes') of water will be measured, to check if people's values for the Waikato River are being achieved,

- total nitrogen (TN)
- total phosphorus (TP)
- chlorophyll *a* (monitored to measure floating algae levels in the river)

What's the issue

Floating algae are a natural part of lake and lake-fed river webs. However, they can also affect water clarity, taste, smell and colour. Blooms of certain algal species can result in skin irritations and may be toxic.

Floating algae only become a problem in the main stem of the Waikato River. This is partly due to the dams slowing the river's natural flow.

Information considered and findings

The Technical Leaders Group considered the following information:

- patterns (for example seasonal and location-specific patterns) and trends in chlorophyll *a* and nutrients
- results of two bioassays (tests which measure the effects of a substance on living things), and key findings from further bioassay work
- research on patterns and trends in water quality at the Waikato main stem sites
- a review by a caucusing of experts who interpreted the results of the bioassays.

After considering the information above, the Technical Leaders Group found that:

- Annual median concentrations of chlorophyll *a*, TN and TP generally increase with distance down the Waikato River.
- There appears to be a strong relationship between annual medians of TN, TP and chlorophyll *a*.
- Analysis of relationships between annual median chlorophyll *a* and TP and TN at individual sites over the last 20 years generally shows positive relationships with TP, but weak or negative relationships with TN. So under current conditions in the Waikato River, chlorophyll *a* is mainly responding to TP, not TN.
- Long term trends (since 1990) at sites on the Waikato Rivers show decreasing chlorophyll *a* but increasing TN and therefore a greater ratio of TN to TP at all sites.
- The exotic daphnid zooplankton, which eats floating algae, may have contributed to the pattern of reduced chlorophyll *a*. However, as this species has been in the Waikato River for at least 18 years, it's unlikely it is the key reason for the decreases in chlorophyll *a*.

The Technical Leaders Group also notes the following seasonal patterns of concentrations:

	Winter	Spring	Summer	Autumn
Chlorophyll *a*	lowest	higher		
Dissolved inorganic nitrogen	higher	-	lower	-
Dissolved reactive phosphorus				

They noted that TN to TP ratios are lowest in summer and autumn and highest in winter, at all sites from Ohakuri downstream to Tuakau. Occasional nitrogen limitation may occur in summer and autumn.

After considering the bioassay studies, the Technical Leaders Group agreed that:

- Neither nitrogen or phosphorus alone promoted growth of floating algae at any site at any time. Floating algae increased most often with addition of both nitrogen and phosphorus.
- The fact that the concentration of chlorophyll *a* in Lake Karapiro increased when nitrogen was added in March, but did not further increase when phosphorus was added, supports evidence that adding nitrogen in summer to autumn could result in increased floating algae growth.

Conclusions

The Technical Leaders Group agreed that the range of information they considered indicates that presently, phosphorus affects the annual median amount of floating algae in the Waikato River more than nitrogen does.

However, at times and in places during summer and autumn (when nitrogen levels in the water are lower due to catchment retention processes, such as in-river uptake by plants) adding nitrogen could increase the amount of floating algae in the river.

This suggests that efforts to control floating algae in the Waikato River should focus most on controlling phosphorus.

However, evidence suggests a secondary focus on nitrogen control is required:

- to help control summer/autumn chlorophyll *a* levels
- as a precautionary approach against increased annual median floating algae abundance, in case there is a reversal in reductions in phosphorus seen in the last decade, for example by extreme climate events that increase erosion processes and deposit more phosphorus-laden sediment into the river system, and as a precautionary approach against nuisance plant effects in downstream estuary and coastal environments.

More information

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