BEFORE THE INDEPENDENT HEARINGS PANEL

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of Proposed Variation 4 (Omnibus) to the Canterbury Land and Water Regional Plan

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STATEMENT OF PRIMARY EVIDENCE BY KATHRYN JANE MCARTHUR ON BEHALF OF THE ROYAL FOREST AND BIRD PROTECTION SOCIETY OF NEW ZEALAND

AMENDMENT CATEGORIES A, H, L AND P

29 JANUARY 2016

SUMMARY

1. Īnanga are the most common (and caught) of the whitebait species and an important component of New Zealand's aquatic life. Īnanga lay their eggs amongst vegetation on land that is inundated by high tidal events. Eggs develop within the vegetation and are washed out to sea on the next tidal event. Īnanga return to freshwater and migrate upstream in whitebait 'runs' to access habitat to grow into adult fish. They are short lived and only spawn once in their lives.

2. Īnanga are identified as an "at risk" and "declining" species of native fish in recent threat classifications. Īnanga are defined as 'conservation dependent', meaning without continued management intervention, there is a high probability they will fall into a higher threatened species class in future. The key īnanga critical habitat requirements are: 1) access to freshwater habitats during juvenile migrations in from the sea (lack of barriers to whitebait runs), 2) access to undisturbed spawning habitat at the inland/upper extent of the high tide inundation area of freshwater and estuarine systems, and 3) good quality riparian vegetation for egg survival and development.

3. I am generally supportive of Canterbury Regional Council's (CRC) approach to protecting īnanga spawning, and the model used to predict īnanga spawning habitat is fit for purpose, at a reasonable spatial resolution, and has employed an appropriate level of scientific rigour. Policies and rules that provide protection of the critical habitat requirements of īnanga in the predicted spawning areas is the most ecologically sound manner to protect this significant indigenous species.

4. Many activities in the beds and margins of rivers and lakes are unlikely to have adverse effects on īnanga spawning if they occur outside the period 1 January to 1 June. In exchange for applying a wider, habitat-based approach to managing īnanga spawning, rules can be more permissive for some activities occurring outside the spawning exclusion period.

5. Some activities have the potential to destroy or restrict the extent of īnanga spawning habitat. These activities require management of such effects year-round in predicted spawning habitat. Recommendations for wording of policies and rules associated with īnanga spawning are included within this evidence.

6. Riparian vegetation is important to aquatic ecosystem health for a number of reasons. It provides shade, assists in reducing contaminant transfer and run-off to water, introduces woody debris into aquatic systems for food and cover, and provides spawning habitat on the margins of rivers and lakes for native fish.

7. Adequate control of riparian disturbance (e.g. vegetation clearance, alteration and disturbance, stock access, cultivation, earthworks, sediment discharge, and bank protection or instream structures) is key to providing habitat for riparian spawning species. In essence, native fish need plants and trees.

8. Vegetation clearance and stock access are activities that can restrict the form and function of braided rivers. These rivers are icons of the Canterbury landscape and have high aquatic biodiversity and ecosystem health values. The intent of policies proposed by CRC to maintain these values is supported.

9. Recommendations associated with policies and rules for vegetation clearance and stock exclusion in these systems is provided in order to strengthen the Council's intended protection of braided rivers.

INTRODUCTION

Qualifications and experience

10. My full name is Kathryn (Kate) Jane McArthur.

11. I hold a Bachelor of Science degree with Honours in Ecology and a Master of Applied Science with Honours in Natural Resource Management, both from Massey University. My areas of post-graduate research include the influence of land use on freshwater macroinvertebrate communities and the interaction between policy and science for improved freshwater resource management, with a particular focus on water quality objectives and limits. I have 15 years post-graduate experience working in the field of freshwater management and I joined The Catalyst Group (an environmental consultancy based in Palmerston North) as the Practice Leader - Water Quality in 2012.

12. Before joining The Catalyst Group, I held the role of Senior Scientist – Water Quality with Horizons Regional Council (Horizons). Over 6 years with Horizons I coordinated the State of the Environment (SOE) and discharge monitoring programmes for water quality and aquatic biodiversity, produced expert evidence for a number of resource consent hearings and enforcement actions (relating mainly to takes of, and discharges to, water). During my work on the One Plan I led the identification of Sites of Significance – Aquatic work, reviewed and refined the river, lake and coastal water quality limits and project managed water quality evidence for the One Plan hearings and Environment Court proceedings.

13. I championed and reviewed the national Envirolink Tools projects to develop methods and guidelines to assess sedimentation in rivers (Clapcott et al. 2011) and review the New Zealand instream plant and nutrient guidelines (Matheson et al. 2012).

14. I have authored and co-authored a range of reports and publications, including technical reports to support the Proposed One Plan. I have also authored and co-authored papers in peer-reviewed journals on topics such as: the relationship between flow and nutrients in rivers; nutrient limitation; methods for monitoring native fish; the calculation of in-river nutrient loads and limits, and the setting of water quality objectives and limits in resource management policy. I have provided evidence in these areas before the Environment Court, in Board of Inquiry and Independent Hearings Panel processes in recent years.

15. I have most recently provided ecological and policy advice to Nelson City Council, Northland Regional Council, Ngāti Kahungunu Iwi Incorporated, Hawkes Bay Regional Council, the Iwi Leaders Group and the Department of Conservation. My work with Northland Regional Council and Nelson City Council both involved the development of significant sites for native fish and īnanga spawning values in these regions.

16. On behalf of the New Zealand Planning Institute I co-lead workshops throughout the country on freshwater science and policy development. Participants have included: local government and industry planners, planning consultants, iwi/NGO resource managers, and the Ministry for the Environment Water Directorate staff. I am a member of the National Objectives Framework reference group.

