HYDROLOGY | FOOD WEBS | VEGETATION | WATERBIRDS | FISH

Gwydir River Selected Area

2021-22 Annual Summary Report

FLOW Monitoring Evaluation Research

Appendix G – Biodiversity of reptiles, amphibians and fish in the Gwydir Wetlands

This monitoring project was commissioned and funded by the Commonwealth Environmental Water Office.

Copyright

This report should be attributed as 'Bower, D. & Mika, S. 2022. Biodiversity of reptiles, amphibians and fish in the Gwydir Wetlands. A report to the Commonwealth Environmental Water Office, Canberra'

Cover image: Eastern Dam in the Lower Gwydir wetlands in March 2022 (Photo: Jo Ocock, NPWS).

Disclaimer

Contents

List of Figures

List of Tables

Executive Summary

- This project was funded as part of a biodiversity survey in the Gwydir Wetlands. The study used fauna surveys to assess the distribution and occupancy of reptile, amphibian and fish species in the Gwydir wetlands following a severe drought.
- Reptiles were sampled at various sites in the Gwydir Wetlands in 2021 and 2022, results were also compared to turtle data from 2019.
- Turtle capture rates were lowest in winter 2021 and highest in 2019 and 2022.
- Little known species were observed including the grey snake (*Hemiaspis daemelii*) listed as Endangered in Queensland and under the International Union for the Conservation of Nature (IUCN), and the red-naped snake (*Furina diadema*), listed as threatened in Victoria.
- There was evidence of recruitment into the turtle population for all three species in the Gwydir wetlands.
- Burrowing frogs emerged in April 2022 following extended floodplain inundation suggesting that the La Nina weather has been positive for floodplain vertebrates.
- There is growing evidence of the importance of the Gwydir Wetlands for providing habitat to reptiles and amphibians not available in the broader agricultural environment.

1 Introduction

Reptiles and amphibians are important in the environment for pest control, ecosystem engineering, and as prey to larger animals such as birds and mammals (Valencia-Aguilar et al. 2013). Small-bodied fish (small fish) are also critical components of wetland food webs, linking microinvertebrate productivity to higher-level predators such as larger fish, water birds and snakes. Small fish, frogs and reptiles can disperse in shallow water and are therefore among the first aquatic vertebrates to colonise recently inundated wetland habitats.

A global decline of reptiles and amphibians has occurred owing to habitat loss, disease, and exploitation (Gibbons et al. 2000, Qazi & Ashok 2012). For aquatic reptiles and small fish river regulation and anthropogenic change have driven declines in populations. For example, in the Murray-Darling Basin, reptiles and frogs such as Murray River turtles (*Emydura macquarii*) and southern bell frogs (*Litoria raniformis*) have declined (Wassens 2010, Van Dyke et al. 2019), along with many species of small-bodied fish (Appendix E: Fish Diversity). In addition, increased climatic variability driven by climate change is further altering the hydrology of wetlands and impacting the resilience of local populations.

Floodplain reptiles, amphibians and fish are adapted to dynamic environments, exploiting the productivity that occurs in response to the variable water regime (Bower et al. 2014). Floodplain reptiles, amphibians and small fish may respond to favourable conditions by breeding, dispersing, or with periods of recruitment or growth. However, the detectability of reptiles and amphibians can be extremely low during drought periods when they are inactive in unsuitable conditions (Ocock et al. 2016). Therefore, fauna surveys that occur over long-time periods are necessary to detect long-term trends in populations.

Knowledge of floodplain reptiles and their population dynamics is sparse. To address this knowledge gap and provide baseline information on floodplain aquatic vertebrate assemblages in the Gwydir Floodplain, we surveyed for frogs, reptiles, and small fish in

2021, and frogs and reptiles in 2020 to determine the distribution and occupancy of species using the floodplain.

