

Warrego-Darling Selected Area: Research

Research project title	Date of Completion	Objectives	2019-20 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	Training with Geoscience Australia on datacube access and capability complete and water indices etc generated. High-resolution ground truth data (field-based and aerial) captured. Work with MDBA (MDBsat) to access all Sentinel images for water year. All imagery processed to Modified Normalised Difference Water Index (MNDWI). Link to hydrograph and consideration of output products underway. Project is on schedule.
		* Access the Geoscience Australia Data Cube and wetland/water related indices	
		* Capture a set of high-resolution satellite and aerial images to compare against the derived Data Cube products	
		* 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	31/12/2020	* Undertake bathymetric surveys of key Warrego River waterholes	Fieldwork for this component is scheduled for October/November 2020 where bathymetric data will be acquired. Model calibration will be undertaken shortly thereafter. Project is on schedule.
		* Use bathymetric data for model calibration	
WD3: Building resilience: understanding ecological thresholds in low flow refugia	31/03/2022	* Define, identify and describe chemical and biophysical characteristics of refuge habitats	Three field sampling trips have been undertaken for this project (December 2019, March 2020, June 2020) that collected water quality data and invertebrate samples. Targeted sampling around 2020 flow event in Warrego was impacted by COVID-19. Temperature/Dissolved Oxygen loggers were placed in waterholes in December 2019, and have been downloaded in March and June 2020. Future
		* 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.	

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			fieldwork will be undertaken in collaboration with the food webs indicator of the MER project, in Spring/Summer 2020. Project is on schedule.
WD4: Developing a model to predict food web responses to environmental water delivery	30/06/2022	* Develop a bioenergetic food web model using Ecopath	Data for use in this project has been collected on three occasions in December 2019, March 2020 and June 2020. Future fieldwork will be undertaken in collaboration with the food webs indicator of the MER project, in Spring/Summer 2020. Project is on schedule.
		* Model food web response under different environmental flow scenarios	
WD5: Developing a method to assess lignum condition	31/03/2021	* Develop a lignum monitoring regime for uptake into MER project monitoring	Literature review and method development complete. Method was first applied during March 2020 surveys at lignum sites within the Warrego-Darling and Gwydir Selected Areas, and will be continued in line with future MER vegetation diversity monitoring. Project is on schedule.
		* Understand the resilience of lignum to drought conditions and its capacity to respond following inundation	
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	Field collection of sediment from bars and benches delayed due to COVID-19. Fieldwork for this component is scheduled for October/November, with mesocosm experiments planned for summer 2020/21.
		* In mesocosms, quantify the emergence of zooplankton and vegetation from bench and bar sediments	
WD7: Biodiversity responses to environmental water (multiple projects)	WD7.1: Fish recruitment, age, origin and diet - 31/3/22	* Quantify the potential for breeding and recruitment of native fish (focus on Golden Perch) in the Warrego River, Darling River and Western Floodplain	A suitable connectivity event occurred in March-April 2020, however fieldwork was not undertaken due to COVID-19 related travel restrictions
		* Understand the mechanisms leading to a successful recruitment event	
	WD7.2: Turtle capture-	* To assess the recruitment and size distribution of turtles in northern-western	Work orders for these projects approved August 2020. Sound recorders for frogs and GPS

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	mark-recapture - 30/6/2021	populations of freshwater turtles in the MDB	trackers for turtles have been ordered from the supplier. Fieldwork scheduled for October/November 2020.
		* To quantify the density of turtles and distribution of species in habitats with different flow characteristics	
		* To quantify the behaviour of north-western turtle species in relation to environmental variables	
	WD7.3: Frog Recruitment - 30/6/2021	* To quantify frog diversity and abundance and breeding activity of frogs in the Warrego region.	

