

The status of Murray Crayfish in
Talbingo Reservoir, Yarrangobilly
River and Wallace Creek in June 2025

Sylvia Zukowski & Matt Jacobs



Report to Snowy Hydro Limited

snowyhydro



August 2025

This report may be cited as:

Zukowski, S. and Jacobs, M. (2025). The status of Murray Crayfish in Talbingo Reservoir, Yarrangobilly River and Wallace Creek in June 2025. Report to Snowy Hydro Limited. Nature Glenelg Trust, Victor Harbor.

Correspondence in relation to this report contact

Dr Sylvia Zukowski
Senior Aquatic Ecologist
Nature Glenelg Trust
MOB: 0438 815 489
sylvia.zukowski@ngt.org.au

External review history

Version	Date issued	Issued to	Reviewed by
1 st draft	July 2025	Snowy Hydro	Elizabeth Pope
Final	August 2025	Snowy Hydro	Elizabeth Pope

Disclaimer

Although reasonable care has been taken in preparing the information contained in this publication, neither NGT, nor Snowy Hydro accept any responsibility or liability for any losses of whatever kind arising from the interpretation or use of the information set out in this publication.

Acknowledgements

This project was funded through Snowy Hydro Limited (Snowy Hydro). Thanks to Elizabeth Pope (Snowy Hydro) for initiating and managing the project, field logistics, support and constructive review of the report. Thanks to Kris Hansson, Shane Bilish, Joel Cubol, Leah Leask, Jordan Chenery, Junaidi Ibrahim and Gemma Wood for field logistics and support. Thanks to Stephen Campbell-Brown, Nina Campbell-Brown, and Colin Cook (NGT) for field sampling and support. Thanks to Nick Whiterod for mapping expertise. Thanks to Melissa Herpich and Lachlan Farrington for report review. All sampling was undertaken in accordance with NSW DPI Scientific Collection Permit (P18/0023-2.0), Animal Research Authority (The Secretary's Animal Care and Ethics Committee), and NSW National Parks & Wildlife Service Scientific Licence (SL1021143) to permit sampling within the Kosciuszko National Park in which Talbingo Reservoir lies.

Contents

Background.....	2
Project objectives	5
Field surveys (Talbingo Reservoir).....	6
Study region	6
Survey sites	7
Survey methods	9
Data collection	9
Results (Talbingo Reservoir)	11
Catch summary	11
Changes over time	15
Length structure.....	17
Habitat and Site Characteristics	19
Water Quality.....	20
Field surveys (Yarrangobilly River and Wallace Creek)	22
Survey sites	22
Survey methods	23
Data collection	24
Results (Yarrangobilly River and Wallace Creek)	25
Catch summary	25
Water Quality and site characteristics	25
Discussion.....	26
Talbingo Reservoir.....	26
Yarrangobilly River and Wallace Creek.....	27
Conclusion	28
References	29

Background

Murray Crayfish *Euastacus armatus* (von Martens 1866) is one of 53 described species within the genus *Euastacus*. This genus contains high levels of cryptic diversity (Austin, Whiterod et al. 2021) however, *E. armatus* is the most widely distributed with an estimated extent of occurrence >150,000 km². The species is endemic to Australia and is the second largest freshwater crayfish worldwide, with a maximum documented occipital carapace length of 174 mm. It is long-lived (~28 years), slow-growing ($K = 0.0933$), late-maturing (~8–9 years) and has low fecundity (up to 2000 eggs per mature female each breeding event) (Gilligan, Rolls et al. 2007, Furse and Coughran 2011). It spawns annually and utilises a winter-spring brooder strategy (Morison 1988, Gilligan, Rolls et al. 2007).



Murray Crayfish prefer relatively cool, oxygenated (dissolved oxygen (DO) concentrations >2 mg L⁻¹) water with physical structure (Geddes, Musgrove et al. 1993, McCarthy 2005, Gilligan, Rolls et al. 2007). Freshwater crayfish are considered intolerant to pollutants and pesticides, yet no thresholds have been defined for Murray Crayfish (e.g., Gilligan, Rolls et al. 2007). It is capable of short-term emersion to avoid adverse conditions, although mortality can result from extended periods out of the water (McKinnon 1995).

Murray Crayfish is an iconic species endemic and once widespread in the waterways of the southern Murray-Darling Basin (MDB). This species has experienced substantial declines in range and abundance over the second half of the twentieth century (Gilligan, Rolls et al. 2007, Furse and Coughran 2011). Recent population decline across sections of its range (McCarthy, Zukowski et al. 2014, Noble and Fulton 2017, Whiterod, Zukowski et al. 2018) indicate that the species is experiencing a declining trend in population status, fostering concerns over its long-term sustainability. Murray crayfish has been listed as a vulnerable species under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (Date effective 05-Mar-2025). Murray Crayfish is considered *threatened* in Victoria under the *Flora and Fauna Guarantee Act 1988*, *vulnerable* in NSW (*Fisheries Management Act 1994*)

and the ACT (*Nature Conservation Act 1980*) and protected in South Australia under the *Fisheries Management Act 2007*.

In response to species decline, there has been dedicated research and monitoring focusing on the following:

- sustainability of recreational fishing ([Zukowski, Curtis et al. 2011](#), [Zukowski, Watts et al. 2012](#), [Zukowski, Whiterod et al. 2013](#)),
- the impacts of extreme hypoxic blackwater ([King, Tonkin et al. 2012](#), [McCarthy, Zukowski et al. 2014](#), [Whiterod, Zukowski et al. 2018](#)),
- habitat degradation ([Noble and Fulton 2017](#)),
- a comprehensive genetic assessment ([Whiterod, Zukowski et al. 2017](#)),
- the development of a stochastic population model to provide a framework to address management and conservation scenarios ([Todd, Whiterod et al. 2018](#), [Whiterod, Todd et al. 2020](#)), and
- Murray crayfish conservation genomics analysis (paper in prep.).

In addition, translocations undertaken over five years on the Murray River, near Echuca, have resulted in the establishment of a translocation method ([Whiterod, Asmus et al. 2021](#)) and assessment of conservation translocation feasibility for the entire genus (*Euastacus*) has been undertaken, with specific reference to priority 2019-20 bushfire-impacted species ([Zukowski, Whiterod et al. 2021](#)).

This collaborative research and monitoring has improved the wider understanding of the species and facilitated effective conservation management. It has also emphasised the requirement for research and monitoring to conserve known populations of this threatened species, particularly for populations with potential to be impacted by disturbance.

The species was historically abundant in the region of the Tumut River, which is artificially impounded by Talbingo Reservoir ([Gilligan, Rolls et al. 2007](#)). Whilst a flow specialist, Murray Crayfish has persisted following the construction of the reservoir and the species is protected from recreational fishing in the reservoir. The population has been shown to be genetically distinct from a broad, interbreeding lowland population across the wider Murray-Murrumbidgee region ([Whiterod, Zukowski et al. 2017](#)). Targeted annual surveys within Talbingo and Blowering Reservoirs during the period 2008–2010 provided the first

assessment of the status of the species in these reservoirs ([Zukowski, Whiterod et al. 2013](#)). In Talbingo Reservoir, Zukowski *et al.* (2013) demonstrated a healthy population with a 1:1 sex ratio, and good population structure (including regular recruitment and long-term survival). Whilst sampling of a single site in 2013 in Talbingo Reservoir (NSW DPI, unpublished data) demonstrated a similar abundance, a considerable reduction in catch was observed in 2018 surveys ([Cardno 2019](#)), raising concern about the status of the species in the reservoir. In the winter of 2019, 2020, 2021, 2022, 2023 and 2024 surveys were undertaken to resolve the status of Murray Crayfish populations in Talbingo Reservoir to better inform considerations for the species in the Snowy 2.0 project. Fourteen sites were sampled within the reservoir (7 existing sites previously surveyed and 7 new sites) at which 19, 14, 18, 33, 6 and 21 individuals were recorded, respectively. ([Zukowski and Whiterod 2019](#), [Zukowski, Whiterod et al. 2020](#), [Zukowski and Whiterod 2022](#), [Zukowski and Whiterod 2023](#), [Zukowski and Whiterod 2024](#), [Zukowski and Whiterod 2024](#)). This project used a repeat spatial monitoring design in 2025 to determine and compare the numbers of Murray Crayfish one, two, three, four, five and six years on from the 2019, 2020, 2021, 2022, 2023 and 2024 surveys, respectively, and determine presence of Murray Crayfish within Talbingo Reservoir in 2025. In 2025, an additional two locations within the area to be impacted by Future Generation were also sampled.

