CONFIDENTIAL REPORT

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Platypuses in the greater Melbourne area: survey results 2023.

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Version control

Date	Version	Description	Author	Reviewed By
29/2/2024	Draft	Draft Report	Preston T., Webster, W., Griffiths, J., Snowball G., Bloink C.	
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Abbreviations

Abbreviations	Description
PIT	passive integrated transponder
TVI	tail volume index
CPUE	captures per unit effort
APC	Australian Platypus Conservancy

Contents

Executive Summary

Melbourne Water Urban Platypus Program is one of the longest-running and most comprehensive platypus survey programs in Australia. In 2023, Melbourne Water commissioned Ecology Australia and EnviroDNA to complete live-trapping surveys of platypus at 18 discrete locations across 5 major catchments. A total of 107 individual platypus were caught in 182 trap nights across both autumn and spring sampling events. Overall CPUE across all locations (0.60) was similar to recent years.

Only 11 juveniles were captured during the 2023 survey program. The juvenile capture rate during autumn (16%) was very low compared with previous years (48% average 2015–18). Very low juvenile recruitment rates are likely to have been impacted by spring/summer 2022 flooding events. Most juvenile captures were from less urbanised areas that typically have lower stormwater inputs.

Moderate to good results (CPUE) were recorded at most locations across greater Melbourne and continues an overall trajectory of increasing CPUE over the last decade following extensive declines. High CPUE was recorded at several locations such as Werribee, Labertouche, Belgrave and Upper Tarago. Encouraging, but variable, results were recorded at Athlone and Bacchus Marsh. Conversely, relatively low captures continued to be recorded at Eltham.

Notably, a 23 year old male platypus was captured in Monbulk Creek, Belgrave, setting a new longevity record for wild platypuses.

Key recommendations to support platypus populations are centred on:

- Ensuring adequate baseflow (which can include delivery of environmental entitlement, alternative water options [such as smart-tanks], or appropriate management of non-regulated waterways).
- Reducing stormwater inputs to waterways to reduce high flow variability in urban streams.
- Improving riparian and instream environments to improve habitat quality.

Many of these actions are aligned with the Melbourne Water Healthy Waterways Strategy performance objectives.

Introduction

Platypuses *Ornithorhynchus anatinus* can be found in waterways throughout the greater Melbourne region. The platypus is identified as a key environmental value in Melbourne Water's Healthy Waterways Strategy (HWS) in acknowledgment of the vital role the species plays in aquatic ecosystems as an apex predator, its widespread appeal, and public concern for its conservation (now listed as vulnerable under the Flora and Fauna Guarantee Act). As such, since 1995 Melbourne Water have invested in a long-term monitoring program, the Melbourne Water Urban Platypus Program (MWUPP), to understand the current status of platypus populations, track long-term trends, and identify key factors impacting their distribution and abundance. Results of the MWUPP are primarily utilised to assess achievement against Healthy Waterways Strategy (2018) performance objectives and guide future works programs. However, the extensive data collected during the MWUPP has also been used to explore impacts of; urbanisation on platypus distribution (Serena & Pettigrove 2005, Martin et al. 2014), rainfall on reproductive output (Serena et al. 2014), population genetics (Furlan et al. 2010), climate change (Klamt et al. 2011), flow regimes (Griffiths et al. 2019a) and rates of platypus litter entanglement (Serena and Williams 2022). Additionally, data from the MWUPP have been used to characterise platypus habitat use, movement patterns and burrow sites (Serena et al. 1998, 2001, Serena and Williams 2013), to describe life-history attributes (Serena et al. 2014, 2024) and temporal variation in platypus fyke-netting outcomes (Serena and Williams 2012), as well as develop new environmental DNA monitoring techniques (Lugg et al. 2017) and predictive models of habitat suitability for the species (Coleman et al. 2022).

Central to the MWUPP have been extensive live-trapping surveys to understand abundance, population and recruitment trends (Serena & Williams 2008, Griffiths et al. 2018a), and to obtain genetic samples from individuals to investigate population connectivity, genetic health, and familial relatedness (Weeks & van Rooyen 2014, Griffiths & Weeks 2018a). More recently, environmental DNA (eDNA) has been used to systematically explore platypus distribution and site occupancy (as a measure of population health) at broader spatial scales (Weeks et al. 2015, Griffiths et al. 2017, 2018b). Public sightings through platypusSPOT (www.platypusSPOT.org) and other citizen science and social media platforms are providing valuable complementary data as well as engaging the community on platypus conservation and broader river health issues. Most platypus populations appear to have declined over the duration of the MWUPP, largely attributed to the impacts of the Millennium Drought and urbanisation (Coleman et al. 2022). As of 2019, some populations had shown variable levels of recovery (increased abundance and recruitment), although others seemed to have remained static or continued to decline (Griffiths et al. 2020).

In 2023, live-trapping surveys were undertaken for the first time since 2019 to understand the current status of platypus populations and temporal trends. The survey program generally focused on high value locations with good spatial coverage across the 5 major river catchments in Melbourne.

Methods

Live-trapping surveys

Live-trapping surveys were conducted by EnviroDNA and Ecology Australia. The method of capture utilised by both organisations is the same (paired fyke nets deployed overnight); however, there are some minor differences in on-site deployment and platypus handling.

All platypus surveys were conducted using fyke nets (Serena 1994, Serena and Williams 2012), consisting of a central capture chamber (mesh size 15 x 15 mm) with several one-way baffles that detain the animal without entanglement. Mesh wings on either side of the entrance were positioned to block the width of the waterway and guide platypuses into the capture chamber. The distal end of the capture chamber was securely suspended above the water level to allow captured platypuses (and bycatch) access to air.

At each site, a pair of fyke nets was set with one facing upstream and one facing downstream to capture platypuses travelling in either direction. Nets were set during the afternoon and removed at dawn the following day. Nets were checked at regular intervals during the night to remove captured platypuses and bycatch in accordance with relevant animal ethics guidelines (Serena et al. 2015), and to repair holes caused by rakali (water rats *Hydromys chrysogaster*). Net sites were selected with water depth and flow appropriate to the size of the nets and with suitable banks so that the wings could effectively block the entire channel. Ecology Australia followed the approach described in Serena and Williams (2012) that was employed by the Australian Platypus Conservancy for the MWUPP from 1995–2006 and by Ecology Australia at 'roving' MWUPP sites in 2013/14. The method involves approximately 45–60 minutes of net setting time per site, with considerable effort applied to eliminate all gaps between the channel bed and entire lower margin of the net and wings with rocks, holding the top margin of the wings 5–10 cm above the water with sticks, and either extending the distal end of each wing 1 m up onto the bank or, in the case of vertical banks, pinning or otherwise attaching the netting firmly to the bank substrates to block passage. To do this effectively and efficiently, this typically entails minimising the length of the wings needed to reach the bank by using only the 2 outer wings of each fyke net (connecting the two 'D' entrances of the fyke wings with cord) with a perpendicular angle. Where there is insufficient space to arrange the nets in this way (connecting the two 'D' entrances), the 2 nets are used separately with all wings deployed, again using a perpendicular angle to reach the banks to minimise the number of rocks and effort required to eliminate all gaps under the wings. Under either approach this essentially means the fyke net wings are used to block the stream with an impenetrable wall of netting, directing the platypus to search along the wing wall for the net entrance. EnviroDNA followed the same approach, but with both wings utilised for each net, forming a V-shaped funnel to help direct platypuses into the capture chamber.

Survey locations

In consultation with Melbourne Water, live-trapping sites were selected along multiple stream or river segments (referred hereafter as 'locations') within each catchment to provide good spatial coverage throughout the greater Melbourne area. The survey program in 2023 incorporated 18 locations and was the most extensive live-trapping survey program conducted by Melbourne Water since 2018. Individual net sites were selected based on the location of established sites (Australian Platypus Conservancy [APC] or Cesar Australia), adequate spacing between sites, access, safety, recent eDNA results, HWS priorities, and field inspection of site suitability under the flow/depth conditions encountered at the time of survey. The number and location of sites surveyed was kept as consistent as possible between autumn and spring sampling. The locations where live-trapping surveys were performed during 2023 are described below and displayed in Figure 1. Sub-catchments are as defined by the Healthy Waterways Strategy 2018.

Dandenong Catchment

1. **Belgrave** – Monbulk Creek. From Park Drive to Birdsland Reserve, Belgrave. Corhanwarrabul, Monbulk and Ferny Creek sub-catchment.

Maribyrnong Catchment

2. **Sunbury** – Jacksons Creek. From Homestead Way Sunbury to Organ Pipes National Park. Jacksons Creek sub-catchment.

Werribee Catchment

3. **Werribee** – lower Werribee River. From Riverbend Historical Park to Princes Freeway, Werribee. (Surveyed by Ecology Australia for APC in autumn, results included in this report with thanks to APC.) Werribee River Lower sub-catchment.
4. **Bacchus Marsh** – middle Werribee River. Werribee Vale Rd to Fisken St, Bacchus Marsh. Werribee River Middle sub-catchment.

Western Port Catchment

5. **Athlone** – Lang Lang River and Minnieburn Creek. From Main South Road bridge, Poowong East, to Drouin-Korumburra Road. Lang Lang River sub-catchment.
6. **Bunyip** – upper Bunyip River and tributaries, including Diamond Creek and Snake Creek. From the confluence with Diamond Creek to Freemans Mill Camp. Bunyip River Middle and Upper sub-catchment.
7. **Cardinia** – Cardinia Creek. From Manestar Rd to Beaconsfield-Emerald Rd, Beaconsfield. Cardinia, Toomuc, Deep and Ararat Creeks sub-catchment.
8. **Labertouche** – Labertouche Creek, from the confluence with the Tarago River to McDonald Road. Tarago River sub-catchment.
9. **Lower Tarago** – lower Tarago River, from Morrison Road to Tarago Reservoir. Tarago River sub-catchment.
10. **Upper Tarago** – upper Tarago River, from Tarago Reservoir to Spion Kopje Track. Tarago River sub-catchment.

Yarra Catchment

11. **Eltham** – Diamond Creek. From Allendale Rd to Eltham Lower Park, Eltham. Diamond Creek (Rural) sub-catchment.
12. **McMahons** – McMahons Creek, from the McMahons weir to the confluence with the Yarra River. Yarra River Upper sub-catchment.
13. **Mullum Mullum** – Mullum Mullum Creek. From Old Warrandyte Rd to Main Yarra Trail, Warrandyte. Mullum Mullum Creek sub-catchment.
14. **Lilydale** – Olinda Creek. From Mount Evelyn Recreation Reserve/Glenholme Ave to Akarana Rd, Lilydale. Olinda Creek sub-catchment.
15. **Warburton** – Yarra River tributaries, including McKenzie King and Surrey Road Creeks, from McKenzie King Drive, Milgrove to Woods Point Road bridge, East Warburton, and Big Pats Creek from the Yarra River to Big Pats Creek Road. Yarra River Upper sub-catchment.
16. **Watsons** – Watsons Creek from One Tree Hill Road to Henley Road, Kangaroo Ground (autumn only). Watsons Creek sub-catchment.
17. **Chum Creek** – Chum and Myers Creek from Myers Creek Rd to Lowes Rd, Chum Creek. One new site was added in spring on Donnellys Creek just above Watts River confluence. Watts River sub-catchment.
18. **Woori Yallock** – Woori Yallock, Sassafras and Menzies Creek, from Kallista-Emerald Rd to Baynes Park, Monbulk. Woori Yallock Creek sub-catchment.

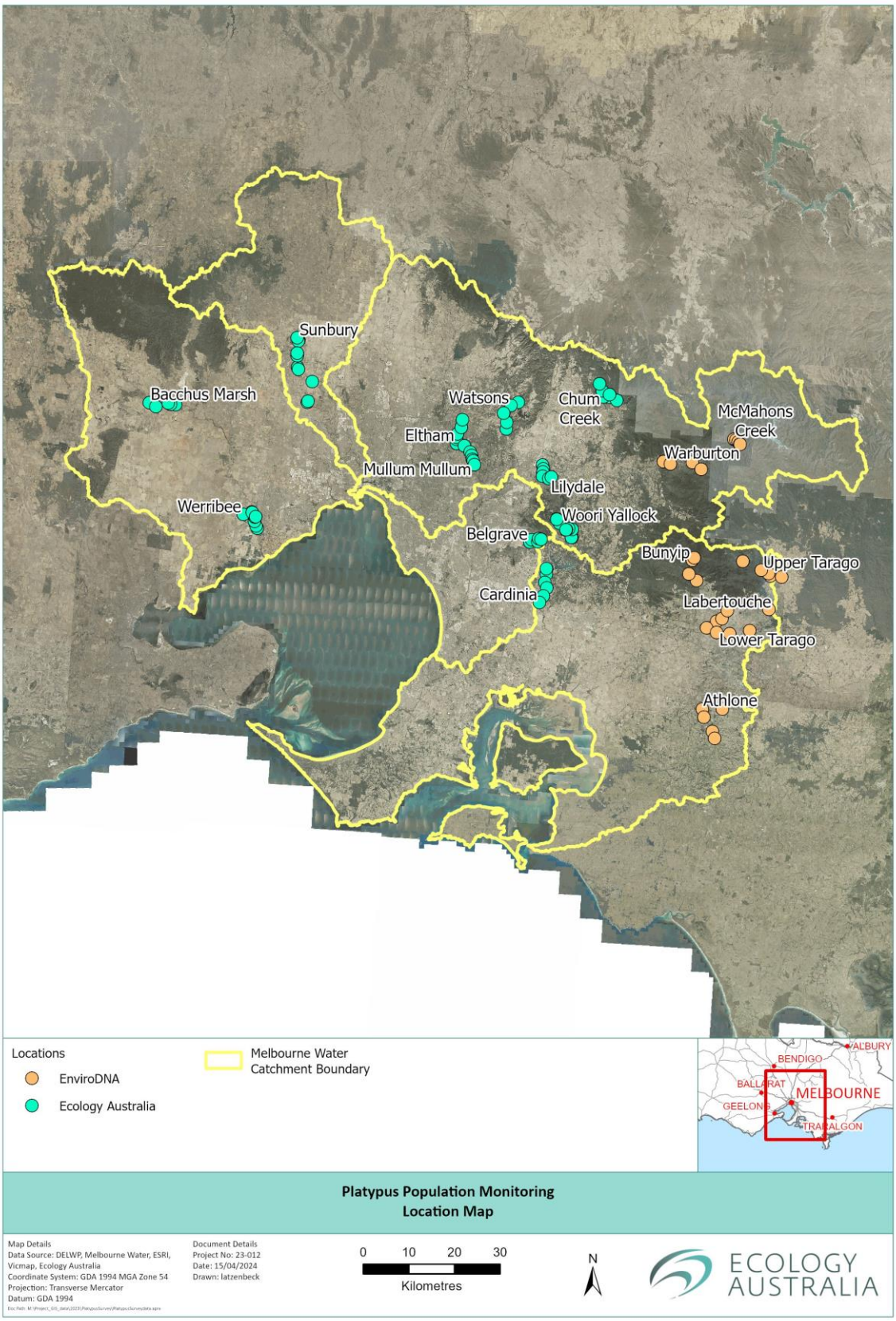

Figure 1: Map of the survey locations for the 2023 MWUPP.

Measurements and condition of captured platypuses

When captured, platypuses were carefully removed from the net and placed into a calico bag. All platypuses were initially scanned for the presence of an individually coded microchip (Passive Integrated Transponder). If no microchip was present, one was inserted subcutaneously between the scapulae (LifeChip, Allflex or BioMark APT12). The sex and age class of each platypus was based on presence/absence and morphology of the calcaneal spurs (Temple-Smith 1973, Williams et al. 2013). Three male classes exist including juvenile (≤ 10 months), sub-adult (11–23 months) and adult (≥ 23 months), and two female classes, juvenile (≤ 10 months) and sub-adult or adult (> 10 months). A 5-point tail volume index (TVI) was used to characterise body condition (Grant & Carrick 1978). As platypuses store a large proportion of total body fat in their tail, this index uses tail shape and thickness as a broad indicator of body condition. Individuals were classified as described below:

Category 1 Excellent condition – tail turgid with the ventral side convex.

Category 2 Good condition – tail able to be folded slightly at lateral edges. Ventral side flat. Rest of tail turgid.

Category 3 Average condition – lateral edges of tail can be easily rolled. Ventral side slightly concave. Rest of tail turgid.

Category 4 Fair condition – tail can be folded along ventral midline. Whole tail soft.

Category 5 Poor condition – vertebrae showing through tissue on ventral side. Whole tail soft.

Body mass was recorded to the nearest 1 g using bench scales (EA) or to the nearest 25 g using Pesola spring scales (EnviroDNA) and standard morphometric measurements taken to the nearest 0.1 mm using electronic calipers (bill width, bill length) or the nearest 1 mm using a flexible tape measure (total body length). A small tissue sample was obtained from the distal edge of front foot toe webbing and preserved in ethanol for future genetic analysis. Each platypus was assessed visually and manually for evidence of litter entanglement, particularly around the neck, in front of the shoulder and behind the front legs.

EnviroDNA processed all captured platypuses immediately on-site and returned animals to the waterway at the point of capture, thereby minimising holding times for each animal. Individuals are released on the side of the nets where they originated from and presumably where burrows are located to minimise the chance of recapture during the same night. Ecology Australia processed platypus at a central processing base after completing each round of net checks and returned them to the waterway on the following 2-hourly check, thereby maximising net checking and processing efficiency and minimising holding time in nets, if more than 1 platypus was encountered in a given round. Ecology Australia placed animals in fresh alpha-numeric-coded calico bags upon capture and again after being processed (if the bag was soiled), carefully recording the details to ensure animals were released at the correct site.

Bycatch identification

Bycatch was identified to species level (where possible) using McDowall (1996) and Allen et al. (2002) (fish), Cogger (1992) (turtles), McCormack (2012) (spiny crayfish), and Menkhorst & Knight (2004) (rakali). The presence of rakali, however, was usually inferred by the occurrence of characteristic holes in nets. When captured in fyke nets, rakali are well known to chew holes through the mesh in order to escape (Williams and Serena 2018).

Understanding temporal trends in abundance

Captures per unit effort (CPUE) is a metric of relative abundance used to generate charts to examine potential spatial and temporal population trends. To calculate CPUE, the number of individual platypuses captured in a sampling period is standardised by the survey effort. Survey effort reflects the total number of nets or sites (almost invariably one pair of nets set per site) deployed during a survey period. This standardisation allows comparison of capture rates across waterways, catchments and survey periods. Although widely accepted as a measure of relative abundance, CPUE is undoubtedly a coarse index of abundance, particularly for sparsely distributed species such as platypuses, and CPUE data must be interpreted carefully as a broad indicator of population trajectories only. The difficulties in estimating population size for platypuses and limitations of CPUE as an index of abundance has been discussed in previous reports (see Griffiths and Weeks 2011, Griffiths et al. 2020).

We present CPUE as 2 different calculations in this report. Firstly, we present CPUE calculations based on total individuals, including juveniles captured at each location consistent with the approach of previous MWUPP reports, for continuity with practice since 2007. Juveniles have been included previously, as they comprise a valuable component of healthy wildlife populations and their exclusion would result in a CPUE of zero at locations where only juveniles were captured (typically in autumn), which then may be misinterpreted as no platypus present and would lead to a zero-inflated dataset. However, in consultation with Melbourne Water, for this report CPUE has been calculated at the site level, rather than individual nets, and historical data has been transformed accordingly for comparison.

Secondly, based on discussions with Melbourne Water, we provide a calculation of CPUE that excludes juveniles, which may be considered to be more representative of the core population. This assumes that some juveniles disperse from the location or are potentially lost from the population at some point prior to maturity (Serena and Williams 2012) and the number of juveniles each year varies more widely with annual environmental conditions than adult numbers (e.g. rainfall; Serena et al. 2014, Serena and Grant 2017). However, platypus populations are also thought to comprise a number of transient males that may also not be considered part of the ‘core’ population (Serena et al. 2014, Bino et al. 2015), so both CPUE metrics are included here. To complement CPUE calculations in which juveniles are not included, annual reproductive success is estimated separately by calculating the percentage of juveniles of all captures at each location.

The number of platypuses detected during a survey will be a function of actual platypus abundance as well as factors that influence encounter rates with nets that should be considered when making temporal or spatial comparisons of CPUE. During the breeding season (August to mid-October in Victoria) both adult males and females are more active as they attempt to improve body condition, search for mates, and males defend territories (Bethge 2002, Grant 2007, Griffiths et al. 2014). This increased activity is expected to lead to

increased encounter rates with nets and higher captures (Serena and Williams 2012, Griffiths et al. 2020). In addition, platypus movements appear to be inhibited by very low flows (Griffiths & Weeks 2015) that reduce longitudinal hydrologic connectivity and presumably increase predation risk leading to lower capture rates (Griffiths et al. 2020). It has been suggested that platypuses develop learned net avoidance behaviour following their initial capture (Connolly & Obendorf 1998, Stewart 2001, Griffiths et al. 2013), potentially resulting in lower recapture rates than would otherwise be expected. Therefore, overall capture probability has been predicted to decline over time with increasing survey history at long term monitoring locations. However, a multivariate analysis by Griffiths et al. (2020) found no significant relationship between survey history and CPUE, suggesting that net avoidance may be innate rather than learned, or that it has little impact on overall CPUE trends. High rainfall events during summer, particularly those resulting in bankfull or overbank flows (flooding), have also been associated with low rates of subsequent juvenile capture, implying that juveniles are vulnerable to drowning in nesting burrows or shortly after they first emerge (Serena et al. 2014, Serena and Grant 2017). High rainfall events were recorded during spring and summer 2022/23 prior to the current survey season.

Results

2023 live-trapping surveys

A total of 107 individual platypuses were captured from 182 total trap nights during surveys in 2023 (where 1 trap night = 1 pair of fyke nets set to block the channel at a given site). Overall CPUE for 2023 across all locations was 0.61, which is similar to 2017/18 and 2018/19 but higher than the longer-term average and higher than trends recorded during and immediately following the Millenium Drought. However, while this provides an indication of broad trends, data should be interpreted cautiously due to differences in some survey locations between years and potential differences in the way nets have been set over time. Across the region, and including all data for 2023, CPUE was slightly lower in spring (CPUE = 0.55) compared to autumn (CPUE = 0.62).

For individual survey locations, comparatively high CPUE was recorded at Werribee, Labertouche, Belgrave and Upper Tarago. Further encouraging, but variable, CPUE results were recorded at Athlone and Bacchus Marsh. Conversely, relatively low captures were recorded at Eltham.

The platypuses captured this year comprised 56 adult males (51% of the total), 39 adult/subadult females (36%), 3 subadult males (3%), 7 juvenile males (6%), and 4 juvenile females (4%). Fourteen of the platypuses had been previously captured (13%). The proportion of juveniles captured during autumn (16%) was low compared to recent years (average of 48% from 2015–18), although direct quantitative comparisons are invalid due to different survey locations between years. Details of all captured platypuses can be found in Appendix 1.

Dandenong Catchment

Belgrave

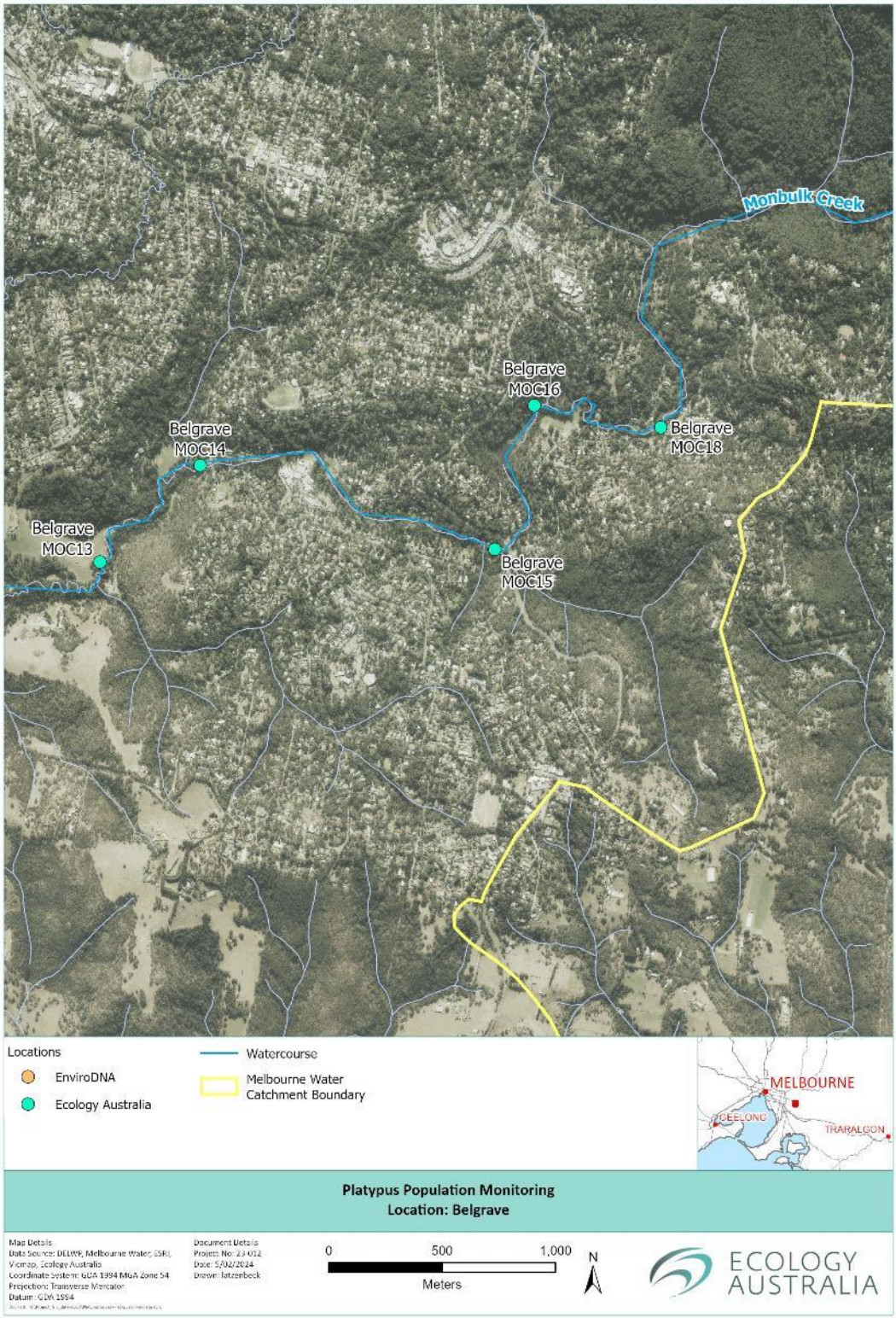

Figure 2: Site locations for Monbulk Creek, Belgrave.

