AUSTRALIAN FRESHWATER SCIENCES SOCIETY
Formerly Australian Society for Limnology, Est 1961

AFSS member update from Tasmania
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Compiled by Tasmania Rep, Bridget White

University of Tasmania

Heavy metals in Central Highlands lakes: Harrison Stevens (PhD Candidate):

The dammed lakes in the Central Highlands of Tasmania are vital for hydroelectric power generation and for irrigation. As dammed lakes, they provide a unique opportunity to study recent anthropogenic impacts because their sedimentation rates are much higher than those in natural lakes. This means we can get a high-resolution look into the past ~200 years since European settlement in Tasmania, and how the geochemistry has changed over time. As part of my project, I investigate metal concentrations, nutrient sources, and 'fire sugars' (a bushfire tracer). Here is an update on the metals side of things.

High concentrations of metals such as As, Cd, Cu, Hg, Pb, and Zn are toxic to aquatic life. The good news is that metal concentrations in these lakes remain below Australian interim sediment quality guidelines, even though they have been slowly increasing since the start of the 20th century. This increase is likely related to increasing organic matter content, rather than any direct, increased input of metals. The largest anthropogenic impact to these systems was damming, which typically led to an increase in organic matter content either directly, by the trapping of particles and nutrients, or indirectly, by stimulating primary production in the lake. This increased organic matter content, in turn, increased the retention of metals, manifesting as an increase to measured metal concentrations. Despite recent concerns of metal contamination in the Tasmanian Wilderness World Heritage Area from distant mining activities in the state's west, there is no strong evidence in this study indicating that lakes in the Central Highlands (a similar distance away) have been impacted by long-distance atmospheric deposition. This is likely related to the decreased rainfall, and thus decreased rates of wet deposition of aerosols in the east of Tasmania, compared to that of the west and in the Tasmanian Wilderness World Heritage Area.

Harrison out collecting samples

New lecturer in Freshwater Animal Ecology: Dr Jia Huan Liew

Dr Jia Huan Liew has recently been appointed as a Freshwater Animal Ecology lecturer at the University of Tasmania. Jia Huan graduated with a PhD from the National University of Singapore, where he characterised the food webs of freshwater communities in reservoirs using stable isotope data. Jia Huan then built on his research into freshwater food webs as a postdoctoral fellow at the same institution, focusing on stream communities from Singapore and neighbouring Malaysia. Upon completing his fellowship, Jia Huan moved to the University of Hong Kong to study the drivers of global trade in threatened freshwater animals by modelling the effects of various socio-economic factors. Jia Huan then joined the Lingnan University of Hong Kong, first as a Research Assistant Professor, and subsequently Assistant Professor. Here, Jia Huan built a small team of research staff and students to investigate the multifaceted consequences of anthropogenic modification of streams and their associated catchments. By employing a wide array of approaches, Jia Huan and his team characterised changes in the diets, movement, and overall assemblages of freshwater animals in response to human impacts. Jia Huan hopes to continue quantifying the effects of anthropogenic influences on freshwater ecosystems, with the aim of conserving threatened species and their ecological roles within the broader environment.

Flow change impacts on macroinvertebrate communities: Bridget White (PhD Candidate):

Bridget has been collecting data about how flow changes impact macroinvertebrate communities in natural and agricultural settings. She has spent the summer building temporary weirs in streams, and collected data before, during and after the construction in order to understand the impact of flow changes on macroinvertebrate communities, and the amount of time it takes for the macroinvertebrate communities to recover. Alongside this, she also collected information on algae growth and leaf and cotton decomposition to learn how some ecosystem functions are impacted by flow changes and hopes to link these to the changes in the macroinvertebrate community.