In February 2023, January 2024, and June 2024, additional surveys targeting Murray Crayfish were undertaken to determine the status of Murray Crayfish populations in Yarrangobilly River (3 sites) and Wallace Creek (2 sites) to further inform considerations for the species in the Snowy 2.0 project. During this sampling, two crayfish were sampled in 2023, one in Yarrangobilly River and one in Wallace Creek and one Murray Crayfish was sampled in Wallace Creek in January 2024 and no Murray Crayfish were sampled in June 2024. Six Murray crayfish were previously detected at two sites (one in Yarrangobilly River and five in Wallace Creek) during Environmental Impact Statement (EIS) surveys. Backpack electrofishing was selected for the survey method as it is a very effective technique for collecting crayfish in a variety of freshwater habitats, and is particularly effective for shallow, slow flowing streams and for drawing crayfish out from sources of instream cover (e.g., logs, boulders). It is restricted to use in shallow (<1.25 m) water with low turbidity and a

conductivity of 10–1500 $\mu\text{S cm}^{-1}$. In June 2025, the sites were again sampled, and results outlined in this report.

Project objectives

The specific objectives of this project were to:

- Undertake a comprehensive repeat survey in 2025 of sites surveyed in 2019/2020/2021/2022/2023/2024 in Talbingo Reservoir.
- Translocate any Murray Crayfish sampled at sites 9, 10, 11 and 14 into another section of Talbingo Reservoir less likely to be affected by works.
- Undertake a repeat survey of Murray Crayfish in the Yarrangobilly River and Wallace Creek.
- Record habitat (physical structure, aquatic vegetation, water depth and location (GPS coordinates) for each net deployment and site-based water quality parameters).
- Collect data on population abundance and demographics (length, weight, sex ratio, reproductive stages of individuals).
- Consider (a) the spatial trend in abundance and demographics, and (b) presence in southern areas of Talbingo Reservoir, Yarrangobilly River and Wallace Creek.

Field surveys (Talbingo Reservoir)

Study region

Talbingo Reservoir (Figure 1) occurs within and adjacent to the Kosciuszko National Park just south of Tumut in the Murrumbidgee Valley on the Tumut River, south-eastern Australia. The reservoir, completed in 1970, creates a head storage for the operation of the Snowy Hydro Tumut 3 hydroelectric pump-storage project. Water released from the reservoir is used to supply irrigation and industry, hydro-power and environmental flows. The reservoir is also used for recreational activities including waterskiing, sailing, boating, and fishing. It is primarily fed by releases from Tumut 2 power station tailrace at the southern end of the reservoir. Other waterways provide additional inflows, including Tumut and Yarrangobilly Rivers, and Long, Honeysuckle, Plain and Middle Creeks. The study region was severely affected by bushfires in January 2020.



Figure 1. Talbingo Reservoir location (left), images of reservoir (top middle and right) and works associated with Snowy 2.0 project (bottom middle and right).

Survey sites

The targeted surveys of Murray Crayfish in Talbingo Reservoir were undertaken 2nd to 16th June 2025. Repeat sampling of the 14 sites surveyed in 2019, 2020, 2021, 2022, 2023 and 2024 was undertaken to allow spatial comparison (Table 1 and Figure 2). The seven existing sites (sites 1–7) of Zukowski et al. (2013), including site 3 – Honeysuckle, also sampled previously (NSW DPI, unpublished data; and Cardno 2019), and seven additional sites (sites 8–14) were sampled to assess areas that may be subjected to disturbance from Snowy 2.0 Main Works. An additional two sites were also sampled to investigate the presence of crayfish in two Future Generation sites where substrate additions were planned which could impact crayfish at these sites. Particular attention was given to the Yarrangobilly River and Middle Creek arms of Talbingo Reservoir (Figure 2).

Table 1. Summary of sites sampled across Talbingo Reservoir in 2025.

Site no.	Site description	Date sampled	(Zone 55)	
			Latitude	Longitude
1	Adjacent to car park	13/6/2025	-35.62940	148.30534
2	Near swimming area	13/6/2025	-35.63425	148.29387
3	Honeysuckle Creek arm	12/6/2025	-35.68451	148.29282
4	Landers Creek arm	12/6/2025	-35.65421	148.32961
5	Lick Hole Creek arm	11/6/2025	-35.70437	148.33427
6	Long Creek arm/Cascade Bay	11/6/2025	-35.74113	148.32155
7	O'Hares Campground (Sue City)	10/6/2025	-35.81193	148.36365
8	Plain Creek arm	10/6/2025	-35.75841	148.34213
9	Opposite Tumut and Yarrangobilly rivers	9/6/2025	-35.75852	148.35837
10	Middle Creek arm	5/6/2025	-35.76043	148.37302
11	Yarrangobilly River upstream	5/6/2025	-35.77102	148.37379
12	Yarrangobilly River middle	4/6/2025	-35.77266	148.37862
13	Yarrangobilly River bottom	4/6/2025	-35.77411	148.38280
14	Open site at rivers junction	9/6/2025	-35.75714	148.35378
FG1	Future Generation 1	6/6/2025	-35.76932	148.37556
FG2	Future Generation 2	6/6/2025	-35.77145	148.37555

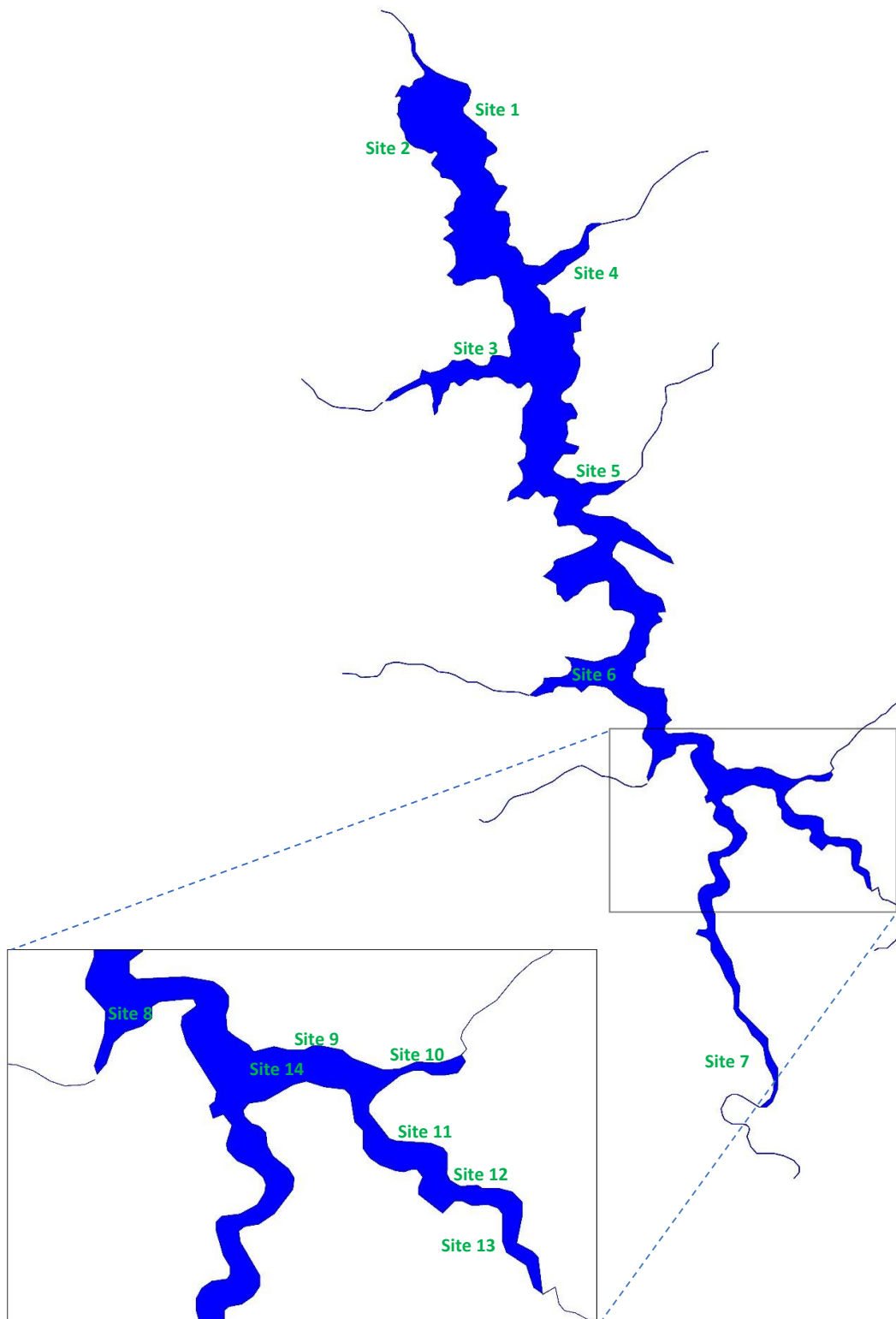


Figure 2. Sites sampled across Talbingo in the present study.

