

Warrego-Darling Selected Area: Research

Research project title	Date of Completion	Objectives	2020-21 Progress/Findings
WD1: Modelling inundation extent - Warrego Western Floodplain	31/03/2021	* Train WD MER project staff in Data Cube and MDBSat access and use	Project complete.
		* Access the Geoscience Australia Data Cube and wetland/water related indices	Findings presented in Appendix G: Warrego Hydrological Research
		* Capture a set of high-resolution satellite and aerial images to compare against the derived Data Cube products	Additional refinement may occur following completion of Toorale Water Infrastructure project
		* Provide a quantitative accuracy assessment of products derived from the Data Cube	
		* Develop a range of products specifically for the Western Floodplain, incorporating field data, local knowledge, data from LTIM derived system maps, depth loggers and vegetation communities.	
WD2: Hydrodynamic model finalisation	30/6/2022	* Undertake bathymetric surveys of key Warrego River waterholes	The plan and timelines for this project have been modified in consultation with CEWO, due to modifications to the lower warrego dams through the Toorale Water Infrastructure project. Contracting of ELA hydrological modeller underway.
		* Use bathymetric data for model calibration	Project is on schedule.

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WD3: Building resilience: understanding ecological thresholds in low flow refugia	31/03/2022	<p>* Define, identify and describe chemical and biophysical characteristics of refuge habitats</p> <p>* Characterise biogeochemical processes, foodweb structure and target species they support, and how these change over time with refuge maintenance, or disconnection, contraction and then reconnection.</p>	<p>Fieldwork for this project undertaken in November, December 2020 and March 2021. No sampling undertaken since then due to high flows. Invertebrate identification up to date and water sample analyses completed.</p> <p>Project is on schedule. Sampling was completed when sites were reconnected during higher flows. Findings reported in Appendix C: Foodwebs. Future work will investigate the origins and bioavailability of DOC as a major basal food source, conditions permitting.</p>
WD4: Developing a model to predict food web responses to environmental water delivery	30/06/2022	<p>* Develop a bioenergetic food web model using Ecopath</p> <p>* Model food web response under different environmental flow scenarios</p>	<p>No fieldwork undertaken in last reporting period due to high flows and rainfall limiting access. Invertebrate identification up to date and water sample analyses completed.</p> <p>Data analysis and reporting are underway for primary productivity and metabolism field experiments conducted Q2 2020-21 water year. Additional experiments will be undertaken in collaboration with MER Basin-scale foodweb researchers during the 2021-2022 water year conditions permitting.</p> <p>Project is on schedule dependent upon future travel restrictions.</p>
WD5: Developing a method to	31/06/2022	* Develop a lignum monitoring regime for uptake into MER project monitoring	Method has been incorporated into surveys at lignum sites within the Warrego-Darling and Gwydir

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assess lignum condition		* Understand the resilience of lignum to drought conditions and its capacity to respond following inundation	Selected Areas since March 2020, along with contingency monitoring sites in the Southern section of the Western Floodplain. Lignum condition monitoring will continue in line with future MER vegetation diversity monitoring. Project is on schedule.
WD6: Contribution of bars and in-channel benches during high flow events (Darling)	31/12/2021	* In mesocosms, quantify the release of sediment associated C,N and P from Bars and benches into the water column	Glasshouse mesocosm experiments completed at UNE in March 2021. Water samples currently being analysed for macronutrients.
		* In mesocosms, quantify the emergence of zooplankton and vegetation from bench and bar sediments	Microinvertebrates have been analysed and data are ready for reporting. Project on schedule pending COVID related delays with water sample analysis.
WD7: Biodiversity responses to environmental water (multiple projects)	WD7.1: Fish recruitment, age, origin and diet - 30/6/22	* Quantify the potential for breeding and recruitment of native fish (focus on Golden Perch) in the Warrego River, Darling River and Western Floodplain	Fieldwork scheduled for September 2021, but may be delayed with flows and COVID-19 related travel restrictions. If surveys undertaken before end of 2021, then project should still be able to be completed by 30/6/2022, given time is needed for lab analysis of fish gut content.
		* Understand the mechanisms leading to a successful recruitment event	Project on schedule, dependent on future travel restrictions.
	WD7.2: Turtle capture-mark-recapture - 30/6/2022	* To assess the recruitment and size distribution of turtles in northern-western populations of freshwater turtles in the MDB * To quantify the density of turtles and distribution of	Capture of turtles attempted in over Summer 2021, however none were caught. No sampling undertaken since then due to restricted access with floodplain and COVID-19.

