

Science and Technical Advisory Group Meeting

Minutes

Dates and Location: Wednesday 1 May 2019 9.30am-4.00pm, Meeting Room 1A - Matairangi, Environment House, 23 Kate Sheppard Place, Wellington.

STAG Members present: Mike Joy, Marc Schallenberg, Clive Howard-Williams, Ken Taylor, Bryce Cooper, Jon Roygard, Bev Clarkson, Jenny Webster-Brown, Graham Sevicke-Jones (after 10am), Adam Canning (after 10am)

Officials: Jen Price, Isaac Bain, Ton Snelder, Carl Howarth, Jo Burton (up until nutrient discussion), Lucy Bolton (nutrient discussion onwards)

Apologies: Chris Daughney, Ra Smith, Ian Hawes, Jamie Ataria, Russell Death

Items:

1. Previous meeting minutes and actions arising, apologies, feedback from other advisory groups

Discussion points:

- The chair mentioned the changes to the agenda today – there will be extra time to discuss ecosystem health metrics, and there will be a discussion on the format of STAG recommendations.
- There may be a requirement for STAG to provide additional information and evidence to decision makers.
- STAG role is to provide evidence to inform policy, not design policy. There are different policy options other than attributes and monitoring requirements. Monitoring requirements are not a “soft option” compared to attribute tables and there has been a tendency within the group to view them in this way.
- The chair outlined key questions that officials will need answers to:
 - How confident are we that the numbers represent robust break points or bottom lines?
 - What’s the likely scale of natural departures from those critical thresholds?
 - How urgent is the need to collect data on the things we’re interested in now, to allow us to design policy now, or in the longer term? Attribute tables take effect in 2025.
 - How urgent is it to make changes now?
 - At what scale does the relationship between the activity on the land, and the effect on the water body, apply?
- Ton Snelder has recently completed an analysis that showed the relationship between the Southern Oscillation Index and water quality¹. This should be taken into account.
- The chair and Marc gave an outline of their presentation to the Freshwater Leaders Group (FLG). FLG has asked STAG to be clear about the improvements that will be made possible by the STAG’s recommendations. FLG is keen to understand the level of agreement among STAG members.
- Marc outlined one of the issues that has been talked about in FLG – trout and salmonids. FLG has noted that trout and salmonids are part of the ecosystem now, and they are valued

¹ Provided in background reading.

by people. There is a desire from FLG not to always give a negative weighting to trout and salmonids. Mike Joy noted that trout and salmonids are useful indicators of land use change and the IBI incorporates trout for this reason.

- Another issue raised by FLG is the definition of reference condition. Going back to a pre-human state is not relevant for calculating expected reference values.
- The ecosystem health value description includes “minimally disturbed state”. This is because it separates ecosystem health in a transparent way from other things we value the environment for. It’s important to make sure the wording of the narrative is carefully chosen, and that the values are clearly communicated.
- FLG has also raised the issue of the human health indicators. They are keen for a revision of these. MfE staff gave a brief update – there are likely to be changes to the *E. coli* attribute in this round and the details are being worked out. There is a need for substantial further science work on this issue.

Minutes from 16 April:

- Invertebrates: 200 count vs. full count – we need to be clear on what we are recommending
- Page 5 nitrogen cap – we need to be consistent – how many STAG members raised points.

Outcome:

- The minutes were approved with the changes above.

2. Ecosystem Health metrics

Aim: finalise recommendations on fish, lake dissolved oxygen, LakeSPI, macroinvertebrates, ecosystem metabolism, periphyton, and prioritise metrics for future work)

Fish

Questions posed to STAG:

- 1) Are you satisfied that there is sufficient evidence to support inclusion of the fish IBI as an attribute in national direction now? Consider the above considerations (possible limitations), and the “metric guiding criteria”, particularly:
 - a. Link to the ecosystem health value (e.g. presence/absence).
 - b. Evaluation of current state of the metric on a national scale
 - c. Relationship to resource use limits and/or management
- 2) Are you satisfied that there is sufficient evidence to support stronger policy to require Monitoring and Responding to declining fish health, using measures of diversity and abundance?