Warrego-Darling Selected Area: Contingency Monitoring

Monitoring element	Indication of monitoring	2019-20 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 2020, however fieldwork was not undertaken due to 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.	A suitable connectivity event occurred in March-April 2020, however fieldwork was not undertaken due to COVID-19 related travel restrictions
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.	A suitable connectivity event occurred in March-April 2020, however fieldwork was not undertaken due to COVID-19 related travel restrictions
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 Golden Perch). Monitoring will include length, weight, condition and otolith (age	A suitable connectivity event occurred in March-April 2020, however fieldwork was not undertaken due to COVID-19 related travel restrictions

Monitoring element	Indication of monitoring	2019-20 progress
	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.	Temperature/Dissolved Oxygen loggers were placed in waterholes in December 2019, and have been downloaded in March and June 2020. They continue to log as the system dries after the March-April 2020 connection event. Three field sampling trips have been undertaken (December 2019, March 2020, June 2020) that collected water quality data and invertebrate samples. Future fieldwork will be undertaken in collaboration with the food webs indicator of the MER project, in Spring/Summer 2020.
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.	No incident response monitoring was undertaken in 2019-20

Warrego-Darling Selected Area: Communications and Engagement

Outcomes and Outputs 2019-20

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 brolgas and magpie geese.
- Selected Area newsletter (as per the Basin-scale contract)
- Northern Basin Research workshop
- Participate in a community event / knowledge sharing / field day (or events) led by the CEWO or other agencies
- Annual communications and engagement report
- Planning meeting with northern Local Engagement Officers, probably face to face in Armidale (or elsewhere if mutually convenient), to share progress, receive feedback
- Contribute to the Basin scale web site
- Curriculum development (in conjunction with the northern LEOs)
- 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.
- Regular press releases linked to key events or outcomes
- Regular conversations with the northern LEO’s to discuss opportunities
- Meetings and field events (at least 6)
- Academic events (conference presentations and papers)

1.2 Post-COVID19 restrictions

- Increased to monthly for the broader team. Increased to fortnightly with LEOs and monthly including MDBA REOs. (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 brolgas and magpie geese. May be limited of 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
- Meetings with Local Engagement Officers (LEO's) increased to fortnightly meetings – video conferencing (measure – meetings undertaken)
- Contribute to the Basin scale web site
- Curriculum development (in conjunction with the northern LEOs)
- Aboriginal engagement planning and delivery – Alternative activities focused on development of Aboriginal wetland resources document which is providing source information leading to improved communication products.
- Regular press releases linked to key events or outcomes
- 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 fortnightly meeting with the 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 brolgas 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 2020. 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. 	<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). 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 	<ul style="list-style-type: none"> Achieved and ongoing. Underway. Achieved and ongoing (February meetings with JMAC, LALC, Maranguka group, High school group.

	<p>Aboriginal community within the WD Selected Area.</p> <ul style="list-style-type: none"> • 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"> • 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 calendar year. Other planned activities will be reported on in the next report.

The February trip to meet with and listen to Aboriginal community groups (JMAC, LALC, Maranguka and local high school students) 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 2021 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 2020 was well received and we will endeavour to hold this type of meeting annually.

In regard to our online work, scientific stories about fish attained the best performance across social media platforms as indicated by high rates of post interaction (Table 1, Figure 1). Fish are strongly associated with waterways and their health and they are also at the core of recreational activities such as fishing. These associations drive people's investment in 'fish' as a topic which has shone through as a high rate of interaction with our posts of this theme. Conversely, stories of people and culture performed better in terms of in-person response (Table 1, Figure 1). We think the Aboriginal communities should receive more recognition and the broader community appreciate seeing this as well as the 'human behind the scientist'. People relate to things that reflect a part of themselves therefore stories of people and culture provoke stronger reactions than the alternatives. Our cultural story on the Yellowbelly, "Dhagaay", touched on people, culture and fish and provoked the strongest in-person response of all stories, despite its intermediate performance online. The feedback from

industry and community members on this story was abundantly positive and supportive, showing that stories of this calibre have greater access to peoples interests and willingness to care.