Table 1: Summary of 2023 survey results for Monbulk Creek, Belgrave. Table includes seasonal and overall survey effort, number of individuals captured (including adult recaptures), and CPUE.

Total platypus captures	Adults/subadults	Juveniles	% Juveniles
No. platypus	**7 (4)**	**0**	**0**
CPUE including juveniles	No. platypus	Trap nights	CPUE
Autumn	3	5	0.6
Spring	4	5	0.8
Total	**7**	**10**	**0.7**
CPUE excluding juveniles	No. platypus	Trap nights	CPUE
Autumn	3	5	0.6
Spring	4	5	0.8
Total	**7**	**10**	**0.7**

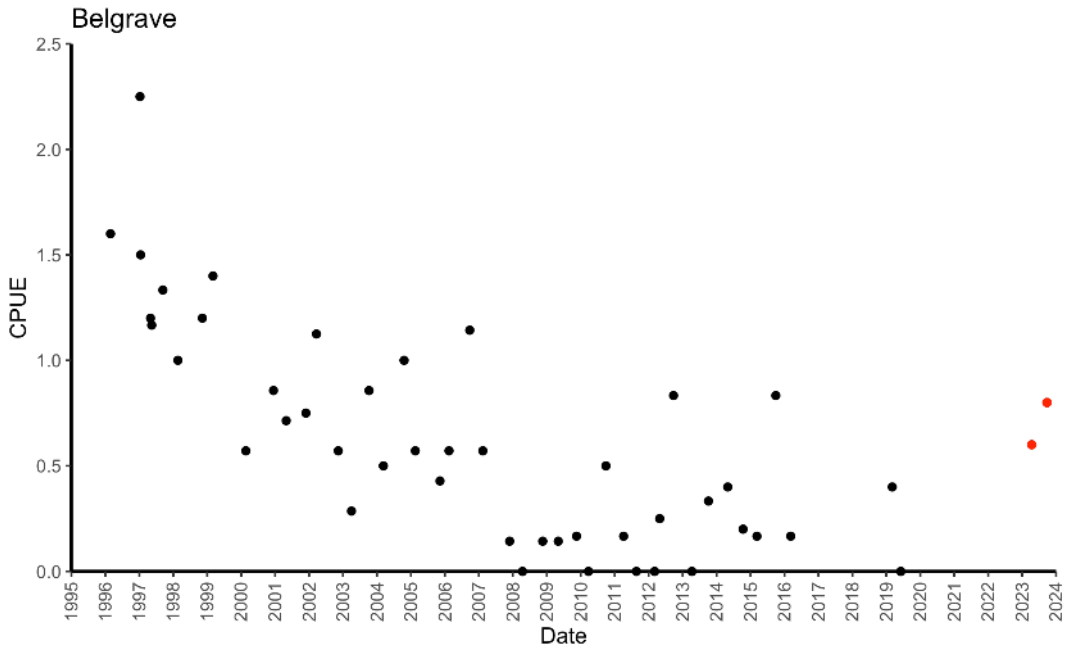

Figure 3: Historical and current CPUE (including juveniles) data available for Monbulk Creek, Belgrave. Current (2023) surveys are in red.

A total of 10 trap nights conducted in Monbulk Creek resulted in the capture of 7 individual platypuses during 2023 (Table 1). This included 2 adult females, who were both new captures. These results indicate that successful recruitment is taking place in Monbulk Creek, which is an encouraging sign given that this population is small and isolated. Of note is the recapture of an adult male (001F603FF) in both autumn and spring surveys. This male was first captured on 17 November 2000 (by APC) as a subadult male. This would make the platypus at least 23 years old, which eclipses the age of the previous oldest known platypus from Monbulk Creek (21 years) and is a new longevity record for a known-age wild platypus (Serena et al. 2024).

No safety issues or litter entanglement was noted for Monbulk Creek.

Overall CPUE for 2023 has increased slightly from more recent surveys but is still less than pre-Millennium drought.

Four other aquatic species were recorded as bycatch during the surveys comprising short-finned eels (2), brown trout (2), redfin (2) and rakali (1), plus a single black duck.

Works such as rock armouring, establishment of a designated dog swimming point in Birdsland Lake and riparian plantings have been completed over recent years. Melbourne Water together with several partner organisations (and supported by the Australian Research Council) is now implementing an ambitious project to protect baseflows in Monbulk Creek. Water sources such as the Belgrave Lake and interconnected 'smart' water tanks throughout the catchment will be used to supply the creek with water during extreme low flow periods in summer and autumn. Further collaboration with Southern Rural Water to ensure that minimum baseflows are being met through the implementation of bans and restrictions on irrigators downstream of Birdsland Reserve is essential to ensure that the water added to the system upstream is retained downstream. There is potential for habitat improvement downstream of Birdsland Reserve, which would increase the overall habitat availability for platypus and potentially allow a greater carrying capacity. The isolated nature of this population is still a cause for concern and may require genetic translocations for improved genetic diversity in the longer term.

In response to an invitation by Ecology Australia, a number of cameras were set up by Dana Dekkers (Melbourne University PhD candidate) to monitor nets set in Monbulk Creek during the spring survey. Initial results suggest that some platypus that encountered the nets evaded capture. Further camera studies are needed to investigate net avoidance behaviour and help operators to optimise net setting protocols.

Recommendations:

- Continued implementation of the Monbulk Creek Platypus Management Plan (Griffiths & Weeks 2018b).
- Continued riparian restoration (native revegetation, exclude stock) to improve habitat quality in lower Monbulk Creek to facilitate expansion of population.
- Implementation of bans and restrictions on water extraction from Monbulk Creek when flow falls below the minimum baseflow.
- Develop a translocation strategy to increase genetic diversity and improve population resilience, presuming that additional animals can be translocated to this system without potentially compromising the welfare of established individuals.

Maribyrnong Catchment

Sunbury

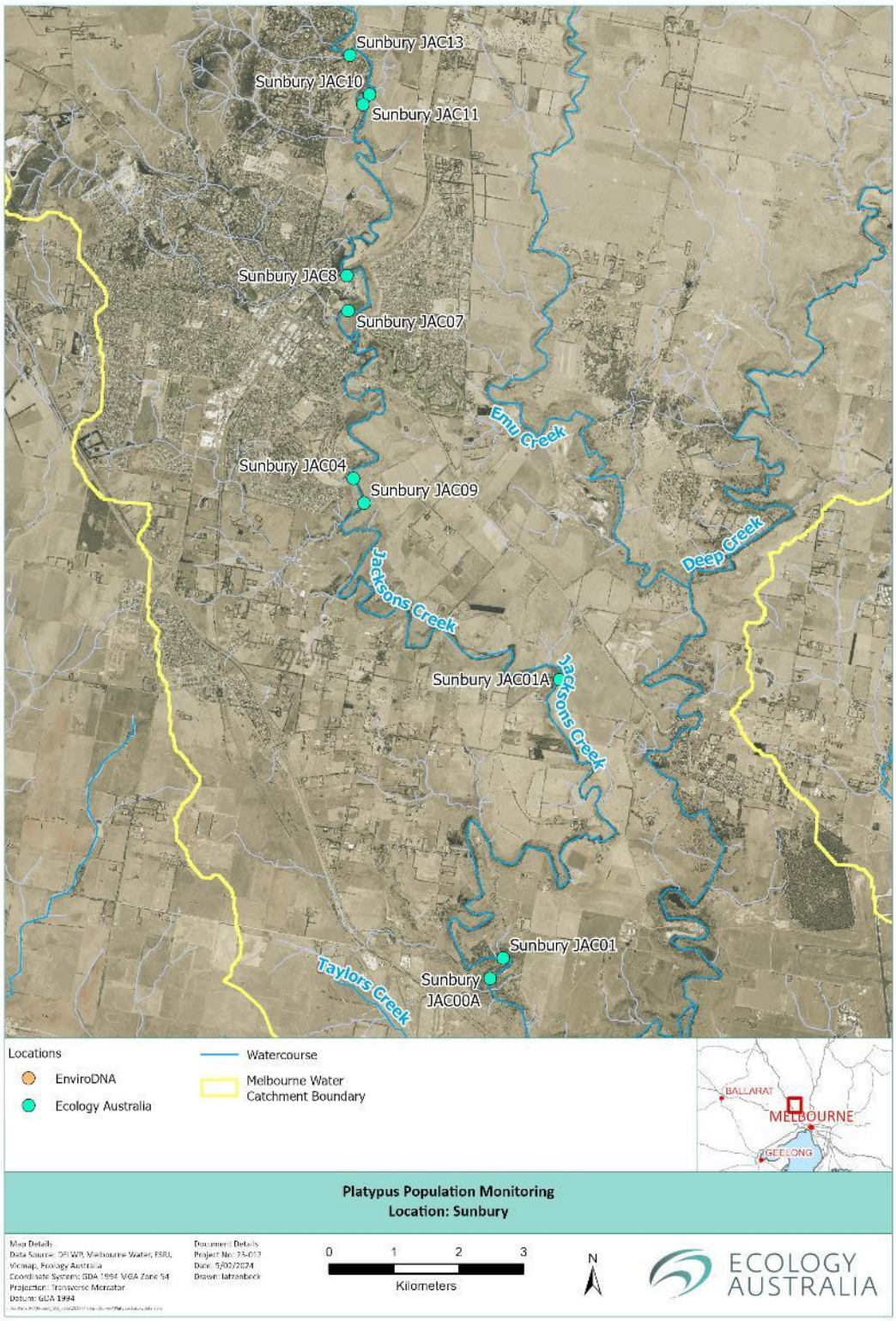

Figure 4: Site locations for Jacksons Creek, Sunbury.

Table 2: Summary of 2023 survey results for Jacksons Creek, Sunbury. Table includes seasonal and overall survey effort, number of individuals captured (including adult recaptures), and CPUE. Note that surveys were conducted over 2 nights in autumn and 1 in spring.

Total platypus captures	Adults/subadults	Juveniles	% Juveniles
No. platypus	**15 (2)**	**1**	**6.2**
CPUE including juveniles	No. platypus	Trap nights	CPUE
Autumn 1	3	4	0.7
Autumn 2	3	5	0.6
Spring	10	9	1.1
Total	**16**	**18**	**0.89**
CPUE excluding juveniles	No. platypus	Trap nights	CPUE
Autumn 1	2	4	0.5
Autumn 2	3	5	0.6
Spring	10	9	1.1
Total	**15**	**18**	**0.83**

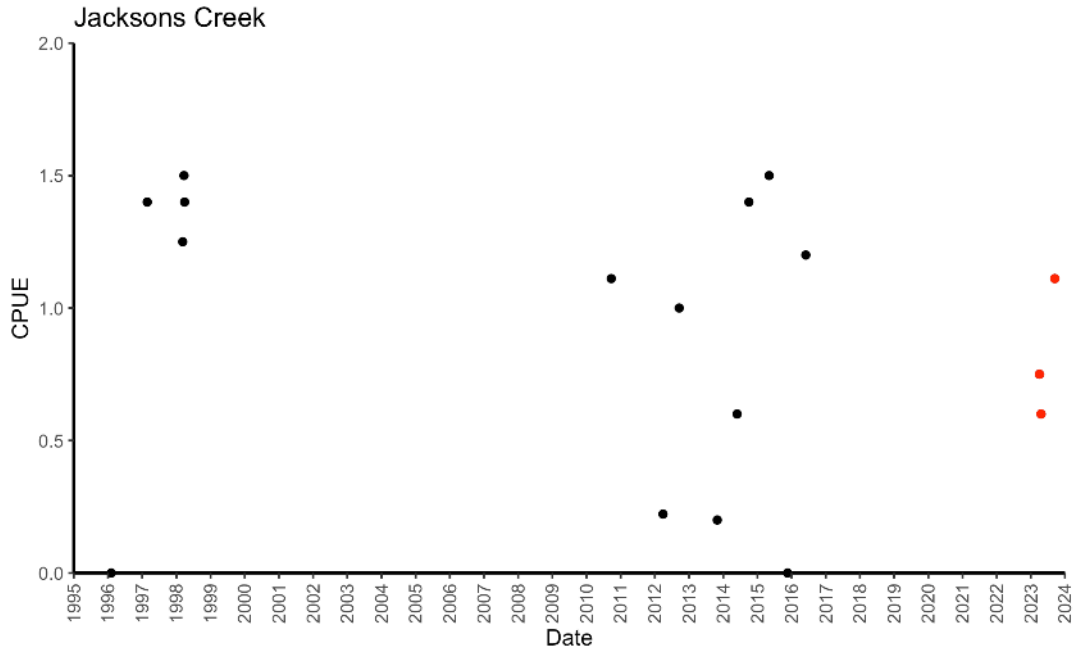

Figure 5: Historical and current CPUE (including juveniles) data available for Jacksons Creek, Sunbury. Current (2023) data is in red.

A total of 18 trap nights conducted in Jacksons Creek resulted in the capture of 16 individual platypuses during 2023 (Table 2). This included 4 adult females and 1 juvenile female, who were all new captures. Only 1 male platypus was recaptured from previous years (first captured in 2014), and another was recaptured in spring after being tagged in autumn 2023. These results indicate that successful recruitment is taking place in Jacksons Creek.

Some sites were not surveyed as they were deemed unsuitable to set nets or due to safety (landholder) issues. No litter entanglement was noted.

Overall CPUE for 2023 remains within the range of the most recent surveys. From 1996 to 2001, the adult/subadult CPUE along Jacksons Creek was 0.79 (Serena and Williams 2008), which was similar to that recorded in 2023 (0.83), suggesting that platypus numbers are now similar to those recorded before and at the start of the Millennium drought. However, this finding needs to be confirmed through further analysis, ideally by comparing results obtained at the same sites in both periods.

Four other aquatic species were recorded as bycatch during the surveys comprising short-finned eels (6), brown trout (1), common galaxias (1) and carp (3), plus a single black duck.

The Jacksons Creek catchment continues to experience significant urban development, which can have detrimental impacts on water quality (i.e. increased turbidity and stormwater), however, there are significant efforts being made to mitigate this impact through the implementation of water sensitive urban design (WSUD).

Recommendations:

- Continue to monitor the Jacksons Creek platypus population as development increases in the catchment.
- Continued investigation and implementation of alternative sources of water to supply baseflow to Jacksons Creek.
- Continued implementation of WSUD throughout the catchment to minimise the impacts of stormwater in Jacksons Creek.
- Work with landholders to improve riparian vegetation and exclude stock from some sections of the creek.

Werribee Catchment

Werribee

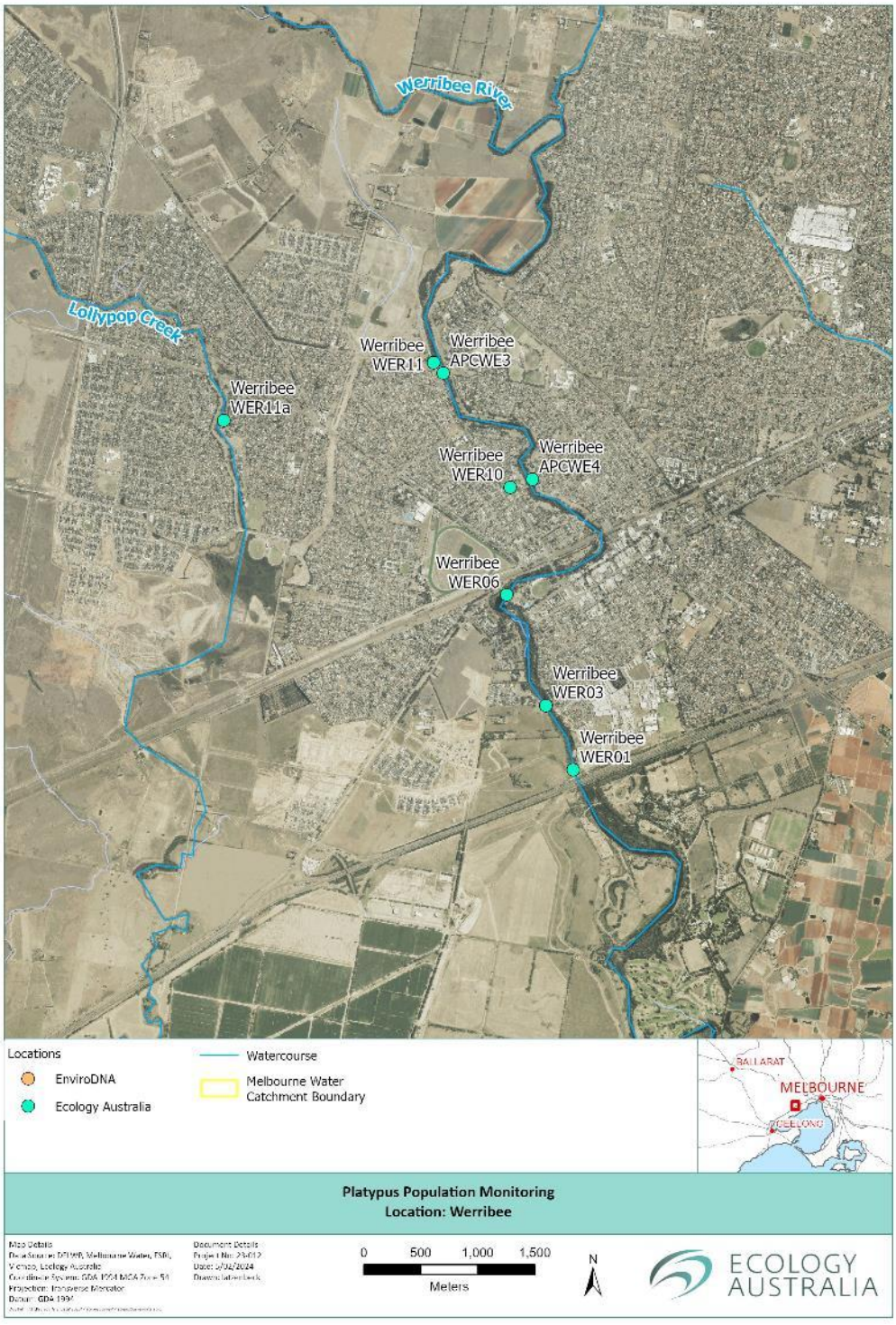

Figure 6: Site locations for lower Werribee River, Werribee.

Table 3: Summary of 2023 survey results for lower Werribee River, Werribee. Table includes seasonal and overall survey effort, number of individuals captured (including recaptured adults), and CPUE. Data from a single survey conducted by APC and Ecology Australia for the Werribee Riverkeeper and Bacchus Marsh Platypus Alliance in February 2022 is also included for reference (not included in 2023 CPUE calculations).

Total platypus captures	Adults/subadults	Juveniles	% Juveniles
No. platypus	**7**	**0**	**0**
CPUE including juveniles	No. platypus	Trap nights	CPUE
Autumn	4	5	0.8
Spring	3	6	0.5
Total	**7**	**11**	**0.64**
CPUE excluding juveniles	No. platypus	Trap nights	CPUE
Autumn	4	5	0.8
Spring	3	6	0.5
Total	**7**	**11**	**0.64**
2022 platypus captures	Adults/subadults	Juveniles	% Juveniles
Summer	**1**	**2**	**66**

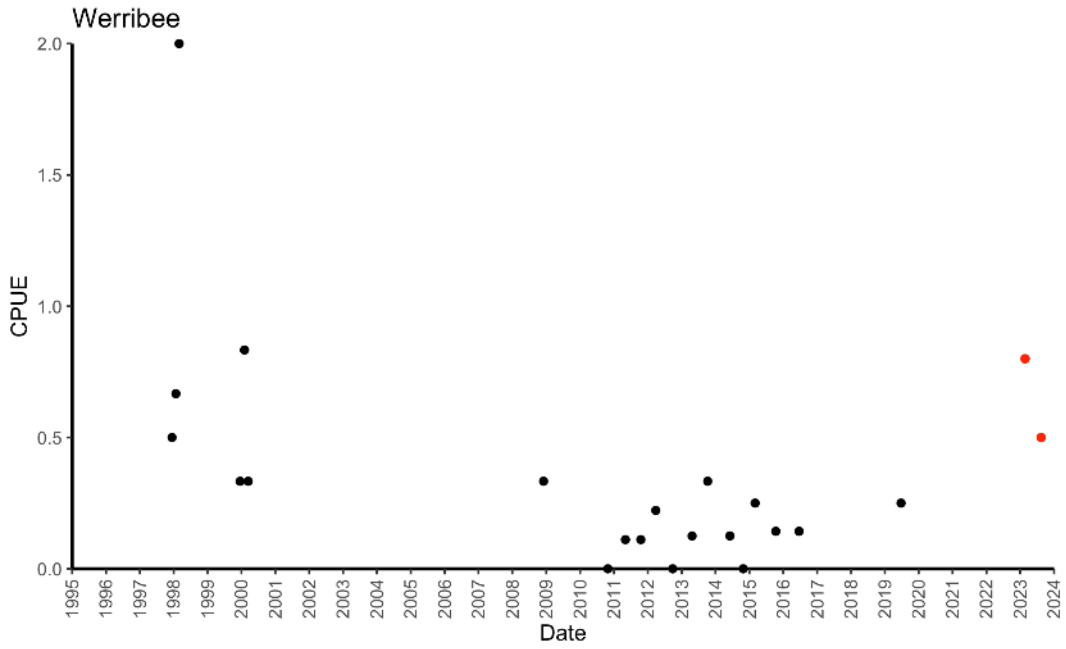

Figure 7: Historical and current CPUE (including juveniles) data available for lower Werribee River, Werribee. Current (2023) data shown in red.

A total of 11 trap nights were conducted in Werribee River lower, with 1 set of nets stolen between net setting and the first check in autumn. Autumn and spring survey efforts resulted in the capture of 7 individual platypuses during 2023 (Table 3). This included 5 adult females and 2 adult males, who were all new captures. This is an encouraging result with the highest survey CPUE recorded since 2000, even though no juveniles were captured. The survey conducted in February 2022 resulted in a juvenile male and female, as well as an adult male capture. From 1997 to 2000, adult/subadult CPUE along the Werribee River at Werribee township was 0.62 (Serena and Williams 2008), which was effectively the same as that recorded in 2023 (0.64), suggesting

that platypus numbers are now similar to those recorded before and at the start of the Millennium drought. However, this finding needs to be confirmed through further analysis, ideally by comparing results obtained at the same sites in both periods. Results from 2023 surveys are encouraging and indicates population recovery following the deaths of 8 individuals in a single illegal net set in the lower Werribee River in 2018 (https://www.abc.net.au/news/2018-09-10/eight-platypuses-found-dead-in-fishing-trap-in-werribee-river/10221950).

One adult female captured in autumn was entangled in a thick plastic band of unknown origin caught over her shoulder and under the front limbs. This litter was removed, and no significant cuts or injuries were observed. A second female captured in the same survey had deep scars on both sides of her neck, indicative of previous litter entanglement in which the item had been fortuitously lost before the animal died.

Five other aquatic species were recorded as bycatch during the surveys including long-finned eel (1), tupong (10), Australian grayling (3), Australian bass (2) and pouched lamprey (10).

