The Physical Susceptibility of Estuaries

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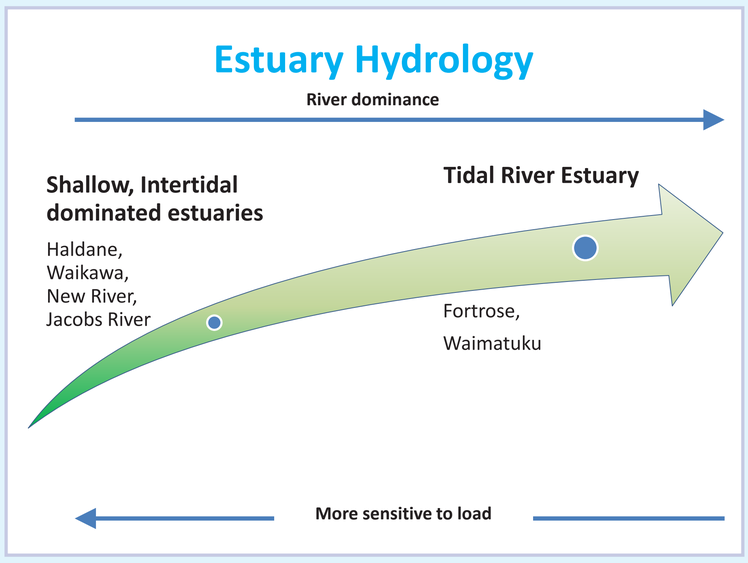


The susceptibility of an estuary to eutrophication is influenced by the flow of water. This includes tidal action and the amount of freshwater flowing in from its tributaries. By better understanding a system's hydrology, we can better assess its susceptibility to eutrophication.

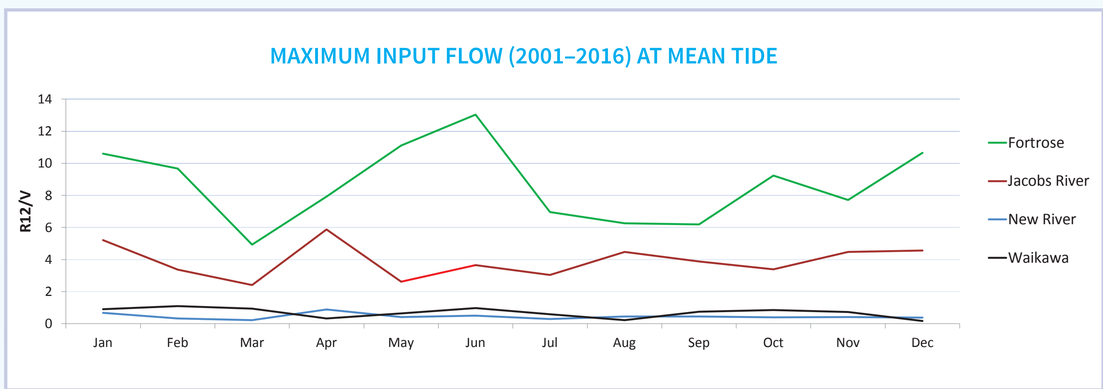
We looked at how in-flowing nutrients and sediment are diluted and retained. In most cases, if the water (and therefore nutrients) are flushed quickly, susceptibility to eutrophication is low. However, if the estuary has a long residence time, there is more time for nutrients to be taken up by algae and for 'blooms' to develop.

River dominance

A system with a greater river dominance is less sensitive to the load being delivered. For example, Fortrose (Toetoes) Estuary has the largest river dominance and is the least susceptible to eutrophication. Conversely, New River and Jacobs River estuaries have less river dominance and are therefore more susceptible to eutrophication.

The graphs show a comparison of the river dominance between a tidal river estuary (Fortrose (Toetoes)) and tidal river lagoon estuaries (Waikawa, New River, Jacobs River). Maximum flow has been used to express when we are seeing high river dominance (flood events).

Note how these systems are dynamic through time. Also note the difference between the system types, such as Fortrose (Toetoes) and Jacobs River estuaries. Differences can also be observed within system types, i.e. Jacobs River, New River and Waikawa estuaries. The similarity between New River and Waikawa estuaries indicate that Waikawa is as susceptible to load. However, Waikawa does not realise the same level of eutrophication as the Jacobs River or New River estuaries due to lower load inputs. This indicates potentially similar outcomes for Waikawa as New River Estuary if loads increase to a high enough level.



R12 is defined as the volume of river water flowing into the estuary during a tidal cycle (12.4 h). V is defined as the volume of the estuary at high water. Estuaries with a large R12/V ratio are dominated by river forcing. Fortrose has the largest R12/V ratio and despite its current high nutrient load, is expressing the least symptoms of eutrophication.


Toetoes Harbour

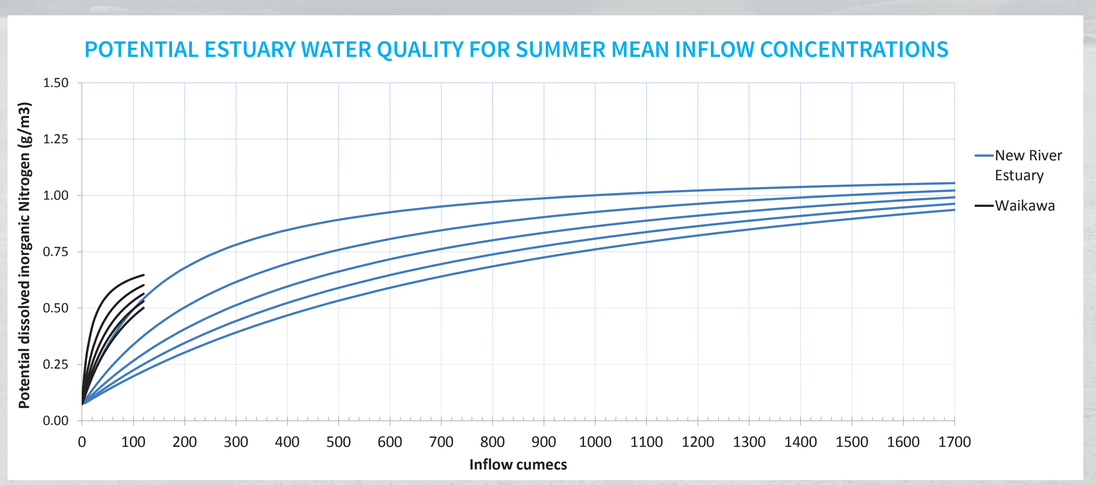

Waikawa Harbour

Potential estuarine water quality

We can also take the hydrological information of estuaries and river monitoring data to predict potential water quality in a system, based on the dilution of river water into the tidal waters.

The graph shows the potential water quality concentration for mean tide and mean TN summer inflow concentrations at different return flow fractions.

Multiple lines are shown, reflecting the fact that we do not know the return flow factor (water coming back in on the next tide). The return flow reduces dilution within the estuary. Therefore return flow has been calculated for 50-90% and are shown as separate lines on the graph. New River Estuary is likely to be between 70-80%. Where the lines stop but do not converge is where maximum flows recorded have been reached.



There is the potential to use this type of information to help understand these systems, the relative contributions to them and how to best manage them. The understanding gained from comparison of these systems provides valuable insight towards making informed management decisions.


New River Estuary


Jacobs River Estuary