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		species in habitats with different flow characteristics	Fieldwork planned for October-December 2021 depending on conditions and travel restrictions.
		* To quantify the behaviour of north-western turtle species in relation to environmental variables	Project on schedule, dependent on future travel restrictions.
	WD7.3: Frog Recruitment - 30/6/2022	* To quantify frog diversity and abundance and breeding activity of frogs in the Warrego region.	Solar powered acoustic recorders still deployed and collecting data. Data download scheduled for October-December 2021 depending on conditions and travel restrictions. Project on schedule, dependent on future travel restrictions.

Warrego-Darling Selected Area: Contingency Monitoring

Monitoring element	Indication of monitoring	2020-21 progress
Connectivity events	Contingency monitoring of multiple indicators before, during and after flow events will provide information on flows needed to influence channel habitats; improve water quality; and provide for longitudinal connectivity (particularly important for fish) in the Warrego-Darling Selected Area. This will improve understanding of short-term environmental outcomes from flow management in the Warrego-Darling, including trade-offs between connecting the Warrego channel to the Darling River and/or the inundation of the Western floodplain by Commonwealth water for the environment.	A suitable connectivity event occurred in March-April 2021, however fieldwork was not undertaken due to flooding restricting site access and COVID-19 related travel restrictions
Western Floodplain biodiversity	This contingency monitoring element will monitor abundance of key faunal groups on the Western floodplain not captured through current monitoring programs (e.g. small bodied fish, frogs, snakes and turtles) and how their response changes with inundation timing, frequency, spatial extent and duration of watering. This information will allow the CEWO to better target environmental water to the Warrego Channel or Western floodplain.	No suitable connection event occurred in 2020-21.
Waterbird recruitment	The Western Floodplain has extensive lignum and macrophyte communities that may be important habitat for waterbird breeding. These rookery areas will be the target of event-driven survey effort. Surveys of colonial bird breeding events and fledging success are proposed using standard methods. Surveys will be initiated by confirmed commencement of bird breeding events.	No suitable recruitment event occurred in 2020-21.
Fish recruitment	Monitoring of fish recruitment could occur in any year. Additional fish methods and evaluation over and above standard methods will target event-based fish recruitment in the Warrego-Darling (including the Western Floodplain, connection of Warrego channel with the Darling and the role of refuge habitats). Monitoring will track inundation events and the potential for breeding and potential recruitment of native fish (with a focus on	A suitable connectivity event occurred in March-April 2021, however fieldwork was not undertaken due to flooding restricting site access and COVID-19 related travel restrictions

Monitoring element	Indication of monitoring	2020-21 progress
	Golden Perch). Monitoring will include length, weight, condition and otolith (age and chemistry – research linked to MER Basin Scale) to link to flow triggers in the upstream Darling or Warrego reaches.	
Low flow refuges in the Warrego and Darling Rivers	The focus of this monitoring of refuges will be in drier years. This monitoring will consider the duration of cease to flow events at waterholes in the Warrego and Darling, and monitor how the habitat and food changes (focus on native fish such as golden perch and Murray cod). This project will contribute to the evidence base for the CEWO to better target environmental water to the Warrego Channel or Western Floodplain.	Fieldwork for this project undertaken in November, December 2020 and March 2021. No sampling undertaken since then due to high flows. Invertebrate identification up to date and water sample analyses completed. Results reported in Appendix C: Food Webs.
Incident response monitoring	This monitoring could happen in any year. Opportunistic monitoring can be undertaken for water quality (spot measures and samples) or ecological indicators (fish, frogs, turtles, birds, mussels, other) as agreed between UNE and the CEWO.	Vegetation monitoring of an additional 12 plots located in the southern section of the Western Floodplain were undertaken in Spring 2020 to assess the vegetation response in less frequently inundated areas of the floodplain. Follow up surveys in Autumn 2021 were cancelled due to rain, and will be undertaken in Spring 2021, dependent on future travel restrictions.

Warrego-Darling Selected Area: Communications and Engagement

Outcomes and Outputs 2020-21

1 Objectives

1.1 Pre-COVID19 restrictions

- Teleconference (or face to face meeting if possible) with CEWO team including the northern LEOs, and any other representatives of government agencies or the community nominated by the CEWO (e.g. possibly DPIE EES and MDBA Regional Engagement Officers)
- Regular flow of photographs that can be used in CEWO products (such as ‘updates’) and which include people and researchers in some photographs. This would include unusual species – possibly Hyrtl’s tandan – or charismatic species such as broilgas and magpie geese.
- Selected Area newsletter (as per the Basin-scale contract)
- Northern Basin Research workshop
- Annual communications and engagement report
- Meeting with northern Local Engagement Officers, face to face in Moree (November 2020), to share progress, receive feedback
- Meeting with northern Local Engagement Officers, face to face in Bingara (February 2021), to share progress, receive feedback
- Contribute to the Basin scale web site
- Cultural Advisor pilot program developed in cooperation with CEWO Local Engagement Officers Jason Wilson and Jane Humphries – Kevin Knight appointed as Warrego-Darling Cultural Advisor
- Regular conversations with the northern LEO’s to discuss opportunities
- Academic events (conference presentations and papers)

