

AFSS member update from Western Australia February 2024

Compiled by WA Rep, Adrian Pinder

Department of Biodiversity, Conservation and Attractions (DBCA)

Collaborative research and monitoring of Ramsar wetlands in Western Australia

Wetlands listed under the Ramsar convention are a priority for management in Western Australia and significant research and monitoring is undertaken to inform management actions. Dr Michael Venarsky leads a DBCA Ramsar research and monitoring program, including collaborations between DBCA, universities, natural resource management groups and Department of Water and Environmental Regulation (DWER).

- In the Peel Yalgorup wetlands, Michael is undertaking baseline surveys of aquatic invertebrate communities with DBCA's Adrian Barrett and Kirsty Quinlan; a study of the effect of terrestrial ground cover spread on shorebird populations at Lake McLarty with DBCA's Dr Michael Craig; a study of the role of shallow groundwater in supporting a thrombolite threatened ecological community, undertaken in collaboration with DBCA's research hydrologist Dr Gavan McGrath, Carey Johnson (DWER), and Dr James McCallum and Prof. Greg Skrzypek (University of Western Australia); and development of drone-based methods for monitoring vegetation structure (with DBCA's Bart Huntley).
- Adrian Pinder (DBCA) is analysing aquatic fauna and water quality data from a 2021/22 fill event of Lake Toolibin. Waterbird composition has been relatively stable since the mid-1990s, but is quite different to that present before declining rainfall saw this freshwater wetland fill less reliably. Inflows to the lake are now managed to divert more saline flows and a system of pumps are used to manage the shallow groundwater table to reduce impact on the lake-bed trees. Some elements of the invertebrate community are depauperate, perhaps reflecting reduced egg bank viability, low dissolved oxygen, and few freshwater sources of colonisation nearby. New hydrological models have been completed by DBCA's Dr Jasmine Rutherford and consultant Dr Neil Milligan, and geophysical and hydrogeochemical research has been carried out by Jasmine and Dr Dioni Cendon (ANSTO). This research will assist with aspects of the lake's management, such as revegetation and understanding implications of surface water management on subsurface salt stores.



DBCA's Jessica Striano sampling zooplankton in Lake Toolibin.

Rutherford J (2020). Hydrological Conceptualisation of Toolibin Lake and Catchment. Department of Biodiversity, Conservation and Attractions, Perth.

- Regular surveys of waterbirds using the Lake Warden system are undertaken by DBCA, supported by South Coast NRM with National Landcare Program funding. Summer counts are timed to coincide with Birdlife Australia's Shorebird Monitoring Program. The system's waterbird fauna is showing shifts in community composition, partly associated with changing lake depths and rainfall. Depths in parts of the system are regulated to increase shorebird habitat and preliminary studies have recently been undertaken (funded by Shire of Esperance) into the potential benefits of restoring hydrological connectivity between key wetlands. Michael Venarsky has also commenced surveying fish populations in some of these wetlands.

Pinder A, Venarsky M, Felton F, Barrett A, Cale D, Barrat, P and Bucktin, H (2023), *Waterbird usage of Lake Warden and Lake Gore Ramsar sites from 2006 to 2023*, Department of Biodiversity, Conservation and Attractions, Perth.



DBCA's Heidi Bucktin counting Cape Barren Geese on Pink Lake (left). Red-necked avocets on Lake Warden (right).

- Regular surveys of waterbirds using the Lake Gore system are undertaken by DBCA, supported by South Coast NRM with National Landcare Program funding. Summer counts are timed to coincide with Birdlife Australia's Shorebird Monitoring Program.
- Surveys of waterbirds using the Muir-Byenup system are undertaken by DBCA's Ian Wheeler, supported by South West Natural Resource Management (SWNRM) through National Landcare Program grants. Michael Venarsky has been undertaking surveys of fish, water quality and invertebrates in these wetlands, with Kirsty Quinlan (DBCA) undertaking identifications of the latter. Jasmine Rutherford (DBCA) is undertaking research into the hydrogeochemical processes underlying severe acidification in some of these wetlands with, declining rainfall and wetland drying exposing acid sulfate soils. This work is also supported by NLP funding through SWNRM. As part of this project, Jasmine collected peat samples for a global study of peat microbiomes and chemistry led by Michigan Technological University with a US National Science Foundation grant.

Rutherford J (2021) Petrophysics of peat in the Muir-Byenup wetlands – why they dry, generate acid, and burn: Part 2 – focus on Tordit-Gurruup Lagoon. Department of Biodiversity, Conservation and Attractions. Perth. 69pp.

Watmough et al. (2023). Variation in carbon and nitrogen concentrations among peatland categories at the global scale. Plos One, 17(11): e0275149. doi.org/10.1371/journal.pone.0275149.

Verbeck et al. (2022). Latitude, elevation, and mean annual temperature predict peat organic matter chemistry at a global scale. *Global Biogeochemical Cycles*. <https://doi.org/10.1029/2021GB007057>

- The coastal parts of the Eighty Mile Beach Ramsar site are surveyed annually for migratory shorebirds by Birdlife WA with support from DBCA. The inland part of this Ramsar site in the Great Sandy Desert includes a large saline playa, fed by a mangrove lined permanent saline creek, with organic mound springs along its southern shore. With groundwater in the region being allocated to agriculture and the resources industry there is a need to better understand the groundwater systems that sustain the springs. Jasmine Rutherford is leading multidisciplinary research to better understand how groundwater sustains these springs. DBCA's Adrienne Markey is completing a vegetation map of the area.

Rutherford J, Ibrahim T, Munday T, Markey A, Viezzoli A, Rapiti A, Paterson R (2021) An Assessment of Water Sources for Heritage Listed Organic Mound Springs in NW Australia Using Airborne Geophysical (Electromagnetics and Magnetics) and Satellite Remote Sensing Methods. *Remote Sensing* 13. doi.org/10.3390/rs13071288.

- DBCA staff Mike Venarsky, Adrian Pinder and Dave Chemello recently installed depth logging equipment to better understand the role of Parry Creek as a source of water for Parry Lagoons, a major floodplain habitat in the Floodplains of the Lower Ord River Ramsar site. Floodwaters from the Ord River would once have been the dominant source of water for these wetlands but with river regulation for irrigated agriculture, understanding the roles of other catchments is important. Water samples were collected for analysis of agricultural chemical residues and waterbird surveys of Marlgu Billabong (the only permanently inundated part of Parry Lagoon) and Lake Kununurra were undertaken.