2 Methods

2.1 Mark-recapture

Between 16 – 17 June 2021, 12 – 14 April 2022, we undertook aquatic sampling in the Gwydir Wetlands State Conservation Area, and upstream in the Gwydir River at Tyreel (Table 1; Figure 1). Turtles and small fish were captured by setting traps in 2021 and turtles were surveyed again in 2022 (Table 1). We compared these data to previous sampling undertaken to assess movement of turtles (Appendix H: Turtles). Turtles were measured using Vernier Calliper 0-600 mm Digital Stainless Steel callipers for straight carapace and plastron, length and width, to the nearest 1mm. Mass was measured using a 5 kg Pesola Macro-Line Spring scale to the nearest 10-gram increment. Eastern long-necked turtles (*Chelodina longicollis*) were sexed, if their carapace length was over 110 mm, by looking for a convex (female) or concave (male) plastron (Ryan et al., 2015). Broad-shelled turtle*s* (*Chelondina expansa*) and Murray River turtles were sexed by the longer tail length of males. Fish were identified to species and counted.

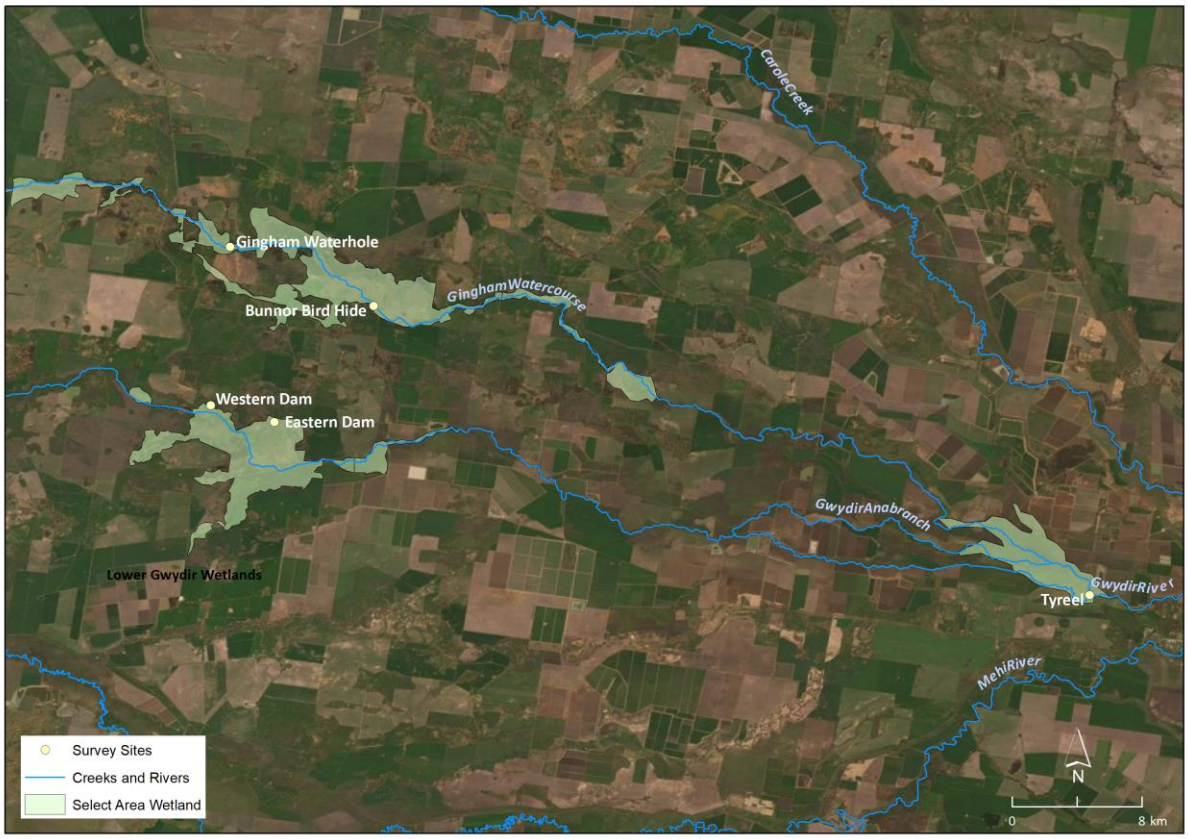

Figure 1 The study area in the Gwydir Wetlands.

Table 1 Trap effort for aquatic vertebrates in the Gwydir wetlands.