17. I have been a member of the New Zealand Freshwater Sciences Society since 2001 and I am currently elected onto the Society's executive committee. I have been a member of the Resource Management Law Association of New Zealand (RMLA) for six years and RMLA scholarship recipient in 2010 for my work on water quality limits for the Manawatū River. I am a guest lecturer in environmental planning at Massey University and an accredited RMA hearings commissioner.

Purpose and scope of evidence

18. This statement of evidence was prepared for the Royal Forest and Bird Protection Society of New Zealand Incorporated ("the Society") in support of their submission and further submissions on Plan Change 4 to the Canterbury Land and Water Plan.

19. The purpose of this evidence is to provide technical advice to the Independent Hearings Panel (IHP) in relation to ecological and water quality issues in Canterbury and the response to these through Plan Change 4.

20. This evidence covers the following matters:

    a. Issue 1: Īnanga spawning protection;

    b. Issue 2: Vegetation clearance and earthworks;

    c. Issue 3: Stock exclusion from water; and

    d. Issue 4: Surface water quality limits.

21. In preparing my evidence, I have read the following material:

    a. Relevant sections of the Society's submission and further submissions;

    b. The National Policy Statement for Freshwater Management (2014) ("NPS-FM");

    c. Relevant provisions of the Canterbury Land and Water Plan (LWRP), Plan Change 4 (omnibus);

    d. Related provisions of the Canterbury Regional Policy Statement and Coastal Policy Statement;

    e. Section 42A report prepared by Philip Maw and Matthew McCallum-Clark (including Appendix B – Technical Memoranda prepared by Greer and Tompkins);

    f. Environment Canterbury Technical Report: Predicting īnanga/whitebait spawning habitat in Canterbury prepared by Greer et al. (2015); and

    g. Section 32 Evaluation Report for Plan Change 4 (Omnibus) to the Canterbury Land and Water Regional Plan.

Expert code of conduct

22. I have read the Code of Conduct for Expert Witnesses in the Environment Court's Practice Note 2014 and I agree to comply with that Code of Conduct. I confirm that the issues addressed in this brief of evidence are within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express. I have specified where my opinion is based on limited or partial information and identified any assumptions I have made in forming my opinions.

AMENDMENT CATEGORY A: ĪNANGA SPAWNING PROTECTION

23. The New Zealand threat classification system is used to assess species at risk. The system uses nationally understood and consistent categories and criteria to assess the risk of extinction to all New Zealand species (Figure 1). Nationally, 78% of our native freshwater

fish have a conservation threat status assigned to them. This is an increase from the last two reported threat classifications where 67% were identified as threatened or at risk in 2009 and 53% in 2005 (Allibone et al. 2010; Hitchmough et al. 2007). Increases in the proportion of threatened or at risk species can result from changes in taxonomic resolution for some species and changes in threat classification method since the 2005 and 2009 classifications. However, this does not explain the total pattern of decline and it is generally accepted by freshwater ecologists that native fish populations are continuing to decline nationally for reasons associated with resource use and habitat loss (Joy 2009; Brown et al. 2015). More threatened species are in higher threat classification classes than in the past, meaning they are becoming more threatened with extinction (Goodman et al. 2014).

24. Allibone et al. (2010) suggest declines in migratory species in particular may be the result of a ‘source and sink’ effect whereby ‘sinks’ occur in relatively poor habitat that does not provide the critical requirements for successful reproduction, recruitment or long-term survival. With respect to īnanga a ‘sink’ habitat may provide for juveniles and be adequate for growth of those fish into adults, but have no available spawning habitat and thus the fish in that habitat never reproduce. The risk of source and sink affected populations is that very rapid population decline (either regionally or nationally) is possible once source areas (spawning areas which allow for successful reproduction and recruitment of fish into the next generation) are depleted or destroyed. Such declines are now indicated in species that were once common, like the longfin eel and īnanga. Allibone at el. (2010) warn that:

> “*More serious effort is now required to reverse the decline in native freshwater fishes and to manage the instrumental causes of their decline that are ongoing, and in some cases increasing, if the extinction of further freshwater fish is to be prevented*.”

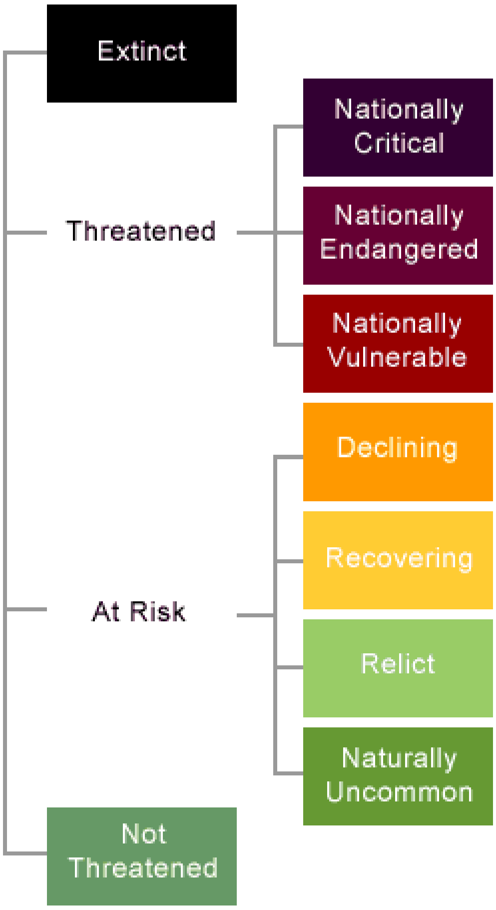

Figure 1. New Zealand Threat Classification System categories. Source: Department of Conservation.