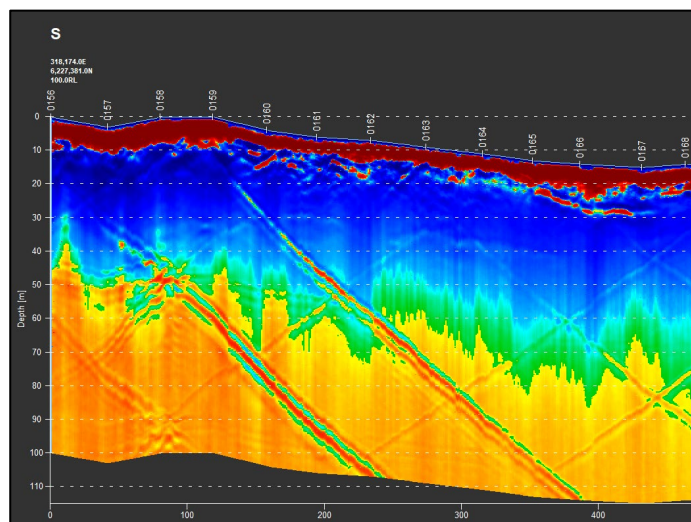


DBCA's David Chemello (East Kimberley District) and Michael Venarsky surveying waterbirds on Lake Kununurra (left), Mike with a pressure transducer to be installed in a dry creek bed (right)

Leeuwin-Naturaliste cave ecohydrology

Dr Gavan McGrath and Dr Michael Venarsky (DBCA), Dr Mattia Sacco (Curtin University)

Threatened ecological communities in Leeuwin-Naturaliste caves are affected by declining groundwater, with some aquatic habitats having all but dried in recent decades. Gavan and Mike have used geophysics (Deep Ground Penetrating RADAR) and, with Mattia Sacco (Curtin University), eDNA, to investigate the sources of groundwater and dissolved organic matter supporting communities in some of the caves. Gavan and Mike are now extending this work by establishing a monitoring program to understand changes in cave water tables and water chemistry, as well as forest tree water use through leaf area change. This work was initiated following a severe fire in summer 2021 that burned 5000 ha of the Boranup Forest surrounding Mammoth, Lake and Calgardup caves, which, combined with high rainfall, appears to have significantly increased groundwater recharge to the caves. eDNA samples are being collected for later investigation of the occurrence of threatened invertebrates.



Vertical section from Deep Ground Penetrating Radar along a transect on the Leeuwin-Naturaliste Ridge. The colour scheme corresponds to the following: Caves/karst – Red. Weathered Material – Blue. Granite Interface – Green/Orange. The diagonal lines at angles of 45° are due to occasional poor contact.

Responses of aquatic invertebrate communities in Pilbara river pools to invasive redclaw crayfish

Adrian Pinder, Adrian Barrett, Kirsty Quinlan, David Cale (DBCA), Chris Bird (Department of Primary Industries and Regional Development) and Adam Harman (Stantec, now Lateral Environmental).

Redclaw crayfish (*Cherax quadricarinatus*) has become established throughout much of the Pilbara region of north-western Australia, following initial introduction to a water supply reservoir and then human-mediated spread to other catchments. Initial work by DBCA and Wetland Research and Management (now part of SLR Consulting) suggested significant impacts of the species on zooplankton and elements of the benthic fauna. A collaboration between DBCA, WA's Department of Primary Industries and Regional Development (DPIRD) and Stantec (led by Adam Harman, now Lateral Environmental) has further investigated the potential impacts by resurveying wetlands for which we have pre-redclaw invertebrate community data and which now either had redclaw or that remained free of redclaw. Samples are being processed by Kirsty Quinlan and David Cale from DBCA, Russell Shiel (RJ Shiel and Associates, Adelaide), and Stantec. Samples for zooplankton metabarcoding have been processed by Dr Josephine Hyde (DBCA, now Biologic) and DBCA's Dr Laurence Dugal and dna sequenced.



DBCA's Adrian Barrett sampling zooplankton (left) and DPIRD's Chris Bird sampling redclaw in the same pool (right)

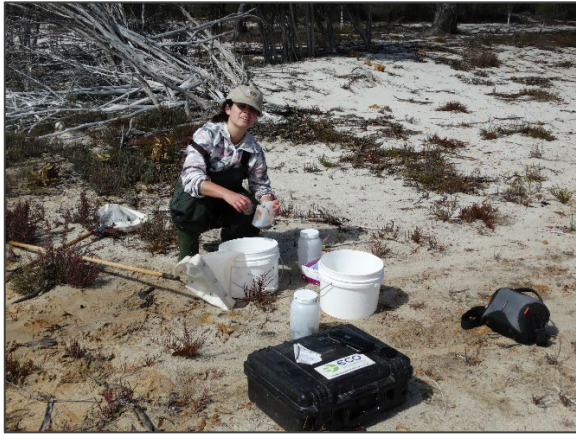
Pinder A, Harman A, Bird C, Quinlan K, Angel F, Cowan M, Lewis L, Thillainath E (2019) Spread of the invasive redclaw crayfish *Cherax quadricarinatus* (von Martens, 1868) into natural waters of the Pilbara region of Western Australia, with observations on potential adverse ecological effects. *Bioinvasions Records* **84**: 882-897.

Responses of Wheatbelt wetland invertebrate communities to changing rainfall

David Cale, Adrian Pinder and Karin Strehlow (DBCA), Dr Belinda Robson, Dr Jane Chambers and Sean Atkinson (Murdoch University) and Dr Stuart Halse (Bennelongia Pty Ltd).

A program of monitoring fauna and vegetation in 25 wetlands of the south-western Australian Wheatbelt ran from 1996 to 2012, led by David Cale and Michael Lyons. This project was driven by a need to understand the ongoing impacts of dryland salinity, but over this period there was a significant decline in rainfall with consequent changes to wetland hydrology and water quality. Analyses of this data by Sean Atkinson (Murdoch University), revealed significant declines in invertebrate alpha and gamma diversity (but not beta diversity) over the study period. Above average rains across the Wheatbelt in 2021 provided an opportunity to examine the capacity for invertebrate diversity to recover in a wet year. Summer scholarship student Dylan Macgregor (Murdoch University) is examining patterns in the cyclopoid copepod data.