The catchment surrounding Werribee River lower continues to become further urbanised and experiences flash flooding events. High river levels and flooding at Cottrel St Ford were recorded throughout spring 2022 during the platypus nesting phase (https://www.melbournewater.com.au/water-and-environment/water-management/rainfall-and-river-levels#/reader/231237A). Spring floods may inundate burrows, resulting in failed breeding attempts. It is predicted that annual stormwater production in the Wyndham municipality will grow from 19 GL per year in 2018 to 35 GL per year by 2050 (DELWP 2021), so large scale stormwater harvesting is essential to mitigate the impacts of this increased stormwater on platypus breeding.

Flow conditions in the lower Werribee River will continue to pose a challenge during dry years, with the passing flow of 1 ML/d from the southern diversion weir below the recommended baseflow of 6 ML/d for this reach during summer and autumn.

Recommendations:

- Ensure fishway design for the lower Werribee diversion weir also allows for platypus passage.
- Delivery of Central and Gippsland Region Sustainable Water Strategy commitments to return water to the Werribee River (Policy 8–4 and 8–5) and ensure that minimum flow recommendations are delivered.
- Investigate whether water transfers for irrigation from Melton Reservoir to the lower diversion weir can be delivered in a way that reduces extreme flow variability, which would improve conditions for platypus in this section of the Werribee River.
- Large scale harvesting of stormwater for Werribee.
- Implement and/or continue community education campaigns about litter and fishing practices.

Bacchus Marsh

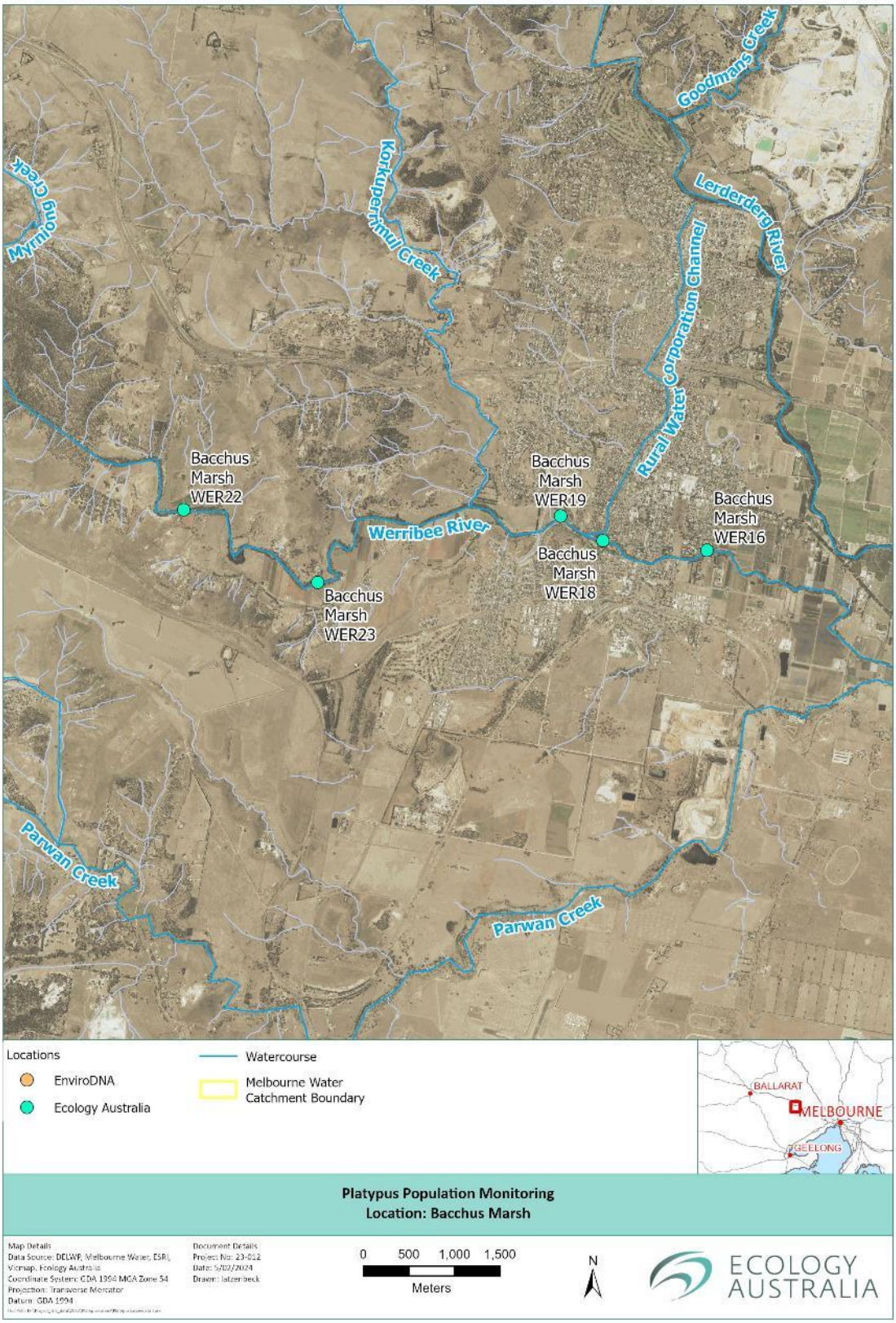

Figure 8: Site locations for middle Werribee River, Bacchus Marsh.

Table 4: Summary of 2023 survey results for middle Werribee River, Bacchus Marsh. Table includes seasonal and overall survey effort, number of individuals captured (including recaptured adults), and CPUE. Data from a single survey conducted by APC and Ecology Australia for the Werribee Riverkeeper and Bacchus Marsh Platypus Alliance in February 2022 is also included for reference (not included in 2023 CPUE calculations).

Total platypus captures	Adults/subadults	Juveniles	% Juveniles
No. platypus	**4**	**0**	**0**
CPUE including juveniles	No. platypus	Trap nights	CPUE
Autumn	4	5	0.8
Spring	0	5	0
Total	**4**	**10**	**0.40**
CPUE excluding juveniles	No. platypus	Trap nights	CPUE
Autumn	4	5	0.8
Spring	0	5	0.0
Total	**4**	**10**	**0.40**
2022 platypus captures	Adults/subadults	Juveniles	% Juveniles
Summer	**4**	**0**	**0**

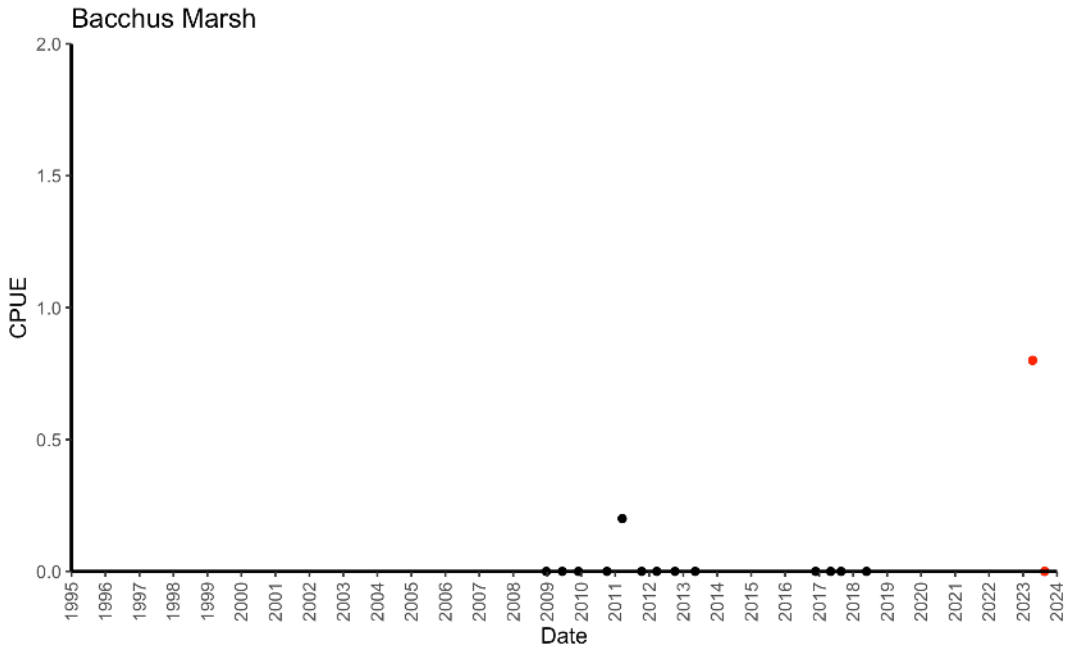

Figure 9: Historical and current CPUE (including juveniles) data available for middle Werribee River, Bacchus Marsh. Current (2023) data shown in red.

A total of 10 trap nights conducted in Werribee River at Bacchus Marsh resulted in the capture of 4 individual platypuses during 2023 (Table 4). All 4 platypus were adult males captured in autumn, 1 being a recapture from 2022. Although no females or juvenile platypus were captured in 2023, an adult/subadult female (plus 1 subadult and 2 adult males) were recorded in surveys conducted in 2022 (Serena et al. 2022). CPUE from the single summer survey in 2022 was 0.4, the same as the overall 2023 CPUE.

Conditions in the surveyed area of the Werribee River differed between autumn and spring, with higher flows and wider channels in spring. Nets at sites WER23 and WER19 were moved marginally between seasons to

allow for safe setting. Site WER15_core was not surveyed in either season due to the channel being too deep and wide. No litter entanglements were noted for any platypus.

Three other aquatic species were recorded as bycatch during the surveys comprising short-finned eels (6), redfin (5) and roach (8).

The area surrounding Werribee River at Bacchus Marsh is subject to large scale urbanisation, with increased stormwater runoff and frequent incidents of high turbidity resulting from runoff at building sites observed (Jodie Valpied pers. comm., 2023). River levels recorded at Bacchus Marsh during spring 2022 were elevated due to significant rain events and may have impacted upon platypus breeding attempts if burrows were flooded.

Platypus in the lower and middle Werribee may be isolated from each other with the Melton Reservoir acting as a movement barrier. A recent assessment of the impact of large weirs on platypus dispersal rated Melton Reservoir as a problematic barrier for platypus moving upstream or downstream (Serena et al. 2023).

In contrast, Bacchus Marsh weir is a low structure that is predicted to be readily circumvented by a platypus dispersing from Werribee Gorge to Bacchus Marsh or vice-versa. This is supported by evidence from both sightings and eDNA surveys (Serena et al. 2022, MW unpublished data). Recent reliable platypus sightings in the Lerderderg River have been confined to its downstream end, within 6.5 km of its confluence with the Werribee River (Serena et al. 2022).

Recommendations:

- Further surveys to improve understanding of the platypus population demographics and whether regular usage of the lower Lerderderg River occurs.
- Enforcement of building site regulations to prevent runoff into stormwater systems.
- Improved integrated water management in urbanised areas to reduce stormwater inputs.
- Investigation of opportunities to deliver environmental entitlement from Pykes Creek Reservoir to provide flow during dry conditions.
- Implementation of bans and restrictions on water extraction on Lederderg River to expand potential available habitat of platypus.

Westernport Catchment

Athlone

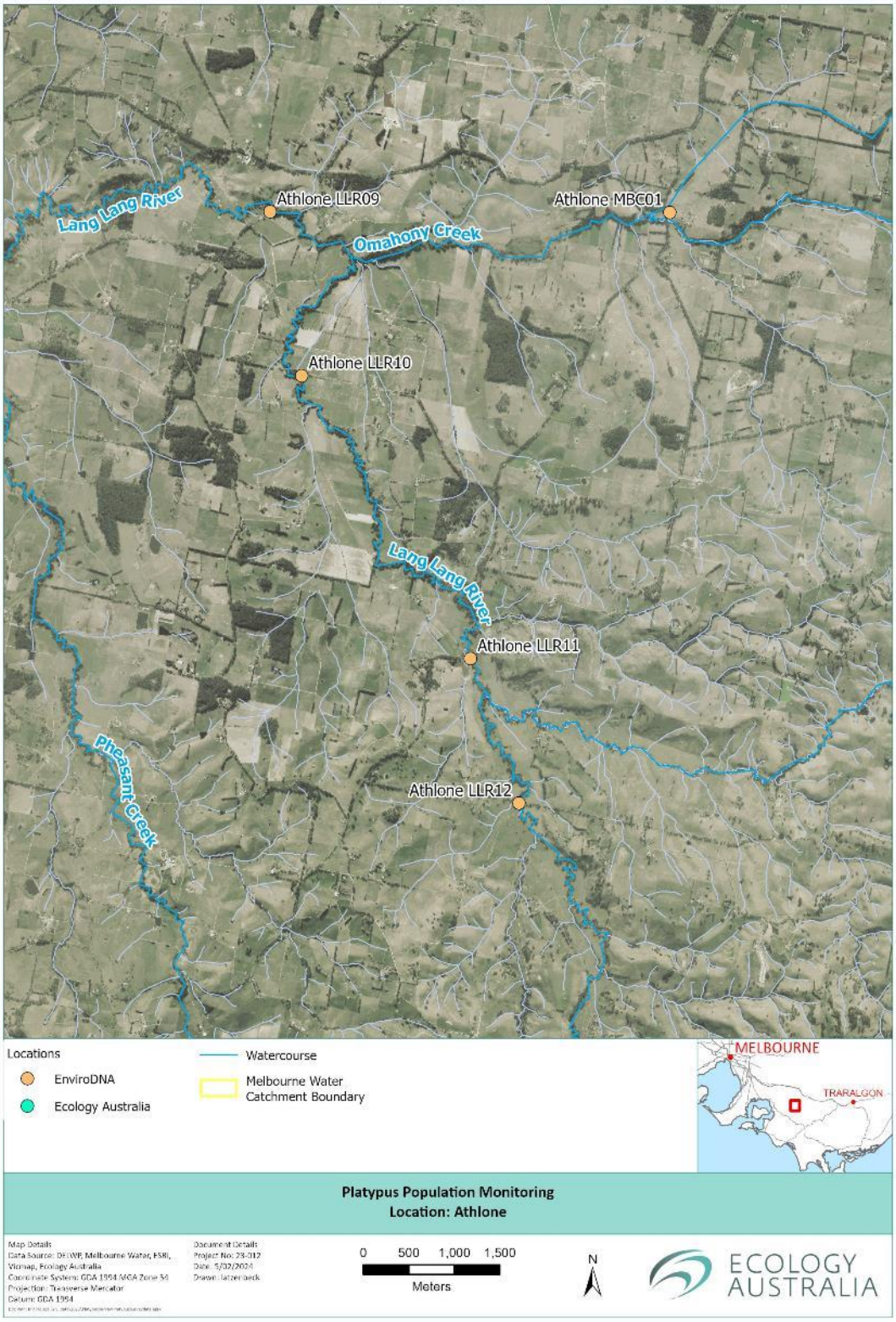

Figure 10: Site locations for Lang Lang River and Minnieburn Creek, Athlone.

Table 5: Summary of 2023 survey results for Athlone. Table includes seasonal and overall survey effort, number of individuals captured (including recaptured adults), and CPUE.

Total platypus captures	Adults/subadults	Juveniles	% Juveniles
No. platypus	**5**	**0**	**0**
CPUE including juveniles	No. platypus	Trap nights	CPUE
Autumn	4	3	1.33
Spring	1	4	0.25
Total	**5**	**7**	**0.71**
CPUE excluding juveniles	No. platypus	Trap nights	CPUE
Autumn	4	3	1.33
Spring	1	4	0.25
Total	**5**	**7**	**0.71**

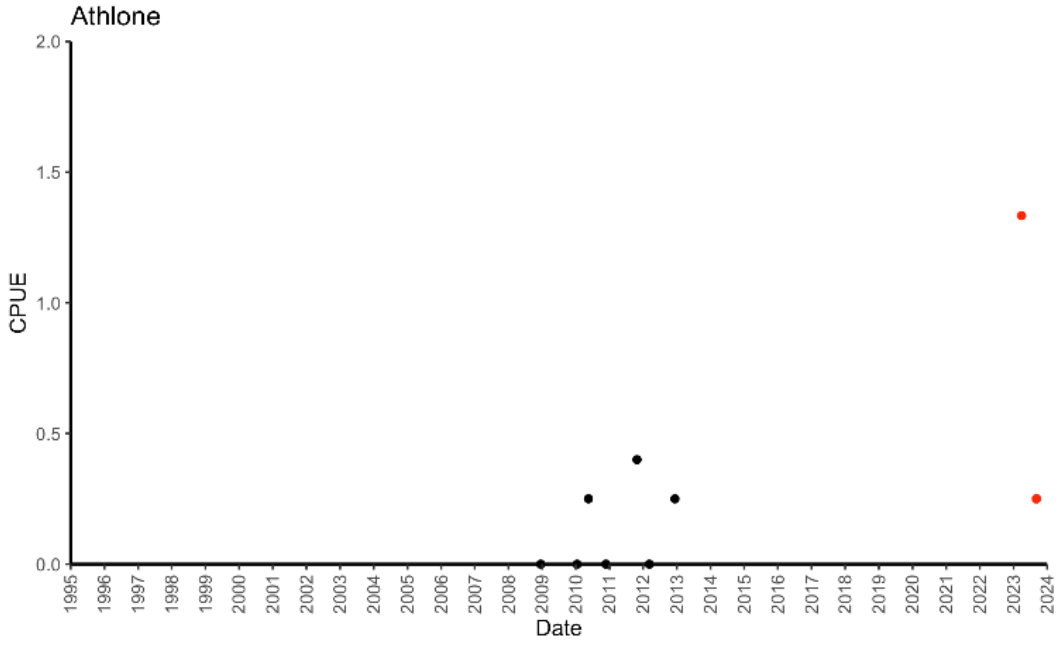

Figure 11: Historical and current CPUE (including juveniles) data available for Athlone. Current (2023) data shown in red.

A total of 7 sites were surveyed in Lang Lang River and Minnieburn Creek at Athlone which resulted in the capture of 4 individual platypuses during 2023 (Table 5). Two of the captured platypuses were adult males and 2 were adult females. One of the females captured in autumn was recaptured in spring at the same site.

Conditions were vastly different between autumn and spring surveys. In autumn, the Lang Lang River was dry upstream of site LLR11, limiting the capacity to survey upstream sites. Platypuses are unlikely to permanently occupy the reaches upstream of the confluence with Minnieburn Creek due to regular, extensive cease to flow events. In contrast, flows were quite high in spring, with nets retrieved in the early hours of the morning and nets unable to be set at all at site LLR09 (where most captures have been historically recorded). No litter

entanglements were noted for any platypus. These are the first surveys at this location since 2013, and CPUE during autumn (1.33) was the highest ever recorded.

Two other aquatic species were recorded as bycatch during the surveys; short-finned eels (8, 4) and spiny crayfish (1, 1) in autumn and spring respectively.

The area surrounding Lang Lang River and its tributaries is largely agricultural pasture, with increased and stochastic nutrient loads potentially resulting in eutrophication and proliferation of invasive taxa and reductions in food resources for platypuses. Stock access and subsequent erosion of banks may also reduce suitable burrowing habitat for platypus and increase in-stream sedimentation. The Athlone population of platypus is reasonably isolated, with little connectivity to Tarago and Bunyip River populations. Therefore, the population is of high regional conservational importance, but also highly susceptible to stochastic impacts. Genetic analysis of the population will allow for a better understanding of the connectivity, relatedness and inbreeding.

Recommendations:

- Continue to work with landowners to rehabilitate riparian zones with particular focus on removing willows and excluding stock.
- Working with Southern Rural water and landowners to improve flow regimes including reducing extent and duration of cease to flow events and minimising flow variability.

Bunyip

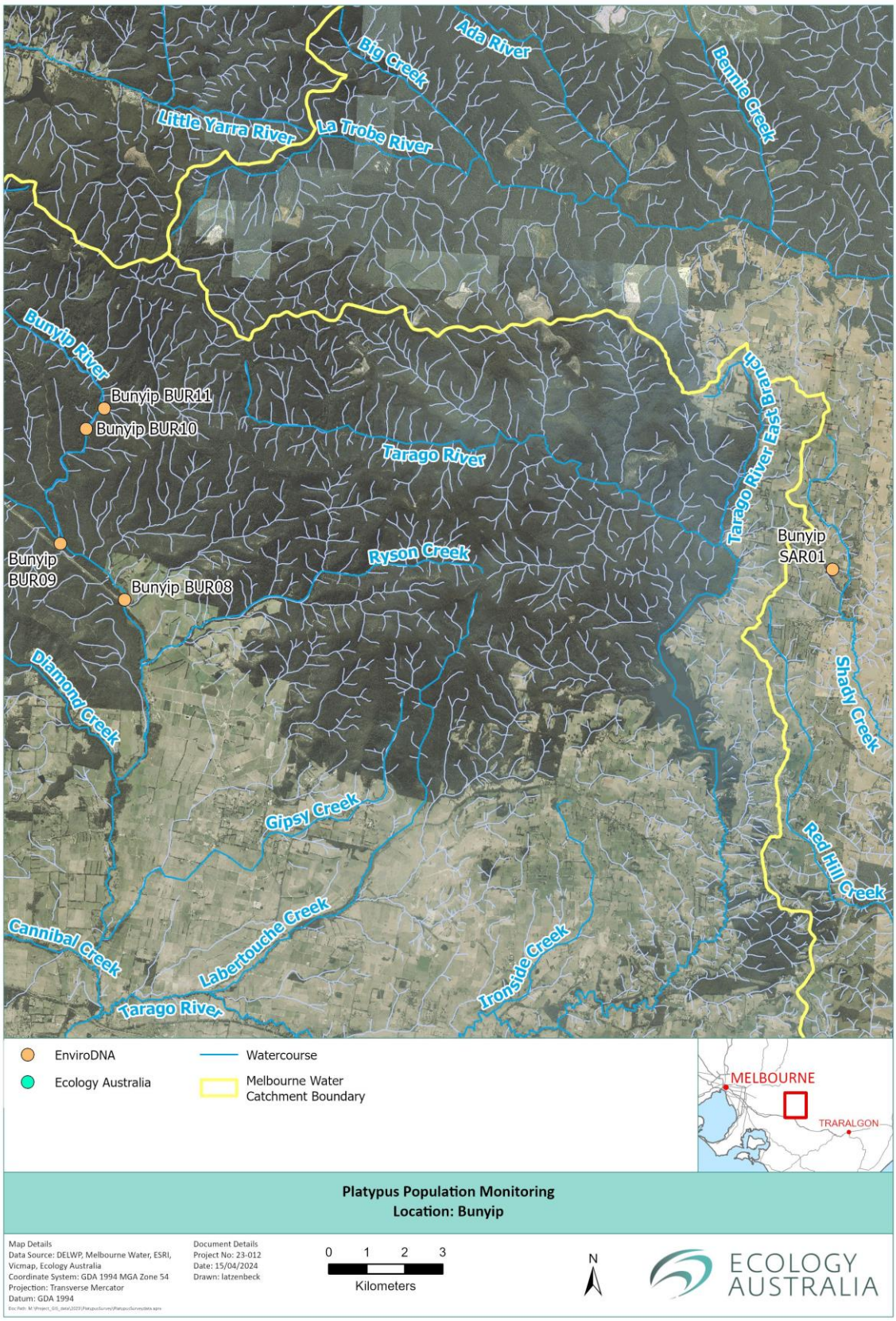

Figure 12: Site locations for Bunyip (upper Bunyip River and tributaries).

Table 6: Summary of 2023 survey results for Bunyip. Table includes seasonal and overall survey effort, number of individuals captured (including recaptured adults), and CPUE.

Total platypus captures	Adults/subadults	Juveniles	% Juveniles
No. platypus	**0**	**0**	**NA**
CPUE including juveniles	No. platypus	Trap nights	CPUE
Winter	0	5	0
Spring	NS	NS	
Total	**0**	**5**	**0**
CPUE excluding juveniles	No. platypus	Trap nights	CPUE
Winter	0	5	0
Spring	NS	NS	
Total	**0**	**5**	**0**

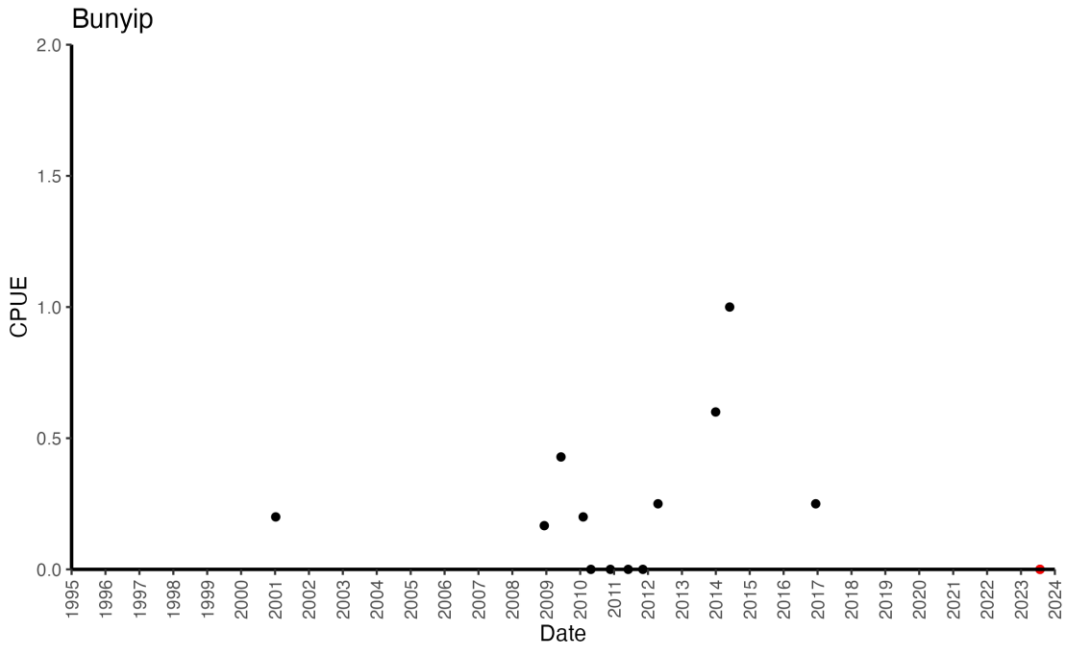

Figure 13: Historical and current CPUE (including juveniles) data available for Bunyip. Current (2023) data shown in red.

