HYDROLOGY | FOOD WEBS | VEGETATION | WATERBIRDS | FISH | FROGS

## Gwydir Selected Area: Research

Research project title	Date of Completion	Objectives	2019-20 Progress/Findings
GW1: Modelling inundation extent - Gwydir Wetlands and Gingham Waterourse	31/03/2021	<ul> <li>* Train WD MER project staff in Data Cube and MDB Sat access and use.</li> <li>* Access the Geoscience Australia Data Cube and wetland/water related indices.</li> <li>* Capture a set of high- resolution satellite and aerial images to compare against the derived Data Cube products.</li> <li>* Provide a quantitative accuracy assessment of products derived from the Data Cube.</li> <li>* 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</li> </ul>	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.
GW2: Building resilience: understanding ecological thresholds in low flow refugia	31/3/2022	<ul> <li>* Define, identify and describe chemical and biophysical characteristics of refuge habitats.</li> <li>* 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.</li> </ul>	Four field sampling trips have been undertaken for this project (October 2019, November 2019, December 2019, March 2020) that collected water quality data and invertebrate samples. Temperature/Dissolved Oxygen loggers were placed in waterholes in October 2019, and have been downloaded in November, December, and March. Future fieldwork will be undertaken in collaboration with the food webs indicator of the MER

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			project, in Spring/Summer 2020.	
			Project is on schedule.	
GW3: Building resilience: understanding ecological thresholds in low flow refugia	31/03/2022	<ul> <li>* Develop a bioenergetic food web model using Ecopath.</li> <li>* Model food web response under different environmental flow scenarios.</li> </ul>	Four field sampling trips have been undertaken for this project (October 2019, November 2019, December 2019, March 2020) that collected water quality data and invertebrate samples. Temperature/Dissolved Oxygen loggers were placed in waterholes in October 2019, and have been downloaded in November, December, and March. Future fieldwork will be undertaken in collaboration with the food webs indicator of the MER project, in Spring/Summer 2020. Collaboration with MER Basin	
			scale food web research underway, piloting Ecopath models for Gwydir food webs. Project is on schedule.	
GW4: Ecosystem Response to fire and the influence of environmental water	30/06/2022	* What is the response of wetland vegetation communities to fire of differing severity (from DPIE-EES mapping)? * What is the water quality (nutrient and algae) and microinvertebrate response to rewetting in sediments exposed to differing fire intensity?	Sites have been selected and sediment collected for mesocosm experient in October 2019, which will be undertaken over summer 2020. Field survey of vegetation response will commence in Spring 2020 then follow MER projects vegetation monitoring seasonal surveys. Project is on schedule.	
GW5:	GW5.1: Fish	* Quantify the potential	Several connectivity events	
Biodiversity	recruitment, age,	for breeding and	occured in February-March	
responses to	origin and diet -	recruitment of native fish.	2020, however fieldwork was	
environmental	31/3/22	* Understand the mechanisms leading to a	not undertaken due to COVID- 19 related travel restrictions.	

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water (multiple projects)		sucessful recruitment event.	Some bony herring otoliths were collected during May/June 2020 fish sampling which may be used to tie breeding back to flow conditions.
	GW5.2: Turtle capture-mark- recapture - 30/6/2021	<ul> <li>* To assess the recruitment and size distribution of turtles in northern-western populations of freshwater turtles in the MDB.</li> <li>* To quantify the density of turtles and distribution of species in habitats with different flow characteristics.</li> <li>* To quantify the behaviour of north- western turtle species in relation to environmental variables.</li> </ul>	Project is on schedule. Transmitters placed on 15 Eastern long-necked turtles and 16 Murray River turtles in December 2019 with movement of individuals sucessfully tracked over Summer/Autumn/Winter. During the tracking period the Gingham waterhole dried completely and we recorded mortality of four Murray River turtles and one Eastern long- necked turtles. During the drought most Eastern long- necked turtles remained in terrestrial refuge on the floodplain whereas Murray River turtles either remained in the dry wetland or attempted to migrate (one successfully moved over a kilometre to a dam). Project is on schedule.
	GW5.3: Frog Recruitment - 30/6/2021	* To quantify frog diversity and abundance and breeding activity of frogs in the Warrego region.	However, Masters student currently has restricted travel due to COVID-19. Short term acoustic data has been collected at seven sites along the Gwydir catchment with data in the process of being analysed to determine the auditory response of frogs to environmental flow. A five year dataset collected by DPIE on frog community responses to water in the Gwydir River has also been analysed and manuscript drafting is underway. Results suggest

Research project title	Date of Completion	Objectives	2019-20 Progress/Findings
			that the number of spotted marsh frogs and eastern sign bearing froglets increased when environmental flows were released.
			Project is on schedule.