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 Title, category and total online performance (total online interactions) of the Flow-MER ‘stories’ published online from April-July of the 2019-20 water year. Total interactions is the sum of engagements and interactions each story acquired after being posted on the media platforms managed by 2rog Consulting (i.e. Twitter, Facebook and LinkedIn).

Issue No.	Title	Date published online	Category	Total online interactions
1	A frog’s dream	27/4/2020	Science	1,800
2	Yellowbelly: the fecund Warrego nursery	12/5/2020	Science	1,486
3	Waterbirds in the Gwydir	19/5/2020	Science	925
4	Controlling lippia: the role of environmental water	2/6/2020	Science	1,235
5	Fish, flows and food	5/6/2020	Science	2,607
6	Observations from the bird guru: Steve Debus	19/6/2020	Personal	1,173
7	Dhagaay, Gagalin, Bidyin, Yellowbelly	24/6/2020	Personal	1,348
8	‘Big dry’ survivors	1/7/2020	Science	1,939
9	Wading through the Warrego	15/7/2020	Personal	2,703

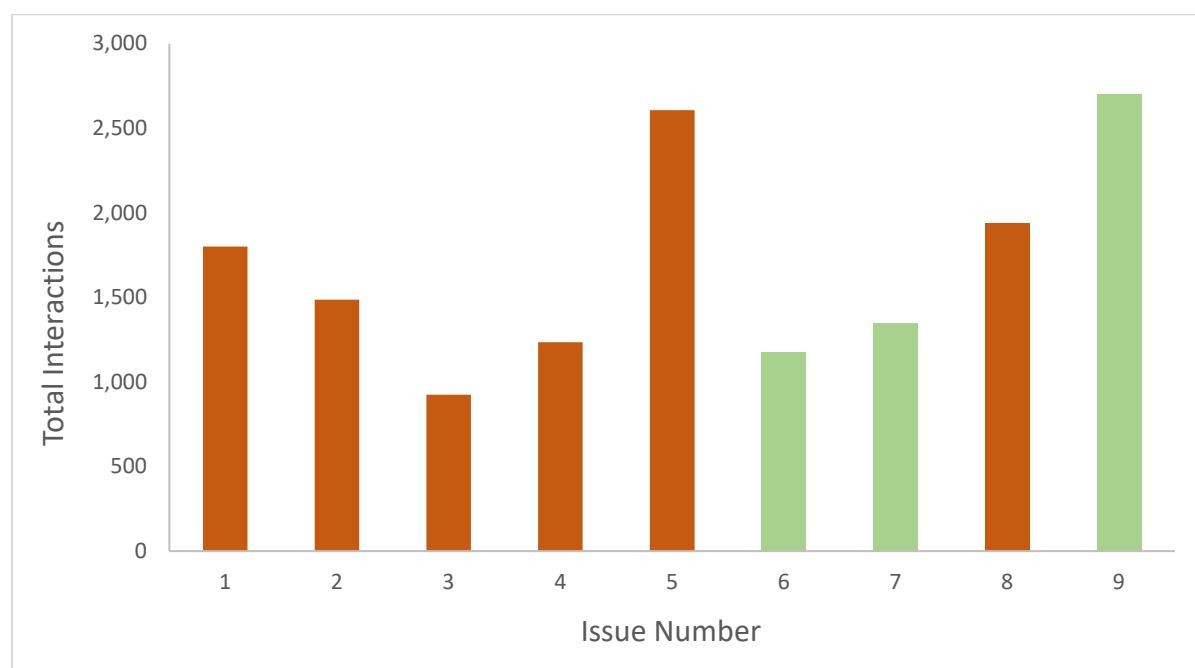


Figure 1 ‘Total interactions’ is the combination of post impressions and engagements across all utilised social media platforms. Posts have been highly variable across both post types, i.e., scientific (orange) or personal (green). Issues 5 and 9 received the most interaction, representing scientific and personal stories, respectively.

Issues 3 and 6 had the fewest interactions, representing scientific and personal stories, respectively, although both regarding waterbirds in the Gwydir Wetlands.