Survey methods

In Talbingo Reservoir, the field survey employed hoop and Munyana nets (Figure 3) to maximise the probability of detection. The standardised hoop net sampling protocol was employed at each site (sites 1–14 and FG1-2), with 20 replicate single hoop nets (700 mm diameter with a mesh size of 13 mm) baited with approximately 300 g of ox liver set and checked hourly (and deployed at the same location) for a total of three hours (60 hoop net hauls per site) during daytime hours (0800–1700) ([Zukowski, Whiterod et al. 2013](#), [McCarthy, Zukowski et al. 2014](#), [Whiterod and Zukowski 2017](#), [Whiterod, Zukowski et al. 2018](#)).

Munyana nets, a type of commercially available crab net (Munyana net, Wishart, Queensland: 60 mm mesh, two 0.76 m diameter steel hoops and two 0.18 m × 0.12 m openings), were used in addition to hoop nets at all sites to increase the rate of capture (see McCarthy 2005). At each of these sites, nets were baited with approximately 300 g of ox liver and set overnight. This type of method is designed to have greater retention of crayfish unlike hoop nets from which crayfish can enter and exit.

For each net, location (latitude and longitude), time set and retrieved, sampling level (in metres above sea level, mAHD, to account for variation in reservoir level), water depth, and habitat descriptors was recorded. Water quality parameters (water temperature, pH, dissolved oxygen concentration and electrical conductivity) (HANNA HI98194 multiprobe) and percentage cover of submerged aquatic vegetation were recorded at each site.

Data collection

Sampled Murray Crayfish were sexed, weighed (W, in g) using waterproof scales (A&D weighting, Tokyo, Japan) and occipital carapace length (OCL, measured from the rear of the eye socket to the middle of the rear of the carapace, to the nearest 0.1 mm) was measured using Vernier calipers (Kinchrome, Scoresby, Victoria, Australia). The stage of maturity ([stages 1-3: following Turvey and Merrick 1997](#)) was recorded for females as was the presence of eggs. Additionally, each crayfish was marked using a Uni PAINT PX-20 marker ([Mitsubishi Pencil Co. Ltd, Milton Keynes, UK: see Ramalho, McClain et al. 2010](#)) to identify potential recaptures (during sampling events) before being returned to the water at the point of capture. These marks persist for months (potentially until the next moult which occurs annually in adult crayfish) and have been employed successfully for a medium-term

mark-recapture study on the species ([Zukowski, Asmus et al. 2018](#)). Note Murray Crayfish sampled at sites 9, 10, 11 and 14 were relocated to site 8 during 2025 surveys.



Figure 3. Munyana (top) and hoop (bottom) nets with Murray Crayfish sampled from Talbingo Reservoir.

In addition to this current report, the following data is maintained in an Excel spreadsheet.

- Data on surveys completed (date, method);
- Descriptive information (GPS location, sampling level and water depth, bank habitat) for each hoop and Munyana net deployment;
- Number of individuals caught; and
- Demographic information (length, weight, sex and life stage) for all sampled crayfish.

Results (Talbingo Reservoir)

Catch summary

In total, 21 Murray Crayfish (7 females, 14 males) were sampled from 960 hoop net retrievals (1 crayfish) and 82 Munyana net retrievals (20 crayfish) in Talbingo Reservoir during June 2025 surveys. Most Murray Crayfish sampled appeared in good health with no obvious deformities, disease, or parasite infestations apparent (Figure 4). Seven females were recorded, and all were sexually mature. Of the sexually mature females, four were carrying eggs (i.e. berried). Individuals were recorded from eight sites during the present survey (Table 2, Figures 5 and 6), compared to records from eight sites in 2024, three sites in 2023, eight sites in 2022 and five sites in 2021.

Table 2. Summary of Murray Crayfish sampled during 2025 surveys at 14 sites in Talbingo Reservoir and two FG Impact Sites (Occipital Carapace Length (OCL)); (Net type H=Hoop net, M=Munyana net).

Date	Site	Net type	Net No.	Latitude	Longitude	Depth (m)	Sex	Length mm (OCL)	Weight (g)	Crayfish notes
13/06/2025	1	M	5	-35.63276	148.30823	4	M	92	469	
13/06/2025	1	M	4	-35.62985	148.30522	7.4	M	81	228	
13/06/2025	1	M	4	-35.62985	148.30522	7.4	M	101	481	
13/06/2025	1	M	3	-35.63106	148.30502	8.1	F	133	983	Berried
13/06/2025	1	M	3	-35.63106	148.30502	8.1	M	122	928	
13/06/2025	1	M	3	-35.63106	148.30502	8.1	M	131	1028	
13/06/2025	1	M	3	-35.63106	148.30502	8.1	F	122	709	Berried
13/06/2025	1	M	2	-35.63232	148.30679	7	F	79	269	Berried
13/06/2025	1	M	1	-35.63234	148.30768	10	M	136	1148	
13/06/2025	1	M	1	-35.63234	148.30768	10	M	91.5	442	
12/06/2025	4	M	3	-35.65275	148.33246	5	F	131	962	
12/06/2025	4	M	5	-35.65319	148.32945	9	M	133	1125	
10/06/2025	5	M	4	-35.70244	148.33614	10	M	110	590	Missing L claw and 3 legs
10/06/2025	5	M	4	-35.70244	148.33614	10	F	111	772	Berried
10/06/2025	5	M	3	-35.70237	148.33707	10	M	131	995	
10/06/2025	8	M	3	-35.76128	148.34122	6	M	103	411	No claws
10/06/2025	8	H	11	-35.76110	148.34125	10	M	91	528	
9/06/2025	9	M	4	-35.75908	148.36226	4	M	101	631	#3. Relocated to site 8
5/06/2025	11	M	2	-35.77202	148.37582	8	M	137	694	#4. Broken R claw. Relocated to site 8
9/06/2025	14	M	2	-35.75897	148.35686	4.5	F	129	978	#2. Relocated to site 8
6/06/2025	FG1	M	3	-35.76919	148.37561	4	F	129	763	#1. Relocated to site 8



Figure 4. Murray Crayfish captured in Talbingo Reservoir in June 2025 including berried females (Top left and Bottom left) and a Yabby (Middle Left).

