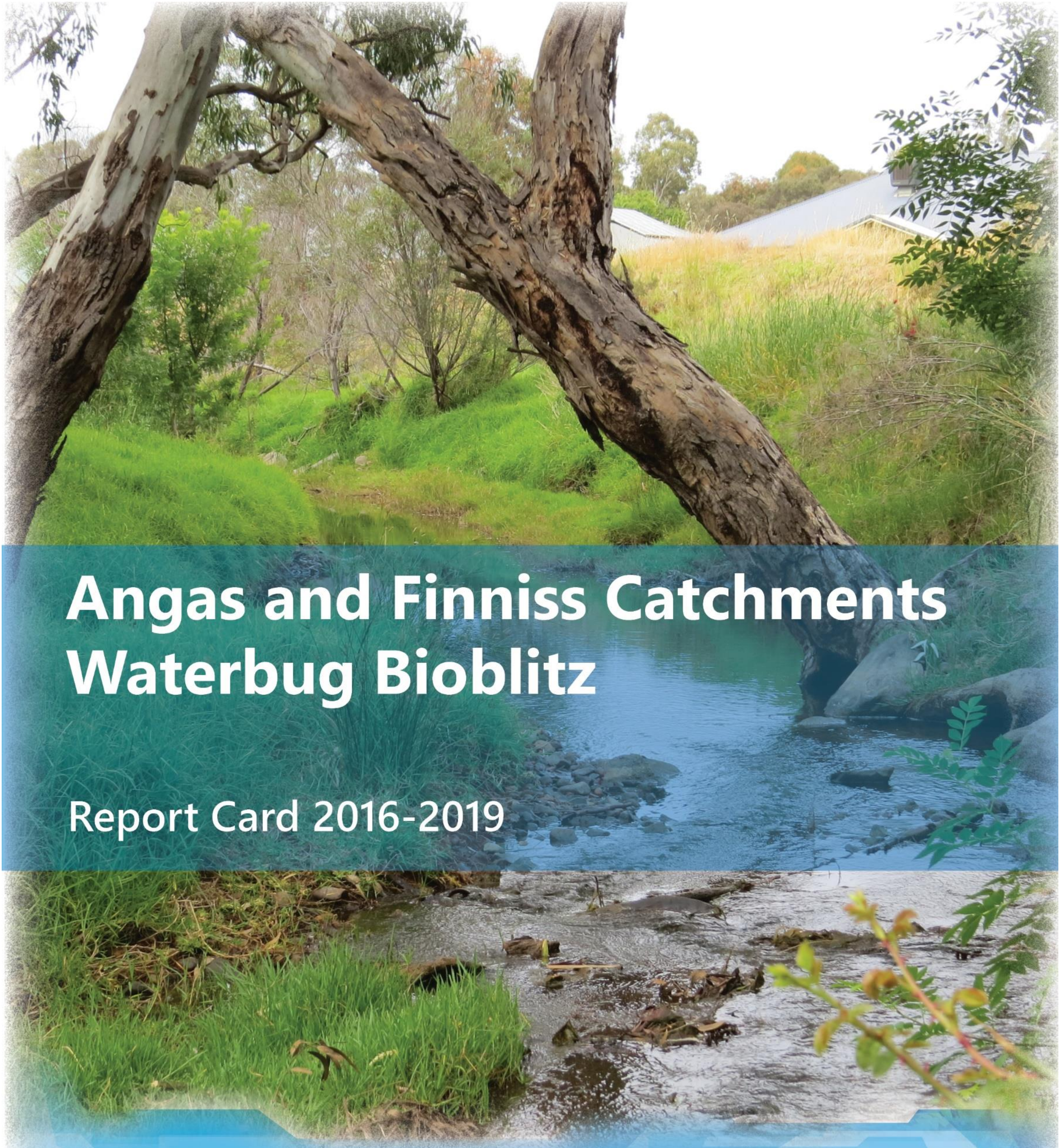

# Angas and Finniss Catchments Waterbug Bioblitz

Report Card 2016-2019

LANDSCAPE SOUTH AUSTRALIA
MURRAYLANDS AND RIVERLAND

**Cite as**

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# 1 What is a Waterbug Bioblitz?

A Waterbug Bioblitz is a citizen science monitoring event where volunteer and professional scientists collect ecosystem health data from local creeks and rivers.