1.2 Post-COVID19 restrictions (version 2)

- Increased to monthly for the broader team. (measure - conferences conducted).
- Regular flow of photographs that can be used in CEWO products (such as ‘updates’) and which include people and researchers in some photographs. This would include unusual species – possibly Hyrtl’s tandan – or charismatic species such as broilgas and magpie geese. May be limited if field restrictions remain long term
- Selected Area newsletter (as per the *core monitoring* contract)
- Northern Basin Research workshop

- Participation in community events partly undertaken in early 2020, restricted at present – alternative effort on online engagement. (measure – online stories developed and shared)
- Annual communications and engagement report
- Contribute to the Basin scale web site
- Curriculum development (in conjunction with the northern LEOs)
- Collaborating with Warrego-Darling Cultural Advisor, Kevin Knight to enhance Aboriginal engagement
- Regular conversations with the northern LEO's to discuss opportunities
- Field events are highly restricted, radio interviews undertaken with 2WEB and online story sharing approach developed (measure – stories shared)
- Academic events - conferences postponed in 2020, papers ongoing. Continue preparing academic papers, participate in online fora.

2 Outcomes

Period	Deliverable Original Work Order (amended for COVID-19)	Reflections
Every three months (starting Dec 2019)	<ul style="list-style-type: none"> Monthly teleconference with the broader CEWO team including the northern Regional Engagement Officer's and northern Local Engagement Officer's. Online meetings with any other representatives of government agencies or the community nominated by the CEWO (e.g. possibly DPIE-EES and NPWS). Regular flow of photographs that can be used in CEWO products (such as 'updates') and which include people and researchers in some photographs. This would include unusual species – possibly Hyrtl's tandan – or charismatic species such as broilgas and magpie geese. May be limited if field restrictions remain long-term. 	<ul style="list-style-type: none"> Achieved. Achieved and ongoing.
Every three months (start Mar 2020)	<ul style="list-style-type: none"> Selected Area newsletter (as per the <i>core monitoring</i> contract). 	<ul style="list-style-type: none"> Achieved.
Jan-Aug 2020	<ul style="list-style-type: none"> Northern Basin Research workshop. Participation in a community event / knowledge sharing / field day (or events) led by the CEWO or other agencies restricted at present. Alternative effort on online engagement. (measure – online stories developed and shared). 	<ul style="list-style-type: none"> Delivered for 2021. Online stories achieved.
Dec 2020	<ul style="list-style-type: none"> Annual communications and engagement report. 	<ul style="list-style-type: none"> Achieved.
Mar/Apr 2020 and Sep/Oct 2020	<ul style="list-style-type: none"> Planning meeting with northern Local Engagement Officers, via video conference, to share progress, receive feedback (November 2020). 	<ul style="list-style-type: none"> Achieved.
On going	<ul style="list-style-type: none"> Contribute to the Basin scale web site Curriculum development (in conjunction with the northern LEOs). Cultural Advisor pilot program 	<ul style="list-style-type: none"> Achieved and ongoing. Underway. Achieved and ongoing.

	<ul style="list-style-type: none"> • Aboriginal engagement planning and delivery – including through listening with Jason Wilson and others. Draft plan that has ownership by Aboriginal groups by 30 March 2020. Alternative activities focused on development of Aboriginal wetland resources document which can later be tested with the Aboriginal community within the WD Selected Area. • Regular press releases linked to key events or outcomes. • Fortnightly conversations with the northern LEO's to discuss opportunities. 	<ul style="list-style-type: none"> • Achieved and ongoing (February meetings with JMAC, LALC, Maranguka group, High school group. • Ongoing. • Achieved and ongoing.
As requested/arranged	<ul style="list-style-type: none"> • Engagement activities focused on engagement through development and distribution of web-based stories and radio interviews. • Conference postponed in 2020, papers are ongoing. Continue preparing academic papers, participate in online fora. 	<ul style="list-style-type: none"> • Online stories successful. • Achieved.

3 Lessons learned

This section reflects on activities that were achievable in the water year.

The November trip to meet with and listen to Aboriginal community groups (JMAC, LALC, Maranguka and local school in the Gwydir catchment) was a great start to our community communication. Unfortunately, travel restrictions have meant that we have had to postpone planned on-country activities but these are ready for 2022 with any luck. In-person engagement always seems to be best.

