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Summary of Presentation to the Biodiversity BCG

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27 April 2017

Report No. 2017/092

1 Introduction

1. At the request of Jan Crawford, on behalf of the Biodiversity Collaborative Group, I provide below a summary of the presentation made on 27 April 2017, and the key messages for the group to consider in drafting an indigenous biodiversity National Policy Statement (NPS) which provides for freshwater indigenous biodiversity.

2. The National Policy Statement for Freshwater Management (NPS-FM) addresses some aspects of water quality and quantity but not habitat, threatened species or the full range of potential objectives and limits to provide for ecosystem health. There are gaps which need to be filled if the full range of freshwater indigenous biodiversity is to be provided for in national policy. The NPS-FM list of attributes is not the whole picture in terms of providing adequate water quality for ecosystem health and there are some significant gaps in the current form of the National Objectives Framework (NOF).

3. These gaps include: water quality attributes for dissolved oxygen, temperature, sediment, metals and other toxins; technical methods to determine the state of ecosystem health in freshwater systems; acknowledgement of native fish and threatened freshwater species, consideration of physical habitat and connectivity between systems; strong direction to protect remaining habitat (including terrestrial habitat) and connectivity to habitat through regional plans and consents; and methods to examine cumulative effects/stressors on fish and other threatened freshwater species and habitats.

4. This document provides recommendations on areas of indigenous freshwater biodiversity that may fit the requirements of the draft NPS, gives an example of a method to determine ecosystem health in freshwater, identifies key areas for consideration with respect to indigenous biodiversity in freshwater systems and provides some examples of approaches that may assist in development of a biodiversity NPS.

5. In order to explain some of the technical context with respect to freshwater, I begin by outlining the basis for many discussions in regional plans and in ongoing amendments of the NPS-FM.

6. I then briefly summarise the critical components of freshwater biodiversity that need to be captured in a biodiversity NPS. Finally, I detail the gaps in the NPS-FM that result in freshwater biodiversity being left out in the cold.

2 Some Science for Context

7. When we talk about water quality in Aotearoa New Zealand we are most often referring to the 'big three': nutrients (nitrogen and phosphorus), sediment and faecal contaminants. With respect to freshwater ecosystems we also need to consider physical habitat and water availability.

8. The growth of algae on the bottom of rivers is often a contentious issue in freshwater resource management, as nuisance growth implies a need to limit nutrient contaminants. Collectively the community of algae and slime that grows on river beds is known as 'periphyton'. Periphyton is the productive base of the aquatic food chain. Like any plant, it grows when conditions are suitable. When additional nutrients are added, periphyton growth increases, sometimes to nuisance levels which affect ecological health (as well as other freshwater values). In the case of periphyton, floods that disturb the river bed remove growth, and periphyton grows again,

depending on the nutrient supply until the next flood event. If the period between floods is long and there are sufficient nutrients added, periphyton can grow to nuisance levels. The effects of nuisance algal growth on river values include reducing swimming and fishing opportunities, river closure from toxic algae (commonly *Phormidium autumnale*), reduced cultural and aesthetic appeal, and reduced quality of stream life. Periphyton also has a direct relationship with dissolved oxygen concentrations in water. When photosynthesis ceases at night, algal cells respire and remove oxygen from the water column, reducing its availability for fish and macroinvertebrates. This mechanism can cause fluctuations in pH, which can also make conditions more stressful for aquatic life. Nuisance periphyton growth can result from both indirect (urban and rural runoff) and direct (point-source discharge) nutrient inputs.

9. Aquatic macroinvertebrates are the community of insects, snails, worms, crustaceans and other macroscopic organisms that live on the bed of the river. They are a key food source for larger organisms such as fish and birds and are an important aspect of indigenous biodiversity in their own right. The MCI (Macroinvertebrate Community Index) is a measure of the health of the invertebrate community that uses the sensitivity/tolerance of invertebrates to organic enrichment and thus can be used as an indicator of water quality and some aspects of ecosystem health. Use of the MCI allows an indicator score to be determined for sites. A number of parties, including the Land and Water Forum, the NOF Reference Group and the New Zealand Freshwater Sciences Society (NZFSS) have advocated for the inclusion of the MCI as an attribute in the NPS-FM, with a bottom line of 80. A score of 80 is the lower threshold of the MCI range indicating a water quality class of 'fair', a degradation category of 'probable moderate pollution' and, as I have proposed for Nelson City Council, can be part of an assessment of ecosystem health (Table 1).