The methods that are used are a hybrid between agency (e.g. EPA) monitoring methods and Waterwatch methods. During a Waterbug Bioblitz, data is collected on water chemistry, water bugs (macroinvertebrates), flow and vegetation (although not all indicators are recorded at every event). This approach has been used in the Angas River catchment since autumn 2016 and the Finniss River catchment since spring 2016. A core set of sites were visited each event, with others sampled if time permitted. If sites were dry, this was also recorded.

This method has also been used to monitor the state of the Marne and Saunders rivers since 2017 (results reported separately).

# 2 Why are Waterbug Bioblitzes held?

The Waterbug Bioblitzes were originally designed to monitor flows in the catchments and how plants and animals would respond to changes in flow. The results can also be used to monitor catchment health and water quality, which is a priority for the community members involved in the surveys. Waterbug Bioblitzes collect scientific data that supplements other monitoring programs and provides an opportunity for volunteer and professional scientists to learn together. They also provide an opportunity for the local community to share their knowledge about catchment health and processes.

The Flows for the Future Program is being implemented across the Eastern Mount Lofty Ranges and commenced work in the Angas River catchment in 2017. The program aims to improve catchment health by installing low flow devices on dams and watercourse diversions. These devices allow low flows of water to pass more freely and more naturally through the catchments.

Returning these small (low) flow volumes into streams sooner in the season (rather than waiting for dams to fill and spill) will help to ensure our catchments stay healthy and support the aquatic ecosystems. The WaterWatch and Bioblitz activities provide a critical dataset to measure the outcomes of this significant change to the way water is managed in these catchments. It is important to continue to build our understanding of how the catchments respond to the changes we make so we can continue to make improvements and ensure our water management policies are sustainable.

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The data collected during the Waterbug Bioblitzes to date is contributing to a baseline assessment of the condition of a range of sites under different management and varying seasonal conditions. This report presents a summary of the data and what approaches to interpreting the data appear most useful as well as potential trends in the data.

The macroinvertebrate data collected during these events is archived with the Biological Database of South Australia and can be publicly accessed through NatureMaps https://data.environment.sa.gov.au/NatureMaps, and becomes part of the national Waterbug Database https://www.waterbugblitz.org.au/explore.php. This ensures the results are available for others to use for a range of research purposes now and in the future.

The Bioblitz monitoring supplements other monitoring undertaken in the catchments by government agencies such as Aquatic Ecosystem Condition and surface and groundwater level and salinity monitoring. Only data collected during the Waterbug Bioblitzes is presented in this report. This report covers four years (2016 to 2019) and provides an update to the first (2016-2017) Bioblitz Report (Miles et al. 2018). The results of detailed vegetation surveys are presented in the previous report (Miles et al. 2018) but have not been included here as the surveys have not been repeated.

Water chemistry and flow data are also collected at a number of sites in the Finniss catchment throughout the year by the Finniss Catchment Group. These are stored in the Community Monitoring Online Database http://www.samdbnrm.sa.gov.au/portals/9/CDMT/index.asp and add further information on the state of the rivers.

# 3 How is the Waterbug Bioblitz data used?

Because the monitoring methods used are a hybrid of other monitoring methods, existing standard measures of condition (i.e. what is “good” and “poor”) can’t be applied to the data collected in the Waterbug Bioblitzes. The monitoring that has been undertaken to date is contributing to the development of new indicators. These indicators will help to understand the health of the monitoring sites, and in particular if water flow within the catchments is being improved.

Interpreting ecosystem data is difficult, and one of the key challenges is knowing ‘What is a normal level of variation and what is change in condition?’. Another challenge is being able to determine the cause of a difference in condition between sites or dates because the results are a reflection of factors operating at multiple scales (see diagram below). Monitoring a range of sites over several years using the same methods will help to overcome these challenges.