25. The majority of freshwater fish classified as threatened or at risk belong to the *Galaxias* genus, of which īnanga are the best-known member. Īnanga have been identified as "at risk" and "declining" in the most recent threat classifications (Goodman et al. 2014; Allibone et al. 2010). The criteria and qualifiers associated with this threat classification for īnanga are an estimated 10-70% declining trend[1] and a 'conservation dependent' status. Although there is an estimated population of >100,000 mature individuals, īnanga are defined as 'conservation dependent', meaning without continued management intervention, there is a high probability that they will fall into a higher threat class in future (Townsend et al. 2008).

26. The key īnanga critical habitat requirements are: 1) access to freshwater habitats during juvenile migrations in from the sea (lack of barriers to whitebait runs), 2) access to undisturbed spawning habitat at the inland/upper extent of the salt-wedge (Figure 2) inundation area of freshwater and estuarine systems, and 3) adequate height and quality of marginal (riparian) vegetation to maintain humid conditions suitable for egg survival and development.

[1] Population changes are calculated over 10 years or three generations, whichever is longer (Townsend et al. 2008). For īnanga this is a ten-year trend due to their short life-span.

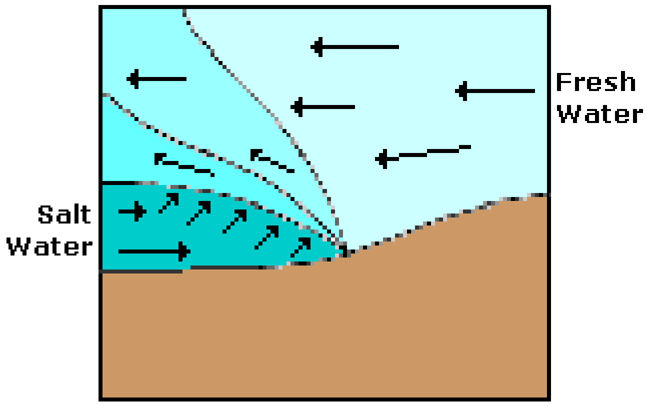

Figure 2. Diagram of the salt water wedge found at the interface between freshwater flowing out to an estuary or coast and the wedge of denser salt water on the bed. This salt water wedge moves at the bottom of the flow and against the land as the tide comes in, with the freshwater flowing over the top of it.

27. Many īnanga spawning habitats are found within estuaries. Estuaries are highly modified and threatened environments, often with degraded water quality, form, function and/or riparian habitat and vegetation. An obligate habitat requirement at the interface between fresh and salt water (meaning īnanga in river systems *must* have this habitat to spawn and most often that habitat is estuarine), in combination with having a singular spawning per adult fish[2] makes īnanga at high risk of reproductive failure and continued population decline, hence their conservation dependent threat status.

28. The leading causes of decline in native fish have been identified as declining water quality, water abstraction, exotic fish species, and loss of habitat via land-use change and land-use activities, and river modification (Allibone et al. 2010). Hickford and Schiel (2011) consider the biggest threat specific to īnanga is the destruction and restriction of their spawning habitat at the freshwater/coastal interface.

29. The reliance of īnanga on coastal and freshwater connectivity makes protection of their spawning habitat a difficult resource management issue, requiring an integrated coastal and freshwater policy approach and a catchment framework that applies the principle of ki uta ki tai[3].

30. Juvenile īnanga are the most common species in the whitebait catch. Reductions in the abundance of spawning habitat, adult īnanga numbers and the reproductive success of

[2] Īnanga are short lived compared to other galaxiid species, living only 2-3 years. They only spawn once during their lifetimes (McDowell 1990; 2001).
[3] Mountains to the sea.

īnanga and other whitebait galaxiid species not only affects indigenous biodiversity values, but threatens recreational and mahinga kai values through reduced whitebait catch over time.

31. I **support** the approach taken by Canterbury Regional Council in developing and applying a predictive model to determine likely īnanga spawning habitat and the use of this information within the planning maps of the LWRP and the policies and rules for īnanga spawning protection. This level of management intervention is required in order to halt the decline in this important freshwater species.

32. The tested accuracy of the predictive model, through comparison of predicted sites with known spawning sites, yielded strongly positive results (Greer et al. 2015), providing added confidence that the modelled approach is a good predictor of likely īnanga spawning habitat. The removal from the maps of habitat upstream of known barriers also provides a rational and practical level of detail. In my opinion, the methods used by CRC to develop planning maps of predicted spawning habitat for inclusion in Plan Change 4 is fit for purpose, at a reasonable spatial resolution, and has employed an appropriate level of scientific rigour.

33. New Zealand's native fish fauna are largely diadromous (migratory) and often cryptic (difficult to find and survey accurately). These factors, in combination with environmental variability (particularly between tide height and river flow) and the high level of resources needed to monitor native fish, mean that our knowledge of the locations of native fish habitats at the regional scale is patchy, at best. The approach taken by CRC uses the best available technical information and applies a pragmatic solution to a problem that would otherwise be difficult and expensive to solve through on-the-ground surveys.

Spawning sites vs. spawning habitats in the Plan

34. In my experience, site schedules based on known native fish survey data can be problematic. Where there is a paucity of environmental information associated with habitat suitability, schedules of known sites are often the only option available as an immediate management tool to try to halt the decline of threatened fish, although they are not ideal. Where information *is* available to accurately predict critical habitat factors, a predictive approach is more ecologically sound, and is likely to provide better species protection through wider habitat retention and better accounting for natural variability in the environment.

35. Additionally, protection of sites known for īnanga spawning provides only for the current state of the īnanga population. As discussed above, īnanga are classified as an at risk and declining species. Protecting their known spawning habitat only maintains the population in a sub-optimal, declining state. A site-based approach does not provide for improvement or

enhancement of spawning habitat or improvement of the aspect of ecosystem health[4], mahinga kai[5] or aquatic life and indigenous biodiversity[6] that īnanga comprises.