10. Most regional councils currently monitor macroinvertebrates and calculate MCI scores as part of their State of the Environment (SOE) monitoring. National datasets are available to assist in determining the state of ecosystem health at national and regional scales.

Table 1: Macroinvertebrate Community Index (MCI) scores and degradation categories, water quality classes and suggested ecosystem health grades.

Degradation category[1]	Quality class[2]	MCI score	Suggested Ecosystem Health grade[3]
Clean water	Excellent	> 119	A
Doubtful quality or possible mild pollution	Good	100-119	B
Probable moderate pollution	Fair	80-99	C

[1] Boothroyd IKG, Stark JD 2000. Use of invertebrates in monitoring. Pp. 344–373 in Collier KJ, Winterbourn MJ (*Eds*). N*ew Zealand stream invertebrates: ecology and implications for management.* New Zealand Limnological Society, Christchurch.

[2] Stark JD, Maxted JR 2007. A user guide for the Macroinvertebrate Community Index. Prepared for the Ministry for the Environment. Cawthron Report No.1166. 58 p.

[3] McArthur KJ 2017. Freshwater Objectives and Water Quality Limits: recommendations to support policy development in the Nelson Plan. Draft report prepared by The Catalyst Group for Nelson City Council. Pp. 28.

Probable severe pollution	Poor	< 80	D

3 Elements of Freshwater Biodiversity that need to be addressed within the Indigenous Biodiversity NPS

11. Below I briefly summarise critical components of freshwater biodiversity that require addressing in national policy. These components are critical to protecting freshwater biodiversity because of the threat status of many species, particularly native fish, and because without some protection there is a high likelihood of loss of species and poor biodiversity outcomes. The ecosystem processes which require protection include provision for the habitat of adult species, including feeding and refugia habitats, and provision of spawning habitat and connections between terrestrial and coastal ecosystems that will enable successful reproduction and juvenile recruitment into adult populations. Providing for indigenous freshwater species is also linked to other freshwater values, including cultural values like mahinga kai.

12. The habitats for adult species and spawning habitats of freshwater fish are in decline or degraded as a result of activities that can be managed under the Resource Management Act (RMA). For example, vegetation clearance in estuarine and riparian margins, earthworks, stock trampling and sedimentation. Freshwater species comprise part of our indigenous biodiversity as a whole. Provision for the maintenance and enhancement of freshwater ecosystems and species are subject to the same obligations as for terrestrial biodiversity and ecosystems.

4 Providing for the freshwater/coastal interface within the NPS

13. Freshwaters and coastal waters are addressed separately at the policy level, both in regional plans and national policy statements. However, this is not an ecologically relevant separation, as many species of freshwater fish traverse the coastal interface and inhabit coastal and freshwater habitats at different times in their lifecycle.

14. For example, īnanga, the most common species in the whitebait catch, spawn within riparian vegetation during high spring tides where the saltwater meets the freshwater. Eggs are laid in the vegetation and then wash out to sea on the next high spring tide. Larvae develop in coastal waters for around 150 days and then migrate back into freshwater systems as whitebait. This ecological process means īnanga are highly vulnerable to impacts on estuarine and lowland river habitat. This is an issue that the biodiversity NPS has the potential to address, and effective tools are available for doing so. Environment Canterbury has developed a simple īnanga spawning habitat model, which is linked to the rules on stock exclusion, land disturbance and earthworks that sit in Land and Water Plan Change 4. The application of this approach at the national level is likely to be extremely beneficial in halting the decline of īnanga. Any tool which is aimed at īnanga spawning habitat needs to cross the freshwater/coastal policy boundary. This means the rules need to be carried into the Coastal Plan, which is not currently addressed in the Canterbury example. In this way, provision for īnanga spawning, and thereby protection of the survival of the

species long-term, is falling through the policy gaps and is not addressed anywhere explicitly within the NPS-FM.

15. The Canterbury approach could be applied nationally; firstly, though identification of potential spawning habitat using a similar modelling approach, and secondly, through national direction for rules in regional and coastal plans (which could occur through the biodiversity NPS).

5 Native fish

16. A large proportion of New Zealand's native freshwater fish species are migratory and spend some time in the coastal/marine environment. Instream barriers can have significant adverse effects on the reproduction and distribution of migratory species by preventing movement of fish and preventing passage between freshwater and coastal/marine environments. The advantage of migratory life strategies is the ability for fish species to recolonise a catchment after a significant disturbance event (e.g. landslide or flood), making migratory species more resilient to natural disturbance but vulnerable to human-made fish barriers.