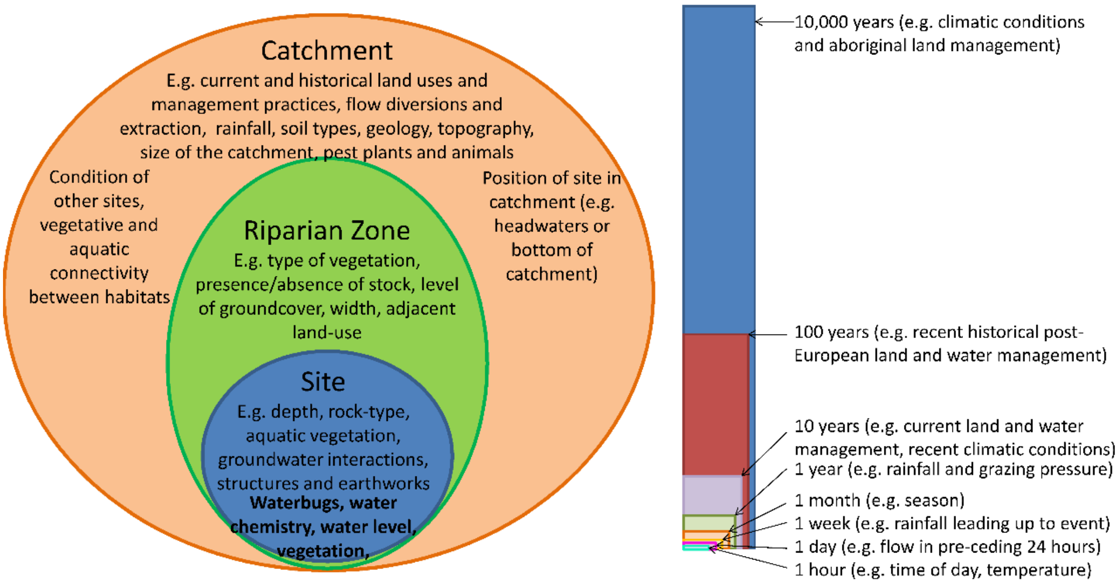


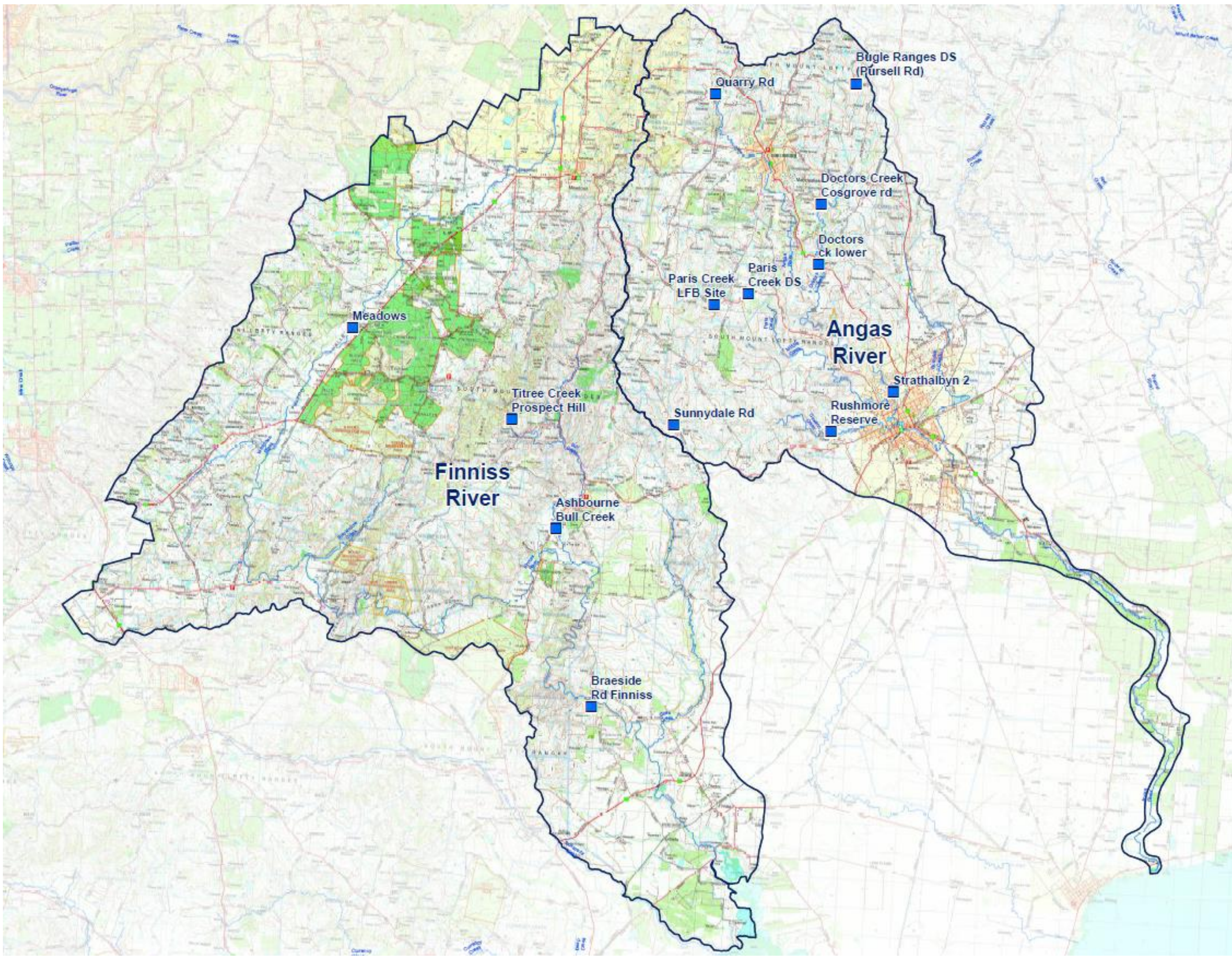

*Figure 1. Diagram showing how the data recorded at each Bioblitz event and each site are a reflection of influences operating at multiple scales in space and time.*

