

Fifth meeting of the Hurunui Science Stakeholders Group.

Wednesday 01 February 2017. St Johns Hall. Amberley

Attendees:

- Environment Canterbury: Ian Whitehouse, Ned Norton (consultant technical lead), Adrian Meredith, Kimberley Dynes
- Zone Committee: James McCone, Ben Ensor and Cynthia Roberts
- Ravensdown: Kelly Morris
- Balance: Rebecca Hyde
- Whitewater NZ: Doug Rankin
- Amuri Irrigation (AIC): Alastair Rutherford, Andrew Barton, Peter Brown
- Beef and Lamb NZ: Julia Beijeman, Turi McFarlane
- Federated Farmers: Lionel Hume
- Fish and Game: Scott Pearson
- Sue Ruston
- Hurunui Water Project (HWP): Alex Adams, Christina Robb
- Dairy NZ: Justin Kitto
- Community and Public Health, CDHB: Kirsty McLeod
- Ngai Tahu Properties: Edwin Jansen
- Ngai Tahu Farming: Ashleigh Campbell
- Rural Advocacy Network: Jamie McFadden
- Greg Burrell

Periphyton in relation to nutrients and flows in the Hurunui River

The focus of the meeting was a presentation by Cathy Kilroy (NIWA) on an investigation from January to May 2015 on nutrients and periphyton in the Hurunui River at four sites between the Mandamus confluence and the top of the Hurunui Gorge.

The report on this work and a copy of Cathy's presentation had been circulated to the working group. The following notes should be read in conjunction with the presentation as the notes cover points made by Cathy when talking to her presentation, answers to questions during the presentation and discussion at the end.

The four sites were: Mandamus (at recorder/sampling site); SH7 (upstream of campground); Balmoral (near the bottom of the forest so below Waitohi confluence but above Pahau confluence); Gorge (at the top of the gorge so below Pahau confluence). The Gorge site is considered to reflect what is happening at SH1 as previous studies showed little nutrient input through the gorge.

The locations sampled at the four sites were chosen to be as similar as possible although there was some difference in the size of the material in the river bed (lots of boulders at Mandamus site).

The investigation was carried out from January to May 2015. River flows were at an “unusually low” level. Sampling started after a moderate flood so initial periphyton cover was relatively low. There were three small freshes during the study period.

Measured dissolved N and P concentrations

Dissolved reactive phosphorus (DRP) concentrations measured were very low. DRP concentrations at the Gorge were generally higher than at the other sites.

Dissolved inorganic nitrogen (DIN) concentration increased down river. Cathy described the concentrations measured at Mandamus as “vanishing low”, at SH7 as “low” and at Gorge as “high but not super high.”

Periphyton accrual

Cathy described the experiments looking at periphyton accrual. At the Gorge site, where accrual rates were highest, it took 40 days in the first experiment (January – February) to get to the threshold in the HWRRP, and 35 days in the second experiment (March – April).

Cathy was asked why rates were higher at SH7 site compared with at Balmoral. She said that N concentrations were similar at the sites, however, the Balmoral site seemed to be more unstable – there was more bed movement (flows may be faster and the river may have a higher gradient in this reach).

Some periphyton was removed by the two small freshes (about 50 m³/s) but accumulated quickly after the freshes.

Nutrient limitation results

Cathy described the nutrient limitation experiments. Mandamus and SH 7 sites were generally N and P limited with respect to periphyton growth, Balmoral and Gorge sites were generally P limited, though there was some variation through the study period.

Changes in periphyton from site to site

The sort of periphyton present and the amount of periphyton cover was determined at each site over the study period. The type of periphyton changes down river. Dominant periphyton cover at Mandamus and SH7 was didymo and filamentous green algae; at Balmoral and Gorge it was *Phormidium*.

Sediment-sourced P for Phormidium

Cathy described the study to investigate if sediment trapped by *Phormidium* could be a source of P for *Phormidium* growth. The study showed this is the case. The greatest amount of very fine sediment was trapped at the Gorge site and this sediment also had higher P concentrations than at other sites. Balmoral was the site with the next most amount of P available from trapped sediment.