A total of 5 sites were surveyed in the upper Bunyip River and Sardine Creek during July 2023. No platypus were captured. Although conditions weren't particularly windy during the survey, the nets were continually fouled by high leaf loads throughout the night which may have contributed to the lack of captures (although CPUE is historically highly variable at this location). Excess leaves in fyke nets increases pressure from flows which can pull the nets out of shape and may reduce effectiveness if openings to bypass nets are created (i.e. under wings if rocks along bottom are dislodged). Although leaves are cleaned out and nets reset during the night, this also increases disturbance at sites. An eDNA study conducted after the 2019 bushfires found widespread positive results for platypus throughout the Bunyip River Middle and Upper sub-catchment (Bloink 2020).

Two bycatch species were recorded: blackfish (1), and brown trout (1).

Recommendations:

- Prioritise surveys at this location during next survey period to generate contemporary data.
- Investigate ways to increase in-stream complexity, particularly substrate which is currently dominated by sand.
- Maintain current conditions and ensure no degradation of flow regimes.

Cardinia

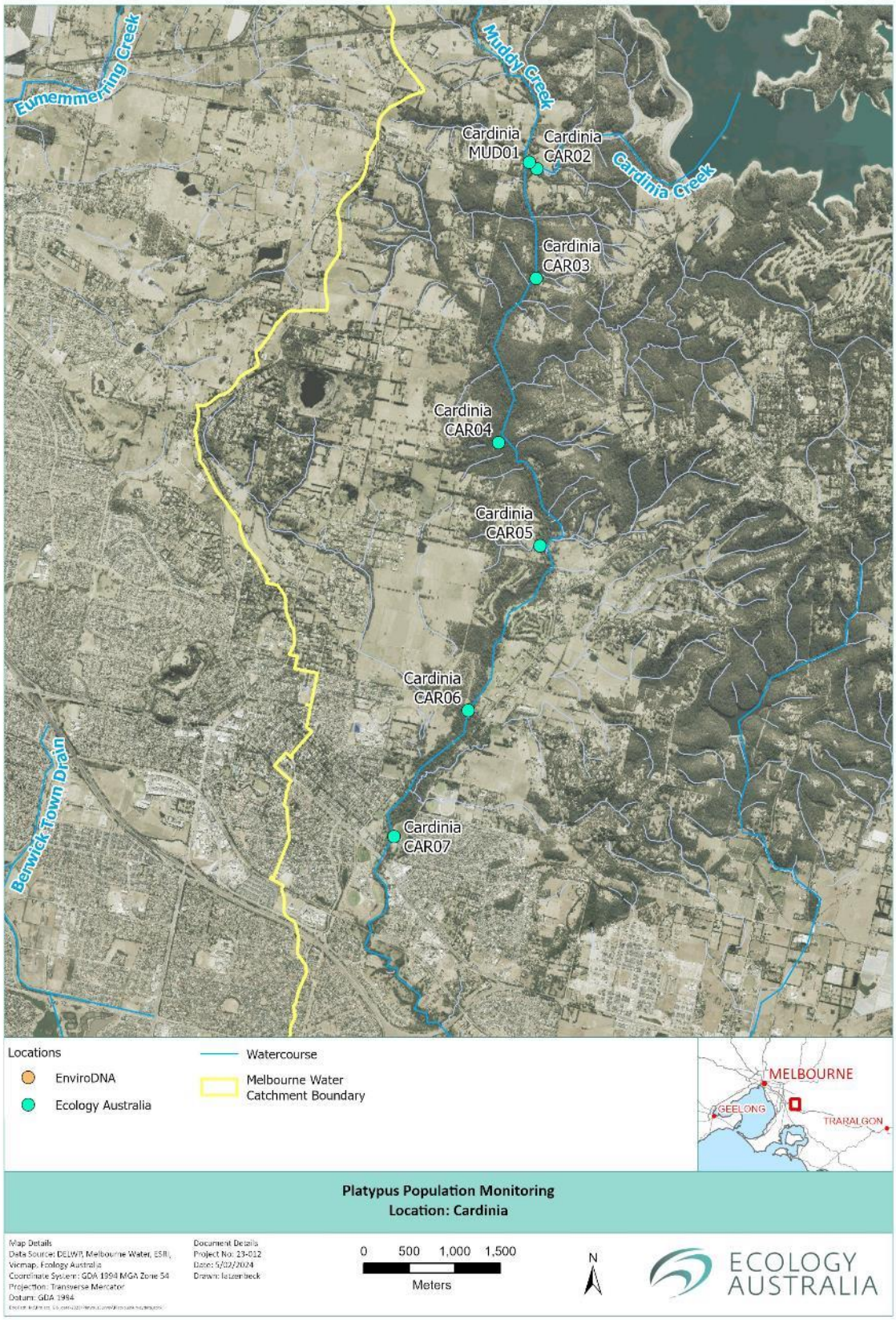

Figure 14: Site locations for Cardinia Creek, Beaconsfield.

Table 7: Summary of 2023 survey results for Cardinia Creek, Beaconsfield. Table includes seasonal and overall survey effort, number of individuals captured (including recaptured adults), and CPUE.

Total platypus captures	Adults/subadults	Juveniles	% Juveniles
No. platypus	**4 (1)**	**0**	**0**
CPUE including juveniles	No. platypus	Trap nights	CPUE
Autumn	1	7	0.1
Spring	3	7	0.4
Total	**4**	**14**	**0.29**
CPUE excluding juveniles	No. platypus	Trap nights	CPUE
Autumn	1	7	0.1
Spring	3	7	0.4
Total	**4**	**14**	**0.29**

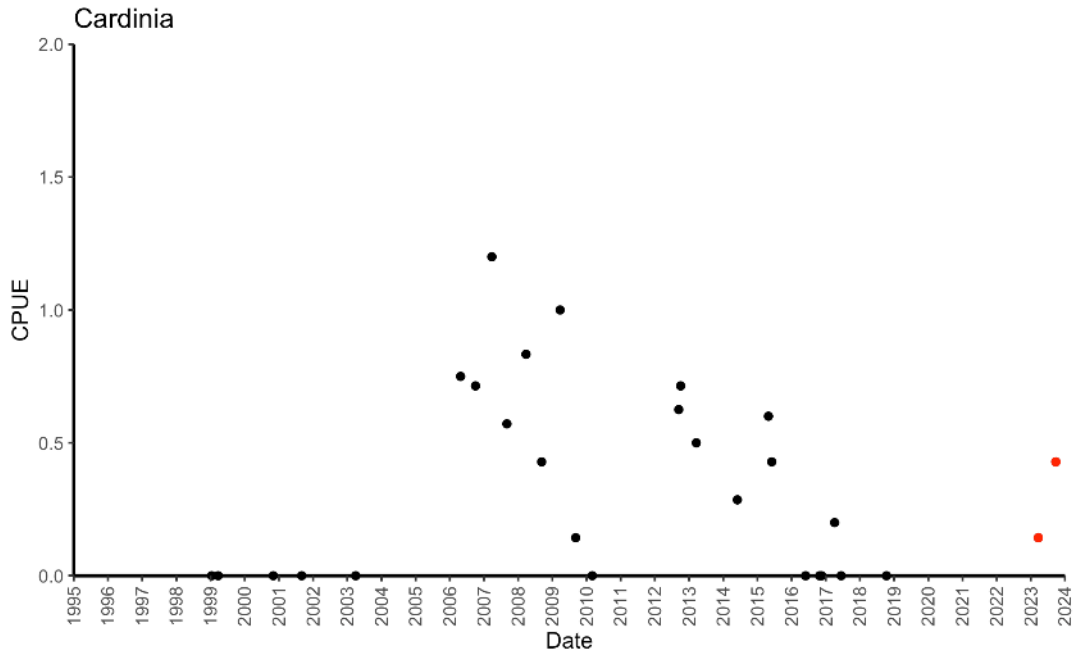

Figure 15: Historical and current CPUE (including juveniles) data available for Cardinia Creek, Beaconsfield. Current (2023) data shown in red.

A total of 14 trap nights conducted in Cardinia Creek resulted in the capture of 4 individual platypuses during 2023 (Table 7). This included 1 adult female in autumn and 3 adult males in spring. One male was a recapture, initially tagged in 2015. The presence of a new female plus 2 new males indicate successful reproduction has occurred and is encouraging for this small, isolated population that was re-established via translocations by APC between 2004 and 2007.

The female platypus showed signs of previous litter entanglement under the right forearm and left shoulder. No safety issues were noted, an attempted survey in spring had to be abandoned due to a rain event that saw the creek levels rise rapidly.

Overall CPUE for 2023 has increased with the more recent surveys, but has remained lower than surveys conducted immediately post-reintroduction.

Seven other aquatic species were recorded as bycatch during the surveys comprising short-finned eels (3), common galaxias (2), brown trout (2), Australian grayling (1), river blackfish (3), tupong (2) and Gippsland spiny crayfish (19), plus 3 black ducks.

Urbanisation of the Cardinia Creek catchment is increasing, and the Healthy Waterways Strategy target is to retain Directly Connected Imperviousness (DCI) below 3% above Cardinia Road where the platypus population primarily occurs. Increased impervious surfaces (as described as both DCI and Attenuated Imperviousness) have long been associated with platypus decline or absence from urbanised waterways (Danger and Walsh 2008; Coleman et al. 2022).

Maintenance of baseflow is essential, and this is currently provided by a 5 ML/d passing flow from Cardinia Reservoir. The isolated nature of this population is still a cause for concern and may require genetic translocations for improved genetic diversity in the longer term.

Recommendations:

- Implementation of actions to achieve the HWS target of maintaining DCI below 3% above Cardinia Rd.
- Ensure passing flows from Cardinia Reservoir are maintained.
- Enhance riparian vegetation around refuge pools.
- Enhance downstream habitat to facilitate population expansion to allow for a viable self-sustaining population.
- Develop a translocation strategy to increase genetic diversity and improve population resilience, as long as this can be achieved without compromising the welfare of animals already established in the system.

Labertouche

Figure 16: Site locations for Labertouche Creek, Labertouche.

Table 8: Summary of 2023 survey results for Labertouche. Table includes seasonal and overall survey effort, number of individuals captured (including recaptured adults), and CPUE.

Total platypus captures	Adults/subadults	Juveniles	% Juveniles
No. platypus	**9**	**0**	**0**
CPUE including juveniles	No. platypus	Trap nights	CPUE
Autumn	4	4	1
Spring	5	4	1.2
Total	**9**	**8**	**1.1**
CPUE excluding juveniles	No. platypus	Trap nights	CPUE
Autumn	4	4	1
Spring	5	4	1.2
Total	**9**	**8**	**1.1**

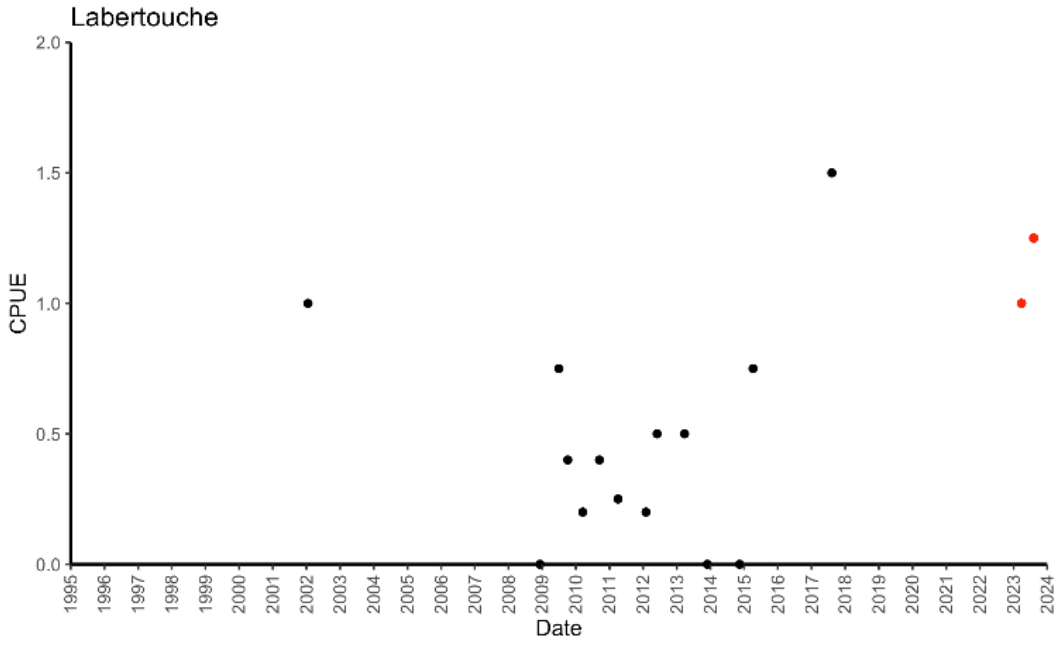

Figure 17: Historical and current CPUE (including juveniles) data available for Labertouche. Current (2023) data shown in red.

A total of 8 sites were surveyed in Labertouche Creek, which resulted in the capture of 9 individual platypus during 2023 (Table 8). All captured individuals were new adults, with 1 male and 3 females caught in autumn, and 3 males and 2 females caught in spring.

In autumn, the nets at Labertouche Creek had to be removed during the night as water levels were rising to an unsafe level. Despite the reduced time in the water, the CPUE was still one of the highest recorded at this location. This is particularly encouraging in the context of 5 individual platypuses discovered drowned in opera house nets in this creek in 2017. There is not enough pre-drought data for Labertouche Creek to compare with recent results.

In autumn, there were 5 bycatch species recorded: short-finned eel (9), blackfish (1), mountain galaxiid (1), tupong (2), spiny crayfish (4). In spring, 4 species were recorded as bycatch: blackfish (1), tupong (1), Australian grayling (3), redfin (1).

Recommendations:

- Continue to work with landowners to rehabilitate riparian zones (native revegetation, remove invasive weeds, exclude stock) to improve habitat quality.

Lower Tarago

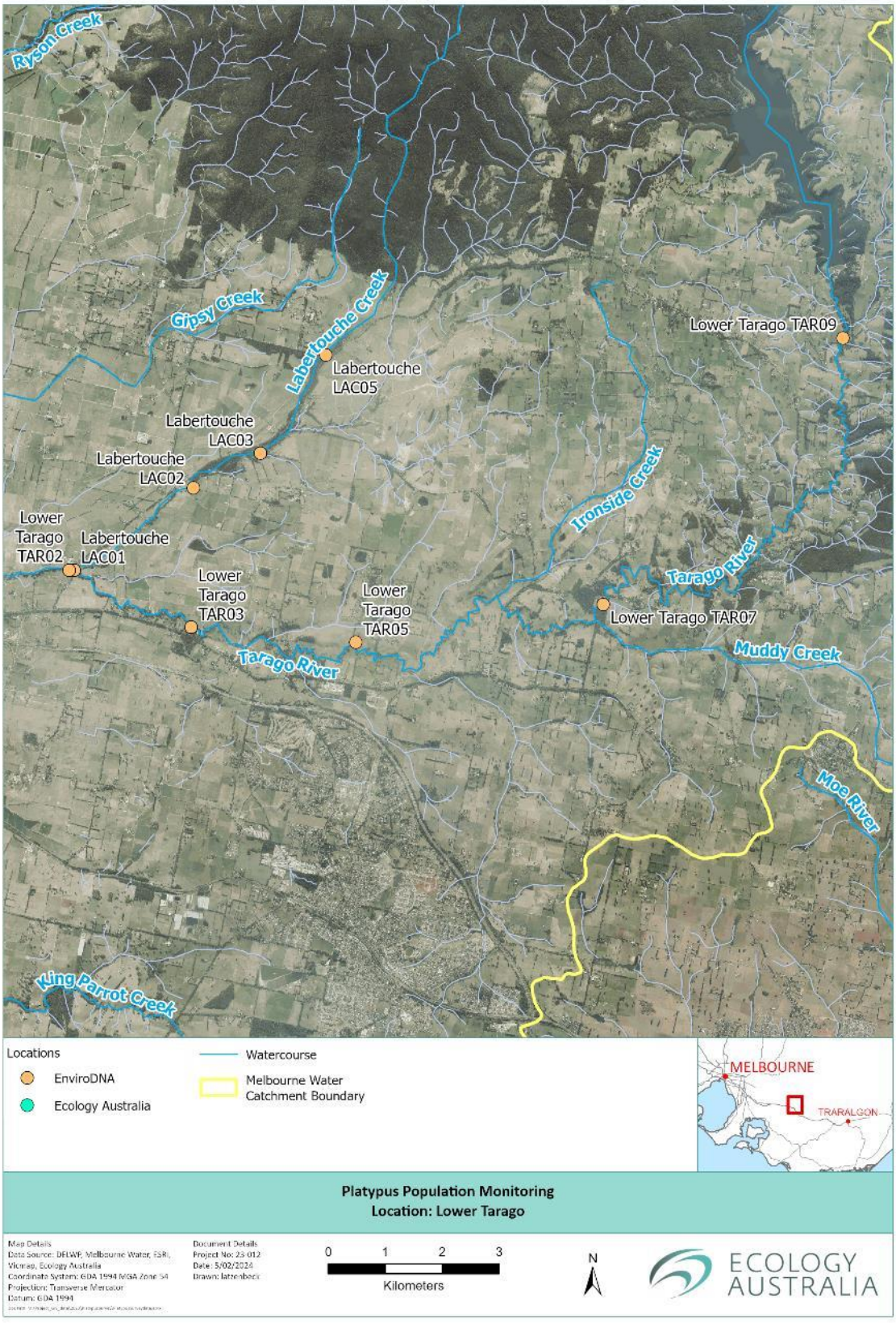

Figure 18: Site locations for Tarago River, Lower Tarago.

Table 9: Summary of 2023 survey results for Lower Tarago. Table includes seasonal and overall survey effort, number of individuals captured (including recaptured adults), and CPUE.

Total platypus captures	Adults/subadults	Juveniles	% Juveniles
No. platypus	**6**	**1**	**14**
CPUE including juveniles	No. platypus	Trap nights	CPUE
Autumn	2	1*	
Winter	3	6	0.5
Spring	2	5	0.4
Total	**7**	**12**	**0.58**
CPUE excluding juveniles	No. platypus	Trap nights	CPUE
Autumn	1	1*	
Winter	3	6	0.5
Spring	2	5	0.4
Total	**6**	**12**	**0.50**

* insufficient survey effort to calculate CPUE.

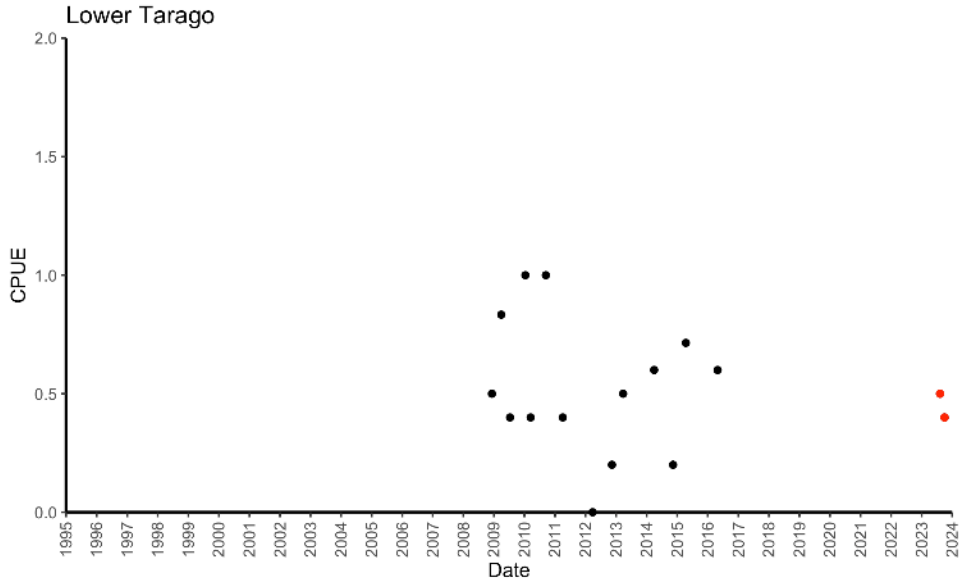

Figure 19: Historical and current CPUE (including juveniles) data available for Lower Tarago, Tarago River. Current (2023) data shown in red.

A total of 12 sites were surveyed in the lower Tarago River, which resulted in the capture of 7 individual platypus during 2023 (Table 9). All individuals recorded were new captures, with 1 adult male, 3 adult females and a juvenile male in autumn/winter, and 1 adult male and 1 adult female in spring. Note that additional nets were also set (1 site) during the Labertouche Creek survey in autumn, which captured 2 additional platypuses (1 juvenile male and 1 adult female), but the remainder of the survey could not be completed due to rising water levels, and CPUE for that night could not be calculated due to low survey effort (minimum 3 sites required).

The long-term trend in CPUE has remained relatively stable for the lower Tarago (2010–2023 mean CPUE = 0.411, SE = 0.07), likely supported through consistent baseflow provided from Tarago Reservoir. The capture of a juvenile in 2023 indicates that reproduction is occurring in the area.

In autumn, 5 bycatch species were recorded: short-finned eel (1), blackfish (3), tupong (1), Australian grayling (1) and Australian wood ducks (2). In spring, there were 7 species of bycatch: rakali (1), short-finned eel (4), blackfish (2), Australian grayling (3), carp (1), spiny crayfish (9), pacific black duck (9).

Recommendations:

- Continue riparian restoration (native revegetation, remove invasive weeds, exclude stock) to improve habitat quality.
- Ensure baseflows are maintained through consistent passing flows water releases from Tarago Reservoir.

Upper Tarago

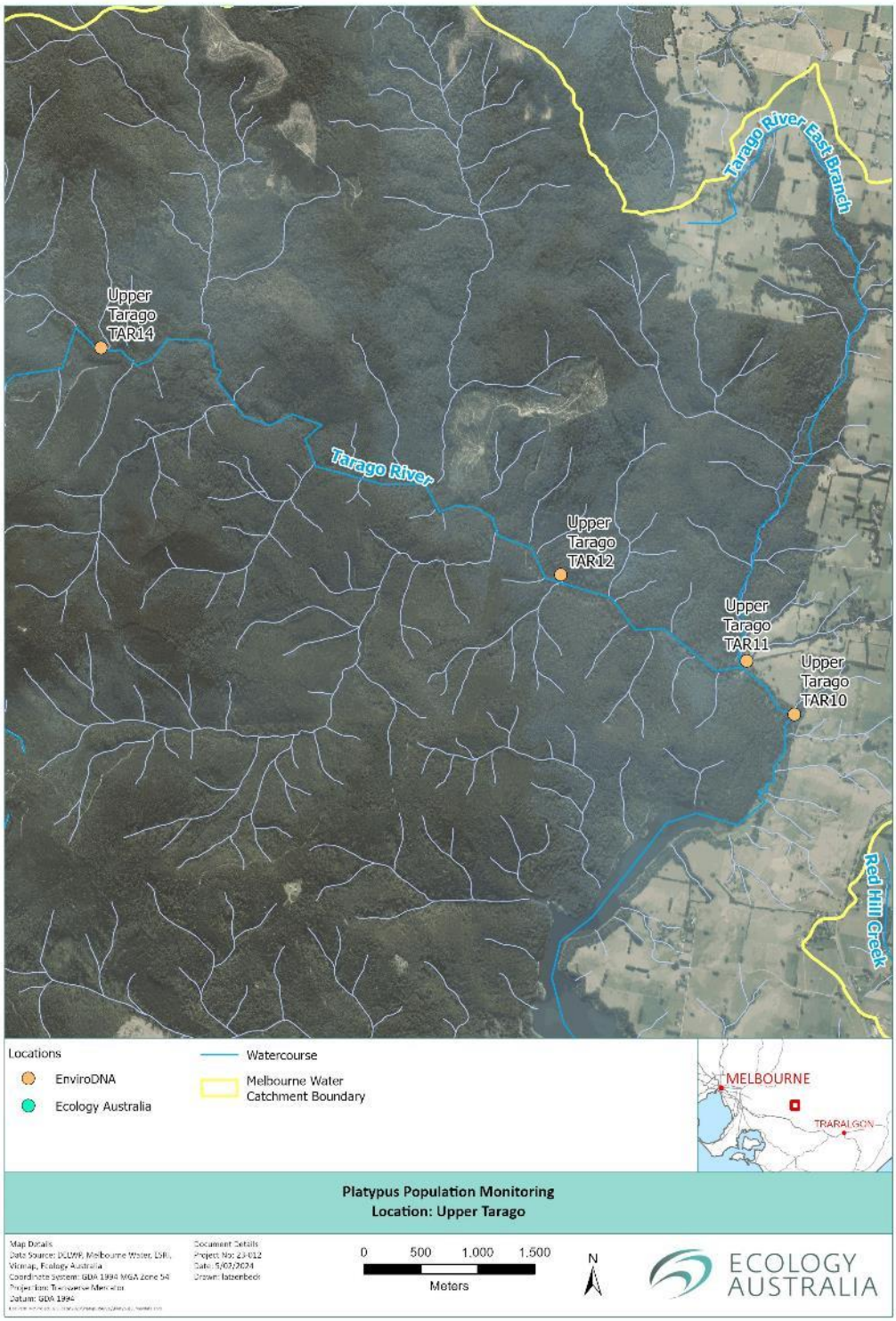

Figure 20: Site locations for Tarago River, Upper Tarago.