Atkinson ST, Cale D, Pinder A, Chambers JM, Halse S.A, Robson B J (2021). Substantial long-term loss of alpha and gamma diversity of lake invertebrates in a landscape exposed to a drying climate. *Global Change Biology*.



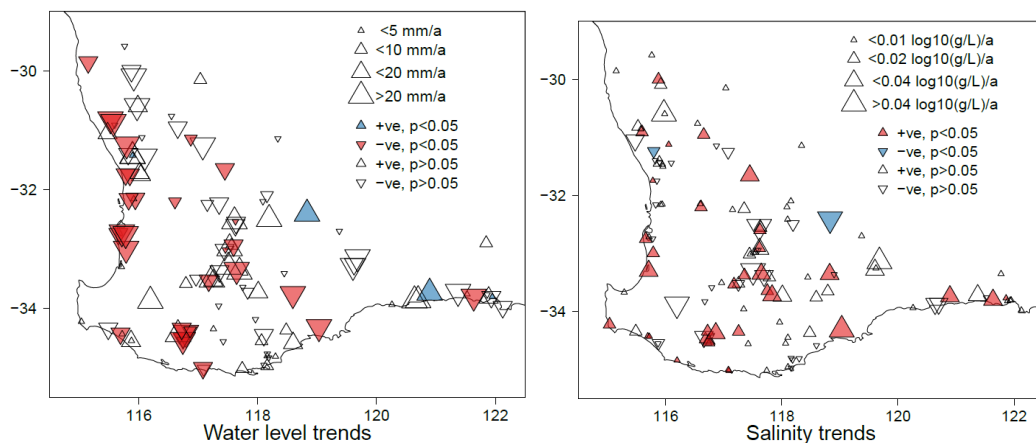
DBCA's Jessica Striano preserving invertebrate samples at Bennett's Lake near the town of Lake King (left). Lake Pleasant View, a high value wetland supporting Australasian bittern and rare and restricted invertebrates (right).

Review of 45 years of Southwest Wetland Salinity Changes

Dr Gavan McGrath

Gavan recently reviewed and analysed historical data collected as part of the South West Wetland Monitoring Program (SWWMP). The study developed methods to classify water level and salinity covariation in the 152 lakes in the SWWMP study. It identified that salinity is increasing in 80% of the lakes with secondary salinization having been responsible for half of that change and climate drying alone the other half. A few lakes near urban centres showed freshening largely due to intervention activities. From this work a collaboration with DBCA's Mike Venarsky and Adrian Barrett and Prof. John Tibby (University of Adelaide) has commenced to develop paleo-hydrology and paleo-fire records in several RAMSAR lakes utilizing the long-term data available through the SWWMP study.

McGrath G. (2023) Long-term salinity changes in the wetlands and lakes of southwest Australia. Department of Biodiversity, Conservation and Attractions. Perth. 172pp.

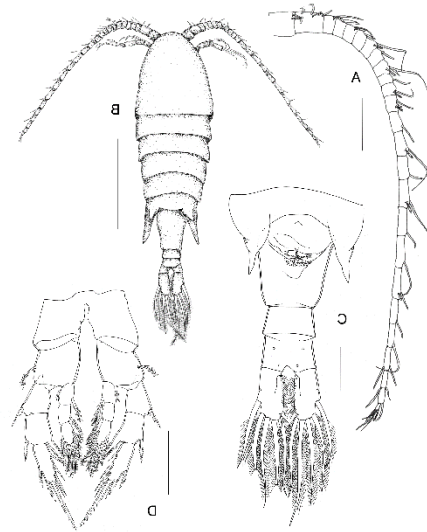


Spatial distribution of September water levels (left) and salinities (right). Coloured symbols are statistically significant trends (p<0.05).

Wetland Biological Survey

Adrienne Markey, Kirsty Quinlan, David Cale, Adrian Barrett, Adrian Pinder, Michael Lyons

DBCA has a long history of surveying biological diversity at differing scales for a variety of purposes. In the wetland space, recent surveys include Kurriji Pa Yajula in the Great Sandy Desert in 2022 undertaken by Adrian Barrett with regional staff, including Marine Ranger Nathan Hunter and Karajarri Traditional Owners. Adrienne Markey, Adrian Barrett, Nicole Godfrey and Annika Spiridis undertook a rapid survey of the flora of putative monsoon rainforest patches in the Wunaamin Ranges in the Kimberley, to assist with identifying such patches from aerial surveys and remote sensing. Kirsty Quinlan has recently analysed data from opportunistic sampling of wetlands in the Goldfields Region in 2014 and 2017, revealing several new species, including a new copepod (right) and new conchostracans.



Boeckella pilkillili Quinlan and Bayly 2017

Vegetated clay-based wetlands of south-western Australia support distinctive flora and fauna communities, with numerous species restricted to such habitats and some new and undescribed species. David Cale has been surveying aquatic invertebrates in this type of wetland in the Wandoo woodlands east of Perth to better understand their values, conservation status and how communities vary between wetlands. This is part of an ongoing effort to document aquatic invertebrate diversity in this type of wetland in south-western Australia. Other surveys are planned in semi-arid zones pending suitable rains.

Barrett A, Pinder A (2023). *Aquatic invertebrate survey of Kurriji Pa Yajula and adjacent soaks on Karajarri Indigenous Protected Area, Great Sandy Desert, September 2022*, Department of Biodiversity, Conservation and Attractions, Perth.

Cale DJ (2020) *Little Darkin Swamp Aquatic Invertebrate Survey*. Department of Biodiversity, Conservation and Attractions, Perth.

Cale DJ (2023) *Julimar Claypan Aquatic Invertebrate Survey*. Department of Biodiversity, Conservation and Attractions, Perth.

Quinlan K, Jackson J, Pinder A, Shiel R (2023) A survey of wetlands across the Goldfields region from 2014 to 2017. Department of Biodiversity, Conservation and Attractions. Perth.