Figure 1 illustrates how the results recorded for each site are influenced by the different characteristics of each site (e.g. whether it is rocky or silty, deep or shallow), the surrounding riparian zone (e.g. the amount of groundcover or if there are overhanging trees) and the catchment (e.g. the amount of water diverted, land uses and condition of other parts of the watercourse). The catchment is located within the greater biogeographic setting of climate, species distributions etc.

The illustration on the right demonstrates how the results are also influenced by the time of day and time of year that monitoring is undertaken, as well as the climatic conditions, water flows and management in the days, weeks, months, years, decades and beyond preceding the monitoring event.

# 4 Results

A total of 113 individual samples from pools or riffles have been collected from the Angas and Finniss catchments and processed by the Angas-Finniss Waterbug Bioblitz program between December 2016 and November 2019. These were collected from 13 sites, 9 in the Angas catchment and 4 in Finniss catchment (Map 1). Across the Waterbug Bioblitzes, an average of 14 samples were processed per event.




*Map 1. Core Angas Finniss Waterbug Bioblitz sites*

## 4.1 Species diversity

The average diversity of all sites assessed through the program is 17 taxa*. This ranges from a high of 28 species (Ti Tree Creek and Quarry Rd) down to 3 species (Meadows) Figure2, Table 1.

Those higher in the catchment tended to have greater aquatic macroinvertebrate (waterbug) diversity than lower down the river system.  The lower sites tended to be larger waterways and more impacted by land use and water extraction.

The more ephemeral sites that dry out regularly show less diversity that the perennial sites with flowing water generally present year-round.