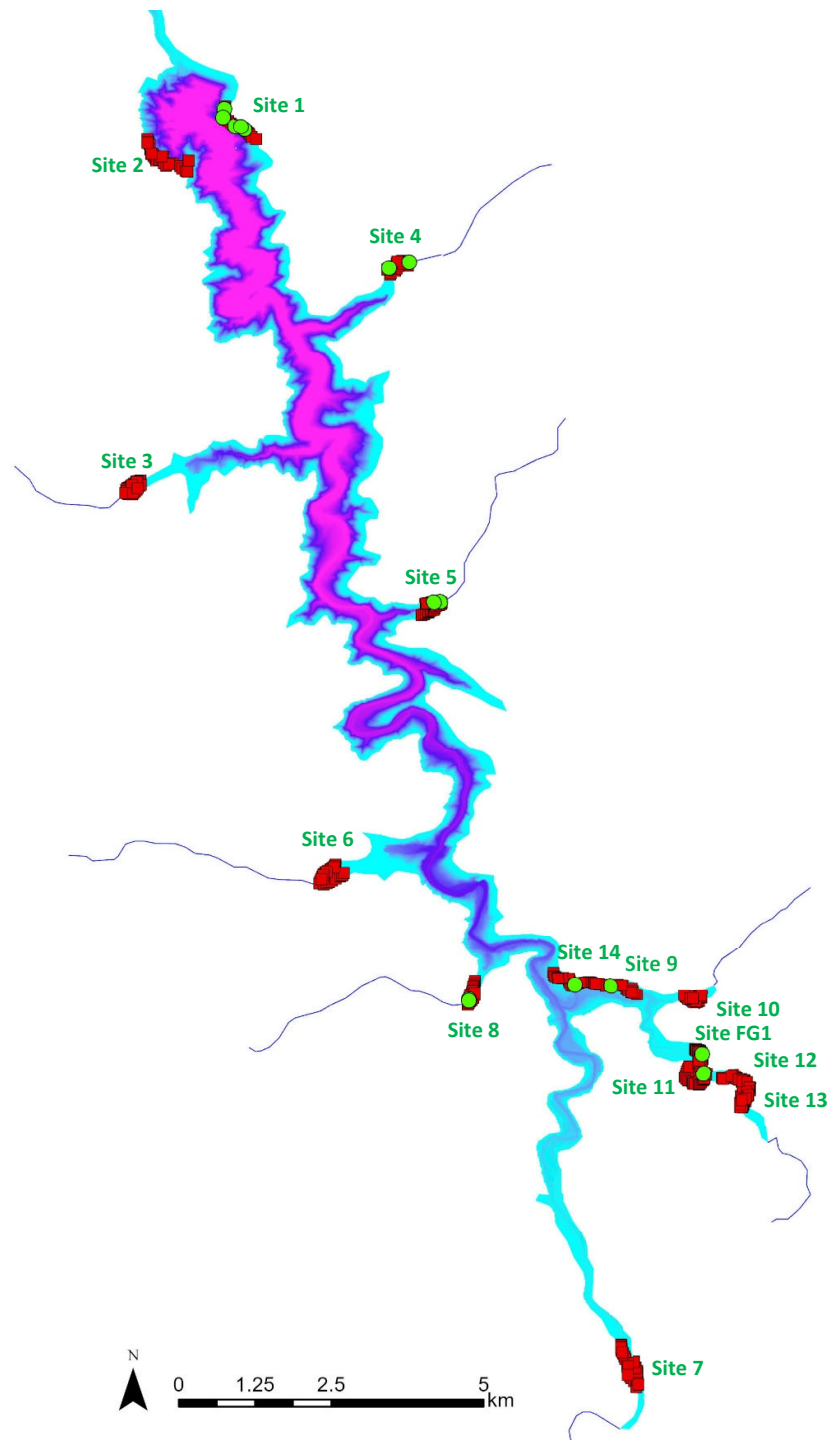


Figure 5. Individual net deployments (red circles) and captured crayfish locations (green circles) in Talbingo Reservoir June 2025. The bathymetry of the reservoir is also shown, with shallower (<20 m) areas indicated in light blue.

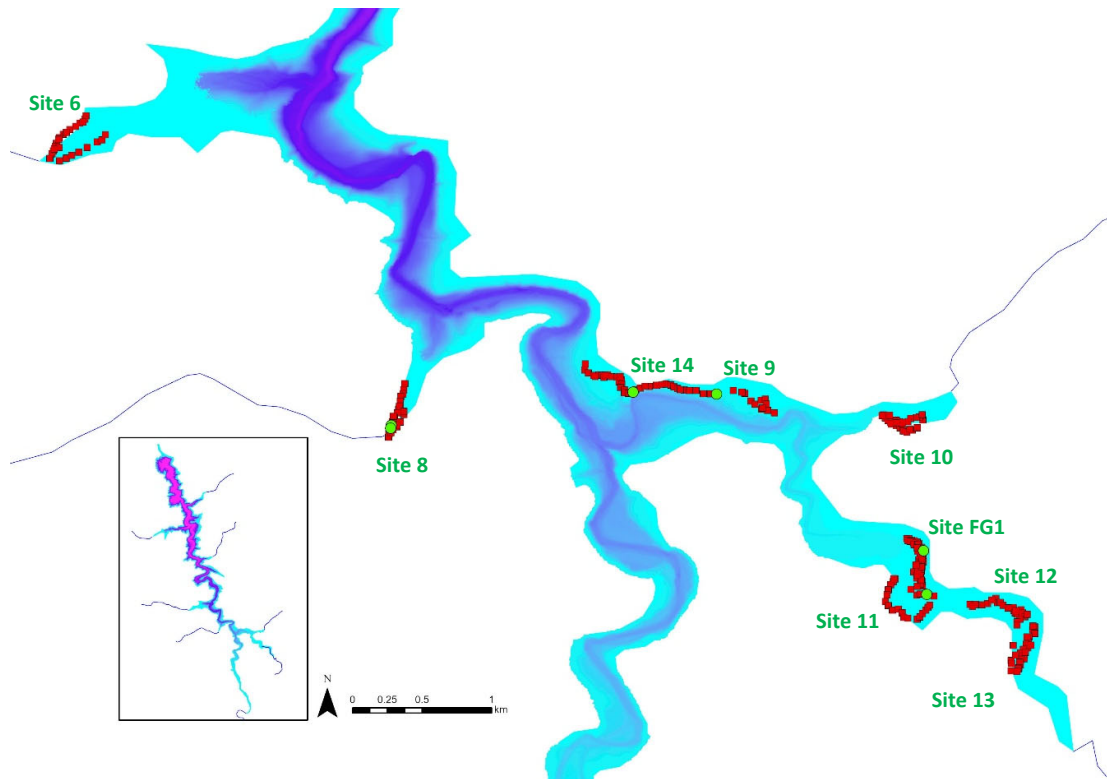


Figure 6. Close up map of the locations of net deployments and crayfish captures in the southern section Talbingo Reservoir in 2025. The shallower (<20 m) areas indicated in light blue.