36. Application of īnanga spawning sites *and* īnanga spawning habitats in the planning maps, Schedule 17 and the policies and rules is unclear. As stated above, in my opinion the methods used to predict īnanga spawning habitat have applied an appropriate degree of rigour and are fit for purpose to identify habitat for protection within Plan Change 4. Taking a site-specific approach may result in activities which restrict or damage spawning habitat that is not identified as a 'site' prior to or during spawning. This is not consistent with a precautionary approach in the face of uncertain information[7].

Timing of īnanga spawning

37. Another area of uncertainty is the timing of īnanga spawning, which can vary markedly depending on latitude and region. The spawning periods applied to Plan Change 4 are based on work by Smith (2015) to define a national fish spawning and migration calendar. The spawning calendar describes the total range of spawning nationally as 1 December to 31 July with the peak at 1 March to 1 July – so including June. Taylor (2002) described some sporadic spring spawning and a peak season of February, March and April; with Southern locations spawning earlier than Northern. The spawning periods in Plan Change 4 apply a degree of pragmatism in the face of uncertainty and variability and are likely to capture the majority of spawning activity. I **support** this approach, although in many cases the extended period of 1 January to 1 June should apply (rather than March – June). I discuss this in more detail below Likewise, an approach which encompasses more of the likely spawning habitat (than discrete sites), in conjunction with a slightly more permissive rule regime is a pragmatic solution, aimed at capturing as much spawning habitat as possible, while still applying rules that are meaningful to manage adverse effects of activities on spawning.

Recommended habitat-based approach

38. The most ecologically sound approach, in my opinion, is to remove the īnanga spawning sites from the planning maps, identifying only the spawning habitat on the planning maps and to

[4] With respect to the compulsory national Ecosystem health value expressed in the NPSFM.
[5] With respect to the additional national value in the NPSFM and CWMS targets.
[6] With respect to Objective A1 of the NPSFM and the CWMS targets.
[7] With respect to Policy 3 of the NZCPS.

apply all provisions proposed to protect īnanga spawning to the spawning habitats ubiquitously throughout Plan Change 4.

39. For some activities there is little potential for adverse effects on īnanga spawning habitat outside the 1 January to 1 June exclusion period. For others activities the effects at any time of the year can have lasting negative consequences for īnanga spawning - potentially destroying the habitat. For the rules associated with most activities the 1 January to 1 June exclusion has been applied in the amendments below, but for others, such as earthworks and vegetation clearance within 5m of the bed, these activities should not be permitted at any time within īnanga spawning habitat and will require consent if the amendments below are adopted. I recommend amended wording for the relevant provisions consistent with such an approach below.

Category A definition and policies

40. The Society's submission seeks to include a definition for īnanga spawning sites as well as īnanga spawning habitat in order to clarify how the policies and rules will apply to the scheduled sites and mapped areas. In my opinion, this is not as ecologically sound a solution to this problem as the habitat-based predictive approach I have recommended. However, should the site-based approach be retained by Plan Change 4, a definition of īnanga spawning sites will be needed.

41. I **support** the recommended exclusion of ephemeral streams from any new definition of īnanga spawning habitat as long as these streams are naturally ephemeral and not simply dry through over-allocation of water resources.

Policy 4.31

42. The addition of a reference to īnanga spawning habitat in the policy and the addition of clause (ba) are **supported**. Applying a habitat-based approach as recommended above would simplify Policy 4.31 in relation to the provisions for stock exclusion for īnanga spawning habitat. This would be achieved simply by removing any reference to īnanga spawning *sites* from Policy 4.31 clause (b) and leaving clause (ba) as proposed in the s42A report. Issues associated with permanent stock damage of the bed or bank of a waterbody that have the potential to affect īnanga spawning habitat are adequately covered by the rest of the policy, which excludes intensively farmed stock and limits access to the beds and banks to water-avoiding species and stocking rates that avoid evident damage. Further reference to īnanga

spawning *sites* is not needed. I therefore suggest the following changes to policy 4.31 (recommended changes to policy as proposed shown in **bold**):

Damage to the bed or banks of water bodies, sedimentation and disturbance of the waterbody, direct discharge of contaminants, and degradation of aquatic ecosystems and īnanga and salmon spawning habitat is avoided by:

(a) Excluding intensively farmed stock from lakes, rivers and wetlands; and

(b) Excluding stock from ~~swimming~~ freshwater bathing sites listed in Schedule 6, ~~**inanga and**~~ salmon spawning sites listed in Schedule 17, and other sensitive water body areas and the waterbody bed and banks closely adjacent to ~~upstream of~~ these areas; and

(ba) excluding stock from īnanga spawning habitat during the period of 1 January to 1 June inclusive; and

(c) Limiting access to wetlands, and the banks or beds of lakes and rivers to stock species that prefer to avoid water and at stocking rates that avoid evident damage.

New policies 4.86A and B

43. A habitat-based approach allows the issues of avoidance of damage and scheduling works outside of the spawning period to be combined.

44. Regardless of whether a site-based or a habitat-based approach is taken, removal of the following terms from the policies is needed: “as a first priority”, “best practicable options to minimise all impacts” and “where it is practicable to do so”. These terms are ambiguous and fail to provide adequate certainty or clarity to plan users or decision makers. It is good planning practice for any exclusion from a policy or rule to be clearly defined within that policy or rule. Otherwise there is potential for the use of ambiguous terms within the policies to undermine the intent of the policies.

45. If a policy requires avoidance “as a first priority” then a cascade of priorities with alternate mechanisms must follow, in order to support a prioritised approach.

