Research highlights

What did we learn?

Held on World Wetlands Day, 2 February 2021, the Project Coorong Science Forum featured presentations from leading researchers under the theme 'Science Informing Action'. Researchers shared their previous understanding of the state of the Coorong, how the Coorong system is changing, new research findings, and how research is informing management of the Coorong to return it to a healthier state. This fact sheet summarises the research highlights presented at the Science Forum. To watch the recorded presentations from the Forum click here.

Ngarrindjeri Knowledge

Presented by Tim Hartman Senior and Candice Love, Ngarrindjeri Aboriginal Corporation

- Ngarrindjeri Caring for Country - Yarluwar-Ruwe is based on the relationship between the people and the Yarluwar-Ruwe which goes back to Creation. Ngurunderi taught the Ngarrindjeri how to sustain their lives and their culture from what were their healthy lands and waters.
- The lands, waters, peoples and all things are connected stitch by stitch, circle by circle. Ngarrindjeri have managed the Kurangk for thousands of years and continue to do so in accordance with their Laws.

Nutrient Dynamics

Presented by Professor Luke Mosley, University of Adelaide

- The Coorong sediment is in poor health (high in organic carbon and nutrients, with anoxic (absent of oxygen) black oozes and few benthic macroinvertebrates) in the South Lagoon and southern region of the North Lagoon.
- The consistency between the nitrogen isotope "signature" in the particulate organic nitrogen in the water and sediment organic nitrogen isotope values suggests an algal derived source to the sediment. This is consistent with algal deposition from a highly eutrophic (nutrient rich) water column.
- Salinity appears to be inhibiting denitrification which is a process where nitrate nitrogen can be utilised by microbes and then removed from the aquatic system (i.e. via gaseous nitrogen form). Investigations strongly suggest that salinity negatively impacts inorganic nitrogen removal processes in the South Lagoon, resulting in nutrients being retained and recycled in the system.
- *Ruppia* (an aquatic plant) is oxygenating sediments in the Coorong through its turions (roots), helping to reduce anoxic black ooze. Macroinvertebrate burrows (where present) also oxygenate the sediment and improve sediment quality.

Aquatic Plants and Algae

Presented by Professor Michelle Waycott, University of Adelaide

- Following the 2020 growing season, *Ruppia tuberosa* (a keystone aquatic plant species) has returned to its pre-Millennium Drought extent in the Coorong.
- A second aquatic plant species (*Althenia cylindrocarpa*) is more prevalent across the central and southern Coorong than previously documented.

- Shallow waters are still significantly impacted by filamentous green algae, leading to declines in *Ruppia* seed production and turion (reproductive structures produced underground that can form a new plant) formation. For example, in the central Coorong more than 10 km^2 of filamentous algae, forming large mats were recorded in 2019-20, conservatively representing 100 tonnes dry weight of algae.

Coorong Hydrodynamic Modelling

Presented by Dr Matt Gibbs, Department for Environment and Water

- Data collected across the Healthy Coorong, Healthy Basin program is being used to improve the Coorong Dynamics Model which provides a useful summary of our knowledge of the system and is the fundamental tool to enable "if-then" scenarios to be undertaken and inform future management.
- Hydrodynamic modelling results over the years 2013-2015 showed the lack of flushing of the Coorong South Lagoon that happens under low flow conditions, with only one third of the water that started in the South Lagoon exiting through the Murray Mouth after 3 years.
- One of the major inputs to the models is data from the water monitoring program, which has been expanded substantially over the past year. This program is providing additional water quality, meteorological and water velocity data to further improve the accuracy of the models.

Coorong Fish

Presented by Associate Professor Qifeng Ye and Chris Bice, South Australian Research and Development Institute (SARDI) Aquatic Sciences

- Freshwater inflow (particularly from the River Murray) is a critical driver influencing fish ecology and habitats in the Coorong, by providing connectivity, aiding salinity reduction and enhancing productivity.
- Since late 2010, the resumption of barrage flows including water for the environment has restored estuarine-freshwater connectivity and improved fish habitat in the Coorong. Fish species richness, abundance and distribution generally increased throughout the system, particularly during high flow years. The abundance of smallmouth hardyhead increased significantly in the South Lagoon, with reduced salinity.
- Increased inflows improved pelagic (open water) productivity and the complexity/resilience of the Coorong food web.
- In more recent years, barrage flows have been managed under suitable hydrological/climatic conditions, supported by water for the environment, to generate favourable salt wedge conditions to promote the recruitment of black bream, an iconic estuarine species.
- Long-term monitoring of diadromous fishes (those that must migrate between freshwater and marine environments to complete their lifecycle) is critical to informing barrage operation, fishway construction and delivery of water for the environment; to maintain connectivity between the ocean and the Coorong, Lower Lakes and River Murray.
- Since 2010, the abundance of diadromous fish such as congolli and pouched lamprey has increased substantially. Targeted seasonal delivery of water for the environment has been key to achieving this outcome.
- Monitoring of pouched and short-headed lamprey in the Lower River Murray has led to greater knowledge and understanding of key migration periods for both species. The insertion of Passive Integrated Transponders, or PIT tags, and detection of fish as they pass through upstream lock and weir fishways has also led to further understanding of the distance of migration from the Southern Ocean to the River Murray Channel. Further research is still needed on lamprey spawning and early life history in the Murray-Darling Basin.