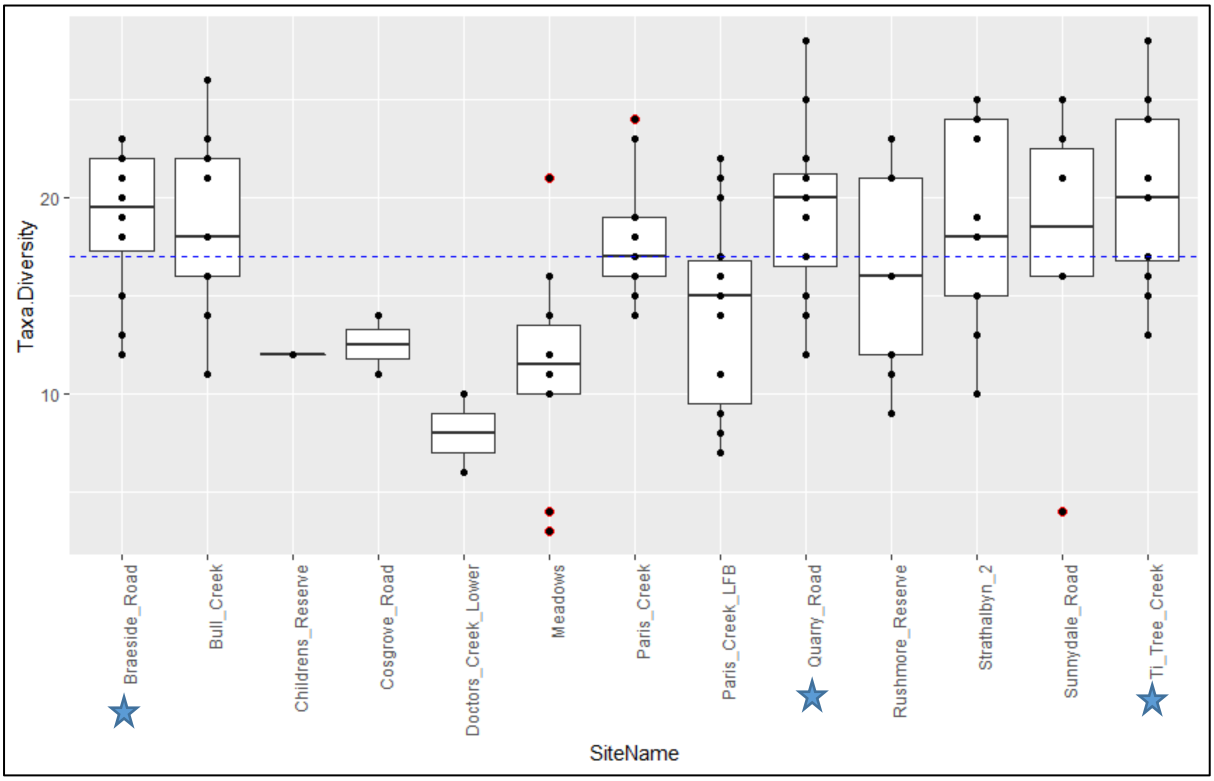



*Figure 2: Boxplot of the taxa richness at the BioBlitz Monitoring sites from 2016 – 2019. The blue dashed line is the overall average diversity across all sites. A boxplot is a standardized way of displaying the distribution of data based on a five number summary ("minimum", first quartile (Q1), median, third quartile (Q3), and "maximum"). Values outlines in red are considered 'outliers' and are considered an anomaly. Blue stars identify perennially flowing sites.*

| Site | Catchment | Flow description | Average Taxa Diversity | Min Taxa Diversity | Max Taxa Diversity | Number of samples (pool and Riffle) |
|---|---|---|---|---|---|---|
| Doctors Creek Lower | Angas | Ephemeral | 8.00 | 6 | 10 | 2 |
| Children's Reserve | Angas | Ephemeral | 12.00 | 12 | 12 | 1 |
| Cosgrove Road | Angas | Ephemeral | 12.50 | 11 | 14 | 2 |
| Paris Creek LFB | Angas | Ephemeral | 14.29 | 7 | 22 | 14 |
| Rushmore Reserve | Angas | Ephemeral | 16.89 | 9 | 23 | 9 |
| Paris Creek | Angas | Ephemeral | 18.11 | 14 | 24 | 9 |
| Sunnydale Road | Angas | Ephemeral | 17.50 | 4 | 25 | 6 |
| Strathalbyn 2 | Angas | Ephemeral | 18.15 | 10 | 25 | 13 |
| Quarry Road | Angas | Perennial | 19.42 | 12 | 28 | 12 |
| Braeside Road | Finniss | Perennial | 18.92 | 12 | 23 | 12 |
| Bull Creek | Finniss | Ephemeral | 18.82 | 11 | 26 | 11 |
| Meadows | Finniss | Ephemeral | 11.30 | 3 | 21 | 10 |
| Ti Tree Creek | Finniss | Perennial | 20.00 | 13 | 28 | 12 |
| Overall BioBlitz | | | 17.07 | 3 | 28 | 113 |

*Table 1. Average, minimum and maximum waterbug taxa richness for each site 2016-2019.*

Sunnydale Road has the widest range of taxa records ranging from 4 (autumn 2019) to 25 (Spring 2016) taxa sampled.

On average Ti Tree Creek (Finniss catchment) is the most diverse site with an average of 20 taxa per sample (ranging from 13 to 28 taxa). Quarry Rd (Angas catchment) (Figure 3) is a close second with an average of 19 taxa (13 to 28).

*Figure 3. Quarry Road Bioblitz site*

Based on the data to date, the following taxa richness categories are suggested for the Angas and Finniss catchments to help compare samples (however these categories are not equivalent of condition indicators):

| | **Taxa richness** | |
|---|---|---|
| **Category** | **Spring sample** | **Autumn sample** |
| Very low | 13 or less | 7 or less |
| Low | 14 to 19 | 8 to 13 |
| Moderate | 19 to 24 | 14 to 19 |
| High | 25 to 31 | 20 to 25 |
| Very high | 32 or more | 25 or more |

## 4.2 Species composition

The most common taxa sampled across the Bioblitz program is the scud (*Austrochiltonia* sp.) (Figure 4A) being present in 82% of the samples collected across the four years. The next most common taxa were non-biting midges (*Chironomus* sp.) (Figure 4B) in 65% of samples, shrimp (*Paratya australiensis*) (Figure 4 C) in 50% of samples, New Zealand mud snails (*Potamopyrgus antipodarum*) in 48% of samples, pond snails (*Physa acuta*) and two species of diving beetle (*Platynectes* sp. and *Necterosoma* sp.) (Figure 4 D & E) found in 43% and 37% of samples respectively.