Changes over time

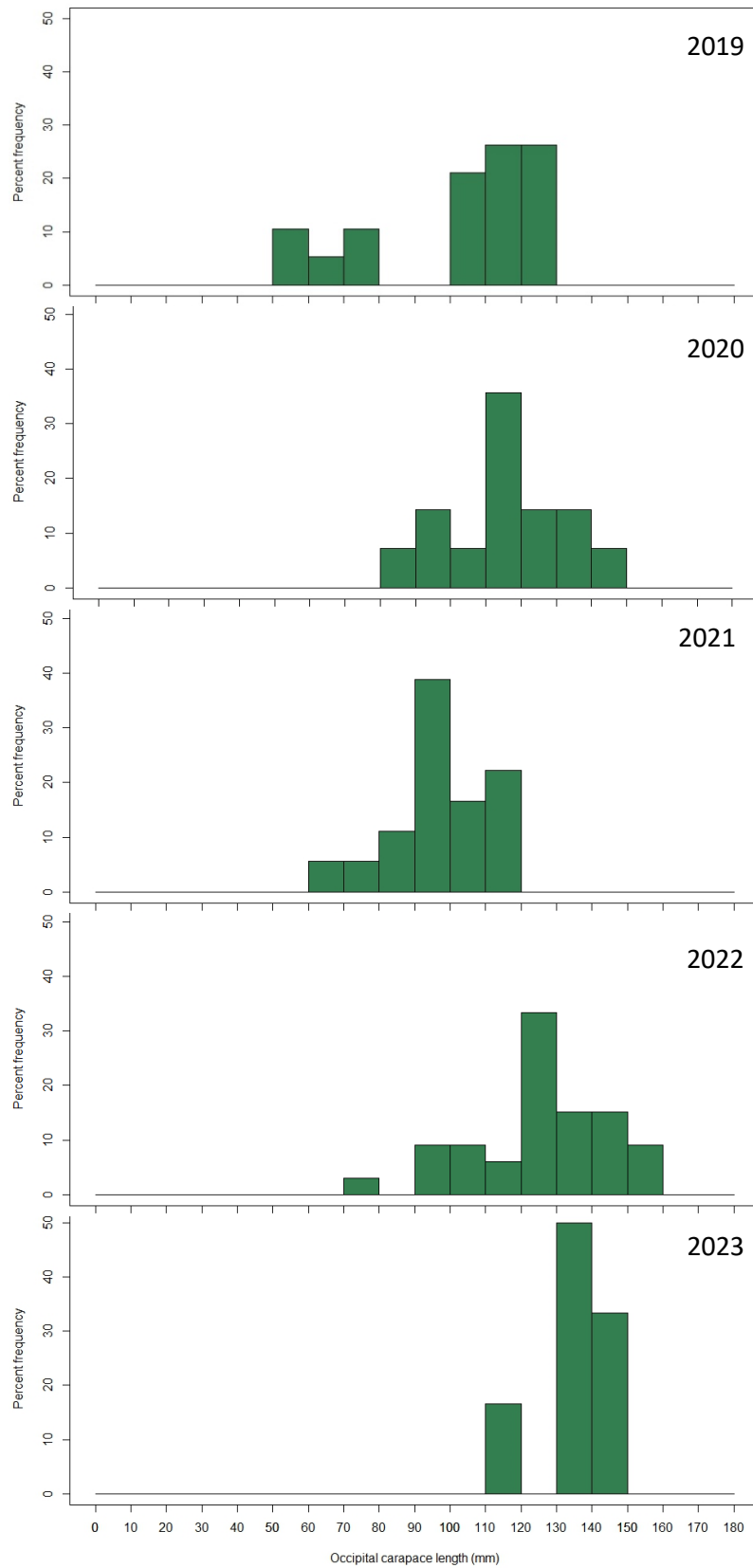
In total, 21 Murray Crayfish (7 females, 14 males) were sampled in Talbingo Reservoir during the June 2025 surveys. For comparison, 19, 14, 18, 33, 6 and 21 individuals were recorded during the 2019, 2020, 2021, 2022, 2023 and 2024 sampling, respectively, and a total of 188 individuals (95 females (13 berried), 93 males) were recorded over the three years of sampling between 2008 and 2010 (Table 3; Table 4). Murray Crayfish were detected at eight sites (sites 1, 4, 5, 8, 9, 11, 14 and FG1) during the 2025 sampling. In comparison, Murray Crayfish were detected in eight sites in 2024, three sites in 2023, eight sites in 2022, five sites in 2021, six sites in 2020 and eleven sites in 2019.

Table 3. Summary of Murray Crayfish numbers across the 14 sampled sites and 2 FG sites (2025 only) from combined 2008–2010 (Zukowski et al 2013) data, 2019, 2020, 2021, 2022, 2023, 2024 and 2025 survey data. HN=Hoop Net, MN=Munyana Net.

Site	2008– 2010 HN	2019 HN	2019 MN	2019 Total	2020 HN	2020 MN	2020 Total	2021 HN	2021 MN	2021 Total	2022 HN	2022 MN	2022 Total	2023 HN	2023 MN	2023 Total	2024 HN	2024 MN	2024 Total	2025 HN	2025 MN	2025 Total
1	19	3		3	1	1	2	1	7	8	2	5	7	1		1	1	4	5		10	10
2	3	1		1								2	2									
3	13	1		1	1	2	3										1		1			
4	73							1	1	2		1	1					1	1		2	2
5	47				1		1										1	4	5		3	3
6	12		1	1								4	4		3	3						
7	21							1		1								1	1			
8			3	3	2		2	1	5	6	2	4	6					2	2	1	1	2
9		2	3	5	1	1	2		1	1		1	1		2	2		2	2		1	1
10		1		1																		
11		1		1								1	1								1	1
12			1	1																		
13			1	1																		
14			1	1	2	2	4					11	11					4	4		1	1
FG1	Not sampled in previous years																				1	1
FG2	Not sampled in previous years																					
TOTAL	188			19			14			18			33			6			21			21

Length structure

In June 2025, all sampled Murray Crayfish were adults and ranged from 79 to 137 mm OCL, and 228 to 1148 g (Figure 7). All sampled individuals, apart from five, were above 100 mm OCL in size in 2025. All the Murray crayfish sampled in 2024 were above 88 mm OCL with 19 of the 21 individuals over 100 mm OCL in size. All the Murray Crayfish sampled in 2023 were above 120 OCL in size. Larger Murray Crayfish were mainly found in 2022, and the majority of smaller individuals were sampled in 2019 (Figure 7).



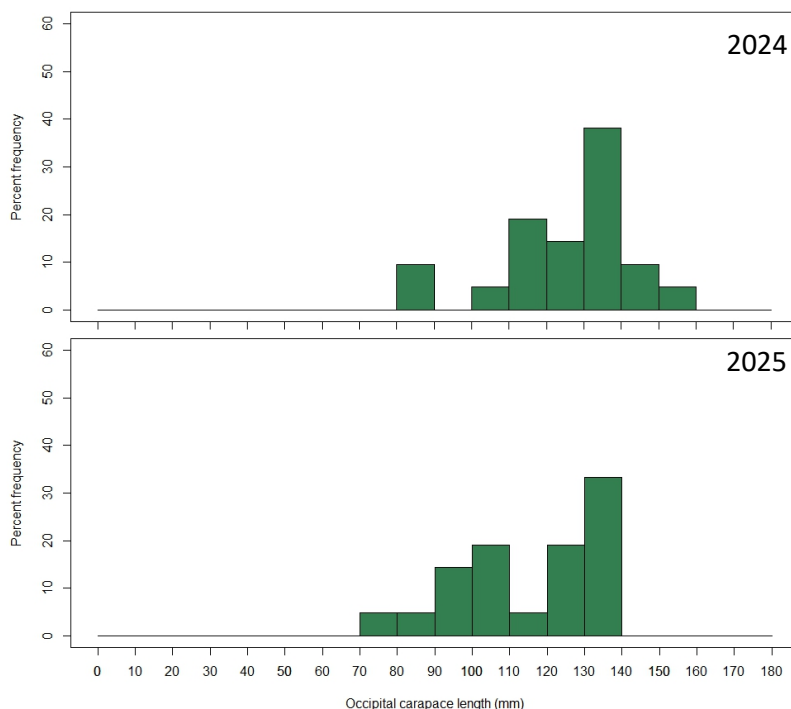


Figure 7. Length structure of Murray Crayfish in Talbingo Reservoir in 2019, 2020, 2021, 2022, 2023, 2024 and 2025 top to bottom, respectively.

Habitat and Site Characteristics

Nets were deployed at depths between 1.5 – 16m (525.7 to 540.9 mAHD) with Murray Crayfish recorded at depths between 4 – 10 m (Table 4). Of the sampled crayfish, only one was found using hoop nets with the remaining twenty individuals detected in Munyana nets (Table 4). Meso-habitat varied between sites and included irregular bank, matted bank, smooth bank and mid-channel. Murray Crayfish were sampled in areas with irregular bank, matted bank and mid-channel (Table 4). The percentage presence of aquatic vegetation was slightly higher in comparison to that found in 2024, 2023, 2022, 2021 and 2020 sampling throughout most of the reservoir. At the time of 2025 sampling, the majority of sites had submerged aquatic vegetation present in low concentrations ($\leq 20\%$ cover), however sites 3, 6 and 12 recorded aquatic vegetation of over 50% (Table 5). Aquatic vegetation was a mixture of Canadian Pondweed *Elodea canadensis*, *Potamogeton* sp. and *Chara* sp..

Table 4. Summary of net type, sampling level and water depth and meso-habitat present where Murray Crayfish were captured in June 2025.