Julimar wetland



Detecting cane toads with eDNA

Josephine Hyde, Laurence Dugal, Renee Evans

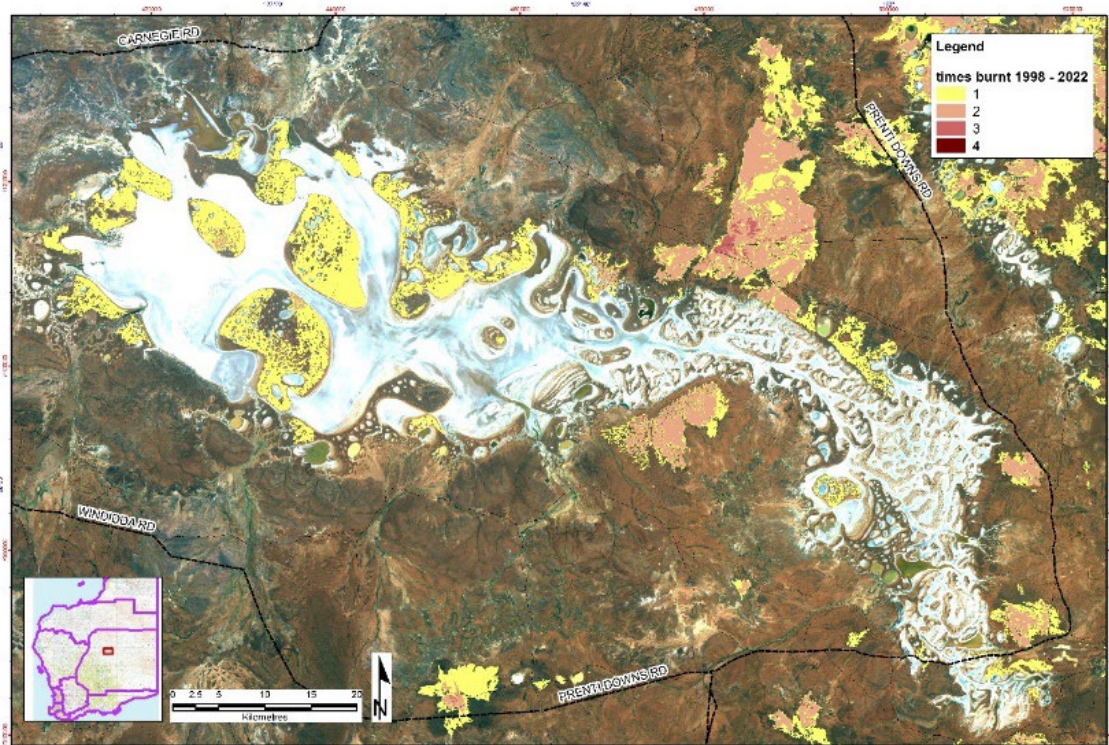
DBCA's eDNA lab have developed equipment (3D printed pumps) and protocols for collecting and filtering water samples at the cane toad invasion front, by DBCA staff, industry partners and Aboriginal Ranger groups. These are sent to Perth and processed in our lab using a qPCR protocol.

McAllister S (2023) Toad tracking technology. *Landscape* **39**: 24-27.

Lake Carnegie Nature Reserve and surrounding area fire history

Jane Chapman (DBCA)

This fine scale 24 year fire history dataset is one outcome of a jointly funded project between DBCA and Tarlka Matuwa Piarku Aboriginal Corporation (TMPAC). This dataset filled a knowledge gap in fire history over the Lake Carnegie Nature Reserve and surrounding area so that an appropriate fire management plan can be implemented. Lake Carnegie Nature Reserve is a complex area of salt lakes, islands and peninsular dominated by low flammability, salt tolerant samphire communities, low woodland, and some hummock grassland as identified in Beard's vegetation mapping. Previously the only fire mapping available was derived from course 250 metre resolution Moderate Resolution Imaging Spectroradiometer (MODIS) imagery from the Terra satellite. Using this data it was not possible to identify small burns in this complex landscape. The fire mapping for this project was undertaken using Landsat satellites 5, 7, 8 and 9 imagery, which has 30 metre resolution. The dataset which was produced is a 24 year fire history from 1998 – 2022. Vegetation mapping of the area indicated samphire communities dominated the lake fringes and islands, so it was surprising to find that a significant portion had been burnt at least once during the 24 year time period.



Landsat 9 satellite image of Lake Carnegie from February 2022 overlaid with the fire history, showing the number of times burnt between 1998 - 2022.

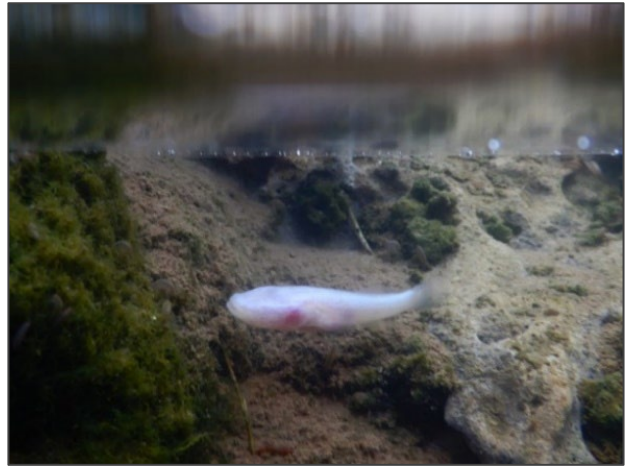
Department of Primary Industries and Regional Development (DPIRD)

Protecting Cave Fish

Chris Bird (DPIRD) and Chantelle Coote (DBCA)

Several years ago the Department of Primary Industries and Regional Development and Department of Biodiversity, Conservation and Attractions implemented a program to eradicate highly invasive guppies (*Poecilia reticulata*) from the NW Cape (Exmouth). Guppies had been released into Dozer Cave, part of the Capes Karst system. Initial survey work indicated they were confined to the one cave, however, they were subsequently spread (via human assisted dispersal) to a nearby surface pool system.

The karst system is home to unique fauna such as the blind cave gudgeon (*Mileringa veritas*). A survey in July confirmed a successful guppy eradication in Dozer Cave (which has now been guppy free for over 4 years), without negatively impacting native fauna in the attached gnamma hole. The efforts to eradicate guppies from the surface pools are yet to be successful. In between eradication attempts of the surface pools a new guppy colour morph and sailfin mollies (*Poecilia latipinna*) have been introduced, indicating more public education to not release aquarium fish is required. The latest sampling indicates the last eradication attempt appears to have at least eradicated the sailfin mollies.