46. Best practicable options, minimisation and practicability are also terms that require clear definition within the policy to ensure the policy is implemented in line with its intent. Without this they should be removed. All conflicts should be resolved within the policy, not left open to later interpretation. I therefore recommend the following changes to the policy/policies:

4.86A Īnanga spawning ~~**sites**~~ **habitat** ~~**are**~~ **is** protected through ~~**as a first priority,**~~ avoiding activities within the beds and margins of lakes, rivers, hāpua, wetlands, coastal lakes and lagoons that may **remove or reduce the suitability for spawning, including but not limited to reduction or removal of the area of tidal inundation or vegetation suitable for spawning** ~~**damage inanga spawning sites, and where these activities cannot be avoided, the use of the best practicable option to minimise all impacts.**~~

This means that activities in the beds and margins of lakes, rivers, hāpua, wetlands, coastal lakes and lagoons must be scheduled outside the īnanga spawning period of 1 January to 1 June inclusive, so as to allow sufficient time for regeneration of the habitat. Some activities will not be appropriate at any time of the year in īnanga habitat, given the damage they can cause.

Amendments to Rules 5.136-5.141, 5.148, 5.151, 5.71, 5.163, 5.167 and 5.168 - overview

47. Many activities can occur outside of 1 January to 1 June without effects on īnanga spawning. However, some activities have adverse effects on īnanga spawning at any time within their habitat.

48. Activities that are unlikely to affect īnanga spawning outside of the 1 January to 1 June period include: drilling and tunnelling or disturbance of the bed; installation of bridges and culverts; installation, maintenance or use of flood control structures; use and maintenance of structures; temporary structures and diversions; and temporary discharges to water or land.

49. Activities with potential adverse effects on īnanga spawning at any time are: 1) vegetation removal within 5m of the bed of a river, and 2) earthworks within the 5m margin. The reason these activities require a longer exclusion period is there is a greater potential for lasting damage to vegetation or the profile of the tidal inundation area of the bank to be altered in a manner that means the habitat is no longer suitable for īnanga spawning.

50. Proposed amendments to Rules 5.136 to 5.141, with regard to restrictions on structures in īnanga spawning habitat are **supported**, subject to the provisos regarding the appropriate exclusion period below (paragraph 53 onwards). The proposed amendments to Rules 5.148 and 5.151 are supported, subject to a proviso, also discussed below. The extension of the exclusion period for vegetation activities between 1 January and 1 June for īnanga spawning habitats in Rules 5.163 is **supported**. The exclusion for vegetation and earthworks activities in Rules 5.167 and 5.168 should apply year-round. I also **support** the prohibited activity status in Rule 5.71 for stock access to īnanga habitat between 1 January and 1 June. This activity status is an appropriate management response to halting the decline of this species.

51. The key habitat requirement that needs protection prior to the peak spawning period (i.e. prior to 1 March to 1 June) is retention of the marginal vegetation (often grasses and rushes) so that the height and quality of that vegetation provides suitably humid conditions for the survival and development of īnanga eggs until the next tidal inundation. If stock are excluded and marginal grasses and other vegetation is left intact, then this aspect of the habitat should be protected or able to recover adequately prior to spawning.

52. If other activities (beyond vegetation clearance, earthworks and stock exclusion) are likely to reduce the height and quality of the marginal vegetation in the 1 January to 1 March period prior to spawning then they also require management via the rules in the plan during this period to allow for regeneration and recovery. It is not clear whether these activities will have these effects, however, activities that may cause the effects Policies 4.31 and 4.86A are trying to avoid need to be managed so that tidal inundation areas and the quality of the marginal vegetation is not reduced or removed entirely. This includes activities within the Coastal Environment and Coastal Marine Area.

Rules 5.136 - 5.141

53. Drilling, tunnelling or disturbance of the bed (Rule 5.136) for pipes, ducts, cables or wires is unlikely to permanently damage a particular īnanga spawning site. Reference to spawning *sites* could be removed from this rule and the extension of the timeframe to exclude the activity occurring between 1 January and 1 June as a permitted activity in spawning *habitats* applied instead. This would allow for less restriction on these activities and ensure any effects on the vegetation in the habitat have had a chance to be remediated prior to the commencement of the peak spawning season.

54. The same approach can be applied to rules relating to the installation of bridges and culverts (Rule 5.137), installation maintenance or use of flood control structures (Rule 5.138), use and maintenance of structures (Rule 5.139), temporary structures and diversions (Rule 5.140) and temporary discharges to water or land (Rule 5.141). It can also be applied to surface water sampling and monitoring equipment (5.140A). The Council (at paragraph G.8 of the s42A report) has accepted Forest & Bird's submission that the īnanga provisions should apply to this activity, and I **support** that.

55. If it can be shown that these activities do not negatively affect the marginal vegetation in the two months prior to peak spawning commencement, or that they will not alter the area of tidal inundation to reduce the availability of spawning habitat then the extended exclusion period could be reduced to the 1 March to 1 June period, along with the removal of any reference

to īnanga spawning *sites*. Without such certainty clearly defined within each of the rules the extended period of 1 January to 1 June should apply as the permitted activity threshold. I therefore recommend the following change to rules 5.136(1), 5.137(4), 5.138(2), 5.139(4), 5.140(1), 5.140A(5) and 5.141(2) (to be adapted as appropriate to wording of each provision):

> The activity is not undertaken in a~~**n īnanga or**~~ salmon spawning site listed in Schedule 17, or undertaken in any inanga spawning habitat during the inanga spawning season of 1 ~~**March**~~ **January** to 1 June inclusive.