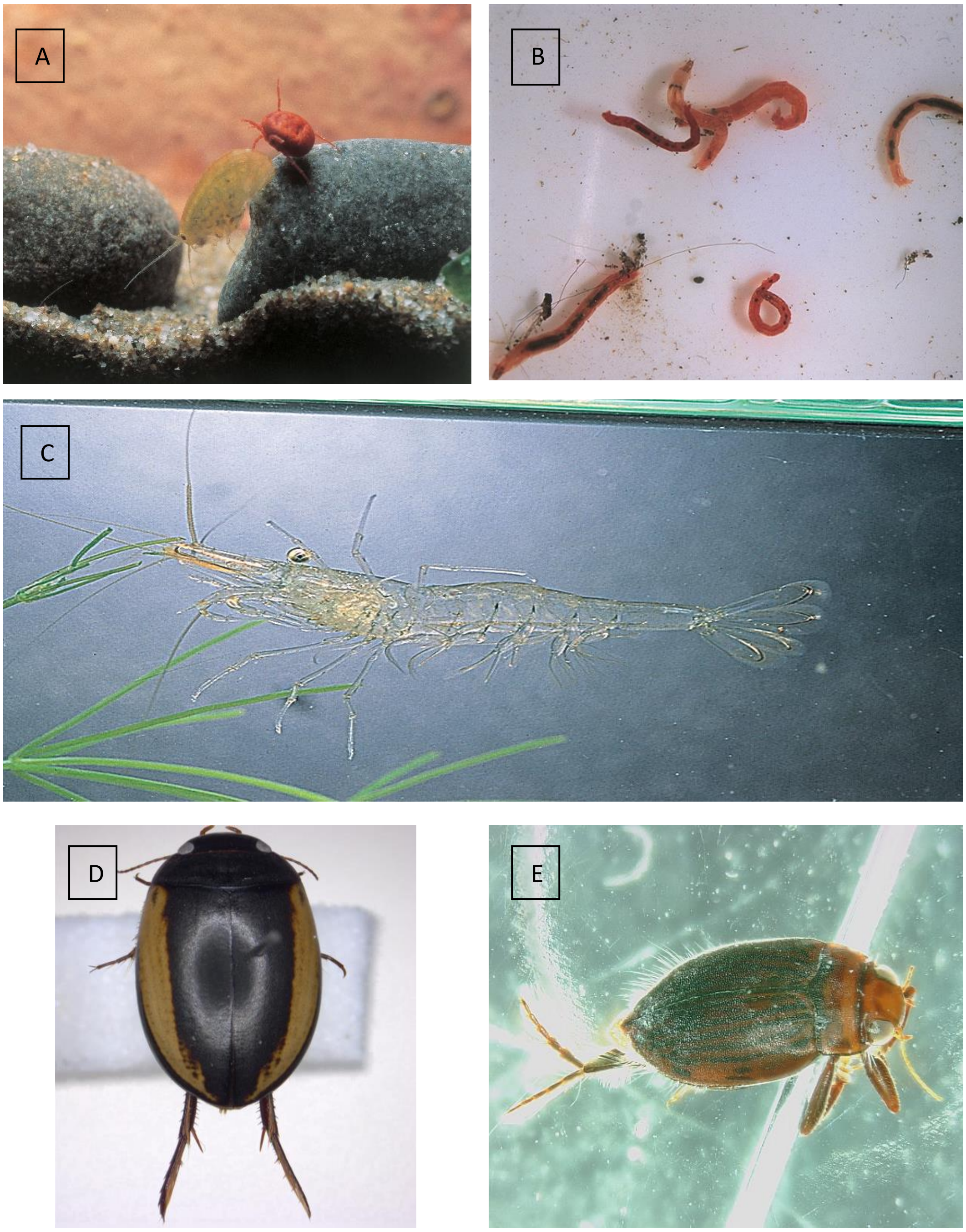



*Figure 4. A -Scud and red water mite, B -non-biting midges and C-shrimp (image credits J Gooderham and E Tsyrlin), D -*Platynectes *sp. diving beetle (image credit R Glatz), & E -*Necterosoma *sp. diving beetle ( image credit C Madden).*

When the data is examined by habitat sampled there is a clear separation between the macroinvertebrate species found in pool samples and riffle samples (Figure 3). This is a well-established pattern in macroinvertebrates and reflects the habitat preferences of different species. Figure 5. Some preferring still water in a pool (eg. shrimp, diving beetles, damselflies and backswimmers), others being adapted to living and feeding in fast flowing rocky riffles (eg. mayfly and stonefly larvae and riffle beetles)