Site and System	Trap type	Trap nights 2021	Trap nights 2022
Bunnor bird hide, Gingham watercourse	Large fyke net	1	0
	Minnow	3	0
	Small fyke net	2	0
Gingham Waterhole, Gingham watercourse	Large fyke net	1	9
	Minnow	3	0
	Small fyke net	2	0
Eastern Dam, Lower Gwydir wetland	Large fyke net	1	0
	Minnow	3	0
	Small fyke net	2	0
Western Dam, Lower Gwydir wetlands	Large fyke net	1	0
	Minnow	3	0
	Small fyke net	2	0
Tyreel, Gwydir River	Large fyke net	0	3

2.2 Visual Encounter Surveys

Visual encounter surveys were completed in 16 – 17 June 2021 and 12 – 14 April 2022 with 2 – 4 observers in waterbodies in the Gwydir Wetlands (Table 2). Observers detected reptiles and amphibians by walking slowly along a random path at night and using a headtorch to view individuals.

Table 2 Conditions during visual surveys.

Survey date	Time start	Time end	Site	Temp	Relative Humidity	Dewpoint	Barometric Pressure	Average wind speed
16/06/2021	20:20	20:50	Bunnor bird hide	17.3	79	13.7	29.29	0
16/06/2021	18:20	18:50	Gingham waterhole	16.5	76.3	12.9	29.31	0.6
17/06/2021	18:26	18:56	Eastern Dam	13.5	79.1	9.6	29.4	0
17/06/2021	18:58	17:28	29.33942, 149.32642	11.9	72.1	7.6	29.42	0
12/4/2022	19:47	21:14	Ecolodge	NA	NA	NA	NA	NA
13/4/2022	19:50	20:17	Ecolodge	NA	NA	NA	NA	NA

3 Results

3.1 Mark-recapture

Three species of turtle were captured across the Gwydir Wetlands. In 2020, Murray River turtles were the most commonly captured turtle in the Gingham Waterhole with 39 individuals and Eastern long-necked turtles were the most captured turtle in Moolaboola Dam with 37 individuals. In 2021, Eastern long-necked turtles were the only species captured and this only occurred at Western Dam in the lower Gwydir.

In 2022, broad-shelled turtles and Murray River turtles were captured in equal numbers in Gingham Waterhole (22 individuals of each species) and 18 Eastern long-necked turtles were captured in lower numbers. This was in contrast to the Gwydir River channel at Tyreel where Murray-River turtles were the most commonly captured species (11), broad-shelled turtles were captured in lower numbers (4) and no Eastern long-necked turtles were sampled (Table 3).

Table 3 Number of uniquely captured turtles in a sampling session from the Gwydir Wetlands 2019 to 2022.

Site and Date	*Broad-shelled turtle (Chelondina expansa)*	*Eastern long-necked turtle (*Chelodina longicollis*)*	*Murray River Turtle (Emydura macquarii)*	Total
Gingham Waterhole				
2019 November	20	11	39	70
2021 June	0	0	0	0
2022 April	22	18	22	62
Gwydir River				
2022 April	4	0	11	15
Moolabulla dam				
2019 November	35	37	14	86
Western dam				
2022 April	0	2	0	2
Eastern dam				
2022 April	0	0	0	0

Site and Date	*Broad-shelled turtle (Chelondina expansa)*	*Eastern long-necked turtle (*Chelodina longicollis*)*	*Murray River Turtle (Emydura macquarii)*	Total
Bunnor bird hide				
2020 April	0	0	0	0

Three species of native small-bodied fish were observed during the 2021 survey: spangled perch (*Leiopotherapon unicolor*), Australian smelt (*Retropinna semoni*) and Western carp gudgeon (*Hypseleotris klunzingeri*), along with the two exotic species Eastern mosquitofish (*Gambusia holbrooki*) and common goldfish (*Carassius auratus*). Bunnor bird hide had the highest fish richness, with all 5 species found, followed by the Western Dam which had 3 species, 1 of which was exotic (Table 4). Spangled perch were found at all sites, while Australian smelt were only found at the Bunnor bird hide. Western carp gudgeon were the most abundant of the native species, with 120 individuals caught in the Western Dam (Table 4).

