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Shifting baselines and political expediency in New Zealand's freshwater management

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Abstract

The New Zealand government has been praised for heeding scientific advice in response to the COVID-19 pandemic, but when it comes to environmental protections the scientific advice seems to be negotiable. Freshwaters have been in decline for decades despite clear science on limits needed to protect them. There are many examples of 'shifting baselines' where limits have been progressively weakened through agency regulatory capture and political expediency.

Background

New Zealand's government has been praised for listening to health experts in its COVID-19 pandemic response (Baker, 2020; Blackburn and Ruyle, 2020); however, when it comes to setting limits to manage the health of waterways, scientific advice seems to be considered negotiable. On numerous occasions over the past few decades, scientific advice for protecting freshwater has been over-ridden by political interference. On all occasions, this has meant a weakening of limits in favour of polluters. Political influences have also driven environmental reporting to emphasise the positive and obscure the negative. This sidelining of science can be seen at both central and local government, and has resulted in failure to protect freshwater (Joy, 2015).

Failure to protect freshwaters is starkly revealed by the poor and declining state of lowland rivers, lakes and wetlands as well as their biodiversity (Weeks *et al.*, 2016; Joy *et al.*, 2019; Ministry for the Environment and Stats NZ, 2020). Nutrient loads in some of New Zealand's farmed catchments now (after normalisation of area) rival some of the world's most intensively used catchments, such as the Mississippi River and Yellow River (Fig 1; e.g., Howarth, 2008; Snelder, Larned and McDowell, 2018).

Public awareness and anger over this freshwater tragedy was highlighted in a recent survey where freshwater was considered the most important environmental issue for 80% of New Zealanders, and freshwater was a significant national election issue in 2017 (Stats NZ, 2018; Rood, 2019). This awareness gave government a clear mandate to significantly improve freshwater health across the nation; leading to the formation of a water taskforce to advance the analysis and development of freshwater policy options.

Water taskforce

This task force included three expert advisory groups: the Kahui Wai Māori group, the Freshwater Leaders Group, and the Science Technical Advisory Group (STAG) (Ministry for the Environment, 2018).

In May 2020, the freshwater reform package was released (Parker and O'Connor, 2020), but despite two years of work from the expert panels, crucial advice was not included. The Minister for the Environment decided to either substantially weaken or postpone the implementation of nutrient limits and other key recommendations (Parker and O'Connor, 2020), meaning New Zealand will continue to lag in having clear, enforceable and meaningful nutrient limits. The STAG, supported by extensive research, gave explicit advice that precise nitrogen and phosphorus limits are necessary to protect the quality of drinking water and the ecological health of waterways, and recommended a dissolved inorganic nitrogen bottom-line of 1 mg/L (Essential Freshwater Science and Technical Advisory Group, 2019, 2020; Canning, 2020; Ministry for the Environment, 2020). Delaying implementation will inevitably result in a continued delay in realising improved water quality, with a corresponding delay in improvement of ecological, cultural, social and economic values (New Zealand Business Council for Sustainable Development, 2008; Kaye-Blake et al., 2014; Essential Freshwater Kahui Wai Maori Advisory Group, 2019).

Implementation

The proposed ecosystem health bottom-lines (which include water quality), were key to achieving meaningful improvement because, in the absence of prescriptive boundaries, decisions are left to the discretion of regional authorities to set or enforce ecologically meaningful limits (Salmon, 2019). Regional authority processes are most often dominated by well-resourced and funded agricultural industry lobby groups, and then independent scientific advice and submissions from environmental care groups weakened to the point where ecosystem health is not protected. By way of example, the majority of the technical caucusing group advising the Waikato River nutrient limit setting process, dominated by industry-funded experts, recommended an almost doubling of the downstream nitrogen limits that were initially proposed, and recommended nutrient limits for tributary rivers based on grandparenting of current state, rather than meaningful relationships with ecosystem health (PC1 Technical Experts, 2019). This means that the nutrients for New Zealand's longest river would only require a 16% nitrogen reduction overall over the next 80 years, instead of the initially proposed 41% reduction (PC1 Technical Experts, 2019). The nutrient bottom-lines would have brought New Zealand into line with the rest of the world (Evans-White, Haggard and Scott, 2013; Poikane *et al.*, 2019; Yu *et al.*, 2019).