MfE staff outlined the proposed policies on fish passage and how this would complement a fish metric in the NPSFM. The Fish IBI has been proposed as a metric. If we use this specific method we need to be sure of the evidence. There are questions around how the expected fish community is calculated. An alternative would be to include a more general policy to monitor fish.

Discussion points:

- IBI is based on guilds that are related to habitat requirement and doesn’t predict what species should be there. It’s a more holistic measure than MCI because connectivity is important. About half the regional councils have a fish IBI developed. It is possible to use a

fish IBI based on abundance data that has been collected using the fish protocols, this has not yet been developed.

- In relation to the fish molecular tools being developed – this is also presence/absence, and a sample at a particular site could have come from anywhere in the catchment. This is a method that is still under development. It may be possible to use molecular methods for fish passage work and in parallel with traditional sampling methods.
- The molecular tools project will be a presence-absence tool. It will be the full fish community present. There is still work to be done on how far downstream the DNA can travel.
- To incorporate the measure into the NPSFM it is necessary to understand the natural departures from the proposed bottom line. Waterfalls and natural pH changes can influence fish populations.
- The group considered whether it would be possible to include a provision for natural variation in the NPSFM – the onus could be on councils to show where natural departures occur.
- It would be helpful to provide examples to decision makers about where and why natural variation occurs.
- One of the members noted the need to be clear about what data has been used to build the IBI.
- The chair noted that the recent Environment Aotearoa 2019 report shows a decline in fish species and this informs the urgency with fish need to be monitored.
- How are pest fish going to be managed? The proportion of non-native fish at the site is included in the Fish IBI.
- This relates to LakeSPI – is it good enough to separate moderate from high-moderate in the attribute states, do we need more resolution?
- The group was happy that Fish IBI can be consistently measured. But we do not understand the scale of natural variation and this would need to be taken into account.
- Does the stocking of trout and salmonids need to be taken into account? No – trout and salmon are there as an indicator of habitat quality and the means of maintaining populations are not important. It is Fish & Game national policy not to introduce salmonids to places where they have not already been introduced previously.
- This would not apply to fish in lakes. There is work going on to produce a lake fish IBI but this is in its beginning stages. There are no established protocols yet.
- There is not universal agreement among fish scientists about the Fish IBI and there might need to have more discussion.
- There was discussion about whether fish monitoring methods go through the NEMS process. It was noted that there are sampling protocols published for wadeable streams and these are being used currently.
- The Fish IBI is a commonly used metric and many councils are developing and using regional IBIs. There is regional variability that is incorporated into the regional IBI scores; how do we acknowledge this variation in the NPSFM?
- Is there a national bottom line? The group agreed that we want to avoid accepting a lower Fish IBI score because of past impacts.
- It was noted that Fish IBI does not predict the expected fish community. It is not based on species assemblages, is based on functional groups such as benthic riffle species.
- One of the members supports IBI, but option B would produce a better gain (ie, specifying that diversity and relative abundance should be monitored, but not specifying that Fish IBI must be used). Councils could use IBI as a tool for reporting and they could choose whether a to use a regional or national IBI. There is a benefit of requiring monitoring of diversity and abundance.
- There was discussion about the merits of the two options. Degraded areas would need to be improved under both proposals.

- The current monitoring of fish is not sufficient to inform policy and management responses. Requiring monitoring of abundance and diversity would be a step forward and could inform future policy. Another option would be to include the Fish IBI now and also specify monitoring requirements.
- It was suggested that you could use proposal B and include a minimum IBI measure. There was a large amount of support for this but one member expressed a desire for the fish science community to have a degree of consensus. The NIWA biodiversity indicator report will need to be considered.
- There was support for including a minimum threshold for monitoring – this could be done with Fish IBI.
- If we wait for a declining trend before acting, there are likely to be fish extinctions. There is a risk that monitoring and associated action plans may take too long to take effect. There is a need for the policy to have “teeth” to ensure that action is taken quickly.
- Severely degraded sites may not show a trend with further degradation and this shows the importance of having a bottom line.
- It is not enough to maintain current state, we need to push for improvement.