Site	Net type	Net no.	Sampling level (mAHD)	Water depth (m)	Meso-habitat	No. of crayfish
1	M	1	530.098	10	Matted Bank	2
1	M	2	533.098	7	Irregular bank	1
1	M	3	532.098	8	Irregular bank	4
1	M	4	532.698	7.4	Irregular bank	2
1	M	5	536.098	4	Irregular bank	1
4	M	3	536.034	5	Mid Channel	1
4	M	5	532.034	9	Irregular bank	1
5	M	3	531.742	10	Irregular bank	1
5	M	4	531.742	10	Matted bank	2
8	H	11	535.745	6	Matted bank	1
8	M	3	531.745	10	Matted bank	1
9	M	4	537.667	4	Irregular bank	1
11	M	2	533.303	8	Irregular bank	1
14	M	2	537.167	4.5	Irregular bank	1
FG1	M	3	536.947	4	Irregular bank	1

Water Quality

Water quality parameters varied across the 16 sites (Table 5). Salinity (EC) was relatively fresh throughout the reservoir and ranged from 22 μScm^{-1} (Site 7) to 51 μScm^{-1} (Site 13). This was similar to EC noted in 2019 (25–76 μScm^{-1}), 2020 (27–80 μScm^{-1}), 2021 (30–56 μScm^{-1}), 2022 (24–58 μScm^{-1}), 2023 (26–40 μScm^{-1}) and 2024 (20–40 μScm^{-1}). Water temperature ranged between 10.72 and 12.08 °C and was like water temperature sampled in 2024 (9.4–11.6°C), 2023 (8.14–10.19°C) and 2022 (7.60–12.98°C), where surveys were also undertaken in June. Water temperature was lower than that sampled in 2021 (11.5–15.8°C), reflecting the later sampling time in the year in 2021, and slightly higher than that found in 2019 (4.15–11.82°C) and 2020 (4.4–10°C). The pH was generally near neutral in 2025 with a range of 6.81 – 7.45. The pH was similar in 2024 (6.78 – 7.62), 2023 (6.01 to 7.03), 2022 (6.11–7.18) and in 2021 (6.13–7.21). In 2020, an alkaline pH above 8 was found at all sites (8.05–8.53) and a mostly slightly acidic pH found in 2019 (6.35–7.09). Dissolved oxygen concentrations (measured during the day) (8.78 – 12.34 mgL^{-1}) were higher than those sampled in 2024 (6.8–8.2 mgL^{-1}), 2023 (7.3–8.9 mgL^{-1}) and 2022 (5.4–8.6 mgL^{-1}) and similar to those sampled in previous years (2019 >11 mgL^{-1} , 2020 >10 mgL^{-1}).

Table 5. Summary of water quality parameters and percentage submerged aquatic vegetation cover at the 14 sampled sites and 2 Future Generation sites in Talbingo Reservoir in June 2025.

Site	Temp (°C)	pH	EC (μScm^{-1})	DO (mgL^{-1})	Submerged aquatic vegetation cover %
1	11.57	7.11	26	11.5	0
2	11.68	6.81	26	11.61	0
3	11.56	7.42	27	11.54	80
4	11.68	7.3	26	11.27	10
5	11.89	7.42	26	11.76	10
6	11.7	7.45	27	10.25	40
7	10.72	7.15	22	11.06	25
8	11.7	7.08	27	11.74	20
9	11.61	7.37	30	11.34	15
10	11.8	7.11	36	9.21	5
11	11.75	7.2	38	9.42	10
12	12.08	6.93	40	8.78	50
13	10.88	7.12	51	8.83	25
14	11.73	7.45	28	12.34	15
FG1	11.72	7.25	38	10.46	5
FG2	11.54	7.18	40	10.68	0

Field surveys (Yarrangobilly River and Wallace Creek)

The Yarrangobilly River, located in south New South Wales, flows in a general southwest direction. The river commences at an elevation of 1490 m near Kennedy Ridge and flows into Talbingo Reservoir (573 m), downstream of Lobs Hole. The Yarrangobilly River drops approximately 935 m over its 50 km course. Wallace Creek, a major channel that flows into Yarrangobilly River in New South Wales starts at an elevation of 271 m and drops to an elevation of 157 m. Flows into Wallace Creek and Yarrangobilly River are generally year-round with higher flows occurring during late winter and early spring.

Survey sites

Five sites in total were sampled in the Yarrangobilly River (n=3) and Wallace Creek (n=2) (Table 6, Figure 8) in June 2025. Sites were chosen based on previous sampling, accessibility, and available Murray Crayfish habitat. Sites are labelled as YR1-3, WC1-2. These sites were previously known as 1A, YR1, TR-18-232 (Yarrangobilly River), 2B, 2A/TR-18-231 (Wallace Creek), respectively. One Murray Crayfish was sampled in Wallace Creek (WC1) in 2024 Jan, and two Murray Crayfish were sampled in February 2023, one in WC2 and one in YC1. Six Murray crayfish were previously detected at two sites (YR2 (n=1), and 2A/TR-18-231 (n=5)) in Yarrangobilly River and Wallace Creek, respectively, during the Environmental Impact Statement (EIS) surveys.

Table 6. Summary of sites sampled in Yarrangobilly River and Wallace Creek and Volts and Hz used at each site during backpack electrofishing in June 2025.

Site	Date	Start Latitude	Start Longitude	End Latitude	End Longitude	Volts	Hz
YR1	03/06/2025	-35.7823	148.3868	-35.784	148.3880	500	75
YR2	03/06/2025	-35.7847	148.3947	-35.7860	148.3960	500	75
YR3	03/06/2025	-35.7924	148.4038	-35.7940	148.4040	500	60
WC1	03/06/2025	-35.7932	148.4137	-35.7943	148.4153	500	60
WC2	03/06/2025	-35.7920	148.4119	-35.7928	148.4132	500	60



Figure 8. Three sites sampled across Yarrangobilly River and Wallace Creek. Top left site WC1, Top right site WC2, bottom row YR3.

Survey methods

In the Yarrangobilly River and Wallace Creek, field surveys employed backpack electrofishing methodology due to the shallow and flowing nature of the water body (Figure 8), to maximise the probability of detection. Standard operating procedures ([Mossop and Whiterod 2018](#)) were utilised as follows: Backpack electrofishing uses a pulsed DC current to attract and temporarily immobilise crayfish which were then collected by fibreglass dip nets. Surveys used a Smith Root LR24 backpack electrofishing unit (output settings range from 50-990 volts, 40 amps peak current, pulses from 1-120 Hz and maximum continuous power output of 400 watts). Low settings were first used, then gradually increased to ensure a satisfactory catch rate while minimising potential injury to fauna.

Electrofishing was conducted with one operator (wearing the electrofisher) accompanied by one netter (carrying fibreglass-handled dip nets). The team moved in an upstream direction to avoid working in disturbed, stirred up water. Periodically the electrofisher was engaged

to stun crayfish, then disengaged when fauna was spotted and subsequently netted. Each site covered 8 x 150 seconds of 'on time'.

For each site, the location (longitude and latitude), start time, water depth, and habitat descriptors was recorded. Water quality parameters (water temperature, pH, dissolved oxygen concentration and electrical conductivity) (HANNA HI98194 Multiprobe) and percentage cover of submerged aquatic vegetation was recorded at each site.

Data collection

If detected, sampled Murray Crayfish were sexed, weighed (W, in g) using waterproof scales (A&D weighting, Tokyo, Japan) and occipital carapace length (OCL, measured from the rear of the eye socket to the middle of the rear of the carapace, to the nearest 0.1 mm) was measured using Vernier calipers (Kinchrome, Scoresby, Victoria, Australia). The stage of maturity ([stages 1-3: following Turvey and Merrick 1997](#)) was recorded for females as was the presence of eggs. Additionally, each crayfish was marked using a Uni PAINT PX-20 marker ([Mitsubishi Pencil Co. Ltd, Milton Keynes, UK: see Ramalho, McClain et al. 2010](#)) to identify potential recaptures (during sampling event) before being returned to the water at the point of capture. These marks persist for months (potentially until the next moult which occurs annually in adult crayfish) and have been employed successfully for a medium-term mark-recapture study on the species ([Zukowski, Asmus et al. 2018](#)).



Figure 9. Backpack electrofishing used to sample for Murray Crayfish in Yarrangobilly River and Wallace Creek.

Results (Yarrangobilly River and Wallace Creek)

Catch summary

No Murray Crayfish were sampled during the backpack electrofishing in June 2025. One Murray Crayfish, approximately 100 mm OCL was observed at YR2 but was too far into bank habitat to sample. Bycatch including Brown Trout, Rainbow Trout and Redfin Perch were sampled during backpack electrofishing surveys.