17. Whitebait is a collection of species made up of five migratory Galaxiid species[4] and common smelt. There are also a number of non-migratory Galaxiids, many of which have a contracted range as a result of anthropocentric activities. Many species are listed within the New Zealand Threat Classification and the number of species listed as threatened and the number of species that have moved into a higher threat class has increased in recent years[5]. Non-migratory species are highly vulnerable to habitat change and degradation.

18. The other major group of native fish species is the Gobiomophids or bullies, many of which are also migratory, and spawn in river bed gravels, with larvae developing in coastal waters.

19. Other than whitebait, harvested freshwater fish species include eels and lamprey. Whitebait harvest is managed by the Department of Conservation, whereas eel harvest is managed by MPI through a quota system.

20. The abundance and diversity of native fish is strongly driven by distance to the sea and elevation[6] because of the large number of migratory species in the New Zealand fish fauna. This important ecological phenomenon is not acknowledged in freshwater or coastal policy at this time and any efforts to address native fish diversity should tackle management and restoration of lowland and coastal habitats as a priority.

6 Threatened species

21. The number of threatened species of native fish has increased over time (Figure 1). Some of this increase may be attributed to changes in taxonomic resolution and changes in methods of

[4] Īnanga, shortjaw kōkopu, banded kōkopu, giant kōkopu and kōaro.

[5] Goodman JM, Dunn NR, Ravenscroft PJ, Allibone RM, Boubee JAT, David BO, Griffiths M, Ling N, Hitchmough RA, and Rolfe JR 2014: *New Zealand Threat Classification Series 7.* 12 p. (New Zealand Freshwater Fish); Allibone R, David B, Hitchmough R, Jellyman D, Ling N, Ravenscroft P, Waters J, 2010 Conservation status of New Zealand freshwater fish, 2009. *New Zealand Journal of Marine and Freshwater Research 44:4,* 271-287.

[6] Jowett IG, Richardson J 1996. Distribution and abundance of freshwater fish in New Zealand rivers. *New Zealand Journal of Marine and Freshwater Research 30*: 239-255.

classifying threatened species since 2005. However, there is a clear pattern of increase in species of fish classified as threatened.

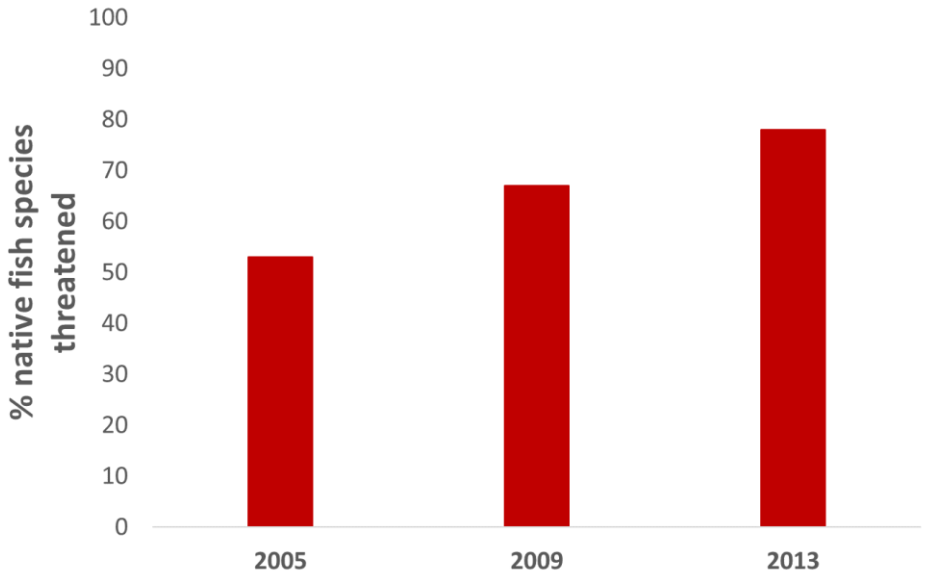

Figure 1: Number of species of native fish listed on the NZ Threat Classification 2005 to 2013.

22. In Aotearoa New Zealand, species are classified using the Department of Conservation Threat Classification framework (Figure 2)[7].