In New Zealand, 85% of waterways in pasture catchments (which make up half of the country's waterways, measured by length) now exceed nitrate-nitrogen trigger value guidelines (ANZG, 2018; Ministry for the Environment and Stats NZ, 2020). The evidence is clear that contemporary freshwater decline has been driven by agricultural intensification, fuelled by a growing dependence on synthetic nitrogen fertiliser (Julian *et al.*, 2017). The main use of synthetic nitrogen is intensive dairy production, but up until the 1980s New

Zealand dairy farmers used clover to naturally fix nitrogen from the air. Furthermore, there is evidence farmers can make more profit by reducing their use (Dewes, Mudge and Whenua, 2017; Shepherd, 2017; Everest *et al.*, 2019). The dairy industry typically claims economic good for the country; however, the growing costs to address environmental degradation, often referred to as 'externality costs' are rarely considered or mentioned (e.g., Destremau and Siddharth, 2018). An independent published study on externalities showed that the industry would be a nil-sum-gain if externalities were paid (Foote, Joy and Death, 2015).

A further reason to limit nitrogen levels in freshwater is that excess nitrogen is not just an issue for ecosystem health but also human health (Schullehner *et al.*, 2018). Nitrate in drinking water at levels close to the nitrogen limit proposed by the STAG has been linked to colon cancer (Temkin *et al.*, 2019), which is disproportionately high in many parts of New Zealand (Bisset *et al.*, 2019). Calls have also come from regional New Zealand public health officials for a nitrate limit in rivers and aquifers supporting the proposed limits to protect people's health as well as ecosystems (Dumble, 2019; Te Paa, 2019).

Politicisation of science and shifting baselines

The politicisation of science seen in the failure to include the STAG recommendations is not new, it has been occurring since the core environmental legislation in New Zealand, the *Resource Management Act (1991)*, was enacted. Under this legislation, sixteen river catchment based regional authorities were established and empowered to develop statutory plans for the management of their lands and waters. However, for the next two decades central government failed to provide effective national policy guidance, resulting in councils developing their own regional limits to protect freshwaters. For nutrient management most local authorities based their guidance on the Australian and New Zealand Environment and Conservation Council (ANZECC, 2000), guidelines which propose a nitrate-nitrogen instream concentration limit to protect lowland waterways of 0.44 mg NO_3-N L^{-1}.

In 2011, the *National Policy Statement for Freshwater Management (NPS-FM 2011)* (NZ) was enacted (two decades later than proposed in the RMA). While this legislation was potentially a positive change, it contained drastically weaker nutrient and pathogen limits than the previous guidelines (ANZECC, 2000). Updated in 2014, the NPS-FM included numeric water quality bands that were far weaker than most of the regional authorities had been using in their plans. For example, under the new legislation an 'A' rating was given to rivers with a nitrate-nitrogen concentration up to 1 mg/L, for 1 - 2.2 mg/L a 'B' and for rivers with concentrations of 2.2 - 6.9 mg/l a 'C', with a 'bottom-line' limit of 6.9 mg/l. Under the NPS-FM any river that is in the >6.9mg/l 'D' band is required to improve over time until it is at least a C grade. The new NPS-FM limits effectively gave a more than ten-fold increase in the nitrate concentration permitted in surface waters over and above the previous guideline. To put this into global context, the Yangtze and Mississippi Rivers would score a 'B' grade (Müller *et al.*, 2008; Xu *et al.*, 2013; Kreiling and Houser, 2016).

The justification given for this weakening was that these bands were there to protect aquatic life from the toxic effects of nitrate, whereas the previous ANZECC guidelines were based on the indirect, but no less toxic, effects on oxygen levels from excess algal and microbial metabolism that happen at much lower levels of nitrate. The 6.9 mg/L NO3-N bottom-line limit claimed to give 80% species protection *(National Policy Statement for Freshwater Management, 2014)*, but this was based on laboratory experiments. Of the 22 species used to derive the criteria, only one New Zealand fish was included (Hickey and Martin, 2009; Hickey, 2013). Obviously, these laboratory conditions are far cry from the high temperatures, low water hardness, low dissolved oxygen, and trophic networks that New Zealand native fish experience in impacted waterways in summer (Close and Davies-Colley, 1990). We instead suggest that nutrient criteria be derived by using relationships between metrics of ecosystem health or species and nutrient concentrations (preferably measured continuously), set to avoid tipping or saturation points, and at concentrations corresponding to the desired level of health.