There was discussion on including trout and salmon as “honorary natives”:

- One member expressed concern because the Biodiversity NPS refers to indigenous biodiversity, and trout and salmon will have an effect on indigenous species where they have been introduced. There will be issues with defining reference condition if trout and salmonids are given “honorary native” status.
- Trout and salmonids are an indicator of habitat quality – indicators of habitat quality are missing from the NPSFM. The Fish IBI works better as an indicator of land use if trout are included.
- There are pros and cons for each option.
- You could have both tables – one could apply where there are sports fisheries and one where there are not. The risk is that you could improve the Fish IBI by adding trout. It was noted that the Fish IBI that includes trout will not expect trout to be in all locations.
- Including trout in the Fish IBI might mean that you would not manage for habitat types that trout prefer, if the relevant native fish were not present. Large pools are a type of habitat that would be captured by this example.
- There is not much native fish diversity in NZ and including trout and salmonids adds power to the tool.
- The conclusion was that it was useful to include trout and salmonids in the IBI but it was not vital.
- It’s important to consider restoration and make sure there is sufficient knowledge base to restore native fish populations.
- Excluding trout completely from the IBI is also an option. There was support for this option.
- How are councils going to respond to their IBI measurements? Changing land use or connectivity etc?

Outcome:

- There was support for a fish metric, and support for Fish IBI as the best available method.
- There was support for using the Fish IBI as a minimum measure and having a trigger threshold for action.
- There is a remaining question about natural variation in Fish IBI
- There should be a dialogue among fish ecologists on the Fish IBI
- There needs to be quick action to remedy declining fish populations as shown by threat status.

- There was support for excluding trout from the Fish IBI.

| Action | For |
|---|------|
| Circulate biodiversity indicator report | MfE |
| Calculate how many waterbodies would fall below bottom line | Adam |
| Calculate IBI attribute table excluding trout and salmon | Adam |

Lake dissolved oxygen

Marc summarised the paper on lake dissolved oxygen. Two attributes have been put forward: lake hypolimnetic (bottom water) dissolved oxygen (a biogeochemical measure) and lake dissolved oxygen for habitat.

Discussion points on the biogeochemical measure:

- The hypolimnetic dissolved oxygen measurement would ideally be measured by continuous monitoring, but monthly profiles could be used. In shallow polymictic lakes, continuous monitoring is needed to pick up short periods of stratification.
- In shallow lakes, you need to ensure you are measuring closer to the lake bottom than the <1m specified.
- There are at least 90 lakes where councils measure dissolved oxygen already.
- This is the priority for lakes (compared to LakeSPI)
- Some lakes have naturally low dissolved oxygen, more research is required on this. Most lakes falling below the bottom line are 10-50 m deep and have a relatively small hypolimnion. It would be necessary to allow for lakes that deoxygenate under natural conditions.
- A lot of lakes have high TN and TP but meet the chlorophyll *a* objectives. Would adding dissolved oxygen be required? Yes - as this provides for habitat and is related to lake morphometry.
- If you have a minimum measure of oxygen at the bottom you may also be providing for habitat for aquatic species. The anoxic hypolimnion is a separate measure that will build on the Trophic Lake Index (TLI) components by adding a component that is more related to lake morphometry.

Discussion points on the habitat measure:

- Anoxia in the hypolimnion prevents aquatic species from accessing cooler waters which provide a thermal refuge from warm conditions.
- The dissolved oxygen concentrations are related to the physiological thresholds from the river dissolved oxygen attribute.
- The measurement at the lake bottom may also provide for habitat. Both may not be needed, but you could measure both at the same time.