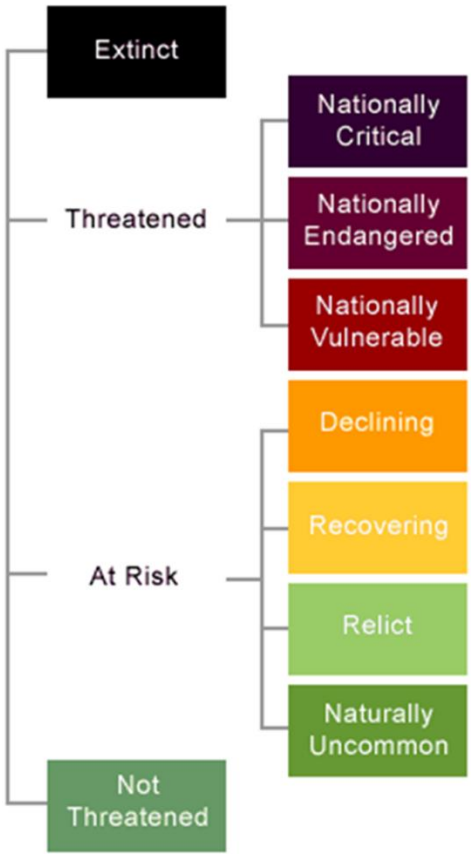

Figure 2: Threatened species classifications in New Zealand.

[7] Townsend AJ, de Lange PJ, Duffy CAJ, Miskelly CM, Molloy J, Norton DA 2008. New Zealand Threat Classification System Manual. Science and Technical Publishing, Wellington, Department of Conservation.

23. In addition to native fish, there are a number of threatened aquatic invertebrates, including freshwater polychaetes (paddle worms), freshwater mussels (kākahi) and freshwater crayfish (kōura). There are three Threatened aquatic plants; six At Risk and 2 Data Deficient[8].

24. These species of animals and plants need to be addressed through the biodiversity NPS because they have no specific protection under the NPS-FM and there is no explicit obligation on councils to provide for their habitats in plans. Sections 30 and 31 of the RMA require councils to maintain and enhance ecosystems and indigenous biodiversity, and maintain and enhance water quality and quantity. However, in the absence of explicit national policy direction, ecosystems and indigenous biodiversity are being addressed in an *ad hoc* manner by councils, and key outcomes for indigenous biodiversity are not being realised. This is well demonstrated by the rise in threatened native fish species over time, despite a greater focus by councils on water quality and quantity.

7 Connectivity between freshwater ecosystems

25. For healthy ecological process to occur, freshwater systems need to maintain their connections. Lakes and wetlands require connection to streams and rivers, and groundwater connectivity to river, lake and wetland ecosystems is also critical to maintaining hydrological and ecological flows and habitat. Aquifers have their own ecological communities, known as stygofauna (subterranean animals that live in aquifers and caves). These are not well understood or defined nationally.
26. Native fish and invertebrates also need access to the hyporheic zone, which is the groundwater that flows beneath the bed of rivers. The hyporheic zone provides refuge to native fish during droughts and floods[9], and some species (such as the lowland longjaw Galaxias) spawn and feed deep within the gravels of this zone. Deposited sediment is the greatest threat to species that inhabit or utilise gravels as it blocks the interstitial spaces (the spaces between the gravel particles) and reduces flow and dissolved oxygen there.

8 Connectivity between terrestrial and freshwater systems

27. Many native fish are riparian spawners. Īnanga spawn only in estuarine/lower river vegetation. Other Galaxiid species spawn in the riparian margins of their adult habitat – often indigenous forested areas, when autumnal freshes overtop stream banks. Maintaining ecologically functioning riparian margins is critical to the spawning success of these species, many of which are threatened.

[8] de Lange PJ, Norton DA, Courtney SP, Heenan PB, Barkla JW, Hitchmough R, Townsend AJ 2009. Threatened and uncommon plants of New Zealand (2008 revision). New Zealand Journal of Botany 47: 61–96.

[9] McEwan AJ, Joy MK 2011. Monitoring a New Zealand freshwater fish community using passive integrated transponder (PIT) technology: lessons learned and recommendations for future use. New Zealand Journal of Marine and Freshwater Research 45: 121-133; McEwan AJ, Joy MK 2013. Responses of three PIT-tagged native fish species to floods in a small, upland stream in New Zealand. New Zealand Journal of Marine and Freshwater Research 47: 225- 234; McEwan AJ, Joy MK 2013. Habitat use of redfin bullies (Gobiomorphus huttoni) in a small upland stream in Manawatu, New Zealand. Environmental Biology of Fishes 97: 121-132; McEwan AJ, Joy MK 2013. Diel habitat use of two sympatric galaxiid stream fishes at two spatial scales a small upland stream in Manawatu, New Zealand. Environmental Biology of Fishes 97: 897- 907.

