

Agreements on lake ecology generally

1. The Lake under Scenario A has significant ecological and angling values, due to excellent spawning and rearing habitat in the tributaries and high macroinvertebrate production in the Lake.
2. The high macroinvertebrate production is concentrated in a productive band that sunlight can penetrate. This band exists near the perimeter of the lake.
3. The band is most productive overall when the lake is full and stable. This is because the band is larger when the lake is larger and because the amount of shallow habitat is higher at high lake levels. Mr. Dungey puts it “Overall productivity can be expected to be greater at high lake levels because of the extent of broad shallow areas”. Stability means macrophyte beds can establish which significantly increases the production of macroinvertebrates.
4. Drawing the lake down from a stable level where macrophytes have established causes a loss of productivity as the macrophytes and associated macroinvertebrates die from desiccation.
5. When the lake refills for a long enough, there is a temporary bump in overall production as worms and midges take advantage of the regained habitat.
6. The return to full production takes longer as the macrophytes and the associated macroinvertebrates take time to recover.

Agreements on scenarios

7. Predicting the differences between Scenario B and C relies on the Model and on inferences on substrate composition near the consented minimum level. The Model has a number of shortcomings which means relying on it is problematic. Mr. Jack and Mr. Coutinho both agree that conclusions based on the modelling should be considered in the context of some uncertainty.
8. Assuming the Model is correct, there are only small differences ecologically between Scenario B and C in either the Lake or the Teviot River. This is because the lake is almost always empty, which means the take is restricted by the minimum lake level and inflow rather than either of the drawdown rates.
9. The stability of the lake under Scenarios B and C would provide some stability and allow macrophytes to grow, however the overall productivity would be heavily limited by the small size of the Lake and its productive band.

Scenario D

10. The effects on the ecology and trout fishery in the Lake under Scenario D could be anywhere from less than minor if the variation is used seldomly to extreme if the variation is used to its full extent.

Clarifications

11. I would like to quickly address some points from the supplementary evidence and speaking notes:
 - a. Mr. Nicolson's supplementary evidence in paragraph 7 questions my percentages on how often the Lake will be at minimum levels. It appears that Mr. Nicolson and table he refers to in Mr. Jacks evidence is looking at the percentage of time the lake is at -5m whereas I was looking at the time it was at the minimum level of -5.2. I acknowledge an oversight where I should have referenced where I got those percentages in my evidence. The percentages I refer to were sourced from page 5 of the peer review of the Model by Teixeira and Coutinho. I also note that the numbers I used are for the calibration period. While the numbers are different the percentage change between Scenario B and C are similar and I don't expect it will have a material difference on either one of our analyses.
 - b. Ms. Coates speaking notes suggests that I said that trout spawning takes place in the Lake. I did not say this and refer her to paragraphs 17,18 and 50 where I talk about spawning.
 - c. Ms. Coates and I appear to have adopted different definitions of the term "productivity". I have used it to talk about the total productivity of the system, whereas Ms. Coates is using it in terms of productivity relative to Lake size. Parts of my evidence could have been made clearer by using the term "overall productivity" as Mr. Dungey does in his supplementary evidence.
 - d. I disagree with Ms. Coates assessment that the high number of small trout is not indicative of fishery at carrying capacity. The flat distribution in the context of ample spawning and rearing suggests that growth is being limited by the habitat available. This distribution of stunted trout is common throughout South Island fisheries where there is a limit on food production for trout. I also note there is unlikely to be a large "die-off" on a Lake size reduction. In that situation there would be a slow drop off in the condition of trout that will eventually lead to deaths over a long period. This will continue until the numbers are down to the new carrying capacity.
 - e. I also disagree with the statement in Ms. Coates speaking notes that the trout fishery will remain similar to what is currently present. If the increased drawdown is used to its full extent, the trout fishery would be a fraction of its current state (Scenario A).
 - f. Mr. Dungey's supplementary evidence in paragraph infers that I said there would not be an increase in "overall" productivity. In that paragraph I was referring to "net" productivity. In other words, I was suggesting there was not enough evidence to say that the productivity bump from the re-flooding event after the lake level is dropped was larger than what was lost due to the low lake period.