Table 10: Summary of 2023 survey results for Upper Tarago. Table includes seasonal and overall survey effort, number of individuals captured (including recaptured adults), and CPUE.

Total platypus captures	Adults (subadults)	Juveniles	% Juveniles
No. platypus	**7 (1)**	**1**	**14**
CPUE including juveniles	No. platypus	Trap nights	CPUE
Autumn	5	4	1.25
Spring	3	4	0.75
Total	**8**	**8**	**1**
CPUE excluding juveniles	No. platypus	Trap nights	CPUE
Autumn	4	4	1
Spring	3	4	0.75
Total	**7**	**8**	**0.86**

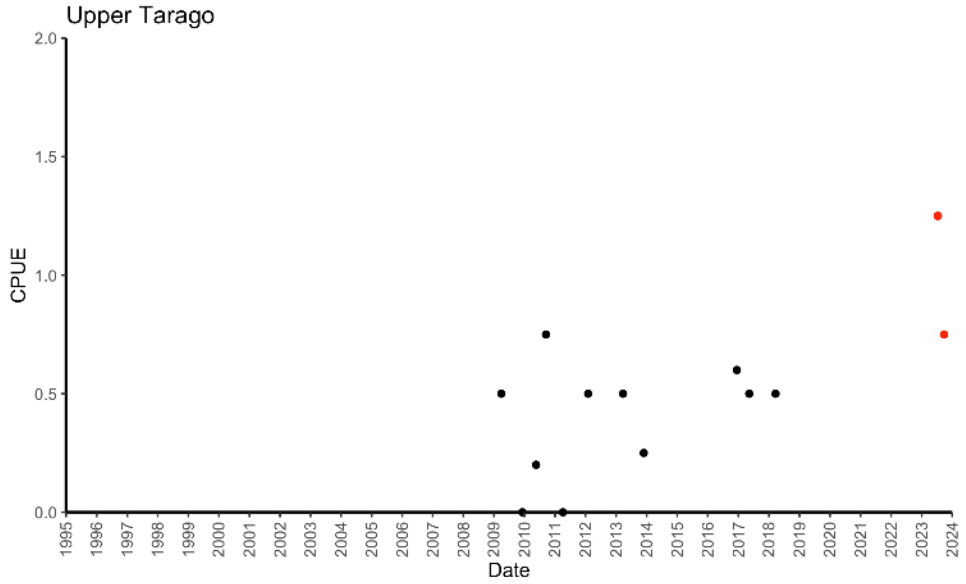

Figure 21: Historical and current CPUE (including juveniles) data available for Tarago River and Quartz Creek, Upper Tarago. Current (2023) data shown in red.

A total of 8 sites were surveyed in the upper Tarago River, which resulted in the capture of 8 platypus during 2023. In autumn, all 5 platypuses caught were male, with 1 juvenile and 1 recapture that is at least 7 years old. The recaptured male was first caught in 2018 approximately 2 km upstream (TAR12) of where it was caught in 2023 (TAR11) and weighed 200 g more than when it was first captured. In spring, 1 adult female, 1 adult male and 1 sub-adult male were caught.

The 2023 surveys had the highest CPUE, indicating the population is increasing in overall abundance since surveys began in 2009 and supported by recent eDNA data (MW unpublished data, Griffiths et al. 2018b). This is particularly pleasing considering this area was badly impacted by bushfires in 2009 and again in 2019.

In autumn, 4 bycatch species were caught: blackfish (3), climbing galaxiids (1), rainbow trout (1), brown trout (2), and in spring, 3 bycatch species were recorded: blackfish (2), mountain galaxiid (1), spiny crayfish (1).

Recommendations:

- Maintain current conditions and ensure no future degradation of flow regimes.

Yarra Catchment

Eltham

Figure 22: Site locations for Diamond Creek, Eltham.

Table 11: Summary of 2023 survey results for Diamond Creek, Eltham. Table includes seasonal and overall survey effort, number of individuals captured (including recaptured adults), and CPUE.

Total platypus captures	Adults/subadults	Juveniles	% Juveniles
No. platypus	**2 (0)**	**0**	**0**
CPUE including juveniles	No. platypus	Trap nights	CPUE
Autumn	1	6	0.2
Spring	1	4	0.2
Total	**2**	**10**	**0.20**
CPUE excluding juveniles	No. platypus	Trap nights	CPUE
Autumn	1	6	0.2
Spring	1	4	0.2
Total	**2**	**10**	**0.20**

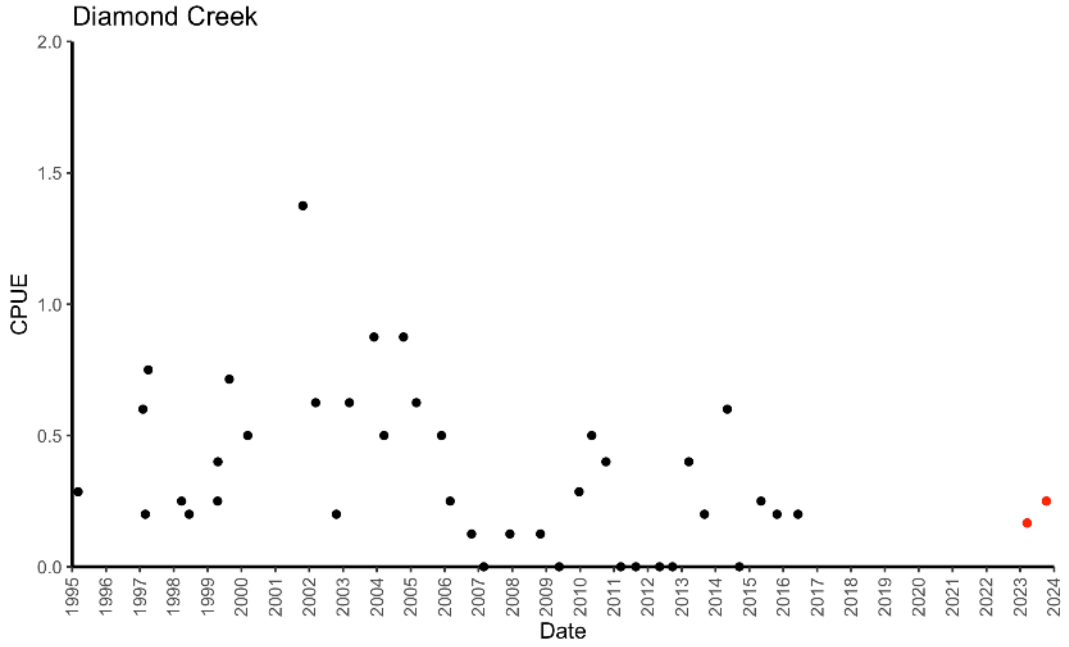

Figure 23: Historical and current CPUE (including juveniles) data available for Diamond Creek, Eltham. Current (2023) data shown in red.

A total of 10 trap nights conducted in Diamond Creek resulted in the capture of 2 individual platypuses during 2023 (Table 11). This included 1 adult male in autumn and 1 adult female in spring, both new captures. Only 4 sites were sampled in spring (compared with 6 in autumn) due to high levels of rainfall the week prior resulting in the creek being too deep to safely set nets at 2 sites. There were no signs of litter entanglement on either platypus, which is good considering that this location has historically been a litter entanglement hotspot. However, a lot of rubbish was observed in the waterway, including smaller items that have the potential to entangle platypus.

Overall CPUE for 2023 was low, consistent with results from the most recent surveys.

Seven other aquatic species were recorded as bycatch during the surveys comprising short-finned eels (9), redfin (2), roach (5), river blackfish (1), Australian bass (1), long necked turtle (1) and rakali (2), plus 11 black ducks.

Diamond Creek is a flashy urban creek, and spring 2022 rains resulted in high flows that could have been detrimental to any platypus trying to breed in this waterway. The urbanised reach of Diamond Creek monitored in this study is eroded and generally has very poor habitat complexity. Riparian vegetation is lacking and poor in many parts, with the HWS target to improve from a low to moderate trajectory.

Flows in Diamond Creek can become very low during dry or drought periods, which can be exacerbated by water extraction upstream. Connection with the Yarra River is considered vital for this platypus population, particularly as a refuge in dry years.

Recommendations:

- Continuation of litter education campaigns in this area.
- Continued implementation of Local Management Rules for Diamond Creek, and update and implementation of the Drought Response Plan as required.
- Riparian restoration along the Diamond Creek corridor to improve habitat conditions for platypus.
- Improvements to physical form where possible to increase habitat complexity as recommended by Streamology (2021).
- Reduce stormwater inputs to the creek through implementation of integrated water management solutions.

McMahons

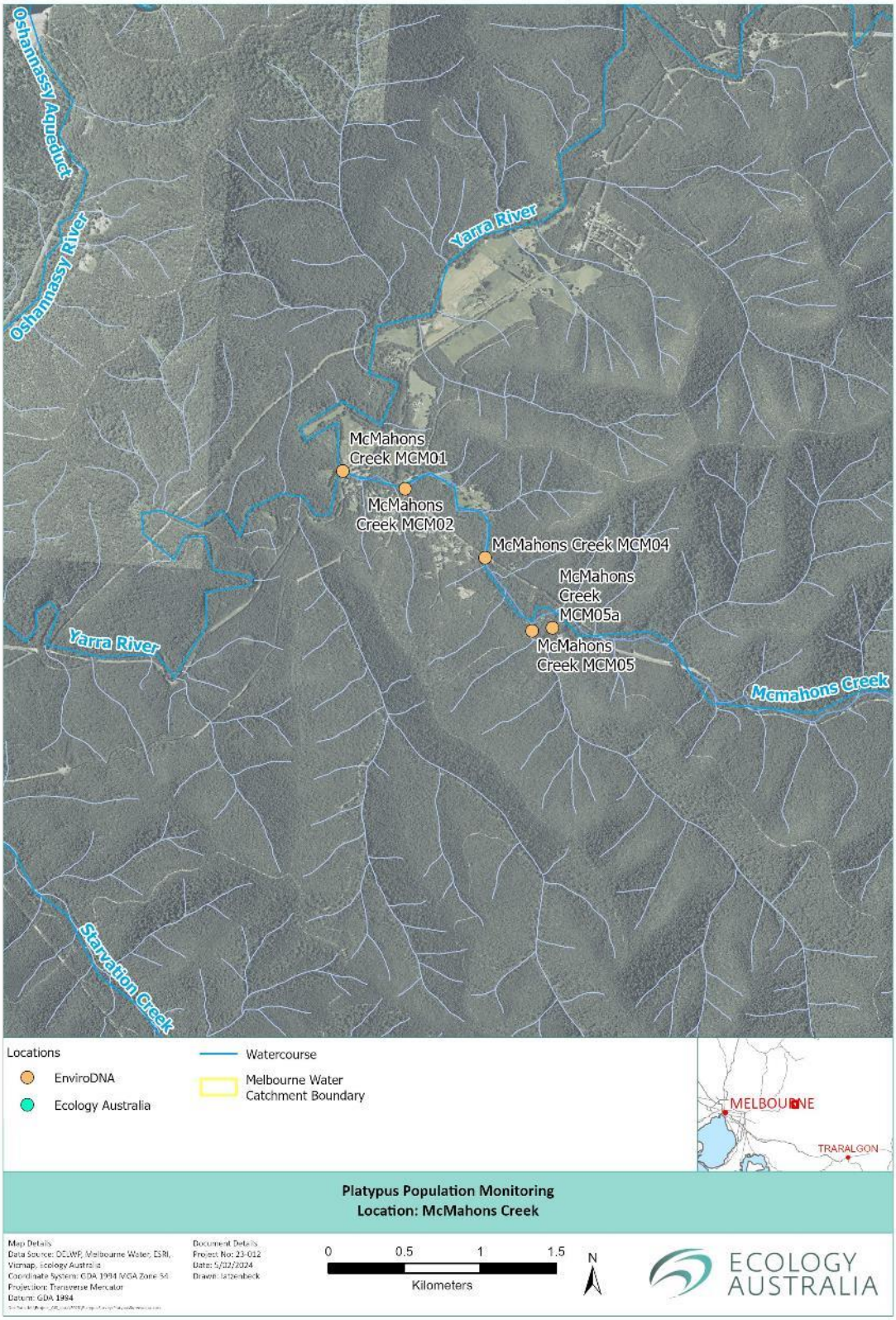

Figure 24: Site locations for McMahons Creek, McMahons.

Table 12: Summary of 2023 survey results for McMahons Creek. Table includes seasonal and overall survey effort, number of individuals captured (including recaptured adults), and CPUE.

Total platypus captures	Adults/subadults	Juveniles	% Juveniles
No. platypus	**4**	**1**	**20**
CPUE including juveniles	No. platypus	Trap nights	CPUE
Autumn	4	5	0.8
Spring	1	5	0.2
Total	**5**	**10**	**0.50**
CPUE excluding juveniles	No. platypus	Trap nights	CPUE
Autumn	3	5	0.6
Spring	1	5	0.2
Total	**4**	**10**	**0.40**

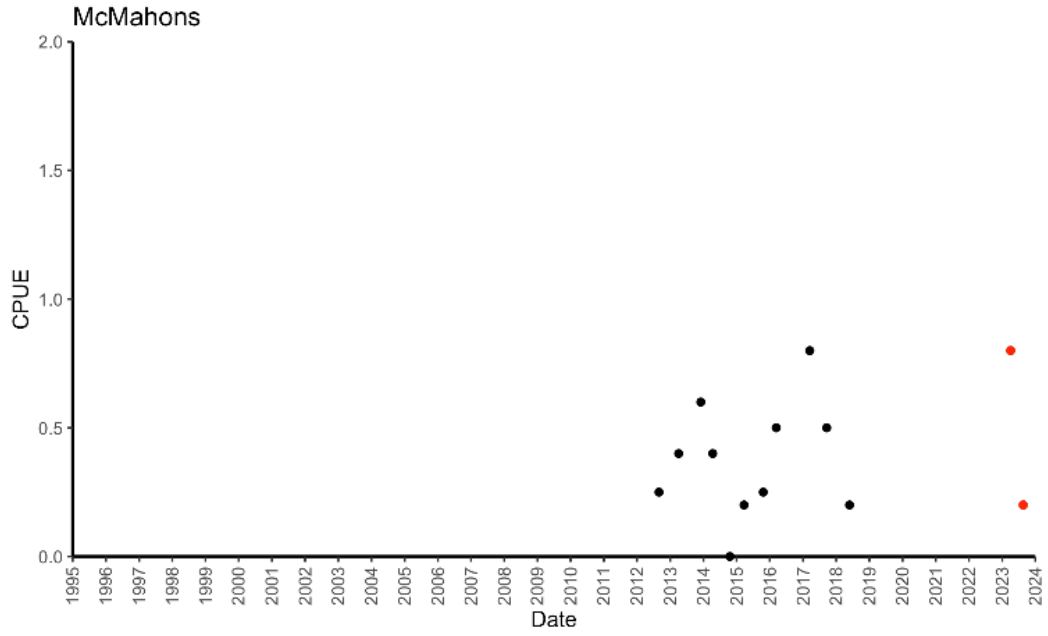

Figure 25: Historical and current CPUE (including juveniles) data available for McMahons Creek. Current (2023) data shown in red.

In total, 10 trap nights were conducted in McMahons Creek, resulting in the capture of 5 platypus during 2023. In autumn, 4 females were caught, including 1 juvenile. In spring, 1 adult male was captured. All platypuses caught in McMahons Creek in 2023 were previously unrecorded.

The 2023 McMahons Creek CPUE is slightly higher than the average since 2010 (mean = 0.392, SE = 0.067). The capture of a juvenile also indicates that reproduction is occurring. Long term CPUE has been relatively consistent since surveys began in 2013, with juveniles regularly recorded, suggesting the population is relatively healthy and stable.

In autumn, there was only one bycatch species: blackfish (9), in spring there were 3 bycatch species: blackfish (5), brown trout (2) and spiny crayfish (3).

Recommendations:

- Maintain current conditions and ensure no degradation of flow regimes.

Mullum Mullum

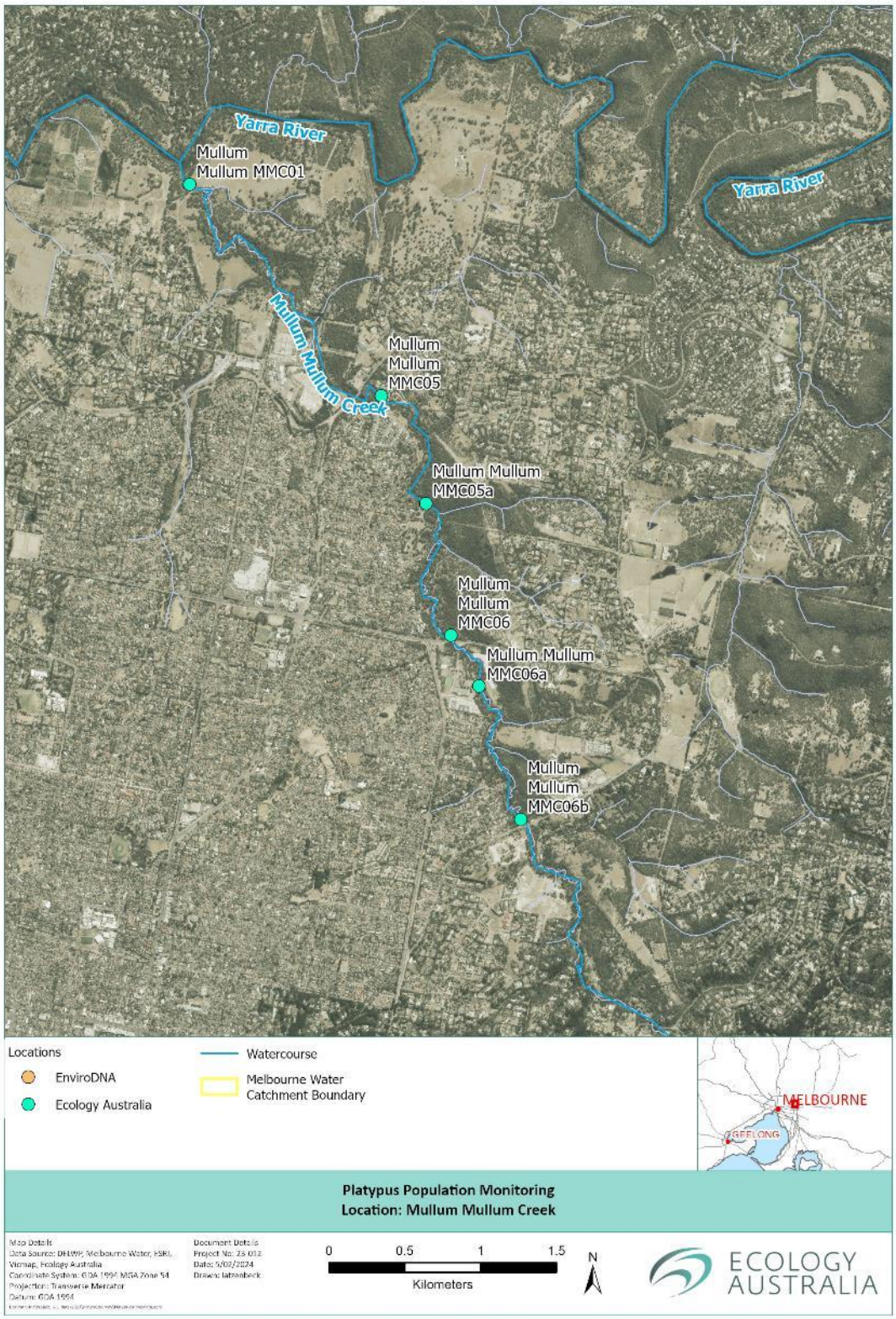

Figure 26: Site locations for Mullum Mullum Creek, Warrandyte.

Table 13: Summary of 2023 survey results for Mullum Mullum Creek. Table includes seasonal and overall survey effort, number of individuals captured (including recaptured adults), and CPUE.

Total platypus captures	Adults/subadults	Juveniles	% Juveniles
No. platypus	**10 (0)**	**0**	**0**
CPUE including juveniles	No. platypus	Trap nights	CPUE
Autumn	7	6	1
Spring	3	4	0.7
Total	**10**	**10**	**1.0**
CPUE excluding juveniles	No. platypus	Trap nights	CPUE
Autumn	7	6	1
Spring	3	4	0.7
Total	**10**	**10**	**1.0**

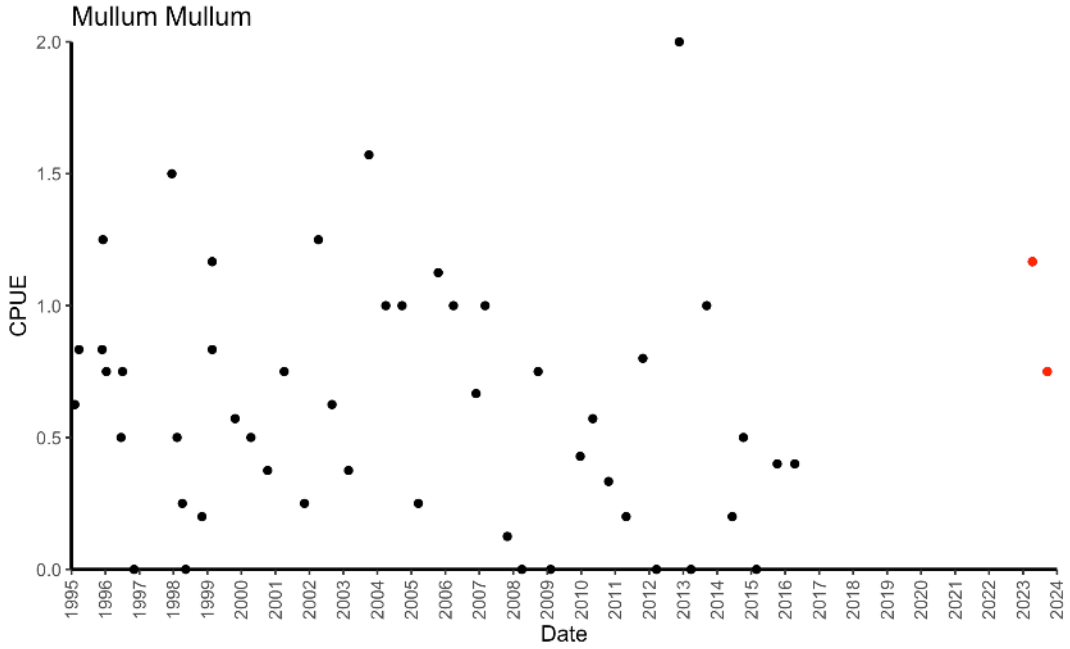

Figure 27: Historical and current CPUE (including juveniles) data available for Mullum Mullum Creek. Current (2023) data shown in red.

A total of 10 trap nights conducted in Mullum Mullum Creek resulted in the capture of 10 individual platypuses during 2023 (Table 13). All 10 platypuses were new adults, only 2 were female. Mullum Mullum Creek can be used as a surrogate for platypus trends in this part of the lower Yarra (which is unable to be surveyed using fyke nets), given that radio-tagged animals captured in Mullum Mullum Creek were found to divide their time between the creek and the river (Serena et al. 1998). However, connectivity with the Yarra is likely to be essential as a refuge during periods of low flow and for the overall better habitat conditions it presents.