Gee Creek with a temporary weir to alter stream flow

Bridget at the microscope

Conservation genetics of Galaxiid fishes: Charlotte Jense (PhD candidate)

My PhD research focuses on conservation genetics of two Tasmanian endemic galaxiid fishes: the Clarence galaxias (*Galaxias johnstoni*) and the Swan galaxias (*Galaxias fontanus*). Both species are restricted in range and are under threat from the invasive brown trout (*Salmo trutta)*. Supported by Bioplatform Australia's Threatened Species Initiative (TSI), we have conducted genomic studies to understand intraspecific genetic diversity of these two species. The populations we have sampled from the Clarence galaxias have shown to be genetically distinct, prompting us to investigate whether the introduction of trout influenced this current population structure. More specifically for the Swan galaxias, we have collaborated with NRM south and developed an environmental DNA (eDNA) assay for detecting Swan galaxias to assist translocations. I am also conducting a case study to look at the potential of eDNA to obtain population genetic information. To achieve this, we have employed two different methods: a targeted approach and a metagenomic approach. The targeted approach focuses on analysing specific DNA fragments with known variants, while the metagenomic approach involves a broad range of DNA fragments, allowing the analysis of variants across the entire genome. Preliminary data analysis has demonstrated the efficiency of these approaches, highlighting the promise of eDNA as a non-invasive sampling technique for population genetic applications.

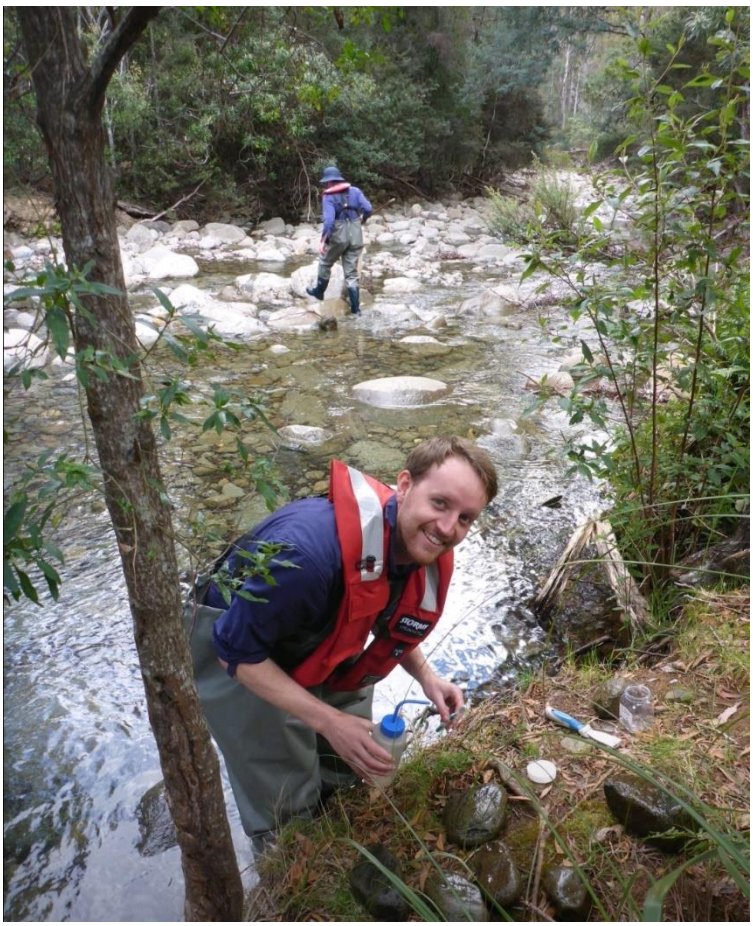
Collecting Clarence galaxias (Galaxias johnstoni) in a Tasmanian central highland lake (Chris Burridge and Charlotte Jense pictured)

Department of Natural Resources and Environment Tasmania (NRE Tas)

Science supporting water management

The Water Management Assessment Branch of NRE Tas has been actively monitoring the condition of our State's rivers through our River Health Monitoring Program (RHMP) since 1994. This program is a comprehensive, long-term initiative focused on monitoring the health of freshwater ecosystems and understanding the impact of landscape-scale pressures and diffuse pollution on Tasmania's rivers. The program's findings are used for various purposes, including assessing river conditions at different scales, evaluating water development projects, and reporting on the state of the environment.

Our program uses the AusRivAS protocols, concentrating on studying waterbug communities and habitat quality, and more recently the inclusion of monitoring sediment and algae assessments on riverbeds.



During autumn and spring 2023, the team, Scott Hardie, Kyle Weatherman, Adam Uytendaal and Matt Sinclair, assessed river health at 47 long-term monitoring sites. Encouragingly, the results from the autumn sampling revealed that many sites showed stability or slight improvements in the health of the rivers. These positive changes are likely due to increased flows in the rivers in Tasmania over the past three wet years (La Niña years).