Blind Cave Gudgeon (left), rotenone treatment of small Quailing Pool (right)

Murdoch University - Harry Butler Institute

Freshwater Macroinvertebrates of the Swan Coastal Plain Wetlands and Surrounding Hills

Dr Holly Emery-Butcher, Dr Edwin Chester, Dr Belinda Robson

As the climate dries in Southwest Western Australia, the primary source of permanent water in the landscape is perennial dams which have the potential to act as biodiversity refuges. Over 100 sites (including dams and reserves) are being surveyed in a multiyear/season project, with data including water quality, frog calls, bird observations and macroinvertebrate species richness/diversity being collected. Some sites have also been selected for experimental *Gambusia* trapping and inclusion of woody debris to increase habitat complexity and biodiversity. This research is funded by State NRM, Murdoch University and industry partners (DBCA, Perth NRM) and involves many volunteer landholders

Freshwater invertebrate outreach

Dr Holly Emery-Butcher

Within the metropolitan area of Perth, Holly is also working with The Cockburn Wetlands Centre and the Harry Butler Institute to establish education programs for primary and secondary students about freshwater macroinvertebrates and the wetlands they inhabit. Hopefully this will eventually extend into revised management plans for the Beelii Regional Park wetland chain, which have not had an updated management plan since 2006.

Effects of interaction between small and large-scale disturbances on stream biodiversity and ecosystem function

Sean Atkinson (Graduate Researcher)

Sean is working on a research project funded by an ARC Discovery Grant to Leon Barmuta (University of Tasmania) and Belinda Robson (Murdoch University) investigating how the distribution of flow related invertebrate traits are impacted by short-term disturbances, and how those impacts are mediated by agricultural land clearing in stream catchments.

This was achieved by constructing temporary weirs in southwestern Australian streams where there was more than or less than 30% clearing (a clearing threshold seen in other studies on invertebrate communities). The purpose of these temporary weirs was to manipulate flow for three weeks. On the inside, flow is reduced, while on the outside, the diverted water increases flow. Environmental variables were collected so that stream conditions in each level of clearing could be delineated. Leaf packs and cotton strips were installed and FPOM was quantified to measure organic matter processing. Algal counts were taken by scraping algae off artificial substrates to measure primary production. Invertebrate traits were assigned a priori and using local information. The study is being done in conjunction with the University of Tasmania (Leon Barmuta, Bridget White), to allow for comparisons between different biomes. Analysis is complete and thesis submission is fast approaching, so Sean is looking forward to presenting the results of these experiments at the next AFSS Conference.



Barriers controlling flow in Sean's experimental streams

Saving Our Snake-Necked Turtle (SOSNT)

Dr Anthony Santoro, Dr Jane Chambers, Dr Catherine Baudains and A/Prof. Stephen Beatty

The southwestern snake-necked turtle (*Chelodina oblonga*) is under threat from several anthropogenic pressures, including urbanisation, introduced predators, and climate change. A major issue is failing recruitment due to female turtles being killed during nesting movements and their nests being destroyed. To combat this, SOSNT partnered with 20 local councils throughout the southwest to educate and train their community in turtle conservation, including monitoring nesting females and protecting their nests. Approximately 450 community members became 'Turtle Trackers' and ~4500 volunteer hours were logged between mid-September and mid-December 2023. This resulted in over 1500 turtle observations and ~650 nests being protected. Turtle population surveys occurred at 39 wetlands, providing baseline data and allowing monitoring of the effects of the citizen science into the future. The combined data from the citizen science and population surveys is being used to create a management plan for the species.

New southwestern snake-necked turtle PhD projects

April Sturm and Kiera Gordon (Graduate Researchers)

Following their Honours research, April and Kiera have started PhD's. April's research is focused on the early-life history of the southwestern snake-necked turtle. In particular, optimising artificial incubation and assessing the potential effects of climate change on in-situ incubation. She is also assessing hatchling habitat use and the efficacy of head-starting for the species. Kiera's research is focused on the effects of aquatic infrastructure (such as dams) on the species' activity and fine-scale behavioural patterns. Biologgers and VHF radio-telemetry will be used to monitor activity, movements, and habitat use in rivers with and without aquatic infrastructure. She will assess the influence of temperature, salinity and other environmental factors on turtle behaviour. Both projects will provide information essential to the species' conservation. The supervisory team for April and Kiera include Dr Anthony Santoro, Dr Jane Chambers, Dr Karissa Lear, and Dr Stephen Beatty.

Assessing the value of artificial refuges (firefighting water points) for biodiversity conservation in bushland areas of southern Australia

A/Prof. Stephen Beatty, Prof. Alan Lybery, Prof. Trish Flemming, A/Prof. David Morgan, Dr Mark Allen, Dr Belinda Robson, Dr Rachel Standish, Dr Joe Fontaine, Dr Rochelle Steven (Murdoch University/Harry Butler Institute), Dr Ty Matthews (Deakin University), and Dr Paul Close and Dr Barbara Cook (UWA)

This project aims to assist the globally unique biodiversity of southern Australia to cope with the growing impacts of climate change. We are investigating the role of artificial aquatic refuges, specifically those created to provide reliable and accessible water for firefighting, in mitigating these impacts. Thousands of water points have been constructed in bushland areas across Australia and over many years of sampling, our research team discovered that many contain thriving populations of fish and macroinvertebrates, including threatened species. A comprehensive survey of the habitat, water quality, and biodiversity at over 130 water points will be conducted in 2024, focusing on the Warren Bioregion of southwestern Australia in Noongar Boodjar, a global hotspot of species endemism. The key habitat characteristics of water points that support the highest levels of biodiversity will be determined and this information will be used to develop



Fire water points such as this example in the Kent River catchment of south-western Australia, provide a reliable and accessible supply of water for fire management as well vital refuge habitat for native biodiversity.

a framework for land managers to optimise the construction and operation of new fire water points. The ultimate aim is to increase the amount of permanent surface water in the southern Australian landscape to help mitigate the growing threat of bushfires and provide additional climate refugia for native biodiversity. This three-year project, funded by The Ian Potter Foundation, is a collaboration between scientists from Murdoch University, The University of Western Australia, and Deakin University, in partnership with the Western Australian Department of Biodiversity, Conservation and Attractions, Department of Primary Industries and Regional Development, Department of Water and Environmental Regulation, Department of Fire and Emergency Services, Traditional Custodian groups, and citizen scientists.