Rule 5.139(4)

56. I agree that the proposed amendment (in the s42A report at page 53) to this rule is a pragmatic approach to the necessary maintenance of support structures that may occur within the spawning exclusion period. In saying that, it would be best environmental practice for Transpower to identify infrastructure that is within īnanga spawning habitat and avoid routine maintenance in these areas wherever possible, although I acknowledge Transpower's internal maintenance practices are not matters for this hearing if the proposed exemption is accepted.

Rules 5.148, 5.151 and 5.152

57. Removal of the reference to īnanga spawning *sites* from Rules 5.148(9), 5.151(1) and 5.152(2) in preference for the provisions relating to īnanga spawning habitat would simplify these rules, with some amendments to the exclusion periods.

58. However, there is potential for the stockpiling of extracted gravel (including surplus or reject material) to affect the marginal vegetation and reduce the tidal inundation area. This activity should also be subject to the extended exclusion period of 1 January to 1 June.

59. I therefore recommend the following amended wording for clause (9) of Rule 5.148

    The activity is not undertaken in a~~**n inanga or**~~ salmon spawning site listed in Schedule 17, or in any īnanga spawning habitat during the īnanga spawning season of 1 March to 1 June inclusive **and any excavated material (including surplus or reject material) is not stockpiled in any īnanga spawning habitat between 1 January and 1 June**"

60. Any reduction in these aspects of the habitat will require remediation prior to the commencement of the extended spawning exclusion period and should be matters for

suitable consent conditions that flow from new policies 4.86A and B. Suitable[8] vegetation for īnanga spawning habitat could be required to be planted to allow for remediation of a site prior to 1 January as a condition of consent.

Rule 5.71 Prohibited activity status – stock exclusion

61. Rule 5.71(1) sets out the prohibitions with respect to stock use and disturbance of the bed and banks of a river or lake. A prohibited activity status for stock use and disturbance of the bed and banks within īnanga spawning habitat between 1 January and 1 June is appropriate, given the declining status of īnanga populations, the key threat posed by habitat loss and stock trampling, and the value of īnanga as components of indigenous biodiversity and mahinga kai. Stock trampling and removal of grasses and rushes has the potential to significantly damage or destroy īnanga spawning habitat. If these effects are removed, via stock exclusion prior to the commencement of the peak īnanga spawning season, then marginal vegetation is likely to regenerate and provide suitable conditions for egg protection and development. As long as the presence of stock is not causing permanent damage to the spawning habitat (i.e. reduction or alteration of the tidal inundation area through stream bank erosion) then exclusion via prohibition to īnanga spawning habitats (not sites) is an appropriate control of this effect. These effects are covered adequately by Rule 5.68.

62. I therefore recommend the following change to Rule 5.71(1)

    In a~~**n**~~ ~~**inanga or**~~ salmon spawning site listed in Schedule 17, <u>or undertaken in any īnanga spawning habitat during the period 1 January to 1 June inclusive;</u>

Rules 5.163, 5.167 and 5.168

63. Rule 5.163 clause (7) relating to vegetation clearance as a permitted activity should not occur in any īnanga spawning *habitat* during the extended spawning period 1 January to 1 June. This wording could be reflected within the clause by removal of reference to īnanga spawning *sites* and is consistent with the habitat-based approach recommended above.

64. Rule 5.167 relates to vegetation clearance in riparian margins (within 5m of the bed of a river or lake) and is directly relevant to managing effects on īnanga spawning habitat. If amended

[8] Information on suitable vegetation can be found in a number of resources, including: Richardson J, Taylor M 2002. A guide to restoring inanga habitat. NIWA Science and Technology Series No. 50; Taylor M 2002. The national inanga spawning database: trends and implications for spawning management. Science for Conservation 188, Department of Conservation, Wellington.

to refer only to īnanga spawning habitat (consistent with the recommended approach in this evidence), clause (4) allows vegetation clearance within 5m of a river or lake bed as a permitted activity outside of the 1 January to 1 June period in īnanga spawning habitat. This creates a risk of permanent loss of vegetation within spawning habitat. As a permitted activity threshold for vegetation clearance, this should be a year round exclusion from any īnanga spawning habitat, with remediation of grassy or rush vegetation a matter of discretion.

65. I therefore recommend the following wording for Rule 5.167(4):

The vegetation clearance does not occur adjacent to a salmon **~~or an inanga~~** spawning site listed in Schedule 17, or undertaken in any inanga spawning habitat **~~during the period of 1 January to 1 June inclusive~~;**

66. Rule 5.168 controls earthworks in riparian margins (within 5m of the bed of a river or lake). As above, if amended to refer only to īnanga spawning habitat, clause (3) allows earthworks within 5m of a river or lake bed as a permitted activity outside of the 1 January to 1 June period. This creates a risk of permanent changes to the tidally inundated area and bank profile of īnanga spawning habitat. As a permitted activity threshold for earthworks, this should be a year round exclusion from any īnanga spawning habitat, with the bank profile and tidal inundation area a matter of discretion.

67. I therefore recommend the following wording for Rule 5.168(3):

The activity does not occur adjacent to a salmon **~~or an inanga~~** spawning site listed in Schedule 17, or in any īnanga spawning habitat **~~during the period of 1 January to 1 June inclusive;~~**

68. The addition of a specific reference to īnanga spawning habitats in clause (4) of Rule 5.169 will assist in managing effects through the restricted discretionary provisions. I recommend the following wording:

The actual and potential adverse environmental effects on areas of natural character, outstanding natural features or landscapes, areas of significant indigenous vegetation, **indigenous biodiversity including īnanga spawning habitat** and significant habitats of indigenous fauna, mahinga kai areas or sites of importance to Tangata Whenua;

Removal of ephemeral waterways from rules

69. I agree with the response of Greer and Tompkins to the issues of uncertainty raised by Fulton Hogan's submission. The uncertainty in the model predictions exists largely around ephemeral waterways, other predictions of īnanga spawning habitat are sound and accurate.