*Table 4 Small fish abundance in the Gwydir wetlands in June 2021. * denotes exotic species.*

Site	Spangled perch (*Leiopotherapon unicolor)*	Australian Smelt (*Retropinna semoni)*	Western carp gudgeon (*Hypseleotris klunzingeri)*	Eastern mosquitofish* (*Gambusia holbrooki)*	Common goldfish* (*Carassius auratus)*	Site Richness
Bunnor bird hide	2	6	2	10	1	5
Gingham Waterhole	10	0	0	0	1	2
Eastern Dam	1	0	12	0	0	2
Western Dam	4	0	120	0	1	3
Total abundance	**17**	**6**	**134**	**10**	**3**	

3.2 Visual Encounter Surveys

In June 2021, four winter active frog species were detected (barking frog, salmon striped-frog, spotted marsh frogs, and beeping froglet). Considerably more species were detected in April 2022 (Table 5), including the broad-palmed rocket frog (*Litoria latopalmata*), emerald tree-frog (*Litoria peronii*), holy cross frog (*Notaden bennettii*), and green tree frog (Litoria caerulea). Additionally, in April 2022 we detected three snake species (grey snake (*Hemaispis*), curl snake (*Suta suta*) and red-naped snake (*Furina diadema*); Figure 2). Curl snakes were detected the most frequently (3 individuals; Table 6). Tessellated geckos (*Diplodactylus tessellatus*) were also observed on the floodplain.

Figure 2 Floodplain reptiles and amphibians detected in the Gwydir wetlands: holy cross frog, grey snake, tessellated gecko, red-naped snake, curl snake, De Vis banded snake.

Table 5 Detection of frog community in the Gwydir Wetlands in 2021 and 2022.

Date	Broad-palmed rocket frog (*Litoria latopalmata*)	Emerald-spotted tree frog (*Litoria peronii*)	Barking frog (*Limnodynastes fletcheri*)	Green tree frog (*Litoria caerulea*)	Holy cross frog (*Notaden bennettii*)	Salmon-striped frog (*Limnodynastes salmini*)	Spotted marsh frog (*Limnodynastes tasmaniensis*)	Beeping froglet (*Crinia parinsignifera*)
16/6/21	0	0	11	0	0	0	1	0
16/6/21	0	0	25	0	0	1	0	0
17/6/21	0	0	0	0	0	0	1	0
17/6/21	0	0	1	0	0	1	0	1
11/4/22	0	1	55	1	1	1	1	0
12/4/22	0	0	4	1	0	0	1	0
13/4/22	1	0	0	0	0	0	0	0

Table 6 Detection of reptile community in the Gwydir Wetlands in 2021 and 2022.

Date	Curl snake (*Suta suta*)	De Vis' banded snake (*Denisonia devisi*)	Grey snake (*Hemiaspis damelii*)	Red-naped snake (*Furina diadema*)	Tessellated gecko (*Diplodactylus tessellatus*)
11/04/2022	1	1	0	0	1
12/04/2022	1	0	1	0	0
13/04/2022	1	0	0	1	0

4 Discussion

We found a variety of amphibian and reptiles species using the Gwydir floodplain including some poorly known species. The freshwater turtle populations are extensive in the Gwydir wetlands and a comparison to the main river channel shows the importance of the floodplain habitat in the Gwydir wetlands for supporting the Eastern long-necked turtle populations and broad-shelled turtles. Interestingly, broad-shelled turtles were captured in equal proportions to the Murray River turtle in the Gingham Waterhole following the severe drought event, whereas Murray River turtles were dominant in the river channel at that time, and had previously been dominant in the Gingham Waterhole prior to the drought. This suggests that broad-shelled turtles were either better at surviving the drought, or were better at recolonising the floodplain after the drought, and demonstrates the importance of the floodplain for supporting the two long-necked (*Chelodina*) species.

Visual encounter surveys also revealed a considerable number of species using the floodplain following the rains. This included the grey snake, which is a poorly known and listed as threatened by the IUCN and in Victoria. Though it is not listed in NSW, grey snake populations have likely declined and require research attention to better understand drivers of population growth (Michael et al. 2020). In addition, a more detailed understanding of the broader floodplain reptile assemblage and an understanding of how populations respond to flood would benefit environmental managers and conservationists. For example, we do not understand what constitutes high quality habitat for floodplain reptiles and what vegetation structure is required to facilitate survival during inundation of the floodplain. It is likely that floodplain vegetation and gecko populations interact to influence survival during immersion of water. It is also possible that floodplain reptiles require fast life histories (high growth, vagility, and high dispersal capability) but this information is currently unknown.