Brine shrimps in Australian salt lakes: Native *Parartemia* and exotic *Artemia*

Aminul Islam (Graduate Researcher)

Australia boasts numerous salt lakes rich in diverse and mostly endemic biota, with invertebrates dominating these ecosystems. Among them, the brine shrimp *Parartemia* stands out as one of the most speciose genera, found exclusively in these lakes. Additionally, the exotic brine shrimp *Artemia* is known to occur in some salt lakes and coastal saltworks. Aminul Islam is currently pursuing his PhD at Murdoch University under the supervision of Dr. Jennifer Chaplin and Dr. Peter Spencer from the university and Adrian Pinder from DBCA. His project focuses on expanding our understanding of both native *Parartemia* and exotic *Artemia*, with three main objectives. Firstly, using DNA to elucidate the species relationships within *Parartemia* and to examine the validity of currently known 18 *Parartemia* morphospecies. Secondly, utilizing DNA to explore the evolutionary history and phylogeography of *Parartemia*. Lastly, providing an up-to-date distribution of *Artemia* occurrence in Australia and using DNA to investigate the species identity, origins and spread of *Artemia* in Australian salt lakes. His findings are anticipated to expand our knowledge and contribute to the development of evidence-based management planning for the conservation of native *Parartemia*.



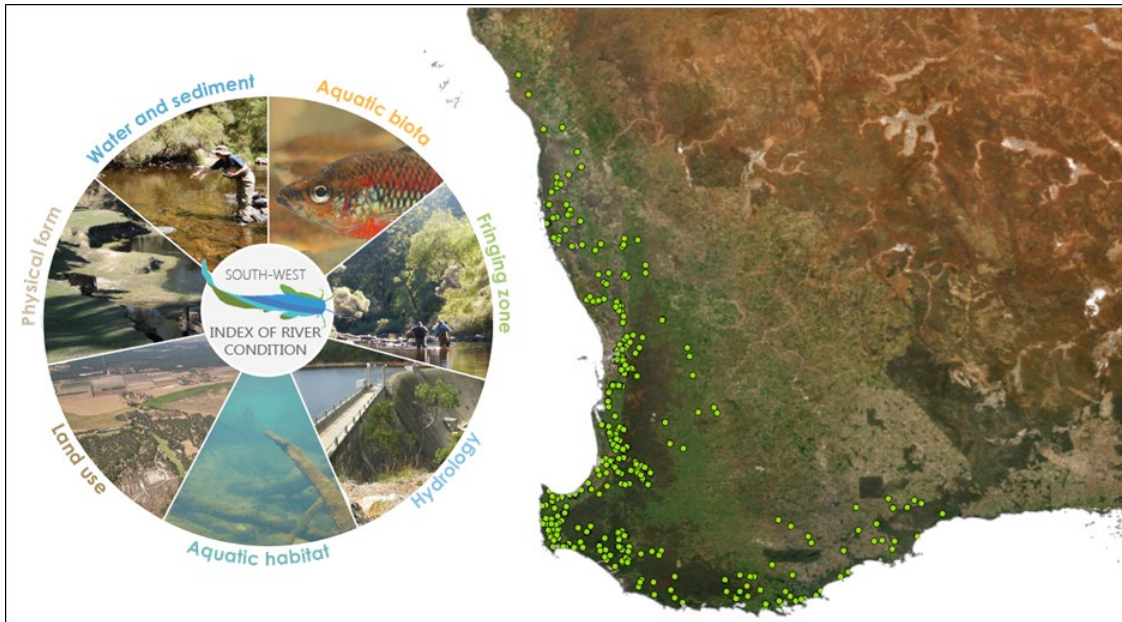
Female *Parartemia informis* (photo Aminul Islam)

Department of Water and Environmental Regulation (DWER)

Researchers in DWER are working on a range of projects detailed below. Contact Tim Storer (tim.storer@dbca.wa.gov.au) for more information.

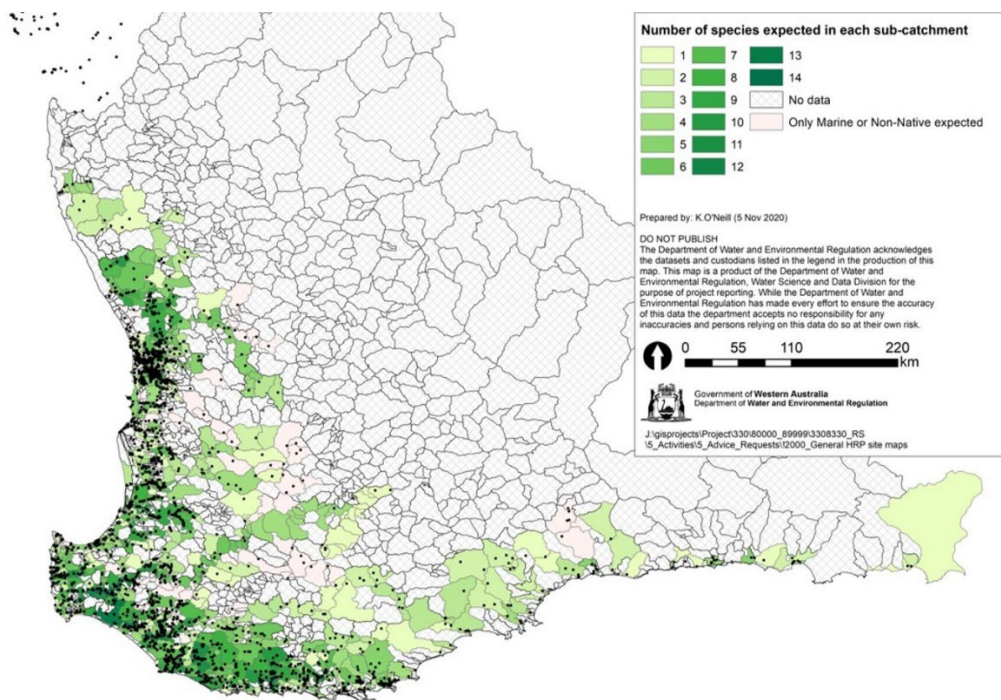
Healthy Rivers Program – river health evaluation

DWER continues to routinely monitor river health as part of its [Healthy Rivers program](#), which includes triennial assessments of ~150 sites across the south-west of WA since 2008. Assessments includes field and desktop data for aquatic and riparian biota, water quality, streamflow, habitat, land use and riparian vegetation at all sites. Through 2024, work was conducted through the Whicher (Cape to Cape), Albany and Harvey regions. Following the recent completion of our integrated ecological database we have begun more detailed interrogation of relationships between all factors, with a focus on understanding changes related to climate and land use.