General discussion points:

- Table 4 shows how monitored lakes would compare to the suggested attributes. This sample is biased towards impacted lakes because that's where councils monitor.
- This measure is affected by legacy loads of nutrients due to release from the bottom sediments.
- There will be time lags in restoration due to legacy effects of past nutrient inputs.
- There is a high degree of confidence in these numbers.
- We don't have a good idea about natural variation yet.

- The biogeochemistry measure is the more important of the two.
- This is an urgent issue for management.
- Chlorophyll *a* is the driver of dissolved oxygen, this is mediated by lake morphometry.
- How much information do we have on the comparative internal and external loads of nutrients? We know this for some lakes. This is important information for management.
- Recovery of lakes can take a long time. It's important to consider both the catchment and internal loads of nutrients.
- Having both measures would impose an additional monitoring requirement. Both measures are required to provide protection.
- It was recommended that the narrative for band B in the biogeochemical indicator is changed to "Some risk from bottom DO....."

Outcome:

- The group supports advancing both measures. There is more confidence in the numbers for biogeochemical processes.
- STAG is comfortable with the suggestion to provide provision to opt-out in situations where there is naturally low dissolved oxygen.

| Action | For |
|--|----------------|
| Provide a case study on internal vs. external nutrient loads | Jon Roygard |
| Compare data from lakes against both tables | Lake sub-group |

Lake Submerged Plant Indicators (LakeSPI)

Marc introduced LakeSPI and outlined the work the lakes sub-group has done to develop proposed attribute tables.

Discussion points:

- It was noted that about 38% of lakes would fail the national bottom line proposed in the table. Lakes in a devegetated state would fall below the bottom line but wouldn't have a separate category. However, some lakes would fall below the bottom lines under natural conditions, such as lakes with low pH or lakes at high altitude.
- There is a range of management levers and actions available to improve LakeSPI scores.
- There are two proposed attribute tables, the native condition index and invasive impact index. These two scores can be combined to create the overall LakeSPI score and it would be an option to require Councils to calculate this.

Outcome:

- There is support from the group for the two indices. The science is robust. Both indices are needed.

Macroinvertebrates

Discussion points:

- The options presented are not mutually exclusive. These are different metrics that can be calculated with the same data.
- The narratives of the different metrics are different – Macroinvertebrate Community Index (MCI) measures organic enrichment and Average Score per Metric (ASPM) is a more general measure of community health.

- The group was comfortable with progressing both metrics.
- It is crucial that we have standardised sampling across the country.
- One of the members supports updating the MCI monitoring requirements to align with what is being required for fish. It would be possible to specify what needs to be monitored (e.g. abundance and diversity) and specify that reporting needs to use the metrics of MCI and ASPM.
- Adam's table outlines monitoring requirements to provide a minimum standard for data quality.
- One of the members was not 100% comfortable with bands for ASPM but is comfortable with bottom lines.
- It would be an option to be prescriptive enough about methods to allow to calculate the different metrics.
- There might be a requirement to use the lowest of the scores.
- The group discussed the merits of full counts versus 200 counts – there was support for using full counts but 200 is the absolute minimum
- A bottom line MCI score of 80 is in the current NPSFM and the proposal is to change this is 90.
- There is an option to increase the number of samples each summer to allow better calculation of trends. The 5-year time period is intended to account for variation in abundance.
- Setting the MCI bottom line at 80 is too low as there is little discriminatory ability at this value, i.e. no change in the community with further degradation.
- There is potential for a change in the bottom line from 80 to 90 to have an effect on which sites are included in the action plan requirement. 90 is not a completely degraded state.
- A bottom line of 80 was originally introduced because it aligned with practices at the time.
- Measured MCI at reference sites around the country never falls below 100. Predicted MCI at reference sites never falls below 90.
- There is a linear relationship between MCI and land use – there is not an inflection point upon which to base a bottom line.
- Less than 1% of river reaches fall between 80 and 90.
- 80 was described by Stark (the author of the MCI) as “severely polluted”, is this an appropriate place to set a bottom line?
- This change won't make a big difference in the total number of sites affected, but it will make a difference to the ecology of specific sites.