No safety issues or litter entanglement were noted for Mullum Mullum Creek.

The CPUE for Mullum Mullum Creek was 1, which rates well compared with other locations surveyed in 2023. However, CPUE of 1 is well within the range of results recorded for Mullum Mullum previously, which have typically been highly variable between 0 and 2.

Six other aquatic species were recorded as bycatch during the surveys comprising short-finned eels (4), common galaxias (3), flathead gudgeon (1), roach (1), long necked turtle (1) and rakali (1), plus black ducks (7).

Heavy rain in late spring 2022 resulted in high flows that could have been detrimental to any platypus trying to breed in Mullum Mullum Creek (or the nearby Yarra River that also experienced high flows) and may be a contributing factor to the lack of juveniles caught at this location in the following autumn. As an urban stream, Mullum Mullum Creek experiences significant impacts from stormwater, and riparian vegetation quality is lacking in the urbanised upper reaches.

Recommendations:

- Update and implement the Drought Response Plan as required.
- Investigate opportunities for stormwater harvesting that may be utilised to supplement baseflows under dry conditions.
- Riparian restoration along the Mullum Mullum Creek corridor to improve habitat conditions for platypus.

Lilydale

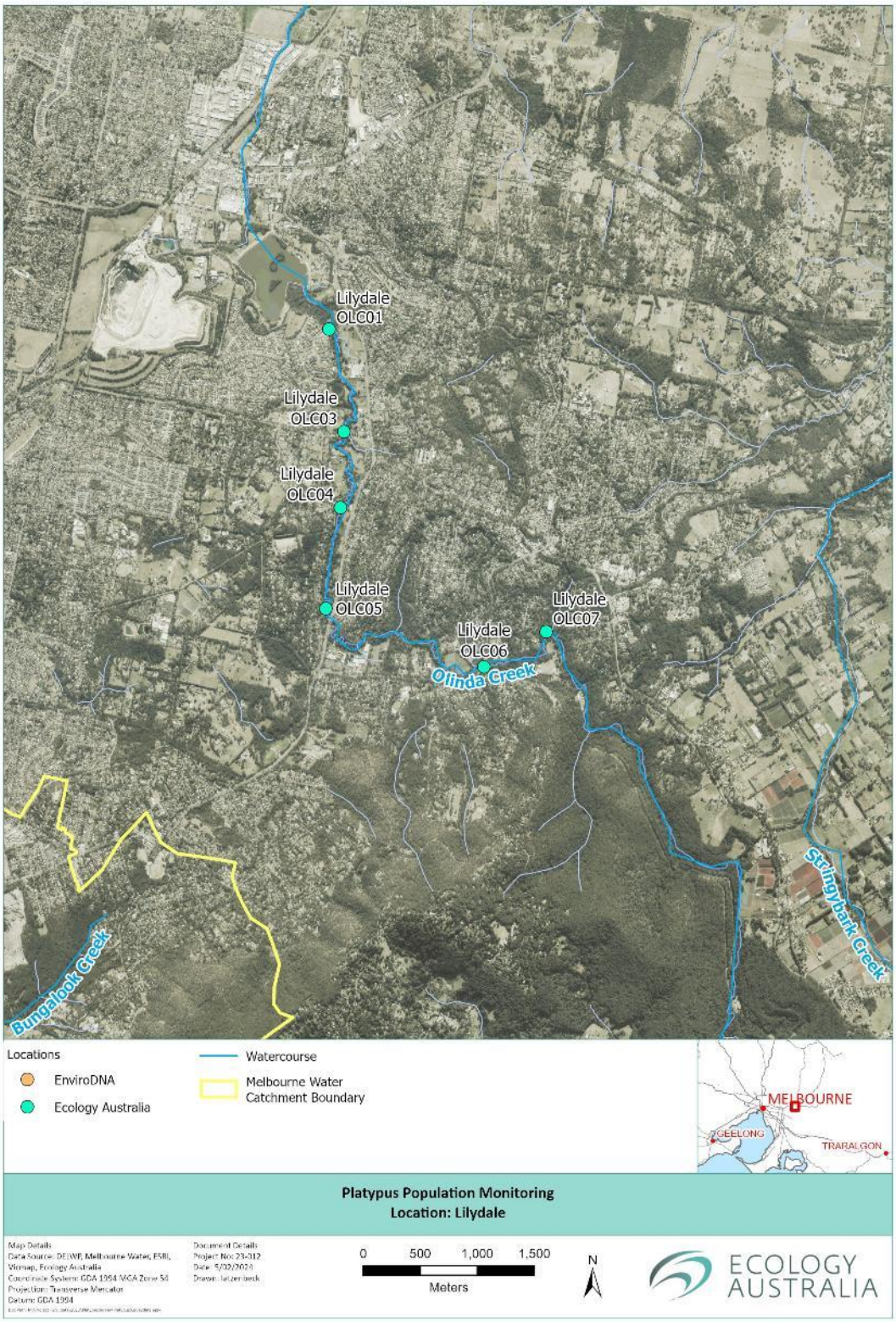

Figure 28: Site locations for Olinda Creek, Lilydale.

Table 14: Summary of 2023 survey results for Olinda Creek, Lilydale. Table includes seasonal and overall survey effort, number of individuals captured (including recaptured adults), and CPUE.

Total platypus captures	Adults/subadults	Juveniles	% Juveniles
No. platypus	**3 (1)**	**1**	**25**
CPUE including juveniles	No. platypus	Trap nights	CPUE
Autumn	1	6	0.2
Spring	3	5	0.6
Total	**4**	**11**	**0.36**
CPUE excluding juveniles	No. platypus	Trap nights	CPUE
Autumn	0	6	0
Spring	3	5	0.6
Total	**3**	**11**	**0.27**

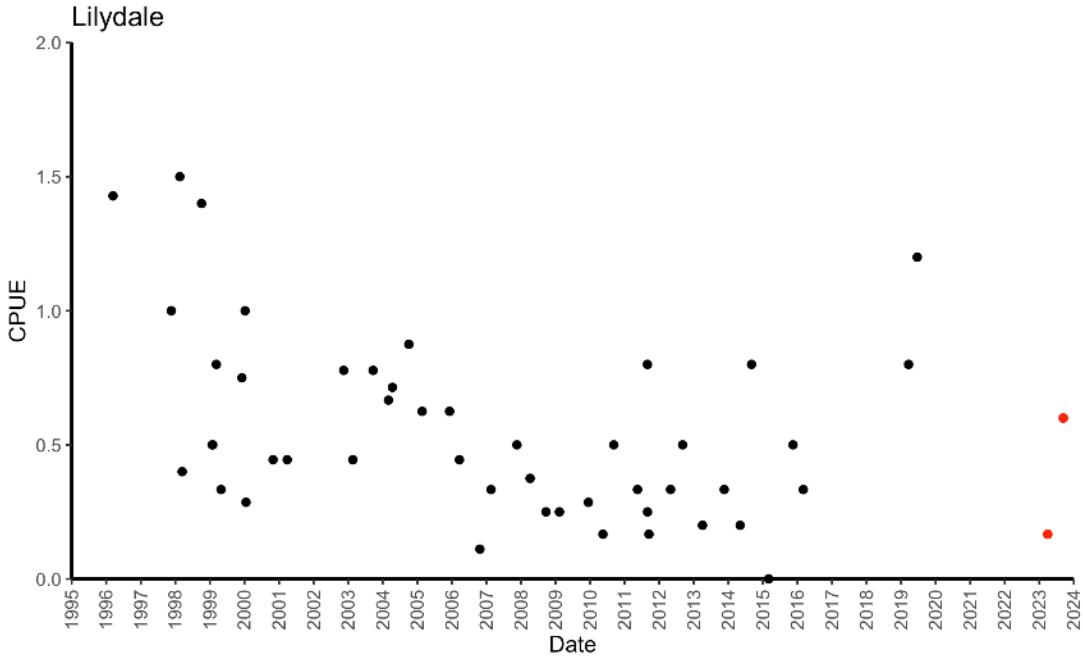

Figure 29: Historical and current CPUE (including juveniles) data available for Olinda Creek, Lilydale. Current (2023) data shown in red.

A total of 11 trap nights conducted in Olinda Creek resulted in the capture of 4 individual platypuses during 2023 (Table 14). This included 1 juvenile male in autumn. A new adult male, new adult/subadult female and a recaptured male first tagged in 2015 were also captured in spring. These results indicate that successful recruitment is taking place in Olinda Creek, which is an encouraging sign given that this population is small and isolated.

The new adult male was captured during daylight while setting the nets, which is extremely unusual. Upon inspection, he had a piece of flexible wire penetrating his bill. Ecologists took the platypus to Healesville Sanctuary, where the wire was removed, and a vet determined he was healthy enough to be immediately

released. This resulted in less time to set nets, so 5 nets were set in spring compared with 6 in autumn. No site safety issues were noted for Olinda Creek.

Overall CPUE for 2023 was typical of what was recorded at this location from mid-2000s to mid-2010s. However, the CPUE this year was lower than the last survey result in 2019 and is below some of the highest CPUE figures from the late 1990s.

Four other aquatic species were recorded as bycatch during the surveys comprising short-finned eel (1), roach (4), river blackfish (4) and Gippsland spiny crayfish (2).

The Olinda Creek platypus population is considered isolated and genetically distinct. There is poor habitat connectivity below Lillydale Lake, which makes connection with the Yarra River unfeasible for platypus. The isolated nature of this population is a cause for concern and may require genetic translocations for improved genetic diversity in the longer term.

Olinda Creek is a groundwater dependent drought refuge, and flows should be maintained through implementation of the Stream Flow Management Plan (SFMP) and Drought Response Plan. The passing flow of 2 ML/d from Silvan Reservoir is critical to preserve baseflow year-round and contributes to the persistence of platypus in Olinda Creek.

Recommendations:

- Investigation into the use of Lillydale Lake by platypus and potential barrier removal, habitat connection and restoration below the lake to reconnect this population with the broader Yarra catchment.
- Preservation of flows in Olinda Creek through the maintenance of passing flows and continued implementation of the SFMP and DRP.
- Maintain and enhance riparian vegetation.
- Infiltrate and manage stormwater arising from increased imperviousness in the catchment.

Warburton

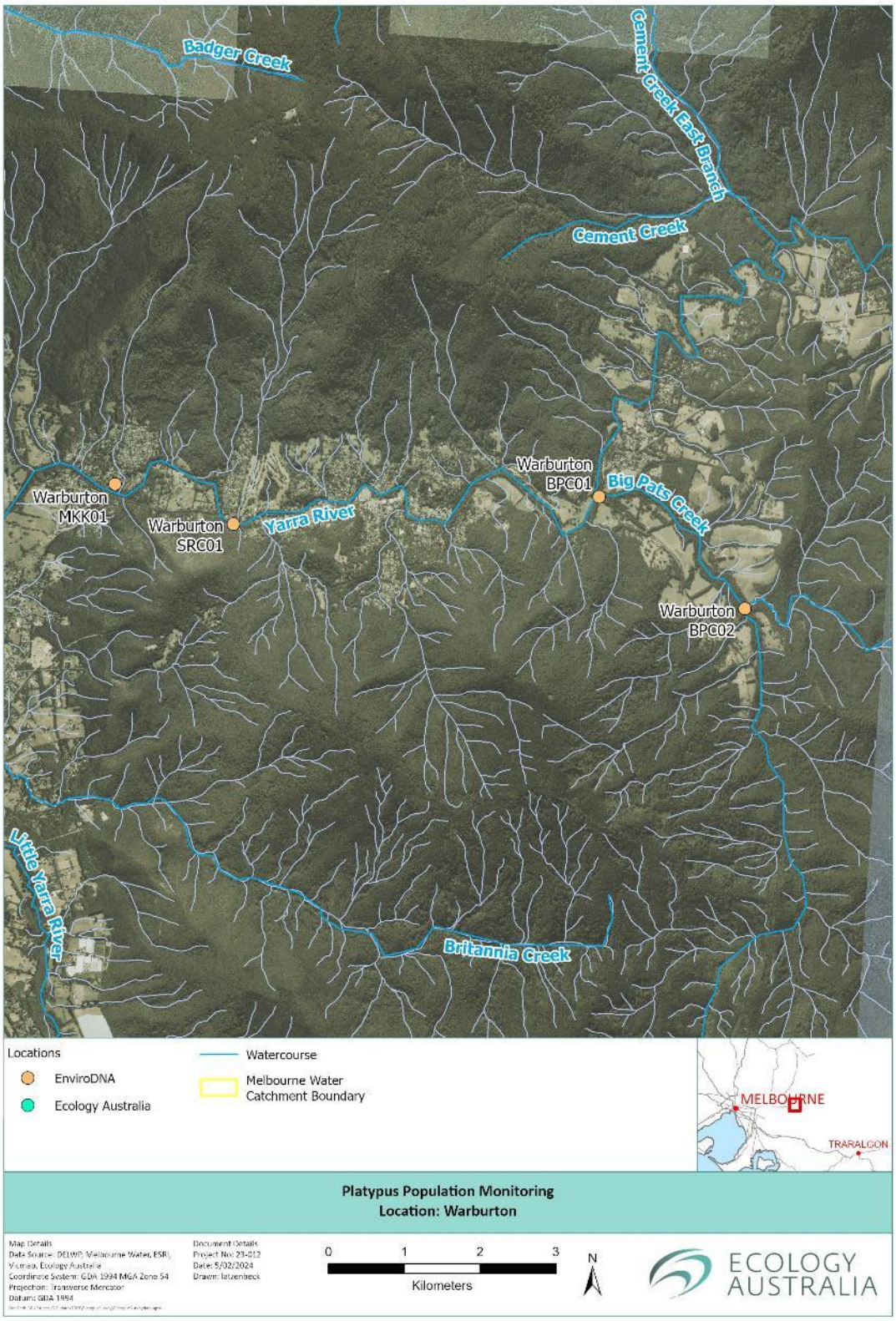

Figure 30: Site locations for tributaries of the Yarra River, Warburton.

Table 15: Summary of 2023 survey results for Warburton. Table includes seasonal and overall survey effort, number of individuals captured (including recaptured adults), and CPUE. NS = Not surveyed

Total platypus captures	Adults/subadults	Juveniles	% Juveniles
No. platypus	**1**	**1**	**50**
CPUE including juveniles	No. platypus	Trap nights	CPUE
Autumn	2	4	0.5
Spring	NS	NS	
Total	**2**	**4**	**0.5**
CPUE excluding juveniles	No. platypus	Trap nights	CPUE
Autumn	1	4	0.25
Spring	NS	NS	
Total	**1**	**4**	**0.25**

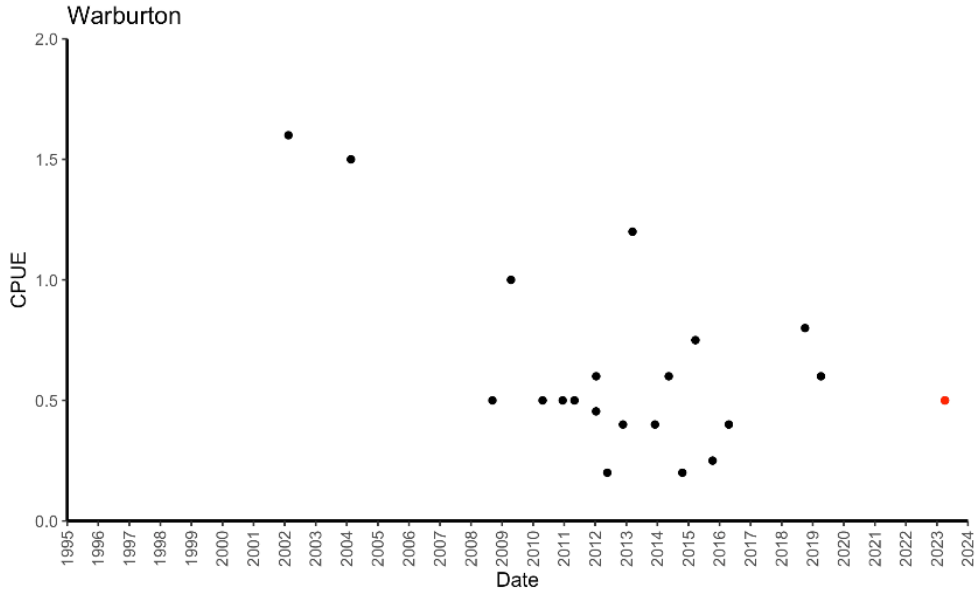

Figure 31: Historical and current CPUE (including juveniles) data available for Warburton. Current (2023) data shown in red.

A total of 4 sites were surveyed in the creeks surrounding Warburton, which resulted in the capture of 2 platypus (Table 15). In autumn, 2 females were caught, 1 juvenile and 1 adult, both of which had not previously been recorded. An attempted survey in spring had to be abandoned during the night due to high flows with nets not remaining in the water long enough to fulfil survey requirements.

The 2023 Warburton CPUE was consistent with recent results and similar to the long-term average (2010–2023 mean CPUE = 0.493, SE = 0.075).

In autumn, there were 2 bycatch species: blackfish (1) and brown trout (1), in spring there were 4 species: blackfish (2), rainbow trout (2), spiny crayfish (2) and yabbies (1).

Recommendations:

- Maintain current conditions and ensure no degradation of flow regimes.

Watsons Creek

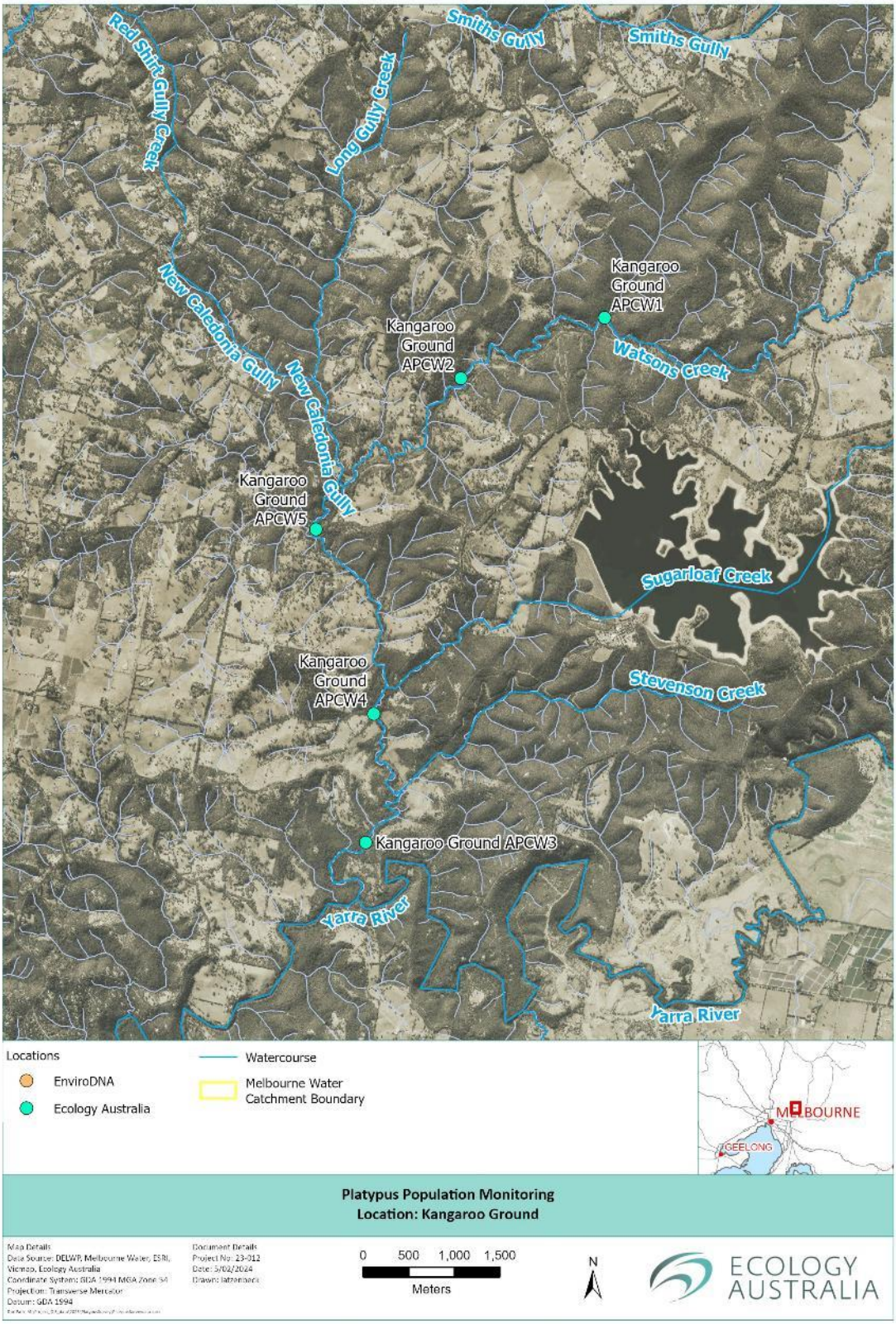

Figure 32: Site locations for Watsons Creek, Kangaroo Ground.

Table 16: Summary of 2023 survey results for Watsons Creek. Table includes seasonal and overall survey effort, number of individuals captured, and CPUE. NS = Not surveyed.

Total platypus captures	Adults/subadults	Juveniles	% Juveniles
No. platypus	**0**	**0**	**0**
CPUE including juveniles	No. platypus	Trap nights	CPUE
Autumn	0	5	0
Spring	NS	NS	
Total	0	5	0
CPUE excluding juveniles	No. platypus	Trap nights	CPUE
Autumn	0	5	0
Spring	NS	NS	
Total	0	5	0

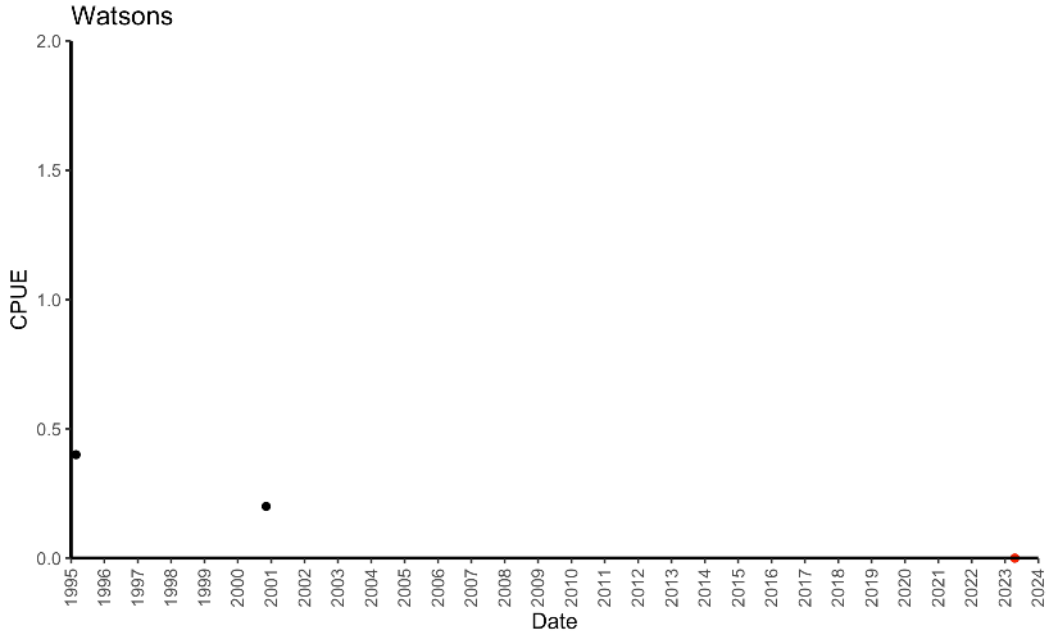

Figure 33: Graph displays all available CPUE (including juveniles) data available for Watsons Creek, Kangaroo Ground. Current (2023) data shown in red.

A total of 5 trap nights were conducted in Watsons Creek in autumn 2023, resulting in 0 platypus captures (Table 16). Habitat observations and fish bycatch were indicative of high levels of flow intermittency in this section of Watsons Creek. A decision was made with Melbourne Water to not repeat the survey in spring.

A HWS performance objective to improve the flow regime for platypus in refuge reaches of Watsons Creek was a driver for this survey. Environmental DNA indicated the sporadic presence of platypus in the lower reaches of Watsons Creek, where platypus are likely to be transient from the nearby Yarra River. Investigations into the potential of delivering environmental entitlement from Sugarloaf Reservoir found it to be unfeasible, as water would need to be delivered via Sugarloaf Creek and would only influence a small section of lower Watsons Creek before the confluence with the Yarra. Flows in this unregulated system can only be managed via implementation of irrigation bans and restrictions.

New sites could be selected in closer proximity to refuge pools that contain self-sustaining populations of river blackfish, although much larger refuge pools, or a series of refuge pools in close proximity, are likely required to support platypus. Substantial improvements to flow, riparian and instream habitat would be required to support a self-sustaining population of platypus in Watsons Creek.