A further example illustrating the shifting of baselines relates to the interpretation and scoring of New Zealand's Macroinvertebrate Community Index (MCI), similar to the Hilsenhoff Index in the United States (Hilsenhoff, 1988) and the SIGNAL (stream invertebrate grade number average level) Index in Australia (Chessman, Growns and Kotlash, 1997; Chessman, 2003). The original MCI score interpretations considered streams with scores below 100 as 'grossly polluted'; in 1998, the interpretations changed and scores under 100 were described as 'probable moderate pollution' and under 80 as 'probable severe pollution'; updates in 2004 and 2007, then described scores under 100 as 'fair' and under 80 as 'poor' respectively. Recently, Greenwood et al (2015) proposed new tolerance scores which, on average, raise scores by approximately five MCI points. When assessing the most complete MCI dataset at the time (n = 10548 surveys), using the original scoring approximately 50% had scores less than 100, when applying the new tolerance scores to the same dataset, only 15% of samples scored less than 100. Despite the substantial increase in scores, the narrative bands remained relatively unchanged. The gradual shift in baseline from below 100 representing ‘grossly polluted’ to ‘fair’ with more positive scoring could not be starker (Stark, 1985; Stark and Maxted, 2007; Greenwood *et al.*, 2015). To provide some redress, the new NPSFM, as recommended by STAG, introduced a national bottom line for MCI of 90, with lower scores being indicative of severe organic pollution. Furthermore, the sensitivity scores must be those defined by Clapcott et al (2017), which are largely the original values with several updates (Stark and Maxted, 2007), rather than those from Greenwood et al (2015).

The shifting of baselines is revealed in environmental reporting as well as policy. National scale water quality data for New Zealand rivers is based on the National Rivers Water Quality Network (NRWQN) operated by the National Institute for Water and Atmospheric Research (NIWA; Smith and McBride, 1990). The NWRQN contains data starting in 1989 from 77 monitoring sites on rivers with catchments draining about one half of the total national land area. On most rivers in the NRWQN there are two or more sites, an upstream lightly or unimpacted ‘Baseline’ site and a downstream ‘Impact’ site (Smith and McBride, 1990). They are consistently reported by NIWA as one combined dataset. Control and impact site data merged and reported as one and thus the level of impact is obfuscated (e.g., Ballantine and Davies-Colley, 2014; Julian *et al.*, 2017; Ministry for the Environment and Statistics New Zealand, 2019; Ministry for the Environment and Stats NZ, 2020). Between 2015 and 2019, 21 sites were dropped and sampled at nearby sites by regional authorities (Julian et al 2017), but the data is not added to the database. Of the 21 dropped sites, 15 are impact sites (almost half of the total impact sites, so if this is not accounted for when next reported the combined dataset will likely be dominated by baseline sites (control sites) so conditions will appear to have improved.

Similarly, Ministry for the Environment (MfE) and Statistics New Zealand (StatsNZ) report water quality on their website that conglomerates data from sites with pristine catchments with those from downstream impacted sites (Ministry for the Environment and Statistics New Zealand, 2019; Ministry for the Environment and Stats NZ, 2020). For example, their national reporting contains statements similar to this: “Models suggest 83 percent of total river length for large rivers was not expected to have regular or extended algal blooms” (Ministry for the Environment and Stats NZ, 2017, p. 40). For the uninformed reader this would imply that most waterways were well managed, but obscures the fact that close to half of the length of waterways in New Zealand are small, headwater streams in the

Conservation Estate or undeveloped catchments, thus do not require management and should always be excellent or good.