Outcome:

- The group recommends requiring MCI, Quantitative MCI and ASPM to be calculated. A bottom line would apply for all 3 metrics and councils would need to act on the lowest score.
- ASPM option “B” was supported.
- The group recommends a bottom line of 90 on the basis of having a better level of protection. The group doesn't want the bottom line to be at the level of severe degradation.

Ecosystem metabolism

Discussion points:

- The numbers in the table presented to the group are from Young (2008) and a Waikato Regional Council study for the non-wadeable numbers. One of the members expressed a desire to have ecological processes in the NPSFM but there is a fair amount of work to be done to define management bands.

- Including this metric will signal its value for describing ecosystem health.
- This metric is strongly linked to the recommendation for the dissolved oxygen attribute to apply everywhere.
- Key additional parameters would be average reach depth and temperature. Reaeration is estimated using a calculation. In very shallow and highly aerated systems these will not work, these systems would be exceptions.
- The justification for requiring this is that ecological processes are one of the five core components of ecosystem health and they are not currently measured.
- It would be useful to describe effects in terms of ecosystem health.

Outcome:

- Recommend a monitoring requirement for ecosystem processes based on dissolved oxygen measurements. This would not have a bottom line.

| Action | For |
|---|---------------|
| Revise narrative description of continuum of effects and justification of why this is an important monitoring measure | MfE, Joanne C |

Periphyton

Discussion points:

- At the last meeting it was discussed that an option would be to remove the exceedance criterion and place the onus on councils to demonstrate that a river is in the productive class.
- When the periphyton attribute was developed there was little data available and we now have more data. But it will still likely be difficult to delineate “productive” rivers. (“Productive” was not a good term and it would make more sense to refer to rivers that support high biomass).
- The productive class covers a very small portion of the country (5%).
- There was a discussion about whether point source dischargers would be able to take advantage of the 17% exceedance criteria, or if councils were applying the existing criteria incorrectly.
- There was a discussion about the relative merits and risks of the proposed tables in the Fish and Game NPS compared to the existing attribute in the NPSFM. Adam’s proposal shifts the responsibility to delineate productive classes to the councils.
- The chair noted that this is a policy problem but has potentially serious consequences for ecosystem health.
- It could be an option for MfE to appoint peer reviewers to review objective and limit setting.
- MfE staff asked to clarify if this is a problem of implementation or the science behind the table? How strong is the desire from the group to change the existing table?
- It was suggested that the wording could be tightened.
- MfE staff outlined that there is work progressing to help councils implement the NPSFM. Changing the table might not make a difference if it is an implementation issue.
- When the attribute was developed the advice was that it is possible to reach 200 mg of periphyton (the bottom line) in natural conditions.
- One of the members mentioned the utility of using penetrometers as a supplementary measure to inform periphyton measurements.

Outcome:

- STAG noted the importance of this issue and asked MfE to tighten up the policy wording to assist correct implementation

| Action | For |
|---|---------|
| Circulate map of where exclusions apply | Ton/MfE |

Additional discussion on 8% figure:

- All breaches of periphyton attribute states need to be taken into account. This was discussed in a previous meeting when STAG had presentation on periphyton.
- The rationale was that reference sites have some exceedances.
- It would be informative to analyse the relationship between dissolved oxygen concentrations and instances of exceedances of periphyton biomass objectives.
- It would be useful to examine datasets to see where and how often exceedances occur.
- You could look at reference sites and calculate the actual exceedances of the periphyton bottom lines.

| Action | For |
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| Clive, Mike and Jon will continue the discussion after the meeting | Clive, Mike and Jon |

Prioritising future work

This discussion was deferred due to a lack of time.