The sediment-trapping results generated questions and discussion. Cathy was asked whether the very fine sediment that got trapped in the *Phormidium* (at the Gorge site) was coming into the river all the time or whether it was “legacy” sediment (ie. from an event in the past). Cathy noted that in a related experiment they found that SH7 had the greatest amount of sediment trapped in the river

bed compared to that at Balmoral and Gorge sites. Therefore there could be an upstream source for the sediment trapped by *Phormidium* at the Gorge site.

A question was asked whether *Phormidium* could acquire P from the breakup of periphyton. Cathy considered that it probably could, similar to what happens where nutrients are recycled in didymo mats as cells die off.

There was considerable discussion about how to find out whether the sediment was a legacy from the past or a result of current erosion. It was suggested that studies be done immediately below and above tributaries (like the Pahau River). Cathy commented that this would only provide a snapshot in time. Cathy also commented that some of the fine sediment has higher P concentrations than others and where this high-P sediment comes from could be elucidated in a study.

What additional studies are needed?

As noted above, questions were identified, such as where the fine sediment comes from, that could be the basis for further studies. Additional potential further studies are identified in Cathy's report. Cathy said that an experiment looking at what would happen if N increased but P stayed the same would be good to do.

Ned Norton said that the studies suggested in Cathy's report had been included in a research proposal put together by LincolnTech, NIWA and other research agencies. He noted that results from the study (assuming it was funded) would be available in five years and so would not inform the current plan review. In response to a question Cathy said there were no experiments or studies that urgently needed to be done over the next few months, rather researchers would be looking at doing studies or experiments over next summer.

Participants agreed that a discussion of what additional studies were needed should be scheduled for the 29 March meeting, that is, after the briefings on *Phormidium* and on what we know about the current water quality of the river and catchment.

Other discussion points

The question was asked whether the results, indicating differences along the river length, meant the river should be broken into different FMUs (Freshwater Management Units). Cathy was asked whether the differences warranted different FMUs and commented that there will always be differences between sites.

It was stressed that we need to look at what variables we can manage and make a difference to what you see in the river. For example we cannot control naturally-high sediment flushes such as those that come with alpine floods.

It was noted that there seems to have been a change over the last decade or more in what periphyton communities are at different sites on the river. Furthermore, we need to be mindful that if we are managing to influence the current periphyton communities it is possible that we might end up changing the current community, for example if we manage nutrients to reduce *Phormidium* then

perhaps we could end up replacing *Phormidium* by (nuisance) green filamentous algae (as this might be able to out-compete *Phormidium* when the nutrient levels are different).

So what do the results of the study mean?

Four questions from Ken Hughey were tabled. The questions and Cathy's answers to the first of these follow below.

1. What are the main periphyton species that are likely to be of recreational (esp for swimming and for angling) nuisance value in the Hurunui – in different places on the river?

The main species are didymo (SH7 and above) and *Phormidium* (at Balmoral site and below).

2. Related to the above for each of these species is there a management guideline in terms of N, P etc that Cathy would recommend to us that would, beyond natural events, not cause (or at worst minimise) recreational concern/negative impact?

Cathy said that a lot was known about didymo and the management guidelines were clear – it does best under low – moderate N concentrations with very low P concentrations (as at SH7 site during the study period).

Cathy said she was not an expert in *Phormidium* and noted that there did not seem to be clear guidelines yet. She said *Phormidium* seems to be correlated to high N levels and potentially to elevated P concentrations in deposited fine sediment especially where P concentrations in the water column are very low.

3. Re the *Phormidium* issue, is it possible to identify whether the P in the sediment is legacy from the past or ongoing?

As noted above, it is not known if this is “legacy” sediment or not.

Cathy was asked whether the study confirmed that there was a need to manage both N and P in the catchment. She strongly agreed with this.