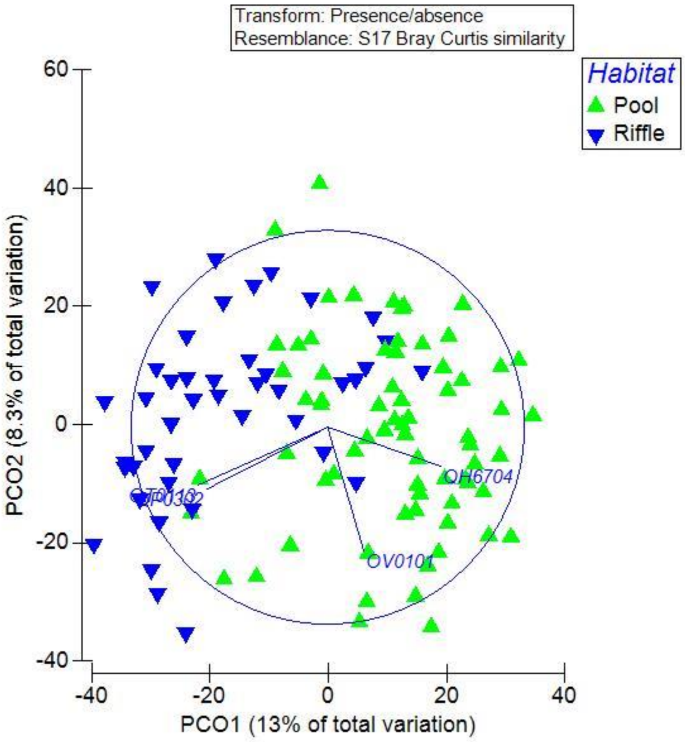



*Figure 5: Principal component ordination of the BioBlitz taxa data labelled by sampled habitat. This process orders objects that are characterized by values on multiple variables (multivariate objects) so that similar objects are near each other and dissimilar objects are farther from each other.*

## 4.3 EPT taxa richness

EPT taxa richness refers to the number of different types of waterbugs from three families; Ephemeroptera (mayflies), Plecoptera (stoneflies) and Tricoptera (caddisflies). These are known to be sensitive to water quality and therefore considered a good indicator of ecosystem condition. Higher EPT taxa richness is considered to indicate better ecosystem condition.

| Ephemeroptera | Plecoptera | Tricoptera |
|---|---|---|
| Mayfly nymph | Stonefly nymph | Caddisfly larvae |
|  |  |  |

The number of EPT taxa recorded at the sites has ranged from 0 to 9 (Figure 6). Quarry Road and Ti Tree Creek (Figure 7) have the highest average EPT taxa richness. These two sites have macroinvertebrates communities that differ from most of the other sites sampled.  In particular they provide habitat for the nymphs* of caddisflies (Hydrobiosidae spp.) and Stoneflies (Gripopterygidae spp.) that are rarely found at other sites in the catchments.