3. Nutrients for ecosystem health

Aim: discuss any remaining questions and finalise recommendations

Discussion points:

- Adam presented the recalculated thresholds based on STAG's recommendations in the previous meeting. Adam has taken "Option 1" from the previous meeting and converted the TN numbers to nitrate.
- It was noted that the previous numbers from Russell Death et al. (presented at 26 February meeting) were using a different weighting system and didn't include ecosystem metabolism.
- The numbers would be the same for DIN or nitrate, because ammonia is a very small component of DIN when assessing concentrations at a wide scale.
- Group members asked to see the working showing how and why the numbers have changed. There has been changes to the weighting and ecosystem metabolism process data has been incorporated. The bands have been harmonised.
- One member expressed concern that the narratives suggest relationships where we are not certain that relationships exist. One option would be to add "could" or "possible/probable/potential for", or "there is increased risk of" into the narrative ("increased risk of" preferred). There is a fine line between acknowledging uncertainty and being too vague.
- There was discussion about the strength of the relationships between nutrients and ecosystem health components, and how the numbers relate to the thresholds for toxicity.
- There was discussion about the process leading to development of Option 1 – this approach used percentiles that are weighted equally, which brings the overall values down.

- The impact of DIN and DRP on trophic state is mediated by other things such as flood frequency and solar radiation. The narrative in the proposed table does not line up with this approach because you are suggesting there is a risk of nitrogen enrichment at given concentrations.
- An approach would be to remove periphyton from the calculation so there is no overlap with the current approach for managing periphyton. The ecosystem health numbers would capture the rivers that do not support periphyton, because the most stringent numbers will apply.
- It would be helpful to re-examine the different options presented at the previous meeting as it might make more sense not to incorporate the percentiles into the calculation of the numbers.
- STAG asked Adam to re-run the analysis without the percentiles.

| Action | For |
|---|---------------------|
| Write up analysis behind numbers | Adam |
| Re-run analysis without the percentiles. | Adam |
| Calculate how many rivers would fall below the bottom line (and 95 th percentile) | MfE |
| Re-word narrative talking about effects of eutrophication, rather than eutrophication itself. | Jenny Webster-Brown |
| Clarify groundwater provisions with Chris Daughney | MfE |

4. Maintain or Improve

Aim: finalise recommendations

MfE staff outlined the intended changes to the NPSFM.

Discussion points:

- A 2019/2017 baseline for existing freshwater quality should not allow for water quality to decline back to that level following improvement in the future.
- Current state does not need to explicitly allow for +/- to account for variability. The important variability in this context is climate/natural changes (e.g. cyclical changes). The appropriate place to discuss these is through the broader assessment and reporting (i.e. how pass/fail assessments are put in context and communicated).
- We don't have a complete understanding of the magnitude of this variation for different water quality components. We will develop capability to understand this in the future.
- It was suggested that ecosystem health metrics such as fish and invasive species should be part of the broader assessment.
- STAG members supported re-framing the broader assessment requirements in terms of the ecosystem health framework. Ecosystem health shouldn't be tacked on at the end.
- STAG members are keen to see the proposal for monitoring requirements for councils. They should at a minimum include the attributes and monitoring requirements.
- There is a need to take care with references to water quality in the broader assessment – this is meant to be about a wider range of information (e.g. when mentioning state and trend, pressures on something, predicted changes in something).
- There is a need to workshop other matters that should be measured, such as habitat.

| Action | For |
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This agenda item was deleted at the request of Kahui Wai Māori.

- S 9(2)(f)(iv)

| Action | For |
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| STAG members will provide further comment by email. | |

Removed from agenda due to staff unavailability

8. Additional agenda item – how will STAG report their recommendations?

Discussion points included:

- It's important that the group's recommendations are made public and visible.
- Communicating what the group agreed on is key, along with the thought processes that lead to the conclusions, what the level of uncertainty is, and what the level of agreement is.
- The minutes should form the source material for the report.
- We need a clear and succinct statement of what the group's recommendations are.
- It is also important to outline the scope of the group and any constraints (e.g. not considering economics)
- The report should also include matters that the group considered they didn't have sufficient information on and were unable to discuss.
- It's important to finalise this document before any public consultation.
- This would be a publicly available document.

| Action | For |
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| MfE to scope up what writing the document would involve, table of contents, and come back to group for comment | MfE |