28. Indigenous riparian vegetation provides an important ecological function for aquatic ecosystems, including shade and temperature buffering, input of terrestrial insects for fish, organic matter for breakdown within streams and woody debris for instream refugia. Additional water quality benefits are derived from reduction of sediment, phosphorus and faecal contaminants entering freshwater.

29. Most macroinvertebrate insects are the larvae of terrestrial taxa (i.e. mayflies, stoneflies, caddisflies, dobson flies, dragon flies, and beetles). Larvae grow in aquatic systems and emerge from the water, providing food for terrestrial species and contributing to terrestrial indigenous biodiversity.

30. Thus, terrestrial and aquatic systems are highly interdependent. Like the separation of freshwater and coastal habitats, the separation of terrestrial and aquatic systems is ecologically irrelevant. The potential of the biodiversity NPS to provide direction on appropriate plan provisions for riparian margins and their ecological function should be considered, to meet this ecological need.

9 What is needed from a Biodiversity NPS to provide for freshwater ecosystems?

a. A focus on physical connectivity — within freshwater systems, between freshwater and the coast, between riparian/terrestrial and freshwater habitats, and between terrestrial habitats and aquatic species.

b. Acknowledgement of threatened species and habitats is needed — similar to the approach taken in Policy 11 of the New Zealand Coastal Policy Statement

c. A focus on estuaries and lowland streams and lakes is warranted — given their ecological importance and high biodiversity value

d. Specific provision for the potential spawning habitat of īnanga at the national level and direction for freshwater and coastal plans to provide habitat protection through rules

e. Specific reference to native fish as a key component of aquatic biodiversity

f. Identification of vulnerable species and specific habitat types to provide protection for vulnerable non-migratory native fish populations

g. Specific direction to address fish barriers through policies and rules in regional plans and clear delineation of responsibility for identification and removal of existing barriers as well as direction on rules for new barriers

h. Better management of harvested native species, consistent with biodiversity conservation outcomes

i. More research and better monitoring — particularly of native fish abundance and long term population viability

10 The National Policy Statement for Freshwater Management (NPS-FM)

31. Figure 3 outlines the basic NPS-FM process for regional councils in developing regional plans. Freshwater Management Units (FMUs) are the spatial scale at which the NPS-FM operates in regional plans. Ideally, these are catchment based and adequately capture the social and cultural area of interest for a particular community or group of communities.

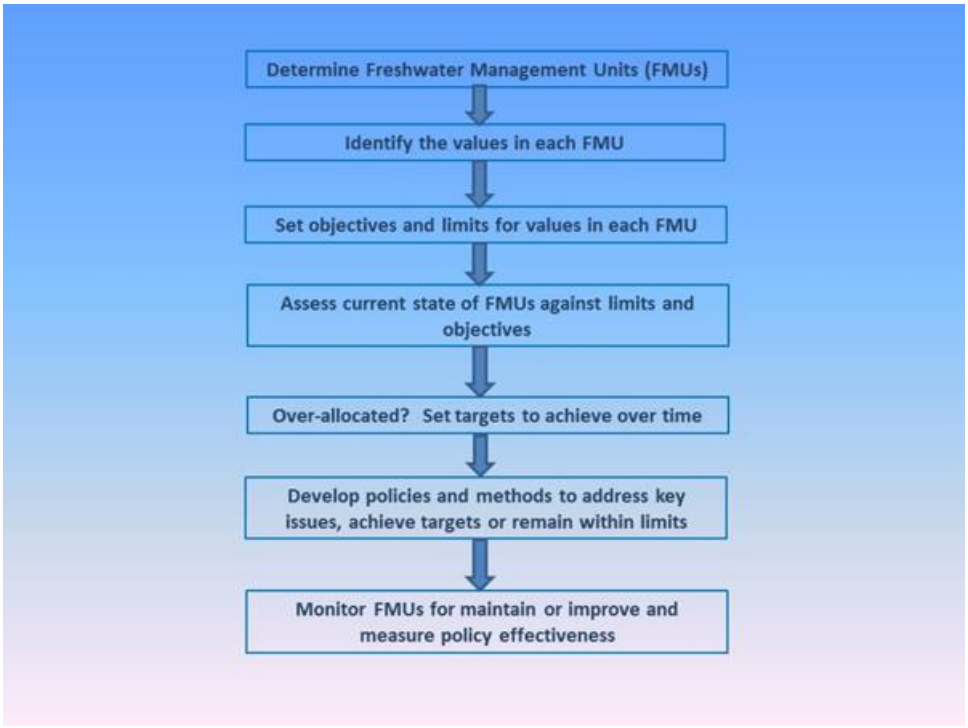

Figure 3: Summary of steps in developing regional plans under the NPS-FM. Source: McArthur KJ 2016. Nelson Freshwater Quality: an analysis of state and issues. Report no. 2016/068 prepared for Nelson City Council by The Catalyst Group. Pp. 120.