No safety issues were noted for Watsons Creek.

Very few surveys have been conducted on Watsons Creek, as it has not been included as a core survey location in the MWUPP. CPUE results from 1995 and 2001 were both low, with CPUE from the 1 survey conducted in 2023 being the lowest at 0.

Two other aquatic species were recorded as bycatch during the surveys comprising short-finned eels (2) and common galaxias (2).

Recommendations:

- Remove the HWS environmental flow performance objective relating to platypus, as it is unlikely that a functional self-sustaining population exists in Watsons Creek and mechanisms to supply environmental entitlement are absent.
- Continue with riparian vegetation restoration and protection of water quality at drought refuges.
- Implement rosters, bans and restrictions and the Drought Response Plan as prescribed in the catchment to protect flows.

Chum Creek

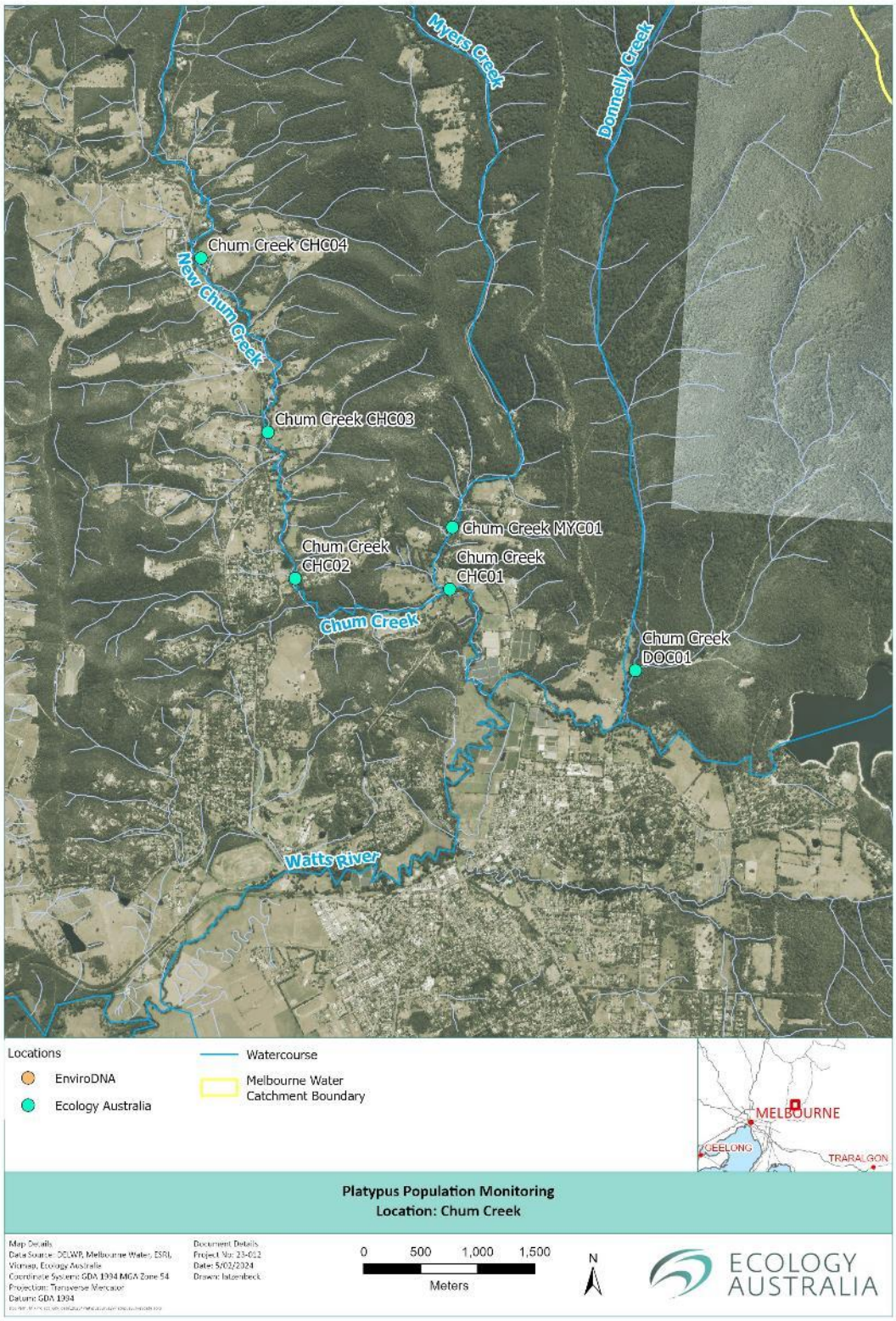

Figure 34: Site locations for Chum, Donnelly and Myers Creek, Chum Creek.

Table 17: Summary of 2023 survey results for Chum, Donnelly and Myers Creeks, Chum Creek. Table includes seasonal and overall survey effort, number of individuals captured (including recaptured adults), and CPUE.

Total platypus captures	Adults/subadults	Juveniles	% Juveniles
No. platypus	**7 (2)**	**3**	**30**
CPUE including juveniles	No. platypus	Trap nights	CPUE
Autumn	4	5	0.8
Spring	6	6	1
Total	**10**	**11**	**0.91**
CPUE excluding juveniles	No. platypus	Trap nights	CPUE
Autumn	1	5	0.2
Spring	6	6	1
Total	**7**	**11**	**0.64**

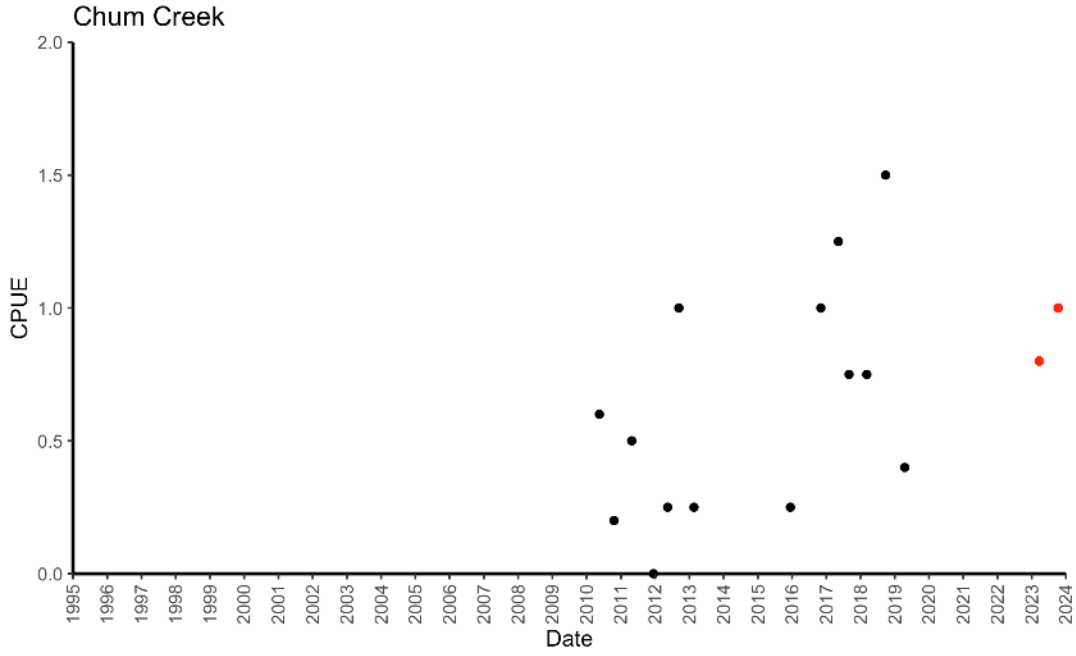

Figure 35: Graph displays all available CPUE (including juveniles) data available for Chum Creek (including surrounding waterways of Myers and Donnellys Creeks), Chum Creek. Current (2023) data shown in red.

A total of 11 trap nights conducted in Chum, Myers and Donnellys Creeks resulted in the capture of 10 individual platypuses during 2023 (Table 17). The site on Donnellys Creek was added in spring, plus a second new site was added in spring on Grace Burn upstream of Watts River confluence, but flows were too high for nets. Three of the platypuses caught were juveniles, which was the highest recorded for any locality in 2023. Additionally, 3 adult females were caught, 1 recapture from 2012 and 2 new individuals. These findings represent strong reproduction and recruitment for this platypus population.

No safety issues or litter entanglement was noted for Chum, Myers and Donnellys Creeks.

CPUE in 2023 was similar to that recorded in the most recent surveys, slightly higher than CPUE figures from the early 2010s. Overall trend in CPUE suggest some increases in this population since 2010 although there is no pre-drought data to compare.

Four other aquatic species were recorded as bycatch during the surveys comprising short-finned eels (6), southern Victorian spiny crayfish (2), river blackfish (5) and brown trout (3).

Based on habitat suitability (e.g. Bloink 2020) and eDNA results, there are likely to be resident platypus in Donnellys Creek and Grace Burn, and regular movement is anticipated to occur between Watts River and all of the perennial tributaries in the area (including Chum Creek and Myers Creek). Although there were no sites surveyed on Watts River itself, a proportion of platypus detected in these tributaries are expected to be Watts River residents.

Flows in Watts River, Donnellys Creek and Grace Burn are highly regulated as part of the Maroondah Water Supply system and have passing flows requirements. Chum Creek and Myers Creek contribute unregulated flows to the Watts River with no environmental entitlement delivery opportunities, and as such flows can only be protected through the implementation of bans and restrictions on water extraction and controlling the number of dams in the catchment. The area includes a mix of intact catchment (headwaters) with increasing levels of agriculture and residential areas in closer proximity to the townships of Chum Creek and Healesville.

Recommendations:

- Implementation of action 4–11 of the Central and Gippsland Region Sustainable Water Strategy to alter passing flows from Maroondah Reservoir in order to optimise flows in the Watts River.
- Conduct live-trapping surveys targeting Donnellys Creek and the Grace Burn.

Woori Yallock

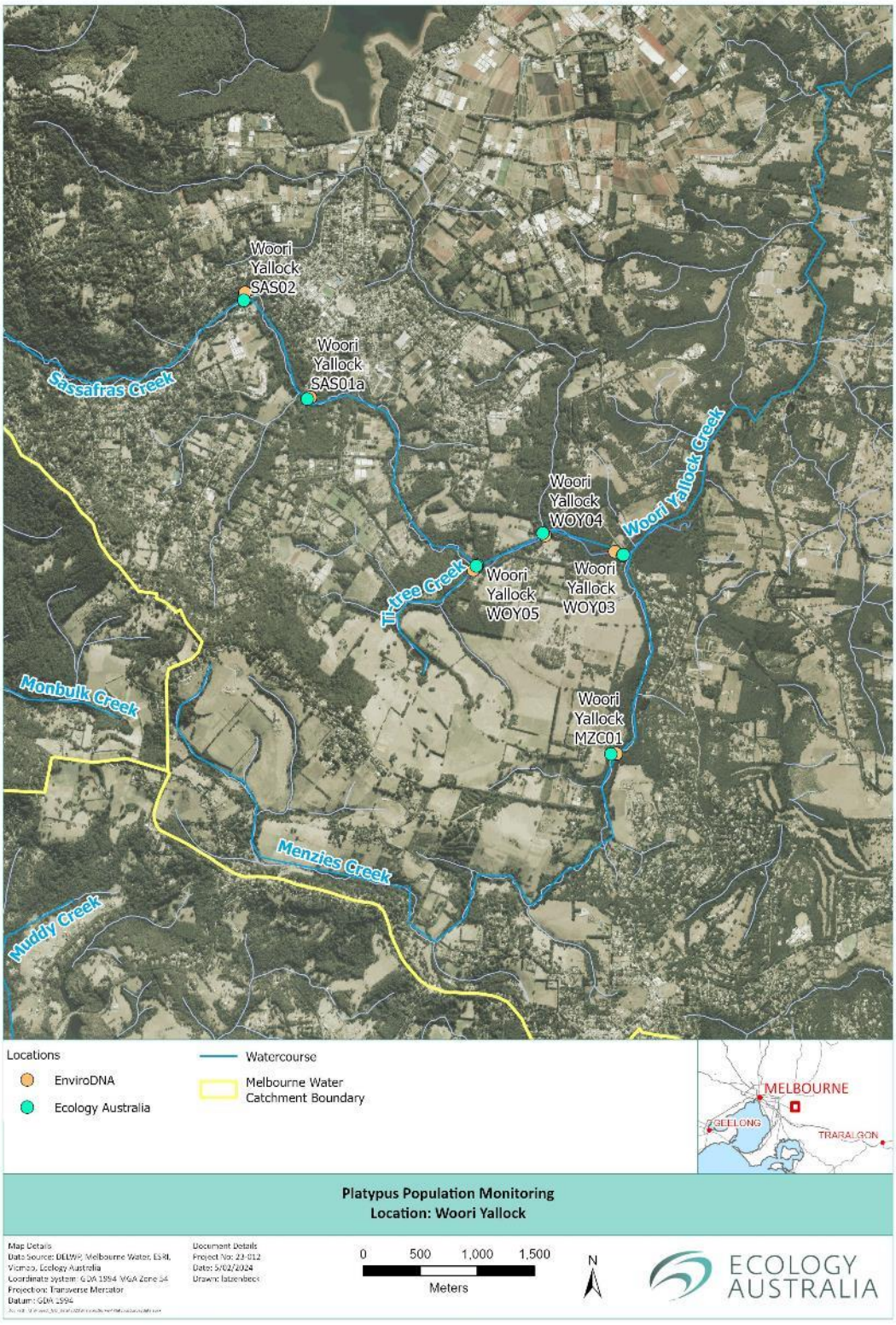

Figure 36: Site locations for Woori Yallock and Sassafras Creeks, Woori Yallock. Note that surveys were conducted by EnviroDNA in autumn, and Ecology Australia in autumn and spring.

Table 18: Summary of 2023 survey results for Woori Yallock and Sassafras Creeks, Woori Yallock. Table includes seasonal and overall survey effort, number of individuals captured (including recaptured adults), and CPUE.

Total platypus captures	Adults/subadults	Juveniles	% Juveniles
No. platypus	**6 (0)**	**1**	**17**
CPUE including juveniles	No. platypus	Trap nights	CPUE
Autumn	1	6	0.2
Autumn	1	6	0.2
Spring	5	6	0.8
Total	**7**	**18**	**0.39**
CPUE excluding juveniles	No. platypus	Trap nights	CPUE
Autumn	1	6	0.2
Autumn	1	6	0.2
Spring	4	6	0.7
Total	**6**	**18**	**0.33**

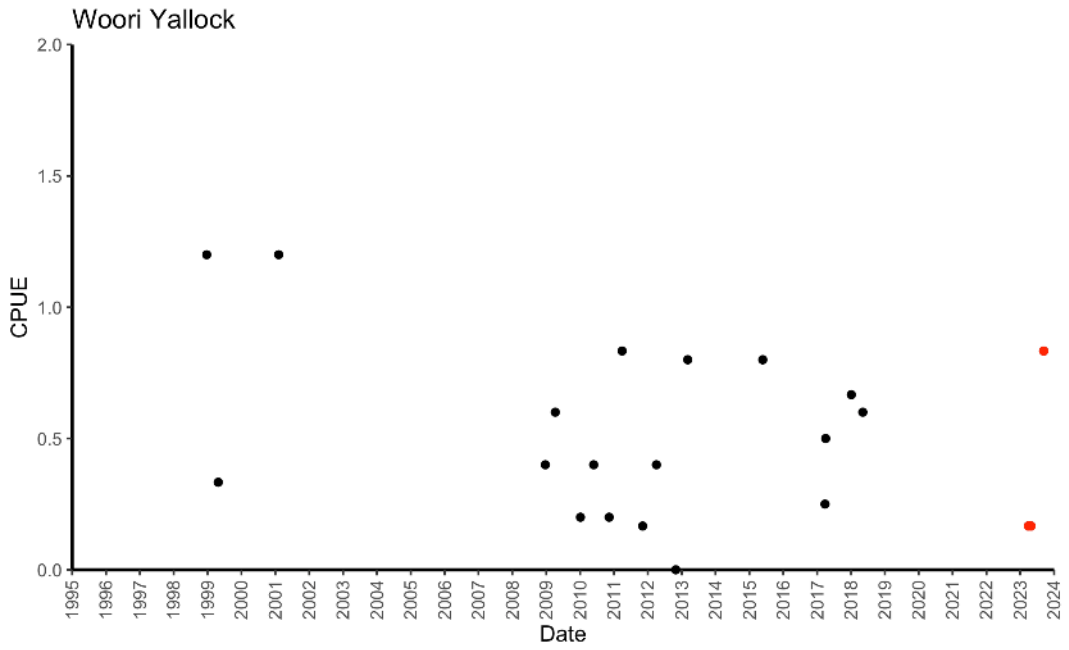

Figure 37: Graph displays all available CPUE (including juveniles) data available for Woori Yallock and Sassafras Creeks, Woori Yallock.

A total of 18 trap nights conducted in Woori Yallock Creek during 2023 resulted in the capture of 7 individual platypuses (Table 18). Both EnviroDNA and Ecology Australia conducted surveys at Woori Yallock in autumn, each yielding the same result of 1 adult platypus (1 adult male, 1 adult female, respectively). Spring captures included 3 adult males, 1 adult female and 1 juvenile female, which were all new captures. These are encouraging results suggesting successful recruitment in the population. CPUE results for 2023 were variable between seasons but consistent with those recorded over the decade from 2009.

No safety issues or litter entanglement was noted for Woori Yallock Creek.

Four other aquatic species were recorded as bycatch during the surveys comprising short-finned eel (1), river blackfish (2), southern Victorian spiny crayfish (1) and brown trout (1).

Woori Yallock is an unregulated catchment with no environmental entitlement delivery opportunities, and as such flows can only be protected through the implementation of bans and restrictions on water extraction and controlling the number of dams in the catchment. As an area with high levels of agriculture, it is important that the existing Stream Flow Management Plan and Drought Response Plans are enforced.

Recommendations:

- Continued implementation of the SFMP and DRP to protect flows in Woori Yallock Creek.
- Riparian restoration (native revegetation, remove invasive weeds, exclude stock) to improve habitat quality.

Key Findings and Discussion

Here, we briefly discuss overall key findings from the 2023 surveys, as detailed findings and discussion for individual populations have been included in the previous section. These are the first platypus live-trapping surveys conducted for the MWUPP since autumn 2019. The surveys comprehensively covered the previous MWUPP locations throughout all 5 river catchments and will inform the HWS evaluation program for this key value.

Relative abundance as estimated by CPUE varied highly amongst locations but were typically equal to or higher than the most recent years at each location, although possibly still lower than those from the late 1990s (pre-Millennium drought). However, further data is needed from a more typical year in which reproduction hasn't been widely compromised as a presumed outcome of flooding. Some locations, such as Werribee River and Upper Tarago, had CPUE levels greater than those recorded in more recent surveys, whereas most other locations had CPUE levels comparable to surveys conducted during the 2010s. The overall CPUE trends indicate platypus populations across the greater Melbourne area may still be impacted by widespread declines observed during the Millennium drought, with improvements in some locations but not others. Many factors can influence CPUE (as discussed in the Methods), and results from a single survey always need to be interpreted with care. A more detailed analysis of CPUE that includes potential confounding variables would help to clarify long term CPUE trends (e.g. Griffiths et al. 2020). Net avoidance was captured on camera for the first time by Dana Dekkers at Monbulk Creek in Belgrave, whereby a platypus entered a net, but then exited prior to capture.

Overall juvenile recruitment was low and corresponds with previous studies that have negatively correlated juvenile recruitment with high summer rainfall events (Serena and Williams 2010, Serena et al. 2014, Serena and Grant 2017). Locations with high urbanisation and influence of stormwater yielded the lowest number of juvenile captures. Spring storms in 2022 resulted in overbank flows for many of these sites, whereas the hydrographs for rural sites indicated more moderate flow pulses during these periods. These results also support recommendations by Jacobs et al. (2016) that delivery of environmental water high flows should be avoided during the spring/summer platypus nesting period. Climate change may increasingly impact juvenile recruitment for platypus populations with increased variability of rainfall and increased probability of intense summer storms predicted (www.climatechangeinaustralia.gov.au).

The challenges facing platypus populations vary by location, but largely remain the same as previously discussed by Griffiths and Weeks (2018a). These include growing urbanisation that leads to increased stormwater inputs, litter entanglement, reduced food resources, degraded habitat, and genetic isolation. The threat posed by drowning in opera house nets has reduced significantly since fishing regulations were changed in 2019 to ban their use in all Victorian waters. Changing flow conditions associated with climate change are likely to continue to be the biggest threat facing platypus (Griffiths et al. 2019, Coleman et al. 2022). Droughts will predictably reduce foraging area and available habitat for platypus, but increases in spring/summer storms, as occurred in 2022, pose challenges to platypus reproductive success.

Improvement Opportunities and Knowledge Gaps

Here, we briefly discuss overall improvement opportunities and knowledge gaps from the 2023 surveys, as detailed recommendations for individual populations have been included in the results section.

Reinstatement of a platypus monitoring program that allows for tracking of progress against the HWS targets is highly recommended. An analysis should be undertaken to determine the minimum number of surveys required at locations during each 5-year HWS enquiry period, and how these ideally should be scheduled to reliably estimate abundance (minimise variance in CPUE estimates for a given period) and provide sufficient statistical power to detect change over time. Where flow conditions allow, the completion of surveys within the same time frame each year is recommended to ensure data is comparable across years. The recommended survey periods are August to mid-October to incorporate the breeding season, and February to April for juvenile emergence and dispersal (Grant 2007).

Further work using cameras trained on fyke nets is needed to determine the rates of platypus net avoidance and escape from nets before capture. This will influence how platypus population size is calculated at a given location based on the platypus capture rates. Results from the camera data may also be used to improve fyke net setting and/or design to reduce the likelihood of platypus escape. However, any impact of the cameras themselves on platypus behaviour (i.e. infra-red light potentially making the nets more visible) needs to be considered. The use of in-stream microchip readers may also be explored to quantify the number of platypuses in a waterway (previous captures only) compared to the number captured each survey to understand how well CPUE represents actual abundance.

A population level genetic analysis is recommended using Next Generation Sequencing to define discrete populations, identify gene flow, estimate effective population sizes, and assess genetic health of populations. This data is critical to understand population viability and inform management strategies for each identified discrete population.

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Appendix 1. Details of all platypuses captured during 2023 surveys.