This weakening of environmental limits we have described in New Zealand is part of a phenomenon known as ‘shifting baselines’ where expectations of acceptable levels of pollution change over generations, and is increasingly recognized as one of the fundamental obstacles to addressing a wide range of today’s global environmental issues (Soga and Gaston, 2018). Managing shifting baselines should involve preserving historical data, incorporating it into contemporary science, and actively communicating the change in ways relatable to audiences, such as through images of historical condition or comparable habitat (Klein and Thurstan, 2016). Though this will be easier said than done, now the new policy also requires water quality be maintained from 2017, a shift from the previous baseline of 1991 in the RMA (1991). There is a second parallel and additive process of politically induced weakening of standards and selective environmental reporting, driven by political expediency and an attempt to protect short term economic measures (Langford and Shaw, 2014).

Environmental reporting

The politicisation of environmental reporting is predictable given that reporting organisations are reporting on their own performance with minimal oversight. At local government level it is revealed by the capture of regulators by vested interests, this phenomenon known as agency capture has long been established (Guerin, 2003; Brown, Peart and Wright, 2016). A recent comprehensive report *Evaluating the Environmental Outcomes of the RMA* highlighted this agency capture of Regional Councils revealed, for example, as “a lack of enthusiasm for setting strong limits for freshwater due to a preponderance of agricultural interests in the council” (Brown, Peart and Wright, 2016, p. 20). The report found that the weakest limitations on implementing the RMA are on managing cumulative effects and a lack of enforcement, thus the causes of decline in water quality are more than just shifting baselines.

Given the failures of environmental protection and reporting through political and business lobbying the need to keep independent scientific advice from political influence is clear. This means there is a critical need for an independent body to manage environmental monitoring, analysis, and enforcement. In New Zealand there is a suitable model for this organisation with the office of Parliamentary Commissioner for the Environment (PCE). With the required resourcing across-party parliamentary relatively independent organisation like this could go a long way to halting the political influence on freshwater science and lead to sustainable freshwater management. Other options could include much more emphasis on enforcement of current legislation, increased costs for non-compliance and more funding for independent freshwater advocacy and monitoring. Additionally, freshwater standards written into trade agreements could increase enforcement and monitoring.

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Figures

Figure 1.

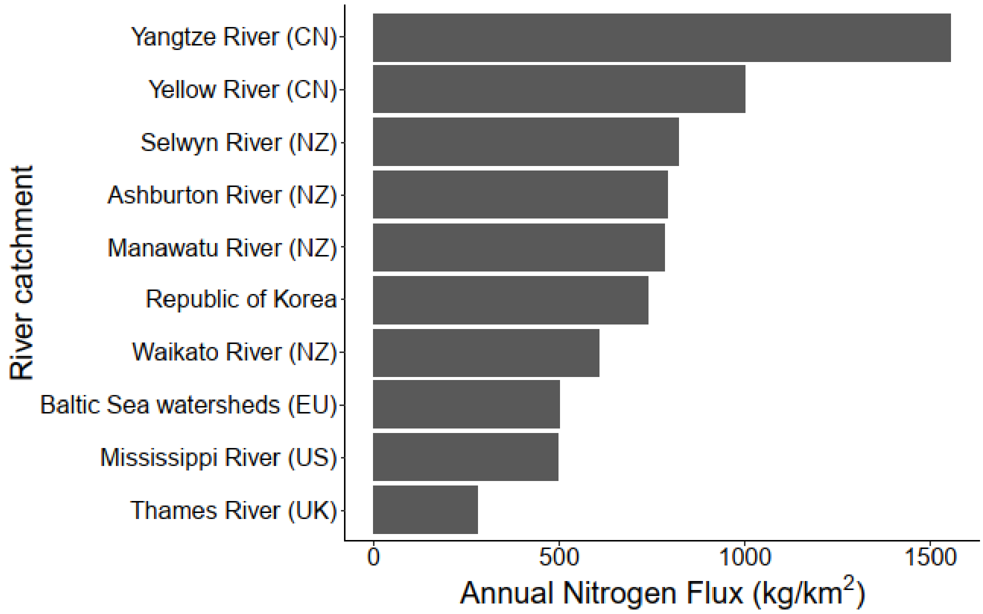

Figure legend

Fig. 1. The annual nitrogen flux of some of New Zealand's agriculturally-dominated river catchments alongside other intensive catchments across the globe (Goolsby *et al.*, 2000; Howarth, 2008; Howden *et al.*, 2010; Xu *et al.*, 2013; Li *et al.*, 2014; Snelder, Larned and McDowell, 2018).