Regular meetings with the LEOs and REOs have proved beneficial and we will look to continue these throughout the project. The online meeting platforms work well for regular meetings considering the distances people are apart. However, it will be nice to re-engage face to face when possible. A combination of both face to face and online will work best.

The Northern Basin research workshop has been a feature of our learning and engagement with cognate agency groups. The event in February 2021 was well received and we will endeavour to hold this type of meeting annually.

In regard to our online work, social media post interactions have been variable during the 2020-21 water year. Posts 3 and 9 both regarded our cultural collaboration with Gamilaraay artist, Lakkari Pitt, and attained the best performance across our social media platforms as indicated by high rates of post interaction (Table 1, Figure 1). There is currently immense support for increased Aboriginal representation and leadership within the Australian water space. The commissioning of artwork from Lakkari Pitt seemed to work in with this growing support. Posts 5 and 8 were of a more scientific theme and received the least online interaction. We believe that a diversity of material is best to capture diverse interest in the community more broadly.

Note that Figure 1 draws from interaction with the 2rog social media accounts only. It does not include interactions from the UNE accounts or individual team members so the numbers of interactions with these posts is much higher than reported here.

Lastly, a number of these communications focussed on the Warrego-Darling and Gwydir Selected Areas simultaneously to efficiently distribute attention across the two sites.

Table 1 Titles and total online performance of the Flow-MER 'stories' published online from July 2020 to June 2021. Total interactions is the sum of total likes, comments and shares each story acquired after being posted on the media platforms managed by 2rog Consulting (i.e. Twitter, Facebook and LinkedIn).

2020-21 publications	Title	Date published online	Total online interactions
1	Big dry survivors	1/7/20	19
2	Wading through the Warrego	15/7/20	43
3	Flow-MER x Lakkari Art	16/9/20	145
4	Murray cod: an icon of the murray darling basin	9/12/20	56
5	When wetlands boom	26/2/21	14
6	A turtles go with no flow	6/3/21	17
7	A guide: monitoring river systems during a global pandemic	14/3/21	19
8	Restarting dry rivers: risks to water quality	18/3/21	16
9	A look at the gwydir march 2021 flows	4/5/21	21
10	White-bellied sea-eagle spotted at Warrego rivers boera dam	10/6/21	22
11	Migratory birds in the Warrego: a home away from home	28/6/21	24
12	Q&A: Lakkari Pitt	7/7/21	61

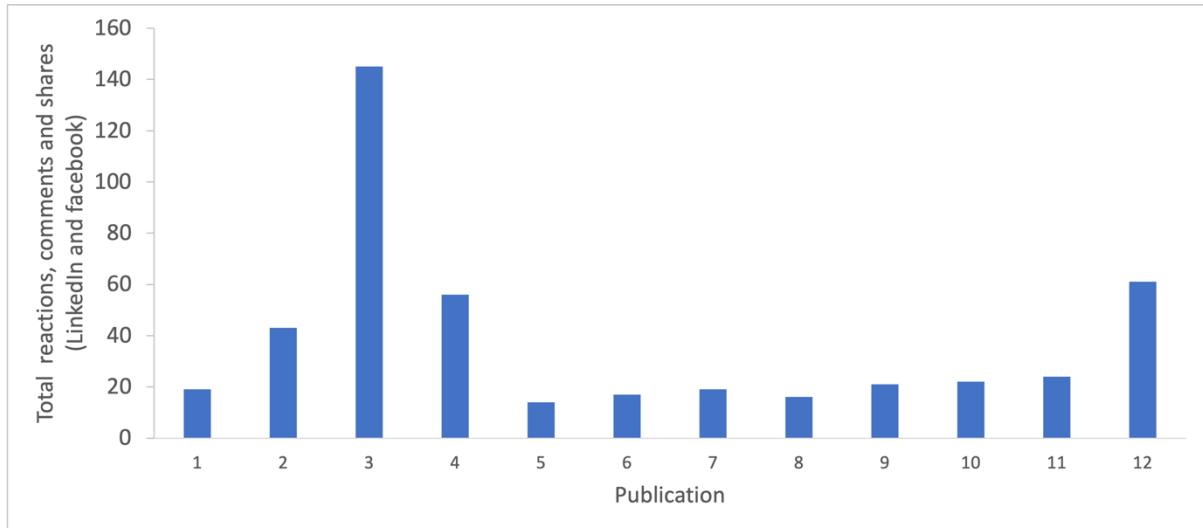


Figure 1 Reactions, comments and shares across LinkedIn and Facebook social media platforms from July 2020 to June 2021.