Waterway	Site Code	Latitude	Longitude	Direction of travel	Date	Time	Microchip number	Sex	Age	TVI	Weight
Monbulk Creek	MOC13	-37.92263831	145.3361369	upstream	18/04/2023	04:17	989001042727873	female	Adult	3	1205
Monbulk Creek	MOC15	-37.92140507	145.3558649	upstream	17/04/2023	22:26	989001041931632	male	Sub-adult	3	1512
Monbulk Creek	MOC16	-37.91562422	145.3575027	upstream	17/04/2023	22:42	TR 00-01F6-03FF	male	Adult	3	2006
Jacksons Creek	JAC10	-37.54530201	144.7414834	upstream	20/04/2023	02:46	989001042727896	male	Adult	3	1764
Jacksons Creek	JAC11	-37.54672116	144.7404101	upstream	20/04/2023	20:45	989001042727896	male	Adult	3	1764
Jacksons Creek	JAC13	-37.53998015	144.7377481	downstream	20/04/2023	22:40	989001042727911	male	Adult	3	2067
Jacksons Creek	JAC01a	-37.62517422	144.7786025	upstream	3/04/2023	22:00	989001041931611	female	Adult	2	795
Jacksons Creek	JAC01a	-37.62517422	144.7786025	upstream	3/04/2023	22:00	989001041931629	female	Juvenile	2	962
Jacksons Creek	JAC01a	-37.62517422	144.7786025	upstream	4/04/2023	07:16	989001041931619	female	Adult	3	1160
Werribee River	WER16	-37.68153527	144.4423696	downstream	13/04/2023	20:04	989001041931602	male	Adult	3	1545
Werribee River	WER23	-37.68611335	144.3940923	upstream	13/04/2023	21:55	TR 00-06F0-51ED	male	Adult	3	1589
Werribee River	WER23	-37.68611335	144.3940923	downstream	13/04/2023	07:00	989001041931622	male	Adult	3	1555
Werribee River	WER23	-37.68611335	144.3940923	downstream	13/04/2023	00:17	989001041931628	male	Adult	3	1673
Werribee River	WER01	-37.919	144.657	upstream	22/02/2023	01:40	989001041931791	female	Adult	3	935
Werribee River	WER03	-37.914	144.654	upstream	22/02/2023	01:20	989001041931880	female	Adult	3	1124
Werribee River	WER06	-37.9054	144.64966	upstream	22/02/2023	04:35	989001041931834	female	Adult	3	882
Werribee River	WER03	-37.914	144.654	upstream	22/02/2023	01:20	989001041931848	female	Adult	3	1135
Cardinia Creek	CAR07	-38.04092	145.36722	upstream	22/03/2023	23:45	989001041931591	female	Adult	3-4	1025
Chum Creek	CHC02	-37.63004	145.50127	upstream	20/03/2023	22:20	989001041931701	male	Juvenile	2	803
Chum Creek	CHC03	-37.6186	145.49788	downstream	20/03/2023	00:45	989001041931603	male	Sub-adult	2	1215
Chum Creek	CHC04	-37.60513	145.49042	downstream	20/03/2023	21:55	989001041931711	male	Juvenile	3	741
Chum Creek	CHC04	-37.60513	145.49042	upstream	20/03/2023	00:32	989001041931624	male	Juvenile	3	530
Diamond Creek	DIC01	-37.735	145.143	downstream	17/03/2023	02:21	989001041931768	male	Adult	2	1898
Olinda Creek	OLC06	-37.796	145.376	downstream	10/03/2023	01:00	989001041931683	male	Juvenile	3	625
Mullum Mullum Creek	MMC01	-37.739	145.163	upstream	12/04/2023	03:50	989001041931626	male	Adult	3	2009
Mullum Mullum Creek	MMC05a	-37.75726	145.18169	upstream	11/04/2023	21:44	989001041931583	male	Adult	3	1667

Waterway	Site Code	Latitude	Longitude	Direction of travel	Date	Time	Microchip number	Sex	Age	TVI	Weight
Mullum Mullum Creek	MMC06	-37.765	145.184	downstream	11/04/2023	22:04	989001041931604	male	Adult	3	1423
Mullum Mullum Creek	MMC06a	-37.76792	145.18624	upstream	11/04/2023	19:17	989001041931584	female	Adult	3	1185
Mullum Mullum Creek	MMC06a	-37.76792	145.18624	upstream	12/04/2023	01:17	989001041931676	male	Adult	3	2010
Mullum Mullum Creek	MMC06b	-37.77571	145.18981	downstream	11/04/2023	22:34	989001041931582	male	Adult	3	1543
Mullum Mullum Creek	MMC06b	-37.77571	145.18981	downstream	12/04/2023	01:37	989001041931633	male	Adult	3	1771
Woori Yallock Creek	WOY04	-37.89282418	145.4317605	upstream	30/03/2023	00:35	989001041931592	female	Adult	3	844
Monbulk Creek	MOC15	-37.92148185	145.3557519	upstream	25/09/2023	19:14	001F603FF	male	Adult	4	1850
Monbulk Creek	MOC15	-37.92148185	145.3557519	upstream	25/09/2023	21:20	985121004992504	male	Adult	3	1883
Monbulk Creek	MOC13	-37.92335426	145.3361627	downstream	25/09/2023	23:14	989001041931870	female	Adult	2	1043
Monbulk Creek	MOC15	-37.92148185	145.3557519	downstream	26/09/2023	03:09	982000191008731	male	Adult	2	1661
Jacksons Creek	JAC07	-37.57525216	144.7391214	downstream	14/09/2023	19:43	989001041931789	male	Adult	3	2011
Jacksons Creek	JAC11	-37.54678498	144.7404426	upstream	14/09/2023	21:28	989001041931874	male	Adult	2	2120
Jacksons Creek	JAC11	-37.54678498	144.7404426	upstream	15/09/2023	02:03	989001042727911	male	Adult	3	1883
Jacksons Creek	JAC11	-37.54678498	144.7404426	upstream	15/09/2023	01:46	989001041931830	male	Adult	3	2026
Jacksons Creek	JAC8	-37.57049516	144.7387774	upstream	15/09/2023	01:55	989001041931803	female	Adult	4	1486
Jacksons Creek	JAC13	-37.53998604	144.7377784	upstream	15/09/2023	04:00	989001041931866	female	Adult	5	1846
Jacksons Creek	JAC00A	-37.66689912	144.7685558	upstream	14/09/2023	12:22	989001042727877	male	Adult	3	2412
Jacksons Creek	JAC01A	-37.62519589	144.7785716	upstream	14/09/2023	21:51	989001042727910	male	Adult	5	1854
Jacksons Creek	JAC01A	-37.62519589	144.7785716	upstream	14/09/2023	3:01	989001041931840	male	Adult	4	2123
Jacksons Creek	JAC04	-37.59848575	144.7411993	downstream	14/09/2023	19:42	982000197527929	male	Adult	4	2270
Werribee River	WER01	-37.919	144.657	upstream	14/08/2023	21:42	989001042727850	female	Adult	3	1019
Werribee River	WER06	-37.9054	144.64966	upstream	15/08/2023	00:03	989001042727917	male	Adult	3	1881
Werribee River	WER10	-37.8969	144.6496	upstream	15/08/2023	00:23	989001042727903	male	Adult	3	1345
Cardinia Creek	CAR04	-38.00164914	145.3779393	upstream	25/09/2023	21:01	982000190529062	male	Adult	4	1694
Cardinia Creek	CAR02	-37.97418096	145.3811487	upstream	25/09/2023	21:50	989001042727934	male	Adult	4	1465
Cardinia Creek	CAR07	-38.0410694	145.3670465	upstream	26/09/2023	01:13	989001042727936	male	Adult	3	1546
Cardinia Creek	CAR03	-37.98501165	145.3813802	upstream	26/09/2023	07:48	982000190529062				
Olinda Creek	OLC05	-37.79176653	145.3596615	downstream	11/09/2023	14:26	989001042727890	male	Adult	3	1606

Waterway	Site Code	Latitude	Longitude	Direction of travel	Date	Time	Microchip number	Sex	Age	TVI	Weight
Olinda Creek	OLC05	-37.79176653	145.3596615	upstream	11/09/2023	18:16	982000190530990	male	Adult	3	1774
Olinda Creek	OLC05	-37.79176653	145.3596615	upstream	11/09/2023	21:52	989001042727904	female	Adult	2	1020
Sassafras Creek	SAS02	-37.87536018	145.4010952	upstream	11/09/2023	23:46	989001041931788	female	Adult	4	772
Woori Yallock Creek	WOY05	-37.89564662	145.4252687	downstream	12/09/2023	00:13	989001041931810	male	Adult	3	1364
Woori Yallock Creek	WOY03	-37.89422553	145.4398749	upstream	12/09/2023	02:18	989001041931655	male	Adult	3	1249
Sassafras Creek	SAS02	-37.87536018	145.4010952	upstream	12/09/2023	03:44	989001041931741	male	Adult	4	1439
Sassafras Creek	SAS01a	-37.88310762	145.4076471	downstream	12/09/2023	06:06	989001041931832	female	Juvenile	3	624
Mullum Mullum Creek	MMC05a	-37.75740145	145.1821401	downstream	18/09/2023	22:01	989001042727930	female	Adult	3	1180
Mullum Mullum Creek	MMC01	-37.73917511	145.1631383	upstream	19/09/2023	23:59	989001042727868	male	Adult	4	1440
Mullum Mullum Creek	MMC01	-37.73917511	145.1631383	upstream	19/09/2023	02:04	989001042727885	male	Adult	3	1472
Chum Creek	CHC01	-37.6303	145.51666	downstream	10/10/2023	21:09	982000148407789	female	Adult	3	1019
Chum Creek	CHC04	-37.60513843	145.4900507	upstream	10/10/2023	23:25	982000405798007	male	Adult	2	1596
Chum Creek	CHC03	-37.61860897	145.4982263	upstream	10/10/2023	23:47	989001042727875	male	Adult	2	1934
Myers Creek	MYC01	-37.62572478	145.5166817	upstream	11/10/2023	05:41	989001042727912	male	Adult	3	1081
Donnellys Creek	DOC01	-37.63599246	145.535476	upstream	11/10/2023	05:57	989001042727853	female	Adult	3	850
Chum Creek	CHC04	-37.60513843	145.4900507	downstream	11/10/2023	08:26	989001042727927	female	Adult	3	661
Diamond Creek	DIC03	-37.72666672	145.1439883	downstream	11/10/2023	04:27	989001041931879	female	Adult	3	897
Labertouche Creek	LAC05	-38.039	145.836	upstream	29/3/2023	17:30	956000013302298	Male	Adult	3	1700
Labertouche Creek	LAC05	-38.039	145.836	upstream	29/3/2023	20:30	956000013294511	Female	Adult	2	1000
Labertouche Creek	LAC01	-38.075	145.788	upstream	29/3/2023	21:30	956000013321711	Female	Adult	2	850
Tarago River	TAR07	-38.076	145.894	upstream	29/3/2023	22:00	956000013309649	Female	Adult	2	900
Tarago River	TAR07	-38.076	145.894	upstream	29/3/2023	22:00	956000012878694	Male	Juvenile	3	1300
Labertouche Creek	LAC01	-38.075	145.788	upstream	30/3/2023	0:15	956000012877347	Female	Adult	2	1000
Minnieburn Creek	MBC01	-38.233	145.836	upstream	30/3/2023	22:45	956000012881295	Female	Adult	2	850
Minnieburn Creek	MBC01	-38.233	145.836	upstream	30/3/2023	23:00	956000013293933	Male	Adult	2	1925
Lang Lang River	LLR09	-38.235	145.786	upstream	30/3/2023	23:45	956000013318618	Female	Adult	2	1150
Lang Lang River	LLR09	-38.235	145.786	Downstream	30/3/2023	23:45	956000012880225	Male	Adult	3	2100
McMahons Creek	MCM05	-37.71	145.845	Downstream	4/4/2023	21:00	956000016650288	Female	Adult	3	700

Waterway	Site Code	Latitude	Longitude	Direction of travel	Date	Time	Microchip number	Sex	Age	TVI	Weight
McMahons Creek	MCM04	-37.70582	145.84122	Downstream	4/4/2023	23:20	956000016653919	Female	Juvenile	3	425
Big Pats Creek	BPC02	-37.763	145.753	Downstream	4/4/2023	23:35	956000016648227	Female	Adult	3	500
Surrey Rd Ck	SRC01	-37.756	145.676	Upstream	5/4/2023	6:45	956000016650049	Female	Juvenile	4	600
McMahons Creek	MCM02	-37.702	145.835	Upstream	5/4/2023	6:15	956000016649068	Female	Adult	2	550
McMahons Creek	MCM05	-37.71	145.845	Upstream	5/4/2023	7:00	956000016654143	Female	Adult	3	500
Woori Yallock Creek	WOY05	-37.896	145.425	Downstream	26/4/2023	20:45	956000016648898	Male	Adult	3	1200
Tarago River	TAR11	-37.962	145.934	Upstream	13/7/2023	22:30	956000012883142	Male	Juvenile	3	700
Tarago River	TAR12	-37.956	145.915	Upstream	13/7/2023	21:15	982000405789848	Male	Adult	2	1950
Tarago River	TAR12	-37.956	145.915	Upstream	14/7/2023	3:00	956000012879531	Male	Adult	2	1500
Tarago River	TAR14	-37.940	145.868	Downstream	14/7/2023	2:00	956000012880120	Male	Adult	3	1200
Tarago River	TAR14	-37.940	145.868	Downstream	14/7/2023	2:00	956000012879220	Male	Adult	3	1600
Labertouche Creek	LAC01	-38.075	145.788	Upstream	8/8/2023	21:25	956000012881112	Female	Adult	3	600
Labertouche Creek	LAC01	-38.075	145.788	Upstream	8/8/2023	21:25	956000012880029	Male	Adult	4	1400
Labertouche Creek	LAC01	-38.075	145.788	Upstream	8/8/2023	21:45	956000012879980	Male	Adult	3	1500
Labertouche Creek	LAC05	-38.039	145.836	Upstream	9/8/2023	6:25	956000012878304	Female	Adult	3	850
Tarago River	TAR02	-38.075	145.787	Downstream	9/8/2023	7:45	956000012880934	Male	Adult	2	1650
Tarago River	TAR07	-38.076	145.894	Downstream	9/8/2023	21:55	956000012878714	Female	Adult	3	700
Labertouche Creek	LAC01	-38.075	145.788	Upstream	10/8/2023	0:56	956000012878779	Male	Adult	3	1800
Tarago River	TAR05	-38.084	145.845	Upstream	10/8/2023	1:45	956000012880004	Female	Adult	3	950
McMahons Creek	MCM04	-37.70582	145.84122	Downstream	22/8/2023	12:44	956000012877447	Male	Adult	4	900
Minnieburn Creek	MBC01	-38.233	145.836	upstream	7/9/2023	21:15	956000012881295	Female	Adult	2	900
Tarago River	TAR12	-37.956	145.915	Upstream	27/9/2023	21:20	956000016651123	Female	Adult	3	550
Tarago River	TAR11	-37.962	145.934	Upstream	28/9/2023	0:35	956000016650328	Male	Adult	2	2050
Tarago River	TAR10	-37.966	145.939	Upstream	28/9/2023	1:05	956000016653101	Male	Subadult	3	1050
Tarago River	TAR09	-38.032	145.939	Downstream	2/10/2023	21:30	956000016650842	Male	Adult	3	1800
Tarago River	TAR02	-38.075	145.787	Upstream	3/10/2023	5:30	956000016651375	Female	Adult	3	900

Appendix 2. Site locations of all platypus surveys conducted in 2023.

Consultant	Catchment	Location	Waterway	Site Code	Latitude	Longitude
Ecology Australia	Dandenong	Belgrave	Monbulk Creek	MOC13	-37.92263831	145.3361369
Ecology Australia	Dandenong	Belgrave	Monbulk Creek	MOC14	-37.91862134	145.3409208
Ecology Australia	Dandenong	Belgrave	Monbulk Creek	MOC15	-37.92140507	145.3558649
Ecology Australia	Dandenong	Belgrave	Monbulk Creek	MOC16	-37.91562422	145.3575027
Ecology Australia	Dandenong	Belgrave	Monbulk Creek	MOC18	-37.91626669	145.3638924
Ecology Australia	Maribyrnong	Sunbury	Jacksons Creek	JAC00A	-37.66689967	144.7685956
Ecology Australia	Maribyrnong	Sunbury	Jacksons Creek	JAC01	-37.66399766	144.7707314
Ecology Australia	Maribyrnong	Sunbury	Jacksons Creek	JAC01A	-37.62517422	144.7786025
Ecology Australia	Maribyrnong	Sunbury	Jacksons Creek	JAC04	-37.5985052	144.7412851
Ecology Australia	Maribyrnong	Sunbury	Jacksons Creek	JAC07	-37.5753488	144.7392433
Ecology Australia	Maribyrnong	Sunbury	Jacksons Creek	JAC09	-37.60185109	144.7433235
Ecology Australia	Maribyrnong	Sunbury	Jacksons Creek	JAC10	-37.54530201	144.7414834
Ecology Australia	Maribyrnong	Sunbury	Jacksons Creek	JAC11	-37.54672116	144.7404101
Ecology Australia	Maribyrnong	Sunbury	Jacksons Creek	JAC13	-37.53998015	144.7377481
Ecology Australia	Maribyrnong	Sunbury	Jacksons Creek	JAC8	-37.57049516	144.7387774
Ecology Australia	Werribee	Werribee	Werribee River	WER01	-37.919	144.657
Ecology Australia	Werribee	Werribee	Werribee River	WER03	-37.914	144.654
Ecology Australia	Werribee	Werribee	Werribee River	WER06	-37.9054	144.64966
Ecology Australia	Werribee	Werribee	Werribee River	WER10	-37.8969	144.6496
Ecology Australia	Werribee	Werribee	Werribee River	WER11	-37.8873	144.6415
Ecology Australia	Werribee	Werribee	Werribee River	WER11a	-37.8925	144.6208
Ecology Australia	Werribee	Werribee	Werribee River	APCWE3	-37.8881	144.6425
Ecology Australia	Werribee	Werribee	Werribee River	APCWE4	-37.8962	144.6518
Ecology Australia	Werribee	Bacchus Marsh	Werribee River	WER16	-37.68153527	144.4423696

Consultant	Catchment	Location	Waterway	Site Code	Latitude	Longitude
Ecology Australia	Werribee	Bacchus Marsh	Werribee River	WER18	-37.68095833	144.4294018
Ecology Australia	Werribee	Bacchus Marsh	Werribee River	WER19	-37.67869831	144.423995
Ecology Australia	Werribee	Bacchus Marsh	Werribee River	WER22	-37.6794446	144.3771549
Ecology Australia	Werribee	Bacchus Marsh	Werribee River	WER23	-37.68611335	144.3940923
Ecology Australia	Western Port	Cardinia	Cardinia Creek	CAR02	-37.9743	145.38118
Ecology Australia	Western Port	Cardinia	Cardinia Creek	CAR03	-37.98512	145.38169
Ecology Australia	Western Port	Cardinia	Cardinia Creek	CAR04	-38.00152	145.37799
Ecology Australia	Western Port	Cardinia	Cardinia Creek	CAR05	-38.0115	145.38376
Ecology Australia	Western Port	Cardinia	Cardinia Creek	CAR06	-38.02812	145.37576
Ecology Australia	Western Port	Cardinia	Cardinia Creek	CAR07	-38.04092	145.36722
Ecology Australia	Western Port	Cardinia	Cardinia Creek	MUD01	-37.9736873	145.3801522
Ecology Australia	Yarra	Kangaroo Ground	Watsons Creek	APCW1	-37.64910018	145.2914507
Ecology Australia	Yarra	Kangaroo Ground	Watsons Creek	APCW2	-37.65573005	145.2739786
Ecology Australia	Yarra	Kangaroo Ground	Watsons Creek	APCW3	-37.7018274	145.2647983
Ecology Australia	Yarra	Kangaroo Ground	Watsons Creek	APCW4	-37.68913678	145.2650461
Ecology Australia	Yarra	Kangaroo Ground	Watsons Creek	APCW5	-37.67124359	145.2568266
Ecology Australia	Yarra	Chum Creek	Chum Creek	CHC01	-37.6303	145.51666
Ecology Australia	Yarra	Chum Creek	Chum Creek	CHC02	-37.63004	145.50127
Ecology Australia	Yarra	Chum Creek	Chum Creek	CHC03	-37.6186	145.49788
Ecology Australia	Yarra	Chum Creek	Chum Creek	CHC04	-37.60513	145.49042
Ecology Australia	Yarra	Eltham	Diamond Creek	DIC01	-37.735	145.143
Ecology Australia	Yarra	Eltham	Diamond Creek	DIC03	-37.727	145.143
Ecology Australia	Yarra	Eltham	Diamond Creek	DIC04	-37.723	145.143
Ecology Australia	Yarra	Eltham	Diamond Creek	DIC05	-37.716	145.144
Ecology Australia	Yarra	Eltham	Diamond Creek	DIC06	-37.703	145.153
Ecology Australia	Yarra	Eltham	Diamond Creek	DIC08	-37.688	145.155

Consultant	Catchment	Location	Waterway	Site Code	Latitude	Longitude
Ecology Australia	Yarra	Chum Creek	Donnellys Creek	DOC01	-37.63599246	145.535476
Ecology Australia	Yarra	Mullum Mullum	Mullum Mullum Creek	MMC01	-37.739	145.163
Ecology Australia	Yarra	Mullum Mullum	Mullum Mullum Creek	MMC05	-37.751	145.178
Ecology Australia	Yarra	Mullum Mullum	Mullum Mullum Creek	MMC05a	-37.75726	145.18169
Ecology Australia	Yarra	Mullum Mullum	Mullum Mullum Creek	MMC06	-37.765	145.184
Ecology Australia	Yarra	Mullum Mullum	Mullum Mullum Creek	MMC06a	-37.76792	145.18624
Ecology Australia	Yarra	Mullum Mullum	Mullum Mullum Creek	MMC06b	-37.77571	145.18981
Ecology Australia	Yarra	Chum Creek	Myers Creek	MYC01	-37.62541	145.51663
Ecology Australia	Yarra	Woori Yallock	Menzies Creek	MZC01	-37.90992981	145.4395653
Ecology Australia	Yarra	Lilydale	Olinda Creek	OLC01	-37.77	145.359
Ecology Australia	Yarra	Lilydale	Olinda Creek	OLC03	-37.778	145.361
Ecology Australia	Yarra	Lilydale	Olinda Creek	OLC04	-37.784	145.361
Ecology Australia	Yarra	Lilydale	Olinda Creek	OLC05	-37.792	145.36
Ecology Australia	Yarra	Lilydale	Olinda Creek	OLC06	-37.796	145.376
Ecology Australia	Yarra	Lilydale	Olinda Creek	OLC07	-37.793	145.382
Ecology Australia	Yarra	Woori Yallock	Sassafras Creek	SAS01a	-37.88312926	145.4076921
Ecology Australia	Yarra	Woori Yallock	Sassafras Creek	SAS02	-37.8756096	145.4009171
Ecology Australia	Yarra	Woori Yallock	Woori Yallock Creek	WOY03	-37.8942648	145.4397921
Ecology Australia	Yarra	Woori Yallock	Woori Yallock Creek	WOY04	-37.89282418	145.4317605
Ecology Australia	Yarra	Woori Yallock	Woori Yallock Creek	WOY05	-37.89564662	145.4252687
EnviroDNA	Western Port	Athlone	Lang Lang River	LLR09	-38.235	145.786
EnviroDNA	Western Port	Athlone	Lang Lang River	LLR10	-38.251	145.791
EnviroDNA	Western Port	Athlone	Lang Lang River	LLR11	-38.278	145.814
EnviroDNA	Western Port	Athlone	Lang Lang River	LLR12	-38.292	145.821
EnviroDNA	Western Port	Athlone	Minnieburn Creek	MBC01	-38.233	145.836
EnviroDNA	Western Port	Bunyip	Bunyip River	BUR08	-37.983	145.756

Consultant	Catchment	Location	Waterway	Site Code	Latitude	Longitude
EnviroDNA	Western Port	Bunyip	Bunyip River	BUR09	-37.9705	145.736
EnviroDNA	Western Port	Bunyip	Bunyip River	BUR10	-37.943	145.742
EnviroDNA	Western Port	Bunyip	Bunyip River	BUR11	-37.938	145.747
EnviroDNA	Western Port	Bunyip	Sardine Creek	SAR01	-37.967	145.967
EnviroDNA	Western Port	Labertouche	Labertouche Creek	LAC01	-38.075	145.788
EnviroDNA	Western Port	Labertouche	Labertouche Creek	LAC02	-38.061	145.811
EnviroDNA	Western Port	Labertouche	Labertouche Creek	LAC03	-38.055	145.824
EnviroDNA	Western Port	Labertouche	Labertouche Creek	LAC05	-38.039	145.836
EnviroDNA	Western Port	Lower Tarago	Tarago River	TAR02	-38.075	145.787
EnviroDNA	Western Port	Lower Tarago	Tarago River	TAR03	-38.083	145.812
EnviroDNA	Western Port	Lower Tarago	Tarago River	TAR05	-38.084	145.845
EnviroDNA	Western Port	Lower Tarago	Tarago River	TAR07	-38.076	145.894
EnviroDNA	Western Port	Lower Tarago	Tarago River	TAR09	-38.032	145.939
EnviroDNA	Western Port	Upper Tarago	Tarago River	TAR10	-37.966	145.939
EnviroDNA	Western Port	Upper Tarago	Tarago River	TAR11	-37.962	145.934
EnviroDNA	Western Port	Upper Tarago	Tarago River	TAR12	-37.956	145.915
EnviroDNA	Western Port	Upper Tarago	Tarago River	TAR14	-37.940	145.868
EnviroDNA	Yarra	McMahons Creek	McMahons Creek	MCM01	-37.701	145.830
EnviroDNA	Yarra	McMahons Creek	McMahons Creek	MCM02	-37.702	145.835
EnviroDNA	Yarra	McMahons Creek	McMahons Creek	MCM04	-37.70582	145.84122
EnviroDNA	Yarra	McMahons Creek	McMahons Creek	MCM05	-37.71	145.845
EnviroDNA	Yarra	McMahons Creek	McMahons Creek	MCM05a	-37.70976	145.84648
EnviroDNA	Yarra	Warburton	Big Pats Creek	BPC01	-37.7506	145.7304
EnviroDNA	Yarra	Warburton	Big Pats Creek	BPC02	-37.763	145.753
EnviroDNA	Yarra	Warburton	McKenzie King Ck	MKK01	-37.752	145.658
EnviroDNA	Yarra	Warburton	Surrey Rd Creek	SRC01	-37.756	145.676

Consultant	Catchment	Location	Waterway	Site Code	Latitude	Longitude
EnviroDNA	Yarra	Woori Yallock	Menzies Creek	MZC01	-37.909878	145.440123
EnviroDNA	Yarra	Woori Yallock	Sassafras Ck	SAS01a	-37.883	145.408
EnviroDNA	Yarra	Woori Yallock	Sassafras Ck	SAS02	-37.875	145.401
EnviroDNA	Yarra	Woori Yallock	Woori Yallock Ck	WOY03	-37.894	145.439
EnviroDNA	Yarra	Woori Yallock	Woori Yallock Ck	WOY04	-37.893	145.432
EnviroDNA	Yarra	Woori Yallock	Woori Yallock Ck	WOY05	-37.896	145.425