Our Rural Water Use Strategy, released in 2021, uses a science-based and long-term approach to managing our State's freshwater resources, and includes several activities to enhance our knowledge of our surface water and groundwater systems. The ecohydrology team is undertaking targeted case-study research in four catchments (Pipers River, Mountain River, upper Ringarooma River and the River Leven) to unpack and understand what the drivers of changes are that we are seeing in river health and water quality in some of our catchments. Kirsten Adams and Bryce Graham have been working with CSIRO and BoM experts to deliver a project to understand how we best incorporate new climate projection data into our surface water models that estimate catchment yields, and Rebecca Sheldon, Miladin Latinovic and Adam Uytendaal have developed a new Groundwater Risk Assessment Tool with the help from Glenn Harrington from Innovative Groundwater Solutions which will guide how we manage Tasmania's groundwater resources into the future.

The 2023 Rural Water Use Strategy Progress Report has recently been released on the NRE Tas website (https://nre.tas.gov.au/water/water-legislation-policies-and-strategies/rural-water-use-strategy) and provides an overview of the achievements made over the last 12 months in implementing the Strategy.

Winston Churchill Fellowship – Dr Scott Hardie

Congratulations to one of NRE Tas' aquatic ecologists, Dr Scott Hardie, who has recently been awarded a 2023 Churchill Fellowship. Scott is one of eight Tasmanians who will travel in the next 12 months to exchange knowledge and pursue their passion. Scott is really excited about this unique opportunity to meet with scientists and waterway managers in NZ, USA and Canada to explore approaches to monitoring, disentangling and managing impacts on inland waterways.

Scott is a freshwater scientist with over 20 years' experience studying the diverse freshwater ecosystems of Tasmania, and during his career has focused on freshwater fish ecology and conservation, the effects of water level fluctuations on lake ecosystems, environmental flows, and relationships between activities in catchments and river health.

Scott will no doubt bring back a great range of knowledge and learnings from this experience which he can further share with us and the broader community to enhance the management of waterways in Tasmania and Australia.

University of Strathclyde

<u>Impacts of invasive willows on macroinvertebrates in the Tyenna river: Tom Williams</u>

Tom is a Masters student from the University of Strathclyde, who is completing his environmental engineering Master's project in Tasmania. Tom is interested in studying the effects of willow growth on macroinvertebrates in the Tyenna river, comparing sites with no willows to sites which still have high densities of willows. Tom has been out in the field at the end of November, collecting macroinvertebrate samples from 6 sites, which he is now busy picking and identifying.

Tom collecting macroinvertebrates from the Tyenna

Derwent Estuary Program

Using novel in-situ nutrient analyser technology to revolutionise river water quality monitoring- Bernadette Proemse

Derwent Estuary Program Catchment Scientist Dr Bernadette Proemse with one of the Eco Detection real-time water quality analysers. (photo credit: Justine Latton)

In 2021, the Derwent Estuary Program was successful in securing a grant from The Ian Potter Foundation and funding from stakeholders to kick off a three-year trial of in-situ real-time water quality analysers in the River Derwent catchment. From May 2022, seven Eco Detection analysers have been operating in the River Derwent, its tributaries, and industry outfall sites, to test the benefits and limitations of this new technology. River sites include River Derwent below Meadowbank dam, Tyenna, Clyde, Ouse and Florentine rivers.

The analysers use capillary electrophoresis based technology developed by Prof. M. Breadmore's team at the University of Tasmania and is now being commercialised by Melbourne-based company Eco Detection. The units can measure nitrate, nitrate, phosphate, sulfate, chloride and ammonium simultaneously, up to every 40 minutes, with data being streamed from the field to the Cloud for remote data access from anywhere.

To validate the data generated by the Eco Detection units, traditional grab samples were collected as part of a 12-months assessment with nutrients analysed at Analytical Services Tasmania, demonstrating excellent agreement between field and lab analyses. The high frequency data will help us gain new insights into daily nutrient variability, rainfall-runoff dynamics, and pollution events, which is not possible with traditional monthly monitoring programs. For more information visit www.derwentestuary.org.au and www.ecodetection.com.