Water Quality and site characteristics

Water quality in 2025 was different to that sampled during warmer months in 2024 and 2023 most likely due to the different time of year at sampling (Table 7). The pH sampled in 2025 was slightly acidic (6.42-6.58) and different to 2024 where the water was slightly alkaline. The water was fresh with 28-32 μScm^{-1} , and dissolved oxygen relatively high (7.18-7.68 mgL^{-1}). Water quality was suitable for Murray Crayfish at the sampled site except for the pH which was slightly acidic and would be more suitable ≥ 7 . There was a lack of submerged aquatic vegetation at the sites, with rock, boulder and bedrock making up most of the instream substrate. Sedimentation and silt were noted at the sites similar to that observed in 2024 and 2023. Flow past the Yarrangobilly gauging station was lower on the sampling day (3 June 2025) (0.577 m^3/s) compared to previous sampling occasions (June 2024; 0.9 m^3/s , January 2024; 1.9 m^3/s , February 2023; 1.5 m^3/s).

Table 7. Summary of water quality parameters and percentage submerged aquatic vegetation cover at Yarrangobilly River and Wallace Creek in June 2025.

Site	Temp ($^{\circ}\text{C}$)	pH	EC (μScm^{-1})	DO (mgL^{-1})	Depth (m)	Submerged aquatic vegetation cover %
YR1	10.9	6.52	28	7.18	0.1-0.2	0
YR2	10.9	6.58	28	7.20	0.1-0.3	0
YR3	10.9	6.53	28	7.68	0.1-0.2	0
WC1	10.9	6.45	32	7.21	0.1-0.3	1
WC2	10.9	6.42	32	7.30	0.1-0.3	1

Discussion

The present survey provided an assessment of the status of the Murray Crayfish population in Talbingo Reservoir and in Yarrangobilly River and Wallace Creek in June 2025.

Talbingo Reservoir

By utilising the same monitoring design over the past seven years, a robust and comparative assessment has been undertaken of the ongoing presence of the species in the reservoir and of key metrics (abundance, length structure, evidence of recruitment) of Murray Crayfish as well as assessments of the habitat and water quality parameters associated with Murray Crayfish. In 2025, Murray Crayfish found at sites 9, 10, 11 and 14 and the FG sites were moved to site 8 to remove them from possible impact sites.

Murray Crayfish were found in low numbers ($n=21$) during the June 2025 survey in Talbingo Reservoir, the same number of individuals as was sampled in 2024, however numbers were higher than that sampled in 2023 where only six individuals were sampled. Prior to 2023, the number of Murray Crayfish sampled in the reservoir had increased over the past three years with 14, 18 and 33 individuals sampled from 2020 to 2022, respectively. Although these numbers were significantly lower than those sampled from 2008 to 2010 ($n=188$), the increase in numbers was a positive indication that Murray Crayfish were persisting at a sustainable rate in the reservoir.

In 2025 Murray Crayfish were sampled at eight sites, with only one individual sampled at site 14, one of the future disturbance impact sites, where four individuals were sampled in 2024, and the most crayfish were found in 2022, despite no crayfish being found here in 2023. In 2025, seven females were recorded and all were sexually mature, as well as 14 male crayfish, the opposite of the 14 females and 7 males recorded in 2024. Of the sexually mature female crayfish in 2025, four were berried with bright red healthy eggs which is a positive sign of ongoing reproduction occurring in Talbingo Reservoir. In comparison eight berried females were sampled in 2024, three in 2023, fourteen in 2022, eight during 2021 and five in 2019 and 2020. Two Juvenile-sized crayfish (< 85 mm OCL) were sampled in 2025, however the female at 79 mm was berried showing early maturation and the male at 81 mm being close to maturation. This is compared to 2024 where no juvenile crayfish were sampled with all individuals being mature (> 85 mm OCL). Although juveniles less than 50 mm OCL are rarely

sampled in crayfish surveys, individuals between 50 to 120 mm OCL are frequently sampled. Thus, the ongoing survival of juveniles and recruitment in the reservoir is uncertain.

Measured water quality parameters including low electrical conductivity and water temperature were suitable for Murray Crayfish at the time of sampling. Dissolved oxygen concentrations (measured during the day) were above 6.5 mgL⁻¹ at all sites in 2025. The pH was found to be slightly acidic at two sites, however, was overall more neutral in 2025 than 2024 where four sites were slightly acidic. Levels of pH at or below 7 could cause problems for calcification, molting, growth and reproduction (e.g., [Haddaway, Mortimer et al. 2013](#), [Beaune, Sellier et al. 2018](#)).

The microhabitat characteristics in which Murray Crayfish were found in 2025 included physical structure such as irregular banks, matted banks and mid-channel. These habitats provide shelter and refuge and are near clay banks which are believed to be necessary for burrowing ([Gilligan, Rolls et al. 2007](#), [Zukowski 2012](#), [Noble and Fulton 2017](#)). Just as in 2024, Murray Crayfish were only sampled in water depths ≤10 m which is deeper than that found in 2023 (8 m) but shallower than found in previous years (< 13 m). This depth may reflect the preferred depth and habitat as guided by environmental parameters such as dissolved oxygen levels, proximity to available burrows, habitat availability and food source availability.

In 2025, as in the previous four years, the majority of Murray Crayfish were sampled in Munyana nets (n=20) with only one individual sampled in a hoop net. Interestingly, in 2019 and 2020 similar numbers of crayfish were captured using both methods. However, since 2021, using Munyana nets has shown to have higher sampling rates.

Yarrangobilly River and Wallace Creek

Murray Crayfish were surveyed using the backpack electrofishing methodology in Yarrangobilly River and Wallace Creek in June 2025 during lower flows than in previous sampling events. Decreased flow and water levels led to better visibility during the current sampling. Electrofishing for Murray Crayfish at Yarrangobilly River and Wallace Creek is recommended below 1.5 m³/s for future events to ensure best conditions and maximum sampling success. Increased sedimentation and silt at sites decreased visibility during January 2024, June 2024 and this sampling event.

No Murray Crayfish were sampled in June 2025. All sampled sites had good water quality despite the slightly acidic pH and flows suitable for Murray Crayfish, however, increased sedimentation and silt were observed indicating that habitat conditions were not optimal for the species. High numbers of trout and presence of redfin detected during past surveys could also be contributing to the low numbers of Murray Crayfish found. Predation by these fish species is likely a common occurrence.

Ongoing annual monitoring of the five sites is recommended through backpack electrofishing, following the methodology described in this report. Further, eDNA analysis as part of the monitoring could test for the presence of Murray Crayfish at each of the sites if no crayfish are detected in future monitoring events. The past presence of Murray Crayfish at these sites demonstrates that the species have persisted in these sites following the bushfires, albeit in low numbers, and populations may increase with time without further disturbance.

Conclusion

The number of Murray Crayfish sampled in 2025 was the same as 2024 and higher than 2023, however it is lower than historical surveys. The presence of berried females provides a positive indication of ongoing species recruitment and anticipated persistence in Talbingo Reservoir. The continued use of a robust repeat sampling methodology, as outlined in this report, allows the comparison of numbers of Murray Crayfish over time and space and allows for the detection of the presence of individuals throughout Talbingo Reservoir, including within the potential impact area associated with Snowy 2.0. The continued low numbers of individuals detected during more recent surveys, combined with the lack of juvenile crayfish records, highlights the importance of ongoing habitat and water quality management for the long-term viability of the remaining population in Talbingo Reservoir, and the wider distribution of the species in general. Ongoing monitoring and translocations to boost declining populations remain an essential component in the conservation management of this species.

In June 2025, the third round of backpack electrofishing surveys targeting Murray Crayfish were undertaken to determine the status of Murray Crayfish populations in the Yarrangobilly

River and Wallace Creek. One Murray Crayfish was observed but no Murray Crayfish were sampled, however previously low numbers have been detected. The inclusion of these sites in annual monitoring can be challenging due to variable river heights and flow, however, it is important when considering changes in the status of the overall population over time and space.