32. The NPS-FM has two compulsory national values that apply everywhere: Human Health for Recreation and Ecosystem Health. Appendix 1 of the NPS-FM has a useful definition of ecosystem health. Box 1 summarises the key aspects of the NPS-FM definition.

Box 1: Key aspects of the Ecosystem Health definition summarised from Appendix 1 of the NPS-FM.

The key terms in the NPS-FM **Ecosystem Health** description can be broken down more simply as:

I. **Ecological processes** include the ability of species associated with freshwater to be able to function, feed, grow and reproduce successfully (this includes plants, invertebrates and fish).
II. **Range and diversity of indigenous flora and fauna** includes the numbers of different native species of plants and animals which comprise the freshwater community.
III. **Resilience to change** means the ability of species to remain present over the long term through environmental change, including the ability to recolonise following environmental disturbance. Resilience may be affected by the scale of change and whether changes are within the *natural* range expected for a freshwater system.

33. There are a number of attributes in the National Objectives Framework (NOF) that are designed to provide national bottom lines and attribute state to provide for the Ecosystem Health value. These are:
    a. phytoplankton, total nitrogen and total phosphorus in lakes and periphyton in rivers;
    b. nitrate and ammonia toxicity; and
    c. dissolved oxygen in rivers (only below point source discharges).

    These compulsory attributes are to be included in regional plans as numeric freshwater objectives, with limits set to meet the objectives. However, this list of attributes is not the whole picture in terms of providing adequate water quality for ecosystem health and there are some significant gaps in the current form of the NOF.

10.1 What is missing from the NPS-FM

34. Dissolved oxygen is a critical requirement for life-supporting capacity and ecosystem health. Water temperature is also important in supporting aquatic life and in regulating the saturation (availability for fish and invertebrates) of dissolved oxygen — the higher the temperature the less saturated oxygen is available. These are both missing from the NOF.

35. The NOF would better provide for ecosystem health by immediate inclusion of water quality attributes closely associated with life-supporting capacity and ecosystem health, including:
    - Dissolved oxygen — in all freshwater bodies, not just in rivers below point sources[10]
    - Temperature — needs to be able to apply to activities at the broad catchment scale including land use change

[10] Davies-Colley R, Franklin P, Wilcock B, Clearwater S, Hickey C 2013. National Objectives Framework: Temperature, Dissolved Oxygen & pH Proposed thresholds for discussion. NIWA Client Report No: HAM2013-056. Prepared for the Ministry for the Environment.

- Sediment — low water clarity reduces the ability of fish to sight feed and clogs the gill lamellae of invertebrates and fish, smothering them; whereas elevated deposited sediment negatively impacts feeding and spawning habitat and access to the hyporheis
- Metals and other toxins — directly affect aquatic life through chronic and acute effects

36. Other considerations/approaches that would be useful in the NPS-FM (or potentially fit better within a biodiversity NPS) include:
    - Clear and direct acknowledgement of fish and threatened freshwater species, physical habitat and connectivity between systems
    - Direction on methods to determine the state of ecosystem health — to fit a maintain or improve framework
    - Strong direction to protect remaining habitat and connectivity to habitat (including coastal, groundwater and terrestrial habitats) through regional plans AND consents
    - Methods to examine cumulative effects/stressors on fish and other threatened freshwater species and habitats

10.2 Water availability and allocation

37. The policy direction on water allocation in the NPS-FM is not as strong as for water quality and relies largely on the setting of minimum flows and allocation limits, as well as efficient allocation. Recent research suggests the current minimum flows and in particular allocation limits are not adequate to provide for ecosystem health and fish in many cases[11]. Without adequate flow, there is no habitat for aquatic life to inhabit. The cumulative and broad scale effects of current and proposed water allocation on native fish and other aquatic life are not well understood and difficult to ascertain at the catchment scale. Interconnectedness and cumulative consideration of groundwater and surface water takes is not always taken into account in water allocation planning and consenting. Water abstraction resulting in the rapid drying of small waterways does occur at times as a result of poor management of the resource as a whole (e.g. eel deaths at Mangaroa Marae, Hawkes Bay).

10.3 Determining the state of ecosystem health

38. Although Ecosystem Health is a national compulsory value in the NPS-FM, there is little direction for regional councils to determine the current state of ecosystem health to set attributes and define policy direction with respect to maintaining or improving water quality. Macroinvertebrates have been suggested as a good proxy indicator for ecosystem health, and in many cases, they are. But macroinvertebrate community health does not always tell the whole story with respect to fish.