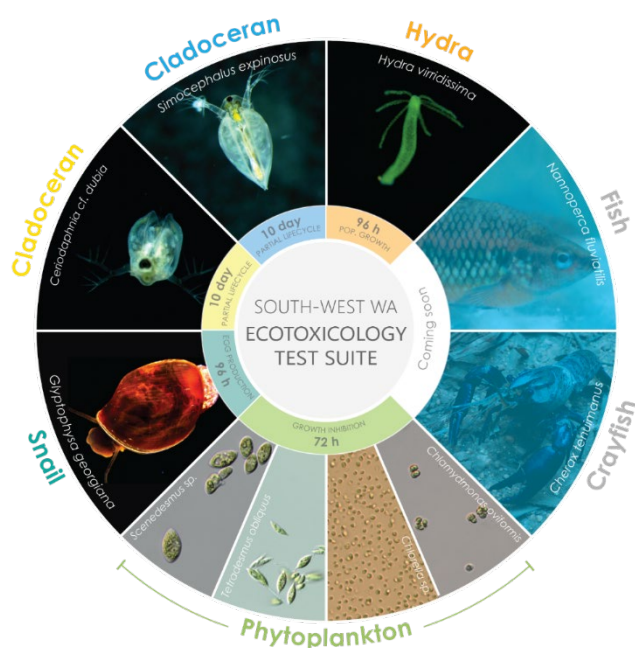
Climate Resilient Rivers project

DWER have just embarked on a new 4-year program to map and prioritise ‘river values’ across south-west WA, with a focus on identifying the areas with greatest current or potential resilience to drying climate. The project focus on pulling together data and generating new information on river character (type), biodiversity value, presence of river pools and springs, cover, and health of riparian vegetation. In combination with this, various restoration actions targeted at protecting and enhancing restoration are being trialled and will be published to support future management actions (following identification of priority areas to focus on for environmental values and climate resilience).



Development of local ecotoxicity tests and water quality thresholds

The River Science team has been working towards developing local species ecotoxicological tests for use in development of more locally relevant water quality guidelines. A species suite for the south-west has been created (left image) and is near ready for use in deriving new contaminant guidelines, assessment of some priority contaminants is already underway. We hope to publish methods and results soon and to run a similar process for other regions (Pilbara, Kimberley) in future.



River Restoration

Work is ongoing on enhancement of historically modified waterways to accommodate drainage and irrigation to improve ecological benefits. This includes a major project in the Harvey River to encourage the recolonisation of species following significant channel modification and desnagging, through reintroductions of large woody debris and foreshore revegetation – without impacting conveyance requirements. To date large logs have been returned to provide habitat and water quality benefits, which includes encouraging the formation of deeper pools to support climate resilience. Led by the Harvey River Restoration Taskforce and working with Murdoch University, Water Corporation, Alcoa and local school and indigenous groups, the department is excited to continue monitoring and move to deployment of purpose-built fish hotels in phase two of the project.



Ongoing review of design of discharge management infrastructure

The department continues its ongoing review and updates to the design of in-stream structures used in gauging stream flows... this focussed on minimising environmental impacts from the structures but ensuring we can gather accurate real-time hydrological information that is critical to support management of water resources.



Edith Cown University - Molecular Ecology and Evolution Group (MEEG)

Macroinvertebrate diversity in urban wetlands in relation to groundwater management

Dr Quinton Burnham and Emily Lette

In 2023 macroinvertebrate diversity was surveyed in urban wetlands in Perth to monitor wetland health related to groundwater extraction on the Swan Coastal; this is a continuation of a project that (now Emeritus) Prof. Pierre Horwitz has run for 27 years and is undertaken in conjunction with Department of Water and Environmental Regulation.

Associated with the work they are undertaking on documenting wetland macroinvertebrates, Quinton and Emily have completed the first round of a study comparing the biodiversity detected via traditional methods with that detected via an eDNA approach. Via these methods they detected a range of local endemic, rare, and invasive species across more than 30 orders of invertebrates. This project is ongoing and expanding in 2024.



Image: Fabian Boesl, ECU

Engaewa eDNA detection

Dr Quinton Burnham

Quinton has been involved in a collaboration between South-West Natural Resource Management, eDNA Frontiers and Curtin University that resulted in successful eDNA detection of a Critically Endangered burrowing freshwater crayfish *Engaewa pseudoreducta*. A manuscript based on this work has been submitted.

Microhabitat distributions of aestivating freshwater fish

Dr Anna Hopkins, Dr Quinton Burnham, Prof. Pierre Horwitz and Paige Wilson (MSc student)

This project is seeking to understand the microhabitat distributions of aestivating freshwater fish in the Windy Harbour area in southwestern WA. In 2023, Paige did three surveys of wetlands in the region using a combination of traditional trapping and specific eDNA detection methods that she has developed. This project is being undertaken in conjunction with the Department of Biodiversity, Conservation and Attractions.



Finding flamingos: how far does eDNA travel in river systems?

Suzanne Thompson (MSc student)



Suzy ran a large study in 2023 to determine how far eDNA can be detected downstream in a flowing river system. To test this, Suzy released artificially created flamingo DNA into a section of the Canning River and collected water samples across several time points and distances downstream to see how far and how fast the artificial DNA travelled. This information is now being fed into a flow model to allow the information to be used more widely. The findings of this study will have important implications for the interpretation of eDNA detections in flowing river systems. Suzy is being supervised by MEEG's Anna Hopkins

and Annette Koenders, as well as Gavan McGrath and Josephine Hyde from the Department of Biodiversity, Conservation and Attractions.