References

- Beaune, D., Y. Sellier, G. Luquet and F. Grandjean (2018). "Freshwater acidification: an example of an endangered crayfish species sensitive to pH." Hydrobiologia **813**(1): 41-50.
- Cardno (2019). Aquatic Ecology Impact Assessment. Appendix M.2, Snowy 2.0 Main Works Environmental Impact statement, EMM Consulting.
- Furse, J. M. and J. Coughran (2011). "An assessment of the distribution, biology, threatening processes and conservation status of the freshwater crayfish, genus *Euastacus* (Decapoda: Parastacidae) in continental Australia. III. Case studies and recommendations." Crustaceana Monographs: New Frontiers in Crustacean Biology **15**: 265-274.
- Geddes, M. C., R. J. Musgrove and N. J. H. Campbell (1993). "The feasibility of re-establishing the River Murray crayfish, *Euastacus armatus*, in the lower River Murray." Freshwater Crayfish **9**: 368-379.
- Gilligan, D., R. Rolls, J. Merrick, M. Lintermans, P. Duncan and J. Koehn (2007). Scoping the knowledge requirements for Murray crayfish (*Euastacus armatus*). Cronulla, NSW Department of Primary Industries.
- Haddaway, N. R., R. Mortimer, M. Christmas and A. M. Dunn (2013). "Effect of pH on growth and survival in the freshwater crayfish *Austropotamobius pallipes*." Freshwater Crayfish **19**(1): 53-62.
- King, A. J., Z. Tonkin and J. Lieshcke (2012). "Short-term effects of a prolonged blackwater event on aquatic fauna in the Murray River, Australia: considerations for future events." Marine and Freshwater Research **63**: 576-586.
- McCarthy, B. (2005). Distribution of Murray Crayfish (*Euastacus armatus*) in the Mallee Region 2004. Mildura, Murray-Darling Freshwater Research Centre.
- McCarthy, B., S. Zukowski, N. Whiterod, L. Vilizzi, L. Beesley and A. King (2014). "Hypoxic blackwater event severely impacts Murray crayfish (*Euastacus armatus*) populations in the Murray River, Australia." Austral Ecology **39**(5): 491-500.
- McKinnon, L. J. (1995). "Emersion of Murray crayfish, *Euastacus armatus* (Decapoda:Parastacidae), from the Murray River due to post-flood water quality." Proceedings of the Royal Society of Victoria **107**: 31-38.
- Morison, S. (1988). Results of surveys of Murray River spiny crayfish - *Euastacus armatus*. Unpublished report. Victoria, Kaiela Fisheries Research Station, Fisheries Division, Department of Conservation, Forests and Lands.
- Mossop, D. and N. Whiterod (2018). Standard Operating Procedures: Freshwater Crayfish Survey. Victor Harbor, Aquasave - Nature Glenelg Trust.
- Noble, M. M. and C. J. Fulton (2017). "Habitat specialization and sensitivity to change in a threatened crayfish occupying upland streams." Aquatic Conservation: Marine and Freshwater Ecosystems **27**(1): 90-102.

- Ramalho, R. O., W. McClain and P. M. Anastácio (2010). "An effective and simple method of temporarily marking crayfish." Freshwater Crayfish **17**(1): 57-60.
- Todd, C. R., N. S. Whiterod, S. Raymond, S. Zukowski, M. A. Asmus and M. Todd (2018). "Integrating fishing and conservation in a risk framework: A stochastic population model to guide proactive management of a threatened freshwater crayfish." Aquatic Conservation: Marine and Freshwater Ecosystems **28**(4): 954-968.
- Turvey, P. and J. R. Merrick (1997). "Reproductive biology of the freshwater crayfish, *Euastacus spinifer* (Decapoda: Parastacidae), from the Sydney region, Australia." Proceedings of the Linnean Society of New South Wales **118**: 131-155.
- Whiterod, N., C. R. Todd, S. Zukowski, S. M. Raymond, M. Asmus and M. J. Todd (2020). "A population model provides support for management decisions, enables ongoing research and reinforces strong partnerships to manage a threatened freshwater crayfish." Aquatic Conservation: Marine and Freshwater Ecosystems **30**(9): 1836-1840.
- Whiterod, N. and S. Zukowski (2017). The status of the Murray crayfish recreational fishery in Victoria. Areport funded by the Victorian Government using Recreational Fishing Licence fees. Goolwa Beach, Aquasave-Nature Glenelg Trust.
- Whiterod, N. S., M. Asmus, S. Zukowski, D. Gilligan and T. Daly (2021). Reintroduction to re-establish locally extirpated populations of the second largest freshwater crayfish in the world (Murray Crayfish *Euastacus armatus*). Global conservation translocation perspectives: 2021. Case studies from around the globe. P. S. Soorae. Gland, Switzerland, IUCN SSC Conservation Translocation Specialist Group.
- Whiterod, N. S., S. Zukowski, M. Asmus, D. Gilligan and A. D. Miller (2017). "Genetic analyses reveal limited dispersal and recovery potential in the large freshwater crayfish *Euastacus armatus* from the southern Murray–Darling Basin." Marine and Freshwater Research **68**: 213-225.
- Whiterod, N. S., S. Zukowski, M. A. Asmus, C. R. Todd and D. Gwinn (2018). "Take the long way home: minimal recovery in a K-selected freshwater crayfish impacted by significant population loss." Ecological Indicators **89**: 622-630.
- Zukowski, S. (2012). Impacts of fishing regulations on the sustainability of Murray crayfish (*Euastacus armatus*), Australia: social and biological perspectives. Doctor of Philosophy, PhD Thesis. Charles Sturt University.
- Zukowski, S., M. Asmus, N. Whiterod, A. Conallin, J. Campbell, I. Fisher and T. Bright (2018). "Collaborating with recreational fishers to inform fisheries management – estimating population size for an iconic freshwater crayfish." Ecological Management and Restoration **19**(1): 85–88.
- Zukowski, S., A. Curtis and R. J. Watts (2011). "Using fisher local ecological knowledge to improve management: The Murray crayfish in Australia." Fisheries Research **110**: 120-127.
- Zukowski, S., R. Watts and A. Curtis (2012). "Linking biology to fishing regulations: Australia's Murray crayfish (*Euastacus armatus*)." Ecological Management & Restoration **13**(2): 183-190.
- Zukowski, S. and N. Whiterod (2019). The status of Murray Crayfish in Talbingo Reservoir. Report to Snowy Hydro and EMM Consulting. Goolwa Beach, Aquasave–Nature Glenelg Trust.
- Zukowski, S. and N. Whiterod (2022). The status of Murray Crayfish in Talbingo Reservoir, 2021. Report to Snowy Hydro. Victor Harbor, Aquasave–Nature Glenelg Trust.

Zukowski, S. and N. Whiterod (2023). The status of Murray Crayfish in Talbingo Reservoir in 2022 and in Yarrangobilly River and Wallace Creek in 2023. Report to Snowy Hydro. Victor Harbor, Nature Glenelg Trust.

Zukowski, S. and N. Whiterod (2024). The status of Murray Crayfish in Talbingo Reservoir in June 2023, Yarrangobilly River and Wallace Creek in January 2024. Report to Snowy Hydro. Victor Harbor, Nature Glenelg Trust.

Zukowski, S. and N. Whiterod (2024). The status of Murray Crayfish in Talbingo Reservoir, Yarrangobilly River and Wallace Creek in June 2024. Report to Snowy Hydro. Victor Harbor, Nature Glenelg Trust.

Zukowski, S., N. Whiterod and R. Watts (2013). "Comparing Murray crayfish (*Euastacus armatus*) population parameters between recreationally fished and non-fished areas." Freshwater Crayfish **19**(2): 153-160.

Zukowski, S., N. Whiterod and C. Young (2020). The status of Murray Crayfish in Talbingo Reservoir, 2020. Report to Snowy Hydro and EMM Consulting. Victor Harbor, Aquasave–Nature Glenelg Trust.

Zukowski, S., N. S. Whiterod, J. M. Furse, R. McCormack, S. Chara, T. S. Walsh, T. A. Raadik, M. Lintermans, S. Ahyong, C. M. Austin, J. Marshall, A. D. Miller and M. Watson (2021). Assessing the feasibility of conservation translocations for Australia's endemic freshwater crayfish genus *Euastacus*, with reference to priority 2019-20 bushfire-impacted species. Victor Harbor, Australia, Aquasave-NGT.