39. As the top of the aquatic food chain, fish are important indicators too. For the Nelson Plan, I have been developing a method to determine the state of ecosystem health using macroinvertebrates (e.g. Table 1) and fish. This dual approach has been formulated to respond

[11] http://www.cawthron.org.nz/coastal-freshwater/news/2016/trout-and-native-fish-need-more-water-we-think-research-finds/

to measures of invertebrates and fish, which indicate different aspects of ecosystem health in the Stoke FMU – a network of small coastal streams feeding into the Waimeha Inlet. The Stoke streams have a high diversity of native fish and generally score well using the IBI (Index of Biotic Integrity). However, MCI scores and many water quality attributes indicate that water quality is poor. When both fish IBI and MCI are assessed and the catchment stressors are examined (high urban development, stream channelisation and reclamation/piping combined with poor water quality and high sedimentation) the measures of ecosystem health imply a system under stress – which would indicate the need for an 'improve' or 'enhance' policy framework for freshwater (Figure 4).

40. This contrasts with the Whangamoa catchment where MCI and fish IBI indicate a good state of ecosystem health, despite some sites in the Whangamoa being at high elevation and much further from the sea than the Stoke streams (and thereby less easily accessible for fish). Thus, a policy framework that maintains water quality is appropriate (Figure 5) for this FMU.

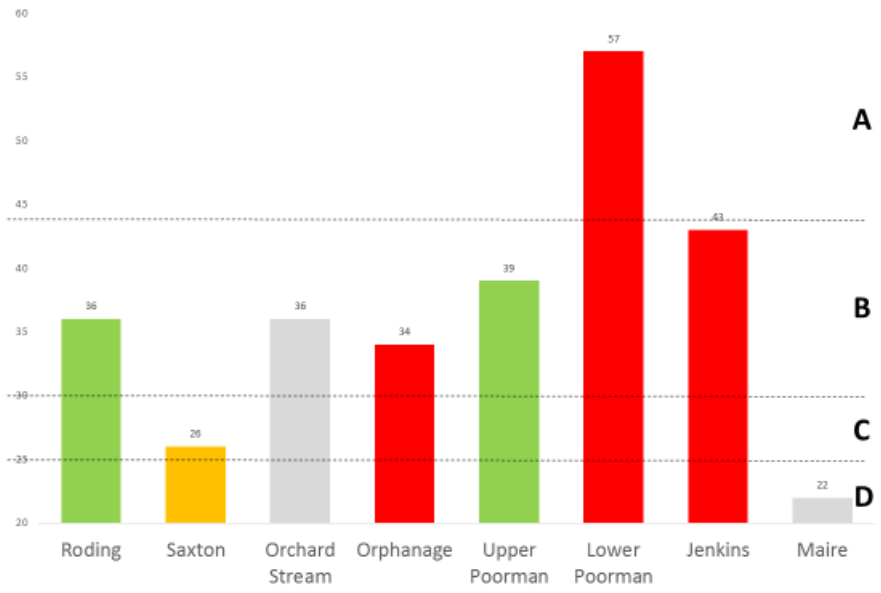

Figure 4: Fish IBI grading (A-D) and MCI score (colour of bar) for the Stoke FMU, Nelson. Light green bar = good MCI, orange = fair MCI, and red = poor MCI. Grey bar indicated no MCI data available. Source: McArthur KJ 2017. Freshwater Objectives and Water Quality Limits: recommendations to support policy development in the Nelson Plan. Draft report prepared by The Catalyst Group for Nelson City Council. Pp. 62.