Winter trapping revealed little reptile activity but revealed four species of winter-active frogs using the floodplain and reflects the importance of repeated surveying for reptile and amphibian populations. The detection of the holy cross frog was also an important record as they were not detected in standardised frog surveys over the past five years (Appendix I: Frogs), likely owing to drought conditions. Repeated surveying of cryptic species that are highly responsive to environmental conditions such as snakes and burrowing frogs is an important component of understanding long-term environmental water management.

Bony bream (*Nematalosa erebi*), olive perchlet (*Ambassis agassizii*) and fly-specked hardyhead (*Craterocephalus stercusmuscarum*) were found in surveys undertaken at the same wetland sites in 2015-16 (Commonwealth of Australia 2016, Appendix H), but not during the 2021 surveys. Both the fly-specked hardyhead (9 individuals) and olive perchlet (2 individuals) were found in very low numbers in the Gingham Waterhole in 2015-16 and did not survive the waterhole drying out during the 2018-19 drought. However, NSW Fisheries released 360 olive perchlet back into Gingham Waterhole in June 2021 once it filled up, so future surveys may once again detect this species. Eastern mosquitofish were similarly reduced by the drought, only recorded at Bunnor bird hide in 2021. Spangled perch were not found in Eastern Dam in 2015-16, but a single individual was found there in 2021. Small populations were maintained at Bunnor bird hide, Gingham Waterhole and the Western Dam after the 2018-19 drought, although the population at Western Dam was much smaller than observed in 2015. Australian smelt were not observed in the Gwydir Wetlands in the 2015-16 surveys, but

a small population was found in 2021 at Bunnor bird hide. Given the widespread hydrological connectivity in the lower Gwydir system over the past 2 years, follow up surveys would detect if any small-bodied fish species have recolonised these floodplain habitats.

5 References

Bower DS, Valentine LE, Grice AC, Hodgson L, Schwarzkopf L. 2014. A trade-off in conservation: Weed management decreases the abundance of common reptile and frog species while restoring an invaded floodplain. Biological conservation **179**:123-128.

Commonwealth of Australia 2016. Commonwealth Environmental Water Office Long Term Intervention Monitoring Project Gwydir River System Selected Area – 2015-16 Evaluation Report. Commonwealth of Australia, Canberra.

Gibbons JW, et al. 2000. The Global Decline of Reptiles, Déjà Vu Amphibians: Reptile species are declining on a global scale. Six significant threats to reptile populations are habitat loss and degradation, introduced invasive species, environmental pollution, disease, unsustainable use, and global climate change. BioScience **50**:653-666.

Michael DR, Bourke G, Paris D, Wassens S. 2020. A range extension for the endangered Grey Snake'Hemiaspis damelii'(Gunther 1876) in the Murrumbidgee catchment, southern NSW. Australian Zoologist **40**:652-655.

Ocock J, Kingsford R, Penman T, Rowley J. 2016. Amphibian Abundance and Detection Trends During a Large Flood in a Semi-Arid Floodplain Wetland. Herpetological Conservation and Biology **11**:408-425.

Qazi AH, Ashok K. 2012. Global amphibian declines: a review. International Journal of Biodiversity and Conservation **4**:348-357.

Valencia-Aguilar A, Cortés-Gómez AM, Ruiz-Agudelo CA. 2013. Ecosystem services provided by amphibians and reptiles in Neotropical ecosystems. International Journal of Biodiversity Science, Ecosystem Services & Management **9**:257-272.

Van Dyke JU, Spencer RJ, Thompson MB, Chessman B, Howard K, Georges A. 2019. Conservation implications of turtle declines in Australia's Murray River system. Scientific reports **9**:1-12.

Wassens S. 2010. Flooding regimes for frogs in lowland rivers of the Murray-Darling Basin. Ecosystem Response Modelling in the Murray-Darling Basin:215-129.