Macroinvertebrates

Presented by Professor Sabine Dittmann, Flinders University

- The density and distribution of macroinvertebrates in the Coorong and Murray Mouth fluctuates subject to water flow from the River Murray. Higher flow volume and continuity of flow are beneficial for macroinvertebrate communities.
- Long-term data indicate a decrease in the diversity, individual densities and biomass of macroinvertebrates along a spatial gradient from the Murray Mouth to the Coorong South Lagoon. This is driven by higher salinity further south in the Coorong.
- Macroinvertebrates provide a good source of prey for shorebirds and fish foraging in the Murray Mouth and Coorong North Lagoon. The South Lagoon in comparison cannot provide the same food supply due to high salinity and uninhabitable sediments for a majority of macroinvertebrates.
- Macroinvertebrates affect nutrient dynamics through bioturbation (re-working of sedimentary deposits by living organisms) which improves nutrient flux and sediment conditions.
- Recent findings include rediscovery of a species of lugworm not commonly found in the Coorong, which could be beneficial for processes in the sediment and as an additional prey item in the ecosystem.

Waterbirds

Presented by Dr Thomas Prowse, University of Adelaide

- Preliminary trend analyses of 20 years of time-series data from the annual waterbird census for the Coorong South Lagoon (Paton et al. 2020) have documented winners and losers amongst the waterbird assemblage during the Millennium Drought, along with a recovery in abundance for some species post 2011.
- Of 23 significant trends detected for the drought period which encompassed surveys between January 2000 and 2010, 70% (16 species) were declining trends, e.g. common greenshank, grey teal, fairy tern, great crested grebe.
- Only 10 significant trends were detected for the post-drought period, of which 60% (six species) were declining trends.

Lower Lakes Ecology (vegetation, threatened fish and frogs)

Presented by Dr Jason Nicol, SARDI Aquatic Sciences and Scotte Wedderburn, University of Adelaide

- Water level is a key driver of maintaining aquatic and littoral (shoreline) vegetation in Lakes Alexandrina and Albert.
- Results from The Living Murray vegetation condition monitoring program have informed water level management in the Lower Lakes, in particular the introduction of lake level cycling (surcharging in spring to 0.85 m AHD and receding in autumn to 0.55/0.6 m AHD) to improve littoral vegetation abundance and diversity. Noting a cycle of drawdown to 0.5 m AHD is only required at least once in every 5 years)
- The change in plant communities has been small in recent years, indicating the community may be approaching equilibrium. The vegetation is resilient but restricted to a narrow band around the edge of the lakes.
- Recent examination of fish otoliths (ear stones) show fish breeding likely coincided with the timing of a spring flow pulse, highlighting a significant benefit of water for the environment. Additionally, otoliths of threatened southern pygmy perch showed higher daily growth rings at the same time a flow pulse was delivered to Lake Alexandrina. However more research is warranted to confirm this direct correlation.

- There appears to be a significant relationship between the abundance of southern pygmy perch and water levels throughout summer to autumn. Specifically, it appears detrimental to threatened fish populations if water levels fall too low over this period.
- Monitoring of threatened southern bell frogs is undertaken using automated sound recorders and manual nocturnal surveys. The lack of detection (no frog calls) in recent years suggests current water level management may not provide a breeding cue of sufficient magnitude.
- Southern bell frogs were calling in higher abundances in previous years when the scale of water level change was greater.

Climate Adaptation

Presented by Dr Mike Dunlop, Commonwealth Scientific and Industrial Research Organisation (CSIRO)

- The Coorong region is an interlinked physical and social system that is continuously evolving on multiple timeframes. Deep cultural connections and multiple economic and social values have persisted through periods of significant change.
- There are multiple ecological change processes and many interacting factors. There will be significant changes across the whole food web and ecological changes have potential to be large, but a wide diversity of habitats and species will still be supported.
- The Climate Analogues Explorer indicates that Victor Harbor's proposed future climate in 2080-2099 matches the current climate experienced in places like Quorn (SA) and Northam (WA) (under RCP 8.5 emissions scenario and maximum consensus climate future).
- It is getting drier and sea level is rising. In the Murray-Darling Basin, rainfall is predicted to decrease up to 40% by 2090 and there will be increased evapotranspiration. There will be significantly reduced in-flows to the River Murray and reduced flows into Lake Alexandrina. This is compounded by complex hydrological processes in the Coorong, Lower Lakes and Murray Mouth with a net result of lower water levels, less freshwater input, decreased connectivity, increased concentration of salt and nutrients and increased acidity.

Science and Integration

Presented by Professor Michelle Waycott, Department for Environment and Water

- Knowledge translation, application and integration is supporting Coorong site management to recover the ecological health of the Southern Coorong. This includes consolidating science across the Healthy Coorong, Healthy Basin program, developing improved hydro (water), biogeochemical and ecological models, and informing policy and management of the site.
- The desired state of the Southern Coorong – discussion paper seeks to build a shared understanding of the existing and emerging scientific knowledge of the Southern Coorong. It communicates what we know, where our knowledge gaps are, and provides ideas for how we might achieve the desired state. The information is drawn from syntheses of available knowledge across environmental value, salinity, high nutrient state and food webs.

Coorong Infrastructure Investigations

Presented by Peter Mettam, Coorong Infrastructure Investigations Project, Healthy Coorong, Healthy Basin

- The Coorong Infrastructure Investigations Project (CIIP) is investigating the feasibility of multiple long-term operational infrastructure and management options to improve the ecological health of the Coorong.
- In 2020, the HCHB program asked the community to tell us what they believed to be the essential criteria for shortlisting the options, and help in the prioritisation process. . Five infrastructure/management options have now been shortlisted for further investigation.
- It's important to note this is just an investigation into feasibility at this stage, not a decision to proceed with any particular option.
- Further community consultation will be required on any options deemed to be feasible before such a decision would be made.
- The feasibility investigations (ecological, engineering, cultural and socio-economic) are underway, and will continue throughout 2021, drawing on the best available science to inform decision-making.
- The community will be involved in the decision-making process throughout the project.

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For information contact Project.Coorong@sa.gov.au or visit https://www.environment.sa.gov.au/topics/coorong