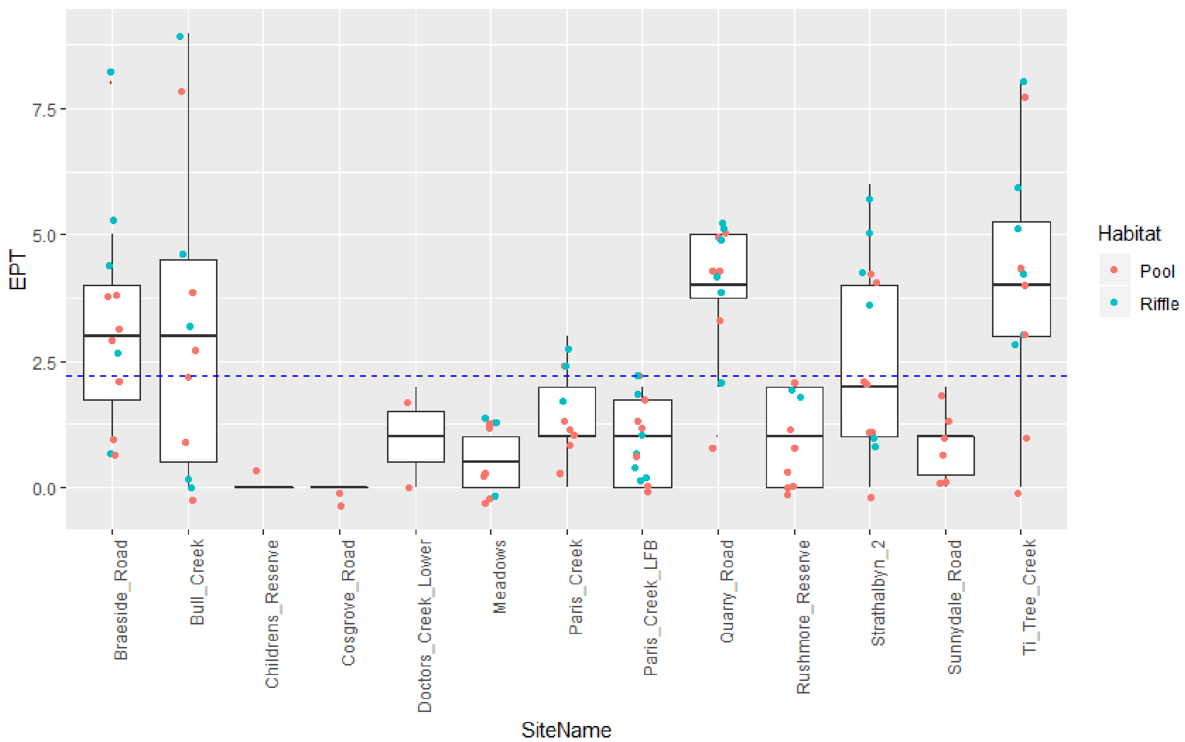



*Figure 6. Boxplot of EPT richness at the Waterbug Bioblitz monitoring sites 2016-2019. The blue dashed line is the average across all sites, dates and habitat types.  Pool and riffle samples are identified by colour.*

*Figure 7. Ti Tree Creek Bioblitz site*

To date, the EPT taxa richness recorded at the sites appears to be influenced by water quality (dissolved oxygen and salinity), surrounding land use, time of year (i.e. spring vs autumn), and year (i.e. dry vs wet years), however longer-term data are required to confirm these trends statistically.

***Dissolved oxygen (DO)***

The average number of EPT for each site over all sampling is generally higher where there is higher average DO and lower at sites with lower DO. However, changes in EPT richness between sampling dates does not seem to be as strongly related to DO (i.e. a drop in EPT on one date at a site that usually has high EPT does not always correspond with an unusually low DO levels at that site on that date).

***Salinity***

EPT richness and total taxa richness generally follow the same trends of being higher on average in Spring than Autumn, and both being higher or lower at the same sites, however there are two notable exceptions: Rushmore and Sunnydale sites both had very high taxa richness in Spring 2016 and 2018 and yet EPT taxa richness on these dates was low (between 0 and 2). These sites also have the highest average salinity (both around 6000 EC µS/cm). The Childrens Reserve site also recorded similar salinity levels with low EPT richness as well as low total taxa richness.

***Surrounding land use***

In general, higher numbers of EPT taxa have also been recorded at sites where the immediate surrounding land and upstream riparian zone is used for conservation (remnant native vegetation or revegetation) or passive recreation (town parks). Sites that are unfenced and the adjacent land use is primary production all had an EPT taxa richness of three or less. However, conservation or recreation sites with higher average salinity had low EPT taxa numbers.

***Season***

Across all sites, the average EPT richness has been lower in autumn than spring.

# 5 Waterbug bioblitzes and changes in catchment management

When the Waterbug Bioblitzes began in 2016 in the Angas and then Finniss catchments, these citizen science activities were managed by Natural Resources SA Murray-Darling Basin. As of July 1 2020, new Landscape Boards were created across the state and these catchments are now part of the Hills and Fleurieu Landscape Board whose staff will manage the bioblitz events into the future.

The Flows for the Future program is continuing to be implemented across the EMLR with an anticipated end date of December 2023. In that time, hopefully many more landholders will build low flows devices on their properties and increase the low flow returns to the Angas and Finniss catchments. The program began during very wet seasonal conditions, and the last 2 years have been extremely dry. As such, the data has not been able to show an impact as yet through such wildly changing flow conditions. Over the next 3 years we might see some more average conditions and be able to measure the benefits of restoring low flows.

***Glossary:***

**Taxa** = unique units of biological classification, but an individual taxa may not be able to be identified to level of species where species are difficult to identify or have not been named at species level

**Nymph** = juvenile life forms of insects that go through gradual transformation to adult form and generally look similar to the adults. They do not have a pupal stage.

**Larvae** = juvenile life forms which look very different from adult forms and pupate when changing from larvae to adult.

Did you know that nymphs of insects with an aquatic life stage are sometimes called naiads, an Ancient Greek name for mythological water 'nymphs'?