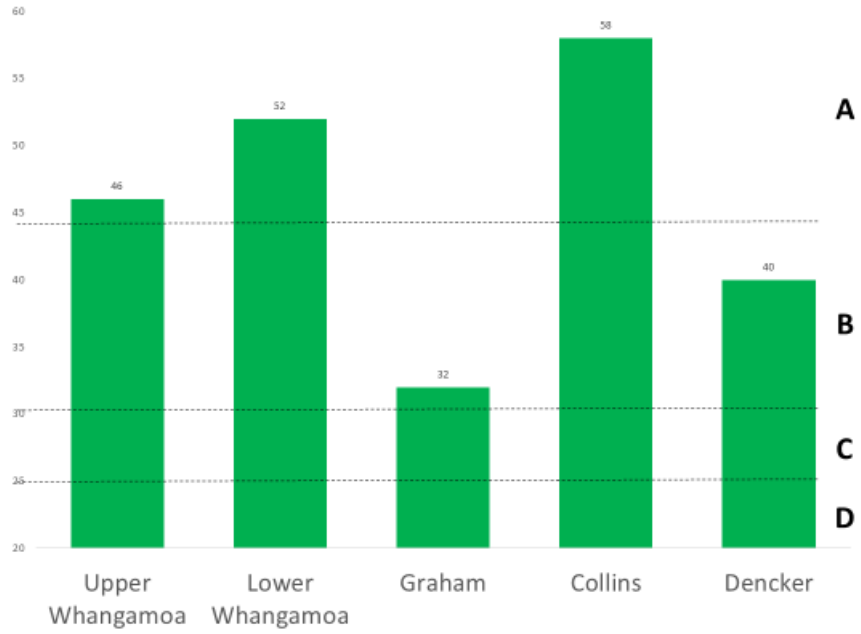

Figure 5: Fish IBI grading (A-D) and MCI score (colour of bar) for the Whangamoa FMU, Nelson. Dark green = excellent MCI. Source: McArthur KJ 2017. Freshwater Objectives and Water Quality Limits: recommendations to support policy development in the Nelson Plan. Draft report prepared by The Catalyst Group for Nelson City Council. Pp. 62.

11 Fish barriers

41. Because of the migratory nature of many native fish, the diversity and abundance of native fish is significantly affected by elevation and distance to the sea. The greatest abundance and diversity of native fish in New Zealand naturally occurs in lowland aquatic habitats close to the sea[12], reducing as you move away from the coast. Although some species, such as longfin eels, lamprey and kōaro penetrate far inland because of their ability to move across the land (in the case of eels) and scale large barriers and waterfalls by climbing (kōaro and lamprey), the abundance of native fish naturally declines with distance inland. This can confound any analysis of fish communities based purely on the number of species. Methods are available to reduce the confounding influence of elevation and distance from the sea, such as the IBI[13].

42. Therefore, in terms of protecting, maintaining or restoring native fish diversity and/or abundance, lowland aquatic ecosystems are a high priority. Fish barriers are an issue that we don't manage well at present and there is conflicting responsibility (regional councils versus Department of Conservation) and regulation (i.e. Freshwater Fisheries Regulations - Part 6 (1983) versus regional plans). However, there is a wealth of tools available for best practice for

[12] Jowett IG, Richardson J 1996. Distribution and abundance of freshwater fish in New Zealand rivers. *New Zealand Journal of Marine and Freshwater Research 30*: 239-255.

[13] Joy MK, Death RG 2004. Application of the Index of Biotic Integrity Methodology to New Zealand Freshwater Fish Communities. Environmental Management 34: 415-428; Joy MK, Henderson I 2012. A Fish Index of Biotic Integrity (IBI) For the Tasman-Nelson Region. Report and user guide for use with the Tasman-Nelson Fish IBI excel macro. Ecology Group, Institute of Natural Resources, Massey University, Palmerston North. Pp. 20.

culverts and retrofitting of fish passes and fish friendly tide/flood gates. This issue could be dealt with adequately through direction of policies and rules in regional plans via an NPS Biodiversity.

43. Connectivity is a critical requirement for migratory species. The scale of the issue can (and should) be identified at the national level through regional council data on fish barriers and predictions based on roading and other transport networks. Non-migratory species are vulnerable to disturbance (natural or human induced), often because of their contracted range, and in many cases these species need a specialist approach to protect and restore their health and habitat. The Department of Conservation has specific management plans for non-migratory Galaxiids and these are a great source of information on the impacts and critical habitat requirements of these species. Non-migratory, vulnerable populations are amenable to a case by case approach, ideally, following a process of national identification of these habitats (both known and predicted).

12 Further expert resources for the BCG

44. Professional societies in Aotearoa New Zealand are a great resource for independent review of national policy direction. The New Zealand Freshwater Sciences Society has had considerable input to the NPS-FM and its amendments over recent years. While some useful dialogue has taken place between the NZFSS and Ministry officials on the NPS-FM, the ability for the Society to provide an independent, evidence based view on the development of national policy has been hampered by the submission process, with the ability to provide feedback only occurring after policy has already been drafted.

45. I encourage the BCG to 'front foot' any wider engagement with technical experts on the development of a draft biodiversity NPS, and to take advantage of the wealth of knowledge and experience that sits within the New Zealand Ecological, Freshwater and Marine Science Societies.

Kate McArthur
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The Catalyst Group