I **support** the recommendation to remove ephemeral waterways within the mapped habitats from the policy and rule provisions, providing these are *naturally* ephemeral waterways and not dry because of the over-allocation of water resources in the area. It is pragmatic to remove naturally ephemeral waterways from the policy and rule requirements and this may most efficiently be achieved through amendments to the definition of īnanga spawning habitat. However, identification of ephemeral waterways is difficult and a clear definition will be needed in the Plan.

Additional sites not predicted by the model

70. To reduce any uncertainty around īnanga spawning habitats that have not been identified by the predictive model (particularly along the Kaikōura and North Canterbury coastlines), Canterbury Regional Council have the ability to develop non-regulatory monitoring methods around identifying additional sites and including these in future Plan reviews. I recommend this is undertaken in conjunction with Ngāi Tahu and would add value to the īnanga spawning habitat provisions in future Plan reviews.

71. Additionally, examination of the one known īnanga spawning site not predicted by the model is needed. This site should be added into the planning maps as 'īnanga spawning habitat' with an upstream buffer associated with the same tidal boundaries used in the model.

AMENDMENT CATEGORY H: VEGETATION CLEARANCE AND EARTHWORKS IN THE BEDS OF LAKES AND RIVERS AND RIPARIAN MARGINS

Riparian vegetation

72. Riparian vegetation is important to aquatic ecosystem health for a number of reasons. It provides shade, assists in reducing contaminant transfer and run-off to water, introduces woody debris into aquatic systems for food and cover, and provides spawning habitat on the margins of rivers and lakes for galaxiid fish species. The abundance of instream cover is a critical factor for most native fish taxa due to their cryptic and nocturnal nature. Instream cover also provides refuge from predatory and pest fish and birds.

73. Maintaining and improving riparian margins provides for a number of critical habitat requirements across a range of native fish species. For species that spawn on riparian margins (i.e. lamprey, large galaxiids and īnanga), intact and undisturbed riparian margins are an essential habitat for successful reproduction and recruitment into the next generation.

Connectivity between the flowing channel and the riparian margin during spawning periods (via flood or tidal inundation) is a critical factor to the effective functioning of riparian margins for spawning.

74. Adequate control of riparian disturbance (e.g. vegetation clearance, alteration or disturbance, stock access, cultivation, earthworks, sediment discharge, and bank protection or instream structures) is key to providing habitat for riparian spawning species. In essence, native fish need grass and trees.

Braided rivers

75. Braided rivers are an important habitat for New Zealand's freshwater fish and birds and are an iconic part of the Canterbury landscape. Freshwater species that inhabit or utilise these rivers are declining nationally. For example, kōaro, bluegill bully and torrentfish have had their conservation threat status increased from 'not threatened' to 'at risk - declining' to reflect the more serious effort needed to reverse the decline to avoid and prevent species extinctions in the future (Allibone et al. 2010). These species are flow demanding and good swimmers that either dwell within the fast flows in braided river habitat (i.e. bluegill bully and torrentfish), or use these areas as conduits to penetrate far inland to habitat with indigenous forest margins (kōaro).

76. Torrentfish are the only member of their genus (*Cheimarrichthys*) world-wide and thus they have special biodiversity value. Torrentfish are often found in the fast-flowing channels of braided rivers. There is mounting evidence in the freshwater fish database that they are declining in some large river systems (*R. Allibone pers comm.*).

77. Braided rivers often support a diverse fish fauna because of the range of habitats available across multiple channels (e.g. fast-flows, variation in depth, river profile and substrate size, backwaters, marginal wetlands and pools). If connectivity to the sea is good, low altitude braided rivers, like those found on the Canterbury Plains, can provide habitat suitable for a high number of declining and threatened native species when water quality and flows are adequate.

Earthworks and sediment effects

78. There are significant ecological and water quality issues arising from sedimentation of freshwater from earthworks. In many aquatic environments nationally, sediment from erosion and earthworks is a key contaminant of concern and significant adverse effects occur.

79. Sediment has multiple adverse effects on ecosystem health, cultural and recreational values. Sediment affects aquatic ecosystems through two mechanisms: 1) direct deposition on the bed of rivers, streams and lakes, and 2) as suspended sediment in the water column. Suspended sediment from multiple activities accumulates across a catchment landscape and can end up being deposited on the bed when particles fall out of suspension. Earthworks, depending on the scale, accelerates the delivery of sediment to waterways and reduces the particle size of bed sediment (Clapcott et al. 2011).

80. In combination with vegetation encroachment, deposited sediment can cause loss of stream width in rural streams (Davies-Colley 1997), resulting in a shift from a gravel bed to a soft-bottomed stream. Sedimentation that causes this type of habitat change has highly detrimental effects on aquatic macroinvertebrates and fish, and reduces water quality through lowered dissolved oxygen and increased water temperatures, with a commensurate reduction in ecosystem health values.

81. Suspended sediment directly smothers the feeding and gill structures of invertebrates and fish and is known to reduce fish diversity (Richardson and Jowett 2002) and cause avoidance behaviour in a number of native species, including juvenile banded kōkopu (Rowe et al. 2000; Richardson et al. 2001). Suspended sediment also reduces the ability of fish to feed (Rowe and Dean 1998).

82. Deposited sediment directly affects aquatic life by increasing invertebrate drift out of affected habitats (Suren and Jowett 2001); reducing interstitial spaces[9], spawning habitat and refugia for aquatic invertebrates and fish (Clapcott et al. 2011); enables the establishment of aquatic weeds, alters bed habitat and can create anoxic conditions in downstream estuarine environments. In severe cases, estuarine sedimentation contributes to anoxia and mortality of estuarine fauna (Robertson and Stevens 2007, 2011).