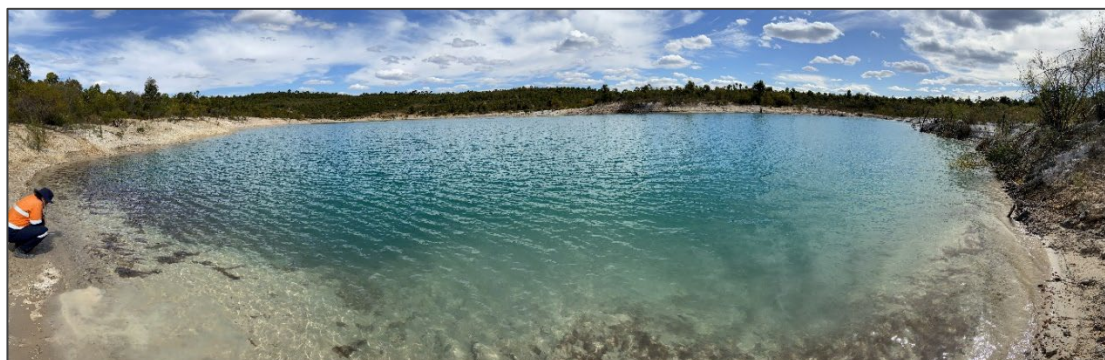
Edith Cowan University - Mine Water and Environment Research Lab

2023 was a busy year for the Mine Water and Environment Research Lab (part of the Conservation and Biodiversity Research Centre) at Edith Cowan University. Dr Rachele Bernasconi, Dr Melanie Blanchette and A/Prof. Mark Lund have worked together on projects examining the rehabilitation of saline and acidic mine pits in Qld, NSW and WA. A key 2023 publication relating to this work was:

Lund MA, Blanchette ML (2023) Closing pit lakes as aquatic ecosystems: Risk, reality, and future uses. WIREs Water 10(4): e1648. <https://doi.org/https://doi.org/10.1002/wat2.1648>

Additionally, they have continued water quality monitoring of the Yellagonga Wetlands (four urban

wetlands), undertaken assessment of drainage from the Wangara industrial area and a biodiversity survey of artificial wetlands across the city of Joondalup.



Edith Cown University - The Centre for People, Place and Planet

PEAT | Protecting Peatland Ecosystems and Addressing Threats

Prof. Pierre Horwitz and Dr David Blake

Pierre and David co-lead the PEAT | Protecting Peatland Ecosystems and Addressing Threats project, which is co-led by Edith Cowan University and UWA, and guided by elders - a collaboration between academic and community-based scientists, managers, and volunteers, including the Undalup Association, the Department of Biodiversity, Conversation and Attractions (DBCA), the Western Australian Museum (WAM) and the Walpole-Nornalup National Park Association (WNNPA) aimed at the conservation of peatlands throughout the Walpole Wilderness Area (WWA).



Southwestern Australia is losing its extensive peat ecosystems to climate change, changed fire regimes, and damage from feral pigs. A unique and slow-forming habitat harbouring endemic microbes, plants and animals, peatlands are increasingly impacted by declining rainfall and groundwater. These processes are drying soils and vegetation, which enables peats to burn when previously they were not likely to, sometimes causing their irreversible loss. Moreover, some fauna associated with peatlands, such as sunset frogs, are in serious decline.

The project has the following four goals:

1. To build a collaboration, based on local knowledge holders and technical specialists, to better manage and promote southwestern peatland ecosystems.
2. To characterise far southwestern peatland geodiversity to inform and prioritise management.
3. To characterise far southwestern peatland biodiversity to inform species and habitat management.
4. To develop a comprehensive management strategy and implement critical/urgent actions for southwestern peatlands and their cultural and natural values.

Co-design discussions have begun with Aboriginal Elders, ensuring Elder leadership and retention of intellectual property through appropriate Human Ethics approval. This has been followed by workshops (face-to-face and online) where all parties have shared knowledge and aspirations, discussed applications and limitations of existing peatland datasets, and considered how the management of peatlands can be improved.



Image: David Edmonds, WNNPA

The characterising of peatland geodiversity has commenced with Dave Blake and Fabian Boesl (ECU) collecting sediment cores, water, and soil gas flux samples from peatlands in the WWA. Greg Skrzypek (UWA) has commenced isotope analysis of water samples collected monthly, to ascertain which hydrological sources (rainfall, groundwater, or seeps/runoff) are maintaining the peatlands. Gavan McGrath (DBCA) has commenced geophysical surveys of the peatlands to also better understand the hydrological systems that support them.

Nicki Mitchell and Emily Hoffmann (UWA) have commenced sampling of Sunset Frog (*Spicospina flammocaerulea*) sites to further our understanding of their spatial distribution and the habitats that support this unique species. Nikolai Tatarnic (WAM) is leading a study of the wingless stilt fly *Badisis ambulans* which lays its eggs in the pitchers, and the larvae develop in the pool of pitcher fluid, feeding on captured prey.

This work will be continuing through to the end of 2027 and we will continue to update the progress of the project.

Lateral Environmental

Adam Harman and colleagues

Lateral have been leading a range of studies of inland waters across Western Australia including:

- A Shared-learning approach to the monitoring and management of inland waters across the Pilbara bioregion, with respective traditional wwner groups.
- Groundwater dependent ecosystem investigations including isotope analysis, DOM fluorescence and species-level identification of several biological indicators of aquatic health condition and alluvial connectivity with surface water environments.
- Innovative eDNA approaches to the detection of cryptic aquatic fauna species, as well as terrestrial species closely associated permanent river pools.
- Trapping, population estimates and research into the impacts of the invasive Redclaw crayfish *Cherax quadricarinatus* on aquatic ecosystem health condition across the Pilbara.
- Genetic sequencing and morphological description of a potential new species of freshwater (billabong) mussel *Velesunio* sp. east Kimberley bioregion.
- Targeted Carters Freshwater Mussel (CFM) surveys across SW WA, including age-size class and population estimation.
- Landscape scale spatial mapping of Inland Waters using DEA Geosciences Water Observations from Space (WoFS) and Sentinel-2 satellite imagery, to characterise seasonal and temporal variability in surface water extent and persistence across the Pilbara bioregion.