# Gwydir Selected Area: Contingency Monitoring

Monitoring element	Indication of monitoring	2019-20 progress
Connectivity events	Opportunities to monitor connectivity events are expected in drier years following a wetter year (to replenish water availability). The monitoring would track water quality and fish responses to connectivity events released from Copeton Dam along the length of the Gwydir River, and in the Mehi River and/or Carole Creek. Outcomes will help better understand the response of water quality and fish to 'first flush' flows through to monitoring fish recruitment from connection events.	No specific monitoring of connectivity events was undertaken in 2019-20.
Waterbird recruitment	Opportunities to monitor waterbird recruitment are expected in wetter years. The well-known colonial bird rookeries within the Gingham-Gwydir Watercourse rookery areas will be the target of event-driven survey effort. Surveys of colonial bird breeding events and fledgling success will be assessed using standard methods. Surveys will be initiated by confirmed commencement of bird breeding events and continue to fledgling.	No colonial waterbird breeding was identified 2019-20.
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 lower Gwydir, and follow spawning through time to successful recruitment. This monitoring would focus on specific flow releases with targeted fish objectives, monitoring the hydrology, habitat and food resources and otoliths to tie to flows that are supporting recruitment events in the lower Gwydir.	No specific monitoring of connectivity events was undertaken in 2019-20.
Low flow refuges	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, and monitor how the habitat and food changes.	Extensive monitoring undertaken throughout 2019-20. Please see Appendix F: Pool Refugia, for further details and results.

Monitoring element	Indication of monitoring	2019-20 progress	
Watercourse biodiversity	This monitoring could occur in all years. The monitoring will help to develop a holistic biodiversity response to specific environmental watering events.	No specific monitoring of watercourse biodiversity was undertaken in 2019- 20 as no larger planned watercouse inundation releases were made.	
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, platypus, other) as agreed between UNE and the CEWO.	Two incident response monitoring trips were undertaken in 2019-20. Please see Appendix F: Pool Refugia for further details and results.	

# Gwydir Selected Area: Communications and Engagement

### Outcomes and Outputs 2019-20

#### **1** Objectives

#### **1.1 Pre-COVID-19 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 Freshwater catfish – 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 Jane Humphries, 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-COVID-19 restrictions

- Teleconferences 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 or charismatic species such as brolgas and magpie geese. May be limited by field restrictions in current year but will 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 has been used to help improve communication products with more culturally inclusive approaches and outputs.
- 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

Poriod	Deliverable Original Work Order (amended for COVID-19)		Reflections		
Period					
Every three	Monthly teleconference with the broader	٠	Achieved.		
months	CEWO team including the northern Regional				
(starting	Engagement Officer's and fortnightly meeting				
Dec 2019)	with the northern Local Engagement Officer's.				
	Unline meetings with any other				
	community nominated by the CEWO (e.g.				
	possibly DPIE-EES and NPWS)				
	<ul> <li>Regular flow of photographs that can be used</li> </ul>	•	Achieved and ongoing.		
	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				
<b>F</b> 11	restrictions remain long-term.		A 1 ' 1		
Every three	Selected Area newsletter (as per the core     manitaring contract)	•	Achieved.		
(start Mar	monitoring contract).				
2020)					
Jan-Aug	Northern Basin Research workshop.	•	Delivered for 2020.		
2020	• Participation in a community event /	•	Online stories		
	knowledge sharing / field day (or events) led		achieved.		
	by the CEWO or other agencies restricted at				
	present. Alternative effort on online				
	engagement. (measure – online stories				
Dec 2020	Annual communications and engagement		Achieved		
	report.	•	Acmeved.		
Mar/Apr	Planning meeting with northern Local	٠	Achieved.		
2020 and	Engagement Officers, via video conference, to				
Sep/Oct	share progress, receive feedback				
On going	Contribute to the Basin scale web site.	•	Achieved and ongoing.		
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	Curriculum development (in conjunction with	•	Ongoing.		
	the northern LEOs).				
	Aboriginal engagement planning and delivery	•	Ongoing.		
	- 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	1			

	document which can later be tested with the Aboriginal community within the Gwydir Selected Area.		
	<ul> <li>Regular press releases linked to key events or outcomes.</li> </ul>	Ongoing.	
	• Regular conversations with the northern LEO's to discuss opportunities.	• Achieved and ongoing.	
As requested/ arranged	<ul> <li>Engagement activities focused on engagement through development and distribution of web- based stories and radio interviews.</li> </ul>	Online stories     successful.	
	• Conference postponed in 2020, papers are ongoing. Continue preparing academic papers, participate in online fora.).	Achieved.	

#### **3** Lessons learned

This section reflects on activities that were achieveable in the calendar year. Other planned activities will be reported on in the next report.

The December trip to meet with the LEOs, Gavin Pryde from the CEWO and the Gwydir Valley Irrigators Assocation was successful and a good start to explore the diversity of offering for the MER program. Unfortunately, travel restrictions have meant that we have had to postpone planned on-country activities but these are ready for 2021 if restrictions ease. 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 endevour 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 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.

Lakkari Pitt's indicator art work has just been released (15 September 2020). The immediate impact has been substantial from a wide range of audiences. We hope to bring this work to Country in 2021 (or earlier) to build on this approach.

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).

lssue 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.