Definitions and policies

83. My comments relating to the definitions of earthworks and vegetation clearance are only within the context of potential effects on water quality or aquatic biodiversity. It is not within my areas of expertise to comment on the effects of earthworks or vegetation clearance on terrestrial biodiversity or ecology.

84. In terms of potential effects on water quality or aquatic biodiversity, I **support** the amendments to the definitions of vegetation clearance and earthworks to include soil

[9] The spaces between gravels that fish and invertebrates inhabit and feed amongst.

cultivation occurring after 5 September 2015. In my opinion, this is a pragmatic approach to curtailing the continued expansion of an identified environmental issue that is difficult to undo, whilst still allowing for existing land use activities to continue. This is appropriate as long as effects on water quality and erosion are controlled through other rules in the LWRP, and any provisions requiring whole farm plans.

85. In relation to potential effects on water quality and aquatic biodiversity, clause (b) of the definition of vegetation clearance is too broad and should be deleted. The permitted activity thresholds within the rules for vegetation clearance in riparian margins and in īnanga spawning habitat have been amended to allow for many activities that are required for utilities or structures, but this approach will only be effective if these activities are captured within the definition which those rules are linked to.

86. The Society's submission requests that vegetation removal is amended to include reference to vegetation alteration and disturbance. In relation to īnanga spawning habitat I **support** the addition of amendments to the definition to capture vegetation alteration and disturbance, which also needs to be avoided. For example, īnanga do not spawn in exotic reeds. Alteration of the vegetation within spawning habitat from tall fescue grasses or native rushes to exotic reeds will result in adverse effects on īnanga spawning. In relation to the benefits of riparian vegetation to other aspects of aquatic ecosystem health, intact riparian vegetation is an important component of a healthy, functioning system. I **support** the use of the terms "alteration" and "disturbance" where it applies to riparian vegetation outside of īnanga spawning habitat.

New Policy 4.85A

87. I **support** new Policy 4.85A with the exception of the exemption for the operation, maintenance or repair of structures or network utilities. Many aspects of these activities are already exempted within many of the rules and do not need exemption at the level of the policies as well, as this undermines clause (b). The policy can be further improved through the addition of coastal lagoons and wetlands to clause (a) and by changing the word "limiting" at the beginning of clause (b) to "preventing". This would support the intent of the policy more clearly. I agree with many of the points raised in the discussion within the s42A report (paragraphs H.47 to H.51) that seeks to limit cumulative effects on the functioning of braided river systems.

New Policy 4.92A and new Rules 5.146A and 5.146B

88. Policy 4.92A and Rules 5.146A and B are **supported** to enable the removal of fine sediment from the bed of a river for habitat restoration, in a manner that ensures effects of the sediment removal are avoided, remedied or mitigated through the conditional provisions.

Amended Rules 5.163, 5.164, 5.167, 5.168, 5.170 and 5.171

89. Generally, I **support** the amendments to these rules, notwithstanding my comments with respect to īnanga spawning provisions in the Category A paragraphs of this evidence. I **support** all amendments relating to the discharge of sediment or sediment-laden water to water within these rules and any provisions that relate directly to riparian vegetation and the beneficial effects this has on aquatic ecosystem health. Spring-fed streams and wetlands should also be protected by provisions relating to sediment discharge. Reference to these waterbody types should be included in Rule 5.170.

AMENDMENT CATEGORY L: STOCK EXCLUSION FROM WATER

New Rule 5.68A

90. New Rule 5.68A to clarify the extent of a braided river for the purposes of stock exclusion is **supported**. Braided rivers are ecologically important to native fish and other indigenous species. Maintaining their riparian margins and their form and function as braided systems is critical to sustain their habitat suitability for indigenous flora and fauna.

91. I **oppose** the 5m margin suggested by Fonterra & Dairy NZ as there is no scientific basis for a reduction in the margin that will still maintain the natural function of the braided river system. As stated in the s42A report, paragraph L.20: "*The amendment to the vegetation clearance provisions, coupled with the stock exclusion rules amendments, are intended to manage areas within the braided river environment that have been cleared and used for stocking and ultimately <u>restricting the natural movement of the braided river system</u>. The outer setback limit protects the braided river system*." (Emphasis added).

92. The combined intent of these rules is not to manage sediment and stock effluent, as submitted by Fonterra & Dairy NZ. The example of the 5m and 3m riparian setbacks cited in the Fonterra & Dairy NZ submission (the Selwyn and Hinds Plan changes) is not related to protection of braided rivers systems and is therefore irrelevant to Rule 5.68A.

Amended Rule 5.68

93. Stock access to water has known environmental effects on water quality, spawning habitats of native fish, sedimentation of water bodies and pugging and erosion of the structure of banks and beds. Rules that allow stock access to waterways as a permitted activity (including hill and high country lakes) must be able to demonstrate that these activities will not have any significant adverse effects on aquatic life as a result of the discharge of contaminants from those animals (after reasonable mixing) in order to meet the s70(1) requirements of the Act. Stock should be excluded from these lakes too unless evidence can be provided that there are not significant adverse effects on aquatic life.

94. See above for discussion of Rule 5.71.

AMENDMENT CATEGORY P: GROUNDWATER AND SURFACE WATER LIMITS

Amendment to Policy 4.13

95. I **support** the amendment to Policy 4.13 as worded in the s42A report recommendation. This version of the policy is clear, better supports the intent of the policy to stop further degradation of water quality in degraded waterbodies and is consistent with the requirements of the NPSFM (2014).

Kathryn Jane McArthur

29 January 2016

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